STREnGth_M
Strengthening EU
Road Transport R&I

Deliverable D1.3

Training actions supporting Road Transport area in Europe and Internationally

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101096253.

Summary sheet

Deliverable number	D1.3
Deliverable title	Training actions supporting Road Transport areas in Europe and Internationally
Deliverable version	1st revision
Work Package number	WP1
Work Package title	Methods and tools for a collaborative framework
Due date of delivery	30/09/2024
Actual date of delivery	15/04/2025
Dissemination level	Public
Type	Document, report
Contributor(s)	Hassan Hussin, Rupprecht Consult Vladislav Sidorov, Rupprecht Consult Daniel Franco, Rupprecht Consult Joseph Paul, Ruprecht Consult Prof. Dr. Oliver Lah, UEMI Kathleen Demateera, UEMI Prof. Dr.-Ing. Peter Urban, RWTH Aachen Judith Anne Adem Owigar, UN-Habitat
Reviewer(s)	Verena Wagenhofer, AVL Jeanett Bolther, PNO Consultants (Multiplier Group) Hans Schurmans, Proximus (Multiplier Group)
Project name	Stimulating road Transport Research in Europe and around the Globe for sustainable Mobility
Project acronym	STREnGth_M
Project starting date	1 February 2023
Project duration	36 Months

List of abbreviations and acronyms

Acronym	Meaning
CSA	Coordination and Support Action
D	Deliverable
ERTRAC	European Road Transport Research Advisory Council
M	Month
MS	Milestone
R&I	Research and Innovation
RTR	Road Transport Research
SDGs	Sustainable Development Goals
SM	Social Media
SRIA	Strategic Research and Innovation Agenda
TRA	Transport Research Arena
WP	Work Package
CCAM	Connected and Cooperative Automated Mobility
ZEV	Zero Emission Vehicles
SUMP	Sustainable Urban Mobility Plan
EU	European Union
EV	Electric Vehicle
ITS	Intelligent Transport Systems
LCA	Life Cycle Assessment
ICT	Information and Communication Technology
NGOs	Non-Governmental Organizations
VR/AR	Virtual Reality/Augmented Reality
AI	Artificial Intelligence
IoT	Internet of Things
UN	United Nations
R&D	Research and Development
KPI	Key Performance Indicator
OEM	Original Equipment Manufacturer

List of Figures

List of Boxes

List of Tables

1 Introduction to the report

1.1 Project abstract and reference to the work plan

STREnGth_M is a Coordination and Support Action funded by the European Commission under the Horizon Europe Programme. The project aims to foster the transformation of the road transport sector in Europe and globally by enhancing the sector's capacity to address pressing challenges such as decarbonization, digitalization, automation, and sustainability. The project's primary goal is to strengthen research, innovation, competitiveness and education within the road transport ecosystem by improving coordination between European, national, and international programmes, and by facilitating knowledge exchange and collaborative efforts across stakeholders in the sector.

In line with these objectives, STREnGth_M aims to identify future research needs in road transport, support the development of strategic research agendas and roadmaps, and track the progress of emerging technologies in different regions of the world. The project also addresses capacity-building needs by identifying and promoting relevant education and training actions, ensuring that the workforce is equipped with the skills needed to meet the demands of the evolving transport landscape. Additionally, STREnGth_M supports the dissemination of research results and fosters global collaboration through events, workshops, and strategic partnerships with key road transport organizations and initiatives.

The project is organized into six Work Packages (WPs), each designed to address specific objectives that contribute to advancing sustainable and innovative road transport systems. **WP1** focuses on methods and tools for creating a collaborative framework, including stakeholder mapping, engagement strategies, road mapping evaluation, and identifying education and training actions for both European and international stakeholders. **WP2** centres on harmonizing research and innovation plans, identifying future research needs and supporting ERTRAC Working Groups and Horizon Europe partnerships. **WP3** emphasizes aligning European, national, regional, and international roadmaps and strategies, fostering collaboration across funding programmes, and creating tools to support alignment. **WP4** facilitates global progress and exchange by strengthening links with emerging economies, fostering international cooperation, and tracking the progress of electric mobility. **WP5** drives dissemination and outreach, promoting sustainable road transport through events, workshops, and communication efforts aligned with the European Green Deal and UN Sustainable Development Goals. Finally, **WP6** ensures efficient project management, overseeing administrative processes, communication, deliverables, and data management. Together, these WPs provide a comprehensive framework to address the multifaceted challenges in road transport research, innovation, and capacity building.

STREnGth_M is actively engaging stakeholders from academia, public authorities, industry, NGOs, and research organizations to align its efforts with the needs of the road transport sector, thus ensuring that the project's outcomes are practical, impactful, and sustainable. By addressing both the technological and human resource aspects of the transport transition, STREnGth_M seeks to contribute to the realization of the European Green Deal and other

global sustainability targets, while also ensuring that the road transport sector remains a driver of innovation, economic growth, and public health.

1.2 Related work package and task

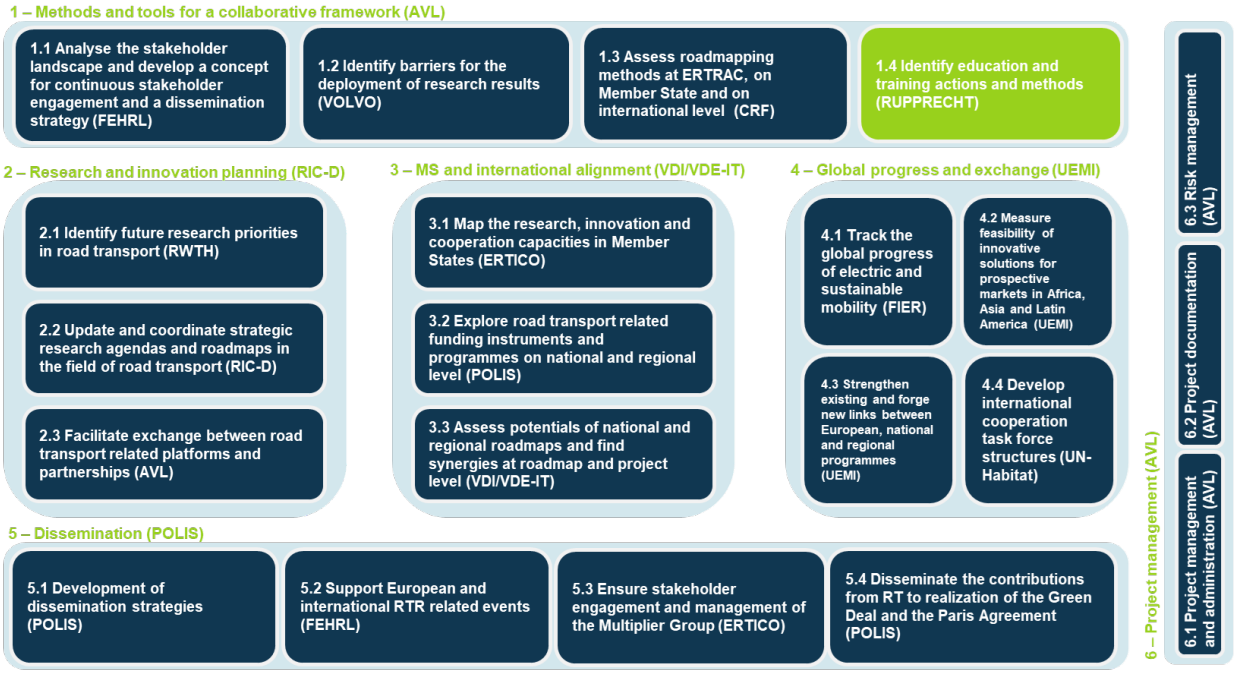


Figure 1: STREnGth_M: Work Packages and Tasks Overview

Work Package 1: Methods and Tools for a Collaborative Framework

Work Package 1 (WP1), titled *"Methods and Tools for a Collaborative Framework,"* serves as a foundational component of the STREnGth_M project. WP1 focuses on creating a cohesive and collaborative structure to support road transport research, innovation, and capacity-building activities at the European and international levels. Its key objectives include:

- Mapping and analysing the stakeholder landscape within the road transport sector.
- Identifying barriers to the deployment of research outcomes.
- Analysing and improving road mapping mechanisms at the European, national, and international levels.
- Proposing education and training actions to strengthen capacity building.

WP1 provides the strategic groundwork to ensure that the diverse objectives and tasks across the STREnGth_M project are aligned, stakeholder-driven, and effectively implemented.

Task 1.4: Identify Education and Training Actions and Methods

Task 1.4, *"Identify Education and Training Actions and Methods,"* is a pivotal part of WP1 and directly supports its overarching goals. This task is dedicated to understanding and enhancing the capacity-building dimensions of the road transport sector by focusing on education and training frameworks. The scope of Task 1.4 includes:

- Analysing current education and training practices across formal academic programmes, capacity-building initiatives, and knowledge-sharing platforms.
- Identifying gaps and emerging key stakeholders' needs in training and education, particularly in key areas such as zero-emission mobility, air quality & climate change, freight transport, circular economy, RT Safety & Security and CCAM.
- Proposing targeted actions to bridge gaps and strengthen the sector's ability to meet future challenges.

The findings from Task 1.4 provide critical insights into how stakeholders can build and adapt their capacity to align with technological, environmental, and societal changes.

Task 1.4's Relation to Other Tasks and Work Packages

Task 1.4 is intrinsically linked to other tasks and work packages within the STREnGth_M project, ensuring a holistic and integrated approach to achieving the project's goals.

1. **Relation to Other Tasks in WP1:**
    - Task 1.4 builds on **Task 1.1**, which maps the stakeholder landscape, providing a foundation for identifying the actors involved in education and training.
    - Insights from **Task 1.2**, which evaluates road mapping mechanisms, inform Task 1.4 by highlighting how education and training align with broader strategic agendas.
    - **Task 1.3**, focused on identifying barriers to research deployment, complements Task 1.4 by addressing capacity-related challenges that impede the implementation of research outcomes.
2. **Connection to Other Work Packages:**
    - Task 1.4 directly supports **WP2**, which deals with research and innovation planning. The outputs of Task 1.4 feed into the identification of future research needs and priorities, ensuring alignment between training systems and research goals.
    - Task 1.4 also aligns with **WP4**, which addresses Global Progress and International Exchange. The education and training gaps identified in Task 1.4 contribute to WP4's strategies for overcoming these barriers.
    - The recommendations from Task 1.4 are integral to **WP5**, which focuses on dissemination and stakeholder engagement. Task 1.4 outputs guide the development of targeted dissemination strategies to enhance the adoption of training and education frameworks.

By collaborating across tasks and work packages, Task 1.4 ensures that capacity-building efforts are integrated into the project's broader objectives, driving progress toward sustainable and innovative road transport systems.

1.3 Objectives and scope of this report

1.3 Objectives and Scope of This Report

The primary objective of this report is to identify and evaluate education and training frameworks within the road transport domain. The report focuses on analysing current practices, identifying gaps, and offering targeted recommendations to enhance capacity building for a sustainable and innovative road transport sector.

The report aims to:

- **Provide an overview** of existing training actions, methods, and platforms, highlighting their objectives, methodologies, and limitations.
- **Identify gaps** in education and training, particularly those related to emerging technological advancements and societal challenges.
- **Propose actionable recommendations** that address these gaps, with the goal of improving the capacity of stakeholders to adapt to future demands and opportunities.

The scope of the report is centred around the main domains:

- **Academia** and official educational programmes, including formal degree programmes, professional certifications, and collaborative research initiatives.
- **Training and capacity-building programmes**, such as workshops, internships, and vocational training aimed at enhancing practical skills and adaptability.
- **Self-Learning Knowledge-sharing platforms**, encompass digital tools, e-learning resources, webinars, and networks that facilitate the exchange of best practices and foster collaboration.

In addition, the recommendations are directly related to the focus topics of ERTRAC's Working Groups, which in their areas of expertise include zero emissions urban mobility, connected cooperative automated mobility (CCAM), air quality and climate change, circular economy, freight transport, and safety and security. The recommendations also consider cross-cutting themes such as social equity, multidisciplinary collaboration, and stakeholder engagement, ensuring that the proposed actions are comprehensive and adaptable to diverse contexts. This alignment with ERTRAC's strategic priorities ensures the findings contribute meaningfully to Europe's vision for a competitive, sustainable and innovative road transport system.

1.4 Connection to European Technology Platforms and/or Horizon Europe Partnerships

The STREnGth_M project is a CSA to **ERTRAC**, the European Technology Platform for Road Transport, recognized and supported by the European Commission. Through Task 1.4, the project also engages with other European and international platforms, ensuring its recommendations address current and future needs in the field of education and training.

Task 1.4 supports Horizon Europe partnerships such as the **2ZERO Partnership**, **CCAM Partnership** or the Batt4EU Partnership and the Clean Hydrogen Partnership and is closely interlinked with associations like EARPA, EUCAR, CLEPA, and POLIS. By involving these platforms, the task ensures its outputs align with the strategic goals of the European Green Deal and Horizon Europe while fostering consensus among stakeholders on training and capacity-building priorities.

This collaborative approach ensures the relevance and applicability of the deliverable's findings and recommendations, enhancing the sector's ability to address challenges and seize opportunities in the transition to sustainable and innovative road transport solutions.

1.5 Method

This report is based on structured and multi-faceted methods. First, a comprehensive literature review and desk research were conducted to evaluate existing academic, training, and capacity-building practices in the road transport sector. These provided a foundational understanding of current methods, their objectives, and their limitations. Education and training actions were categorized into three key domains: formal academic programmes, vocational and capacity-building initiatives, and knowledge-sharing platforms. Each category was analysed to assess its goals, methods, and relevance to the evolving needs of the sector.

Building on the literature review and desk research, the project team engaged with international research and consulting projects, including many international Sustainable Urban Mobility Plans (SUMPs) projects, such as SOLUTIONS+ worldwide, LATAM in Latin America, SUMP Türkiye, SMMR in Southeast Asia, etc. This engagement provided additional insights into training gaps and emerging priorities.

A critical component of the method was a comprehensive survey targeting key stakeholders in the road transport sector. These surveys were distributed to project partners within the STREnGth_M Consortium, leveraging their diverse backgrounds and expertise across academia, industry, research, and policy. Additionally, surveys were extended to organizations and stakeholders outside the consortium to broaden the perspective and include insights from a wide array of actors involved in road transport. To enrich and validate the survey findings, follow-up interviews were conducted with select stakeholders, providing qualitative depth to the quantitative data collected.

The synthesis of these methods—literature review, surveys, interviews, and engagement with related international projects—ensured a robust and comprehensive understanding of existing training practices and gaps. The findings were then analysed using a combination of qualitative and quantitative methods to identify patterns, trends, and specific areas of improvement. This systematic approach informed the development of actionable recommendations to address current challenges and future demands, offering practical solutions to enhance education and training systems in the road transport sector.

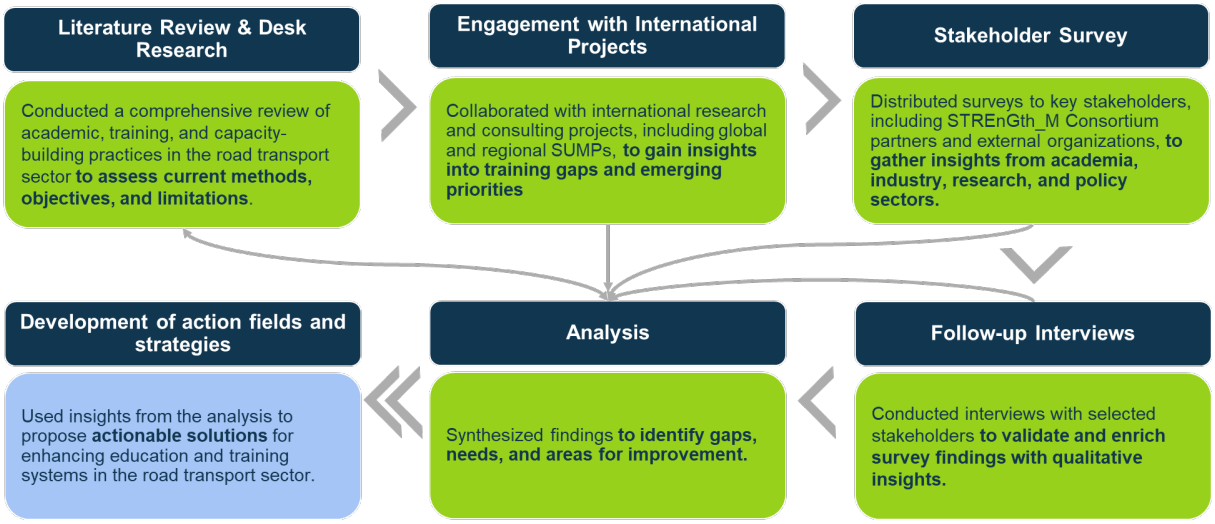


Figure 2: Methodology

1.6 Outcome abstract

The STREnGth_M project represents a comprehensive effort to advance the road transport sector by addressing critical challenges through research, education, and collaboration. This deliverable D1.3 consolidates insights into the evolving landscape of road transport, highlighting the critical roles of education, stakeholder engagement, and thematic priorities in advancing sustainability and innovation in road transport.

Chapter 1 introduces the STREnGth_M project, its objectives, and its structured approach to strengthening research, innovation, and capacity building in the road transport sector. Operating through six work packages, the project aligns research efforts, fosters stakeholder collaboration, and supports education and training actions to address evolving demands while contributing to global sustainability and climate goals, such as those outlined in the European Green Deal and Horizon Europe.

Chapter 2 explores the education and training methods and actions critical in the road transport sector. Three distinct domains—formal academic programmes, training and capacity-building initiatives, and self-learning and knowledge-sharing platforms—form the foundation of these efforts. Formal education provides structured and incremental learning, fostering systematic problem-solving skills. Training programmes focus on practical, hands-on learning tailored to specific challenges, while self-learning platforms democratize knowledge through accessible, flexible, and scalable resources. Collectively, these methods cater to diverse audiences and address gaps in skills and expertise.

Chapter 3 examines the roles and needs of key stakeholders shaping road transport, including academia, public authorities, private industry, NGOs, and research consultancies. Through surveys and follow-up interviews, this chapter highlights the unique contributions of each stakeholder group and the challenges they face. Academia emphasizes research and foundational learning, while public authorities focus on policy implementation and urban planning. The private sector drives technological innovation, NGOs advocate for sustainability and equity, and research consultancies provide critical data and insights. Interdisciplinary collaboration, updated training content, and accessible resources emerge as common needs across groups.

Chapter 4 delves into six action fields: Zero Emission Urban Mobility, Connected and Cooperative Automated Mobility (CCAM), Freight Transport, Safety and Security, Circular Economy, and Air Quality and Climate Change. Each topic reflects pressing global challenges and highlights opportunities for innovation and capacity building. For instance, zero-emission urban mobility focuses on electrification and active transport solutions, while CCAM addresses the integration of autonomous and connected systems. Freight transport emphasizes sustainable logistics, and safety and security prioritize accident reduction and passenger protection. Circular economy initiatives promote resource efficiency, and air quality measures align with climate action goals.

Chapter 5 identifies key barriers to effective training in the road transport sector, including rapid technological change, limited resources, outdated content, and weak stakeholder collaboration. To address these, it highlights strategies such as digital learning, tailored training, stronger academia-industry partnerships, standardized certifications, and continuous professional development, ensuring a skilled and adaptable workforce.

Chapter 6 concludes by emphasizing the need for modernized, flexible, and collaborative training in the road transport sector. Addressing technological shifts, resource limitations, and outdated content requires integrated strategies, including digital learning, industry-academia cooperation, and continuous professional development. Strengthening these efforts will ensure a well-equipped workforce capable of supporting a sustainable and evolving transport landscape.

This deliverable underscores the interconnected nature of research, education, and collaboration in addressing the complex challenges of the road transport sector. By leveraging diverse educational methods, engaging key stakeholders, and prioritizing critical thematic areas, the STREnGth_M project provides a roadmap for innovation and capacity building, fostering a sustainable, inclusive, and resilient future for road transport globally.

2 Road Transport Training actions in Europe & Internationally

The transport sector in Europe employs more than 10 million people and contributes around 5% to the Gross Domestic Product (GDP) (Key Figures on European Transport 2023[1]). This sector remains a cornerstone of economic development and social connectivity, while also facing transformative changes due to ongoing technological advancements. Digitalization, the promotion of new mobility services, electrification, and automation are reshaping traditional operations and creating both opportunities and challenges for the workforce.

The transition to transport decarbonization, alongside the adoption of alternative fuels and the development of technologies, will further influence and shift job landscapes. These changes, coupled with increased necessary investments in road transport projects, expose significant skills shortages and gaps in the workforce to account for these rapid changes. From a labour perspective, addressing these shortages and skills mismatches requires not only immediate workforce development but also a focus on sustainable skill development. This approach ensures that efforts are not just reactive, tackling current challenges, but also proactive, preventing future workforce disruptions.

The EU Report on the future of European Competitiveness[2] highlight the persistent skills shortages faced by European companies. Around one-quarter of European companies face difficulties in finding employees with the right skills, while another half report some difficulties. Furthermore, 77% of EU companies report that newly recruited employees often lack the required skills. Nearly 60% of EU companies identify the lack of skills as a major barrier to investment. The rates of job vacancies in clean tech manufacturing within the EU have doubled between 2019 and 2023, underscoring the need for skilled labour in emerging sectors.

Projections to 2035 indicate that labour shortages will be most pronounced in high-skilled, non-manual occupations—those requiring a high level of education—driven by replacement needs due to retirements and the changing demands of the labour market. Europe produces high-quality talent in STEM fields, but the supply remains limited, with around 850 STEM graduates per million inhabitants per year, compared to more than 1,100 in the US. This gap in the STEM talent pool further exacerbates the challenge.

For instance, the digitalization of the transport sector has significantly increased demand for data specialists who can analyse and manage transport data. Various studies estimate that the United Kingdom and Europe will require 1.7 million new technical jobs in the public sector

[1] Key figures on European transport – 2023 edition

[2] The future of European competitiveness - Part A | A competitiveness strategy for Europe, 2024 (97e481fd-2dc3-412d-be4c-f152a8232961_en)

alone to meet evolving demands[3]. While the UK transport industry is projected to need approximately 3,000 new data-related roles, the United States anticipates a demand for 45,000 mobility engineers[4]. Similarly, African countries, such as South Africa, Kenya, and Nigeria, face high demand for highly skilled professionals, including logistics managers, transport engineers, and ICT specialists, further exacerbated by rapid sectoral growth and insufficient training infrastructure[5] [6].

Another pressing issue is the ageing workforce. For instance, in Australia, the transport and logistics industry faces a significant demographic challenge, with the majority of the workforce aged 45-54. As the median population age is projected to reach 40.5 years by 2040, this disproportionate reliance on older workers and a shrinking pipeline of younger talent necessitates targeted efforts in reskilling and upskilling.[7]

The EU report on competitiveness[2] also highlights the underuse of skills intelligence, pointing to the lack of reliable, granular, and comparable information on skills needs, which is essential for assessing and forecasting skills gaps and targeting policies effectively. Despite spending around EUR 64 billion on skills investment, the results have been limited due to factors like a lack of coordination among Member States and insufficient industry involvement.

These dynamics highlight the urgency of targeted education and training programmes to bridge skill gaps, promote workforce resilience, and foster innovation. Suggested actions by the EU Report on the future of European Competitiveness[2] are to address skills shortages, including enhancing skills intelligence, revising curricula with input from employers, establishing a common certification system across the EU, redesigning EU education programmes to improve funding impact, and addressing technical and STEM shortages through adult learning and vocational training reforms. Furthermore, initiatives like the Tech Skills Acquisition Programme are suggested to attract tech talent from outside the EU.

---

[3] Chinn, D. et al. 2020. The future is now: Closing the skills gap in Europe's public sector, McKinsey and Company. [Accessed 31 July 2024]. Available from: https://www.mckinsey.com/industries/public-sector/our-insights/the-future-is-nowclosing-the-skills-gap-in-europes-public-sector

[4] Michigan Mobility Institute. 2021. Preparing Talent for the Future of Mobility Careers. [Accessed 31 July 2024]. Available from: https://michiganmobilityinstitute.org/

[5] Maame, E. 2018. *Skilling Africa's Informal Sector for Growth: The Role of Technical and Vocational Education and Training.* [Accessed 29 July 2024]. Available from: Skilling Africa's Informal Sector for Growth: The Role of Technical and Vocational Education and Training | Wilson Centre

[6] International Finance Cooperation. 2021. *Demand for Digital Skills in Sub-Saharan Africa. Key Findings from a Five-Country Study: Côte d'Ivoire, Kenya, Mozambique, Nigeria, and Rwanda.* [Accessed 29 July 2024]. Available from: World Bank Document

[7] Transport Systems Catapult. 2015. The Transport Data Revolution: Investigation into the data required to support and drive intelligent mobility.

By ensuring knowledge transfer and building technical and managerial capacity, structured training actions enable the road transport sector to remain a critical driver of sustainable development and economic progress.

2.1 Overview of Education and Training in the Road Transport Sector

2.1.1 Role and Objectives of Education and Training Activities in the Road Transport Sector

Training and education are indispensable in addressing the transformative challenges faced by the road transport sector. As the industry adapts to rapid technological changes and evolving sustainability goals, education programmes play a vital role in equipping the workforce with the skills needed to remain competitive, resilient and visionary. They serve as a foundation for knowledge transfer, professional development, and capacity building, aligning the sector with global sustainability frameworks such as the European Green Deal and the Paris Agreement.

The primary role of training actions is to build both technical and managerial competencies across a diverse range of stakeholders. This ensures that professionals are equipped to adopt innovative practices, including automation, digital logistics, and green mobility solutions. Training actions also foster mechanisms for knowledge sharing that address regional and global challenges, promoting collaboration and scaling up best practices. Outside of the EU, education and training in the road transport sector are crucial for addressing unique challenges such as infrastructure gaps, diverse socio-economic conditions, and varying levels of technological adoption. These programs aim to build local capacity, enhance technical skills, and promote sustainable practices tailored to regional needs. By aligning with global sustainability frameworks, these initiatives help bridge the gap between local realities and international standards. By bridging regional disparities and preparing a workforce capable of meeting emerging demands, structured education programmes contribute to the overall development and adaptability of the sector.

The objectives of training actions extend beyond skill-building to enhancing workforce adaptability and encouraging collaboration among stakeholders. These initiatives create opportunities for professional growth across different roles, from technical specialists to policymakers, fostering a workforce that can address both technological and operational changes. Through targeted training, the road transport sector can effectively contribute to sustainability, drive innovation, and achieve long-term economic growth while ensuring equity and inclusivity in its workforce development efforts.

2.1.2 Methods of Training and Education in the Road Transport Sector

Future experts for the transport sector are taught using a variety of methods tailored to different audiences and learning objectives. These approaches include both formal and informal techniques, ensuring flexibility and inclusiveness. Below is an overview of key methods, aligned with the durations and exposure outlined in the visual:

- **Seminars and Lectures:** These sessions, often lasting half a day to a full day, involve focused presentations by subject matter experts. Seminars typically emphasize theoretical knowledge transfer and provide opportunities for participants to engage in Q&A

or discussions. They are ideal for introducing concepts, sharing new research, and fostering dialogue on specific topics.

- **Workshops:** Workshops, lasting one to three days, are hands-on and interactive. Participants actively engage in group problem-solving, brainstorming, and skill-building exercises. They are designed to develop practical skills or tackle specific challenges, often resulting in actionable outcomes such as strategies or solutions.
- **Conferences:** Spanning two to three days, conferences bring together a wide range of stakeholders, including policymakers, researchers, and industry professionals. They serve as platforms for presenting research, discussing emerging trends, and building networks. Conference formats often include keynote speeches, panel discussions, breakout sessions, and exhibitions.
- **Trainings:** Focused on specific topics or skills, training sessions typically last three to five days and combine lectures, hands-on exercises, and collaborative activities. They are designed to equip participants with the tools and knowledge required for immediate application in their professional roles.
- **Study Tours and Field Visits:** These experiential methods, lasting one to two weeks, provide participants with first-hand exposure to successful transport systems, infrastructure projects, or innovative practices. By observing real-world examples, participants gain practical insights and ideas that can be adapted to their local contexts.
- **Shadowing and Mentorship Programs:** These programs pair learners with experienced professionals over several weeks or months. Shadowing allows participants to observe and understand daily operations, while mentorship provides guidance, advice, and the opportunity for skill-building through a personalized approach.
- **Webinars and Online Seminars:** Ranging from one to several hours, these virtual sessions are led by experts and include presentations, demonstrations, and Q&A sessions. They allow participants to learn from global thought leaders without the need for travel, enabling wide participation across geographic regions.
- **Massive Open Online Courses (MooCs):** MooCs provide in-depth learning opportunities on specific topics and are highly flexible, allowing learners to progress at their own pace. Courses may last several weeks to months, often including video lectures, quizzes, and assignments.
- **E-Libraries and Digital Repositories:** These online platforms offer continuous, on-demand access to a wealth of resources, including technical reports, case studies, research papers, and multimedia materials. They are valuable for self-guided learning and long-term professional development.
- **Professional Training and Certification Programs:** These structured programs, which can last from months to a year or more, are typically delivered by universities,

industry organizations, or specialized institutes. They certify participants in specific competencies, enhancing career opportunities and meeting industry standards.

- **Customized Knowledge Reports and Expert Dialogues:** These approaches involve tailored studies or discussions focused on the specific needs of an organization, region, or topic. They often occur over several weeks or months, providing actionable insights and fostering an in-depth understanding of complex issues.
- **Simulations, Modeling, and Virtual Reality Training:** These immersive tools replicate real-world scenarios, such as transport system operations, crisis management, or infrastructure planning. They provide hands-on experience in a controlled environment, enabling participants to develop skills and test solutions for complex challenges.

These methods ensure that learners and stakeholders have access to diverse, flexible, and effective options to build their knowledge and skills. By combining these approaches, the road transport sector addresses a wide range of educational and professional needs while promoting collaboration, innovation, and alignment with global sustainability goals.

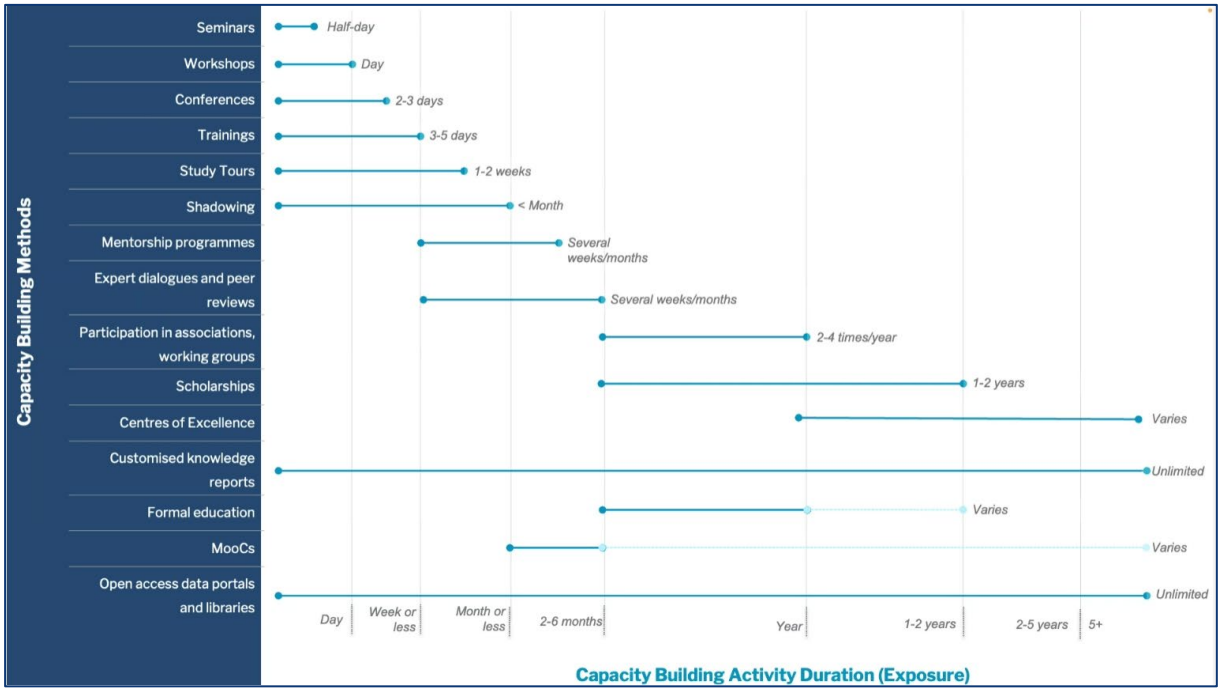


Figure 3: Capacity Building methods-duration Diagram. Source: Capacity Building in Sustainable Urban Mobility for Low-Income Countries. A project by: Transport For Cairo – DT Global – UKAID - 2024

2.1.3 Factors Influencing the Effectiveness of Training and Education

The success of education and training programmes depends on several interrelated factors that affect both the delivery and reception of materials:

- **Language:** Programmes in local languages are more accessible to regional audiences but may limit international reach. Conversely, using international or secondary languages may pose barriers for non-proficient learners.
- **Contextualization:** Tailored content that reflects regional, cultural, and technical needs is more effective than generic materials, ensuring relevance and applicability.

- **Mode of delivery:** The choice of in-person, online, or hybrid delivery formats impacts engagement. In-person programmes foster networking and collaboration, while online formats offer greater accessibility and flexibility.
- **Synchronous vs. asynchronous learning:** Synchronous methods, such as live webinars or interactive classrooms, encourage real-time participation, while asynchronous formats, such as recorded lectures and self-paced courses, provide greater flexibility.
- **Self-learning vs. interactive learning:** Programmes that include group discussions, case studies, and mentorship often yield better outcomes than one-way communication formats.
- **Accessibility:** Factors such as cost, internet connectivity, and location influence the inclusiveness of training programmes.
- **Integration with existing knowledge:** Programmes that build on learners' prior knowledge or skills are more impactful than standalone introductory sessions.
- **Frequency and duration:** Training schedules influence participant retention and depth of learning. Short, focused sessions are effective for skill updates, while longer programmes are better suited for comprehensive learning.
- **Practical application:** Training with hands-on activities, simulations, or real-world problem-solving enhances knowledge retention and practical skills.
- **Inclusivity and diversity:** Programmes that target underrepresented groups, such as women, youth, and marginalised communities, contribute to workforce equity and innovation.
- **Feedback mechanisms:** Incorporating feedback from participants ensures continuous improvement in programme content and delivery.
- Teaching the teachers: Effective programmes require skilled educators who can communicate and adapt materials to meet diverse learner needs.

By addressing these factors, training programmes can maximize their impact and ensure alignment with the sector's evolving needs. A critical enabler of success is the **Training of Trainers** (**ToT**), which equips educators with advanced teaching techniques, communication skills, and the ability to contextualize content for diverse audiences. These initiatives ensure that trainers can deliver learning outcomes with clarity, relevance, and impact. Together, these measures foster inclusive, flexible, and high-quality education and training programmes that prepare the road transport sector to meet future challenges.

2.2 The Three Education and Training Domains

To address the challenges and leverage opportunities in the road transport sector, education and training activities can be broadly categorized into three clusters: formal education and academia, capacity-building programmes, and self-learning knowledge-sharing platforms. These clusters serve as overarching frameworks that encompass the diverse methods and actions of education and training.

Academic Education Programmes include structured programmes such as degree courses, classroom-based learning, and research collaborations. These initiatives equip learners with

foundational and advanced knowledge, providing a strong theoretical base for careers in road transport.

Training & Capacity Building Programmes focus on upskilling and institutional strengthening. These programmes, often implemented by development agencies or professional associations, include practical training, internships, and train-the-trainer models. They emphasize hands-on learning and the application of knowledge in real-world scenarios.

Self-Learning and Knowledge Sharing Platforms comprise activities such as webinars, MooCs, and digital repositories. These methods prioritize accessibility and scalability, enabling widespread dissemination of best practices and fostering independent learning.

Each cluster addresses specific needs within the sector while collectively ensuring a comprehensive approach to workforce development. The following sections delve into these clusters, providing insights into their roles, strengths, and areas for improvement.

2.2.1 Academic Education Programmes

Universities and academic institutions worldwide play a pivotal role in bridging the gap between the evolving needs of the road transport sector and the availability of skilled professionals. Through technical and vocational education, institutions train new entrants and upskill the existing workforce to address the sector's challenges, including digitalization, decarbonization, and automation. However, it is important to understand the scope of these programmes, the thematic areas they cover, and their advantages, challenges, and limitations.

A typical engineering study programme includes three levels of higher education:

- **Bachelor's Degree (180–240 ECTS, 3–4 years):** This undergraduate programme lays the foundation for engineering disciplines, focusing on theoretical knowledge, basic engineering principles, and introductory courses in transport, logistics, and mobility. It typically includes a combination of lectures, practical labs, and projects, with class sizes ranging from 30 to 100 students, depending on the institution. Students are often required to complete a capstone project or internship to demonstrate applied knowledge.

- **Master's Degree (60–120 ECTS, 1–2 years):** At the postgraduate level, students delve deeper into specialized fields such as Intelligent Transport Systems (ITS), sustainable urban planning, or traffic management. These programmes emphasize advanced technical and managerial skills, often blending coursework with research-based projects. Class sizes are smaller, typically 10–50 students, to enable focused learning and close interaction with professors. Internships or industry collaboration projects are integral to these programmes, ensuring alignment with real-world applications.

- **Doctorate (PhD, 3–5 years):** The highest level of academic qualification focuses on research and innovation, often addressing complex challenges in the transport sector. PhD candidates work closely with faculty mentors to conduct original research, publish findings in academic journals, and present at conferences. This level typically includes minimal coursework but places a strong emphasis on thesis development and collaboration with industry or government stakeholders.

While these programmes follow similar structures worldwide, their thematic focus and level of specialization vary significantly across regions. Europe boasts the most diverse and

specialised transport, mobility and logistics programmes with more than 200 programmes and a significant emphasis on niche areas such as Intelligent Transport Systems (ITS) and sustainable urban planning. In contrast, the other regions of the world tend to focus more broadly on transportation/traffic engineering and logistics, often without the advanced specialisations seen in European offerings. Most programmes are at the master's level, reflecting a trend towards in-depth, advanced study in these fields.

A significant aspect of academic programmes can be their alignment with industry needs. However, there are notable differences across universities. Some institutions maintain close links to industry through collaborative research, internships, and applied projects, while others focus more on theoretical and fundamental research. These differences are often shaped by the institution's research focus, disciplinary strengths, and regional contexts. For universities with strong industry ties, partnerships with private companies, government bodies, and research organizations play a key role in shaping programme content and delivery. These collaborations ensure students gain practical, real-world experience through initiatives such as internships, case studies, and applied research projects. Such alignment prepares graduates for the challenges of the modern transport sector, from managing urban mobility to advancing automation technologies.

Boxes 1: Types of Academic Education Programme Methods

Types of Academic Education Programme Methods

International degree programmes

International degree programmes involve collaborations between universities across countries, often allowing students to study in multiple locations and earn joint or dual degrees. These programmes expose students to diverse cultural and professional practices, enhance global networking opportunities, and provide access to varied academic resources. However, they can be prohibitively expensive due to tuition fees and relocation costs, limiting accessibility for students from underrepresented regions or lower-income backgrounds.

Hybrid classrooms

Hybrid classrooms combine online and in-person learning, offering flexibility for students to access educational content remotely while still benefiting from direct interaction during face-to-face sessions. This method accommodates students with varying schedules and geographic constraints while reducing travel costs. However, it requires reliable internet access and can result in inconsistent engagement if students struggle to balance the online and in-person components effectively.

Academic conferences

Academic conferences serve as a platform for students and professionals to present research, exchange ideas, and engage with leading experts in the field. These events foster collaboration between academia and industry and provide valuable exposure to cutting-edge research. Despite their benefits, conferences can be costly, with high registration and travel expenses that may restrict participation for those with limited financial resources.

Internships and practical training

Internships and hands-on training offer students the opportunity to apply theoretical knowledge in real-world scenarios, providing a bridge between academia and industry. These experiences enhance employability by developing practical skills, building professional networks, and familiarizing students with workplace environments. However, access to quality internships can be competitive and geographically limited, and not all hosting organizations provide meaningful learning experiences.

Project-based learning

Project-based learning emphasizes solving real-world challenges through collaborative efforts, often involving teamwork on industry-sponsored or research-driven projects. This method fosters critical thinking, problem-solving, and interdisciplinary skills, preparing students for the complexities of the transport sector. Success, however, depends on well-designed projects and active mentorship, and poorly structured initiatives can fail to deliver meaningful outcomes.

In addition to these geographic disparities, the academic field suffers from a lack of coordination across disciplines. Mobility and road transport are inherently multidisciplinary, falling under the purview of faculties such as urban planning, transportation engineering, and environmental studies. Despite the sector's multidisciplinary nature, there is often little collaboration among faculties to provide integrated, interdisciplinary education. This siloed approach limits the ability of programmes to address the complex, interconnected challenges faced by the road transport sector. Enhanced coordination among faculties could create richer, more holistic educational experiences, equipping students with the diverse skillsets needed for modern mobility challenges.

Another gap lies in the transition between high school and college-level education. Most high school curricula lack foundational courses on transportation or mobility, leaving students unprepared for advanced studies at the university level. Strengthening this bridge by introducing transport-related topics in secondary education could build early interest and provide a smoother pathway for students entering the field.

One of the key limitations of higher education in the road transport sector is the outdated nature of curricula and the inability to keep pace with rapidly evolving industry trends. Programme curricula are typically updated every 4–5 years, which often leads to significant delays in incorporating the latest advancements from industry and research into educational programmes. This issue is particularly pronounced in fast-moving fields like vehicle automation and electrification, where technologies can advance so quickly that new developments are outdated by the time they are integrated into academic content. The process of introducing new programmes or revising existing ones is further hindered by bureaucratic hurdles, including lengthy accreditation procedures. These administrative constraints restrict universities' ability to adapt quickly and innovate, creating a disconnect between academic programmes and the dynamic needs of the industry.

Even universities with strong collaborations with industry players, such as internships, collaborative research, and applied projects, face challenges in aligning their curricula with industry changes. While these partnerships provide valuable opportunities for students to engage with real-world trends and technologies, they often fail to translate into formal course content due to rigid curriculum cycles. As a result, graduates may enter the workforce without being fully equipped to address the latest challenges and innovations in the sector, underscoring a critical gap between education and industry demands.

However, rigid and independent departmental structures within universities often act as a barrier to innovation. These structures make it difficult to adopt interdisciplinary approaches, which are increasingly essential to reflect the complexities of modern industry challenges. Aligning academia with industry and public-sector priorities requires not only updating content but also transforming how universities collaborate across departments, industries, and public entities to deliver cutting-edge, holistic education.

Boxes 2: Case study: EIT Urban Mobility Master School

Case study: EIT Urban Mobility Master School

EIT Urban Mobility, an initiative of the European Institute of Innovation and Technology (EIT), currently offers three master's programmes: Sustainable Urban Mobility Transitions, Smart Mobility Data Science & Analytics, and Business Engineering in Urban Mobility.

These two-year dual master's programmes allow students to study at two different partner universities within the EU, earning two master's diplomas upon completion. The programmes emphasise practical industry applications, including a summer school across two European cities focused on critical urban challenges. Additionally, students participate in a shorter challenge project that includes an internship with companies or organisations addressing urban mobility issues.

Students benefit from the EIT Urban Mobility community and collaborations with leading industry partners, particularly through internship placements. The programmes are offered by a consortium of prestigious universities, including Politecnico di Milano, KTH Royal Institute of Technology, Polytechnic University of Catalonia (UPC), Eindhoven University of Technology, Aalto University, Ghent University, and the University of Tartu. This collaboration enables students to study at various institutions and customise their learning paths.

The primary limitation of the programme is the high tuition fees for non-EU citizens. However, EIT Urban Mobility offers a range of partial fee waivers and allowances to help offset these costs.

Key takeaways

- **Cross-institutional learning:** The dual-degree structure enhances academic diversity and allows students to gain expertise from multiple universities, fostering a well-rounded education.
- **Industry integration:** Practical exposure through internships and challenge-based projects ensures that students develop real-world problem-solving skills relevant to urban mobility.

- **Collaborative ecosystem:** The programme benefits from strong partnerships with industry leaders, providing students with networking opportunities and career pathways.
- **Global perspective:** Studying in different EU cities broadens students' cultural and professional outlook, preparing them for international careers in urban mobility.
- **Financial barriers:** High tuition fees for non-EU students pose accessibility challenges, though partial waivers help mitigate this issue.
- **Customised learning paths:** The flexibility in university selection and curriculum choices allows students to tailor their education based on their interests and career goals.

Concluding this section, the most significant advantage of academic education lies in its structured and systematic approach as well as its large scientific expertise. Curricula are designed to build knowledge incrementally, with each course or module reinforcing the previous one. This method not only equips students with foundational and advanced knowledge but also instils the analytical frameworks and systematic thinking required to tackle complex challenges and understand difficult thematic relations. These skills empower graduates to adapt their learning and apply methodical solutions to real-world issues throughout their careers.

While this consistency and depth are valuable, academic programmes must also strive to remain relevant to the rapidly evolving demands of the road transport sector. By integrating more up-to-date industry developments, fostering collaboration across disciplines, and bridging the gap between theory and practice, academic education can better align with the sector's dynamic needs while maintaining its strengths in building a resilient and innovative workforce.

2.2.2 Training & Capacity Building Programmes

Training and capacity-building programmes are essential components of education and professional development in the road transport sector. These programmes focus on interactive and hands-on learning methods tailored to the specific needs of professionals and organizations. They are offered both internally—within organizations like private automotive companies to upskill their workforce—and externally, as services provided by consultancies to public authorities, municipalities, and other stakeholders.

These programmes aim to address practical challenges and real-world applications by creating opportunities for active engagement. Through workshops, webinars, study tours, and other formats, participants can directly interact with experts, collaborate with peers, and apply their learning in real-time scenarios. Such approaches are particularly effective in bridging the gap between theoretical knowledge and operational needs, providing tools and strategies that can be immediately implemented in professional settings.

Boxes 3: Types of Training and Capacity-Building Programmes Methods

Types of Training and Capacity-Building Programmes Methods

Workshops and seminars

Workshops and seminars offer structured, interactive sessions designed to engage participants in discussions, group exercises, and problem-solving activities. These formats allow for the exchange of ideas and the development of tailored solutions to specific challenges. While workshops encourage collaboration and dynamic learning, their success depends on the expertise of the facilitators and the active participation of attendees.

Webinars and online training modules

Webinars have become increasingly popular due to their flexibility and accessibility. These online sessions enable participants to benefit from expert-led presentations and real-time discussions without the need for travel. However, maintaining engagement in virtual settings can be challenging, and webinars often lack the depth of interaction found in in-person formats.

Study tours and field visits

Study tours and field visits provide immersive learning experiences by allowing participants to observe and analyse successful transport initiatives firsthand. These programmes are particularly effective for municipal authorities and policymakers, as they combine theoretical learning with exposure to best practices. However, they can be resource-intensive, limiting participation for smaller organizations with restricted budgets.

On-the-job training and mentorship programmes

On-the-job training and mentorship programmes focus on equipping participants with practical skills through real-world tasks and one-on-one guidance. These programmes are especially common in private automotive industries, where specialized skills in electrification, automation, or digital logistics are required. While these methods are highly effective, they often depend on the availability of experienced mentors and a supportive organizational culture.

The primary advantage of training and capacity-building programmes lies in their interactive nature, which fosters engagement, collaboration, and immediate practical application. By allowing participants to engage directly with trainers and peers, these programmes build confidence and competence in handling complex challenges and social interactions. Moreover, their adaptability ensures that training content can be customized to address the unique needs of different sectors and regions.

Despite their effectiveness, these programmes face notable challenges. High-quality training can be expensive, making it less accessible for smaller municipalities or underfunded organizations. Geographic disparities in access to training also persist, with many programmes concentrated in regions with established transport industries. Additionally, the success of these programmes heavily relies on the quality of trainers and the relevance of the content to participants' specific roles and challenges.

Boxes 4: Case Study: Capacity-Building Workshops for Sustainable Urban Mobility

Case Study: Capacity-Building Workshops for Sustainable Urban Mobility Plans

A notable example of training and capacity-building programmes is the series of workshops organized by international consultancies for European municipalities on implementing SUMPs. These workshops combined theoretical presentations with interactive group exercises, allowing participants to co-develop action plans tailored to their cities' unique needs.

Topics covered included stakeholder engagement, emissions reduction strategies, and data-driven decision-making.

Participants reported that the workshops enhanced their capacity to address urban mobility challenges while fostering collaboration across departments. However, the need for follow-up training and ongoing support was emphasized, as implementing SUMPs requires sustained effort and adaptation over time. These workshops highlight the potential of capacity-building programmes to deliver impactful learning experiences that translate directly into actionable outcomes.

Key takeaways

- **Interactive and practical learning:** Combining theoretical presentations with group exercises enhances engagement and enables participants to develop actionable plans suited to their local contexts.
- **Cross-departmental collaboration**: Workshops facilitate cooperation among municipal departments, improving coordination in SUMP implementation.
- **Need for continuous support**: While the workshops were impactful, ongoing training and follow-up support are necessary to ensure long-term implementation and adaptation of SUMPs.
- **Action-oriented outcomes**: The workshops successfully equipped municipalities with the tools and strategies needed to translate learning into concrete urban mobility improvements.

In summary, training and capacity-building programmes are essential in the road transport sector, offering interactive and tailored learning opportunities for professionals and organizations. These programmes foster active engagement, helping participants bridge the gap between theory and practice and equipping them with the skills and knowledge needed to tackle real-world challenges. Ensuring accessibility, reducing costs, and addressing geographic disparities are critical steps to maximize the impact of these programmes.

2.2.3 Self-Learning and Knowledge Sharing Platforms

Self-learning and knowledge-sharing platforms play a pivotal role in modern education and training, particularly in the road transport sector. These platforms are primarily designed for independent learning, offering accessible and flexible materials that cater to diverse audiences. They range from comprehensive digital repositories to engaging formats like short videos and podcasts, each serving specific educational purposes and learner needs.

These platforms serve two primary roles: providing professionals with reliable tools and resources to support their work, and introducing learners to new fields through accessible and engaging content. For professionals, platforms like e-libraries and knowledge hubs compile technical reports, case studies, and industry guidelines, ensuring a steady stream of trusted information. For broader audiences, platforms such as Massive Open Online Courses (MooCs) and newer formats like podcasts or video tutorials offer opportunities to explore topics like urban mobility, transportation engineering, or logistics.

Boxes 5: Types of Self-Learning and Knowledge-Sharing Platforms

- **E-libraries and knowledge hubs**

Digital repositories such as the UITP Knowledge Hub offer extensive collections of resources, including research papers, technical guidelines, and case studies. These platforms are invaluable for professionals and researchers seeking reliable and up-to-date references. However, their non-interactive nature can make learning feel isolated, and outdated content may reduce their effectiveness if not regularly maintained. The Urban Living Lab Centre by UN-Habitat offers teaching material on sustainable mobility for university lecturers with a focus on Asia, Africa and Latin America, drawing from EU-funded projects such as SOLUTIONSplus.

- **Massive Open Online Courses (MooCs)**

Platforms like EIT Urban Mobility, Mobility Academy, Civitas Learn Centre, Coursera, and more.. deliver structured courses across diverse topics, from transportation engineering to urban mobility. MooCs are accessible and scalable, offering flexibility for learners to progress at their own pace. While affordability and global reach are significant advantages, the lack of personalized feedback and the self-paced format can reduce completion rates and limit deeper engagement.

- **Short Videos and Podcasts**

Social media Platforms like LinkedIn, YouTube and Spotify provide bite-sized, engaging content that introduces learners to new ideas or fields of study. These formats are particularly effective for capturing public interest and encouraging initial exploration of complex topics. However, their brevity often limits the depth of knowledge conveyed, and they typically lack pathways for advanced learning or critical thinking.

The appeal of self-learning and knowledge-sharing platforms lies in their accessibility and inclusivity. Learners can access content at their own pace, overcoming barriers of location, cost, and scheduling. These platforms are particularly effective in attracting individuals who may not have the time or resources to engage in formal education, while also providing professionals with targeted resources for continuous development. However, their self-directed nature comes with challenges. The lack of interactivity limits opportunities for active discussion, debate, and real-time feedback—critical components of more immersive educational experiences. Additionally, while automated tools like quizzes or simulations provide some degree of engagement, they cannot replace the nuanced guidance of a mentor or expert.

Concluding this section, self-learning and knowledge-sharing platforms are indispensable in modern education and training systems, especially for their ability to reach new audiences and provide flexible learning opportunities. Their greatest strength lies in democratizing access to knowledge, but their non-interactive nature highlights the importance of integrating these platforms with more hands-on, collaborative methods for a comprehensive learning experience.

Boxes 6: Case Study: The Mobility Academy by Rupprecht Consult

Case Study: The Mobility Academy by Rupprecht Consult

The Mobility Academy, developed by Rupprecht Consult, is a prime example of an interesting self-learning and knowledge-sharing platform in the field of sustainable urban mobility. This e-learning platform provides a range of courses tailored to both professionals and enthusiasts, covering topics such as public transport, intelligent transport systems, active mobility, integrated mobility planning, electric mobility, and more. Designed to be accessible and flexible, the courses offer valuable insights into specific aspects of these topics, encouraging learners to explore best practices and innovative solutions in urban mobility.

The Academy's emphasis on practical implementation enhances its appeal. For instance, the course "Co-creating Sustainable Mobility at the Neighbourhood Level" guides participants through real-world processes, including the co-identification of problems, co-development of solutions, and co-implementation phases. Real-world examples from cities such as Bremen and Lisbon enrich the learning experience by demonstrating how theoretical concepts translate into tangible outcomes.

A notable feature of the Mobility Academy is its language accessibility. Most courses are offered in English, making them broadly accessible to an international audience. Additionally, some courses are available in Spanish, catering to specific regions and language groups. However, due to resource limitations, not all regions or languages are adequately covered, reflecting the inherent challenges of scaling such platforms to meet diverse global needs. Many courses on the platform are linked to specific projects that fund these capacity-building initiatives. For example, topics often align with project objectives and the regions those projects are focused on, which can leave certain regions or themes underrepresented. While the Academy excels in providing specialized knowledge to its audience, gaps in regional and thematic coverage remain a challenge due to the limited resources allocated to this type of training and education.

By integrating theoretical content with practical, real-world applications, the Mobility Academy highlights the strengths of self-learning and knowledge-sharing platforms. It showcases how such platforms can drive capacity building in sustainable urban mobility, despite the challenges posed by resource constraints and limited linguistic diversity.

Key takeaways

- **Accessible and flexible learning:** The e-learning format allows professionals and enthusiasts to engage with sustainable urban mobility topics at their own pace.
- **Practical implementation focus:** Courses emphasize real-world applications, guiding learners through co-creation processes and showcasing best practices from cities like Bremen and Lisbon.
- **Language and regional gaps:** While English and Spanish courses enhance accessibility, resource constraints limit broader linguistic and regional coverage.
- **Project-driven content:** Course offerings are often aligned with specific projects, which ensures relevance but may leave certain topics and regions underrepresented.
- **Scalable knowledge-sharing model:** Despite challenges, the platform demonstrates the potential of self-learning and digital training in advancing capacity-building efforts in urban mobility.

2.3 The Synergy of Education and Training in Shaping the Future of Road Transport

Concluding this chapter, Education and training activities are indispensable in addressing the evolving challenges of the road transport sector. The rapid pace of technological advancement, coupled with the global push toward sustainability, underscores the need for a well-equipped and adaptable workforce. The diverse education and training approaches explored in this chapter—academic education, training and capacity-building programmes, and self-learning and knowledge-sharing platforms—highlight the multifaceted nature of professional development in this sector.

These three clusters, while distinct, are deeply interconnected and complementary. Academic education provides foundational knowledge through traditional classroom settings, structured degree programmes, and academic conferences, instilling systematic problem-solving skills that are essential for addressing complex, interdisciplinary challenges. Training and capacity-building programmes, on the other hand, offer interactive and practical learning experiences through workshops, seminars, study tours, and mentorship programmes, bridging the gap between theory and real-world applications. Meanwhile, self-learning and knowledge-sharing platforms democratize access to knowledge through MooCs, e-libraries, podcasts, and video tutorials, offering flexible and scalable solutions that cater to a wide range of learners and professionals.

Boxes 7: Case Study: The Urban Living Lab Centre (ULLC)

Case Study: The Urban Living Lab Centre (ULLC)

Bridging Research, Practice, and Education for Sustainable Urban Development

The **Urban Living Lab Centre (ULLC)**, a UN-Habitat Collaborating Centre co-hosted by the Wuppertal Institute MIT, TU Berlin and regional partner universities, serves as a global hub for advancing urban transformations. Through its network of **20+ active Living Labs across Asia, Africa, Europe, and Latin America**, the ULLC integrates academic, policy, and practical domains to address pressing urban challenges like decarbonization, mobility, and climate resilience.

Joint Training Repository and Curricula Co-Development

The ULLC has created a comprehensive **training repository** that includes:

- **Train-the-lecturer programmes** equipping educators with tools to deliver up-to-date and practical knowledge on urban planning, e-mobility, and sustainability.
- **Online courses**, such as MIT's e-learning modules, focusing for example on climate-action and mobility transitions.
- Joint development of **master's and PhD curricula** in collaboration with partner universities, addressing thematic areas like urban energy, mobility, resources, and digitalization.
- **Capacity Building and Peer Learning**

- The ULLC offers structured programmes for policymakers, local authorities, and entrepreneurs:
- **Regional training hubs** provide localized workshops on urban mobility and decarbonization strategies.
- **Peer-exchange initiatives**, connecting cities within its Living Lab network, facilitating knowledge-sharing sessions globally.
- Practical integration of **Living Lab findings** into teaching content and projects, ensuring direct application of theoretical knowledge.

Linking Training, Research and Innovation
The ULLC partners actively engage in co-supervising **Master's theses, and PhD projects**, and hosting **visiting researchers**, which aims to link applied research with academic assignments allowing students to be actively involved.
Academic institutions can join the global ULLC network and co-design solutions with cities and private sector partners and foster local capacities for the mobility transition. More information can be found here: https://www.living-lab.Centre.

Key takeaways

- **Holistic integration of research, practice, and education:** ULLC effectively bridges academia, policy, and practical applications to tackle urban challenges like mobility and decarbonization.
- **Comprehensive training approach:** The Centre offers diverse learning formats, including train-the-lecturer programs, online courses, and co-developed master's and PhD curricula, ensuring up-to-date and applied knowledge dissemination.
- **Capacity building through localized and peer learning:** Regional training hubs and global peer-exchange initiatives foster collaboration, enabling cities to share best practices and develop localized solutions.
- **Living labs as practical learning environments**: Findings from Living Labs are integrated into educational programs and projects, ensuring real-world application of theoretical knowledge.
- **Strong research and innovation linkages:** Co-supervision of graduate research and collaboration with academic and private sector partners create opportunities for applied research and real-world impact.

This combination of educational approaches ensures that the unique needs of various stakeholders in the road transport ecosystem—academia, public authorities, private industry, and civil society—are met effectively. Contemporary methods such as e-learning and virtual reality-based simulations complement more traditional techniques, enabling both broad accessibility and deeper specialization. Diversifying training and education methods not only enhances the quality of learning but also addresses the regional and contextual disparities that often hinder workforce development. For cities and organizations, tailoring education and training programmes to local gaps and needs is critical for achieving sustainable and inclusive progress.

In conclusion, education and training are the cornerstones of innovation and resilience in the road transport sector. By fostering collaboration across the three clusters and leveraging a

blend of modern technologies and traditional methods, stakeholders can build a dynamic and skilled workforce equipped to tackle the challenges of the future. However, sustained investment and commitment are required to ensure that education and training systems remain inclusive, responsive, and aligned with the sector's evolving demands. This holistic approach will be pivotal in driving sustainable mobility solutions and supporting the global transition toward a greener, more connected future.

3 Stakeholders Shaping Road Transport: Their Roles and Training Needs

The road transport sector is shaped by a diverse array of stakeholders, each playing a pivotal role in its development, innovation, and sustainability. These stakeholders can be grouped into distinct clusters—academia, public authorities, private industry, NGOs, and research consultancies—each contributing uniquely to advancing the sector. Academia fosters the next generation of experts and conducts vital research, while public authorities develop policies and regulations, and implement strategies to ensure efficient and sustainable transport systems. Private industry drives innovation through technology and service development, NGOs advocate for equitable and sustainable practices, and research consultancies provide data-driven insights and policy recommendations.

This chapter delves into the status, challenges, and needs of these key stakeholder clusters about education and training programmes within the road transport sector. By understanding their specific roles and perspectives, we can better identify gaps and opportunities in capacity-building efforts.

A comprehensive survey was conducted between July and October 2024, reaching stakeholders through social media, LinkedIn, and targeted mailing lists. Designed to capture diverse perspectives on road transport training, the survey was distributed both within the STREnGth_M Consortium, leveraging the expertise of partners from academia, industry, research, and policy, and beyond, engaging external organizations and professionals in the sector. In total, 54 organisations participated in the survey. A list of the organisations that participated in the survey per sector can be found in the Annex. The map below shows the geographical distribution of the survey participants' operational regions[8].

[8] Survey Limitations: This survey targeted stakeholders in the road transport sector globally and was distributed through social media channels and professional networks, reaching an estimated 3,000 individuals. The survey remained open for three months. Given the project's time and budget constraints, this approach represented the maximum feasible outreach. However, the resulting sample, outside Europe, may not be fully representative of the international sector of each continent, as participation was voluntary and subject to the availability and willingness of the contacted organizations. Future research could build on this effort by employing more targeted methods such as dedicated workshops, interviews, or focus groups to achieve broader and more balanced participation in underrepresented regions.

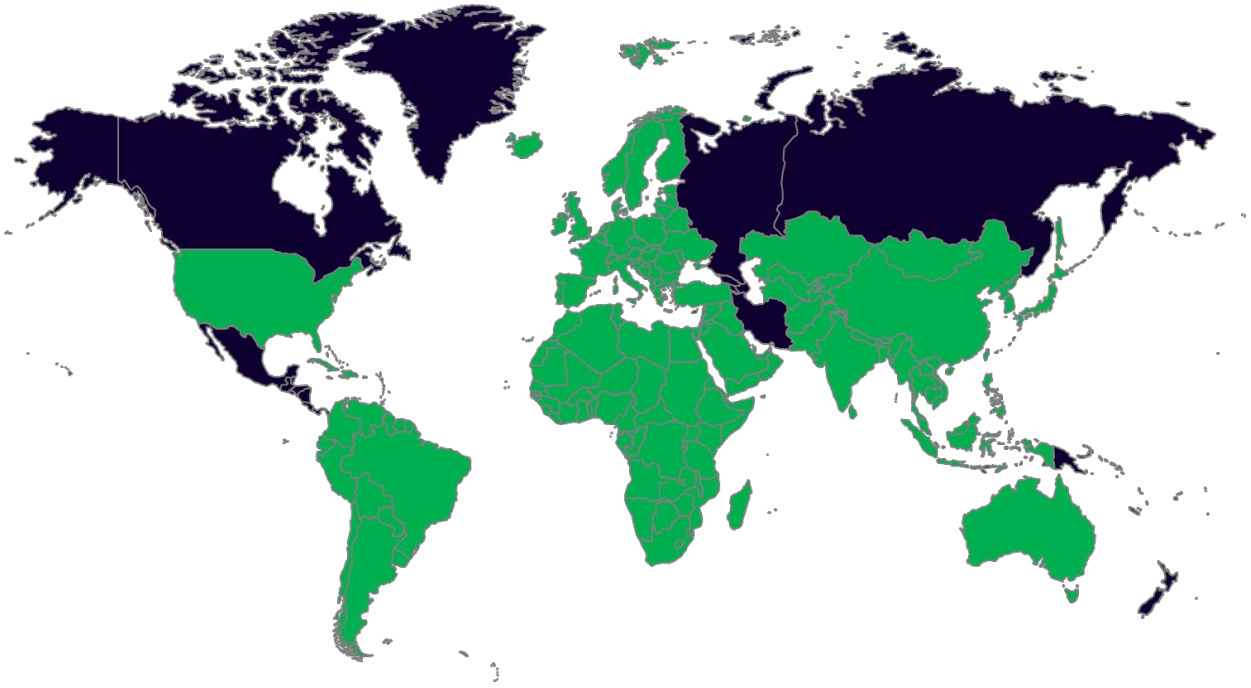


Figure 4: Geographical distribution of the survey participants' operational regions (in Green)

To further enrich and validate the findings, six follow-up interviews were conducted with select stakeholders, each with different operational scopes, providing deeper qualitative insights into regional, sectoral, and thematic contexts. To expand the contributions beyond the initial interviews, the output of this deliverable was shared with MG members and STREnGth_M partners, offering the opportunity to add insights, elaborate on certain aspects, or fill any missing gaps. This combined approach ensured a well-rounded understanding of training needs and challenges in the road transport sector.

In addition, this chapter integrates insights from relevant literature and practical experiences in SUMP projects and research initiatives across Europe and internationally. By combining these sources, it offers an overview of the training and education needs of stakeholders, forming the foundation for targeted interventions and capacity-building strategies in the road transport sector.

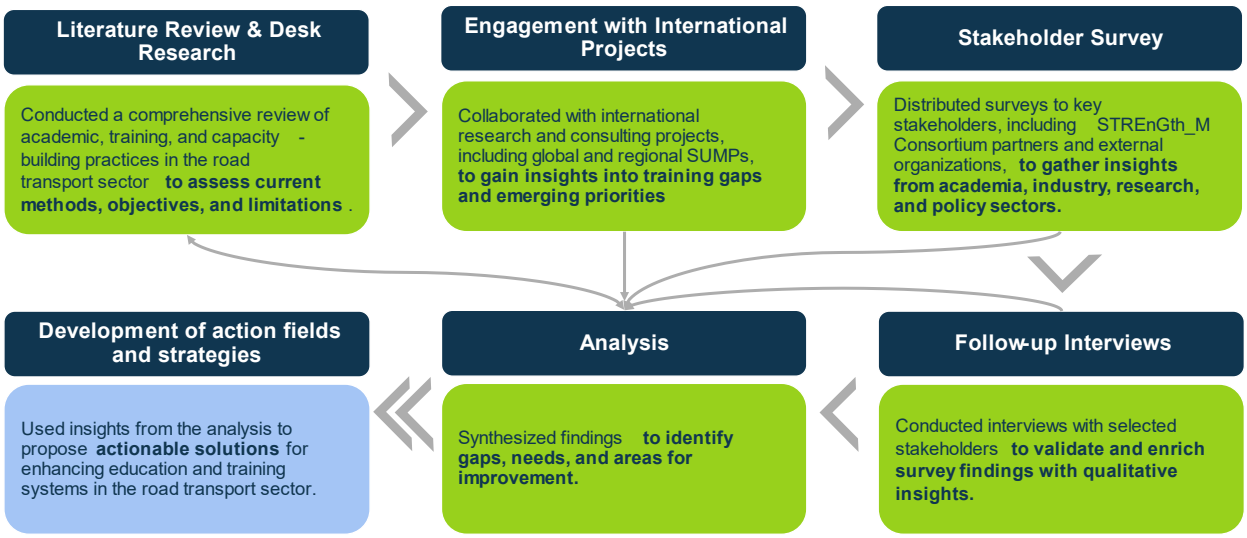


Figure 5: Methodology

3.1 Academia

Academic institutions play a fundamental role in the development of knowledge and expertise in the road transport sector. Addressing their specific training needs is crucial for preparing future professionals to tackle the challenges of an evolving transport landscape. This section provides a comprehensive overview of the areas where academic institutions are actively working, the challenges they face, and the support needed to advance their goals in the road transport domain.

The Role of Academia: Bridging Research and Practice

Academic institutions play a pivotal role in advancing the sector through research and education. Universities, technical colleges, and research Centres provide foundational and specialized knowledge across disciplines, including engineering, environmental sciences, and policy studies. Programmes increasingly integrate cutting-edge subjects such as vehicle electrification, autonomous technologies, and sustainable mobility strategies.

However, academia often faces the challenge of bridging theoretical research with practical industry needs. Collaborative programmes with public authorities and private sector players can address this gap, ensuring that academic curricula reflect real-world challenges and solutions.

Academic Institutions' Strategic Focus and Work Topics in the Road Transport Field

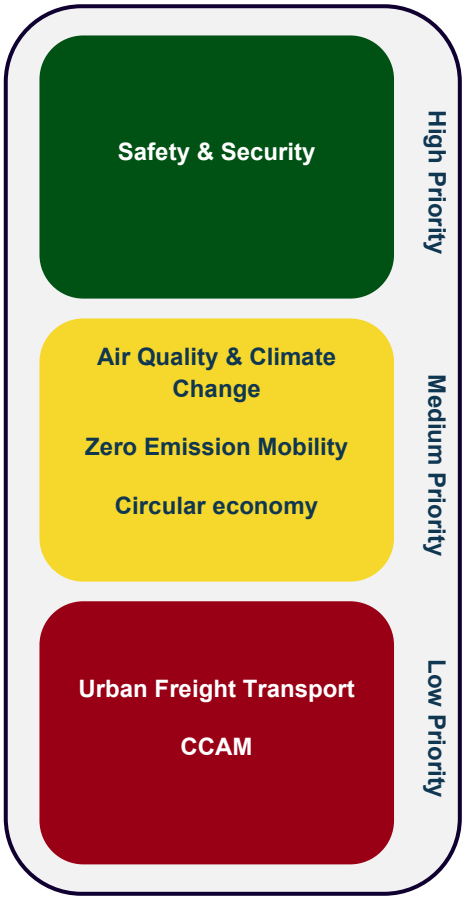
In the road transport sector, academic institutions are intensively engaged in several key strategic areas that reflect their top priorities. They are dedicated to enhancing **road safety** through better design and management practices aimed at developing safer transport systems. The

environmental impacts of transport are also a primary concern, with efforts concentrated on reducing the sector's environmental footprint through innovative practices. Additionally, a significant area of focus is **vehicle technology and maintenance**, where institutions keep pace with advancements in vehicle technologies and maintenance practices to ensure cutting-edge knowledge and application.

Incorporation of Priority Topics

When examining how academic institutions incorporate the main priority topics into their initiatives and curriculum, it is evident that the level of integration and focus varies, reflecting differences in strategic focus but also highlighting areas for improvement and further development:

- **Air Quality and Climate Change**: Moderately incorporated, focusing on greenhouse gas emissions, renewable energy integration, and climate change mitigation strategies.
- **Road Transport Safety and Security**: Highly integrated, covering essential aspects such as traffic safety and ensuring passenger security.
- **Zero Emission Mobility**: Moderately incorporated, featuring topics such as electric vehicle technology and active mobility solutions.
- **Urban Freight Transport**: Low incorporation, addressing challenges in last-mile delivery solutions, sustainable freight practices, and logistics management.
- **Circular Economy and Business Models**: Moderately incorporated, focusing on lifecycle assessment and sustainable product design.
- **Connected Cooperative Automated Mobility (CCAM)**: Low integration, however focusing on human factors, connectivity, and autonomous vehicle technology.



The topics considered most relevant by academic institutions in shaping the future of digitized, electrified, and sustainable road transport systems, which should therefore be emphasized in academic training and research, include:

- **Air Quality and Climate Change**: This area is critical because it directly impacts public health and the environment, aligning with global sustainability and climate action targets. Academic research and education can drive innovation in emission reduction technologies and develop new methodologies for integrating renewable energy solutions into the transport sector.

- **Mobility Safety & Security**: Essential for ensuring the safety of all transport system users, this area requires focused academic inquiry into traffic safety management, the design of safer road infrastructures, and the development of technologies to enhance passenger security. Preparing students and professionals to tackle these challenges is crucial for reducing road-related incidents.
- **Circular Economy**: Increasingly important for promoting resource efficiency and waste reduction within the transport sector. Academic institutions are uniquely positioned to lead research on lifecycle assessment and sustainable product design, integrating these concepts into curricula to prepare students for future challenges in sustainable transport.

Challenges and Support Needs in Training for Academic Institutions

Academic institutions face several challenges that impact the effectiveness of their training and overall mission in the road transport sector:

- **Rapidly changing technologies and trends**: Necessitating constant curriculum updates.
- **Insufficient/outdated content**: Often there is a lag in integrating the latest industry developments into educational content.
- **Insufficient collaboration between key stakeholders**: Enhanced collaboration among universities, industry, and government is needed to ensure that education aligns with real-world needs.

Gaps and support needs

- **Partnerships with industry for practical insights**: Crucial for bridging the gap between theoretical knowledge and practical application.
- **Collaboration opportunities with other academic institutions**: Necessary to share knowledge, resources, and best practices.
- **Increased funding for research and development**: Essential for advancing research and developing new technologies.
- **Government or policy support and collaboration**: Needed to align educational programmes with policy developments.

3.2 Public Authorities & Municipalities

Public authorities are essential in shaping the future of road transport through strategic planning and the implementation of progressive transport policies. They do this by designing frameworks that align with sustainability goals, overseeing infrastructure development, and regulating technological adoption to ensure sustainable, resilient, and efficient transport systems. It is crucial to address the specific training needs of public authorities to enhance their capacity to manage and innovate within the rapidly evolving transport sector. Training typically targets professionals in areas such as policy analysts, urban planners, regulatory officers, and transport managers, equipping them with skills in data-driven decision-making, policy development, and advanced transport technologies. This section provides a comprehensive

overview of their strategic focus areas, challenges, the gaps and the support required to advance their objectives in road transport.

The Role of Public Authorities: Shaping Sustainable and Safe Transport Systems

Public authorities, including government ministries, municipal planners, and transport agencies, are at the forefront of implementing policies and infrastructure that shape mobility systems. These stakeholders need the knowledge to address dynamic challenges, such as creating low-emission zones, enhancing public transport systems, and improving road safety.

Equipping public officials with the tools to navigate complex regulatory environments, environmental management, data-driven decision-making, and engaging with the public is crucial for aligning policy initiatives with sustainable mobility goals.

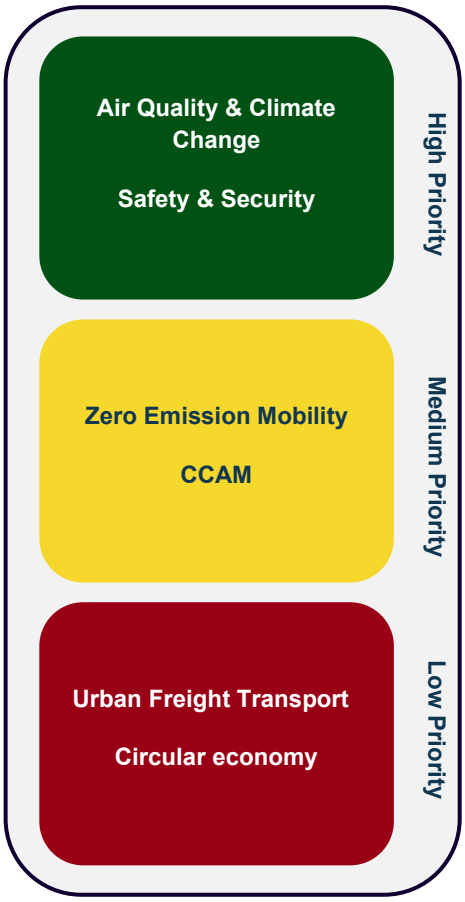
Public Authorities' Strategic Focus and Work Topics in the Road Transport Field

In the road transport sector, public authorities are intensely focused on several key strategic areas that reflect their core responsibilities and current expertise. **Mobility Planning** is a primary focus, with public authorities working to develop sustainable transport systems that minimize congestion and reduce environmental impact. **Traffic Engineering** represents another critical area, involving the design and management of roadways and traffic control devices to optimize traffic flow and safety. **Intelligent Transport Systems (ITS)** are also a priority, with efforts directed toward leveraging technology to enhance traffic management and information systems. Finally, **Road Safety** remains a central concern, with dedicated initiatives aimed at keeping citizens safe and reducing accidents and fatalities.

Incorporation of Priority Topics

When examining how public authorities incorporate priority topics into their policies and projects, the level of focus and integration varies, highlighting their current priorities and areas for growth:

- **Air Quality and Climate Change**: Highly emphasized, with strategies focused on integrating renewable energy sources into transport systems and reducing greenhouse gas emissions.
- **Road Transport Safety And Security**: Demonstrates high engagement, including comprehensive emergency response protocols and traffic safety measures to minimize road accidents and enhance passenger security.
- **Urban Zero Emission Mobility**: Receives an average level of incorporation, focusing on policy frameworks that support zero-emission vehicles and environmentally friendly public transport systems.



- **Urban Freight Transport**: Shows a lower level of strategic incorporation, addressing the planning of infrastructure to support efficient and sustainable freight movement, particularly in urban areas.
- **Circular Economy and Business Models**: Incorporated at a very low level, indicating an emerging focus where resource recovery and recycling are beginning to be considered within the lifecycle assessment of transport systems and vehicles.
- **Connected Cooperative Automated Mobility (CCAM)**: Moderately incorporated, focusing on ensuring automated systems are safe and account for human factors, integrating these technologies to enhance safety and efficiency.

This strategic integration highlights public authorities' commitment to addressing contemporary challenges in road transport. By educationally focusing on these topics, public sector employees can be better equipped to implement these strategies effectively and sustainably.

The topics considered most relevant by public authorities in shaping the future of road transport systems, which should therefore be emphasized in their training and professional development programmes, include:

- **Air Quality and Climate Change**: A critical area for public authorities, aligning with global environmental goals and addressing the impact of transport on public health. Training in this area helps develop effective policies for reducing emissions and integrating renewable energy into transport systems.
- **Mobility Safety and Security**: Central to the role of public authorities, ensuring the safety of all road users through effective traffic safety initiatives, passenger security measures, and emergency response planning.
- **Circular Economy**: Increasingly important as public authorities work to integrate sustainable resource management, lifecycle assessments, and recycling strategies into transport systems.

Challenges in Training for Public Authorities

Public authorities face several challenges that impact the effectiveness of their training and skills development initiatives:

- **Rapidly changing technologies and trends**: Continuous adaptation is necessary to keep up with technological advancements in transport systems.
- **Outdated content**: Training materials often lag behind the latest industry developments.
- **Lack of professionals and funding**: There is a pressing need for more skilled professionals and increased financial resources to support training and development.

Gaps and support needs

- **Practical insights and case studies**: Collaborations with industry leaders to provide staff with real-world applications and enhance the practical relevance of training programmes.

- **Professional development and continuous training**: Ongoing professional development programmes to equip staff with the skills required to manage and adapt to innovations in the transport sector.
- **Enhanced training facilities and resources**: Investing in state-of-the-art training infrastructure, such as simulation labs and interactive learning environments, to improve programme effectiveness.
- **Interdisciplinary training approaches**: Incorporating elements of engineering, environmental science, urban planning, and sociology into training to provide more comprehensive solutions.
- **Increased funding for training and development**: Necessary for exploring new technologies and methodologies, pilot projects, and implementing innovations.

3.3 International Organizations & Research Consultancies

International organizations and research consultancies are critical in shaping policies and innovations in the road transport sector. Addressing their unique training needs is essential for enhancing their ability to navigate rapidly changing technologies and complex regulatory environments effectively. This section provides a comprehensive overview of the areas where these entities are actively working, the challenges they face, the gaps and the support needed to advance their goals in the road transport domain.

The Role of International Organizations and Consultancies: Global Perspectives and Expertise

International organizations and consultancies are instrumental in setting global standards, providing policy recommendations, and fostering cross-border collaboration. These entities often identify emerging trends and challenges, such as achieving net-zero emissions or advancing road safety, which inform the training needs of transport professionals worldwide.

Consulting services in road transport increasingly recognize the demand for training in key areas such as data analysis and management, digital and technical skills, and cross-disciplinary knowledge combined with systems thinking. To address these needs, international organizations and research consultancies employ a diverse range of educational formats to update skills and disseminate knowledge effectively into their projects.

By fostering international collaboration, these organizations help disseminate best practices and harmonize training programmes across borders, ensuring a unified approach to global challenges.

International Organizations and Research Consultancies' Strategic Focus and Work Topics in the Road Transport Field

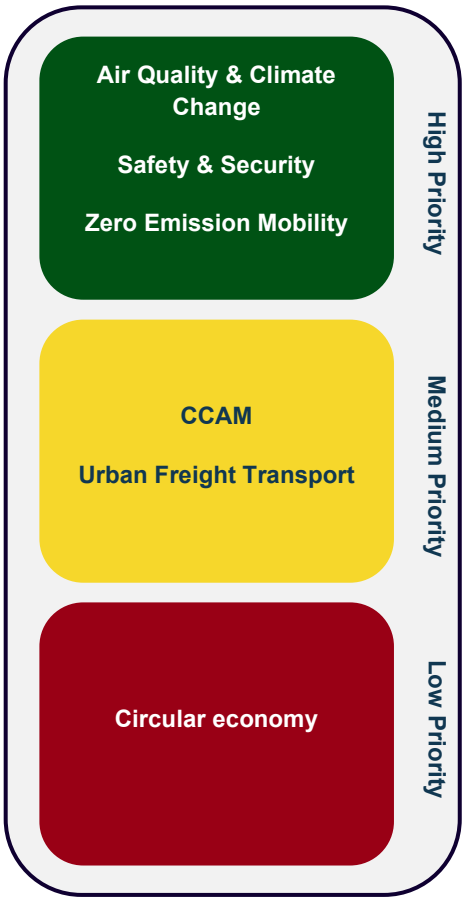
In the road transport sector, international organizations and research consultancies are intensely focused on several key strategic areas. They aim to reduce the environmental footprint of transport systems through sustainable practices, a primary focus under their **Environmental Impacts of Transport** initiatives. **Urban Mobility Planning** is another critical area, with efforts focused on developing strategies to enhance urban transport efficiency and sustainability.

Additionally, leveraging technology to improve traffic management and safety is a significant focus within their work on **Intelligent Transport Systems (ITS)** and Traffic Engineering.

Incorporation of Priority Topics

When examining how international organizations and research consultancies incorporate the main priority topics into their projects, it is evident that the level of integration and focus varies, reflecting differences in strategic focus but also highlighting areas for improvement and further development:

- **Air Quality and Climate Change**: Highly incorporated, focusing on strategies to reduce greenhouse gas emissions, integrate renewable energy, and implement climate change mitigation strategies.
- **Road Transport Safety & Security**: Well incorporated, with projects aimed at improving traffic safety and enhancing passenger security.
- **Zero Emission Mobility**: Highly incorporated, emphasizing urban planning for zero emissions, enhancing public transport systems, and advancing electric vehicle technology.
- **Urban Freight**: Moderately incorporated, addressing infrastructure planning, sustainable freight practices, and last-mile delivery solutions.
- **Circular Economy**: Low incorporation but includes significant aspects like lifecycle assessment and sustainable product design.
- **Connected Cooperative Automated Mobility (CCAM)**: Increasingly incorporated, focusing on connectivity and data exchange, ethical and regulatory considerations, and safety related to human factors.



The topics considered most relevant by these entities in shaping the future of digitized, electrified, and sustainable road transport systems, which should therefore be emphasized in their strategic planning and research, include:

- **Air Quality and Climate Change**: This topic is of paramount importance due to its significant impact on global health and environmental policies. International organizations and research consultancies play a crucial role in developing and advocating for strategies that reduce greenhouse gas emissions and promote renewable energy integration.
- **Zero Emission Mobility**: Essential for advancing sustainable urban development, this topic aligns with global initiatives to reduce urban pollution and carbon footprints.

Training in this area helps ensure that their teams are equipped to lead and support the transition to sustainable mobility solutions.

- **Urban Freight**: With the increasing focus on urbanization and the logistics efficiency required in dense urban settings, this topic is crucial for optimizing supply chains and reducing logistical bottlenecks.

Challenges in Training for International Organizations and Research Consultancies

These entities identify several challenges that impact the effectiveness of their training and overall mission in the road transport sector:

- **Rapidly changing technologies and trends**: Necessitating continuous learning and adaptation.
- **Insufficient/outdated content**: Often there is a lag in integrating the latest industry developments into training programmes.
- **Insufficient collaboration between key stakeholders**: Enhanced collaboration among different sectors is crucial.

Gaps and support needs

- **Increased funding for research and development**: Crucial for advancing technological and methodological innovations.
- **Government or policy support and collaboration**: Necessary to ensure that project outcomes align with regulatory requirements and can influence policymaking.
- **Professional development and training for staff**: Essential for maintaining expertise in the latest transport technologies and strategies.
- **Support for interdisciplinary approaches**: Encourages a holistic view that integrates various disciplines to enhance the effectiveness and sustainability of transport solutions.

3.4 Road Transport & Automotive Industry

Players in the road transport and automotive industry face a rapidly evolving landscape, influenced by technological advances, regulatory changes and vast expenses. Addressing their specific training needs is crucial for maintaining global competitiveness and fostering innovation capabilities in this dynamic sector. This section examines their training needs, strategic focus areas, and the integration of expertise to prepare them for future challenges and opportunities.

The Role of Industry Players: Driving Innovation

The automotive and transport industries are leading innovation in areas such as connected vehicles, autonomous systems, and clean energy solutions. Industry-led training initiatives often emphasize technical skills in areas like artificial intelligence (AI), robotics, and cybersecurity, alongside compliance with evolving regulations.

Transport companies, as key players in the logistics sector, must adapt to the needs and expectations of their customers, including **retailers**. Retailers, in turn, significantly influence transport practices. When selecting transport partners, retailers must prioritize sustainability goals, emphasizing the importance of **partnering for emission-free transport solutions**. By working together with transport providers on sustainable logistics strategies, retailers can drive the adoption of cleaner, more efficient transport practices, ultimately contributing to broader environmental objectives.

These stakeholders also foster collaboration through apprenticeships, on-the-job training programmes, and partnerships with academia. The industry's drive for innovation has led to rapid advancements, but it also underscores the need for a workforce capable of adapting quickly to new technologies. Aligning workforce development strategies with technological advancements ensures the sector is ready for future challenges.

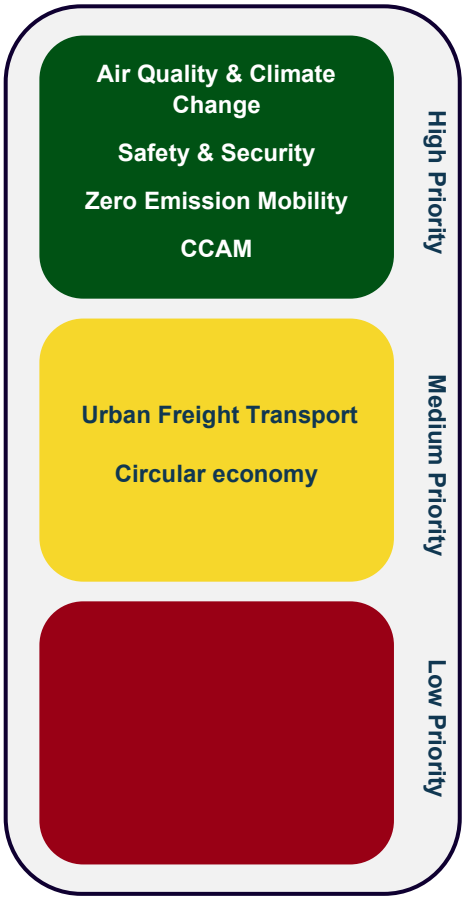
Road Transport and Automotive Industry Players' Strategic Focus and Work Topics in the Road Transport Field

In the road transport sector, industry players are intensely focused on several key strategic areas that reflect their top priorities. **Environmental impacts of transport** are a major concern, with efforts aimed at reducing the sector's environmental footprint through sustainable practices. They also emphasize **vehicle technology and maintenance**, focusing on the development and maintenance of advanced vehicle technologies that enhance performance and safety. Additionally, **Intelligent Transport Systems (ITS)** is a critical area of focus, where systems are implemented to improve vehicle connectivity and traffic management.

Incorporation of Priority Topics

When examining how industry players incorporate the main priority topics into their strategies, projects, and products, it is evident that the level of integration and focus varies, reflecting differences in strategic priorities but also highlighting areas for further development:

- **Air Quality and Climate Change**: Climate change is highly incorporated, with a focus on reducing greenhouse gas emissions and integrating renewable energy solutions. However, air quality receives comparatively less attention.
- **Road Transport Safety and Security**: Highly incorporated, with a focus on cybersecurity in transport systems, enhancing traffic safety, and ensuring passenger security.
- **Zero Emission Mobility**: Highly integrated, with initiatives centred around electric vehicle technology, urban planning for zero emissions, and developing supportive policy frameworks.



- **Urban Freight**: Moderately incorporated, addressing logistics and supply chain management, last-mile delivery solutions, and sustainable freight practices.
- **Circular Economy**: Moderately incorporated, focusing on lifecycle assessment, resource recovery and recycling, and sustainable product design.
- **Connected Cooperative Automated Mobility (CCAM)**: Highly incorporated, with a focus on autonomous vehicle technology, connectivity and data exchange, and considerations of human factors and ethical regulations.

The topics considered most relevant by industry players in shaping the future of road transport systems, and therefore requiring increased focus in training and development, include:

- **Air Quality and Climate Change**: This topic is critical for ensuring compliance with global environmental regulations and promoting sustainability. Industry players must lead advancements in emission reduction technologies and renewable energy integration to meet these goals.
- **Zero Emission Mobility**: As a core area of focus, this topic aligns with the industry's shift toward electric and hydrogen-powered vehicles. Training is essential to equip teams with the expertise needed for the development and deployment of zero-emission vehicles and infrastructure.
- **Mobility Safety and Security**: Ensuring the safety and security of transport systems remains a top priority. This includes advancing cybersecurity measures for connected vehicles, improving traffic safety, and enhancing passenger security through robust systems and practices.

Challenges in Training for Road Transport and Automotive Industry Players

Industry players face several challenges that impact their training and operational effectiveness:

- **Rapidly changing technologies & trends**: Continuous adaptation and learning are required to keep pace with advancements in the sector.
- **Insufficient collaboration between key stakeholders**: Enhanced collaboration with academia, government, and other industry partners is needed to align goals and pool resources effectively.
- **Lack of funding**: Limited financial resources can restrict the ability to invest in new technologies and training programmes.

Gaps and support needs

- **Professional development and training for staff**: Essential for staying current with the latest technologies, methodologies, and industry practices.
- **Increased funding for research and development**: Crucial for pioneering new technologies and methodologies in the transport sector.
- **Support for interdisciplinary approaches**: Encourages a holistic view that integrates various disciplines to foster innovation and problem-solving.

- **Government or policy support and collaboration**: Necessary to align industry developments with regulatory standards and policy objectives.

3.5 NGOs and Advocacy Groups

NGOs and advocacy groups engaged in road transport face unique challenges and opportunities as they strive to develop sustainable and efficient transport solutions. They play a crucial role in transforming the road transport sector towards more sustainable and innovative practices. By addressing their training needs and leveraging collaborations, NGOs and advocacy groups can enhance their impact and effectiveness in promoting safer, cleaner, and more efficient transport solutions. This section provides a comprehensive overview of the areas where they are actively working, the challenges they face, the gaps and support needed to advance their goals in the road transport domain.

The Role of NGOs and Non-Profit Organizations: Promoting Equity and Sustainability in Transport

NGOs and advocacy groups, bring a grassroots perspective to the road transport sector. These stakeholders advocate for inclusive, equitable, and sustainable mobility systems, often focusing on vulnerable road users, public health, and environmental justice.

Their role in training includes raising awareness of social and environmental issues and providing targeted education for specific groups, such as community leaders, local planners, or advocacy networks. For the NGOs themselves, training needs are centred around equipping staff and local partners with the knowledge and skills necessary to effectively advocate for transport policies that prioritize accessibility, sustainability, and safety.

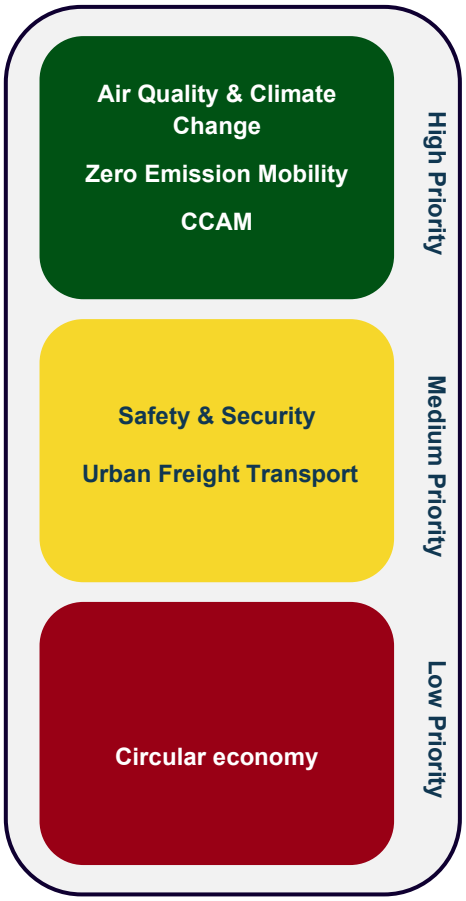
NGOs and Advocacy Groups' Strategic Focus and Work Topics in the Road Transport Field

In the road transport sector, NGOs and advocacy groups are intensely engaged in several key strategic areas that reflect their top priorities. **Urban Mobility Planning** is a primary focus, with these organizations dedicated to enhancing urban transport systems to improve safety, efficiency, and sustainability. A strong emphasis is also placed on the **Environmental Impact of Transport**, aiming to reduce the sector's environmental footprint through the adoption of innovative practices. Additionally, **Intelligent Transport Systems (ITS)** represent a significant area of focus, where cutting-edge, technology-driven solutions are implemented to improve traffic management and system efficiency.

Incorporation of Priority Topics

When examining how NGOs and advocacy groups incorporate the main priority topics into their initiatives and work, it is evident that the level of integration and focus varies, reflecting differences in strategic focus but also highlighting areas for improvement and further development:

- **Air Quality and Climate Change**: Climate change aspects are highly incorporated, with a focus on reducing greenhouse gas emissions, integrating renewable energy, and implementing climate change mitigation strategies. However, air quality specifically sees lower incorporation.
- **Road Transport Safety and Security**: There is an average incorporation, with initiatives centred around enhancing traffic safety and ensuring passenger security.
- **Zero Emission Mobility**: Highly incorporated, with efforts focused on establishing robust policy frameworks, tailored urban planning for zero emissions, enhancing public transport systems, and promoting electric vehicle technology.
- **Urban Freight Transport**: There is an increased focus on integrating last-mile delivery solutions, sustainable freight practices, and infrastructure planning.



- **Circular Economy**: Low integration, but includes significant topics like lifecycle assessment, business model innovation, and resource recovery and recycling.
- **Connected Cooperative Automated Mobility (CCAM)**: Highly incorporated, focusing on human factors and safety, connectivity and data exchange, and addressing ethical and regulatory considerations.

The topics considered most relevant by NGOs and advocacy groups in shaping the future of digitized, electrified, and sustainable road transport systems, and hence requiring increased focus in training and development, include:

- **Air Quality and Climate Change**: This area is critical for aligning with global environmental targets and addressing public health concerns. Training in this topic helps NGOs and advocacy groups design and advocate for effective policies that reduce emissions and integrate renewable energy solutions into transport systems.
- **Mobility Safety & Security**: Essential for ensuring the safety of all transport users, this topic requires expertise in traffic safety initiatives, infrastructure planning, and passenger security strategies. Training in this area enables NGOs and advocacy groups to implement projects that reduce road-related incidents and enhance safety across transport networks.
- **Circular Economy**: Gaining importance due to its role in promoting resource efficiency and waste reduction, this topic provides NGOs and advocacy groups with opportunities

to lead initiatives on lifecycle assessment, sustainable product design, and resource recovery, ensuring long-term sustainability in transport systems.

Challenges in Training for NGOs and Advocacy Groups

NGOs and advocacy groups identify key challenges that impact the effectiveness of their training and overall mission in the road transport sector:

- **Insufficient/outdated content**: Training materials and educational content often do not keep pace with the rapid advancements in road transport technology and environmental regulations.
- **Insufficient collaboration between key stakeholders**: There is a need for more robust collaboration channels between NGOs, government agencies, industry, and academic institutions to enhance the effectiveness of transport initiatives.

Gaps and support needs

- **Government or policy support and collaboration**: Essential for aligning NGO initiatives with national and international policy frameworks.
- **Collaboration opportunities with academic institutions**: Needed to integrate cutting-edge research and theoretical advancements into practical applications.
- **Professional development and training for staff**: Critical to ensure that personnel are up-to-date with the latest technologies, methodologies, and regulatory requirements.
- **Increased funding for project implementation and R&D**: Vital for expanding their initiatives and exploring new innovations within the sector.

3.6 Summary of Challenges and Gaps Across Sectors as outlined in the Surveys and Interviews

Building upon the surveys and interviews conducted with a diverse set of stakeholders—academia, public authorities, international organizations/research bodies, industry players, and NGOs/advocacy groups—two key themes emerged: **(1) sector-specific challenges** that limit effective collaboration and progress, and **(2) gaps and support needs** that stakeholders prioritize to overcome these barriers. The findings are synthesized and illustrated in **Table 1** and **Table 2** below.

The first table highlights prominent obstacles faced by each sector. While some challenges are unique to a particular stakeholder group, others cut across multiple sectors. For example, **limited resources** and **regulatory complexities** are pressing concerns for public authorities and academia alike, whereas **market-driven constraints** and **scalability issues** are more characteristic of industry players. NGOs and advocacy groups often confront **funding uncertainties** and **sustaining grassroots engagement**, whereas international organizations typically face **coordination challenges** when harmonizing efforts across borders.

Overall, **Table 1** reflects the reality that each sector's capacity to innovate, collaborate, and implement initiatives is constrained by diverse yet interrelated difficulties. By recognizing where

challenges overlap, stakeholders can more effectively address shared pain points and pursue collaborative strategies.

Challenges	Academia	Public Authorities	International Orgs / Research	Industry Players	NGOs / Advocacy
Rapidly changing technologies/trends	□	□	□	□	
Outdated / insufficient content	□	□	□		□
Lack of collaboration between stakeholders	□		□	□	□
Lack of professionals / human capacity		□			
Lack of funding		□	□	□	□

Table 1: Reported Challenges across Sectors

The second table summarizes the critical gaps and support mechanisms required to overcome the challenges identified above. Stakeholder input revealed a consensus on the necessity of **enhanced collaboration**—such as partnerships between academia and industry, or strategic alliances involving NGOs, governments, and international organizations. Additionally, many respondents highlighted the importance of **continuous staff training**, **professional development opportunities**, and **robust policy/government support** to ensure long-term sustainability of projects and programs.

Other common needs include:

- **Increased R&D support** to generate new knowledge and technologies, particularly in academia and industry.
- **Interdisciplinary approaches** to tackle complex, cross-cutting issues more effectively.
- **Practical insights and real-world application** of research findings, underscoring the drive to make knowledge and innovations more actionable.

Through these tables, it becomes clear that while each sector faces distinct hurdles, opportunities for synergy also abound. The shared needs—especially in **collaboration**, **training**, **policy backing**, and **resource development**—highlight the potential for collective action to address pressing challenges and foster meaningful progress across all stakeholder groups.

Gaps and Support Needs	Academia	Public Authorities	International Orgs / Research	Industry Players	NGOs / Advocacy
Need for partnerships with industry	✓				
Need for collaboration with academia / peers	✓				✓
Need for policy/government support and alignment	✓	✓	✓	✓	✓
Need for continuous staff training / professional dev.		✓	✓	✓	✓
Need for enhanced training infrastructure/resources		✓			
Need for interdisciplinary approaches		✓	✓	✓	
Need for increased R&D support	✓	✓	✓	✓	✓
Need for practical insights / real-world application	✓	✓			

Table 2: Reported Gaps and Support Needs across Sectors

4 Advancing Road Transport Training in Europe & Internationally

The road transport sector plays a vital role in modern economies, facilitating trade, enabling mobility, and connecting communities. However, as global challenges like climate change, urban congestion, and technological disruptions intensify, the sector faces mounting pressure to evolve. This makes the need for a workforce with advanced skills, current knowledge, and a solid understanding of sustainability more urgent than ever.

To respond to these challenges, the road transport sector is undergoing rapid transformation driven by technological innovations, environmental considerations, and shifting societal needs. Training programs must reflect these changes, equipping professionals to address the demands of a more sustainable, efficient, and secure road transport system.

After examining the needs, challenges, priorities, and roles of key stakeholders in the road transport sector, six action fields were identified to enhance training both in Europe and internationally. These fields are central to shaping the future of road transport training and focus on the evolving needs of the sector.

The six action fields cover a range of priority topics, including Zero Emission Urban Mobility, Connected and Automated Mobility (CCAM), Freight Transport, Safety & Security, Circular Economy, Air Quality, and Climate Change. Each field presents a unique set of challenges and opportunities, necessitating targeted interventions through policy development, technological innovation, and collaborative initiatives. This chapter examines these action fields and discusses how training programs can address these critical needs, drawing on survey results, literature reviews, and insights from stakeholder discussions.

4.1 Towards Climate resilience & Cleaner air

Both the changes in our climate and the decline in the quality of our air are factors that significantly impact public health and environmental sustainability. The road transport sector, as a major contributor to air pollution and greenhouse gas and particle emissions, must play a central role in addressing these challenges.

Policies promoting cleaner fuels, emissions reduction technologies, and modal shifts to public and active transport are helping mitigate the sector's environmental impact. Innovative solutions, such as Carbon Capture, Utilization and Storage (CCUS) technologies and electric mobility, are also gaining prominence. CCUS can be integrated into facilities that manufacture transport fuels or into emissions-intensive vehicle production processes, capturing carbon before it enters the atmosphere. Electric mobility, including Electric Vehicles (EVs), and e-buses, is directly reducing tailpipe emissions and improving air quality in urban areas. Additionally, solutions such as hydrogen fuel cells for heavy-duty vehicles and retrofitting diesel engines with emissions-reduction technologies are being applied to achieve cleaner air standards.

However, disparities in policy enforcement, funding gaps, and resistance to behavioural change hinder progress. Continued investment in research, technology, and education is critical to building resilient, low-emission transport systems that align with global climate goals.

This topic is highlighted as crucial across all sectors, with an increasing need for training that equips professionals with the tools to address environmental sustainability in transport systems.

This survey revealed that air quality and climate change are considered top priorities for training, especially in the context of reducing greenhouse gas emissions and integrating renewable energy solutions. Public authorities emphasized the need for training programmes that focus on the implementation of climate policies, emission reduction strategies, and the transition to sustainable mobility. Industry players underscored the importance of understanding clean vehicle technologies, such as EVs, hydrogen fuel cells, and low-emission technologies, which are crucial for meeting regulatory standards and achieving carbon reduction goals.

Education and Training Needs:

- **Policy and regulation knowledge:** Training should address the implementation of international and local climate policies, emissions standards, and the development of green transport strategies.
- **Technological solutions for emissions reduction:** This includes knowledge of clean vehicle technologies, alternative fuels, and their impact on reducing air pollution.
- **Integration of renewable energy:** Training should focus on how renewable energy sources can be integrated into transport systems, especially in the context of electric mobility and smart grids.

4.2 Enhancing Road Transport Safety & Security

Safety and security remain fundamental priorities in the road transport sector. Reducing fatalities, injuries, and incidents on the road is essential to improving public trust and ensuring equitable access to mobility. Training in this domain must address both technical and behavioural factors, such as the design of safer road networks, traffic management systems, and public awareness campaigns. For example, programmes targeting urban planners can focus on implementing Vision Zero strategies, while those for fleet operators might emphasize driver behaviour monitoring and accident prevention technologies. Additionally, the rise of cybersecurity threats in connected vehicles highlights the need for specialized training in digital safety protocols. With the rise of new technologies such as connected and automated vehicles, it is essential that professionals are trained to manage and mitigate safety risks.

This survey indicated that road transport safety is of paramount importance to all stakeholders, with a strong emphasis on reducing accidents, enhancing infrastructure safety, and improving emergency response systems. Public authorities identified the need for training in traffic management systems and road safety policy, while industry players focused on the safety features of new vehicle technologies, including autonomous systems. NGOs highlighted the importance of equitable safety measures that ensure the protection of vulnerable road users, such as pedestrians and cyclists.

Education and Training Needs:

- **Traffic safety management:** Professionals need training on how to design and implement effective traffic safety systems, including road design, traffic control, and emergency response protocols.
- **Human-centred safety:** Training should include understanding human factors in transportation, focusing on how driver behaviour, road user interactions, and human-machine interfaces influence safety.
- **Technological innovations for safety:** As connected and autonomous vehicles become more prevalent, professionals must be trained to manage these technologies' implications for safety, including cybersecurity concerns.

4.3 Fostering Zero-Emission Urban Mobility

Zero Emission Urban Mobility represents the future of sustainable urban transport systems, driven by the urgent need to reduce greenhouse gas emissions and combat climate change. With urban areas contributing a significant share of global emissions, the transition to zero-emission modes such as electric vehicles (EVs), active mobility (cycling and walking), and efficient public transport is imperative. This shift also contributes to creating more viable cities by addressing not only emissions but also reducing traffic congestion and improving urban liveability.

The adoption of EVs is a cornerstone of Zero Emission Urban Mobility, supported by the expansion of charging infrastructure and incentives for vehicle manufacturers and consumers. Complementing this, active mobility initiatives are transforming urban areas into pedestrian- and cyclist-friendly spaces, reducing dependency on motorized vehicles.

Effective curb-side management and urban hubs also play a crucial role in optimizing the flow of people and goods in zero-emission urban mobility systems. These strategies ensure that limited urban space is efficiently utilized for loading zones, bike lanes, and pedestrian areas, enabling seamless integration of transport modes. Cities are also central to developing SUMPs and SULPs, which provide frameworks for integrating zero-emission mobility into urban freight and logistics systems.

Zero-emission mobility was identified as a top priority across all stakeholder groups. Industry players highlighted the need for training in the development, deployment, and maintenance of electric and hydrogen-powered vehicles. Public authorities emphasized the need for training in regulatory frameworks that support the deployment of ZEV infrastructure, including charging stations and refuelling networks. NGOs and research consultancies stressed the importance of addressing the social and economic impacts of this transition, ensuring that it benefits all demographics equitably.

Training Needs:

- **Technology knowledge:** Training programmes must focus on the technological aspects of electric vehicles, hydrogen fuel technologies, and their integration into the existing transport infrastructure.
- **Infrastructure development:** Professionals need training in the planning, installation, and maintenance of charging stations and other necessary infrastructure for ZEVs.

- **Policy development and implementation:** There is a need for comprehensive training in the policy development required to incentivize ZEV adoption, including subsidies, tax incentives, and regulatory frameworks for emissions reductions.

Boxes 8: Driving E-Mobility Through TVET Systems

Driving E-Mobility Through TVET Systems

The transition to e-mobility is reshaping transport systems globally, requiring a skilled workforce equipped to meet technological and operational demands. Technical and Vocational Education and Training (TVET) systems are crucial in building this workforce, especially in emerging economies where e-mobility aligns with broader development goals.

The e-mobility ecosystem demands specialized skills in areas such as **EV assembly and maintenance**, **charging infrastructure design**, and **integration with renewable energy systems**. Cross-sectoral knowledge, including cybersecurity for connected vehicles and data analytics for transport networks, is also increasingly vital (Lah, 2023). Despite growing demand, significant skill gaps exist. For instance, in South Africa, **84% of TVET institutions lack awareness of hybrid and electric vehicle technologies**, while nearly 90% of lecturers lack formal training (Lah, 2023).

Addressing these challenges requires **modernized curricula** that cover the full lifecycle of e-mobility systems, **innovative learning approaches** like simulations and augmented reality, and strengthened partnerships with industry stakeholders. Initiatives like “train-the-trainer” programmes can ensure educators are equipped with the latest technical and pedagogical skills (Urban Living Lab Centre, 2023).

TVET also presents an opportunity to promote inclusivity, offering non-formal education pathways to underrepresented groups and ensuring equitable access to green skills training. Aligning these efforts with national qualification frameworks and supporting them with policy incentives can scale training and address workforce demands for e-mobility.

4.4 Efficient and Sustainable Urban Freight

Freight transport is the backbone of economic activity, facilitating the movement of goods across cities, regions, and countries. However, with the growth of e-commerce and urbanization, the sector faces increasing pressure to reduce its environmental impact while maintaining efficiency, affordability and consumer-friendliness.

Technological advancements, such as digital logistics platforms and autonomous freight vehicles, are transforming the sector. Innovations in last-mile delivery, such as electric cargo bikes and drone technologies, are addressing urban freight challenges. Additionally, sustainable freight practices, including modal shifts from road to rail or water transport, are gaining traction. Encouraging local purchases to reduce unnecessary movement of goods also plays a vital role in minimizing the environmental footprint of freight operations. To fully capitalize on these changes and advancements, it is essential to ensure proper training and knowledge transfer, which are key to achieving efficient freight processes while minimizing environmental impact.

The survey revealed that although urban freight is a significant concern for cities, only a moderate number of public authorities and industry players have made it a key priority in their activities. Many respondents pointed out that urban freight is often overshadowed by more immediate concerns, such as road safety, emissions reductions, or passenger transport. Public authorities, while recognizing the need for improved urban freight solutions, reported challenges in integrating freight planning into broader urban mobility strategies. Similarly, NGOs and consultancies, while recognizing the importance of urban freight in the context of sustainability, tended to focus more on broader environmental issues and less on the specifics of urban logistics. Adapting delivery Service Level Agreements (SLAs) to enable greater consolidation of goods is another opportunity for improving freight efficiency. By adjusting expectations for delivery speed, companies can optimize logistics to reduce emissions and improve environmental outcomes.

Education and training needs:

Given the relatively low prioritization of urban freight by stakeholders, there is a pressing need for training that can elevate this topic to a more central position in urban transport planning. Key areas where training is needed include:

- **Integrated urban freight planning:** Training should focus on how to incorporate freight into urban mobility planning, ensuring that freight systems are coordinated with passenger transport to reduce congestion and emissions. A particular emphasis should be placed on long-distance logistics and urban freight systems to address the needs of diverse regions and operational contexts.
- **Last-mile delivery optimization:** With the rise of e-commerce, professionals must be equipped with the skills to design efficient last-mile delivery systems that minimize congestion and environmental impacts. This includes exploring the use of electric vehicles, cargo bikes, and micro-hubs while addressing the specific roles and responsibilities of shippers, authorities, and other stakeholders.
- **Sustainable logistics practices:** There is a need for training on sustainable logistics, covering topics like low-emission vehicle technologies, smart logistics systems, and alternative freight modes that align with environmental goals. Training should also explore the sustainable transformation of freight transport systems, emphasizing the deployment of greener solutions across both long-haul and urban delivery networks.
- **Data-driven decision-making:** Training should address the use of data analytics to optimize routes, predict demand, and improve the efficiency of urban freight systems while minimizing negative externalities such as air pollution and noise. This includes fostering a deeper understanding of the impacts of freight operations and how regulatory frameworks can drive sustainable practices.

4.5 Future of Road Transport - Automation & Beyond

Connected, Cooperative and Automated Mobility (CCAM) is revolutionizing the road transport sector by integrating connectivity and automation technologies. CCAM aims to improve safety, reduce congestion, and enhance the efficiency of transport systems through vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communication.

Despite its potential, CCAM encounters challenges such as cybersecurity risks, high implementation costs, and issues with public acceptance. A unified effort to educate stakeholders in the field is essential to overcome these obstacles, ensuring that key players are well-informed about the technology's benefits, addressing safety concerns, and fostering greater public trust and regulatory support for its integration.

CCAM was identified as a priority area by industry players, research consultancies, and public authorities, though integration into training programmes has been slower. The survey revealed that there is a need for greater focus on training in data management, cybersecurity, and the regulatory frameworks that support the deployment of automated vehicles. Industry players emphasized the need for technical expertise in developing and maintaining autonomous systems, while public authorities focused on ensuring that these systems are safely integrated into existing transport networks.

Education and Training Needs:

- **Data management and analysis:** Training should focus on the collection, analysis, and management of the vast amounts of data generated by connected vehicles and infrastructure.
- **Cybersecurity:** As vehicles and infrastructure become more connected, there is an urgent need for professionals trained in cybersecurity to protect transport systems from potential threats.
- **Regulatory and ethical considerations:** Training programmes should address the legal, ethical, and regulatory issues surrounding the deployment of automated vehicles, including questions of liability, privacy, and safety.

4.6 Advancing Circular Economy & Competitiveness in Road Transport

The circular economy model promotes sustainable resource management by minimizing waste and maximizing the lifecycle of products. In the road transport sector, this approach not only addresses challenges related to resource scarcity, waste generation, and environmental degradation but also offers a strategic advantage in reducing reliance on global supply chains. Europe’s road transport sector is heavily dependent on critical raw materials sourced from other regions, such as rare earth elements for batteries and electronic components. This reliance poses economic, geopolitical, and sustainability risks, especially as global demand for these materials surges. By prioritizing recycling, reuse, and remanufacturing within Europe, the sector can significantly reduce this dependency, enhance resource sovereignty, and build resilience against supply chain disruptions.

Strategies such as vehicle recycling, remanufacturing, and the use of renewable materials are being implemented to reduce the environmental footprint of transport systems. The circularity of vehicles, however, raises critical questions. For example, while electric vehicles (EVs) reduce operational emissions, their reliance on complex battery systems presents challenges for material recovery and recycling. Similarly, alternative vehicles like shared e-scooters and cargo bikes often have shorter lifespans, prompting discussions about improving their durability and end-of-life processing. The more we invest in closed-loop systems for material recovery, the less we need to rely on finite resources from external suppliers. However, adopting

circular economy practices requires overcoming barriers such as high costs, limited awareness, and fragmented supply chains. Collaborative efforts across industries and regions are needed to mainstream circular economy principles in the transport sector. The **TranSensus LCA** Coordination and Support Action, coordinated by Fraunhofer, highlights the importance of standardized Life Cycle Assessment (LCA) methods in evaluating the environmental impact of zero-emission vehicles (ZEVs). This harmonized approach not only supports circular economy practices but also ensures transparency in assessing resource use, recycling potential, and end-of-life processes for vehicles. The project's findings also emphasize the need for collaboration among industry, research institutions, and policymakers to create consistent frameworks for circularity in road transport.

According to the survey, circular economy principles were incorporated into the work of several stakeholders, but the level of integration varied. The automotive industry highlighted the importance of designing vehicles for recyclability and sustainability, while public authorities emphasized the need for policy frameworks that support resource recovery and recycling. Research consultancies and NGOs called for greater emphasis on incorporating circular economy principles into supply chains and transport infrastructure.

Education and Training Needs:

- **Sustainable Product Design:** Training should focus on lifecycle analysis, sustainable material sourcing, and the design of products that can be easily disassembled and recycled.
- **Resource Efficiency and Recycling:** Professionals need to be trained in strategies for maximizing resource efficiency in the production, use, and disposal of transport vehicles and infrastructure.
- **Business Model Innovation:** Training should address the development of new business models that incorporate circular economy principles, such as leasing, remanufacturing, and extended producer responsibility.

Horizontal Topics for Specific Contexts

Beyond the six action fields identified above, there is a pressing need to address horizontal issues that affect various stakeholders in road transport. These topics may be context-specific, addressing critical social and regional challenges that are often overlooked in broader discussions.

- **Social equity and gender:** Training programmes must include discussions on social equity and gender, ensuring that all groups—regardless of socioeconomic status, gender, or background—have access to mobility and transportation opportunities. This includes raising awareness of the specific mobility needs of marginalized groups and ensuring that road transport systems are designed and managed in a way that promotes inclusivity and equality. For instance, focusing on gender-sensitive mobility can help address barriers women face in accessing transportation services, such as safety concerns, affordability, or accessibility.

- **Literacy (digital/data & literal):** Another crucial area for consideration is literacy—both digital/data literacy and literal literacy. Many stakeholders, especially in rural or underserved areas, may not have the skills or access to engage with increasingly digital and data-driven transportation systems. Offering training that enhances digital skills is crucial for stakeholders such as transport operators, municipal authorities, and even end users who need to interact with digital platforms for ticketing, routing, or information-sharing. Similarly, addressing literal illiteracy among certain groups is key to ensuring that information on transport systems is accessible to everyone, regardless of their educational background.

- **Mobility resilience:** As road transport systems increasingly face disruptions due to climate change, economic crises, and other external factors, there is a growing emphasis on mobility resilience. Training should address how stakeholders can enhance the resilience of transportation systems to shocks, such as extreme weather, supply chain disruptions, or fluctuating demand. This includes developing contingency planning, risk management strategies, and the ability to adapt to changing circumstances.

- **Rural and suburban areas:** While urban mobility often receives the most attention, rural and suburban areas face distinct challenges that require targeted training. Transport solutions for these regions may need to focus on lower-density settings, longer distances, and the integration of various transport modes that are often less accessible in rural areas. By tailoring training to address these specific needs, cities and regions can develop more sustainable and effective transport solutions that bridge the gap between urban and rural mobility.

By incorporating these horizontal topics into road transport training programmes, stakeholders will be better equipped to address the diverse and often complex challenges they face, ensuring more inclusive, resilient, and adaptive transport systems.

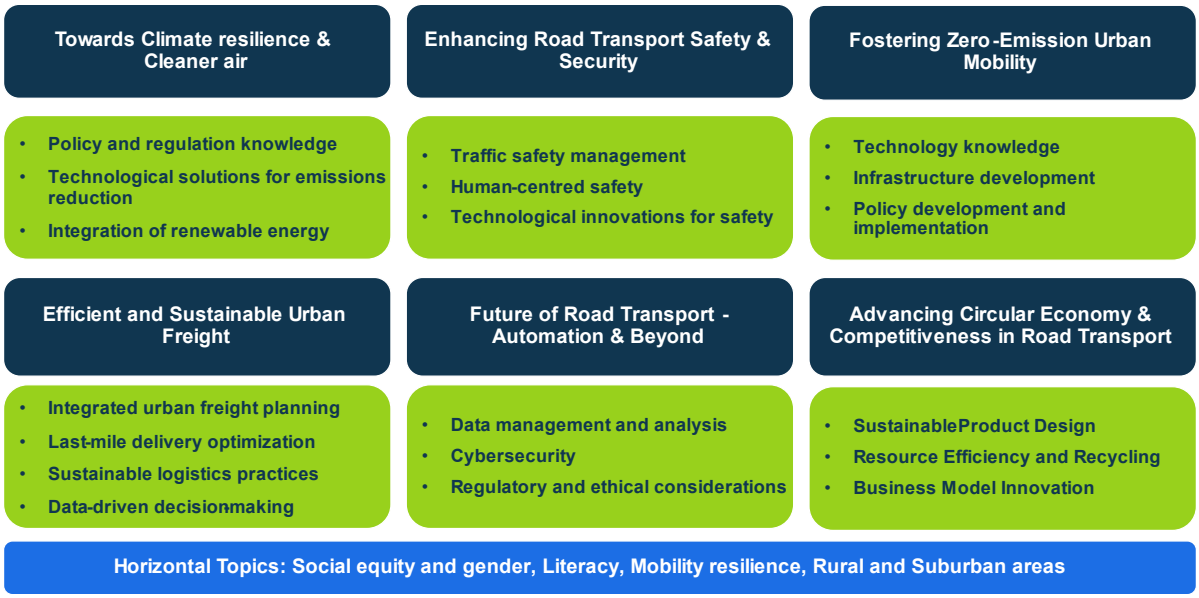


Figure 6: Education and Training Needs

5 Building a Training Framework: Overcoming Barriers and Advancing Strategies

Building on the identification of key priority topics in road transport, it is equally crucial to examine the challenges that impede effective training and explore strategies to enhance training programmes, ensuring that the workforce is equipped to address these evolving needs. To effectively advance road transport training, it is essential to address the barriers that hinder its progress while simultaneously implementing strategies to improve and modernize training programmes. The rapid evolution of technologies, environmental concerns, and changing regulatory frameworks necessitate continuous adaptation in training approaches across the sector. By identifying and overcoming these barriers, stakeholders can ensure that the workforce is adequately equipped with the necessary skills and knowledge to meet the demands of a digitized, sustainable, and efficient transport system.

5.1 Overcoming Barriers to Effective Training

Despite the clear need for enhanced training in the road transport sector, several barriers hinder the development and effectiveness of training programmes. Addressing these challenges is crucial for ensuring that the workforce is equipped with the necessary skills and knowledge to navigate an increasingly complex and evolving transport landscape.

Rapid Technological Advancements

One of the primary barriers to effective training is the rapid pace of technological advancements. As the road transport sector evolves, new technologies, such as autonomous vehicles, connected systems, digital logistics platforms, and electric vehicles, are continuously emerging. This fast pace of change makes it difficult for training programmes to remain up-to-date. Industry professionals and stakeholders often find themselves playing catch-up, trying to adapt to new tools, systems, and regulatory frameworks without sufficient preparation. Moreover, this challenge goes beyond technological know-how; it also includes the ability of experts to gather, internalize, and understand these advancements deeply enough to teach them effectively to others. Without this crucial "train-the-trainer" capacity, the dissemination of knowledge across organizations and industries becomes fragmented and insufficient.

Many traditional training structures are also slow to integrate these new technologies into their curricula. To address this barrier, continuous learning opportunities must be integrated into training programmes. Industry and academia need to collaborate more closely to ensure that training programmes evolve with technological developments. Modular and flexible training formats, such as online courses, microlearning modules, and certification programmes, can allow professionals to stay current without needing to wait for a full curriculum update. Partnerships between industry leaders and training providers are also essential to ensure that the training content remains relevant, practical, and scalable across multiple levels of expertise.

Insufficient Resources and Funding

Another significant barrier is the lack of resources and funding available for training initiatives. Road transport professionals, particularly in public authorities and NGOs, often face financial

constraints that limit their ability to participate in advanced training programmes or to invest in the necessary infrastructure for effective learning. Smaller organizations, in particular, struggle to keep up with the demand for high-quality, specialized training, which can negatively impact the sector's overall efficiency and progress.

Addressing this issue requires a multi-stakeholder approach. Governments, private industry, and educational institutions should collaborate to provide funding opportunities, scholarships, or subsidies for training. Additionally, public-private partnerships can help reduce the financial burden on smaller entities by providing shared access to advanced training tools, simulation environments, and other resources. Increased investment in training infrastructure, such as virtual and augmented reality systems or simulation labs, would also improve accessibility and cost-effectiveness.

Knowledge Gaps and Outdated Content

As the road transport sector faces new challenges, training materials often become outdated, failing to address the latest trends or technological innovations. This issue is especially evident in traditional training models, where curricula may not be updated frequently enough to incorporate the latest industry practices or emerging fields like CCAM, zero-emission technologies, or sustainable urban freight systems.

To combat outdated content, training programmes should be regularly reviewed and updated to ensure alignment with industry developments. A collaborative approach involving industry stakeholders, academic experts, and training providers can help identify gaps in existing training content and develop new curricula. Additionally, integrating case studies, pilot projects, and real-world examples into training materials can enhance the relevance and practicality of the content.

Lack of Collaboration Across Stakeholders

Effective training requires coordination among a variety of stakeholders, including educational institutions, industry players, public authorities, and research organizations. Currently, the level of collaboration between these groups is insufficient, leading to fragmented training efforts and a lack of standardized curricula that would enable mobility professionals across different regions or sectors to share a common understanding of best practices and emerging technologies.

Overcoming this barrier involves fostering stronger partnerships between academia, industry, and government agencies to create a more unified approach to training. Establishing collaborative platforms and networks where stakeholders can share insights, resources, and expertise is essential. This would also allow for the creation of shared training resources and certifications, ensuring that professionals across different organizations and regions can access consistent and high-quality training programmes.

5.2 Strategies for Advancing Training Programmes

To ensure that the road transport sector remains agile and adaptable to future challenges, strategic initiatives must be undertaken to advance training programmes and make them more effective. These strategies should address both the technological shifts occurring in the sector and the organizational challenges that impede the development of training programmes.

Integration of Digital Learning Tools

Digital learning tools, such as online platforms, e-learning modules, webinars, and virtual reality simulations, have the potential to revolutionize training in the road transport sector. These tools can make training more accessible, flexible, and scalable, allowing professionals to learn at their own pace and on their own schedules. Virtual reality, for example, can offer hands-on training experiences that simulate real-world scenarios, such as vehicle operation, traffic management, or disaster response, without the need for physical infrastructure.

Strategy: Encourage the widespread adoption of digital learning tools by offering training in these technologies for both trainers and learners. Developing high-quality, interactive online courses or certifications focused on emerging technologies like autonomous vehicles, electric transportation systems, and sustainable urban mobility will help bridge the skills gap and make continuous professional development more accessible.

Tailored Training for Different Stakeholder Groups

To ensure that training programmes are truly effective, they must be tailored to the specific needs of different stakeholder groups. Cities, municipalities, and other stakeholders should actively identify and communicate their unique training needs, reflecting the local context, challenges, and priorities. This approach ensures that the training content is relevant and directly applicable to their operations.

Additionally, it is essential that training programmes go beyond just meeting immediate needs and equip stakeholders with the tools to continuously assess and improve their own performance. This means teaching participants not only the necessary technical skills but also how to monitor their progress and adapt to changing circumstances. By including self-assessment and feedback mechanisms in training, stakeholders can build their capacity for self-monitoring and autonomous development. This approach not only addresses current gaps but also fosters long-term learning and adaptation, empowering stakeholders to independently evolve and improve their operations as new challenges arise.

Strategy: A successful strategy for this approach involves creating a needs-assessment framework that allows stakeholders to clearly articulate their challenges and areas where capacity-building is necessary. Additionally, training should emphasize equipping stakeholders with the skills to self-monitor and track their progress. This can be achieved by incorporating tools and methodologies for continuous evaluation and performance measurement into the training itself. By fostering a culture of self-assessment, stakeholders can independently adapt and optimize their practices, ensuring that the training provides both immediate solutions and long-term capacity for growth.

Collaboration Between Academia and Industry

A close collaboration between academia and industry is essential for ensuring that training programmes reflect real-world needs and technological advancements. Academia can provide the theoretical foundations and cutting-edge research, while industry can offer practical insights, feedback, and the latest technological developments. This collaboration ensures that training programmes are both scientifically robust and practically relevant.

Strategy: Strengthen partnerships between academic institutions, research organizations, and industry leaders to create a more integrated approach to training. Joint research projects,

internships, and hands-on workshops can provide students and professionals with direct exposure to industry challenges, fostering a deeper understanding of emerging technologies and best practices.

Development of Cross-Sectoral Certifications and Standards

To foster global collaboration and improve mobility systems worldwide, the development of universal training standards and certifications is essential. These standards would ensure that professionals across different countries and sectors can access similar high-quality training and that there is a common understanding of industry best practices and regulatory requirements.

Strategy: Collaborate on the creation of cross-sectoral certifications and training standards that ensure consistency in training quality and content. These standards could be developed by a global consortium of stakeholders, including government bodies, international organizations, and industry leaders. These certifications could be particularly important for technologies like autonomous vehicles and CCAM, where uniform standards are needed for safety and regulatory compliance.

Continuous Professional Development and Lifelong Learning

Given the rapid pace of technological change, it is essential that training does not end at the point of initial qualification. Continuous professional development (CPD) programmes should be an integral part of career progression in the road transport sector. Offering lifelong learning opportunities ensures that professionals remain equipped with the latest skills and knowledge needed to adapt to industry shifts.

Strategy: Promote the adoption of CPD programmes that encourage professionals to pursue ongoing education and training throughout their careers. Government incentives, industry-specific training funds, and institutional support can play a crucial role in facilitating lifelong learning in the transport sector. Furthermore, fostering a culture of continuous improvement within organizations will help ensure that knowledge transfer and skill development remain a priority.

Together, these strategies and solutions will create a more effective and forward-thinking training landscape, enabling the road transport sector to keep pace with technological advancements, address pressing challenges, and contribute to a more sustainable and efficient transportation system.

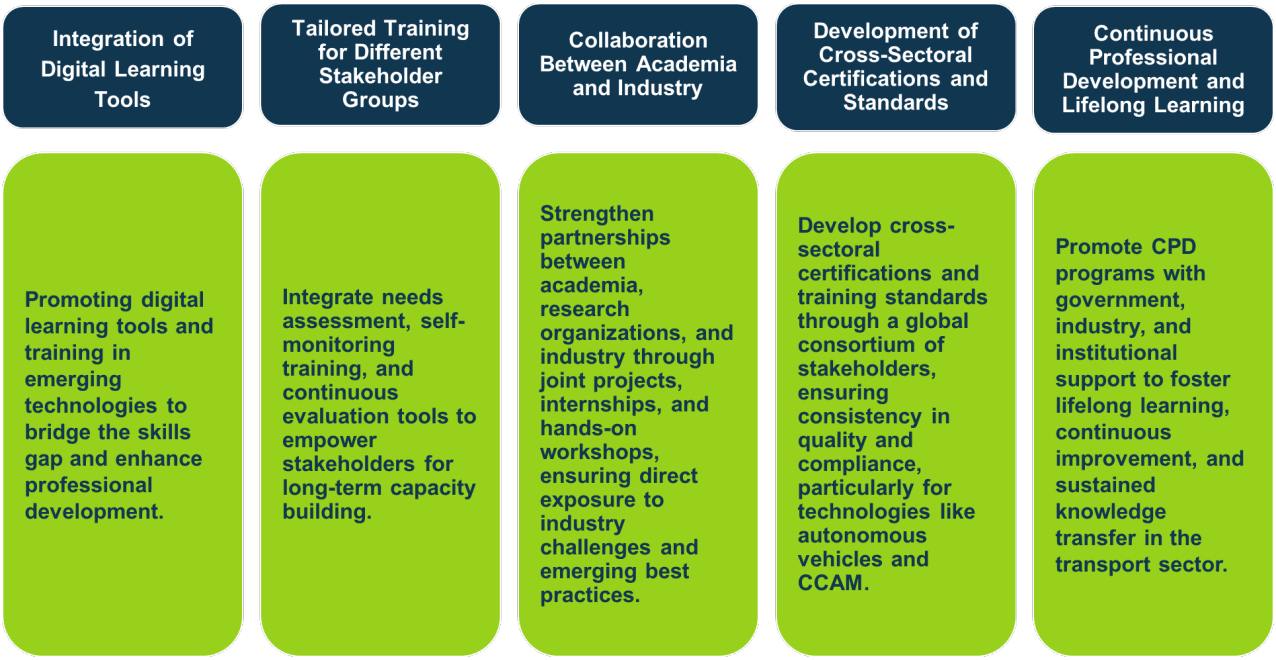


Figure 7: Strategies for Advancing Training Programmes

6 Concluding Remarks

The transformation of the road transport sector is essential to address contemporary challenges, including climate change, urban congestion, digitalization, and the growing demand for sustainable mobility solutions. As the sector evolves, training programs must adapt to equip professionals with the knowledge and skills necessary to navigate this rapidly changing landscape.

Reflecting on the challenges (**Table 1**), gaps and support needs (**Table 2)** identified for each sector, six action fields, outlined in **Figure 6,** were developed to highlight the critical priorities shaping the future of road transport training both in Europe and internationally. Climate resilience and air quality, road safety and security, zero-emission urban mobility, sustainable urban freight, automation and connected mobility, and circular economy strategies all demand targeted training interventions to ensure that professionals remain equipped to implement innovative and sustainable solutions.

A key takeaway from this analysis is the interconnectivity of these action fields. For example, the advancement of zero-emission mobility aligns closely with efforts to enhance air quality and mitigate climate change. Similarly, the integration of automation technologies necessitates not only technical knowledge but also an understanding of road safety, cybersecurity, and regulatory compliance. These connections underscore the importance of holistic, interdisciplinary training approaches that prepare professionals for the multifaceted nature of modern transport systems.

However, beyond recognizing these key action fields, it is essential to address the barriers that hinder effective training and implement strategies to modernize and enhance learning methodologies.

One of the primary challenges (**Table 1)** is the rapid pace of technological advancements, which makes it difficult for training programs to remain current. The introduction of autonomous vehicles, connected transport systems, and digital logistics platforms demands a continuous update of curricula and a commitment to lifelong learning. Furthermore, insufficient resources and funding remain significant obstacles, particularly for smaller organizations and public entities that struggle to access high-quality training.

A multi-stakeholder approach involving government, industry, and academia is necessary to mitigate these challenges by fostering partnerships, developing shared resources, and providing financial support mechanisms.

Addressing existing skill gaps, particularly in emerging fields such as e-mobility, automation, and circular economy principles, is imperative to future-proof the workforce. Training programs must not only focus on technical competencies but also foster adaptability, critical thinking, and problem-solving skills to enable professionals to respond to ongoing sectoral transformations.

Additionally, outdated training content and a lack of collaboration among stakeholders have contributed to fragmented learning efforts. Addressing these issues requires stronger partnerships between educational institutions, industry players, and policymakers. Establishing cross-sectoral certifications and training standards will ensure consistency in training quality and content, while promoting a culture of continuous professional development will help professionals stay ahead of industry trends.

Strategic approaches (as seen in **Figure 7**) must include the integration of digital learning tools such as e-learning platforms, virtual reality simulations, and microlearning modules to make training more accessible and scalable. Tailoring training programs to specific stakeholder needs and embedding self-assessment mechanisms will enhance the effectiveness of learning outcomes. Additionally, fostering closer collaboration between academia and industry will ensure that training remains relevant, practical, and aligned with real-world challenges.

By overcoming these barriers and advancing structured training strategies, the road transport sector can cultivate a skilled, adaptable, and forward-thinking workforce. Investing in comprehensive and innovative training solutions will not only enhance operational efficiency but also contribute to a more sustainable and resilient transport system for the future.

7 Annexes

7.1 Survey Template for Key Stakeholders in Road Transport (eg. Public Authorities tailored-Survey)

Organization Information:

1. Organization Name:
2. Contributor/s (Personnel name/s): Optional
3. Based in Country:
4. Operating in Regions (Select all that apply):
    - North America
    - South America
    - Eastern Europe
    - Central Europe
    - Africa
    - MENA Region
    - Central Asia
    - Southeast Asia (SEA)
    - Far East
    - Australia
    - Other (please specify):
5. Type of Organization: (Drop-down):
    - Academia
    - Public Authorities & Municipalities
    - International organizations & Research Consultancies
    - Road Transport & Automotive Industry
    - NGOs & Advocacy Group

General Perceptions:

6. How would you rate the current state of education and training in the road transport sector in your region of operation? (Scale 1-5)
7. What do you see as the biggest challenges in the road transport sector regarding education and training? (Select all that apply):
    - Lack of funding
    - Insufficient / Outdated content
    - Rapidly changing technologies & Trends
    - Lack of qualified Institutions/trainers
    - Insufficient collaboration between key stakeholders
    - Other (please specify):
8. How important and relevant do you consider the following topics for the future of digitized, electrified, and sustainable road transport systems? (Rate each from 1-5)

- Air Quality and Climate Change
- Urban Zero Emission Mobility
- Mobility Safety & Security
- Urban Freight Transport
- Circular Economy
- Connected and Automated Mobility (CCAM)

General Introduction

1. What are the main areas of focus in your road transport-related strategies and projects? (Select all that apply)

   - Traffic engineering
   - Urban mobility planning
   - Vehicle technology and maintenance
   - Environmental impacts of transport
   - Intelligent transport systems
   - Other (please specify):

2. How often do you update your staff skills competencies to incorporate the latest developments and trends regarding the Road Transport Sector?

   - Annually
   - Every 2-3 years
   - Every 4-5 years
   - Rarely
   - N.A
   - Other (please specify):

3. How does your institution keep staff educated and up-to-date with industry developments? (Select all that apply)

   - Internal professional development programmes
   - External courses and certifications
   - Industry conferences and workshops
   - Research collaborations
   - Other (please specify):

4. How effective do you find these formats in terms of learning new topics or skills for your staff members? (Rate each from 1-5)

   - Workshops
   - E-learning
   - Webinars
   - Podcasts
   - Traditional classroom teaching
   - Other (please specify):

5. What partnerships or collaborations do you have with public or academic organizations? (Select all that apply)

- Research collaborations
- Internship programmes
- Advisory boards
- Joint training programmes
- Other (please specify):

Air Quality and Climate Change:

6. To what extent is air quality monitoring incorporated into your strategies, projects, and products? (Scale 1-5)

7. To what extent are climate change topics incorporated into your strategies, projects, and products? (Scale 1-5)

8. What aspects of air quality and climate change are covered in your strategies, projects, and products? (Select all that apply)

    - Greenhouse gas emissions
    - Air pollution control technologies
    - Climate change mitigation strategies
    - Renewable energy integration
    - Other (please specify):

9. What additional support do you need to advance in covering this topic in your strategies, projects, and products? (Select all that apply)

    - Increased funding for research and development
    - Increased funding for project implementation
    - Professional development and training for staff
    - Collaboration opportunities with academic institutions
    - Enhanced facilities and infrastructure
    - Government or policy support and collaboration
    - Internships and hands-on opportunities for students
    - Support for interdisciplinary approaches
    - Other (please specify): _____

Road Transport Safety & Security:

10. To what extent is Road Transport safety and security incorporated into your strategies, projects, and products? (Scale 1-5)

11. Which topics are covered in your safety and security are covered in your strategies, projects, and products? (Select all that apply)

    - Traffic safety
    - Passenger security
    - Cybersecurity in transport systems
    - Emergency response protocols
    - Other (please specify):

12. What additional support do you need to advance in covering this topic in your strategies, projects, and products? (Select all that apply)

    - Increased funding for research and development
    - Increased funding for project implementation
    - Professional development and training for staff
    - Collaboration opportunities with academic institutions
    - Enhanced facilities and infrastructure
    - Government or policy support and collaboration
    - Internships and hands-on opportunities for students
    - Support for interdisciplinary approaches
    - Other (please specify): _____

Urban Zero Emission Mobility:

13. To what extent is Urban |Zero Emission Mobility incorporated into your strategies, projects, and products? (Scale 1-5)

14. Which topics are covered in your Urban Zero Emission Mobility strategies, projects, and products? (Select all that apply)

    - Active Mobility (Walking, Cycling, ..)
    - Electric vehicle technology
    - Public transport systems
    - Urban planning for zero emissions
    - Policy frameworks
    - Other (please specify):

15. What additional support do you need to advance in covering this topic in your strategies, projects, and products? (Select all that apply)

    - Increased funding for research and development
    - Increased funding for project implementation
    - Professional development and training for staff
    - Collaboration opportunities with academic institutions
    - Enhanced facilities and infrastructure
    - Government or policy support and collaboration
    - Internships and hands-on opportunities for students
    - Support for interdisciplinary approaches
    - Other (please specify): _____

Urban Freight Transport:

16. To what extent has Urban Freight Transport incorporated into your strategies, projects, and products? (Scale 1-5)

17. Which topics are tackled in your urban freight management strategies, projects, and products? (Select all that apply)

    - Last-mile delivery solutions
    - Logistics and supply chain management
    - Sustainable freight practices
    - Infrastructure planning
    - Other (please specify):

18. What additional support do you need to advance in covering this topic in your strategies, projects, and products? (Select all that apply)

    - Increased funding for research and development
    - Increased funding for project implementation
    - Professional development and training for staff
    - Collaboration opportunities with academic institutions
    - Enhanced facilities and infrastructure
    - Government or policy support and collaboration
    - Internships and hands-on opportunities for students
    - Support for interdisciplinary approaches
    - Other (please specify): _____

Circular Economy & Business Models:

19. To what extent Circular economy approach incorporated into your strategies, projects, and products? (Scale 1-5)

20. What aspects of circular economy and business models are integrated into your strategies, projects, and products? (Select all that apply)

    - Lifecycle assessment
    - Resource recovery and recycling
    - Sustainable product design
    - Business model innovation
    - Other (please specify):

21. What additional support do you need to advance in covering this topic in your strategies, projects, and products? (Select all that apply)

    - Increased funding for research and development
    - Increased funding for projects implementation
    - Professional development and training for staff
    - Collaboration opportunities with academic institutions
    - Enhanced facilities and infrastructure
    - Government or policy support and collaboration
    - Internships and hands-on opportunities for students
    - Support for interdisciplinary approaches
    - Other (please specify): _____

Connected and Automated Mobility (CCAM):

22. To what extent is CCAM incorporated into your strategies, projects, and products? (Scale 1-5)

23. What topics related to CCAM are covered in your strategies, projects, and products? (Select all that apply)

    - Autonomous vehicle technology
    - Connectivity and data exchange
    - Ethical and regulatory considerations
    - Human factors and safety
    - Other (please specify):

24. What additional support do you need to advance in covering this topic in strategies, projects, and products? (Select all that apply)

    - Increased funding for research and development
    - Increased funding for project implementation
    - Professional development and training for staff
    - Collaboration opportunities with academic institutions
    - Enhanced facilities and infrastructure
    - Government or policy support and collaboration
    - Internships and hands-on opportunities for students
    - Support for interdisciplinary approaches
    - Other (please specify): _____

Concluding Remarks

1. Any additional comments or suggestions? (Open-ended)

2. Would you be willing to participate in a follow-up interview or focus group? (Yes /No)

3. Contact information (optional):

Thank you for your valuable contribution. If you have any questions or require further information, please do not hesitate to contact us.

Task Leader: Rupprecht Consult, Hassan Hussin; h.hussin@rupprecht-consult.eu

Project Coordinator: AVL LIST GMBH, Verena Wagenhofer , verena.wagenhofer@avl.com

7.2 Survey Participants Organizations per Sector

a) Academia

- RWTH Aachen University
- University of Rwanda
- Warsaw University of Technology
- SAFER / Chalmers Industriteknik
- University of Leeds
- Fraunhofer LBF
- Eindhoven university of technology
- IFP School
- UJEP - Jan Evangelista Purkyně University in Ústí nad Labem
- UGE - France
- T.U. Berlin
- Aristotle University of Thessaloniki
- University of Transport Technology
- CERTH
- AAMUSTED

b) International Organisations and Research Consultancies

- KL-Solutions Ltd.
- Trans-Sport Consulting Lp.
- KTI - Institute for Transport Sciences, Hungary
- Cities Forum
- Transport for Cairo
- International Transport Forum/OECD
- TNO
- GIZ
- UN-Habitat
- Panteia
- SLOCAT Partnership on Sustainable, Low Carbon Transport
- ATO
- Hellenic Institute of Transport - The Centre for Research and Technology, Hellas (HIT/CERTH)
- Safe Mobility in Egypt
- Rupprecht Consult

c) NGOs and Advocacy Groups

- POLIS network
- ERTICO
- UEMI
- Wuppertal Institute
- ICCT
- CODATU
- A.N.G.E.V.-Pro.Civ. OdV - Sede Operativa
- UITP
- ALICE

d) Public Authorities

- LNEC
- The National Road Safety Agency of Colombia
- North Herts Council
- Free and Hanseatic City of Hamburg

e) Road Transport and Automotive Industry players

- Stellantis-CRF
- ELES, d.o.o.
- AVL
- Volvo Group
- Proximus
- Volkswagen AG
- Ricardo
- Forvia
- BMW
- TRANSPOLIS
- Route 66 Conseil

7.3 Samples from the studied Academic Programmes in Europe and Internationally in Road Transport and Mobility Studies

Continent	University Name	Country	Programme Name	Scope of the Programme	Target Groups	Specific learning outcomes	General Advantages / Challenges & Limitations
Europe	TU Delft	Netherlands	MSc in Transport, Infrastructure and Logistics	Transport systems governance, design, operation and management; logistics and supply chain; infrastructure networks	Engineers, planners;	Mastery of transport logistics	Strong research, and industry links; High demand, competitive
	University of East London	UK	MSc in Intelligent Transport Planning and Engineering	Equipping students with advanced knowledge and skills in transport engineering, intelligent transport systems (ITS), and sustainable planning practices.	Recent graduates in relevant fields, mid-career professionals	Learning transport engineering principles, and modern tools for transport modelling; solving complex transportation issues, conducting innovative research, understanding relevant policies and regulations, and learning how to communicate effectively within the transport sector.	Aligns with modern industry needs, and practical application. Very specialised, high tuition fees, require continuous adaptation.
	University of Leeds	UK	MEng in Transport Infrastructure: Design and Construction	Transport infrastructure, planning, design, construction	Civil engineers, transport planners, related engineering, science or math disciplines graduates	Comprehensive knowledge and skills in designing, constructing, monitoring, and maintaining land transport infrastructure using advanced techniques and materials, with an emphasis on practical construction processes and safety regulations.	Strong academic reputation. Competitive admission.
	University of Antwerp	Belgium	MSc in Maritime and Logistics Management/ or Maritime and Air Transport Management	Maritime transport, logistics, air transport	Maritime professionals, logistics managers; or graduates of relevant disciplines	Expertise in maritime transport logistics, expertise in port, and transport business administration and law or aviation logistics	International focus, practical approach. Competitive program.
	University of Birmingham	UK	MSc in Urban and Regional Planning	Urban transport planning, policy development	Urban planners, architects, transport professionals or graduates.	Develop students as reflective practitioners in the planning profession and related disciplines in the built environment with a touch upon transportation in the planning aspects.	Strong academic reputation, and practical projects. High tuition fees.
	University College London (UCL)	UK	MSc in Transport and City Planning	Transport planning, traffic management, sustainable urban development	Urban planners, geographers, engineers transport professionals and graduates	Critically examine the current challenges of transitioning to sustainable travel behaviours and sustainable cities in the UK and internationally.	Strong research focus, and industry connections. Competitive admission.
	RWTH Aachen University	Germany	MSc in Automotive Engineering	The conception and the development of passenger cars and commercial vehicles, and optionally of motorcycles and off-highway vehicles. This comprises technical vehicle design about market, legislative and manufacturing requirements.	Mechanical engineers, automotive professionals or graduates	Expertise in automotive engineering; Graduates will be proficient in relevant technological areas like vehicle dynamics, energy efficiency, acoustics, mechatronics, structural fatigue and durability.	Strong industry connections, cutting-edge research; High demand, rigorous programme and hard admission
	University of Birmingham	UK	MSc in Road Management and Engineering	Planning, appraisal, design construction and maintenance of road networks.	Civil engineers, transport planners;	It offers advanced training to engineers aspiring to higher or middle management in public and private sector road management.	Strong research focus, industry connections; Competitive admission
	University of Leeds	UK	MSc in Transport Economics	Economic analysis, transport policy	Economists, transport professionals;	Transport economics, econometrics and cost-benefit analyses, public transport planning, funding of infrastructure projects	Strong academic reputation, industry connections; Intensive program

	University College London (UCL)	UK	MSc Transport and Mobility Systems	Transport and mobility to shape sustainable, safe, secure, accessible, equitable, and resilient transport systems that promote well-being for all.	Graduates and professionals in relevant subjects	Fostering a holistic understanding of transport and mobility systems. By combining theoretical insights, research-based evidence, and systems thinking, students are equipped to address the intricate interplay of socio-technical systems and behaviours.	Vast network, practical projects and cross-cutting with environment; Competitive and high tuitions
	Trinity College Dublin	Ireland	MSc in Transport Engineering, Policy and Planning	Areas of transport policy, planning, design, modelling and analysis	Individuals interested in pursuing a career in engineering, in particular in the areas of environmental, structural and geotechnical, transport, or sustainable energy engineering	The course aims to equip students with the skills to address the numerous challenges in the transportation field. The course examines areas of transport policy, planning, design, modelling and analysis. The course also incorporates modules addressing issues such as climate change, sustainability, and renewable energy.	Network, sustainability and integrated topics; High tuition fees and competitive
	KTH and EIT urban mobility	Sweden	MSc Transport, Mobility and Innovation	Preparing students to become the next urban innovators and leaders in urban mobility.	Graduates and professionals in relevant subjects	Aimed to educate, inspire, and unite future leaders in the Urban Mobility sector with a diverse set of analytical skills and theoretical knowledge in the field of urban mobility.	Multi-disciplinary, high demand in the market; competitive
	EIT Urban Mobility	Spain	Sustainable Urban Mobility Transitions; Smart Mobility Data Science & Analytics; Business Engineering in Urban Mobility	Public transport systems, urban planning, policies, data analytics, simulation, planning	Urban planners, transport professionals; Mastery in urban mobility solutions	Gain the knowledge to design and manage sustainable urban plans & policies, and the skills to drive responsible innovation; Reshape our urban systems by harnessing big data through advanced data analytics, modelling, and simulation; Learn management concepts and methods to drive change and create sustainable business models in urban mobility.	International focus, industry partnerships; Competitive, intensive program
	Northwestern University	USA	MSc in Transportation Systems Analysis and Planning	Transportation engineering, systems analysis, policy, and planning	Engineers, transport professionals; Skills in systems analysis and planning	Analytical skills in transportation systems, specialize in areas such as transportation science, logistics, travel demand analysis, and urban planning, and gain the ability to lead innovations in the evolving transportation industry	Strong research focus, industry connections; Expensive, rigorous program
	University of Southern California	USA	MSc in Civil Engineering (Transportation)	Planning, design, construction, management, and performance of transportation systems	Engineers, planners;		Strong academic reputation, practical approach; Competitive admission
	Harvard University	USA	Master's in Urban Planning (MUP)	Transport policy, urban planning	Urban planners, policymakers;		Prestigious program, strong faculty; Highly competitive, expensive
	University of California, Davis	USA	MSc in Transportation Technology and Policy	Sustainable transport systems, transport technology, planning, policy	Engineers or any related discipline	Three programme tracks: Vehicles and fuels Demand and behaviour Infrastructure and operations	Strong research focus, industry links; Competitive, rigorous program
	University of Michigan	USA	MEng in Automotive Engineering	Vehicle design, automotive systems	Mechanical engineers, automotive professionals; Expertise in automotive engineering		Prestigious program, strong industry links; Expensive, competitive
	University of Detroit Mercy	USA	Graduate certificate in Systems Engineering	Vehicle dynamics, powertrain systems	Mechanical engineers, automotive professionals;	Utilise the latest technologies in automotive, mobility and manufacturing industries.	Industry connections, practical approach; Intensive program
Asia	Myongji University	Korea	MSc in Transportation Engineering	Design, analysis, and management of transportation systems	Recent graduates in engineering and related fields, mid-career professionals	Expertise in transportation system design and management, mastering analytical and modelling tools, addressing complex transportation problems, conducting research, and communicating effectively with stakeholders in the field	Strong academic reputation, robust curriculum, access to cutting-edge research; Competitive admission

	German Jordanian University	Jordan	BSc. Logistics Sciences	Logistics and supply chain management,	High school graduates	Deep understanding of logistics and supply chain management principles, master advanced logistics technologies and tools, solve complex logistical problems, conduct innovative research, and communicate effectively within the industry.	A blend of theoretical and practical learning, and strong industry connections; the programme requires continuous adaptation to technologies
	The Hong Kong Polytechnic University	Hong Kong	MSc in international shipping and transport logistics	Transport and logistics management, including planning, operations, and optimization.	Recent graduates and mid-career professionals	Expertise in transport logistics management, optimization techniques, and practical problem-solving.	Strong industry ties and practical learning opportunities; emphasis on logistics and supply chain; complex logistics scenarios may require ongoing updates to the curriculum; high workload.
	Indian Maritime University	India	Master's in international Transportation and Logistics Management	International transportation, logistics, and supply chain management,	Recent graduates in maritime studies, business and related fields and mid-career professionals	Expertise in international transportation and logistics principles, mastering advanced analytical and management tools, solving complex global logistics challenges, conducting innovative research, and effectively communicating within the international logistics sector.	Comprehensive curriculum, practical learning.
Australia	University of Sydney	Australia	MSc in Transport	Focuses on advanced education in transport planning, policy, operations, and management, combining theoretical knowledge with practical applications to address global transportation challenges.	Recent graduates in engineering, urban planning, and related fields, mid-career professionals	Expertise in transport planning and policy, mastering analytical and modelling tools, developing solutions for complex transport problems, conducting innovative research, and communicating effectively within the transport sector	Comprehensive curriculum with strong industry connections; high tuition fees
	RMIT University	Australia	Master of Supply Chain and Logistics Management	Supply chain strategies, logistics management and operations	Business professionals, engineers; Expertise in logistics and supply chain management	Deep understanding of supply chain and logistics principles, master advanced analytical and strategic planning tools, solve complex supply chain challenges, conduct innovative research, and communicate effectively within the industry.	Practical approach, industry links; Expensive for international students
	UNSW	Australia	Master of Engineering Science (Transport)	Transport engineering, planning, operations, and management	Recent graduates in engineering and related disciplines, mid-career professionals	Deep understanding of transport engineering principles, master advanced analytical and modelling tools, solve complex transportation challenges, conduct innovative research, and effectively communicate and lead within the transport industry.	Robust curriculum, industry connections; high tuition fees and high reliance on technology necessitate keeping the curriculum aligned.
	RMIT University	Australia	BSc of Engineering (Automotive Engineering)	Automotive design, manufacturing, and systems,	High school graduates	Expertise in automotive design and manufacturing, mastering advanced automotive technologies, developing problem-solving skills for automotive engineering challenges, conducting research and development projects, and communicating effectively within the automotive industry	A blend of theoretical and practical learning, and strong industry connections; the programm erequires continuous adaptation to technologies
	QUOTE	Australia	Master of Sustainable Infrastructure	Designing, implementing, and managing sustainable infrastructure projects, emphasizing environmental, social, and economic sustainability.	Recent graduates in engineering, architecture, and related fields, mid-career professionals	Expertise in sustainable infrastructure design and management, utilising advanced tools for environmental and social impact assessment, developing solutions for sustainable development challenges, conducting innovative research, and effectively communicating sustainability concepts.	Comprehensive curriculum, practical learning; High tuition fees and intense program
	Monash University	Australia	Master of Transport and Mobility Planning	Transport and mobility planning, integrating sustainable practices, policy analysis, and practical applications to address urban and regional transport challenges.	Recent graduates in urban planning, engineering, geography, and related fields, mid-career professionals	Expertise in transport and mobility planning principles, mastering analytical and modelling tools, creating sustainable and effective transport solutions, conducting policy analysis and research, and communicating effectively with stakeholders.	Comprehensive Curriculum, industry connections, practical learning; demanding programme and high tuition

Africa	Stellenbosch University	South Africa	BSc in Geotechnical and Transportation Engineering	Transport systems, infrastructure		Within Transportation Engineering, specialist areas are Pavement Engineering, Traffic & Transportation Engineering (including Intelligent Transport Systems (ITS)) and Traffic Safety Engineering.	Strong research, industry links; Limited regional relevance
	University of Cape Town	South Africa	MSc in City and Regional Planning	Urban transport planning, infrastructure	Urban planners, transport professionals		Strong academic reputation; Limited resources
	University of Lagos	Nigeria	School of Transport: Transport management and operations; Transport Planning and policy, Transport Technology and Infrastructure	Transport policy, traffic management, infrastructure technology, logistics. It aims at enhancing the performance of the transport sector in its critical role in national development.			Regional focus, practical approach; Limited resources
	University of Johannesburg	South Africa	MSc in Logistics Management or Transport Economics	Supply chain strategies, logistics management, transport economics including railways and aviation	Business professionals, engineers; Expertise in logistics and supply chain management and all related disciplines		Practical approach, industry links; Limited regional relevance
	University of Dar es Salaam	Tanzania	Postgraduate Diploma in Civil Engineering - Transportation Engineering	Transport infrastructure	Engineers, planners; Skills in transport infrastructure management		Regional relevance, practical projects; Limited resources
	University of Ghana	Ghana	MSc in Logistics and transportation management	Logistics, planning, management	Social sciences and other related disciplines		Regional relevance, strong academic reputation; Limited resources
	Kwame Nkrumah University	Ghana	MSc in Transport Systems	Aims to provide a comprehensive education in the planning, design, operation, and management of transport systems, blending theoretical insights with practical skills to address contemporary transportation challenges	Recent graduates in engineering, urban planning, and related fields, mid-career professionals looking to enhance their expertise in transport systems.	Advanced knowledge of transport system principles, employing modern analytical and modelling tools, solving complex transport-related problems, conducting innovative research, understanding relevant policies and regulations, and communicating effectively with stakeholders in the transport sector.	Holistic approach, regional relevance; limited access to technologies and infrastructure, limited funding for research

8 References

- **STREnGth_M: Deliverable D1.1** (2024): Barriers for the deployment of research results
- **STREnGth_M: Deliverable D1.2** (2024): Roadmapping methods on European, Member State and international level
- **OECD.** (2020). *The Future of Work in Transport.*
- **International Transport Forum.** (2023). *Transport Outlook.*
- **World Bank.** (2022). *Global Mobility and Workforce Challenges.*
- **TUMI.** (2021). *Knowledge Platform for Sustainable Urban Mobility.*
- **Chinn, D., et al.** (2020). *The future is now: Closing the skills gap in Europe's public sector.* McKinsey and Company.
- **Transport Systems Catapult.** (2015). *The Transport Data Revolution: Investigation into the data required to support and drive intelligent mobility.*
- **European Commission.** (2019). *Transport in the European Union: Current Trends and Issues.*
- **Michigan Mobility Institute.** (2021). *Preparing Talent for the Future of Mobility Careers.* Available at: https://michiganmobilityinstitute.org/.
- **Woodberry, R. D., & Aldrich, H. E.** (2000). Planning and running effective classroom-based exercises. *Teaching Sociology, 28*(3), 241-248.
- **Adipat, S., Laksana, K., Busayanon, K., Asawasowan, A., & Adipat, B.** (2021). Engaging students in the learning process with game-based learning: The fundamental concepts. *International Journal of Technology in Education, 4*(3), 542-552.
- **Kokotsaki, D., Menzies, V., & Wiggins, A.** (2016). Project-based learning: A review of the literature. *Improving Schools, 19*(3), 267-277.
- **Bishop, J. L., & Verleger, M. A.** (2013). The flipped classroom: A survey of the research. *ASEE National Conference Proceedings, 30*(9), 1-18.
- **Laal, M., & Ghodsi, S. M.** (2012). Benefits of collaborative learning. *Procedia - Social and Behavioral Sciences, 31,* 486-490.
- Lah, O. (2023). TVET for Sustainable Mobility: Sectoral Study. Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH. Available at: https://www.govet.international/dokumente/pdf/giz-2024-0068-en-TVET-for-Sustainable-Mobility.pdf
- **Kolb, A. Y., & Kolb, D. A.** (2017). Experiential learning theory as a guide for experiential educators in higher education. *Experiential Learning & Teaching in Higher Education, 1*(1), 7-44.

- **Biljana, Radić-Bojanić, Danijela, M., & Pop-Jovanov.** (2018). Workshops in education: theoretical and practical issues. *9*(9): 223-234. DOI: 10.19090/MV.2018.9.223-234.
- **Jennifer, Moon.** (2000). *Short Courses and Workshops: Improving the Impact of Learning, Teaching and Professional Development.*
- **Craig, Thaine.** (2010). *Teacher training essentials: workshops for professional development.*
- **Amy, J., Kaye, Vanja, Pejic, Kathryn, Theresa, Moffa, Molly, E., Jordan, Kristine, M., Dennery, David, R., & DeMaso.** (2022). Using professional development workshops to support school professionals' capacities to promote students' social, emotional, and behavioral health. *Psychology in the Schools.* DOI: 10.1002/pits.22652.
- **Gegenfurtner, C., Quesada-Pallarès, M., & Knogler, C.** (2019). Learning and satisfaction in webinar, online, and face-to-face instruction: A meta-analysis. *Frontiers in Education, 4,* 130.
- **Andreas, Gegenfurtner, Christian, Ebner.** (2019). Webinars in higher education and professional training: A meta-analysis and systematic review of randomized controlled trials. *Educational Research Review, 28:*100293-. DOI: 10.1016/J.EDUREV.2019.100293.
- **Hepsiba Darius, P. S., Gundabattini, E., & Solomon, D. G.** (2021). A survey on the effectiveness of online teaching-learning methods for university and college students. *Journal of The Institution of Engineers (India): Series B, 102*(5), 1325-1334.
- **UNICEF.** (2021). Effectiveness of digital learning solutions to improve educational outcomes: A review of the evidence.
- **Castro, M. D. B., & Tumibay, G. M.** (2019). A literature review: Efficacy of online learning courses for higher education institutions using meta-analysis. *Education and Information Technologies, 26*(2), 1367-1385.
- **Besser, E. D., Blackwell, L. E., & Saenz, M.** (2022). Engaging students through educational podcasting: Three stories of implementation. *Technology, Knowledge and Learning, 27*(3), 749-764.
- **Kennedy, M. J., Thomas, C., Meyer, J. P., Alves, K. D., & Lloyd, J. W.** (2016). Using content acquisition podcasts to improve learning in teacher education. *Journal of Special Education Technology, 31*(4), 217-228.
- **Parsons, D., & Ryu, H.** (2021). Survey on podcasting to improve teaching-learning process. In *Proceedings of the Mobile Learning Technologies and Applications (MoLTA) Conference.*
- **Engzell, J., & Norrman, C.** (2023). Podcasts as a learning method in engineering education. *European Society for Engineering Education (SEFI).* DOI: 10.21427/5NP5-JM86.