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Urban mobility scenarios: a review of the future

Cenários da mobilidade urbana: uma revisão sobre o futuro

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ABSTRACT
This study analyzed urban mobility perspectives based on research found in the literature. The objective was to identify trends and actions prone to promote a more sustainable mobility future. To this end, 24 studies published between 2014 and 2025 were selected, resulting in 88 distinct scenarios. The studies indicate that technologies such as electric vehicles, autonomous vehicles, and shared mobility are promising but face economic and regulatory challenges. However, established solutions, such as promotion of public transportation and cycling, remain essential. The main trends observed were technological development, with autonomous vehicles and artificial intelligence; investments in public transportation and reducing the need for commuting; and environmental and social impacts, including inequality in mobility access and climate change. The study concluded that there are several major trends and strategic actions that are likely to shape the future of urban mobility.

RESUMO
O presente estudo analisou as perspectivas futuras para a mobilidade urbana com base em pesquisas encontradas na literatura. O objetivo foi identificar tendências de cenários e quais as ações abordadas na literatura propensas a promover um futuro de mobilidade mais sustentável. Para isso, foram selecionados 24 estudos publicados entre 2014 e 2025, resultando em 88 cenários distintos. Os estudos indicam que tecnologias como veículos elétricos, veículos autônomos e mobilidade compartilhada são promissoras, mas enfrentam desafios econômicos e regulatórios. No entanto, soluções já consolidadas, como a promoção do transporte público e do uso de bicicletas, continuam sendo essenciais para a promoção da mobilidade sustentável. As principais tendências observadas foram o desenvolvimento tecnológico, com veículos autônomos e inteligência artificial; investimentos em transporte público e redução da necessidade de deslocamentos; e impactos ambientais e sociais, incluindo desigualdade no acesso à mobilidade e mudanças climáticas. O estudo concluiu que há diversas tendências e ações estratégicas importantes que provavelmente moldarão o futuro da mobilidade urbana.

1. INTRODUCTION

Urban planning and management have been treated as mere administrative and engineering issues (Meerow and Newell, 2019). However, challenges currently faced by cities demand broader and more complex strategies to prevent pessimistic future scenarios for urban mobility from materializing (Störmer et al., 2009). For example, according to the TomTom Traffic Index ranking, drivers in São Paulo, Brazil, lost an average of 111 hours per year due to traffic congestion. By contrast, drivers in London lost up to 98 hours. To measure traffic congestion, Tomtom developed the "Hours Lost" (HL) metric, which calculates the total number of hours lost in congestion during peak commuting periods compared to off-peak conditions. This metric is used to assess traffic congestion in 501 cities across 62 countries (TomTom, 2025). Additionally, The World Health

Organization (WHO, 2021) estimates that by 2030, traffic mortality will be the fifth leading cause of death worldwide. This may result in approximately 2.4 million people dying on urban roads and highways.

Alongside these estimates, new technologies like autonomous vehicles (AVs), electric vehicles (EVs), and shared mobility services have emerged (Dia, 2019; Miskolczi et al., 2021; Nijkamp and Kourtit, 2013). However, their progress is limited by global challenges such as shifting consumer demands and rapid urbanization, driving growing needs for new mobility services and optimized solutions (Miskolczi et al., 2021; Brenden, Kristoffersson and Mattsson, 2017; Zmud et al., 2013). Beyond technology, strategies promoting active mobility, public transport, and reduced commuting remain key to achieving urban sustainability (Navarro-Ligero and Valenzuela-Montes, 2016; Tori et al., 2023).

A major challenge for future urban mobility is balancing economic sustainability, environmental sustainability, and user satisfaction. Solutions addressing these pillars are vital to tackle emerging challenges and ensure resilient, equitable cities (Canitez, 2019; Miskolczi et al., 2021; Nikitas et al., 2017).

This article provides a comprehensive literature overview on the current expectations regarding future urban mobility. The objective of this research is to shed light on where we are heading, where we should go, and what measures are necessary to improve urban mobility. Therefore, this study aims to answer three questions:

- What are the trends observed in urban mobility scenarios?
- What actions are suggested by researchers to improve the future of mobility?
- What are the new technologies present in mobility scenario studies?

2. THE INTERPRETATION OF THE FUTURE THROUGH SCENARIO BUILDING

Scenario planning is increasingly transitioning from being an ancillary component of strategic transport planning to a more mainstream and essential element (Lyons et al., 2021).

Since its development during World War II, scenario-building has evolved to address the need for deeper reflection on uncertainties and future perspectives (Ringland, 2006). Although it does not eliminate uncertainties or precisely envision the future, scenario methodologies outline possible future paths, for example, enhancing the effectiveness of solutions aimed at a just and sustainable future (Turner, 2008).

As Banister, Hickman and Stead (2007) note, scenarios do not predict but illustrate how different interpretations of change forces yield diverse futures. Godet (2006) defines scenarios as configurations of future images based on hypotheses about key variables that must be clearly analyzed. Porter (1989) adds that scenarios are consistent views of future realities grounded on plausible assumptions about critical uncertainties. Van Der Heijden (2000) reinforces this by describing scenarios as possible, imaginable, or desirable futures.

Several analytical methods have emerged, classified by Huss and Honton (1987) into intuitive logic, trend impact analysis, and cross-impact analysis. Intuitive logic, from the 1970s, addresses integrated scenarios for strategic planning. Trend impact analysis projects key variables independently, then adjusts for event impacts. Cross-impact analysis evaluates interrelated events and quantifies their relationships more flexibly than traditional econometrics (Aulicino, 2002).

Prospective analysis, developed by Michel Godet in 1974 distinguishes exploratory and desired scenarios. Exploratory ones identify change or stability trends through technical analysis to guide decision-makers. Desired scenarios reflect future aspirations which must be plausible and feasible (Buarque, 2003; Mara Dorigati and Krupp Luz, 2020). Barrella and Amekudzi (2011) refer to these as prospective and projective, emphasizing that the final scenario step evaluates political feasibility (backcasting). In this process, planners and stakeholder engagement are crucial to overcoming political and social challenges. In the field of urban and transport planning, the scenario planning method has emerged as a preferred approach for addressing systemic uncertainties. For example, Baera et al. (2025) identified critical mobility variables and developed four exploratory scenarios, applying them in urban transport analyses to support more robust and sustainable decision-making in Norwegian cities.

3. METHODOLOGY

Exploring the future of the transportation sector is complex. This is because technological changes interact with user behavior, policies, economic constraints, and market shifts (Miskolczi et al., 2021; Spickermann et al., 2014). To address this, a systematic literature review (SLR) was conducted. SLR is an exploratory method that synthesizes and critically evaluates existing research on a topic from a predefined perspective, aiming to identify research gaps and consolidate concepts (Denney and Tewksbury, 2013).

In this study we used SLR to identify and analyze trends in future urban mobility scenarios. By doing so we aimed at providing insights into technological and socioeconomic changes and support decision-making under uncertainty, especially for long-term planning (Hickman and Banister, 2007; Kaufmann and Ravalet, 2016; Xenou et al., 2022).

The SLR followed PRISMA guidelines, an evidence-based framework for systematic reviews and meta-analyses. Based on this, a trend scenario was constructed. The methodology is detailed next.

3.1. Stage 1: Identification

The selected criteria for research on article search platforms and their respective characterizations were:

(1) Database selection: Choosing reliable and easily accessible search engines: Scopus and Web of Science.

(2) Publication time range: from 2014 to 2025.

(3) Keyword combination: (“Scenario*” or “Scenario Planning” or “Uncertainty*” or “Decision Making” or “Scenario Analysis” or “Scenario Planning” or “Prospective Scenario*” or “Future Mobility” or “Scenario Building” or “Future Of Urban Mobility”) and (“Sustainable Mobility” or “Transport Planning” or “Mobility Planning” or “Transportation Planning” or “Transport Policy” or “Urban Mobility” or “Mobility” or “Transport” or “Urban Mobility Plan” or “Mobility Plan”).

3.2. Stage 2: Screening

The screening rounds consisted of:

(1) Selection of identified articles: Based on the combined keywords on the search platforms we identified: 1,895 documents from Scopus and documents from Web of Science, totaling 3,842 articles.

(2) Exclusion of duplicate articles: 2,305 documents remained.

(3) Selection of articles by title: 101 documents remained – articles were excluded as their titles did not show possibilities to fulfill the research questions.

(4) Selection of articles by abstract: 42 documents remained – articles were excluded as their abstracts did not suggest they could help answer the research questions.

(5) Selection of articles through full-text reading: 23 documents remained (Table 1) – articles were excluded because they did not help to answer the research questions based on the full-text analysis.

Table 1: Articles Selected in the Screening Stage

Authors/ Year of Publication	Study Location	Method Used	Projected Year for Scenarios
Cascetta (2014)	Naples, Italy	Mixed method of Delphi scenarios and literature review	2040
Marletto (2014)	Netherlands	Socio-technical approach (ST) and literature review	2030
Navarro-Ligero and Valenzuela-Montes (2016)	Granada, Spain	MITIGA methodology and literature review	2030
Kaufmann and Ravalet (2016)	France	Literature review and survey research	2050
Milakis et al. (2017)	Netherlands	Intuitive logic and focus group workshops	2030 and 2050
Brenden, Kristoffersson and Mattsson (2017)	Sweden	Literature review and Intuitive Logics (IL)	2030 and 2050
Kane and Whitehead (2017)	Australia	Not specified	2030
Zahraei, Kurniawan and Cheah (2019)	Singapore	Attribute and evidence analysis, survey research, focus group workshops	2040
Keseru, Coosemans and Macharis (2019)	Europe	Multi-Actor Multi-Criteria Analysis (MAMCA), Intuitive Logics technique, and focus group workshops	2030
Vallet et al. (2020)	Not specified	Expert workshops	2030 and 2035
Miskolczi et al. (2021)	Budapest, Hungary	Literature review	2050
Melkonyan et al. (2020)	Rhine-Ruhr, Germany	Multi-Criteria Decision Analysis (MCDA), PROMETHEE method, and focus group workshops	2030
Xenou et al. (2022)	Padua, Italy	Indicators and survey research	2030
Melkonyan et al. (2022)	Rhine-Ruhr, Germany	Multi-Criteria Decision Analysis (MCDA) model	2030
Tori et al. (2023)	Brussels, Belgium	Cross-Impact Analysis (CIB) and focus group workshops	2050
Tori, Te Boveldt and Keseru (2023)	Not specified	Cross-Impact Analysis and focus group workshops	2030
Paul et al. (2023)	Europe	Focus group workshops and Indicators	(+)2040
Sunitiyoso et al. (2023)	Jakarta, Indonesia	Focus group workshops	2030
Yanmaz and Asan (2024)	Istanbul, Turkey	Multi-Criteria Analysis, focus group workshops, and fuzzy logic	2035
Álvarez-Antelo et al. (2025)	Spain	System dynamics model and Monte Carlo simulations	2050
Colin et al. (2024)	Strasbourg, France	Indicators and survey research and focus group workshops	2050
Baera et al. (2025)	Norway	Literature Review, Matrix Summation and Intuitive Logic Technique	2050
Rojas-Rivero et al. (2025)	Spanish	Delphi, survey research, Natural Language Processing and cluster analysis	2050

3.3. Stage 3: Analysis

The procedures for conducting data analysis and obtaining the final results were:

(1) Scenario Synthesis: The synthesis of scenarios included reading each of the 88 scenarios obtained from the 23 selected studies and summarizing the information to simplify it and standardize terms.

(2) Identification of Key Topics: Each scenario was read again in order to identify and group the most frequently occurring terms.

(3) Counting Mentions of Topics (Occurrence Count): After listing the topics covered in the studies, another reading of the 88 scenarios was conducted to count the number of times each topic was mentioned.

4. RESULTS

4.1. Scenarios description

The 24 studies resulting from the SLR collectively presented 88 scenarios. These scenarios are described below in chronological order of publication.

The first study is by Cascetta (2014), who used a mixed approach to design four scenarios for 2040 in Naples. The first, "Incremental Growth – Business as Usual," predicts continued car dominance, supported by technological advancements and expanded infrastructure, especially in emerging countries. The second, "Incremental Growth – Modal Balance," suggests a balance between transportation modes due to high energy costs and environmental concerns, encouraging investment in public transport and sustainable alternatives. The third scenario, "Revolution – Energy Crisis," foresees fuel shortages reducing car use and increasing the value of urban centers with strong public transport. The fourth, "Revolution – Automation," envisions widespread autonomous vehicle adoption, optimizing mobility through on-demand and automated systems.

Marletto (2014) used a socio-technical approach to develop three scenarios for urban mobility in the Netherlands by 2030. The study analyzed interactions among actors, institutions, markets, and policies. The first scenario, "AUTO-city," maintains a system based on individual car ownership. The automotive industry incorporates new players like battery manufacturers, while energy providers gain relevance. Although car sharing increases, the focus remains on car sales. EVs are projected to reach 35% of global sales, but emission reductions depend on the energy mix and broad EV adoption.The second scenario, "ECO-city," envisions an integrated system combining public transport, bicycles, and car-sharing. Between 2013 and 2030, policies evolve through three phases, from pioneering city actions to national adoption, resulting in reduced car ownership. This model offers environmental and social benefits but requires cultural, institutional, and political shifts. The third scenario, "ELECTRI-city," is led by the electricity sector, which expands infrastructure to support EVs and smart grids. Between 2013 and 2030, cities test and scale integration, creating a global electric mobility market. This scenario depends on international cooperation, high investment, and renewable energy to achieve environmental goals.

Navarro-Ligero and Valenzuela-Montes (2016) developed four scenarios for Granada using the MITIGA methodology. The "Private Mobility Scenario" focuses on individual transportation, with little priority given to public transport. The "Sustainable Mobility Scenario" promotes policies favoring active transportation modes, such as cycling and walking, and encourages more compact urban development. The "Unplanned Urban Expansion Scenario" foresees uncontrolled growth and increasing reliance on automobiles. Lastly, the "Automation and Innovation Scenario" considers the advancement of autonomous vehicles and smart technologies to improve mobility and reduce the need for vehicle ownership.

Kaufmann and Ravalet (2016) designed two scenarios for France for 2050. The scenarios were based on a literature review and a survey with 1,800 people. The "Ultramobility" scenario maintains the car as the central mode of transport although with a slight reduction. It anticipates improvements in long-distance public transport, increased bicycle use, and moderate expansion of ride-sharing. The "Altermobility" scenario proposes a structural shift, reducing car use and making strong investments in public transport, cycling, and car-sharing. It creates an integrated and accessible mobility network inspired by successful models from Japan and Switzerland.

Milakis et al. (2017) analyzed the evolution of autonomous vehicles in 2030 and 2050 for the Netherlands resulting in four scenarios. The first scenario, "Autonomous Vehicles on Hold," shows slow adoption of AVs due to the efficiency of existing transportation systems and a lack of government incentives. Second, "Autonomous Vehicles in Full Expansion" predicts rapid adoption of autonomous vehicles driven by massive investments and favorable regulations. However, this leads to other obstacles such as increased traffic. Third, "Autonomous Vehicles in Gradual Growth" envisions slower-than-expected development owing to technological challenges and initial public skepticism, gaining wider acceptance only after 2040. The fourth and final scenario, "Autonomous Vehicles in Doubt", suggests that vehicle automation will remain a niche market due to technological difficulties, lack of investment and low consumer interest.

Brenden, Kristoffersson and Mattsson (2017) used Intuitive Logic to explore possible futures for autonomous vehicles in Sweden by 2030, with projections to 2050. The first scenario, "Same, Same, but Different," envisions a digitalized and efficient society where the sharing economy stalls due to privacy and cybersecurity concerns. While electric vehicles dominate the roads, and public transport becomes more connected, AVs still face resistance. In "Sharing is the New Black," environmental and political crises lead to a sustainable government promoting car-free cities and infrastructure for shared autonomous vehicles. "Follow the Path" depicts a society resistant to change, where car ownership persists and automation advances slowly amid regulatory and technological barriers. The fourth scenario, "What You Need is What You Get," imagines a future led by private corporations, with fully automated, on-demand transport replacing private ownership and reducing the public sector's role in mobility.

Kane and Whitehead (2017) analyzed five scenarios for Australia based on three factors: electrification, automation, and the sharing economy. In the first four, at least one element is missing, leading to suboptimal outcomes. Scenario A combines automation and electrification but retains private ownership, causing congestion. Scenario B adopts shared autonomous services but lacks electrification, increasing emissions. Scenario C merges electrification with the sharing economy but excludes automation, resulting in high operational costs. Scenario D includes all technologies but lacks urban density, fostering sprawl and limiting active mobility. The optimal scenario integrates all three with compact urban planning, reducing car dependency and enhancing public and shared transport efficiency.

Zahraei, Kurniawan and Cheah (2019) developed scenarios for Singapore in 2040 using attribute and evidence analysis, expert interviews, and focus groups. They envisioned two distinct futures: a Shared World and a Virtual World. In the "Shared World", mobility revolves around the sharing economy and multi-zone districts. Shared transport offers temporary access to bicycles and cars, curbing private vehicle use. Multizone planning integrates housing, work, education, and leisure, reducing commute times. E-commerce grows, but physical stores remain relevant, and advanced logistics support efficient deliveries. Public transport dominates, with autonomous buses in service. Though environmentally and socially beneficial, this model requires workforce retraining and strategic planning to address impacts on jobs and traditional transport sectors. In the “Virtual World”, VR, AI, and IoT transform daily life, shifting work, learning, and leisure to virtual spaces and reducing travel. Small autonomous capsules become the primary mode, acting as smart, multifunctional assistants. Infrastructure is redesigned with exclusive lanes and integrated charging. E-commerce prevails, with AI anticipating needs and drones managing deliveries. While highly efficient, this model poses risks of social isolation and job displacement, calling for policies to mitigate its effects.

Keseru et al. (2019) explored three urban mobility scenarios using the Multi-Actor Multi-Criteria Analysis (MAMCA) method. In ” DataWorld,” technology dominates mobility, with private companies leading automation and logistics, while public infrastructure becomes dependent on multinational corporations. In “Slow is Beautiful,” sustainability takes the center stage, prioritizing local transport based on electric bicycles and small vehicles, reducing the carbon footprint and promoting local production. In “Minimum Carbon,” the government responds strongly to climate change with strict regulations, incentives for renewable fuels and carbon taxation, making transportation less environmentally harmful but potentially more expensive.

Vallet et al. (2020) conducted a study using expert workshops and presented three scenarios for urban mobility between 2030 and 2035. Built on previous research, the scenarios offer a broader view of transportation challenges and trends. The first, “More of the Same,” continues current patterns without major structural shifts. Traditional systems persist, technological innovation is slow and uneven, and public policies bring limited impact, yielding minimal improvements. The second, “High Tech and Acceleration of Travel,” envisions rapid technological progress, with widespread adoption of autonomous vehicles, electric mobility, and digital platforms. While travel becomes more efficient and connected, unequal access to these innovations may deepen social disparities. The third scenario, “Societal Change and Deceleration of Travel,” portrays a society that values local living and reduced commuting. Remote work is widespread, local shopping resurges, and active mobility—like walking and cycling—is supported by sustainable policies and better-integrated public transport.

Miskolczi et al. (2021), in a study for Budapest, Hungary, analyzed four scenarios up to 2050, considering the impact of emerging technologies on urban mobility. The first, “Grumpy Old Transport,” foresees minimal change, with continued reliance on private cars, leading to persistent congestion and pollution. The second, “At an Easy Pace,” depicts gradual progress in electrification and sustainability, though automation and shared mobility face persistent barriers. In “Mine is Yours,” shared mobility becomes dominant, reducing car ownership and enhancing public transport, despite limited automation. Finally, “Tech-Eager Mobility” envisions a highly automated and electrified system, where shared autonomous vehicles prevail, cutting emissions and improving mobility efficiency.

Melkonyan et al. (2022) used multi-criteria decision-support tools to analyze mobility scenarios in the Rhine-Ruhr metropolitan region of Germany up to 2030. The “Smart City” scenario emphasizes the use of digital technologies to integrate transport systems. The “Sustainable/Healthy City” promotes active and shared mobility, combined with sustainable public policies. The “Periurbanization” scenario highlights suburban growth due to a lack of investment in urban centers. Finally, the “Business as Usual” scenario reflects the continuation of current trends, with high private transport use and low urban efficiency.

Xenou et al. (2022), in the SPROUT project, developed three scenarios for Padua, considering political, economic, social, technological, environmental, and legal factors. The “Sustainable and Regulated Growth” scenario envisions more efficient mobility driven by regulations and innovation. The “Worst-Case Scenario” predicts stagnation, lack of planning, and increased congestion. Meanwhile, “Urban Expansion and Uncontrolled Mobility” emphasizes unstructured economic growth, resulting in high car dependency and urban quality degradation.

Tori, Te Boveldt and Keseru (2023) developed three urban mobility scenarios for 2030 using cross-impact analyses and participatory workshops. The first envisions a smart, sustainable city where public transport leads, supported by bike lanes and MaaS apps. Tourism thrives, sustaining the economy despite some resistance to expanding pedestrian areas.The second depicts a city in recession, where sustainable mobility struggles. Air pollution remains high, extreme weather worsens, and digitalization stagnates. Bicycles are cost-effective but underused due to adverse conditions. Tourism stays strong, boosting private shared mobility. The third reflects post-COVID-19 shifts, with remote work easing traffic. Public transport adapts to health measures, while bikes and e-scooters grow in popularity. E-commerce expands, driving logistics optimization and electric deliveries. The city center becomes more pedestrian- and cyclist-friendly, reducing car presence.

Tori et al. (2023) presented four future scenarios for urban mobility in Brussels by 2050, using a participatory approach and mixed methods, including cross-impact analysis and creative workshops. In “Unified Brussels,” the city is highly integrated, with centralized public transport, a hyperloop network, and digitalized logistics. Remote work cuts commutes, but spatial segregation emerges, with wealthy, tourism-oriented central areas and underserved peripheries.

“Maximum Freedom” shows a fragmented city where each municipality sets its own traffic rules. Public transport is unsafe and inefficient, increasing reliance on private vehicles. Urban air travel becomes accessible to the wealthy, deepening inequality. Climate change makes walking and cycling nearly impossible. In “Automobilized Brussels,” the city is dominated by cars, with limited public transport and cycling infrastructure. E-commerce expands, supported by drone and boat deliveries. Tourism fuels gentrification and rising costs, while pollution and insecurity reduce quality of life.

Lastly, “Hyperproximity” imagines a 15-minute city promoting active mobility and reduced car use. However, administrative fragmentation causes inconsistencies in infrastructure and mobility rules across neighborhoods, complicating movement.

Paul et al. (2023) developed future scenarios for multimodal mobility between air and rail transport post-2040 in Europe, using expert interviews and analysis of socio-economic, ecological, technological, and infrastructural indicators. The first scenario, “Pre-pandemic recovery,” assumes a return to 2019 mobility trends, with moderate growth in both modes and gradual innovation. The second, “European short-haul shift,” emphasizes high-speed rail over short flights, enabling seamless door-to-door travel and substantial emission reductions. The third, “Growth with strong technological support,” envisions major expansion in both sectors, driven by innovations like hybrid aircraft and enhanced infrastructure. Lastly, “Decentralised, remote and digital mobility” explores how digitalization and telework foster spatial redistribution, improving rural connectivity through new rail stations and small airports.

Sunitiyoso et al. (2023) used expert interviews and causal loop diagrams to create four scenarios for Jakarta and its metro area until 2030. In “One Seamless Ecosystem,” public transport is efficient, reliable, tech-enabled, with modal integration and more electric vehicles. The “Culture of Public Transport” scenario sees the upper middle class adopting sustainable transport and digital services, though suburbs face challenges. The “Exclusive Green Community” highlights mobility inequality: electric vehicles become status symbols, while public transport mainly serves lower-income groups.

The most pessimistic, "Social Dilemma of Public and Private Transport," depicts ineffective policies and private-vehicle-focused infrastructure worsening pollution and congestion.

Yanmaz and Asan (2024) developed scenarios for Istanbul up to 2035 using multi-criteria analysis, expert workshops, and fuzzy logic. The first scenario, "Responsible Development," emphasizes public transport, stable vehicle ownership, predominant remote work, moderate environmental awareness, and widespread decarbonization, though rural connectivity and income inequality remain issues. The second, "Efficient and Green," features highly efficient public transport, extensive remote work, strong sustainability, reduced inequality, and improved urban–rural connectivity. The third, "Individualist," is defined by private vehicle dominance, increased car ownership, a return to in-person work, limited sustainability, strong urban transport, and lower inequality. Finally, the "Chaotic" scenario envisions rising car use, neglected sustainability, stagnant infrastructure, worsening inequality, and little progress in real-time transport data.

Álvarez-Antelo et al. (2025) used a coupled system dynamics model and Monte Carlo simulations in Spain to investigate the modal shift from air to rail between 2015 and 2050, focusing on behavioral factors. The first scenario, "Smart Policy Mix", illustrates how effective policy measures and awareness campaigns can trigger behavioral change, even when personal environmental values are low. "Fast Adaptation" is driven by societal responses to extreme weather events that enable rapid changes in mobility choices. In "Luck in Misfortune", high government investment and high personal environmental awareness are the cause of strong climate change mitigation, but at the cost of policy inefficiency. Finally, "Overcoming the Value-Action Gap" depicts a society with strong pro-environmental values that are hampered by obstacles in daily life and require significant public intervention to translate values into action.

Colin et al. (2024) developed three urban mobility scenarios for the year 2050 in Strasbourg using semi-structured interviews and the Mobival4all model, which integrates qualitative and quantitative data on 51 indicators grouped into 10 categories. The first scenario aims for carbon neutrality by 2050 and focuses on the expansion of public transport, the intensive use of bicycles and the emergence of autonomous vehicles. The second scenario promotes active mobility and teleworking as well as a strong reduction in car use and urban restructuring based on decentralization. The third scenario, proposed by a transport company, aims to decarbonize mobility with limited infrastructure investment and relies instead on multimodal systems and 24-hour public transport services.

Baera et al. (2025) developed four exploratory scenarios for the year 2050 in Norway, focusing on small and medium-sized cities and using a participatory approach and a simplified morphological method. The "Travelling Alone" scenario describes an individualistic society characterized by significant inequality and low use of public transport. "A Simpler Life" presents a transition driven by conscious choices, prioritizing local and active modes of transport. The "Together we are stronger" scenario describes a collaborative future where sustainable mobility is enabled by clean technologies and political engagement. Finally, the "Save us from ourselves" scenario describes a dystopian context of climate crises, social polarization and institutional fragmentation that limits the ability to deliver effective mobility solutions.

Rojas-Rivero et al. (2025) propose four scenarios for urban mobility in medium-sized Spanish cities until 2050, highlighting how structural, relational, and cognitive forms of cooperation shape transport systems. The methodology combined archetype-based scenario creation, a two-stage Delphi survey, and analysis of 158 scenario narratives using NLP and cluster analysis.

The first scenario, "Integrated Smart City," envisions a technology-driven transition supported by national and European funds, with integrated platforms and multimodal systems improving efficiency despite persistent social inequalities. The second, "City of Good Intentions," depicts political inertia where sustainable mobility remains rhetorical, hindered by weak cultural and institutional support. The third, “Expansive Hypermobility” features market-driven innovation and flexibility, leading to urban sprawl, increased inequalities, and diminished public transport. Finally, “Proximity Transition” presents a decentralized, community-led model grounded in environmental awareness and post-materialist values, promoting local planning, bike infrastructure, and low-tech mobility solutions.

4.2. Methodologies and trends in short

Most researchers used a combination of one or more methodologies to build their scenarios. The most commonly used methodology was workshops with experts, literature review, either exclusively or in combination (Figure 1). Other widely used methodologies include, multicriteria decision support and Delphi.

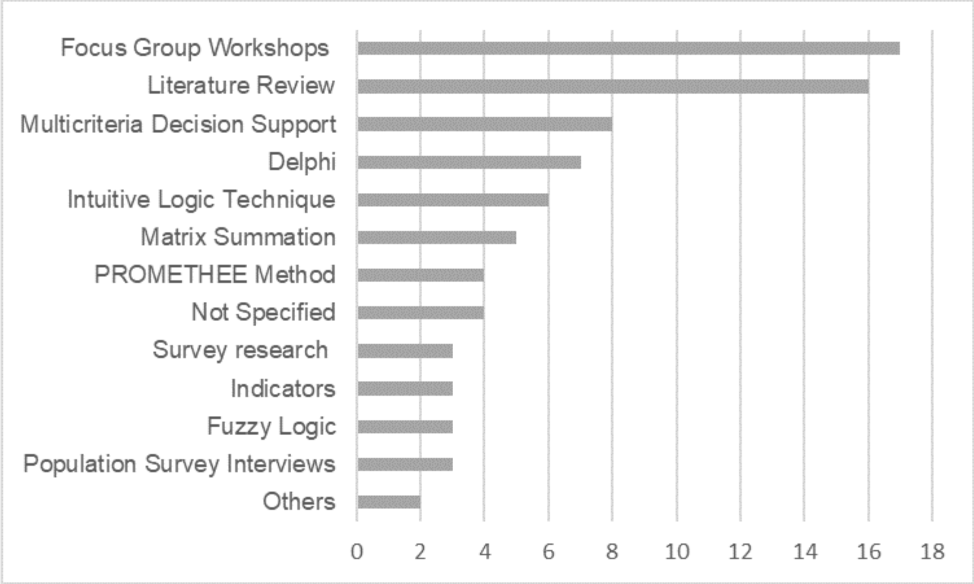

Figure 1. Number of times the methodology for scenario construction was used.

An analysis of the most frequently mentioned topics is presented in Tables 2 and 3. These tables show how often each topic appears across scenarios and the proportion of times it was cited relative to all scenarios or to positive and negative ones.

A total of 57 topics were identified. Each topic was mentioned at least once in the 88 scenarios. They were classified as political (P) or external (E). Political factors depend on government action, while external factors occur independently of urban mobility policies.

This analysis shows that most scenarios in the literature do not depict mobility trends driven by factors independent of political action. Instead, they reflect a tendency for public policies to align with new technologies, market pressures, and benchmark cities. The most frequently cited external factors, those unrelated to direct government intervention, are as follows:

- Factors related to the external market: increase in electric vehicles, increase in autonomous vehicles, increase in shared mobility, implementation of drone deliveries, and increase in energy availability.
- Factors related to population growth and global impacts: increase in temperature, increase in environmental pollution, increase in average transport distances, and increase in traffic congestion.

Table 2: Trends Topics in the Studies - Positive Scenarios

Trends topics	Occurrence count	Political/External factor	Relation to the total number of scenarios
Investment in public transportation	17	P	19%
Increase in electric vehicles	13	E	15%
Intelligent Traffic Systems (ITS) for planning	13	P	15%
Environmental awareness policies	11	P	13%
Increase in autonomous vehicles	9	E	10%
Increase in shared mobility	9	E	10%
Investment in cycling and pedestrian mobility	9	P	10%
Reduction of greenhouse gas emissions	9	E	10%
Multimodal transport	7	P	8%
Policies to encourage the carbon market	6	P	7%
Policies to encourage electrification	6	P	7%
Policies to encourage autonomous vehicles	6	P	7%
Reduction in the need for commuting	6	E	7%
Public subsidies	6	P	7%
Investments in shared cycling mobility	5	P	6%
Teleworking and remote education	5	E	6%
Deliveries by drones	4	E	5%
Reduction in private car usage	4	E	5%
Local neighborhood planning	3	P	3%
Investment in door-to-door transportation	3	P	3%
Reduction in car sizes	3	E	3%
Reduction in traffic congestion	3	E	3%
Increase in energy availability	3	E	3%
Decentralization of public policies	3	P	3%
Increase in the use of sustainable transport	3	E	3%
Transparency policies	2	P	2%
Mixed-use developments	2	P	2%
Investment in shared cars	2	P	2%
Vehicle restrictions in urban centers	2	P	2%
Private vehicle tolling	2	P	2%
Limitation of vehicle traffic in urban centers	1	P	1%
Urban freight consolidation centers	1	P	1%
Private vehicles connected to a public cloud system	1	P	1%
Integrated municipal regulation	1	P	1%
Deliveries in city centers are restricted to small electric vehicles and electric bicycles	1	P	1%
Increase in road capacity	1	P	1%
Reduction in the number of people obtaining a driver's license	1	E	1%
Reduction in accidents	1	E	1%
Autonomous capsules for cargo transport	1	E	1%
Reduction in the use of airplanes	1	E	1%
High adoption of MaaS (Mobility-as-a-Service)	1	P	1%

Table 3: Trends Topics in the Studies - Negative Scenarios

Trends topics	Occurrence count	Political/external factor	Relation to the total number of scenarios
Increase in social inequality	9	E	10%
Increase in average transport distances	8	E	9%
Increase in traffic congestion	7	E	8%
Increase in environmental pollution	6	E	7%
Setbacks in public policies	6	P	7%
Increase in temperatures	5	E	6%
Public transportation is unsafe	5	P	6%
Innovation is less supported due to a lack of financial resources	4	E	5%
Public transportation operated at the municipal level	3	E	3%
Periphery areas becoming less attractive	3	E	3%
Urban sprawl	3	E	3%
Greater autonomy for transport operators	3	P	3%
Fuel shortages	2	E	2%
Automation is not a reality	2	E	2%
Electrification is not a reality	2	E	2%
Increase in energy prices	2	E	2%
Low personal environmental values	2	E	2%
Increase in corruption	1	E	1%
Segmentation of municipalities	1	P	1%
Prioritization of road infrastructure	1	P	1%

Table 4 contains the most frequently cited actions that could be taken by governments and regulatory agencies via public policies. These actions could be used as a starting point for urban planning.

Table 4: Actions to be adopted in urban planning policies

Category	Policies to be adopted
Infrastructure Investments	Investment in public transportation; Investment in Intelligent Traffic Systems (ITS) for planning; Investment in cycling and pedestrian mobility; Investments in shared cycling mobility; Investment in multimodal transport; Investment in door-to-door transport; Investment in urban centers for cargo consolidation; Increase in road capacity.
Policies and Regulations	Environmental awareness policies; Policies to encourage the carbon market; Policies to promote electrification; Policies to encourage autonomous vehicles; Decentralization of public policies; Transparency policies; Integrated regulation of municipalities.
Transport and Mobility Models	Investment in mixed-use developments; Investment in shared cars; Restrictions on vehicles in urban centers; Tariffs on private vehicles; Limitation of vehicle traffic in urban centers.
Technology and Innovation	Investment in private vehicles connected to a public cloud system; Investments in research to develop alternative energy models; Investments in automation.
Logistics and Freight Transport	Incentive for small electric delivery vehicles; Urban centers for cargo consolidation.
Financial Incentives	Public subsidies for fare reduction; Subsidies for fleet renewal; Exemption or reduction of taxes for sustainable vehicles, clean fuels, or sustainable mobility companies; Reduction of tolls or parking fees for electric or shared vehicles.

5. CONCLUSIONS

The studies analyzed show that new concepts are emerging due to technologies such as autonomous vehicles (AV), electric vehicles (EV), and shared mobility services. This answers the last of the three questions outlined in the introduction: "What are the new technologies present in mobility scenario studies?"

The second question, "What actions do researchers recommend to improve mobility scenarios?" is answered by what public policies governments and agencies could adopt, as suggested by the articles. These policies, listed by the frequency with which they appeared in the studies, emphasize "betting on simplicity," focusing on sustainable, inclusive, and democratic modes of transport such as public transit, cycling, and pedestrian mobility. They also highlight multimodal transport, mixed land use, and reducing the need for travel as effective solutions for favorable scenarios.

The first question, "What are the observed trends in urban mobility scenarios?" is addressed by identifying several major trends and strategic actions that are likely to shape the future of urban mobility. Some trends are predominant because they appear in many scenarios, such as: Investment in public transportation; Increase in electric vehicles, Intelligent Traffic Systems (ITS) for planning, environmental awareness policies; increase in autonomous vehicles; increase in shared mobility; investment in cycling and pedestrian mobility and reduction of greenhouse gas emissions. Other trends are mentioned only once in the occurrence count. These may be less relevant for supporting public policies in different contexts, as they reflect uncertainties.

Some scenarios emphasize automation, predicting autonomous vehicles and intelligent transport systems dominating streets, while others show resistance due to low investment, security concerns, or cultural opposition. Social inequality is also key: some foresee equitable access to efficient, sustainable public transport, while others envision growing inequality benefiting only the wealthy with advanced options like urban air travel and premium autonomous vehicles. Regarding climate change, some scenarios highlight worsening conditions hindering active mobility, while others stress investing in resilient solutions. Overall, urban mobility futures depend on public policies, technological progress, social acceptance, and adaptation to urban growth.

One limitation of this article is potential bias in the selected papers due to external market or political influences. The small sample of 24 studies may also limit the identification of complex scenarios. Nevertheless, this research answered all the initial questions and aids understanding of trends and strategic actions that may shape the future of urban mobility. Another limitation of this study lies in the fact that the sample of articles analyzed consists almost exclusively of studies conducted in the global North, particularly in Europe. This underlines the need to promote scientific research on mobility scenarios for other parts of the world.

For future research we recommend conducting a cross-sectional analysis of the scenarios by year of publication. This could help determine whether there are any discernible trends or shifts in urban mobility perspectives over time. In addition, a comparison of the scenarios based on geographical characteristics such as region, city size, and socio-economic development level could reveal important patterns of convergence or divergence.

It is also important to consider the local and temporal context of each study, as these factors can significantly influence the proposed scenarios and their conclusions. For example, the predominance of private or public transport in a given country, the availability and adoption of hybrid or autonomous vehicles at the time of the study, and the public's familiarity with the strategies analyzed are all contextual elements that can influence the results. The inclusion of such contextual analyses in future studies would significantly increase the depth, comparability, and interpretative value of scenario-based research on urban mobility.

AUTHORS' CONTRIBUTIONS

ACGS: conception of the article, methodology design, data collection, data curation, and analyses; LW: data collection, review, and translation; TMCG: guidance, supervision, and review. Conflicts of interest statement.

The authors declare that there is no conflict of interest.

USE OF ARTIFICIAL INTELLIGENCE-ASSISTED TECHNOLOGY

Artificial intelligence-assisted technology was used after the second submission of the article to help summarize the scenarios and comply with the maximum word count required in the guidelines for authors.

DATA AVAILABILITY STATEMENT

Data, models, and code supporting the results of this study are available upon request from the corresponding author.

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