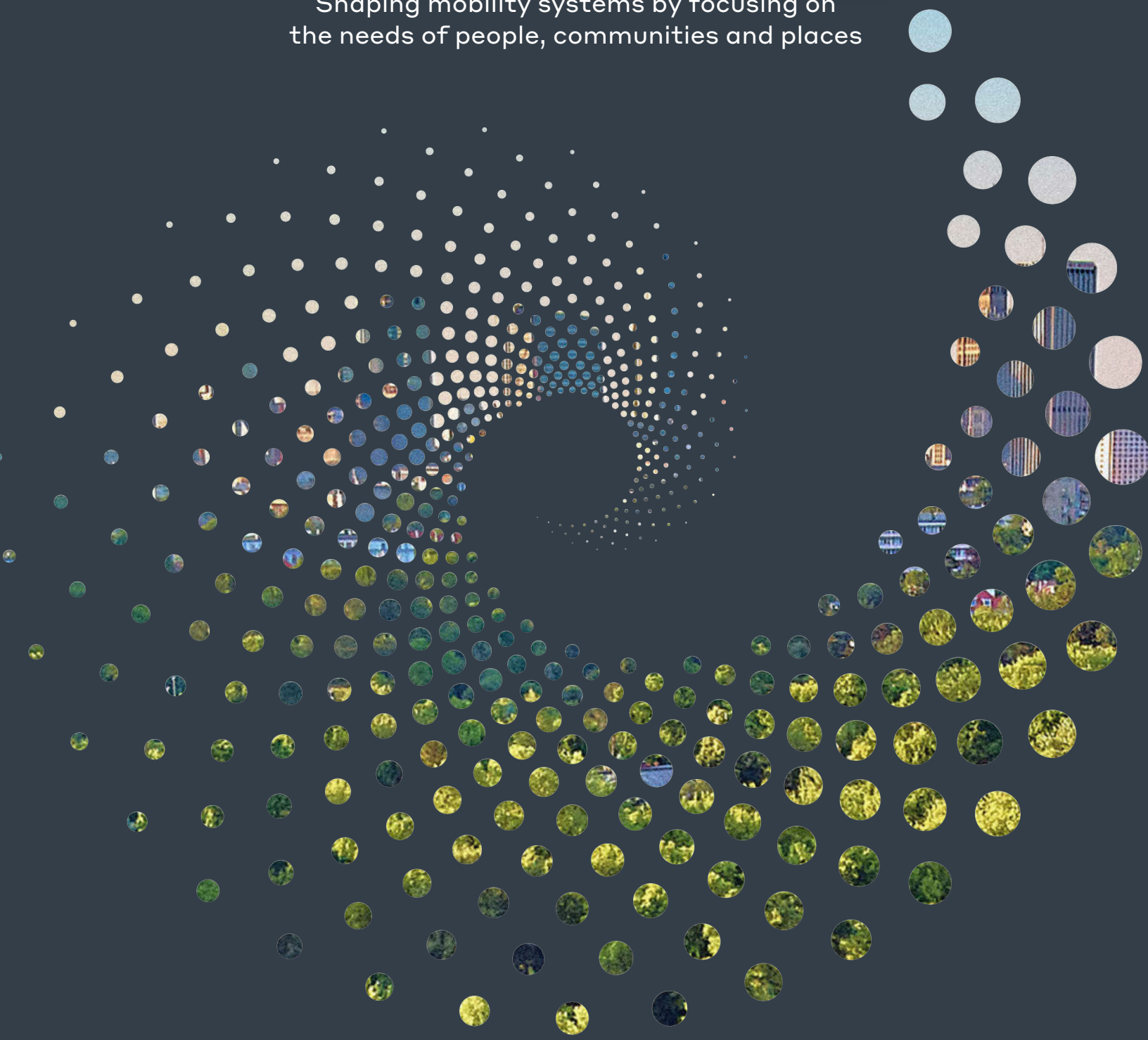# New Mobility
NEXT

Shaping mobility systems by focusing on
the needs of people, communities and places

wsp

Contents

Connect with WSP experts in New Mobility

If you are interested in learning more about New Mobility in your region, WSP offers valuable insights into different markets around the world that go beyond the information included here. We would be delighted to share more of these insights with you; please do get in touch with our team via *NewMobility@wsp.com* or contact the team members noted at the end of the whitepaper.

Foreword

In 2017, we published our global whitepaper *New Mobility Now*. At the time, this was an innovative and forward-facing document framing the changing shape of mobility: all existing and emerging forms of transportation (physical and digital) providing access to places, goods and services. *New Mobility Now* suggested a long-term vision, next steps and an action plan to harness opportunities.

Economic and societal changes, in part a result of the global pandemic, plus ongoing wider changes across government and industry—particularly around the drive for a systematic approach to net zero and the need to bake-in network resilience to cope with climate impacts—have necessitated an update of *New Mobility Now*. That whitepaper recognized the importance of collaboration within and between government agencies, manufacturers and service providers to capitalize upon the opportunities the New Mobility agenda provides; this point is even more relevant today.

Before *New Mobility Now*, transportation innovation was generally described by the ACES (Automated, Connected, Electric and Shared) model, which reflected technology thinking at the time (mid 2010s) with little consideration of the enabling conditions for success. Building on that model, *New Mobility Now* recognized the need for robust business models and associated revenues to underpin the acceleration of technology application and adoption.

Much has happened over the intervening years, and these developments as well as the current situation are discussed in detail in the recently published *New Mobility Now 2.0*[1] but can be summarized as:

- The imperative of focusing on decarbonized transportation (across all use cases) to tackle the significant contribution transport makes to climate change.

- The continued digitalization of society and our economy and, in turn, all facets of transportation across all modes and services.

- The slower than anticipated technology progression for some solutions.

- The consolidation of the marketplace and reduced availability of funding.

- The maturing of underlying business models.

- The slow pace of legislative change has sometimes struggled to keep up with innovation.

- The shift to putting the user / customer at the heart of thinking.

These changes have been fundamental to shaping our thinking, in what is an exciting and fast-moving arena, to focus on the system within which transportation functions and put the customer at the centre of everything we do.

Some six years on from the publication of the original whitepaper, *New Mobility Next* considers mobility systems in the broader sustainability context, to advance transportation options for all people while taking into consideration the pressing issues of today affecting our planet and the quality of people's lives. Ensuring access to mobility services remains an issue throughout the world. Embracing equity, with attention to the diverse needs of community members, is essential as we all try to advance the fairness of outcomes.

New Mobility innovations from the developing world have approached common challenges in very different yet comparably creative ways toward achieving similar outcomes. The intention with *New Mobility Next* is to share our knowledge and evolving view informed by global insights and learning—and further expand the dialogue with consideration of new realities—to deliver lasting benefits. This whitepaper also complements the spirit of WSPs Future Ready®[2] ethos that seeks to bring clarity and vision to complex challenges.

We hope that you find this whitepaper thought-stimulating and helpful, and we look forward to building on these findings with you through fruitful discussions—to advance to the next chapter for New Mobility.

Eric Peissel
Global Director, Transport and Infrastructure

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1   New Mobility Now 2.0, WSP, August 2023.

2   Future Ready® is WSPs global innovation program that seeks to better understand the key trends in climate change, society, technology, and resources and how they are impacting our world, locally and globally. Future Ready® is a registered trademark of WSP Global Inc. in Canada and New Zealand. WSP Future Ready (logo)® is a registered trademark of WSP Global Inc. in Europe, Australia and in the United Kingdom.

Introduction

As with any foresight work, it is vital to reflect on previous thinking and the underlying assumptions prior to considering the future, actively anticipating what might come next and considering how we can prepare in an uncertain world.

In 2017, New Mobility thinking was in its infancy with opportunity to shape the global agenda. The following table provides an objective review of five themes considered in *New Mobility Now*—those that originally shaped the concept—and present questions that can help guide decision-making as we (WSP and other stakeholders who plan and design mobility solutions and the operators who deliver them) look to the future.

Since *New Mobility Now*, we have developed our thinking much further through work we have undertaken with clients in the public, private and third sectors, (non-governmental, non-profit organizations) through observations and engagement within industry and through an evolved process of continual horizon scanning. This approach to framing New Mobility has helped us to anticipate objectively and evidentially what's next for the mobility ecosystem. It considers global as well as local needs and challenges for all types of places, recognizing the externalities that are occurring more generally in societies and our economies and the dependencies therein.

Fundamentally, the approach recognizes that transportation is a derived demand, influenced by all activities within our society and economy. Importantly, transportation is driven by the needs and experiences of the people and organizations it serves, and those needs vary significantly across the socio-economic spectrum. Those customers must be at the heart of everything we do. To deliver meaningful change, we must consider how to effect positive change through innovation and technology from the customer viewpoint, rather than through the historical single lens of technology-readiness.

Reflecting on the thinking contained within *New Mobility Now*, we must also consider innovation and technology alongside the commercial perspective, which remains critical in building the case for investment and sustained viable operation.

	Automated	Connected	Electric	Shared	Business Models and Revenues
What we said in 2017	"With pilots and trials ongoing around the world, increasing on-board automation in new vehicles, and some operational systems already in place, we can expect continued and rapid change."	"Mobility futures will be much more connected. This is inevitable, as the days of 'dumb vehicles' travelling on 'dumb roads' are already behind us in many countries and cities. Many of us already travel in connected cars or public transport vehicles."	"The air quality agenda has reached a tipping point and countries, cities, car manufacturers and fleet operators are now reconsidering vehicle propulsion options. The result is a shift from petrol-fuelled combustion engines towards a focused strategy for the electrification of vehicle fleets."	"Shared mobility is a well-established concept that has accelerated and diversified over recent years, mainly due to the rapid changes offered by the availability of digital information and app-based tools. The basic premise is that sharing can create much more efficient patterns of network use at costs that are less than private car ownership."	"The chosen business model, in particular its reach, its incentives, its influence and its 'teeth', acts as a fundamental enabler for the whole of the New Mobility concept. Done well, this enabler could take separate elements of change related to automated, connected, electric and shared mobility and bind them together so they are mutually reinforcing."
What's changed since?	Automated capabilities of vehicles have continued to develop. We are already benefitting from low-level automaton (advanced driver- assistance, ADAS) in some use cases, while drones and delivery robots have started to move beyond trials. However, mainstream rollout of fully autonomous vehicles has not progressed significantly yet. The growth of wider societal AI applications is providing added impetus to the self-driving agenda.	Considerable increase in uptake of digital-as-a-mode. Connectivity in new cars is now the norm; people are more connected to mobility via smartphones and wearables. Connected infrastructure with AI is beginning to enhance the network management.	Rapid increase in electric vehicle (EV) uptake across some modes. Battery electric dominates with greater uncertainty around hydrogen fuel cell. Infrastructure coverage is inconsistent, and in some territories supply is falling behind demand.	Initially very fast rise and fall of dockless bike-sharing, but the market is now becoming mature with operator consolidation and new regulation. Offer expansion through e-scooters deployment, both trials and commercialization, with growing market for car clubs.	Stronger emphasis on the needs of the user. Ride-hailing companies have moved into bundling offers with other services, such as micromobility, public transit/public transport and food delivery. Continuing evolution of private vehicle "ownership" including subscription services. Mobility-as-a-Service (MaaS) continues to move through trials and some commercialisation.
The reasons for change?	Pivot to a focus on decarbonization. Technology development and the reality of overcoming the regulatory barriers are slowing progress, including questions over legal responsibilities and insurance.	COVID-19 pandemic brought dramatic digitalization of consumption driven through retail / streaming, etc. Customer interest in app-based services and improving user experience.	The climate change imperative, climate crisis declarations and new markets / products opening up. Incentivization of manufacturers through looming bans on sales of ICE vehicles supported in some territories by tax incentives.	Technology readiness, open regulation in some territories and attractiveness to investors alongside a younger generation of urban, tech-savvy customers less interested in vehicle ownership.	COVID-19 drove huge growth in new digitally-enabled business models, which venture capital targeted post-pandemic. Changing approaches to ownership and finance, leading a drive to spread costs in place of purchasing.
What can we see now?	Continued uncertainty of trajectory with different paths continuing to evolve. Previous drivers for automation have stalled or closed, while others are expanding toward commercial readiness.	Continued growth in the connected vehicle market and development of app-based mobility services.	EV adoption for private car continues to face user anxiety, but there is increasing investment in larger-scale hubs. There remains ongoing debate around alternative fuels for heavier use cases.	Continued expansion and maturity of market. Potential for wider deployment into places that have been less commercial to date. Updated regulation of micromobility may open up private ownership for some territories and influence the shared market.	Further consolidation and bundling of services across sectors (e.g., electric car manufacturers bundling electricity supply into vehicle lease agreements). Commercialization of MaaS is already occurring in some territories, while others are reliant on the outcomes of trials before developing and expanding.

Navigating
the changing landscape

We consider that ongoing environmental, societal and economic trends and imperatives have greater and more rapid impacts on mobility than any single transport intervention or innovation. These factors, not technology itself, drive need, demand and use cases to deliver wider beneficial outcomes.

The imperative to achieve net zero is increasingly shaping priorities in decision-making by governments and across sectors. The IPCC *Special Report: Global Warming of 1.5 °C*,[3] examines the relevant scientific literature and calls on society to strengthen the response to the threat of climate change, citing various mitigation pathways, including lowering energy and resource intensity as well as decarbonization/reducing carbon dioxide (CO_2) emissions and CO_2 removal. Greater understanding of the potential negative impacts (without sufficient action) has accelerated decarbonization efforts, circular economy thinking (to reduce waste, reuse assets and recycle materials), CO_2 management practice (for example, guided by PAS 2080[4] in infrastructure), and integrating ways to reduce whole-life CO_2 emissions, which considers the impact of both operational and embodied CO_2 over an asset's entire lifecycle.

In mobility landscapes, the drive to achieve net zero has led to the growing shift to electric vehicles (EVs) around the world and encouragement for more active travel and use of public transport. Rising remote and hybrid working has also impacted travel patterns and transportation mode choices. These trends, in turn, affect mobility landscapes and associated infrastructure requirements.

Environmental, social and governance (ESG) practices are gaining ground, reflecting progress to embrace equity in policies and actions by governments and organizations.

All of these factors support the need to address change from a whole-system point of view—considering the interdependencies between mobility systems and the supporting sectors such as energy and digital that serve it, and the sectors mobility serves such as manufacturing, healthcare, etc. This perspective informs horizon-scanning activities, which provide us with the insights and evidence of future change and help develop future scenarios to identify and mitigate downstream risks.

The broad transport system is complex, comprising people, infrastructure, vehicles, technology and associated data and applications. We must be aware of the unintended consequences of change—where the potential solution for one challenge would actually worsen outcomes for another group of people or an established solution. A whole-system perspective can lead to cascading value and prevent unwanted outcomes within mobility landscapes.

We suggest thinking about the drivers of change by categorizing them in three distinct ways as a means of framing horizon-scanning activities and providing a formalized way of considering change: signals, trends and trajectories.

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3   *Special Report: Global Warming of 1.5 °C*, Intergovernmental Panel on Climate Change (IPCC), accessed 27 July 2023.

4   *What is PAS 2080 (2023 version) carbon management in infrastructure?*, ICE, 05 April 2023.

Signals

These are the first signs of a new changes or technologies. These relate to immature activity which has yet to result in widespread government, development or investment activity.

Example: CPKC (formerly Canadian Pacific) has announced that they will be testing hydrogen-powered heavy-haul railway freight locomotives, starting in 2024.[5]

Example: The US Federal Transit Administration announced in June 2023 $11.6 million funding to research and trial advanced driver assistance systems for transit buses and automated transit bus maintenance and yard operations.[6]

Example: The 20th century witnessed failures and problems in the operations of nuclear merchant ships. Yet, today there is a renewed interest as proven by the recent signature of a memorandum of understanding by organizations based in South Korea (February 2023) to develop nuclear-powered merchant ships equipped with small modular reactors.[7]

Trends

These are instances of new changes or technologies where national and subnational policy is being formulated, a range of trials are being undertaken or significant public- or private-sector investment is being made.

Example: Mobility-as-a-Service solutions are becoming better developed technically, leading to a move toward commercialization across a range of geographies. Commercialization is a goal that no one has yet reached; some trials are aiming to demonstrate the profitability of MaaS. This is the case of the ODIN PASS, a MaaS trial launched in 2021 by Queensland's Department of Transport and Main Roads (TRM), and the University of Queensland.[8] In the United Kingdom (UK), the Department for Transport is funding four MaaS trials where long-term financial sustainability is being explored to be able to run the MaaS platforms once public funding has ceased.

Example: In recent years, courier companies such as Amazon, DHL and Fedex have invested millions in piloting pavement delivery robots (lightweight emission-free vehicles supported by artificial intelligence that use the pavement to deliver goods across communities).[9] These robots, which can be seen in numerous geographies, were first trialled in the UK by Co-op, a major supermarket retailer, in 2018 in Milton Keynes. The number of cities and towns with such trials for home delivery has expanded over the years in the UK.

Trajectories

These are changes or technologies that are becoming established, and a clearer, if not fixed, route to a new business as usual can be seen.

Example: The adoption of private battery electric vehicles is growing exponentially with a total of 14% of all new cars sold in 2022 being electric and an increasing number of electric vehicle (EV) models available to consumers. Leading markets are China accounting for around 60% of the global EV sales, followed by Europe (15%) and the US (8%) (as recorded in 2022).[10] Latest development in wireless or automated charging is expected to make EV ownership more convenient and cost-effective, further increasing the adoption. Yet, early uptake of such innovative technologies will likely be found in premium vehicles or specific commercial use cases such as electric taxis.[11]

Example: Working from home increased dramatically during the COVID-19 pandemic globally. In the UK, between Q4 2019 and Q1 2021, homeworking more than doubled from 4.7 million to 9.9 million people.[12] Remote working had been enabled through investments in cloud-enabled and digital collaboration tools; the number of daily active users of Microsoft Teams worldwide jumped from 20 million in 2019 to 145 million in 2021 and 270 million in 2022.[13] Increased remote working has become a new norm today for some professions, while intensifying and complexifying the cybersecurity needs of organizations with remote workforces.

5   Bill Stephens, "CPKC, Teck Resources pilot program to use hydrogen locomotives in coal train service," Trains.com, 04 May 2023.

6   "Advanced Driver Assistance Systems (ADAS) for Transit Buses Demonstration and Automated Transit Bus Maintenance and Yard Operations Demonstration Program," Federal Transit Administration, accessed 25 July 2023.

7   Chris Baraniuk, "Nuclear-Powered Cargo Ships Are Trying to Stage a Comeback," WIRED, 09 June 2023.

8   "ODIN PASS Mobility as a Service app," iMOVE, 14 February 2023.

9   "Delivery robots are coming. The law isn't ready," TECHMONITOR, 13 January 2022.

10   *Global EV Outlook 2023, Executive summary 2023*, IEA, April 2023.

11   Florian Nägele and Shivika Sahdev, "Perspectives on wireless and automated charging for electric vehicles," McKinsey & Company, 03 April 2023.

12   "Homeworking in the UK – regional patterns: 2019 to 2022," Office for National Statistics, 11 July 2022, accessed 25 July 2023.

13   Lionel Sujay Vailshery, *Number of daily active users (DAU) of Microsoft Teams worldwide as of 2022*, Statista, 22 February 2023, accessed 25 July 2023.

As we horizon-scan for change across mobility systems and the interconnected or adjacent sectors, such as in agriculture or manufacturing, using trusted sources of information and thinking, it is vital that we have a way of considering the state of such changes and what that means from the technological, commercial and customer points of view. We frame these as follows:

Technology Readiness

The technological maturity of a technology or solution, as developed by NASA in 1970s and used commonly.[14]

Commercial Readiness

The commercial maturity of a service or technology ranging from unproven business models/commercial models to a steady state within the marketplace with stable pricing and accessibility (this being our own proprietary index).

Customer Readiness

The willingness of end customers to embrace change, the technology, service or solution, ranging from engaging in limited test rollouts and early adoption through to mainstream business as usual (again, this being our own proprietary index).
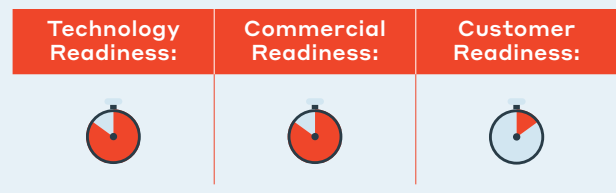
Sinclair C5

The hype and fail of the Sinclair C5

The Sinclair C5 electrically powered car, serves as an example of a new product that faced challenges leading to its failure. These challenges were attributed to the lack of customer readiness and user-centric design, even though the product was mature technologically and commercially. Launched in January 1985, the one-person vehicle featured an advanced injection-moulded polypropylene shell and a chassis designed by Lotus. With a 30-kilometre range enabled by improving battery technology, the C5 entered the market at a starting cost of £399 (≈ CAD 678). However, the public reception was predominantly negative, primarily due to safety concerns, which subsequently led to limited customer interest. Notably, an investigation into the vehicle's failure conducted by the European Journal of Marketing four years after its release highlighted the absence of undertaken market research, despite substantial investments in its development.[15] In 1985, Sinclair faced receivership after selling only 17,000 units.[16] Production ceased the same year, around 8 months after launch.[17]

Technology Readiness:	Commercial Readiness:	Customer Readiness:

14 NASA, Technology Readiness Level, accessed 25 July 2023.

15 Jack Stewart, "Was the Sinclair C5 30 years too early?," BBC, 9 December 2014.

16 Nick Smith, "Classic Projects: Sinclair C5," IET sites, 19 January 2015.

17 Jack Stewart, "Was the Sinclair C5 30 years too early?," BBC, 9 December 2014.

We have undertaken an assessment of technological, environmental, social and economic changes through technology, commercial and customer points of view, along with a consideration of downstream impacts (positive or negative). This has enabled the scoring and ranking of change within a consistent framework.

The following tables present our highest-ranked global drivers of change, providing a useful baseline for 2023. Through our assessment, we have ranked them to indicate their relative importance to the transportation and mobility sector.

Evolving patterns of demand for travel are shifting when, where and how goods are manufactured or services are provided. A lack of in-built resilience to climate change impacts the availability of our networks during extreme weather events. Shifting patterns of land use and development shapes future requirements, and changes to propulsion and energy sources are rapidly pivoting where, when and how vehicles fuel.

As wider demands shift and new ones arise, mobility solutions too must evolve, ideally anticipating changes before they happen rather than, as has largely been to date, lagging and playing catch up to meet new expectations. Innovation is often expressed through the applications of emerging technologies and the mobility services they enable rather than the outcomes and benefits they bring. Mobility services, technologies and innovations ultimately serve the needs of society and the economy rather than vice versa.

It should be noted that systematic horizon scanning is a critical activity as the landscape is constantly shifting (with geographic variations). These drivers of change may impact developed and emerging economies differently, and the abilities of economies to influence or withstand those drivers may be extremely unequal.

Changes in the environment, society and the economy are presented upfront, as these provide the drivers behind and context for subsequent mobility developments.
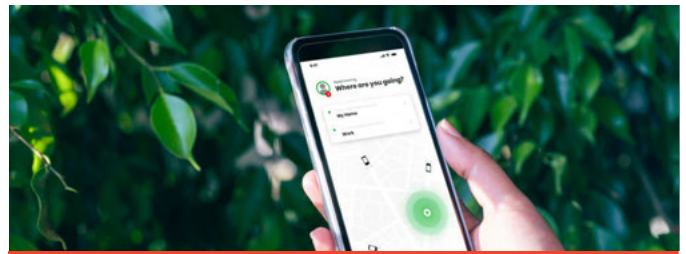
The long-awaited profitability of ride-hailing companies

Ride-hailing is a sector where customer and technology readiness drastically outpaced traditional measures of commercial readiness. Ride-hailing technology—enabled by a real-time marketplace with dynamic pricing—initially supported by venture capital money, has appealed to customers over time. In 2016, Uber reported 45 million monthly active users,[18] which increased to 131 million in 2022.[19] Yet, Uber's first profitable quarter was in 2021. Lyft and Ola share a similar story of taking nearly 10 years to turn a profit.[20] The three companies have each adopted different business strategies to achieve profitability, including Uber successfully developing adjacent food delivery services that are generating more revenue than mobility services (and helped cushion the impact of the reduced travel demand during the pandemic); Lyft launching a business-to-business logistics division[21]; and Ola undertaking efficiency measures.[22]

Technology Readiness:	Commercial Readiness:	Customer Readiness:

18   *Form S-1 Registration Statement, Uber Technologies, Inc.*, United States Securities and Exchange Commission, as filled with the Securities and Exchange Commission on 11 April 2019.
19   "Uber Announces Results for Fourth Quarter and Full Year 2022," Uber Investor, 08 February 2023.
20   Rachel Banning-Lover, "Is ride-hailing finally a profitable business?," Financial Times, 05 November 2021.
21   Robert Scammell, "Uber and Lyft face a long ride to profitability despite pandemic recovery," Verdict, 05 August 2021.
22   Aditi Shah, "Softbank-backed Ola unveils first operating profit ahead of potential IPO," Reuters, 2 November 2021.

Changes in the environment, society and economy		
Rank	**Title**	**Description**
1	Climate Change	Changing global climate caused by increasing greenhouse gas emissions of which mobility is a key contributor. Includes twin challenges of achieving net zero and ensuring climate resilience.
2	Social Inequality	The relational processes in society that have the effect of limiting or harming an individual's or group's life opportunities.
3	Spatial Inequality	The unequal distribution of income and resources across geographical regions as amplified by the cost of living crisis in many countries.
4	Scarcity of Resources	The world's growing population is facing shortages in key areas: energy, water and food, and of other rarer commodities.
5	Digital Economy	Economic activities facilitated by digital technologies and tools including AI; provides productivity gains and platforms for new economic activities.
6	Growing Population and Migration	Increasing national populations through birth rates and/or migration.
7	Urbanization	Increasing populations in cities with people moving away from rural areas.
8	Globalization	The process of increasing interaction and integration between people, organizations, businesses and governments worldwide.
9	Growing Food Demand	Global food demand increases and is expected to increase further along the population growth.
10	Ecosystem Breakdown	Ecological collapse refers to a situation where an ecosystem suffers a drastic, possibly permanent, reduction in carrying capacity for all organisms, often resulting in extinction.

Considering the mobility impacts of these top ten drivers reveals four key areas of convergence:

Environmental impacts and resilience: reducing the environmental impacts of transport particularly through rapid decarbonization but also through supporting the drive to avoid ecosystem breakdown and reverse declines. Alongside reducing harm, we need to make our systems resilient to the impacts of climate change, including extreme weather and shifting populations.

Widespread changes to demand for travel: particularly through those shifting populations, whether from country to country or from rural to urban. With growing urban populations, and therefore increasing urban areas, demand for travel may rise in those areas as well as the distances that people travel. Demand for movement of people and goods may also increase between countries as populations disperse, industries shift and as food production alters, particularly through the influence of climate change.

Ability to support changes in demand for travel: the increasing need for investment, particularly public expenditure, with targeted increases needed for urban infrastructure, services and wider resources against a need to improve resilience and reduce the (embodied) CO_2 within new infrastructure.

Unequal distribution of access: this may continue at a global level but also through the urban/rural divide, which may be further exacerbated through shifting populations but also unequal affordability. New Mobility needs to support the delivery of more equitable access to daily needs, including through both physical transport and digital connectivity.

Turning to technology and services, the following table outlines the Top 10 drivers.

Technology and Services		
Rank	Title	Description
1	Zero Emission Vehicles	Transitions toward vehicles (cars, van, buses, HGVs etc.) that do not emit CO_2 or other greenhouse gases from the tailpipe.
2	E-commerce	Online markets remove the need for physical presence and allow reach of distance customers.
3	Improving Digital Connectivity	Both wired and over the air digital connectivity (including 5G, satellite, etc) is increasing access to online capabilities.
4	Emerging Transport Modes and Services	Emerging technologies, challenges and drivers are paving the way for innovation in transport and the emergence of new modes of transport.
5	Internet of Things	A network of physical devices, vehicles, home appliances, and other objects that are embedded with sensors, software, and connectivity, allowing them to collect and exchange data and perform automated tasks.
6	Virtual Reality	Wearable technology which uses virtual 3D environments, near-eye displays and motion tracking to give users the illusion of being in a different location.
7	Digital Currency	Currency, money, or money-like asset primarily managed, stored, and exchanged on digital computer systems.
8	Blockchain	Money and contracts move to digital open-source protocols enabling and verifying digital scarcity and proof of ownership.
9	Remote Healthcare	Remote patient consultation with a doctor sitting anywhere in the world.
10	Digital Twin	A digital twin, a virtual representation that serves as the real-time digital counterpart of a physical object or process, could provide additional data insights to improve customer outcomes.

The technologies present some opportunities to face the mobility impacts identified above but with challenges to overcome in their application.

Reducing environmental impacts: New technologies present opportunities to reduce the impacts of transport through decarbonizing propulsion, construction and maintenance and also through reducing noise and improving air quality. However, challenges include the affordability of decarbonization and also the increasing demand for travel, both personal and freight, through population growth and changes in consumer behaviour.

The potential of digital technologies (including AI) to drive change in mobility, including the increasing ability of people to connect to work, services and retail online, reducing the needs to travel, but in some cases replacing the movement of people with the movement of goods. However, the potential of digital could go further including through integration of digital into transport infrastructure, vehicles, operators and customers enabling, among other things, greater security, efficiency, speed, transparency of mobility information and transactions.

Disruption to the environment, society and economy: New technologies could generate significant disruption with, for example, the emergence of new modes into the transport market creating competition to existing modes and services. However, disruption could expand beyond mobility into wider area of the environment, society and economy, such as through redundancy or oversupply of new or existing assets, reducing social connectivity or altering demand for traditional service models.

Optimizing delivery: Despite the potential for disruption, benefits from applying new technologies may lead to optimizing transport including through improvements in the design, monitoring and maintenance of infrastructure and services, particularly as result of digital connectivity, automation, payment systems and new sources of revenue.

It is important to take a pragmatic, fact-based approach to documenting such technology and service drivers. As the Gartner Hype Cycle describes (see following page), the various stages of any innovation usually play out in a similar manner. Our understanding of drivers of change and undertaking horizon scanning, via signals, trends and trajectories, helps to develop future scenarios and frame policy, strategy and program visions of success. Major drivers, such as climate change, the ever-evolving internet and the global pandemic, have generated diverse impacts, with geographical interpretation and variation.

As some drivers fade, others grow in influence and new drivers appear on the horizon; we need to consider how, individually and in combination, they may affect the different places we inhabit. Developing plausible scenarios that build on the numerous and complex drivers of change, while taking account of the differences across place types, plays a key role in understanding the future environment in which New Mobility will be delivered and the challenges it will help to resolve.

We advocate prioritizing drivers of change and forming them into scenario levers. Each lever represents a key area of change (e.g., climate change, application of new technologies or population distribution) with the movement of the lever altering or maintaining the current rate of change. In different combinations, those levers enable a range of plausible future scenarios, or alternative futures, to be formed. Using either the same set of levers, or supplementing them with locationally specific levers (e.g., considering different land uses or economic sectors), subscenarios for different place types can be developed.

For each scenario, the overall impact on places and the environment, people and society, and activities and the economy, can be considered and compared across all the alternative futures, leading to the focus on a preferred scenario and, perhaps, differing preferences for different types of place.

For example, Figure 1 (p.13) illustrates three very different scenarios for a sample rural community and the key future drivers within them. This is a significant development from early methodologies, which did not consider the complexities and temporal nature of change.

Applying System Dynamics

WSP's Scenario Planning Toolbox enables decision-makers to test how different assumptions can impact future transport in cities and places around the world.
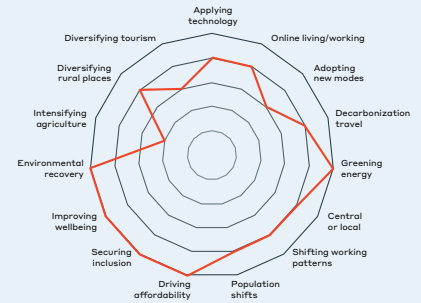
A pilot project with Southern California Association of Governments (SCAG) demonstrates how system dynamics brings improved understanding about the interrelationships between trends to advance decision-making.

More *here*

RURAL TECH REVOLUTION
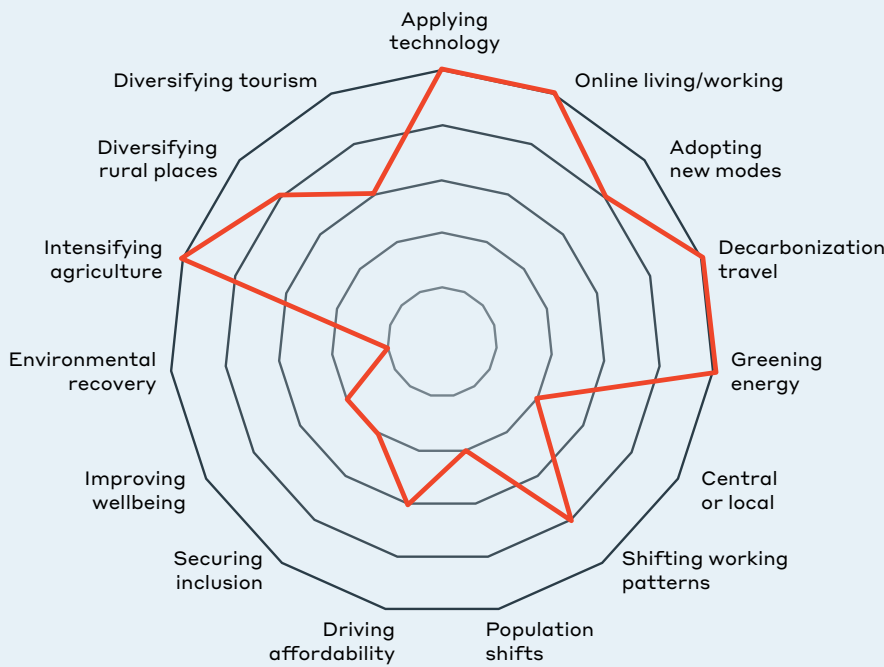
RURAL RECOVERY

RETREATING RURAL
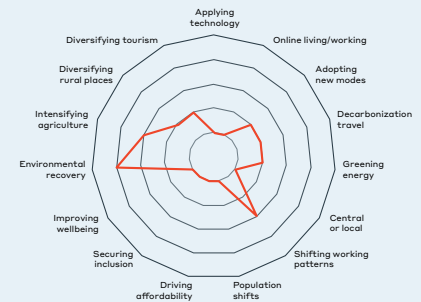
FIGURE 1

The diagrams above present three very different scenarios for a sample rural community and the key future drivers within them. They show the combinations of drivers in different positions; the drivers are placed in one of five positions, with the inner-most circle representing a significant slowing of the rate of change of that driver, the middle circle representing a maintaining of the rate of change and the outermost circle representing a significant increasing of the rate of change.

Gartner Hype Cycle

The New Mobility space has suffered from a great deal of hype and over-promise over recent years. The Gartner Hype Cycle provides an approach to considering and mitigating challenges by mapping innovation against five distinct phases of evolution – the innovation trigger, the peak of inflated expectations, the trough of disillusionment, the slope of enlightenment and the plateau of productivity.[23] Being realistic about promises helps to manage downstream risks and outcomes.

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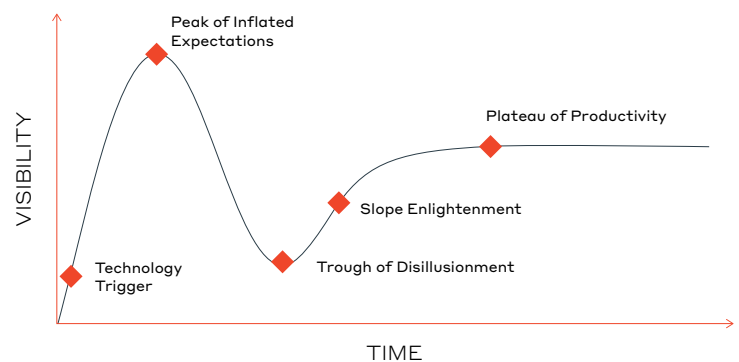
23   Gartner Hype Cycle, Gartner, accessed 25 July 2023.

Scenarios for a sample rural community:

RURAL TECH REVOLUTION:

Rural areas experience a further industrial revolution through the application of new technologies to agriculture, manufacturing and supporting sectors, bringing formerly marginal land into productive use. Significantly improved digital networks enable rural industries to expand into e-commerce and take greater advantage of data and AI in their operations. Opportunities open up to move more digitally intensive employment into rural areas. Lower-skilled employment is replaced by technology with associated populations reducing or becoming less sustainable, but higher-skilled residents move in, supported by technology and digital connectivity. With more land given over to production and used more intensively, priority is given to food over rebuilding natural ecosystems. Technology leads changes in transport provision and use. Digital and electricity infrastructure investment enables adoption of new rural transport modes and services, and decarbonization of transport catches up in rural areas, supported by more space being given over to zero-carbon energy generation and storage. Access is enhanced by digital provision as improved networks enable public services to be delivered online, and consumers more fully engage with e-commerce. Technology also enables new rural-specific service models to deliver bespoke transport solutions that meet the differing needs of countryside and coastal residents and visitors.

RURAL RECOVERY:

Current pathways and speeds of technology adoption remain, but digital connectivity starts to catch-up with urban areas. Investment is made in rural decarbonization, both to transport and particularly energy generation, leading to a focus on greening the rural economy. This is supported by shifts in land use, on marginal land, to focus on environmental net gain and ecosystem recovery alongside CO_2 sequestration and mitigation of adverse impacts of climate change. Communities are supported through new jobs, including within green industries and environmentally conscious tourism. Agriculture remains vital to the rural economy, with farming focused on the most viable and productive land. Service provision is more localized with communities empowered to plan and deliver more themselves, bringing a focus on wellbeing and inclusion. Community delivery expands further into personal and freight transport with networks of small towns and villages working together to provide socially necessary access to services and goods. This is supported by expansion of peer-to-peer delivery models and community sharing of assets, including cars, vans, mini-buses, bikes and EV charging. With a focus on the environment, greater investment is made in active-travel infrastructure supporting intra-rural travel and access to larger centres.

RETREATING RURAL:

Rural areas fall further behind urban counterparts in technology application and digital communications, limiting access to services, constraining businesses and increasing the brain drain of remaining high-paid jobs. A lack of investment in digital and electricity infrastructure means that new modes stay in urban areas and the decarbonization of travel in rural areas lags significantly behind. The population continues to age and decline, with wellbeing and affordability reducing, exacerbated by a further shift to more centralized service provision as communities shrink, reducing viability of local delivery including rural transport services. The rural economy becomes less diverse with a greater reliance on agriculture, and tourism suffers from fewer people available to work in seasonal jobs. Rural areas remain stuck in a CO_2-intensive, car-centric transport system where transport deserts spread further and transport poverty becomes ever more prevalent.

This approach also helps us consider the associated (and critically important) monitoring and evaluation frameworks to determine what "good" and "excellent" are—essential in providing business case and commercial evidence to help inform future initiatives and decision making.

CASE STUDY

Mode Shift

WSP carried out a research project for the UK's Climate Change Committee to understand behavioural barriers preventing mode shift from driving to sustainable modes. The study was a mixed-methods project made up of a rapid-evidence-review of academic and industry literature and primary research through a survey of around 2,000 people and follow-up focus groups.

The work resulted in evidence-based recommendations to encourage mode shift. The recommendations ensure that all aspects of decision-making are addressed, reframing the costs of driving, changing how we look at public space, focusing on incremental change, connecting various transport options, and making interventions locally-specific.

More *here*

Reframing
New Mobility

The rate of change in the mobility and the transportation sector is rapid; some technologies have advanced quickly while others have seen a reduction in pace. The global pandemic has led to a shift and amplification of some priorities.

The signals, trends and trajectories described above can be encapsulated within a revised set of complementary and sometimes interlocking themes for new mobility as defined below.

These themes, which include the five—automated, connected, electric, shared, and business models and revenues—identified back in 2017 (as denoted with * in the table below), have been supplemented to reflect the changing realities over the intervening period. Described below, the themes apply to all modes, are applicable to both organizations and individuals (as consumers) and include passenger, freight and logistics use cases.

It should be noted that this is an ordered list. As the customer is central, people's attitudes and behaviours influence how approaches are designed to tackle the most pressing challenge—decarbonization. Automation and its constituent use cases are informed by many, if not all, of the other themes.
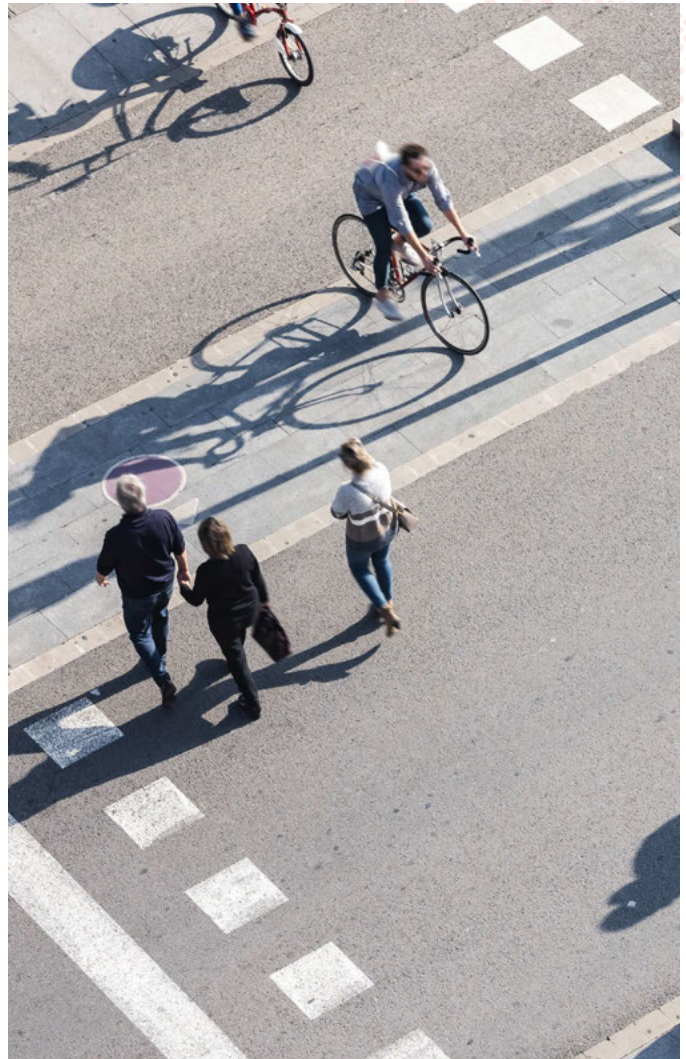
Needs, attitudes and behaviours

The shifting expectations and behaviours of customers within a fast-moving, decarbonizing, digitized and post-pandemic landscape, including travel patterns and modes.

Example: The city of Paris is actively reducing its dependence on cars in developing a wide range of projects aiming to improve air quality, rebalance the public realm toward non-car users and reduce its environmental impact. Such projects include a cycle-centric plan,[24] a low emission zone to progressively forbid access to the most pollutant vehicles[25] and a limited traffic zone.[26]

Example: The rise of e-commerce combined with customer demand for fast deliveries are drastically changing the retail and logistics landscape. While traditional retailers look for customer density, e-commerce ones locate their warehouses in low-density peripheral areas with a high level of accessibility to the transport network.[27]

*Decarbonization

The move to zero-emission (at the tailpipe) vehicles using primarily battery and hydrogen electrification technologies is the overarching challenge of our age, given transport's considerable contribution to climate change impacts. This includes all modes: land, sea and air, and all use cases.

Example: Norway is experiencing a fast transition to EVs. In 2022, 79% of new passenger car registrations were for EVs, an additional 8.5% were plug-in hybrids. This has been enabled through the Government waiving EV import duties and registration taxes.[28]

Example: Rickshaws, small 3-wheeled vehicles used primarily for public transport, and two-wheelers are leading the electric transition in India. There are about 1.75 million electric three-wheelers recorded in the country while 95% of the 430,000 EVs sold in the fiscal year ending March 2022 were two- or three-wheelers. India's government sees the benefit of embracing low-cost EVs to reduce CO_2, and supports their adoption by cutting taxes and providing subsidies for certain models.[29]

24   Un nouveau plan vélo pour une ville 100 % cyclable," Paris, 21 October 2021.

25   Les actions de la Ville pour une meilleure qualité de l'air," Paris, 17 September 2019.

26   Paris crée une zone apaisée dans le centre de la capitale," Paris, 15 April 2022.

27   Jean-Paul Rodrigue, *The distribution network of Amazon and the footprint of freight digitalization,* Journal of Transport Geography, ScienceDirect, October 2020.

28   Felix Richter, "This chart shows how Norway is racing ahead on EV," World Economic Forum, 06 January 2023.

29   Salimah Shivji, "How India's electric rickshaw revolution is forging a low-carbon future," CBC News, 07 November, 2022.

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1101
0111**

*Digitalization (and digital connectivity)

The ongoing growth of digital connectivity of vehicles, assets, control systems and customers within transport and mobility networks and the underlying digital networks themselves, as well as the use of digital solutions to replace the need for travel.

Example: Connected cars is a growing sector—projected to rise from 237 million cars in 2021 to 863 million cars in 2035—making the US the biggest market followed by the European Union and China.[30] Yet, most mobility players including OEMs have been slow to monetize data from the connected fleet.[31]

Example: In 2020, only 17% of the population globally were covered by 5G networks, an increase from 5% in 2019. Great disparities were noticeable among regions and according to country incomes: 47 out of the 57 countries who had launched 5G networks at the end of 2020 were high-income countries.[32]

Changing places

The changing form, function and needs of places, from dense mega cities through to isolated remote rural locations, particularly as populations migrate.

Example: The concept of garden villages has gained popularity as a response to urbanization, aiming to address issues like overcrowding, car-centricity, pollution, and the loss of green spaces in urban areas. "Long Marston Garden Village" in Warwickshire, was once a disused airfield but has now transformed into a lively and green neighbourhood. This development is set to introduce 3,500 new homes, with a specific mandate for 35% of the housing to be affordable. It is a joint venture between local authorities, developers and community stakeholders.[33]

Example: Barcelona has been putting pedestrians first in the re-design of its public realm through the development of superblocks (the first of these dates to 2016[34]). Superblocks are expected to create a city of "compact and connected neighbourhoods with a mixed land use, and high potential for social capital"[35] encouraging sustainable mobility in a less polluted environment. This is enabled by routing traffic around multiblock areas toward an increase of greener and pedestrian-friendly areas almost completely free of cars.[36] Barcelona's ambitious urban planning vision accounts for a total of 503 superblocks being implemented.[37]

30 Martin Placek, *Size of the global connected car fleet in 2021, with a forecast for 2025, 2030, and 2035, by region,* Statista, 28 September 2022, accessed 25 July 2023.

31 Michele Bertoncello at al., "Unlocking the full life-cycle value from connected-car data," McKinsey & Company, 11 February 2021.

32 Anne Delaporte and Kalvin Bahia, *The State of Mobile Internet Connectivity 2021,* GSMA Connected Society, September 2021.

33 "Garden communities set to flourish across England," Department for Levelling Up, Housing and Communities, 24 May 2022.

34 Feargus O'Sullivan, "Barcelona Will Supersize its Car-Free 'Superblocks,'" *CityLab Transportation,* Bloomberg, 11 November 2020.

35 Natalie Mueller et al., *Changing the urban design of cities for health: The superblock model,* ScienceDirect, January 2020.

36 Feargus O'Sullivan, "Barcelona Will Supersize its Car-Free 'Superblocks,'" *CityLab Transportation,* Bloomberg, 11 November 2020.

37 Ronika Postaria, "Superblock (Superilla) Barcelona – a city redefined," Cities Forum, 31 May 2021.

*New modes (and services)

The emergence of new transport modes and associated services within the mobility marketplace with differing degrees of commercial maturity and success.

Example: Drones are being used to deliver blood and medical supplies in Rwanda.[38] Zipline, a US medical drone company, originally started delivering these supplies in Rwanda in 2016 and has since expanded to food, retail, agriculture products, and animal health products. During the COVID-19 outbreak, Zipline adapted its cargo and distributed personal protective equipment and COVID-19 test samples to health facilities.[39] This type of service is part of emerging developments in advanced air mobility, which aims to provide a range of mobility services for communities including on-demand logistics, emergency or high value / risk medical supplies and air taxis.[40]

Example: Cargo bikes are increasingly used for carrying heavier or bulkier loads, around congested cities, rural areas, hilly routes, and narrow lanes more efficiently. Cargodale, a cargo bike scheme established as a grocery and shopping delivery service for residents in Calderdale (UK), covered around 1,800 miles within its first 6 months. This prevented around 500 kg of CO_2 emissions from being produced, compared to using small diesel vans or multipurpose vehicles, such as people carriers.[41] A report from the University of Westminster found that cargo bikes in central London were on average 60% faster than vans while emitting 90% less CO_2 compared with diesel vans and 33% compared with electric vans.[42]
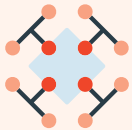
*New business models

New ways which customers pay for and access services and assets, including subscriptions and shared access or ownership.

Example: Uber is testing adding train and coach travel to its app in the UK so that customers can book longer-distance ground travel via a fully integrated tie-up with Berlin-based multimodal travel platform Omio.[43] Currently, Uber offers different ride types in their app, such as shared rides, low-cost rides for large groups, luxury vehicles and wheelchair-accessible vehicles.

Example: Tesla applies special discounts as purchase incentives to take delivery of new inventory vehicles. Recently, Tesla has rolled out three years of free Supercharging to the new inventory of Model S and Model X vehicles.[44] This is a similar model to their home energy products, sold as a bundle with energy generation (solar roof and panels) and energy storage (Powerwall).[45]

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38   "Drones deliver blood and medical supplies in Rwanda," BBC News, 01 May 2018.

39   "How drones are helping to battle COVID-19 in Africa – and beyond," World Economic Forum, 08 May 2020.

40   *Getting Ready for Advanced Air Mobility*, WSP, 25 May 2022.

41   Department for Transport, *Transport in rural areas: local authority toolkit*, 13 April 2022.

42   Ersilia Verlinghieri, "Using cargo bikes for deliveries cuts congestion and pollution in cities, study finds," University of Westminster, 23 August 2021.

43   "Omio announces partnership with Uber, accelerating move towards mobile-first travel," Omio Corporate, 03 August 2022.

44   Fred Lambert, "Tesla discounts Model S/X $8,000, plus 3 years of free Supercharging in end-of-quarter push," Electrek, 17 June 2023.

45   Fred Lambert, "Tesla is only bundling solar products and Powerwall together going forward," Electrek, 21 April 2021.

Aggregation

Physical and digital aggregation of services, facilities and assets to provide new customer or operational propositions, including concepts such as Mobility as a Service (MaaS) and mobility hubs.

Example: Mobility hubs are proliferating around the globe, going beyond the multimodal interchanges to integrating public and shared mobility modes and services with other functionalities, such as business services or shopping, coworking facilities, Wi-Fi access, and social or community facilities. While the hub concept is flexible, CoMoUK has established a mobility hub accreditation to encourage quality standards and minimum thresholds to be met.[46]

Example: Different funding streams are currently supporting the development of MaaS in the UK. The UK Department for Transport has awarded Future Transport Zone funding to four English authorities to deploy and trial MaaS solutions; they have chosen various approaches to delivery and operation and are at different stages of advancement at the time of this report. The Highlands and Islands Transport Partnership has benefitted from the European Union and the Scottish Government funding to launch their Go-Hi MaaS platform in 2021.[47]

*Automation

The transition to automated (and ultimately) autonomous capabilities and solutions across all modes and use cases, enabled by many of the themes above.

Example: Automated long-haul trucking is being developed for commercial deployment in the United States. So far, these self-driving vehicles mostly have a "safety driver" behind the wheel, ready to take control if the AI needs help. In 2018, ICCT reported SAE level 1 automation as commercially available, SAE 2 as pre-commercial, SAE 3 as prototype retrofit and SAE 4 & 5 under research and development.[48] Currently, a number of autonomous driving companies are developing automation for long-haul trucking that is designed to work as a "transfer hub" model, in partnerships with OEM trucking companies and fleet operators and restricted to Sun Belt states. [49]

Example: Australia utilizes the largest number of autonomous mining trucks in the world, with more than 700 trucks across its mines. Autonomous mining trucks have proven to be effective in hauling materials without the need for human operators, especially in large-scale open-pit mines that often involve the movement of massive amounts of earth and minerals. Autonomous haul trucks are present at 25 mines in Australia, compared with 19 across the rest of the world.[50]

Example: CAVForth is a pioneer project led by Fusion Processing Ltd in partnership with public, private, and academic organizations and co-funded by the UK Government. The project delivered the first UK's fleet of buses operating at the SAE Level 4 of autonomy on public roads. Service began in May 2023 with five buses on a 22.5-kilometre route from Edinburgh across the Forth Road Bridge, able to travel in mixed traffic at a maximum speed of 80.5 km/h and to transport up to 10,000 passengers per week.[51]

46   *Mobility hub delivery models*, CoMoUK, October 2021.

47   "Revolutionising travel in rural Scotland," Go-Hi, accessed 27 July 2023.

48   Benjamin Sharpe and Peter Slowik, *Automation in the long haul: Challenges and opportunities of autonomous heavy duty trucking in the United States*, ICCT, 26 March 2018.

49   Lori Atherton, "Assessing the impact of automation on long-haul trucking," Science Daily, 15 March 2022.

50   *Global Autonomous Mining Truck Population Tops 1,000*, Global Data, 01 May 2022, accessed 25 July 2023.

51   "Ambitious and complex CAVForth autonomous bus service launches in Scotland controlled by Fusion Processing's automated drive system," CAVForth Connected Autonomous Vehicles, 11 May 2023.
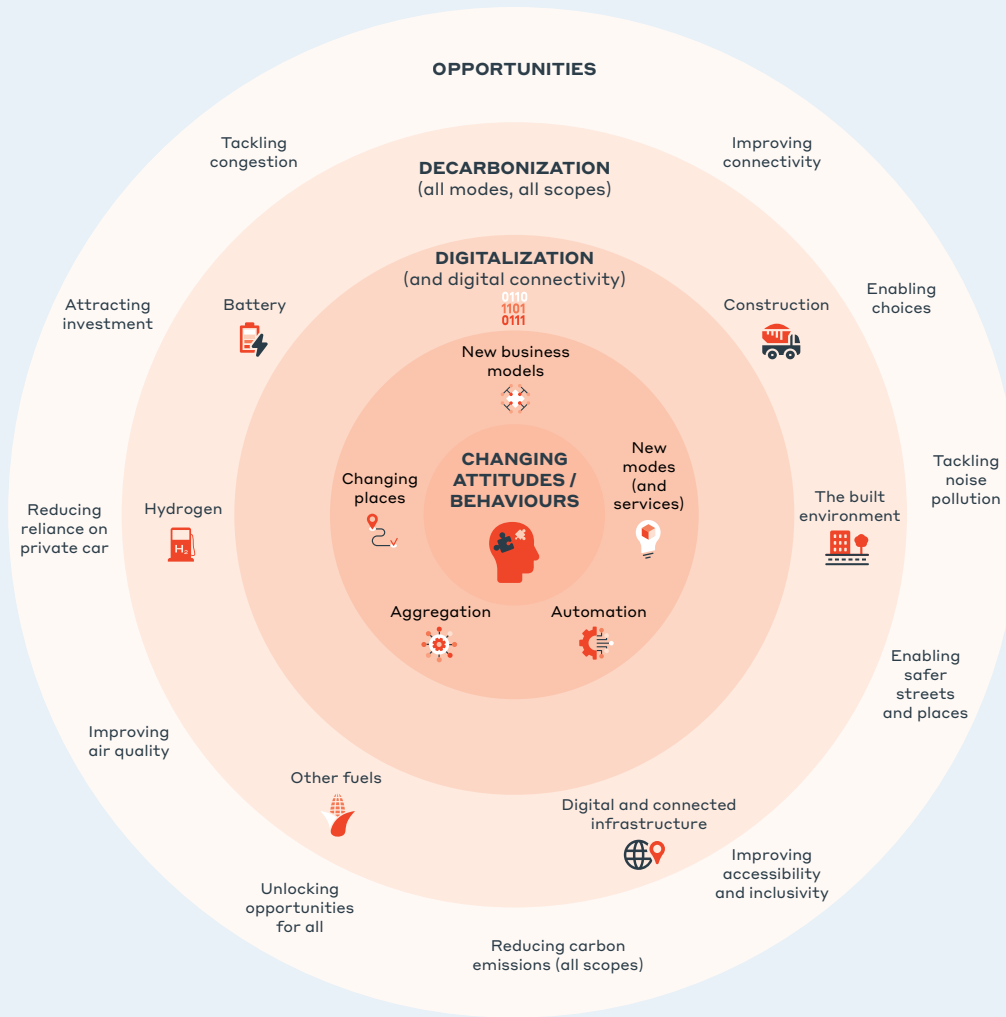
FIGURE 2

Major themes and associated benefits in mobility decision-making with the customer at the center.

The opportunities and benefits associated with these themes are wide-ranging and help to achieve wider societal and economic outcomes, as illustrated in Figure 2. This reframing places the customer at the heart of the changing mobility landscape, with ongoing digitalization and decarbonization being the imperatives that increasingly guide and impact decision-making.

There are interdependencies between these themes. For instance, many automated use cases require good-quality digital connectivity, and the changing shape of our places and communities may lead to new business cases for modes or services.

It should also be noted that progress differs from geography to geography; what might be "new" in one territory could already be "a new norm" in another. The framing of new mobility is intended to encapsulate the intricacies of an uncertain set of interventions inserting themselves and trying to exist within long-established transport systems.

It is vital that we consider the whole system within which existing and new mobility occurs, to understand the ever-increasing interdependencies with other facets of our world. The diagram below illustrates the concept of a new ecosystem and how to consider it through interlinked parts and perspectives.

The viewpoint

The whole organization
The whole area
The whole journey

Vehicles
Materials
Space
Engagement
Staff
Mobility
Energy
Place
Environment
Funding
Delivery Models
People & Behaviour
Activity
Maintenance
Society
Economy
Management
Digital
0110
1101
0111
Policy
Legislation
Infrastructure
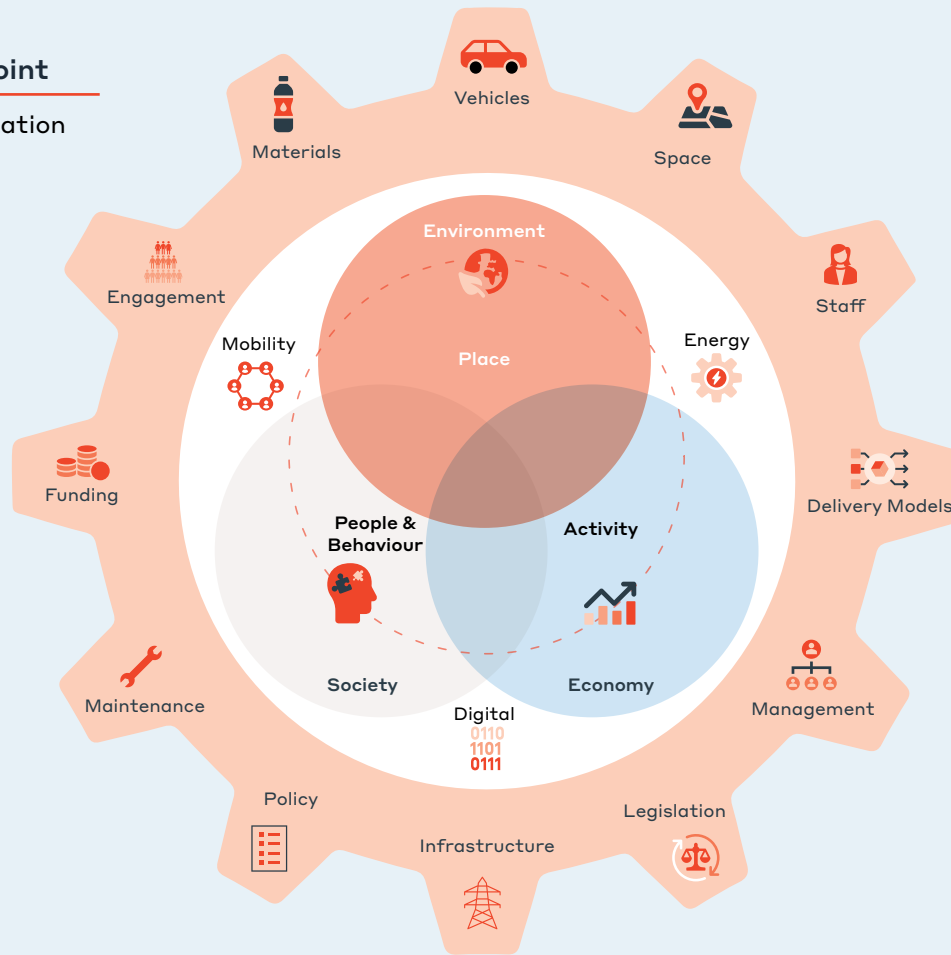
FIGURE 3

The new ecosystem

- **The new ecosystem:** Illustrates the relationships between mobility, and its digital and energy backbones, the society, economy and environment that it supports and the differing needs of people (and organizations), the places they inhabit (or operate) and the activities they undertake that mobility serves.

- **The viewpoint:** This could be a geographical area, considering all the people (and organizations), places and activities in an area; it could be a whole organization, not just those involved in planning, delivering or operating transport; or it could be a whole end-to-end journey, not just an individual stage or mode.

- **The enablers:** The new ecosystem is supported by a range of hard and soft resources that are needed to maximize its effectiveness.

If one part of the system is weak, such as one part is changing at a rapid rate, a too narrow perspective is used, or an interdependency is vulnerable, there is an inherent risk that any mobility solution, or the system itself, will be suboptimal.

Considering mobility this way brings multiple benefits: it gives licence for stakeholders to work together around common objectives and shared resources; it enables critical thinking from varying perspectives; and it helps with the gathering of wider evidence for business case development, which, in turn, helps deliver amplified benefits and outcomes.

Applying such thinking to the new mobility space allows stakeholders to consider significant socio-economic challenges to deliver mobility systems for both the present and the future. Understanding the constituent elements of the system in terms of their connectedness to each other will enable mobility solutions to become highly adaptable to community and societal needs, thus strengthening their resilience to support sustainable outcomes.

CASE STUDY

South West Rural Mobility Strategy, England

WSP (UK) supported Western Gateway and Peninsula Transport Sub-national Transport Body to publish the first major rural mobility strategy in England. The commission applied a detailed place and people-centric approach to considering the challenges in rural countryside and coastal areas.

Our work took the signals, trends and trajectories approach and used it to define a range of different rural scenarios similar to those outlined above. These supported the development of a vision and ten-point framework for rural mobility. The strategy goes on to suggest a suite of pilots to be rolled out in the South West region.

More *here*

CASE STUDY

Transport for the South East Future Mobility Strategy, England

This ground-breaking strategy written by WSP (UK) for Transport for the South East (TfSE) is not only the first future mobility strategy at a subnational level in England, it shapes policy across the country due to the close relationships between TfSE and the other six sub-national transport bodies. It supports wider transport strategy by steering integration of new and emerging modes, service models and infrastructure into the existing mobility ecosystem. The strategy, importantly, cuts across mobility-related sectors, vitally including spatial planning, energy and digital, and leads TfSE's drive to meeting core net zero objectives.

The commission was the first to adopt our signals, trends and trajectories approach, which supported the identification of key drivers of change that may affect transport and the wider South East over the coming decades.

More *here*

Focusing on
people, communities and places

Without understanding the needs of existing and future customers, the organizations we work for, and how individuals consume goods and services—it is arguably impossible to build a robust business model for any sort of service-based intervention that is resilient to external forces and change.

It can be argued that historically the transport sector has not really understood the needs of its customers. The transportation sector understands its services and networks implicitly, it understands the products or access it sells, but generally has little knowledge of who exactly is purchasing their offer and what drives them to make those decisions and choices.

The wider retail industry is adept at this way of thinking; large retail chains understand who, when and why their customers shop, what products they buy and how they are likely to respond to offers. Grocery retailers and e-commerce businesses understand users with ever-increasing complexity, targeting advertisements to highly specific groups of users, knowing that they are more likely to respond.

Putting the needs of people and organizations within the context of place—where people live, work and consume and where organizations operate—pivots us toward taking a targeted, highly customer-focused approach, to deliver better outcomes across all demographics and behaviours.

The relationship between people and the places in which they live, work, learn and play is also critical, in that it differs from location to location and shapes decision-making.

CASE STUDY

The Well-being of Future Generations (Wales) Act 2015 (WFGA)

WFGA is a pioneering policy that aims to improve social, economic, environmental and cultural wellbeing for everyone in Wales, both now and in the future, by placing the welfare of future generations at the heart of decision-making. The Act recognizes that there are a number of challenges facing Wales, including climate change, health inequalities, poverty, as well as jobs and growth.

WFGA has gained global attention through its innovative approach when looking to tackle these challenges. The Act promotes a holistic and long-term perspective to governance in Wales, encouraging consistent and proactive methods that emphasize the need for collaboration and accountability between various public bodies and organizations in Wales.

More *here*

Applying a design-led approach

A design-led approach provides the framework needed to put the customer at the centre and leads to a wider perspective in mobility planning and design—to embrace people from a perspective of diversity rather than any singular point of view. Utilizing a design-led approach, practitioners can better consider the differing characteristics, experiences and needs of people living in all geographies and then plan accordingly.

The approach can be extended to organizations too, helping frame their priorities and needs, and shape how mobility and transportation enables their staff to work effectively, supply chains to be robust, and goods and services get to market.

Effective planning for people is the basis for appropriate solutions—ones derived from analysis of the challenges and pain points identified in each use case, rather than from a predetermined modal approach. Through a design-led approach, we look at the whole mobility system and how people interact within it.

Thinking beyond the traditional "commute" or "leisure" in a more activity-focused way helps understand needs based on a wider set of real-life considerations, such as a young person accessing education, a growing family needing healthcare assistance, or tourists requiring seasonal access to attractions.

Planning in this holistic way helps us design for the customers of tomorrow, namely the youngsters of today who inevitably will think differently from us, have technology expectations and experiences way beyond those of today and have very different social and economic imperatives. As these young people develop into older adults, their needs may be different from those adults of the same age today.
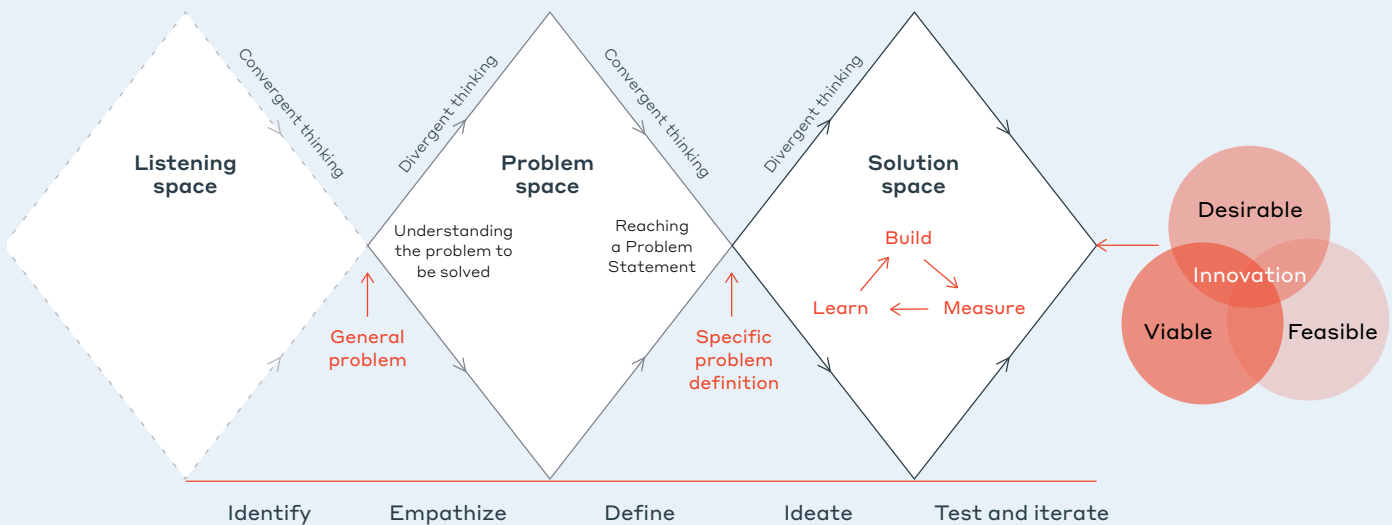
FIGURE 4

**Adapted diagram based on the "Double Diamond" model of design as developed by the Design Council[52].
This model underpins a human-centric, customer-led approach to innovation and design.**

52   "The Double Diamond," Design Council, accessed 25 July 2023.

Considering the needs of people (and organizations)

As customers, we all have different needs and these often change as we pass through each stage of our lives. Finding independence when we are young opens a world of possibility, starting a family will change our world, and moving into retirement dispenses with the commute. Similarly, organizations have variable needs as they expand and mature or face planned or unplanned change.

Planning for people, through an empathetic approach to their needs, their expectations and desires can help shape existing mobility and New Mobility solutions specifically for different groups. This focus can help ensure that vehicles are designed correctly for the elderly or disabled, it can help design ticketing solutions that appeal to those on tight budgets, or can help people without bank accounts or smartphone technology have equal access to opportunities.

Understanding the whole journey is critical in understanding customer needs relative to the activities they engage in—where we think about the full door-to-door journey, from origin to destination. Whether it is a business getting raw materials to make products, or a parent with a young child getting to school and then work, the myriad of interfaces that exist within those trip chains influence and challenge how we apply, and succeed with, existing and New Mobility interventions.

Funding the fuel "tax gap"

The ecosystem is in the midst of transformation to low- and zero-emission mobility. While this transition is driven by climate change policies, an unintended consequence is the significant fiscal challenges from a declining vehicle fuel tax, which creates a potential conflict between encouraging and accelerating decarbonization policy and the need to protect fiscal interests. This could potentially limit or slow down progress toward reaching net zero and the adoption of New Mobility. An equitable alternative is needed, one that considers these changes as part of a complex system—with people at its heart—which is the subject of WSP's companion whitepaper

More *here*

Thinking about people

The Socially / Financially Excluded

Gender/ Orientation/ Ethnicity

Behaviours

Young people

Life Stages & Events

Disabled people

Aging people

Considering people's whole journey with a customer-led approach, rather than the more traditional modal-led approach, reveals so much more within the mobility system. It exposes the potential weak points and gaps, it helps shine a light on the challenges that marginalized or excluded groups face, and, importantly, it provides us with the evidence to develop solutions that enable viable choices.

It also helps us make sure that we invest resources wisely, pursuing interventions that deliver measurable long-term benefits. The same holds true for organizations, whether thinking about how to attract and retain employees or navigate the complexities of global supply chains.

With a "retail led" approach to mobility, rather than a "build it, they will come" approach, it is possible to put the customer first through a process of personas development (again, for people and organizations) that describe their socio-economic status, their needs and expectations, their interests and what drives them, their income, subscriptions and, importantly, their family status and life stage. Personas are a representation of consumers to enable the potential challenges and opportunities of individuals to be identified, and the impacts and benefits of of interventions to be assessed.

Understanding what activities individuals (and organizations) will most likely engage in/with plays a central role in the development of personas. Do they need access to healthcare services, education, or places of employment? These factors and more will vary according to the individual. Persona-based studies enable a human-centred design approach to be taken when considering systems, allowing users to be placed at the centre of decision-making and design.

Having developed these theoretical personas, we validate them through interviews with groups of similar real people and refine the details accordingly. The personas inform pain-point analysis for customers' typical trips through whole-journey mapping. Pain points are inputs to develop targeted solutions to ensure transportation meets customers' needs.

It should be noted that while people (or organizations) could have similar characteristics under any given persona, their experiences of mobility are shaped in large part by the place in which they live or operate.

CASE STUDY

National Centre for Accessible Transport (ncat)

This 7-year, £20 million (~ CAD 34 million) research centre, based at the University of Coventry with partners WSP, the Connected Places Catapult, Designability, RIDC and Policy Connect is taking a human-centric, systems thinking approach to improving accessibility to transport and mobility for disabled people across the UK. Established in early 2023 and funded by Motability, the Charity, the centre will put disabled people at the heart of the research, co-design and piloting process, to deliver transformational change for the millions of users with visible and hidden impairments.

More *here*

Thinking about activity

Education & learning

Tourism, leisure and social activities

Healthcare

The freight and logistics that enable all activities

Working and volunteering

Retail and leisure

Example Persona

About Spencer

Spencer is a 22-year-old with a passion for photography, who is currently doing a BTech course in Media. He lives in with his mother, Eloise, and younger brother, Jermain, and has a weekend job at the local supermarket.

Spencer recently got his driver's license, and is excited that he can finally use his mother's car to get around – when she allows him to. Because he doesn't like using the bus, Spencer sometimes misses out on social events when his mother is busy with the car.

He aspires to one day set up his own business for event photography and is starting to develop a portfolio of his work by offering free sessions to potential clients. This requires him to attend various sporting and social occasions across town, which he drives to.

Another one of Spencer's interests is listening to music on his phone. Unfortunately, after hours of listening to streaming services, the app routinely finishes his limited mobile data and drains his battery, so Spencer is often unintentionally offline.

In their own words:

"Its such a hassle to get anywhere outside of the town, that I don't even bother going if mother doesn't let me drive. No way will I be seen on the bus!"

"I often have to wait around after college for social events because there's no way I can get home and back. I can't wait to get my own car"

"E-scooters are great for getting around town, but expensive."

Core Values
Affordability and self-image

Purchasing Power
Low-income

Tech Confidence
Whizz-kid

Concerns and Frustrations
Running out of mobile data, poor mobile signal, incurring high cost of travel, sharing car with mum
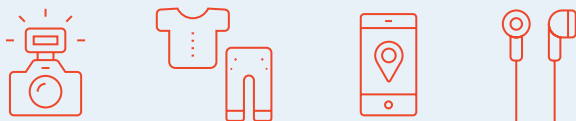
Mobility Assets
One car household (mother's)

Where they live

Subscriptions, Memberships and Interests

Journey Map

Stage	Journey planning	Leaving the house	En-route			Arrival	
Journey Step and Painpoints	Spencer has agreed to be at the University by 3pm. He has coordinated with his mum that he can use the car all afternoon. He knows it usually take him 30mins to get there, when he picks Nathan up. He double checks on Google Maps and on his Waze app to check against existing traffic.	He loads the car with his photography gear and makes his way out of the driveway. Spencer is really excited about this opportunity!	It takes 15mins from his village, to Nathan's. However, there's been a small accident, so traffic is higher than anticipated. This puts a dampener on Spencer's mood.	Finally, he makes it to Nathan, who is waiting outside his house and is ready to go.	The boys enjoy their time together in the car play their music loudly as they approach the University. Spencer catches his reflection in the side mirror and feels really cool.	Spencer forgot to account for time looking for parking. Turns out there is a Basketball game on campus as most visitor parking is taken. He ends up having to drive to the opposite end of campus to find a parking spot.	Spencer and Nathan now have to walk 10 minutes back to where the shoot will be, carrying the cameras and props they've brought. They are now 20 minutes late, but Spencer is relived to have arrived.
Emotions	Anticipation	Excitement	Frustration	Excitement	Excitement	Anxious	Annoyed
MaaS opportunities	MaaS app to include bundled rewards, including mobility credit scheme and subsidies for specific users, to expand such services to people like John's who would otherwise not consider car share for financial reasons.		Build in car routing and push notifications on changes in journey capabilities into app to include drivers in 'mobility ecosystem'.			Build parking viewing/ booking capabilities into MaaS app for opportunity to include drivers in 'mobility ecosystem' – potential for influencing travel behavior and providing incentives for mode shift to public transport from the app.	

Considering the needs of our communities and places

There are obvious differences between urban, peri-urban (or suburban) and rural communities, including across developed and emerging economies, not only in terms of population density, climactic impacts and underlying economic activities but also relative to the density of transportation networks and associated services.

By developing a place typology, considering the distinct characteristics of different place types, we can augment the segmented customer thinking with place-led needs. This helps enrich thinking by considering not only the challenges that people and organizations face but the context of the places they inhabit.

As an example, small estuarial and coastal communities generally face more transportation challenges than those inland face due to their remoteness and disconnection from primary networks or nearby cities. Sparse rural communities face long distances to essential goods and services, but it should also be noted that within small communities there are still opportunities to create walkable and wheelable local access to daily needs. It's not as simple as saying that people in regional or remote communities must travel long distances for all purposes.

While the challenges can be very different across the geographical spectrum from remote rural to dense mega city, the opportunities are also varied, meaning that New Mobility can play very different roles, involving use cases with assorted commercial models and funding sources to achieve desired outcomes. Our paper from 2021, *The 30-minute Rural Community*[53] discussed these issues in the context of the myriad of complex rural communities that are largely forgotten in traditional transport planning activities.

Just as the needs of future generations are a part of the design-led approach, the needs of future places should play a central part, with a focus on the long-term vision and objectives for any given place, as this too frames the New Mobility agenda locally.

Thinking about places

| Urban | Peri-Urban | Near Rural | Remote Rural | Estuarial, coastal and island |
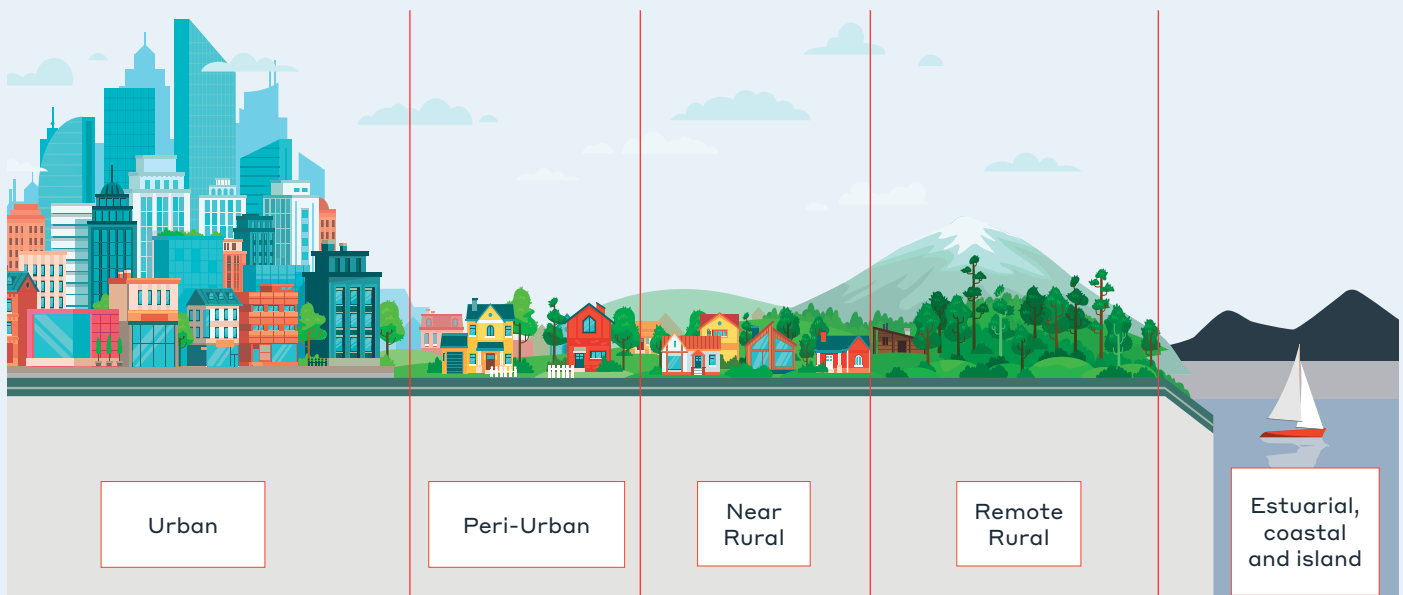
53　"The 30-minute Rural Community," WSP, 2021.

CASE STUDY

The Phoenix Project

📍 LEWES, UK

WSP have been supporting Human Nature with their ambitious plans for a new sustainable development in Lewes, East Sussex. The vision for the scheme is hinged on the principles of a 5-minute neighbourhood to support communal, healthy and sustainable lifestyles, underpinned by low private car ownership.

WSP developed an overarching Mobility Vision document for the scheme to be submitted as part of the planning application and alongside a Transport Assessment. A user-centric approach provided the evidence base for the "Decide and Provide" Transport Assessment elements of the scheme by looking at how potential users are likely to travel to and from the site. Informed by this analysis, the provision of sustainable infrastructure proposed includes a Co-Mobility Hub, which will provide electric car share, a bus interchange, an electric shuttle bus service, a 'last-mile' delivery service, and a 'Bike Hub' with e-cycle, e-cargo bike and e-scooter hire services.

More *here*

What next for New Mobility?

New Mobility is much more than the underlying technologies or services; it's an opportunity to establish publicly accessible transport as a means of tackling some of our major challenges such as decarbonization, environmental recovery, equity and wellbeing.

New Mobility Now focused on the five themes of automated, connected, electric, shared, and business models and revenues. We have since added needs, attitudes and behaviours, changing places, and aggregation—all which should be considered within a human-centred ecosystem. Let's recap the facets of our thinking before introducing the final piece of the jigsaw:

- **Horizon scanning to develop signals, trends and trajectories**

- **Embracing the eight themes (now) for New Mobility**

- **Enacting a whole-system mindset**

- **Adopting a design-led, customer- and place-centric approach and testing these with scenarios**

Three imperatives for *New Mobility*

Given the wider challenges and responsibilities that the transportation sector faces, we advocate three imperatives, which should be intrinsic to all new mobility plans.

Climate action (Sustainable Development Goal 13)

Description

Considering the full CO_2 lifecycle of intervention (Scope 1,2 & 3 to include all CO_2, including embodied)[54] and circular economy thinking and principles[55] to consider wider impacts and opportunities associated with the mobility ecosystem and ensuring its resilience.

Benefits

- Considering wider CO_2 impacts and mitigation beyond the tailpipe
- Factoring wider air quality impacts associated with movement (such as tyre wear, braking) and how these are mitigated
- Thinking comparatively on the environmental impacts of new technologies
- Considering the impacts on biodiversity, waste and wider pollution
- Enabling networks, assets and services that are resilient to climate effects and impacts

CASE STUDY

Live Labs 2: Decarbonizing Local Roads in the UK

Funded by the UK Department for Transport, Live Labs 2 is an ambitious, £30 million (≈ CAD 51 million) innovation programme with the objective of reducing the CO_2 impacts associated with the lifecycle of the local road network from new build, through maintenance, to decommissioning. Focusing on Scope 2 and 3 emissions, the programme comprises seven lead local authorities, covering four themes of a UK Centre of excellence for materials, corridor and place-based decarbonization, a "green" CO_2 laboratory and a future-lighting testbed. At the centre of the approach is a rigorous assessment of the systematic CO_2 impacts of all activities to demonstrate the effectiveness of interventions. WSP provides program direction and management for Live Labs 2 to ADEPT who are running the initiative on behalf of DfT.

More *here*

Enabling Thriving and Inclusive Communities

Description

Enhancing communities of all types, including people, businesses, places and the environment.

Benefits

- Link placemaking and mobility objectives to deliver wider outcomes
- Minimize impacts of mobility within public places and communities
- Provide equity of mobility options to all irrespective of background, abilities or preferences

CASE STUDY

Place-based mobility study

WSP supported Solihull Metropolitan Borough Council on a place-based mobility study in response to the decarbonization agenda and the COVID-19 pandemic. The Council seeks to implement low-carbon interventions that will provide an initial and sustained modal shift. The project was completely rooted in the design-led approach. A deep understanding of community needs informed the exploration of where potential interventions should be focused. The study resulted in the creation of a local co-working hub within the existing community library in Dickens Heath as part of 6-month pilot.

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54 "What is the difference between Scope 1, 2 and 3 emissions, and what are companies doing to cut all three?" World Economic Forum, Climate Change, September 20, 2022.

55 "What is Circular Economy," Ellen MacArthur Foundation, accessed 25 July 2023.

56 *WSP Vision Zero Brochure*, accessed 27 July 2023.

Maximizing positive impacts

Description

Ensuring that New Mobility interventions do not compromise the safety of users, operatives or those living in, around or near new services or infrastructure—ideally positively contributing to outcomes.

Benefits

- Establish the firm link between New Mobility, Vision Zero and Zero Harm thinking
- Recognize the inherent responsibilities that New Mobility has within the established transportation system
- Mitigate risks to both users and non-users from new technologies and ensure that vulnerable users are not overlooked or expected to shoulder responsibility

CASE STUDY

Connected Site

In the UK, WSP has been developing and delivering a vision of a connected site— a construction environment
equipped with technology that enables seamless communication, data exchange, and integration between various devices, systems, and stakeholders. Through the use of sensors, internet connectivity and smart infrastructure, a connected site can collect real-time data, monitor processes and facilitate automated actions, enhancing efficiency, productivity and safety. This interconnectedness allows for better decision-making, safer and smoother construction activities and optimization of resources, making it an integral part of the broader digital transformation of construction.

The connected site plays a pivotal role in contributing to the Vision Zero and zero-harm thinking within the construction of transport infrastructure. Remote engineering assistance, use of advanced headsets with video capability, has removed human operators from hazardous roadside environments, with the risk of accidents and injuries significantly reduced. The use of intelligent traffic management technologies has introduced autonomous systems that can respond swiftly to emergencies, ensuring a faster and more precise response. Through the implementation of such technologies, we have delivered a step change toward achieving the ambitious goal of Vision Zero as well as a net zero environmental impact.[56]

The next period for New Mobility must be mindful of its impacts and relationships; it cannot be technology looking for solutions, it must be outcome- and benefits-focused. It must have easy to understand and compelling narratives, which clearly articulate benefits and allow for embedding in the local planning system.

Given the imperatives we all face as a sector, evidence-based decisions must shape the pathways to achieve visions; given that we must act fast, those decisions need to be made on a no-regrets basis. Indeed, overcoming the fear of failure and enabling a fast failure approach means that if interventions do not perform as expected, lessons can be rapidly learned and shared, which, in turn, will help others make a different choice.

CASE STUDY

Jobs for a clean future

The skills and resources we will need to reach net zero are significant. In the UK, legislation is in place to do this by 2050. WSP undertook research among 4,000 students from ages 16 to 23—the next workforce—about the UK's green transition and future careers. Worryingly, fewer than one-in-ten (8%) chose "making a difference / having an impact" as the most important factor when deciding upon their career. When presented with a range of factors to consider when deciding upon a career, over three-quarters (74%) of the students said "pay" was important overall. So, how do we ensure that we can appeal to the widest future workforce to gain the perspectives, skills and experience that we will need?

More *here*

57   Bill Stephens, "CPKC, Teck Resources pilot program to use hydrogen locomotives in coal train service," Trains.com, 04 May 2023.

Making useful interventions last

As we highlighted in 2017, the importance of robust commercial models and associated revenue streams to enable sustained services cannot be overstated, especially considering the dynamic nature of technological development.

For any New Mobility intervention to be successful and support the delivery of a defined vision, the development of a supporting business model, itself stress-tested within positive and negative scenarios, is critical to attract funding and, importantly, gain and retain customers to provide balance-sheet longevity.

The funding may have to be blended between public sources, private sources and, in some cases, third-sector sources. This will depend upon the use case and the underlying commercial model within the specific geography. Business models that work in urban areas are probably not applicable to rural areas; similarly, constructing a model for specialist services to support a disabled person's travel needs may well require some form of subsidy.

Business cases will be different in their structure and content, depending upon whether they are developed in public, private or third-sector contexts, as their wider objectives will define their particular success criteria. All are concerned with sustained revenue streams, insulation against cost shocks, market share, transaction costs, and, as discussed earlier, customer needs, experience and trends. The long-term viability of any commercial model is critical in giving customers the confidence to use the service.

A similar level of effort and energy should be applied to the commercial case around any intervention as is reserved for the technical solution. The externalities of the local policy, strategy and legislative frameworks provide an overlay to inform the art of the possible in terms of commercial activities and, in turn, the customer offer.

Informed by experiences to date, funders and investors are likely to require that the short-, medium- and long-term risks are considered, and mitigation strategies adopted in the event of partial or complete failure. As we have seen over the period since the pandemic, public and private funding can fluctuate and investment criteria made stricter and arguably more risk averse.

The private markets play an instrumental role in influencing the future mobility agenda. Venture capital firms, with a higher risk appetite, respond to the signals and trends, spearheading the funding for early-stage startups, showcasing potential disruptive solutions in transport technology or innovative business models; private equity, typically with a medium-risk profile, supports later-stage companies showing promising growth trajectories who may head toward listing on the public markets.

Meanwhile, pension funds, with their longer-term and lower-risk stance, are increasingly looking for place-based investments, indirectly contributing to the mobility landscape through infrastructure development. In times where funding is cheap and accessible, we witness ambitious business model experiments brought about by speculative mobility funding.

Looking forward, the CO_2 case as part of any wider business case consideration could become an increasing imperative as climate change impacts start, or continue, to significantly impact geographies; understanding the whole lifecycle CO_2-reduction benefits could be an added consideration, especially if a move to carbon budgeting were to occur.

The opportunities are significant, but the rigour needed is now amplified; we cannot risk poor investments that ultimately fail, leaving stranded or redundant assets, isolated customers or damaged reputations.

Finally, it is also important to note that the skills required to make New Mobility effective will absolutely require a wider breadth (beyond traditional transport planning) and depth than those used to date, especially considering the potential complexities over funding sources, resilience within supply chains and conflicting pressures on available human, capital and revenue sources.

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58 "Advanced Driver Assistance Systems (ADAS) for Transit Buses Demonstration and Automated Transit Bus Maintenance and Yard Operations Demonstration Program," Federal Transit Administration, accessed 25 July 2023.

The New Mobility Next framework

The New Mobility landscape is complex, can be volatile and is fast evolving. While the decarbonization transition is well under way, the more seismic changes as a result of automation and the business models unlocked by technology will be a challenge for planners, designers and operators alike.

We advocate a framework approach to considering challenges and opportunities in the round through a design-led approach to how existing, emerging and new solutions can act harmoniously to deliver the benefits and outcomes that will increasingly be societal imperatives.

IMPERATIVES

- Climate action
- Enabling thriving and inclusive communities
- Maximizing positive impacts

NEW MOBILITY THEMES

- Changing customer attitudes / behaviours
- Decarbonization
- Digitalization (and digital connectivity)
- New modes (and services)
- New business models
- Aggregation
- Changing Places
- Automation

BUSINESS AS USUAL PRACTICES

- Continually horizon scan
- Think critically and question
- Develop an evidence base
- Adopt design-led, customer-led and place-led approach
- Think about the system
- Be outcome-focused
- Develop robust and resilient (to change) business / commercial cases
- Monitor and evaluate outcomes
- Critique and seek feedback
- Fail fast, learn and share

Blueprint for action

The tools you will need and should adopt will be specific to your geography, its context and the specifics of the challenges faced. However, the following provides a blueprint to consider the development of any new mobility intervention:

Understand

Analyze the problem that exists. Gather contemporary data to understand the deficiency or opportunity, and clearly articulate the desired outcome in the widest sense. This helps frame the challenge and enable a design-led approach to problem solving.

Scan

Critically scan the horizon in and around the mobility ecosystem to understand the potential options available to meet the vision and objectives and to understand the externalities which could amplify, enable or hinder success.

Define

Identify a vision and supporting objectives to tackle the problem. The vision should be succinct and can be understood as an elevator pitch for any audience. The objectives should be concise and measurable, this being critical to determining future success through monitoring and evaluation. Clarity here sets the course.

Map

Establish constraints and opportunities within the system including linkages to existing and planned networks and assets, human, capital and revenue sources and the policy / strategy to understand how the intervention contributes to, and is in tension with its surroundings.

Understand

Quantify the main persona groups in the local area, including individuals and organizations. This will help tailor the mobility offer to the specific local audiences, help inform the specification and, downstream, inform marketing and promotional techniques and activities.

Identify

Establish the stakeholders and actors (including financiers) who will shape, influence, impact and enable the intervention. It is critical to understanding how to frame the proposal, make it understood and to elicit buy-in.

Develop

Understand the drivers for the interventions and develop a set of applicable and plausible scenarios to stress test the proposal. Understanding what the key drivers are, their linkages and how the future could influence them is key to defining a robust solution.

Build

Develop a specification for the intervention based on the evidence gathered to date, specific to the locale, the customers and the market conditions. A robust business case, including CO_2 considerations, will be essential in giving confidence to the market and to provide future resilience and customer certainty.

Deliver and Learn

While procuring, mobilizing, delivering and operating the intervention, it is critical to understand performance (through many lenses) and evaluate the effectiveness overall. This is critical in informing future interventions and is effectively the feedback loop to step 1.

Playing to our strengths for collective success

As individuals, none of us will find solutions to the major challenges we face if mobility does not overcome its own barriers to realizing its potential. We need to think about our individual and collaborative roles in enabling a better short term for our lives while also securing the future of generations to come who are dependent on the decisions we make.

The questions we ask will be different, the underlying assumptions may change and the established norms may need challenging. Whether an early career professional, time-honoured expert, or professional in government, private, third or academic sectors, we all have a role to play in the evolving *New Mobility Next*.

The following is a non-exhaustive list of the things we all need to consider in enabling the next chapter of New Mobility.

How...	...do you see the problem or challenge? ...do you see the current landscape? ...do you envisage the evidence base? ...do you see the future evolving if you don't take action? ...do you define the future you want to live in? ...do you see the vision and objectives to achieve that future?
Why...	...doesn't mobility work for you or your area now and can it be improved? ...has the market not responded to any stimuli or opportunities? ...have policies and plans not delivered the necessary change?
What...	...are your skills and life experiences that can be brought to bear? ...new ideas can you bring into the mix? ...is in your immediate control? ...and who can you influence? ...if we already have the answer? ...can you learn from elsewhere? ...might the potential pitfalls and failures be?
Who...	...are the key stakeholders and actors to enable success? ...has the other key knowledge and skills needed to deliver? ...are the blockers to the outcomes you want? ...are the unknown actors who could enable the route to success? ...are the customers and how well do you really know them? ...might future funding come from? ...might be affected if things don't work as envisaged?
When...	...is the optimum or appropriate time for change might be? ...might the conditions for success be best? ...will you know that you have achieved your aims? ...will your customers benefit?

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WSP

As one of the world's leading professional services firms, WSP exists to future-proof our cities and environment. We provide strategic advisory, engineering, and design services to clients in the transportation, infrastructure, environment, building, energy, water, and mining sectors. Our 67,000 trusted professionals are united by the common purpose of creating positive, long-lasting impacts on the communities we serve through a culture of innovation, integrity, and inclusion. Sustainability and science permeate our work. In 2022, WSP derived more than half of its $11.9 B (CAD) revenues from services that support the UN Sustainable Development Goals. The Corporation's shares are listed on the Toronto Stock Exchange (TSX:WSP).

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