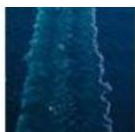




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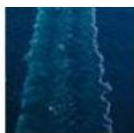
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Environmental sustainability and climate change

The future of rail. Opportunities for energy and the environment (key findings from the IEA report)

Rail is among the most energy efficient modes of transport for freight and passengers - while the rail sector carries 8% of the world's passengers and 7% of global freight transport, it represents only 2% of total transport energy demand.

Today, three-quarters of passenger rail transport activity takes place on electric trains, which is an increase from 60% in 2000 - the rail sector is the only mode of transport that is widely electrified today.

This reliance on electricity means that the rail sector is the most energy diverse mode of transport.

[...] continues

[link](#)

[SP-FP7/H2020]: Project DESTINATE results: Decision-support tools for implementing cost-efficient railway noise abatement measures (article published in Noise & Vibration In-Depth Focus)

DESTINATE is a European research and innovation project funded by the railway joint undertaking Shift2Rail. The DESTINATE project contributes to the Shift2Rail initiative's objectives to improve trains (e.g. quieter and

more comfortable) and attract more users to rail by:

- Enhancing attractiveness and comfort for rail users through improved interior noise prediction and perception-based evaluation of mitigation measures with innovative approaches like auralisation and visualisation (A&V)
- Reducing railway noise annoyance: With A&V of passing trains and simulation of mitigation measures it is possible to systematically investigate perception of rail noise mitigation alternatives. In combination with cost assessment, this is expected to lead to an efficient reduction of railway noise annoyance.

Summary of project research

The project covered the following four main research fields:

1. Interior railway noise prediction
2. Source and sub-assembly characterisation methodologies
3. New technologies including A&V and active technologies for windows
4. Cost-efficiency assessment of railway noise mitigation.

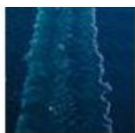
The research fields are not isolated and interact with each other. From the beginning, a close cooperation with the Shift2Rail member project FINE 1 was sought to ensure the uptake of industrial requirements.

[...] continues

[link1](#); [link2](#); [link3](#)



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Performance of the transport system and mobility services

Future advanced long-haul Evacuated Tube Transport (EET) system operated by TransRapid Maglev (TRM): a multidimensional examination of performance

(paper published in Transportation Planning and Technology, 42:2, 2019)

[...]

The future of the world economy and society until and beyond the year 2050 will very likely be characterized by:

(i) continuous growth but also aging of the world's population, expected to reach 9–10 billion;

(ii) growing developing economies contributing to strengthening the 'middle' class and consequently increasing demand for mobility in countries like China, India, Russia, and Brazil; and

(iii) urbanization implying that by the year 2025 about two-thirds of the world's population will live in cities and mega-cities.

Consequently, future transport systems will very likely be exposed to challenges to:

(i) connect large urban agglomerations and markets, thus further fostering globalization of economic, trade, and other social/policy relationships;

(ii) provide transport services of refined quality at reasonable cost/price with respect to highly differentiated passenger needs;

(iii) further diminish the impacts on the environment and society thanks to deploying

innovative and new technologies and operational procedures; and

(iv) contribute to national and global welfare by further increasing direct and indirect employment and expansion, i.e. synergies, with the new technologies from other fields/areas.

The advanced Evacuated Tube Transport (ETT) and TransRapid Maglev (TRM) system seems to be one of the prospective future systems able to contribute to fulfilling the above-mentioned requirements through competition mainly with the long-haul Air Passenger Transport (APT) system. By taking over a part of APT demand, as a presumably environmentally friendlier system/ mode, the ETT-TRM system can contribute to mitigating the overall transport sector-related negative impacts on the environment and society, and consequently contribute to the sector's more sustainable development.

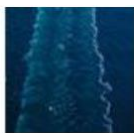
This paper consists of four sections. The next section, Section 2, describes the main components and concept of performance of an ETT-TRM system. Section 3 deals with a multidimensional examination and modeling of the selected indicators of this performance. Section 4 presents an application of the proposed approach to the long-haul passenger transport market where an ETT-TRM system competes with the APT system according to 'whatif?' (hypothetical) scenarios. The last section presents some conclusions.

[...] continues

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The road to seamless urban mobility *(article summarising the report:* *“McKinsey Center for Future Mobility* *(2019) An integrated perspective on* *the future of mobility, Part 3: Setting* *the direction toward seamless* *mobility”)*

The age of modern transit began in 1863, when the first underground railway began rolling in central London. The line was short and smoky, and nothing like it had ever been seen before. But it worked, and cities around the world began to follow London’s lead. Over time, city authorities came to see providing transportation as one of their core responsibilities; governments often owned and ran transit systems themselves.

Despite governments’ best efforts, traffic is getting worse in many cities, and urban mobility has become increasingly complex. From 2010 to 2016, congestion rose in London by 14 percent, in Los Angeles by 36 percent, in New York by 30 percent, and in Beijing and Paris by 9 percent. Congestion carries health consequences, in the form of accidents and air pollution. Demographic trends—more people, and more in urban areas—will accentuate today’s strains, which aren’t solely about the movement of people. E-commerce is also growing fast, adding to the demand for urban commercial transport.

The technological changes associated with mobility’s “second great inflection point” create myriad opportunities for cities to address these challenges. As ridesharing grows up, digital vehicle connectivity deepens, electric vehicles (EVs) become mainstream, and autonomous vehicles (AVs) take hold (see “The trends transforming mobility’s future,” forthcoming on McKinsey.com), it becomes

possible to envision a future of “seamless mobility.” In such an environment, the boundaries among private, shared, and public transport would be blurred, and travelers would have a variety of clean, cheap, and flexible ways to get from point A to point B. Our analysis suggests that seamless mobility could be cleaner, more convenient, and more efficient than the status quo, accommodating up to 30 percent more traffic while cutting travel time by 10 percent.

Today’s reality, though, is far from seamless. Vehicles that are fully autonomous do not yet exist in meaningful numbers, EVs still make up only a small percentage of the global vehicle fleet, and traditional internal-combustion-engine (ICE) cars represent about 40 percent of passenger-kilometers—often more than rail and bus services combined.

Starting from this baseline, urban-mobility systems in dense, developed cities, such as London, New York, and Seoul, could evolve in a variety of ways over the next dozen years. This article describes three potential scenarios and details how public- and private-sector leaders can forge a strategy to make seamless mobility happen. For city planners and other urban-mobility specialists, we have also prepared a longer report, *An integrated perspective on the future of mobility, part 3: Setting the direction toward seamless mobility*.

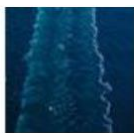
Three scenarios

To develop a perspective on the future, we modeled a set of short (fewer than two kilometers), medium (two to ten kilometers), and long (more than ten kilometers) trips, differentiating between trips within the city business district and trips to and from the city and the suburbs. We also simulated the trade-offs that people make—for instance, deciding

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between a more convenient but pricier autonomous shuttle and a less convenient but cheaper bus—and estimated how these decisions could affect congestion in 2030. Finally, we accounted for “induced travel”—the concept that when it is easier or cheaper to travel, demand tends to rise. This analysis shows that seamless mobility holds many advantages, but achieving it is far from a foregone conclusion.

Scenario 1: Business-as-usual urbanization

Imagine a world in which population growth continued, but large cities managed their transport systems largely as they do today, with little innovation in pricing or policy. Imagine further that complicated traffic patterns, setbacks in technology development, and delays in consumer adoption deterred the large-scale deployment of AVs, and that vehicles did not electrify in large numbers.

In our analysis of such a model, the results are discouraging. Transport demand would increase in line with population growth (about 15 percent by 2030), and greenhouse-gas (GHG) emissions could rise proportionally. City dwellers would travel in mostly the same ways as they do now, and private cars would continue to account for about 35 percent of passenger-kilometers. Average travel times would increase by 15 percent because capacity would be strained. In the United States, without substantial change, this is the likely scenario: few cities, even the largest, have comprehensive plans that consider new and forthcoming technologies.

Scenario 2: Unconstrained autonomy

Now consider an alternative future in which autonomous-driving technology advances, but regulators and city governments don’t keep up. In other words, what if autonomous-

transportation options follow in the footsteps of bikesharing programs and e-hailing, which hit the roads faster than the policies needed to guide them did?

It’s certainly plausible. By 2030, shared AVs—or robo-taxis—could navigate to, from, and within a central business district. Our analysis suggests that, at that point, they could become an attractive alternative to private-vehicle ownership, with the cost per mile of riding in a robo-taxi running about the same as the cost of owning a moderately priced private vehicle, and that travelers could adopt them for individual or shared use for about 35 percent of their travel by 2030.

Compared with the first scenario, this one has clear advantages. The partial displacement of fixed-route buses by robo-taxis with flexible routing would increase the share of point-to-point trips, reducing waiting and walking times between transfers. If the robo-taxis were electric, GHG emissions would fall and air quality improve. Congestion, however, will not improve compared with the baseline, and it could get worse. The average time for a private car trip could increase as an increased convenience of robo-taxis draws more users onto the roads. Other travelers, anxious to avoid the crowded roads, could pack into trains. In all, we estimate that average travel times would be 15 percent higher compared with today’s baseline scenario.

Scenario 3: Seamless mobility

Now for a third possibility: What if cities encourage the use of shared AVs through regulation and incentives? That would make it possible for residents to “mix and match” rail transit and low-cost, point-to-point autonomous travel in robo-taxis, autonomous shuttles, and autonomous buses easily.

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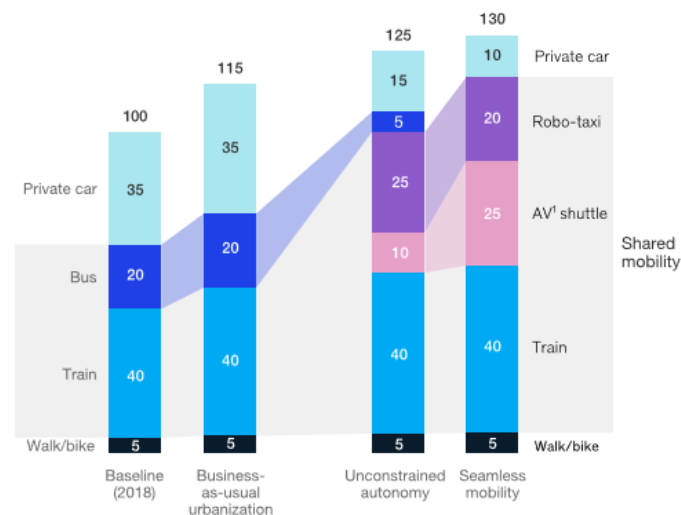
Our analysis suggests that pooled AV shuttles could grab 25 percent of the market (twice as much as in the unconstrained-autonomy scenario), and private cars and

privately used robo-taxis could provide about 30 percent of passenger-kilometers in 2030, compared with 35 percent for private cars today (Exhibit 1).

Exhibit 1

In the seamless-mobility scenario, private cars will be used less, and autonomous shuttles could account for a quarter of passenger-kilometers by 2030.

Passenger-kilometers traveled per year, index: current demand = 100



McKinsey&Company

It's not just autonomous vehicles that would make the difference. Intelligent traffic systems, advanced rail signaling, and connectivity-enabled predictive maintenance would all boost network reliability. Seamless mobility could improve performance on all five indicators that characterize a transit system: availability, affordability, efficiency, convenience, and sustainability. It could accommodate up to 30 percent more passenger-kilometers (availability) while reducing average time per trip by 10 percent (efficiency). It could cost 25 to 35 percent less per trip (affordability), increase the number of point-to-point trips by 50 percent

(convenience), and, if AVs are electric, lower GHG emissions by up to 85 percent (sustainability).

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Economic and industrial competitiveness

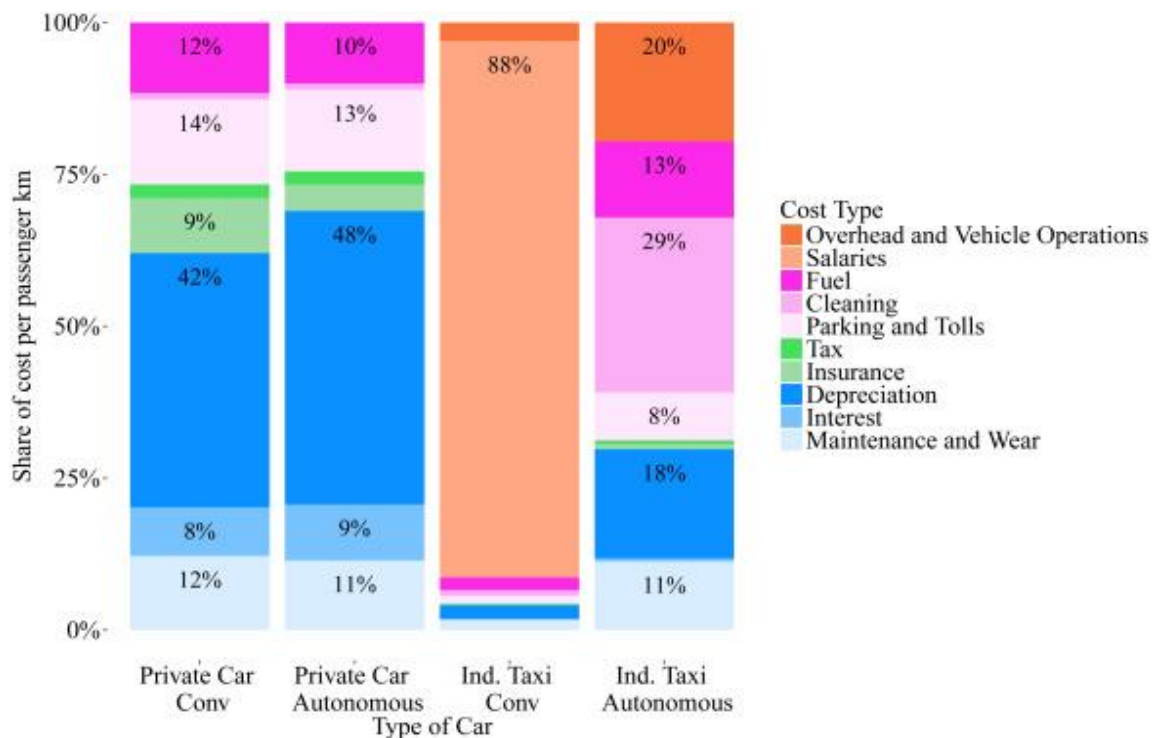
Cost-based analysis of autonomous mobility services [paper published in *Transport Policy*, Vol. 64, 2018]

Fast advances in autonomous driving technology trigger the question of suitable operational models for future autonomous vehicles. A key determinant of such operational models' viability is the competitiveness of their cost structures. Using a comprehensive analysis of the respective cost structures, this research shows that public transportation (in its current form) will only remain economically competitive where demand can be bundled to larger units. In

particular, this applies to dense urban areas, where public transportation can be offered at lower prices than autonomous taxis (even if pooled) and private cars. Wherever substantial bundling is not possible, shared and pooled vehicles serve travel demand more efficiently. Yet, in contrast to current wisdom, shared fleets may not be the most efficient alternative. Higher costs and more effort for vehicle cleaning could change the equation. Moreover, the results suggest that a substantial share of vehicles may remain in private possession and use due to their low variable costs. Even more than today, high fixed costs of private vehicles will continue to be accepted, given the various benefits of a private mobility robot.

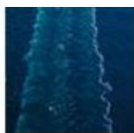
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People-centred approach

SHERPA project aims to better protect trains and stations from terrorist attacks

(project funded by EU ISF Police under grant agreement Nr 815347)

The 'open' nature of stations and trains continually make them targets for terrorist attacks. But with project SHERPA, coordinated by the UIC, key players in the railway sector are coming together and focus on various actions that will help railways cope better with present and future threats.

Terrorist attacks carried out in recent years show an alarming increase of indiscriminate violent actions carried out against civilians gathering in public spaces. Even though railway transport represents a critical infrastructure for any European country, stations and trains can be essentially regarded as 'soft targets' due to their nature of inherently open systems. Several initiatives aiming at increasing their protection from terrorist attacks have been undertaken over recent years at various levels, nevertheless the knowledge about the phenomenon itself and possible countermeasures is still quite fragmented and presents many gaps.

Launched in November 2018, the EU-funded project 'SHERPA' aims to improve the overall protection level for stations and trains in Europe against terrorist attacks by implementing multiple synergistic actions towards the relevant stakeholders, such as providing and sharing an up-to-date, high-value knowledge base on threats and

countermeasures (both technical and procedural); defining a coherent approach for risk assessment, risk management, crisis and disaster recovery management; strengthening cooperation among stakeholders through high-level international training programmes and other practical tools; and outlining the needs and requirements for industry and research to focus on in order to better help railways cope with both present and future threats.

[...] continues

[link1](#); [link2](#)

[SP-FP7/H2020]: From travel time and cost savings to value of mobility
(paper published in Kabashkin I., Yatskiv I., Prentkovskis O. (eds.) (2018), Reliability and Statistics in Transportation and Communication: Selected Papers from the 17th International Conference on Reliability and Statistics in Transportation and Communication, RelStat'17, 18–21 October, 2017, Riga, Latvia. Lecture Notes in Networks and Systems, Volume 36, Springer)

[...]

2 VTT and the Value Proposition of Mobility

The "behavioural shift" of studies on VTT calls for the integration of models and frameworks of individual needs, motivations and preferences adapted to the mobility context. In this respect, which values and expectations should be generally fulfilled and therefore addressed by mobility solutions? The conception, development and deployment of mobility infrastructure, services and solutions

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from the perspective of individual motivations, needs and expectations defines and shapes a Value Proposition of Mobility. This represents a promise of value to be delivered, communicated, and acknowledged to the individual traveller. Group of travellers with similar needs, aspirations, motivations, and expectations are likely to have also a similar general judgment for different transport options. Being a complex ecosystem, there is no single actor in charge of shaping the Value Proposition of Mobility. It is rather a joint outcome of actors cocreating meaning and value to transport and mobility options through policy, implementation, deployment, and participation.

When referring to motivations and needs, a classic reference is Maslow's hierarchy of needs, which has been widely used in the transport context as well. An adapted version

of this model has been recently used in the context of Mobility as a Service (MaaS) in the attempt to describe its value proposition. For instance, a recent study from UK Catapult describes how MaaS value propositions from different providers should address emerging mobility challenges (see Fig. 1).

It is worth noting that Fig. 1 includes a challenge related to VTT, namely "enable faster journeys and increase confidence in arrival times". This challenge is associated to the broader goal of "enhancing end-to-end journeys by improving mobility choice", which is not the highest goal of the hierarchy. To a closer look, the complete fulfilment of the Value Proposition of Mobility would require achieving the objective of "enabling lifestyles by improving mobility fit". The associated challenges combine both general sustainability aspects and individual well-being.

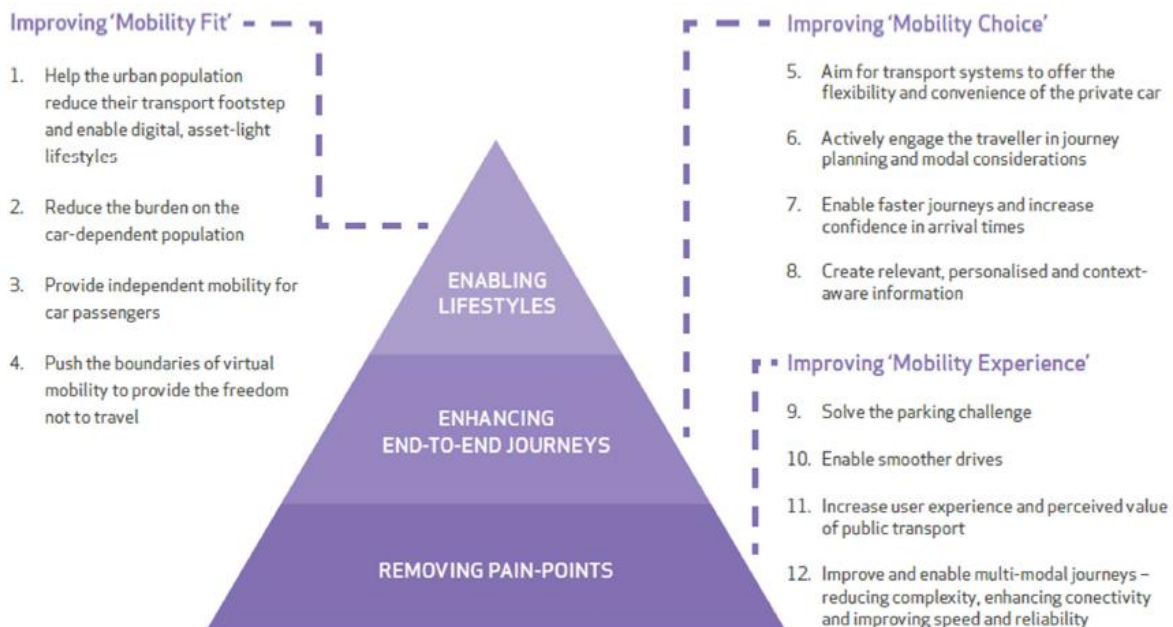


Fig. 1. The traveller needs capability challenges [21].

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When considered from the perspective of the hierarchy of travel needs (adapted to MaaS), the economic view of VTT therefore addresses only the mid-level of the Value Proposition of Mobility. Indeed, the value of travel time cannot be always adequately assessed in terms of travel time savings: as shown by Mokhtarian and Salomon, in the case of leisure travel under some circumstances people travel just for the sake of traveling, because it is “fun”. Indeed, it is not the activity to be carried out at destination that represents utility, and therefore value to the traveller, but the journey itself. The authors of the study include several types of activities falling under this category such as driving an off-road vehicle, recreational walking, jogging, cycling, and hiking. These activities are “undirected” in the sense that they do not necessarily have a specific objective or destination point. On the contrary, value of travel time is often associated to utilitarian travel, such as dropping off/picking up children from school, going shopping or to a medical appointment. The study goes further, describing also utilitarian travel situations in which travellers may decide to travel further (therefore, not minimising travel time) because of intrinsic reasons, such as a “variety-seeking” orientation or just curiosity. These are not exceptional situations: a common decision as dining out instead of eating at home (although food is available and quick to cook) could be included under this category.

New concepts of VTT are therefore necessary to acknowledge and fulfil the highest level of the hierarchy of travel needs, dealing with individual lifestyles and well-being. To further understand individual preferences and motivations in travel choices, a classic model

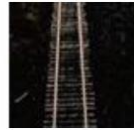
by Sheth distinguishes five utility needs corresponding to motivational dimensions:

1. Functional motives: related to the technical functions the product performs. The combination of product attributes forms the total functional utility of a product.
2. Aesthetic-emotional motives: style, design, luxury, and comfort of a product (class). These motives are not only important for the specific (brand) choice but also for the generic (product) choice. The product class is evaluated in terms of the fundamental values of the consumer in the emotive areas of fear, social concern, respect for quality of life, appreciation of fine arts, religion, and other emotional feelings. Thus, it may be contended that individuals tend to select those product classes that match with their life styles and enable them to express their fundamental values.
3. Social motives: related to the impact that consumption makes on relevant others. Status, prestige, and esteem may be derived from the possession and usage of products and their conspicuous features. Some products are selected for their conspicuousness only (“conversation pieces”), sometimes in combination with aesthetic motives.
4. Situational motives: these are not motives in the sense of long-term desires to reach a certain goal. The selection of a product may be triggered by situational determinants such as availability, price discount, and/or accessibility. These situational factors apply usually for a specific brand or type. The brand choice is usually made in these cases without a careful evaluation of the product class.
5. Curiosity motives: motives that are supposed to prompt trials of new and/or innovative products. The consumer may try a new product; however, his repeat-purchase may be independent of such trials.

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Although Sheth's model was conceived more than forty years ago, it is still current as it acknowledged both intrinsic and extrinsic motivations. A recent study by Mokhtarian et al. underlines that by "focusing exclusively on the extrinsic motivations to travel runs the risk of substantially underestimating the demand for travel". In conclusion, the traditional view of VTT allows only addressing a part of the travel needs and motivations. Conventional models such as the ones from Maslow and Sheth are still current and can be applied to establish a framework of assessing and measuring VTT in a way that it covers the whole Value Proposition of Mobility.

[...]

Value of travel time is highly variable, including a small portion of travel with very high time values, to a significant portion of travel with little or no cost, since travelers enjoy the experience and would pay nothing to reduce it. The MoTiV project introduces a broadened definition and methodology for estimating VTT, acknowledging the shift away from a purely economic view of VTT and the incorporation of behavioural aspects such as personality, preferences, and expectations in its assessment. To do so, the MoTiV conceptual framework builds on Sheth model to investigate motivational factors behind systematic transport mode choices. These factors will be analysed thanks to a European-wide mobility and behavioural data collection through a smartphone application during the project. This dataset will allow, among others, comparisons across gender, age, and geographical contexts. The dataset also will incorporate "qualitative" input from travellers (e.g. "purpose of travel") that will be used to derive the general mobility context (e.g. leisure/work), activities carried out within

mobility, to what extent ICT and transport services/infrastructure supported (or disrupted) such activities, and overall satisfaction/dissatisfaction.

The challenge of an integrated transport and mobility planning is the understanding of the complexity of the parameters involved and their influence on people's choices when they travel. Therefore, understanding effective factors in people decision-making process about travel and activity participation could help planners, policy makers and authorities to make them more attentive to the consequences of their policies in short, medium and long-term. Several managerial implications will emerge from this project: the results will highlight the importance of taking a holistic approach to travellers experience management in terms of preferences and expectations. Outcomes of this study will allow drawing specific policy and business recommendations to signify the role of ICT, transport systems and infrastructure and influence factors in shaping VTT in European context. The expected outcomes of MoTiV would provide useful indications to policy makers for the assessment and development of policies as well as to businesses for delivering new or improved sustainable mobility solutions in European countries.

[...] continues

[link1](#); [link2](#)

The importance of user perspective in the evolution of MaaS [paper published in *Transportation Research Part A: Policy and Practice*, Vol. 121, 2019]

The rapid emergence of Mobility as a Service (MaaS) into the transport sector's lexicon has

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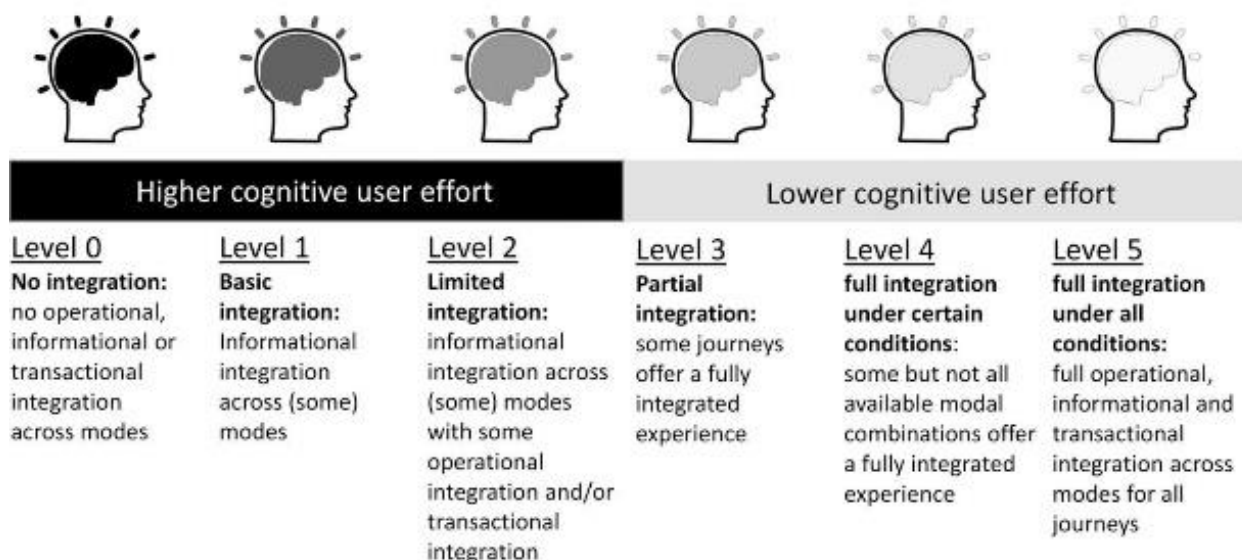
brought with it an air of expectation that suggests a future mobility *revolution*. This paper focusses on the user perspective and offers a deepening of socio-technical thinking about MaaS and its prospects. It first provides an examination of what is understood to date about MaaS in what is a new but rapidly evolving body of literature. This highlights the concept of MaaS as a 'mobility system beyond the private car' and the new centrality of a 'mobility intermediary' layer in that system. The paper then focuses and elaborates upon its contention that MaaS is neither new nor revolutionary but is rather an *evolutionary* continuation in terms of transport integration. Emerging from an era of unimodal travel information systems becoming multimodal and then integrated multimodal information services, MaaS is now about adding seamless booking, payment and ticketing to the

integration offer. The paper puts forward a Levels of MaaS Integration (LMI) taxonomy' analogous to the level 0–5 SAE taxonomy for automation of road vehicles. This taxonomy, designed around the user perspective (including cognitive user effort), concerns operational, informational and transactional integration that it is suggested reflect a hierarchy of user need. From a synthesis of insights from the 'pre-MaaS' literature concerning choice making for travel and the role of information, a MaaS behavioural schema is provided to illustrate potential consideration and adoption of MaaS from the user perspective. In concluding, the paper considers what a user perspective reveals for the future prospects of MaaS and in particular for the mobility intermediaries.

[...] continues

[link](#)

Levels of MaaS Integration



cognitive user effort: the effort involved in relying upon the mobility system beyond the private car to fulfil mobility goals

operational integration: interchange penalties are low and door-to-door journey experience is 'seamless'

informational integration: journey planning and execution information for available modes is offered through one interface

transactional integration: payment and any required booking and ticketing is offered through one interface

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- International transport forum
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- Google Scholar
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