
FREEDOM OF MOBILITY FORUM

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“How Will Our Planet Accommodate the Mobility Needs of 8 Billion People?”

Full Report of Research Findings

"Mobility business models and solutions to be promoted considering urgency to act and population growth"

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Mobility business models and solutions to be promoted considering **urgency to act** and **population growth** (existing models/solutions to scale up, new ones to be created).

- I Introduction**
- II Main Challenges**
- III Solution 1: Sharing Economy at the heart of the transition**
- IV Other Solutions**
- V Deep Dive: Intermodality**
- VI Executive Summary and Questions**
- VII Bibliography**

General context

- The mobility sector is experiencing an international shift: new and stricter regulations, new cars with electrical batteries, public transportation and new ways to use mobility (uber, google maps...)
- Key trends observed in mobility: Decarbonization, Globalization, Digitalization, Electrification, Autonomous mobility (*self-driven vehicles*), micromobility (*lightweight transportation such as bicycles or scooters, especially electric ones that may be borrowed as part of a self-service scheme for short-term use*), Flexible public transportation solutions, Mobility as a service
- Therefore, innovative business models are needed to accompany this transition, we need to find new and smarter ways to use mobility.
- **Why is mobility so important ?** Mobility is at the heart of our everyday life.
 - **Mobility is**
 - **An economical challenge:**
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 - Mobility accounts for [13%](#) of the world GDP.
 - The [global mobility market](#) was valued at US \$31.01 billion in 2022 and will reach US \$73.48 billion by 2027.
 - Mobility is one of the most dynamic sector regarding innovation.
 - **An environmental challenge:**
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 - The transportation sector represents 15 percents of global GHG emissions ([IPCC](#)) and [30%](#) of France GHG emissions . It is the second-largest carbon polluting sector worldwide and it is at the core of Global Climate Agreement, as the Paris Agreement.
 - Transport continues to rely on oil product for nearly [91%](#) of its final energy.
 - Mobility issues are related to the Sustainable Development Goals of the United Nations: SDGs 3 on Health & safety, SD7 on affordable and clean energy, SDGs 8 on decent work, SDG 9 on resilient infrastructure and innovation, SDG 11 on sustainable cities and communities and SDG 12 on sustainable consumption and production.
 - **A social challenge:**
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 - The demand for transportation **is tied to population growth** → more passengers require more mobility. Population is expected to grow to [8.5 billion](#) by 2030. The demand for transportation will increase [three-fold](#) between 2015 and 2050. The demand is driven by developing countries.
 - The transportation sector is a sector under social pressure for the price. Between 2013 and 2023, the cost of fuel increased by 46% (INSEE).
 - Inequality between countries in the world regarding public transportation: more than [72%](#) of people in Northern America and Europe can access public transport, in Sub-Saharan Africa it is under 35%.
 - In many cities, public transport remains unsustainable, unsafe, inefficient, inaccessible or unaffordable.
 - Transport can be linked to other social dimensions : job opportunities, health, education, wellbeing, inequality, social inclusion.
 - **New solutions are needed to accommodate the mobility sector for a sustainable future.**

Focus of the research

Scope of our research:



- By 2050, urban regions are expected to account for 81% of global GDP, up from 60% in 2015. The urban population will double by 2050 at which point that 7 of 10 people will live in cities. Therefore, we decided to **focus** most of **our study on urban mobility**, and we will also take the **countryside mobility into account**.



- As students from HEC France, and European citizens, we have decided to start our research on France and Europe where transportation are already developed, and innovative business model are tried. We will open on other regions of the world.

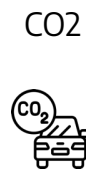


- Due to the recent acceleration of climate change events (storms, flooding, rains, draughts...), there is a real urgency to act. As announced by governments, the priority is **decarbonizing** = reducing greenhouse gases (GHG) emissions → We have used the **Kaya equation** that links GHG emissions with demography, economical factors and energy as a starting point to distinguish key challenges that can be addressed through business model and technology.

The French consulting firm Carbone4 created a version of the **Kaya equation for mobility** that we used to **identify the challenges** we going to address in this research.

Kaya identity

$$\text{Greenhouse Gas Emissions} = \underbrace{\text{Population} \times \frac{\text{GDP}}{\text{Population}}}_{\text{Consumption}} \times \underbrace{\frac{\text{Energy}}{\text{GDP}} \times \frac{\text{Emissions}}{\text{Energy}}}_{\text{Technology}}$$



CO2 =

Traffic x Type of transport x Occupation rate



Can be addressed with new business models

x Energy efficiency x Carbon intensity



Can be addressed with technologies/innovations

Associated challenges

Land use, air pollution, traffic nuisance, Financial accessibility, comfort, convenience, attractiveness of the sector, intermodality, geographical attractiveness, availability efficiency

 Our focus

Challenges

- **Financial accessibility of sustainable ways of travel:**
 - Financial accessibility of EVS
 - **Expensive trains and public transports** compared to more polluting alternatives
 - Challenge in rural areas: **providing public transport in rural areas is difficult** as it needs to offer a service that fits different mobility needs among citizens at a reasonable cost
- **Geographic accessibility of sustainable ways of travel:**
 - Countryside and suburbs: **Limited public transport offering:** Car is often the only solution
 - Solutions that could increase PT ridership in rural areas (e.g. real-time info, “next generation” payment systems, driverless vehicles) cannot increase accessibility in rural areas if there is no functional **PT infrastructure** already available
 - Presence of social capital and strong local networks can positively affect mobility among people in rural areas. **Social networks differs between different rural areas**
 - Traffic jams in cities
 - Public transport saturation in cities
- **User Experience and efficiency :**
 - **Comfort:** Bike + rain
 - **Convenience** + Ease + Efficiency / Delays
 - **Information Gap:** communication on alternatives between users and PT companies
 - **Safety:** more infrastructure separated from other road users
 - Transportation **behavior is difficult to change** as it is central to individuals’ lifestyle and identity and can influence well-being --> Designing interventions that convey information emphasizing intrinsic reasons for using public transportation will promote habit formation

Data

- **Personal Vehicles** in France represent 54% of the emissions of the French transportation sector
 - Electric vehicles could match gasoline cars on price this year due to increased competition, government incentives, falling prices for lithium
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- According to INSEE only 9.3% of PPI go to work with bicycle or walking.
 - According to INSEE 60.3% of trips to go to work which are **less than 5kms are done with car**, in France.
 - In France 41% of car trips are done alone
 - Higher demand for public transportation in developing countries, huge gap with developed regions
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- Between 1995 and 2016, the number of passengers per km travelling by bus and rail in the EU had increased by 18%
 - 4.1% of the car sharing demand and 18.8% of taxi demand is explained by public transport delays
 - In the US, population has grown by 19% and public transportation ridership has increased by 21% between 1997 and 2019

Existing solution to scale up:

Shared mobility services allow private users to rent a vehicle located in the city for a short period of time in an automated way. It includes **shared vehicles and shared rides**.

- Market is growing quickly
- Estimated at US [\\$1.43tn](#) worldwide in 2023
- Number of users expected at [5.13bn](#) in 2028
- Added value:
 - Solution that can be adapted in every corner of the world because no ownership
 - Solutions designed for developing and developed countries
 - Different types of transportation
 - High flexibility, low cost
 - Easy online access with an app
 - Mostly in cities (infrastructures required)

How and with whom to scale up the existing solutions:

Financial institutions and governments by:

- Incentivize car sharing and peer-to-peer vehicle rental to maximize asset utilization
- Subsidize its usage via bonuses granted to users, or free of charge usage for public transport subscribers











International companies by:

- Increase the number of partnerships between companies and states to incentivize its usage related to commuting, or business transportation (reduction of scope 3)

Local actors by:

- Adapt the solutions for the countryside

Examples of shared mobility

	Car sharing (renting)	Buses	Scooter sharing	Bicycles-sharing (biggest fleet worldwide)	Car sharing
Type of service	Renting a car	Sharing a ride in a bus to lower the cost of travel	Renting a scooter for a short time	Renting a classical or an electric bike	Paying for a ride in someone's car
Examples of companies	 	 	 	 	 
Countries	Urban areas in developed countries (US, China, Europe,...)	Within and between cities in all part of the world	Cities in developed and developing countries (Africa, India...)	Cities in developed countries (Europe, Canada) and developing (India...)	Everywhere in developed and developing countries

Solutions to scale up:

- **Deploy financing business models to accelerate the transition**
 - Further develop the **pay-per-use** model to tailor to changing consumer behaviors
 - Promote **innovative financing models** for Electric Vehicles and bikes.

- **Easing Intermodality:**
 - Deploy **mobility as a service**
 - Having one pass to take all means of transport (Train, High speed, Subway, Bike, electric scooter, EV, Car sharing...)
 - **Making intermodality financially attractive**
 - Closing information gap between users and services providers

- **New solution:**
 - Company sponsored clean mobility incentive **“Clean Mobility Pass”**. This pass could allow employees to benefit from **free access to any clean mobility solution**.
 - With gamification aspect and AI to give advice to poorly performing employees about decarbonized alternatives
Ex: (today the train and bus will bring you to Paris in only 35 minutes compared to 48 mins by car !)

How and with whom to implement the solutions:

WHO:

- Financial institutions, Car manufacturers, Mobility services providers, Governments

HOW:

- Develop **new financing models** to make expensive EVs more accessible:
 - **0% interest loans** to purchase EVs Ex: [Experimentation by the French government](#).
 - **Income-based** governmental subsidies to lease an EV Ex: [“Mon Leasing Électrique”](#)
- Make Electric bikes more accessible by proposing **rental services**. Ex: [“Véligo”](#)
- Financially **Incentivize car sharing** with **governmental subsidies** to maximize asset utilization and alleviate the pressure on public transport systems. Ex: [“Klaxit”](#)
- Facilitate the adoption of **pay-per-use models** to promote easy access to mobility equipment for both C2C and B2C users.

WHO:

- Mobility services providers (Car sharing companies, public transport institutions, private mobility, providers...), Governmental and regional entities, Cities.

HOW:

- Partnering with cities/governments to collaborate and **bring together various mobility providers**
- Leverage applications such as [CityMapper](#) to **bridge information gap** and bring together all mobility services providers

WHO:

- Companies small and large (from every horizon and sector).
- Mobility services providers: public transport, soft mobility (bike, scooter), long-distance means of transport (train, buses)
- Government: to **subsidize a share of this “Clean Mobility Pass”**.

HOW:

- Start in cities and close suburbs where intermodality is high, then deploy to the countryside.

Intermodality can be defined as using a combination of several *or* at least more than one transport mode for a single trip.

Mobility as a Service (MaaS): integration of various public and private transport services from different firms into a single service is at the heart of intermodality

- ❖ **Added value:** users can use a single service with a single payment, instead of multiple payment operations.
- ❖ Requires a **combination of different means of transport:**
 - Traditional modes: public transport, taxi, car rentals
 - Emerging transport options: autonomous vehicles, bike- and car-sharing, carpooling
- ❖ Can be **offered in two ways:**
 - subscription for an agreed time period, end-users pay a weekly, monthly or annual fee and receive bundled transit services from several transport modes
 - pay-as-you-go, where end-users pay separately for each leg of their trip
- ❖ Can cover **different trip types** such as urban, suburban, interurban or cross-border.

How to implement MaaS?

Partnerships

Collaboration and partnerships between various stakeholders, such as local governments, transportation providers, and technology companies, is required to implement MaaS.

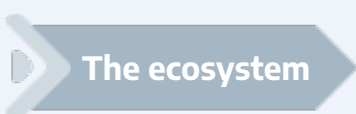
Infrastructure

MaaS requires companies to develop platforms that will be easily scalable to accommodate the increasing number of users and transportation modes.

Legal Framework

In some countries, third parties are not allowed to sell tickets or the price of public transport is regulated and as a result, MaaS operators cannot offer competitive prices. Thus, regulatory and legal considerations need to be addressed.

UbiGo: a mobility app that combines public transport, car sharing, rental car services and taxi in one application based on a flexible monthly subscription with an account shared by all members of a household.



Transport Service Providers

Public transport: *SL, Västra trafik* Carsharing: *greenmotion* Car rental: *Hertz* Taxi: *Cabonline* Parking: *Parkering Göteborg*

Supporting partner
City of Stockholm



Enabling Service Provider

Router: Google Directions, HaCon Billing: Zoho Suite

Nowadays ways of consuming transport are not compatible with a 9 billion people planet with finite resources and ecological boundaries: we have to find innovative models to travel and commute.

3 main challenges that guided our reflections:

- **Financial accessibility of sustainable ways of travel:** sustainable means of transport are not affordable especially in places where public transport offer is scarce.
- **Geographic accessibility of sustainable ways of travel:** In low-density or, conversely, high-density population areas, the sustainable transport options do not allow for satisfactory utilization.
- **User Experience and efficiency:** Polluting modes of transportation, such as cars, are perceived as safer and more convenient than other, more sustainable options.

4 main solutions we bring:

- **Accelerate the sharing economy:** Capitalize on sharing economy solutions to increase its global impact.
- **Deploy financing business models:** Improve the financial accessibility of electric vehicles and bikes especially to those with lower income.
- **Easing intermodality:** Convenience between public transport, private transport and sustainable last-mile transport is crucial to the widespread adoption of sustainable ways of travel.
- **Partner with companies to help incentivize sustainable behaviors:** Create an application to financially encourage employees to take sustainable ways of transportation to commute to work.

The issues we have worked on are obviously not exhaustive, and the solutions we have discussed raise other issues themselves, such as digitalisation (car-sharing applications, for example), resource depletion (linked to the electrification of mobility) or financing (which can be complicated in less developed countries).

General Questions:

- How do you envision the future of personal car ownership in the context of the growing sharing economy ?
- Where are the main issues today to turn ICE fleet into EV fleet ? Is it in the hands of governments (law-makers), companies ?
- What role for car manufacturers in the next decades ? Will they become central actors of the sharing economy and become mobility providers (With cars production being just a share of their business)? Or will they leave this role to innovative tech companies ?
- Should governments be the only ones to put money to financially incentivize citizens to purchase/lease/rent electric vehicles ? Or should car manufacturers also contribute ?
- Should governments prioritize public investment in developing Mobility as a Service (MaaS) technologies, considering potential economic and societal impacts in big cities?

Panelist Questions:

- **Social justice:** Can the scarcity of the mobility, spark riots and political instability in developed and developing countries?
- **AI:** Will reliance on AI for addressing mobility needs in a growing population ultimately free us from congestion, or could it steer us into a new era of technological dependence?
- **Environment:** What role will renewable energy play in the future of mobility, especially in developing countries, where energy infrastructure may be limited and what are the challenges in terms of affordability, scalability, and technological adaptability?
- **Degrowth :** Do you think the car manufacturers are aware that their current business model cannot exist in the 2050 world ? Do you think it will be possible to combine the mobility sector's transition with a decrease in polluting activities ?
- **Stellantis:** Mining of rare-earth and critical metals needed for EV production has a very important environmental and social impact. How will you ensure the sustainability of the resource from a supply, environmental, and social perspective; as demand will continue to surge in the coming decades?

- Barros V., Oliveira Cruz C., Júdice T., Miranda Sarmento J. (2021). Is taxation being effectively used to promote public transport in Europe?, Transport Policy, Volume 114, 2021, Pages 215-224, ISSN 0967-070X, <https://doi.org/10.1016/j.tranpol.2021.10.003>. (<https://www.sciencedirect.com/science/article/pii/S0967070X21002857>)
- Berg, J.; Ihlström, J. (2019). The Importance of Public Transport for Mobility and Everyday Activities among Rural Residents. Social Science Volume 8, Issue 58. <https://doi.org/10.3390/socsci8020058>
- Brutel C., Pages J. (2021). La voiture reste majoritaire pour les déplacements domicile-travail, même pour de courtes distances. Insee.
- Citymapper.com
- Cornet A. et al. (2012). Mobility of the future. McKinsey & Company
- Ewing J. (2023). Electric Vehicles Could Match Gasoline Cars on Price This Year. The New York Times.
- Ile de France Mobilité (2023). Véligo Location : service de location de vélos
- Iles R. (2005). Prelims. Public Transport in Developing Countries, Emerald Group Publishing Limited, Leeds, p. i. <https://doi.org/10.1108/9780080456812-021>
- International Energy Agency (iae.org).
- Jaramillo, P., S. Kahn Ribeiro, P. Newman, S. Dhar, O.E. Diemuodeke, T. Kajino, D.S. Lee, S.B. Nugroho, X. Ou, A. Hammer Strømman, J. Whitehead (2022). Transport. In IPCC, 2022: Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [P.R. Shukla, J. Skea, R. Slade, A. Al Khourdajie, R. van Diemen, D. McCollum, M. Pathak, S. Some, P. Vyas, R. Fradera, M. Belkacemi, A. Hasija, G. Lisboa, S. Luz, J. Malley, (eds.)]. Cambridge University Press, Cambridge, UK and New York, NY, USA. doi: 10.1017/9781009157926.012
- Klaxit.com
- Korma C., Sussman R., and Rosenberg B. (2021). How Cities can Apply Behavioral Science to Promote Public Transportation Use. Behavioral Science & Policy, Volume 7, Issue 1. (pp. 1 – 117). <https://doi.org/10.1177/237946152100700108>
- Latreille, J. (2021). Chapitre Quatre. L'équation de Kaya. Dans : , J. Latreille, Sale temps pour l'économie marchande (pp. 63-74). Paris: L'Harmattan.

- MacPherson H.C., Dickens M., Grisby D.C., Guzzetti A.L. and Skoutelas P.P. (2019). Public transportation Fact Book. American Public Transportation Association.
- Martin L., Michael W., and Xinyu L., (2021). The Influence of Public Transport Delays on Mobility on Demand Services. Electronics 10, no. 4: 379. <https://doi.org/10.3390/electronics10040379>
- Ministry for an ecological and solidary Transition (2019). GHG information for transport services. Application of Article L. 1431-3 of the French transport code. Methodological guide.
- Ministry for an ecological and solidary Transition (2022). Chiffres clés des transports Edition 2022.
- Ministry for an ecological and solidary Transition (2022). Se déplacer en voiture : seul, à plusieurs ou en covoiturage? Data Lab.
- Ministère de l'économie , des finances et de la souveraineté industrielle et numérique (2021). Puis-je obtenir un prêt à taux zéro pour l'achat d'un véhicule peu polluant ?.
- Mobility Market Size and Forecast (by Country, IT Solution Area, Size Band and Vertical) to 2027. globaldata.com
- OECD (2019). ITF Transport Outlook 2019.
- Polydoropoulou A., Pagoni I., Tsirimpa A. (2020). Ready for Mobility as a Service? Insights from Stakeholders and end-users. Travel Behavioural and Society. Volume 21 (pp. 295 – 306).
- Shared Mibility Worlwide (2023). Statista
- United Nations (2021, October 14-16). Sustainable Transport Conference. Beijing, China.
- United Nations, Department of Economic and Social Affairs, Population Division (2017). World Population Prospects: The 2017 Revision, Key Findings and Advance Tables. Working Paper No. ESA/P/WP/248.