Financing sustainable, digital mobility: What model where?

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Abstract:
In France, the anger of the "yellow vests" is but a new symptom of a deep feeling of injustice at a time when fixed costs amount to 61% of the household budget, and nearly 70% for households with a net income of €1300 per month. Most people have no other choice than to use a car to go to work. Not only did the cost of housing in big cities rise threefold over the past twenty years, but also job creations are concentrated in urban agglomerations, while jobs are being destroyed in medium-sized cities. All of this has, over the past forty years, stretched out the distance from home to work. The lack of alternatives to a trip in a single-passenger car for persons on the periphery of urban agglomerations is what causes the saturation of rush-hour traffic on highways. The feeling of not being fairly treated is intense: gasoline price hikes have hit hard low-income residents on the periphery or in rural areas — who, understandably, do not put up with lectures on the environment from people who live where they can use a car less often. A tax is not well accepted if its receipts are not allocated to a purpose, or if no explanation is given about how they will be used. To access zones of employment in urban agglomerations, simple, proven solutions exist that can be rolled out fast. However the question of how to pay for them has not yet been answered. Will the new tools for mobility promised by digital technology provide an answer? How to better connect urban agglomerations with their peripheral areas? As we see, the issues reach far beyond mobility. They have to do with social cohesion and geographical solidarity in a context of a shortage of public funds while the problems related to climate change are becoming more pressing day after day…

Transportation problems have come back to center stage in public debates even as the French parliament is about to definitively adopt a framework bill of law on "mobility" and at a time when the country has experienced deep social strife (without precedent since fifty years ago).[1] In the past two or three years, not a week has gone by without the press discussing the innovations in electronics that hold the promise of a revolution offering clean, inexpensive forms of mobility that can be rolled out in record time.

Meanwhile, empirical reality has caught up, harshly reminding us that we need physical services to be mobile and that these services have to be accessible to as many people as possible and not just to the happy few from the upper classes. It recalls that the car is and will still be the main vector of trips and that rejecting it out of principles is unrealistic in many geographical areas. It is a wake-up call that digital technology is one of the components of a mobility system but that — in the absence of appropriate infrastructures, mass public transit and a sustainable business model — it cannot realize its full potential, nor generate a value over and above everyday forms of transportation.

[1] This article has been translated from French by Noal Mellott (Omaha Beach, France).

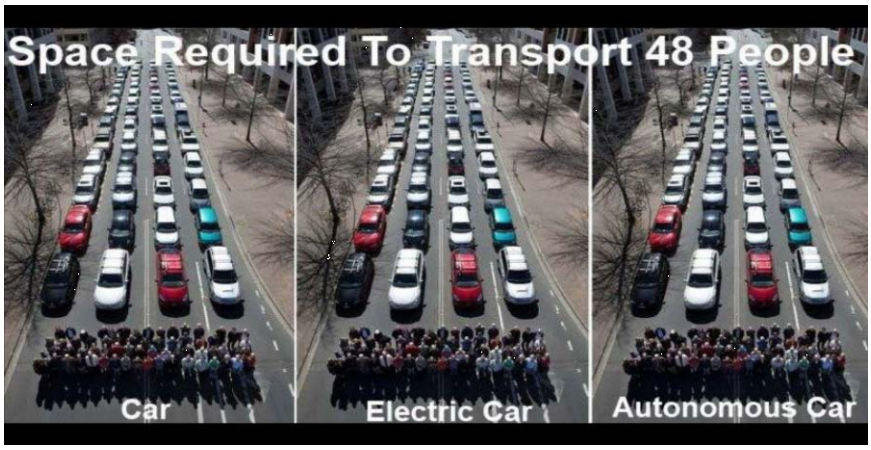
The French do not see this heralded revolution in daily life: the share of the car among modes of transportation has remained nearly unchanged for twenty years now, representing as it does 80% of passenger-kilometers (pkm). Three quarters of the French still take a car to go to work while 10-20% of daily rush-hour trains fail to leave at the appointed time, if they leave at all, and traffic congestion in urban agglomerations is rising from year to year.

Digital technology offers us room for maneuvering, but can it by itself make us switch models? There is room enough for doubts given the feedback from experience and the fundamentals of urban mobility.

Carpooling and ride-sharing concern a very narrow public. During train strikes when a subsidy from Île-de-France Mobilités (€2/trip) was offered, carpooling in Île-de-France region (comprising Paris) only accounted for 4000 trips/day out of a total of 41,000,000! Generalizing this subsidy (with a ceiling of €150/month), as has been announced in Île-de-France, might be successful but it is a potentially bottomless pit for public finance and, therefore, a dead end for mobility — several hundreds of millions of euros per year, maybe even more than one billion!

According to national statistics, the users of carpooling earn on the average €3700/month, *i.e.*, twice the median income, 50% of them have five years of higher education and travel mainly on the weekend for an average distance of 80 km. So, the impact of ride-sharing on everyday commuting is next to naught.

Figure 1: Space needed to transport 48 people



Autonomous vehicles have run into major technological hurdles. Will they be private or shared? Will they run in the same lanes as ordinary cars or in separate lanes? What will be their business model? How to determine liability? How to equip roads? These questions are hard to answer. Now — after years of marketing propaganda — the players in this game have come to admit this. The road ahead is long, very long from promises to realizations; and no one now dares announce a date for the widespread circulation of self-driving vehicles.

Electric vehicles (in all likelihood, hybrid) will help us address the issue of pollution, but only partly so because curbing conventional car traffic by 30% would lower pollution… 8%. Besides, electric or even driverless vehicles do nothing to solve the problems stemming from the occupation by vehicles of public space.

The cant of technology-enthusiasts about innovation is disconnected from the reality of the French. But from which reality?

- Over the last ten years, most jobs mostly been created in big metropolitan areas while nearly all big and medium-sized cities have lost jobs.
- Over the past twenty years, the cost of housing has shot up threefold in metropolitan areas.
- The population of Paris is 45% white-collar as compared with a national average of 16%. In the past thirty hears, the proportion of white collars in Lyon has been multiplied by three while that of employees and workers has been divided by three. For each person dwelling in the center of Paris, three others reside outside the ring road. Paris lost 400,000 inhabitants in 50 years, nearly 20% of its population!

The result of all this is well known and confirmed by all relevant studies: people dwell ever farther from their place of work. If that used to be a personal choice, this is far from the case nowadays. A significant proportion of rush-hour traffic involves trips of 10 km or more. In Paris, 80% of automobilists on the ring road come from the first or second rings of suburbs; and in Île-de-France, trips of more than 15 km account for more than 60% of rush-hour traffic on expressways. Obviously, such distances are not do-able by scooter.

Figure 2: Principal mode of transportation for commuting to work, as a function of the type of environment of the place of residence
Source: INSEE 2018.

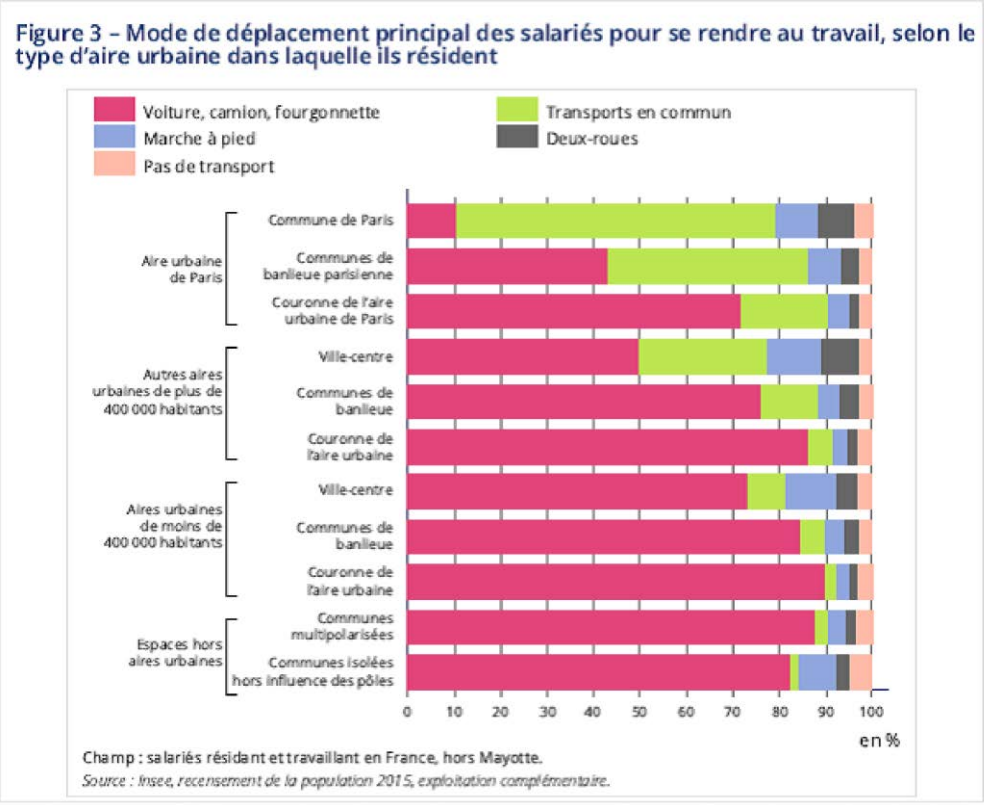


Figure 3: Percentage of car trips (driver or passengers) by type of environment in 2008

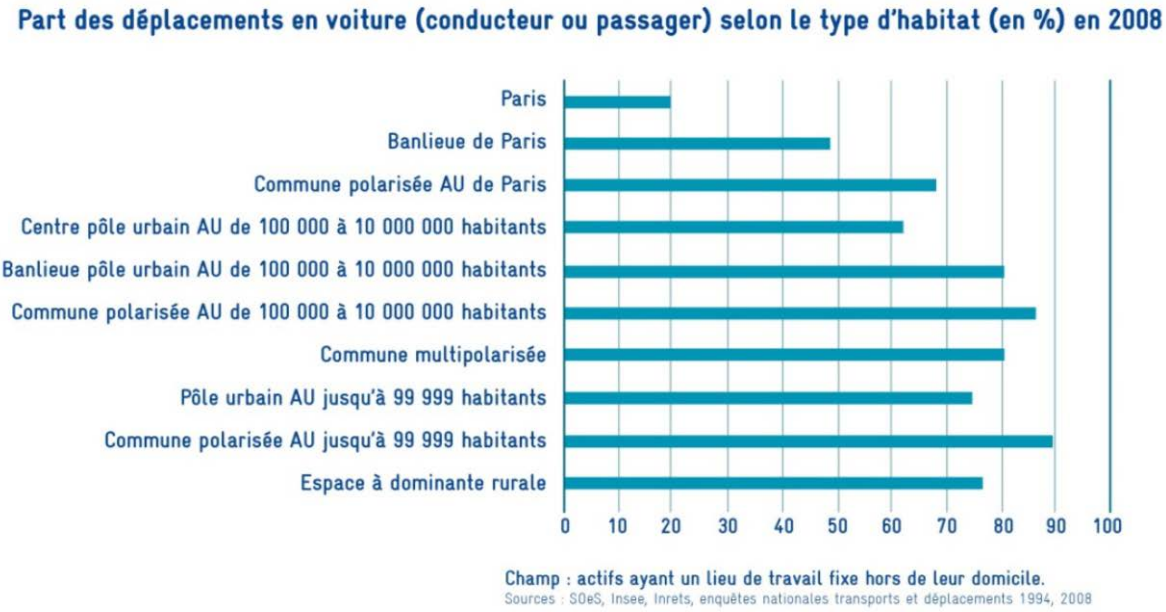
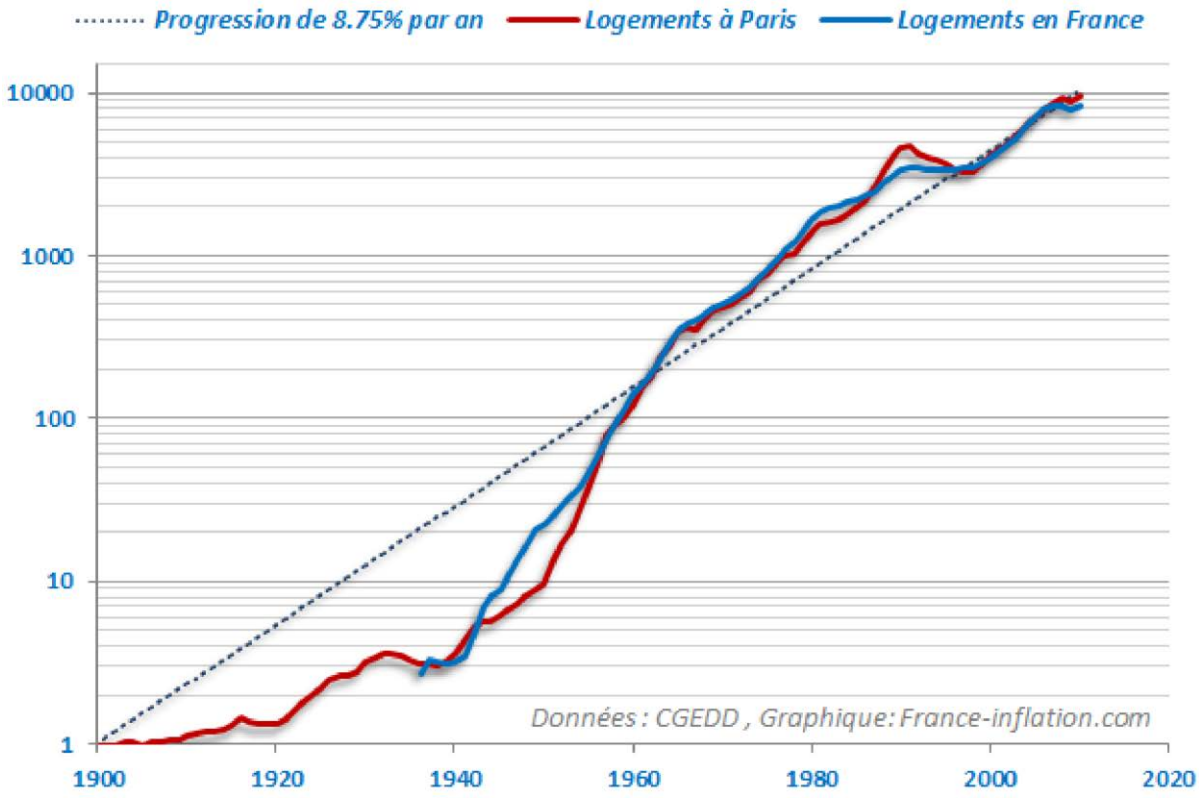
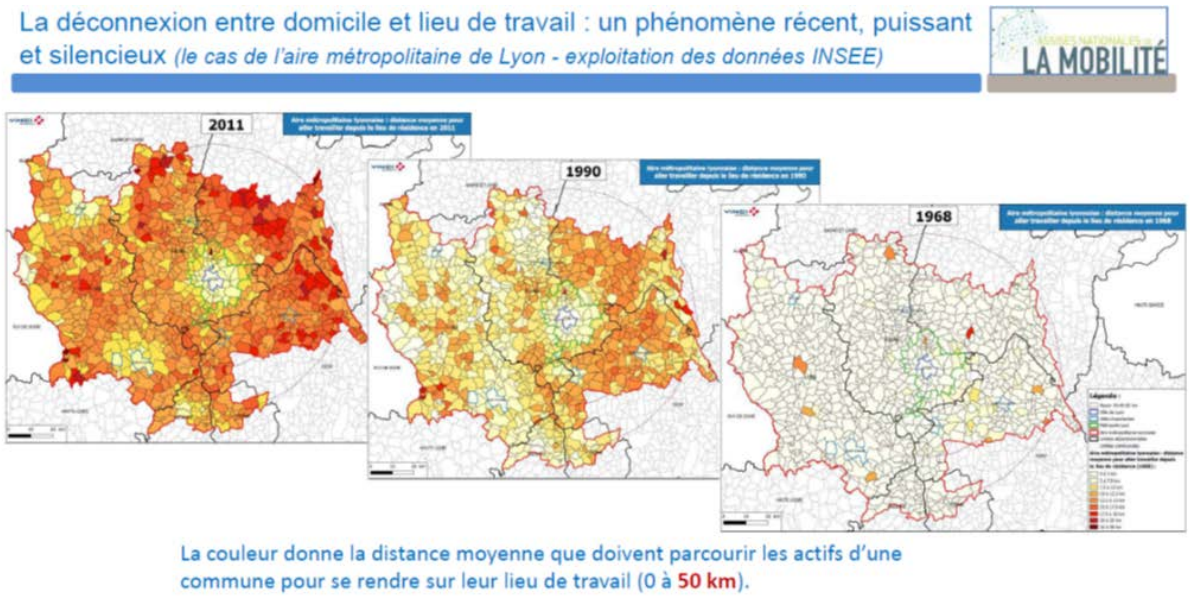


Figure 4: The cost of housing in France and in Paris: A threefold increase from 2000 to 2018.



In France, half of the trips using public transit in urban areas are made in Île-de-France region. But Paris is not France. The shares of various modes of transit have hardly changed over the past ten years. Switching from one mode to another, when it occurs, happens in downtown areas in urban agglomerations. Public transit replaces cars only in Paris and nearby suburbs and in Lyon.

Figure 5: Longer distances from home to work in the Lyon metropolitan area: A recent trend, powerful and silent.
Source: INSEE, AIPCR/ASFA, A. Broto, Assises de la Mobilité, October 2017).



The problem of getting to work — accessing zones with jobs — calls for a combination of solutions that are, in the end, very conventional. The problem of long commutes must be tackled; and a vast plan, drawn up that acts on three axes:

- INFRASTRUCTURES: reserve lanes for public transit (since passengers want to reduce travel time); and increase park-and-ride installations (the current offer falls short of needs: by a coefficient of forty);
- MASS PUBLIC TRANSIT between job zones and peripheral areas in urban agglomerations (a departure every minute during rush hour — five to ten times more often than in cities outside Île-de-France); and
- MOBILITY PASSES so that passengers can seamlessly move from one service to the next (what has been called "mobility as a service"; MaaS).

Figure 6**: Employment trends by type of environment**

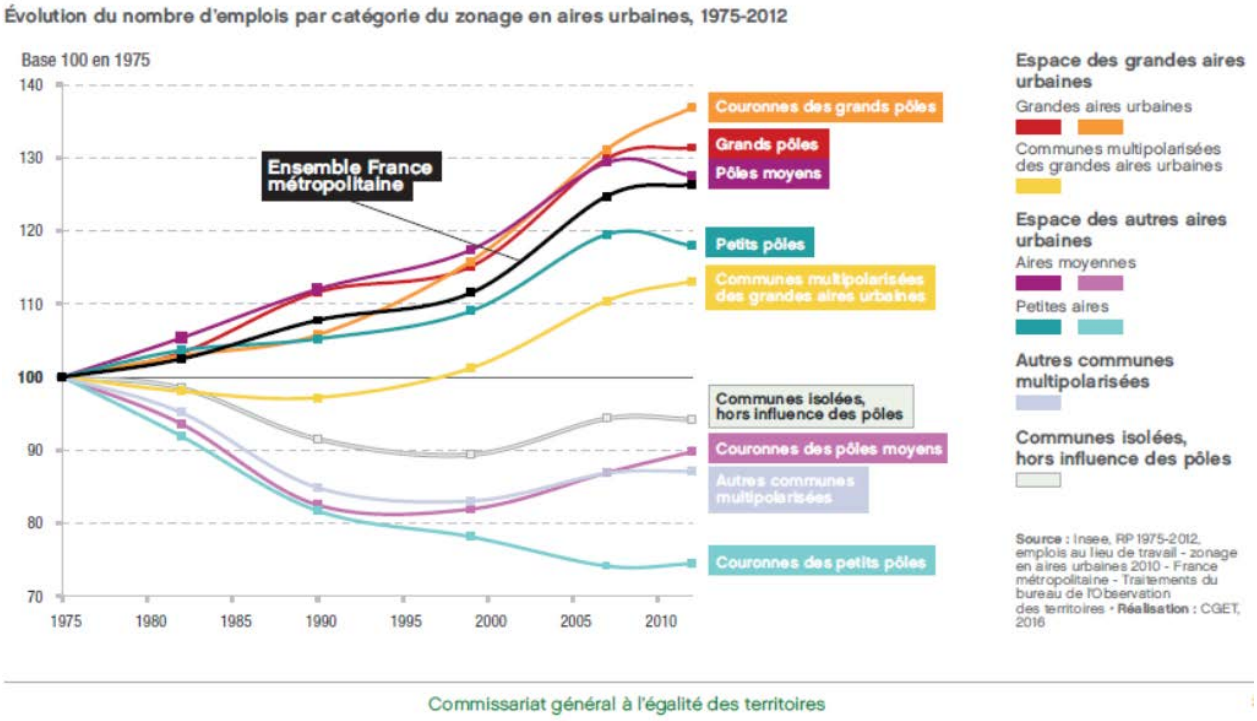
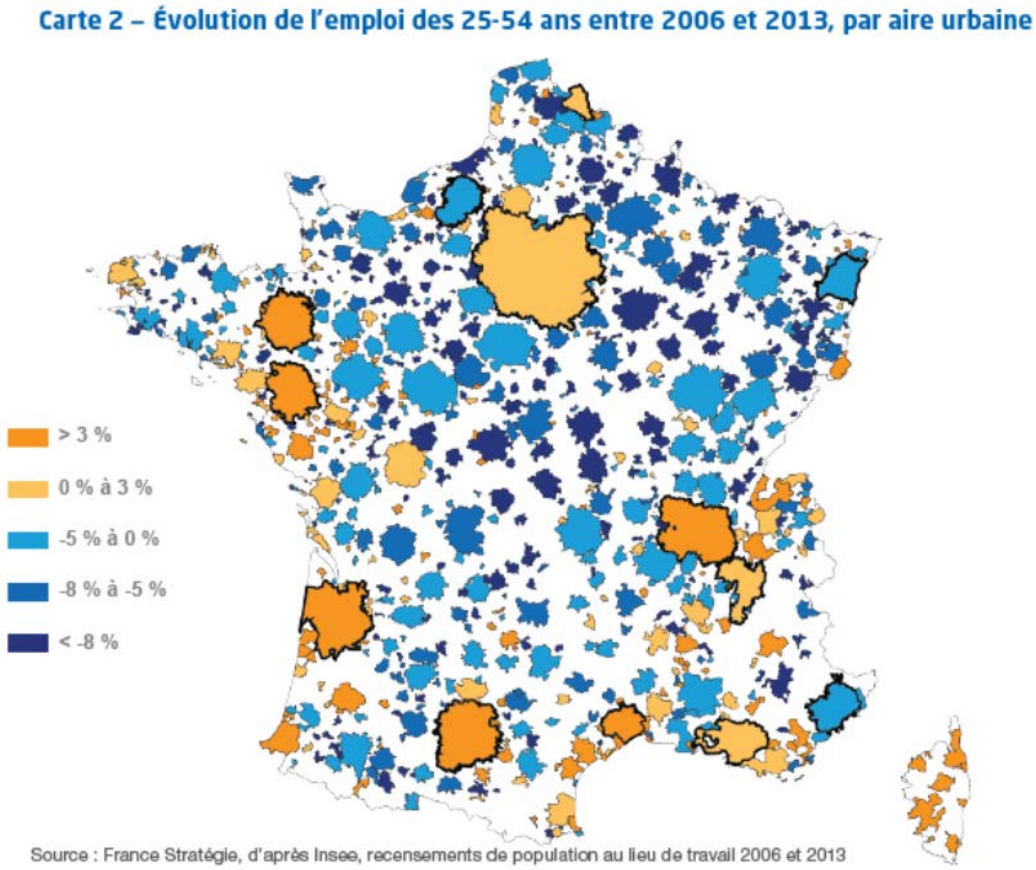


Figure 7: Employment trend of 25-54 year-olds between 2006 and 2013 by urban area



In the end, the promise is to commute faster and at a lower cost than with a car and to drastically reduce the flow of traffic toward agglomerations. This will have much more impact on air quality than the creation of "low-emission zones" (which merely try to keep up with the natural increase in the number of cars); and it will help win back public space and thus improve the quality of life for urban-dwellers. The question is: how to finance this solution for connecting urban centers with peripheral areas? An answer should be found fast in order to respond to urgent climate-related issues.

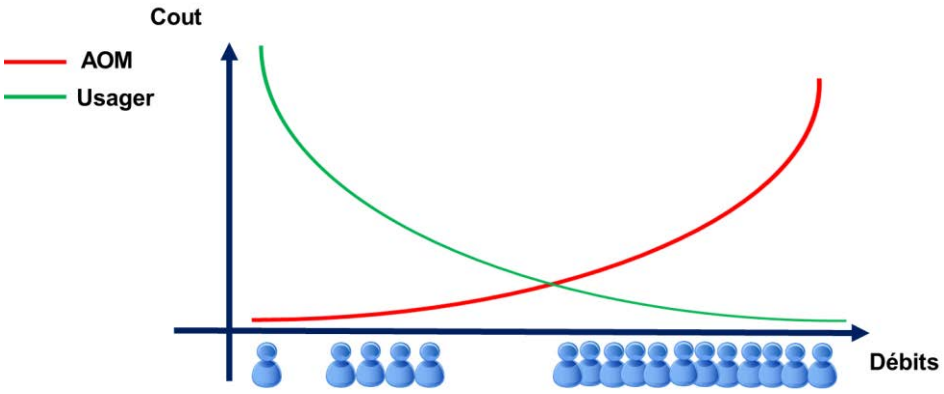
Figure 8: Connecting agglomerations and their peripheries

The so-called new forms of mobility are mainly intended for downtown areas and short distances, conditions for which there are already many alternatives to cars. The companies in this business are now discovering the defect in their business models. Following the bankruptcy of Gobeebike and OFO, Mobike (the only realistic free-floating business) has announced that, owing to difficulties, it is pulling back in Europe. MaaS operators like Whim, Moovel or Moovit have not managed to find a viable B2C model and are now looking for funds. Lyft lost 33% of its value shortly after going public. Uber has lost more money than any previous transportation firm, has never seen a positive quarter and is looking for partnerships with public transit authorities in Europe. Most of these startups are living on the (unprecedented) liquidity of private funds that do not know where to invest and are sinking money in operating losses in the hope of eventually turning a highly uncertain profit. This situation will not last. It recalls the Internet Bubble in the first decade of this century.

The business model adopted by Booking and Airbnb has been flagrantly transposed to mobility. The problem of the business model for a few firms has been confused with the issue of mobility for everyone. The much talked-about MaaS is a multilocal — not a national (and even less a world) — market. It is very unlikely that it can handle the question of daily commuting services without public subsidies. Not only the toll and fee schedules for services of mobility but also the categories of users (young people, big families, etc.) differ from one operator, and from one local area, to another. This situation is simply unmanageable for global firms. A global operator will concentrate on occasional travelers (at most 25% of the user base of public transportation), on very big cities (like Paris), and on people who have the means to pay more for travel services (tourists and business class). All that is, of course, useful, but only accounts for 2% of trips made in France. The model of Booking and Airbnb has worked in the hotel business because the price of a room and the number of stars are standardized categories around the world. It does not at all apply to mobility.

After all, there is a direct relation in mobility between the volume of passengers, the share of the cost paid by passengers and the amount of subsidies. At nearly €2/km, rides with Uber or a taxi are, in fact, luxury products. This means of transportation conveys very few passengers compared with public transit in urban areas, which only costs €0.10/km for users with a subscription, since taxes cover 75% of the costs.

Figure 9**: The relation for users (in green) and public transit authorities (in red) between costs (€/km) and passenger flows.**

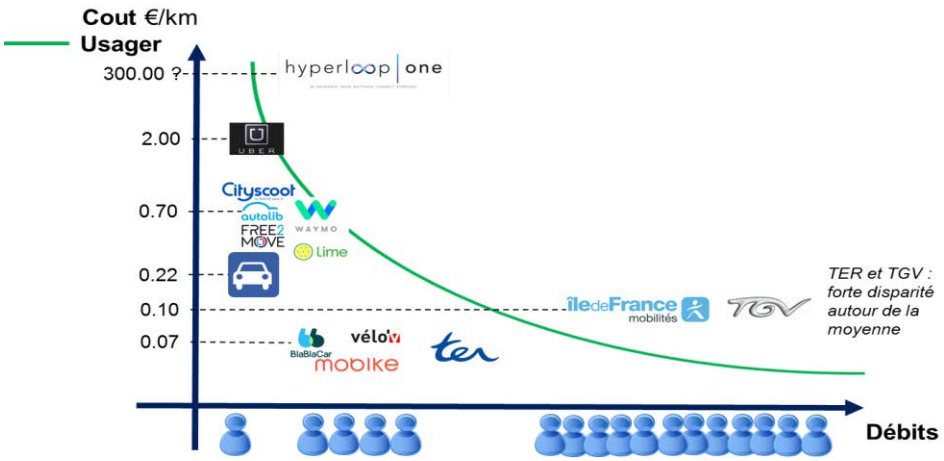


Throughput is a key question for mobility in urban agglomerations. The purpose is not to go faster but to transport many more passengers. Flying taxis and hyperloop — solutions for the 0.1% of the population earning more than €10,000/month — are incapable of moving volumes of passengers. Hyperloop between Orleans and Paris is announced at eight minutes, with an hourly flow rate of 200 persons — ten times less than a single expressway lane, and fifteen times less than a train every ten minutes (Figure 9). The absurdity of such a solution for daily commutes is glaring.

Given the scarcity of public space in dense zones, the solutions for transportation adopted by public authorities have to keep automobiles from invading public space. The new solutions for mobility are unable to sustain the requisite throughput. It is impossible to imagine shifting the 1,500,000 travelers/day on the RER A line running under the rue de Rivoli in the center of Paris onto scooters or bicycles! That would call for major public works and massive public transit services.

Therefore, it is normal for the public sector to cover infrastructure costs; and for operating costs to be covered by funding from public authorities and by payments from users for services. The proportion in this combination varies from country to country: it is 75%/25% in France but nearly the reverse everywhere else in Europe. This raises questions about how to finance public transit.

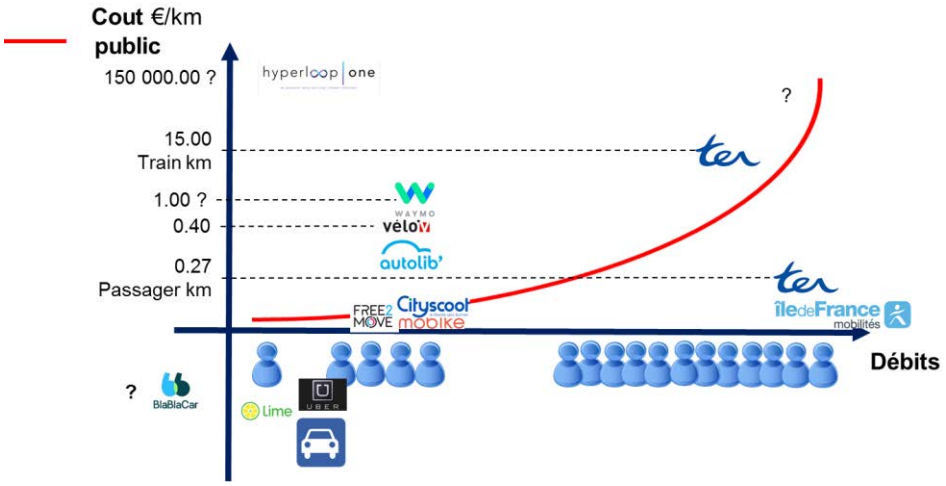
Figure 10**: The relation for users (in green) between costs (€/km) and passenger flows of various forms of mobility.**



On the graph (Figure 10) relating costs (€/km) and passenger flows for users, we see why new forms of mobility have difficulty upgrading their scale of operations. For instance, Lime foot scooters run up a cost of €0.50/km — five times more than public transit in urban areas, and fifteen times more than the subscription fee for regional (TER) trains (€0.03/km). These scooters will never become a means of mass transportation. Robot taxis, once they are ready to run (not before long, if ever), would be two times less expensive than taxis but three times more than private cars and ten times more than public transit. They will be a luxury product and, as a consequence, account for a very low percentage of trips. The cost of trains varies considerably depending on whether or not passengers have a subscription and on the sort of high-speed train the take (OuiGo or a normal TGV). The ordinary high-speed trains (which finance Ouigo) cost close to €0.22/km in second class — as much as a car!

On this graph, it is worth pointing out that the costs of short-distance ride-sharing could be shifted considerably toward transit authorities and public authorities if the decision were made to do so. The costs of doing this in Île-de-France would be three times more than the current public outlay for mass transit. If 20% of automobilists were to carpool, the annual cost would rise toward €1.5 billion.

Figure 11: **The relation for transit authorities (in red) between costs (€/km) and passenger flows of various forms of mobility in rural areas.**



In contrast, in rural areas where public space is not congested and cars cover 125% of their costs (including environmental), there is no reason to finance the mobility of persons (apart from pupils and persons unable to drive). Banishing cars from rural areas is not just unrealistic but meaningless. This remark casts a spotlight on the mainstream moralization by urbanites who project their lifestyle onto geographical areas with quite different problems. The solution for rural areas is to improve the mobility of people who cannot drive and make it cheaper. LOM's "amateur taxis", a very good program, can potentially divide by five the current cost of on-demand transportation services and thus significantly increase the supply.

Table 1:
Costs and benefits of the private car per vehicle-kilometer (€/vkm)

	Use	*CO2*	*Accidents*	*Noise*	*Pollution*	*Total*	*Tolls*	*Gas Taxes*	*Registra-tion*	*Insurance, etc.*	*Total*	*Tax/ Cost ratio*
Dense urban zones	**1.2**	**1.0**	**4.3**	**0.2**	**17.9**	**24.6**	**0.0**	**4.6**	**0.4**	**0.1**	**5.1**	**21%**
Rural areas	**1.2**	**1.1**	**2.5**	**0.0**	**1.1**	**5.9**	**2.1**	**4.7**	**0.4**	**0.1**	**7.3**	**125%**

Table 1 depicts the unfair situation that results from indiscriminately hiking gasoline taxes. Strictly speaking, these taxes should, if this were possible, be cut by 25% in rural areas and multiplied fivefold in dense urban zones — what would clearly resemble an urban toll. In urban areas, cars only cover 20% of their costs (omitting the costs of congestion paid *de facto* by users). This is where efforts should be made. The conventional solutions, already mentioned, could be put to use to lower from 30% to 50% automobile traffic during rush hours and enable users living 40 km from their place of work to gain 30 minutes in commuting time and save €10/day. This would cost billions of euros in investments for the Île-de-France region and, too, nearly €500 million/year in operating costs.

The historical propensity of French politicians, whether on the right or left, to tax firms to finance mobility has created a situation where firms have the lowest margins in Europe and France has one of the highest unemployment rates in the EU. Of course, firms do not vote while the jobless do (and tend to adopt extremist positions). The reports about what should be done at a cost of billions of euros never propose the plans for financing their pipe dreams. This naivety is appalling.

According to the IPCC, we should devote 3% per year of our GNP to containing global warming. Households, too, must be made to pay lest talk be words without deeds. This will have to be done through either the cost of transportation services or else taxes. Since public opinion is fed up with taxes, users are the only source left to be tapped, a choice that will, for sure, prompt them to adapt more virtuous behavior patterns. This program could be funded fast (instead of taking several decades) if a low "fee" for using a car (*e.g.*, €2/day only on workdays and outside the vacation period) were paid. However such measures must be fair and just since social cohesion will be maintained by, above all, paying attention to the weakest. This means:

- applying this pricing method *after* implementing the aforementioned alternatives and *only in* big urban agglomerations with major problems of congestion; and
- exonerating low-income households.

While technology can help optimize the system, strong, inclusive public interventions are needed to connect peripheral areas to urban agglomerations — to adapt infrastructures and extend public transit beyond an agglomeration's administrative perimeter so as to siphon off traffic. Each metropolitan area must assume its role as an economic driving force, including in areas outside its administrative bounds. Being inclusive and politically courageous means explaining that solutions of mobility have to be designed for people who do not live in downtown areas, and that these solutions have to be paid for. The climate question is ever more pressing, day after day, while each year is warmer than the previous year. We must tirelessly explain, convince and persuade so that people support this positive collective ambition which calls for efforts from everyone.