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Who drives the change? New and traditional players in the global automotive sector

The autonomous vehicle for urban collective transport: disrupting business models embedded in the smart city revolution

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Abstract

The complexity of the automotive sector has grown dramatically in the last years. We are probably witnessing an automobile revolution, combining technology disruptions as well as regulation's changes which pave the way for a new robomobility. Accordingly, new economic models are about to connect the fourfold product-service-structure-market leading to a responsible and sustainable mobility in connection with the development of smart cities. In this paper, we aim at characterizing the changes that are occurring and try to anticipate which players are about to lead the transition towards the new paradigm of robomobility.

Key words: autonomous vehicle, business model, smart city

1. Introduction

Over the last ten years, the automobile industry has moved into the ecosystem of mobility. This mutation is due to major disruptions in technological, energetic, socio-economic and ecological aspects as well as in new business model propositions. The new mobility paradigm links industrial strategies and public policies, mainly around smart cities' development. In addition, a new type of customer is emerging called "next-generation consumers" or "next-gen consumers" (Firnkorn, Muller, 2015). These new consumers demand more durable, efficient and cheap mobility and are ready to play by the rules of the circular economy.

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This conducts Attias (2017) to suggest that we are witnessing an automobile revolution. This revolution in the car industry is fully embedded in the revolution of urban areas, mainly through the arrival of autonomous cars, minibuses and shuttles, thus building a new paradigm of urban mobility.

In this paper, we characterize the changes occurring and try to anticipate which players are leading the transition towards the new paradigm of mobility.

In the urban area, private and collective transport will be organized differently in the forthcoming mobility system, which will be much more multimodal than it used to be as yet (Attias, Mira Bonnardel, 2017).

Consequently, in the new system, cars will be marketed through a variety of alternatives that still raise questions, mainly: (1) Will vehicles still be owned by their users or mostly come from car-renting or car-pooling? (2) Will vehicles still represent a cost for their owners or could they rather generate revenue from car-sharing?

The new mobility will combine different channels through which anyone will be able to obtain a vehicle: B2B (business to business) and B2C (business to consumer), but also C2C (consumer to consumer) often named O2O (owner to owner). Numerous O2O web platforms offering car-sharing, charging and parking have developed very fast over the last ten years (Strasser al., 2015).

In this new world of mobility, access to the Internet, IoT and digital solutions will be part of all means of transportation. Route optimization, traffic analysis, car sharing, car rental, car connection and other services linked to mobility will be standard solutions for all cars (KPMG's Global Automotive Executives Survey 2015).

All of these possibilities will be linked to a variety of usages: short, urban journeys versus long rural journeys, professional versus personal movements, lone versus collective mobility.

In the near future, new economic models will connect the fourfold product-service-structure-market to the new mobility technologies and to the societal shift towards sharing, or the circular economy, sustained by digital technologies. This evolution is leading to responsible and sustainable mobility in connection with the development of smart cities (Attias, Mira Bonnardel, 2017).

In terms of methodology, in our capacity as leaders of the Armand Peugeot Research Chair, with the PSA Peugeot Citroën group, we've identified and analyzed the development of the new technologies and innovative business models of the vehicle of the future. This Research Chair is a member of the group's StelLab network, responsible for leading an interdisciplinary network that fosters discussion and dialogue among scientists and experts from PSA Peugeot Citroën. Over the last 6 years, together with StelLab, we have organized research seminars, workshops, and international conferences on the electro mobility economy. This gave us the opportunity to hold several interviews with the executive managers of different companies, car industry experts, and politicians.

Thanks to this research program, we have identified a number of prospective trends supporting the idea that we are about to enter, not only a new mobility paradigm, but a new way of living the urban space. In this transition, public policies and smart city governments have a major role to play.

Firstly, we will briefly describe the present situation of autonomous cars worldwide. Then, we will show how the car industry is about to be profoundly reshaped by new partnership strategies. The autonomous vehicle opens the door to new mobility business models for which we can give a wide range of prospective images, all of them embedded in the smart development of cities.

2. Formidable worldwide development of autonomous public transportation

Over the last 3 years, autonomous cars have become a fascinating subject generating thousands of technological innovations and more and more experiments in large cities worldwide: in 2017 alone, 64 programs were running of which more than 50% were in Europe (MOVEO, 2017)[3].

A study by IHS Automotive[4] considers that the fully self-driving car cannot be expected before 2025, but vehicles with automated driving will represent about 12% of world sales in 2035. The study points out that the number of accidents will be close to zero for these autonomous cars, road traffic should be more regulated, and air pollution will be controlled thanks to the development of programs optimizing energy consumption.

No doubt that the autonomous car will transform the car industry and extend its frontier to take in new players. According to the study carried out by Xerfi/Precepta (2017), two thirds of automotive sales planned for 2025 will be related to software, on-line data processing and security systems. The car itself, produced by manufacturers and OEMs, will only represent one third of the value. Therefore, car manufacturers must take the arrival of newcomers on the market very seriously. This includes not only newcomers like Google, Tesla and Apple, which are already very advanced in their programs (Donada, Attias, 2014), but also brand-new startups that are rapidly interesting investors.

Yet, fleets of autonomous cars will not be seen on the roads right away; prospective analysis forecasts progressive steps from traditional cars to autonomous cars, distinguishing 5 levels ranging from full driver responsibility to full vehicle responsibility:

- Level 1: vehicle provides drivers with information warnings
- Level 2: vehicle integrates detection and response
- Level 3: vehicle is autonomous, driver takes control in emergency
- Level 4: vehicle fully autonomous, occupant does not need the ability to drive
- Level 5: vehicle fully autonomous, connected and cooperating, optimized system operations and passive occupant experience.

Levels 4 and 5 are mostly considered by public authorities worldwide as genuinely disruptive, while in the near future, urban spaces will almost certainly begin to experiment with autonomous vehicles in dedicated areas or lanes.

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[3] TEVAC Etude MOVEO, Benchmark Expérimentations dans le monde des Véhicules Autonomes Connectés, 31/07/2017.

[4] http://news.ihsmarkit.com/press-release/energy-power-media/future-cars-2040-miles-traveled-will-soar-while-sales-new-vehicles-

Obviously, fully autonomous cars may firstly be authorized for collective transportation on the roads, offering a solution for larger cities that struggle to provide adequate public transport. Many cities lack the appropriate infrastructure to support the needs of their residents, a gap that could partially be filled by self-driving buses fulfilling the promise of personal rapid transit and offering a personalized point-to-point service without the hassle, congestion, or crashes involved in driving.

Indeed, the domain of driverless shuttles and buses is rapidly expanding, with several active companies that can be regarded as serious newcomers in the automotive industry specifically for collective transportation, the most advanced being Navya and EasyMiles (French companies), Auro Robotics and Local Motors (US companies). Besides these four companies, the century-old global automotive sector is experiencing formidable rejuvenation with the entry of abundantly creative newcomers, such as NuTonomy, SB Drive, among others.

The examples that we briefly describe hereafter show the diversity and strength of these new players, all of which are strongly supported by strategic founders.

Six typical examples of newcomers in autonomous collective transport

1. **Navya** is a manufacturer and operator of autonomous minibuses; this private French company established in 2014 is currently the largest manufacturer of autonomous buses worldwide, with 65 vehicles operational worldwide for collective transport (in Japan, Singapore, Qatar, Europe, Australia, and the USA). Navya's shuttle is a 100% electric vehicle equipped with state-of-the-art technologies, ensuring autonomous and safe operation, and has the capacity to be mass-produced (we will present its business model in part 4).
2. **EasyMile**, also founded in 2014, has partners in Singapore, Denver, Japan, Taiwan and the Middle East. Its shuttle comes in metro mode (passengers can get on or off at any station), bus mode (passengers request to get off only at certain stations on a predefined route) or on-demand mode (passengers ask the shuttle to go to their destination via a smartphone app). With respect to security and safety, the shuttle is equipped with sensor vision, a laser and GPS, ensuring smooth operation regardless of infrastructure constraints, visibility and/or weather conditions for a certain area. According to the company, the shuttle service can be easily configured to accommodate sudden shifts in demand and adjust its trajectory and speed for obstacle avoidance.
3. **Auro Robotics**, a California-based company founded in 2015, offers its electric campus shuttles based on a mobility-as-a-service model. Its subscription pricing includes insurance and liability coverage for the vehicles, as well as maintenance. It provides commuting services for groups of people like students, the elderly, injured people and people who have difficulty walking. The vehicles move at low speed and offer greater safety for female students commuting at night and children travelling to schools or playgrounds. Auro aims to reduce the costs associated with on-campus mobility and is planning multiple campus trials to achieve this.
4. **Local Motors** is an American vehicle manufacturing company that produces a self-driving vehicle named Olli. Olli is powered by IBM Watson IoT technology and its principle major innovation is its open-source vehicle design. The company supports co-creation by exchanging ideas and solutions with customers and brands. Olli claims to be a safe and sustainable option for collective transport. The vehicle's activity is constantly monitored by a human controller. Its services include interactive

conversation in natural language inside the vehicle, and if requested Olli can provide information of local interest. Olli currently only operates locally, but in the future the company anticipates a fleet of autonomous Ollis operating under complex situations in urban areas to improve public transport.

5. **NuTonomy**, a Boston-based startup spun out of MIT in 2013, has been quietly making big moves in the self-driving-car space. In August 2016, NuTonomy became the first company to launch a fleet of self-driving taxis under a pilot program in Singapore. NuTonomy raised $20 million in venture funding through 2016. Investors include the government of Singapore and Fontinalis Partners, a venture fund founded by Bill Ford, the executive chairman of Ford.
6. **SB Drive** is a Japanese conglomerate of SoftBank's self-driving bus project, a joint venture established with Advanced Smart Mobility. SoftBank remains the majority owner, but Yahoo Japan recently joined the initiative with a $4.4M minority stake and aims to link SB Drive with its Yahoo Maps service and data. Japan is planning to use the 2020 Tokyo Olympics as an opportunity to showcase an autonomous, self-driving taxi service. Tokyo-based Robot Taxi is still on track to start field tests of its driverless service. The company, a joint venture between DeNA (one of Japan's mobile internet pioneers) and ZMP (a robotics firm), focuses on adding driverless capabilities to existing cars and designing, creating, and marketing the taxi service.

Of course these examples are not exhaustive, but the impressive development of these newcomers is seriously impacting traditional players, car manufacturers and OEMs, which are rapidly reacting, mainly by partnering up with the newcomers.

Policymakers are also very seriously considering the potential of autonomous vehicles for public transport, like the European Commission, which launched a call for major projects in its H2020 plan. We are currently working on the AVENUE project, which has been granted significant funding from the Commission to conduct several full-scale demonstrations of urban road transport automation (2018).

The AVENUE project for *Autonomous Vehicles to Evolve to a New Urban Experience* aims to design and carry out full-scale demonstrations of urban transport automation by deploying fleets of autonomous minibuses in low- to medium-demand areas of 4 European demonstrator cities: Geneva, Lyon, Copenhagen and Luxembourg, and 3 replicator cities in a second phase[5]

AVENUE will rework the available public transportation services taking into account passengers' special needs and time constraints on the basis of door2door services and the "Mobility Cloud" concept with the aim of setting up a new public transportation model.

This model aims at implementing safe, efficient, on-demand, emission–free, personalized public transportation, available anytime and anywhere, blending conventional public transport with novel service models such as those of the sharing economy.

The project partners will apply cutting-edge technologies and propose a set of corresponding in- and out-of-vehicle services for road safety, the overall quality of the service, and the value added to the passenger, targeting also elderly people, people with disabilities, and vulnerable users.

[5] https://h2020-avenue.eu

AVENUE relies on a consortium of 16 partners from 7 European countries and the operation of Navya's minibuses. The project's activities are organized into 10 work packages to be implemented within 4 years. The full-scale demonstration will run for 24 months to allow thorough validation, as well as the evaluation of the socio-economic and environmental impacts of the demonstrations. AVENUE's ambition is to boost the adoption and acceptance of autonomous vehicles for public transportation, accelerating their commercial deployment and European leadership in the domain, while stimulating international R&I cooperation.

The abundant emergence of newcomers is seriously impacting traditional players, car manufacturers and OEMs, which are rapidly reacting, mainly by partnering with the new players.

3. Strategic moves: how traditional players stay in the race by partnering with newcomers

To tackle these newcomers, rather than competing against them, traditional carmakers have chosen to partner up with them in a *coopetition* approach, with numerous alliances signed since 2016. Since most traditional players recognize that it is extremely challenging for a single company, on its own, to develop the entire software and hardware stack required for autonomous vehicles, they link up with nontraditional industry participants, such as technology start-ups and digital companies, which are gradually launching relevant solutions onto the market. These partnerships are totally transforming the car industry (Attias & Mira Bonnardel, 2017).

Carmakers are not only implementing partnerships, they have also decided to capture value creation by investing heavily in newcomers' equity. Audi, BMW and Daimler agreed with Nokia on the joint acquisition of the mapping service HERE for €2.8 billion, while Ford has invested $1 billion in the start-up Argo-AI to help build the brains of its robot cars, along with a $ 150 million investment in LiDAR-maker Velodyne and 3D-maps-maker Civil Maps.

This Investment trend involves not only private companies; in France, the public company Keolis[6] has invested in Navya, the French producer of autonomous shuttles. This investment is anchored in a public-private partnership for innovation; it illustrates the significant interest of public authorities in new mobility and will likely open the way to new business models.

Another example of a public-private partnership of special interest is Transdev, which is positioned as a turnkey solution provider for autonomous transport systems (it does not manufacture autonomous vehicles, but uses existing ones). In February 2017, the company teamed up with Renault-Nissan to develop mobility services using autonomous vehicles for public transport and on-demand services. The companies will collaborate to deploy a modular transport system that will allow customers to book a

[6] The Keolis Group is a world leader in public transport operations. Present in 16 countries, Keolis operates urban, suburban, and regional networks on behalf of 300 local authorities. The group carries over 3 billion passengers every year. The Keolis Group is a pioneer and world leader in automated metros and also the worldwide leader in trams. Keolis manages tram networks across the globe, including the world's largest in Melbourne (250km of tracks). The group operates a total of ten different transport modes (metro, tram, train, bus, car, bicycle, etc.) and implements its intermodal know-how around the world. The Keolis Group is 70% owned by SNCF (the French public railway operator) and 30% by the Caisse de dépôts et placements du Québec (CDPQ).

vehicle for a trip and operators to manage a fleet of autonomous vehicles. Field tests are planned at the Paris-Saclay business cluster. However, the vehicles to be used initially are electric cars (Renault Zoe) and not buses. The Athena CVT Final Report studied how autonomous vehicles will impact the design of Grand Paris (2017).

However, partnership strategies are largely overtaking traditional players from the car industry; for example, Alstom (rail industry) has invested in EasyMile, and Airbus (aircraft industry) in Local Motors.

Large companies from the digital industry are reinforcing their position by combining two types of alliance: on the one hand with traditional players and on the other hand with newcomers.

Alphabet, Google's parent company, transformed its Google Car into a commercial subsidiary company with a new brand, Waymo, which has since formed partnerships with Honda and Fiat Chrysler. Apple has invested $1 billion in the Chinese ride-sharing service Didi Chuxing. Intel has acquired Mobileye, a leader in computer vision for autonomous driving technology, for $15.3 billion; General Motors has acquired Cruise Automation, a San Francisco-based developer of autonomous vehicle technology, for $1 billion.

Delphi, an electronics supplier for cars, aims to release self-driving vehicles to the public in 2022. To this end, Delphi signed a deal with Intel in November 2016, agreeing to buy its high-powered computer processors for self-driving systems. Intel recently acquired the autonomous tech company Mobileye in a deal worth $15.3 billion. This revolution concerns all mobility vehicles; a study by Ptolemus Consulting Group shows that big data will also be used by future autonomous trucks (2017).

How do these various examples illustrate profound change in the automobile industry?

Firstly, the amounts invested in these alliances are considerable, which implies that investors are wagering on significant potential returns on investment. For example, the capitalization of the French company Navya quadrupled between 2015 and 2017.

Secondly, partnership strategies are all targeting parts of the connected mobility, anticipating disrupting technical changes likely to provide significant competitive advantages, although individual advantages will probably be short term.

Lastly, the CEOs of large companies are ready to take risks to play a role in the mobility transformation. Uber's CEO, for example, chose to join forces with the founders of Google Car and consequently had to radically change the company's strategy. The risk for the company is considerable, since it is employing an unproven technology in a context where any accident would immediately discredit the company and even stop its development.

The battle around the autonomous vehicle is building the framework for the mobility revolution, because it involves numerous actors in very diverse fields, and forces governments to tackle huge problems as complex as insurance regulation, personal data collection, and energy and communication networks administration, along with the emergence of new business models in the smart city context.

Indeed smart cities and the new mobility are not only related, they also share the same DNA, as they are both a combination of technology push and demand pull (Angelidou, 2015).

Technology-pushed innovations emerge from a melting pot of technologies, such as information technology converging within the domains of IoT and big data management, and also electronics, mechatronics and optronics (CEA, 2017).

On the demand side, citizens converge in their desire for less pollution and decongestion of the urban landscape, while at the same time requiring policymakers to manage public resources more efficiently, maintain high service levels, and diversify them within inclusive rationales.

Developing new business models for autonomous collective public transportation within smart cities seems to be the cornerstone of this combination.

4. Disruptive business model embedded in smart cities

In terms of the automotive industry, the most appropriate definition of a business model is proposed by Zott & Amit (2010), who conceptualize a business model as "*a system of interdependent activities that transcends the focal firm and spans its boundaries. The activity system enables the firm, in concert with its partners, to create value and also to appropriate a share of that value*". New business models are emerging from the transformation of the mobility ecosystem largely supported by digitalization. "*Digitalization is a sociotechnical process that leverages the technical process of the encoding of analog information in a digital format (digitizing) applied to broader social and institutional contexts, transforming their sociotechnical structures, thus rendering digital technologies infrastructural*" (Kaiser, Stocker, Viscusi, 2017).

As analyzed by Kaiser & al (2017), in the automotive industry, the potential transformation enforced by digital innovation is inducing business model innovation. This innovation can widen horizons and business paths that may focus companies' strategies toward greater sustainability and more services to the customer.

Indeed, as RethinkX's report states: "*by 2030, within 10 years of regulatory approval of autonomous vehicles (AVs), 95% of passenger miles traveled will be served by on-demand autonomous electric vehicles owned by fleets, not individuals, in a new business model called* '*transport-as-a-service*' (TaaS)".

The new TaaS business models will surely expand within smart cities. But what actually is a smart city? No single definition exists. The International Telecommunications Union published a report in 2014 citing more than 100 definitions, from which we retain the following: "*Smartness refers not only to the technological issues but also encompasses both the smart integration of all infrastructures and socioeconomic functions, and the smart transition from their current state to the foreseeable desired future. This future can only come about by a smart use of human, financial, and technical resources, simultaneously tackling environmental, demographic, social, infrastructural, and economic challenges, and their interrelations. The concept of a smart city is a vision of a sustainable, fair, and resilient urban area*." (Masera, Bompard, Profumo, and Hadjsaid, 2018).

The development of smart mobility is a key to the transformations cities will have to perform by combining technology into specific local models, such as dynamic traffic management, and extended multi-modalities. But "*the management of urban transport flows is part of a much larger issue in that, in*

the context described above, aims to reorganize the infrastructures that make up towns, enrich the services delivered to their inhabitants and, beyond that, involve those inhabitants in their co-production" (Geoffron, 2017). Inhabitants are becoming prosumers, i.e. both producers and consumers.

Yet the prospective of an increase in the use of autonomous electric vehicles in cities immediately raises the question of energy needs and energy production and requires seriously thinking about the implementation of smart grids. These grids would help to provide energy for the increase in demand, mainly by developing new production models such as peer-to-peer exchanges of electricity among end users amongst prosumers and energy communities (Wei, Mei, Wu, Shahidehpour & Fang, 2017).

Interactions between autonomous connected vehicles and smart cities are twofold: on the one hand, the automotive industry will influence the shape of mobility patterns, and on the other hand, public policies will organize the urban space within the new mobility paradigm, offering multi-modal mobility (Kellerman, 2011). From an economic perspective, this multimodal mobility will offer a wide range of new business models.

Smart cities are sustainable, intelligent, digital, connected and innovative (Firnkorn, Muller, 2015), and highly supported by IT systems. These IT systems aim at organizing intelligent transportation systems to lower congestion and increase safety and control. IT systems also target communication between infrastructures and vehicles (all types of vehicle: cars, buses, bicycles, and trucks) using Internet of Things technologies (Wasielewska-Marszałkowska, 2016). Clearly, smart cities will implement smart mobility patterns (Ishida, Isbister, 2000), or Intelligent Transportation Systems (Nelson, 2009). Besides, by enlarging the implementation of smart grids, smart cities will also regulate energy flows and foster low-carbon electro-mobility.

The arrival of autonomous vehicles challenges traditional car industry business models. Indeed, with autonomous vehicles, the use comes first. Therefore, segmentation by owner has to be changed into segmentation by use. Thus, the widening range of uses involves thinking about the revenue model. Traditional models, based on user payments for each use, may be questioned: financial support implemented by public policy may be extended from partial to full support, meaning free collective transportation either for a targeted type of user or use, or for anyone for any use. Within this framework, private and public funding may be extended to cover not only infrastructure investment but to support operational costs.

The implementation of Navya's shuttle in Lyon, France, is a good example of a public/private partnership pushed by technology and driven by demand, as described below; moreover it is based on a new revenue model. The shuttle conceived by NAVYA is an innovative, effective, clean and intelligent mobility solution that guarantees autonomous transport performance as well as a comfortable journey for the first and last mile, thanks to its smooth navigation. Capable of transporting up to 15 people, NAVYA'S shuttles are implemented in 14 countries in the world and make it possible both for operators to improve productivity on private sites, and for public authorities to ease road congestion in urban centers. Moreover, journeys are totally free for passengers. This free access is possible because the cost is fully supported by public funding, with several cities having accepted to support the experimentation of free autonomous collective transportation, mainly Lyon, France and Sion, Switzerland. Other private sites that welcome the autonomous shuttle benefit indirectly from public funding, like in France for

example at the EDF campus in Civaux, Charles de Gaulle airport, and the La Defense neighborhood in Paris. It should also be noted that the success of Navya is linked to people's positive perception of autonomous vehicles (Rapport Européen DEKRA Automotiv,2016)

According to NAVYA's CEO, Christophe Sapet, the company's mission is clear*:* "*By developing new electric solutions for collective autonomous transportation, we are revolutionizing urban mobility day after day. Working hand in hand with local governments, we create new business models within the TaaS framework*".

The first experiments in the Confluence district of Lyon were a success and an encouragement to deploy the shuttles in others cities. However, this business model based on collective free transportation is still questionable since free access is only possible thanks to public funding. Policymakers justify municipal funding of this type of transportation by arguing that free shuttles foster inclusion by linking all areas of the city, and decrease inhabitants' impression of exclusion by reducing risks of gentrification.

Should the emergence of this new kind of business model also concern individual transportation? In fact it probably will. A study conducted in 2014 by KPMG[7] in partnership with the Center for Automotive Research shows that the business model needs to be reinvented for carmakers: an individual autonomous car may, for example, be paid for per kilometer instead of being purchased as an asset for a given price. Moreover, individual cars for personal use may disappear to be replaced by collective use: door-to-door transportation paid for by the user for a specific usage and excluding parking, maintenance and insurance issues.

5. Conclusion

With the development of autonomous vehicles, the automotive industry is likely to transform into a *robomobile industry.* This so-called "big-bang" in the mobility world sparks passionate debates on the place of the autonomous vehicle. The global race involving numerous companies and car manufacturers as well as energetics specialists and IT companies, is also opening new opportunities for investors. The stakes are considerable for cities willing to open their roads to autonomous vehicles. Their governing authorities will have to totally rethink an urban space model and the place of sociability. Moreover, robomobility could also leverage the economic expansion of cities thanks to the optimization of flows.

The automobile industry itself is being transformed by the integration of newcomers, large companies and startups, the combination of different technologies, and pressure from both social demand and policymakers. Uncertainty remains high and the future of robomobility is still prospective since many questions remain unanswered, mainly how to estimate value creation at a global scale and how to ensure the best match of future supply and demand for mobility.

Last but not least, ethical issues have still not been fully addressed by governments. The new mobility is anchored in big data systems that save and manipulate personal data that can be intimate, such as regarding values, lifestyle, preferences, schedules, etc. All of these data will be captured, processed and likely sold to serve private or public interests. Does this pose a danger for democracies?

[7] KPMG, 2014. Self-driving cars : The next revolution

One possibility is that everyone could take control of their personal data, enhance them with data valuation tools, and selling them, as proposed by the French think tank *Generation Libre* and its founder G. Keonig[8]. This proposition involves three aspects: firstly, the regulation aspect concerning a government's control over all data; secondly, individuals would be allowed to sell their own data to the highest bidder; lastly, a kind of block chain could emerge linking users in a community sharing all data for the best.

To conclude, and to respond to the topic of this congress, over the last 10 years, the automotive industry has become tremendously more complex. Although major companies and governments are urgently making efforts not to stay on the sidelines, we still cannot forecast which players will take the leadership in the ecosystem of mobility currently taking shape.

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