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Chapter 4: The role of automotive financial services in enabling consumer-centric mobility solutions

4.1. Introduction

Currently, new technology and innovation are enabling new mobility solutions that change how consumers live their lives and move around (Business Wire 2024; Cloud4C 2024; Fullpath 2024). In the past, cars were otherwise owned assets, whereas their use was the focus in if cars are shared. All would then have been dwarf engagements by commercial fleet owners; private ownership would be a lease of a car for all house conditions. As Mobility as a Service [MaaS] looks to such solutions along other transportation modes, Automotive Financial Services [AFS] can support new business models by making the consumer-centric solution viable. New and promising innovation is always met with skepticism and many questions regarding feasibility and efficacy. Thus, a soft sceptical attitude is held toward automated vehicles and what they will achieve. A guess is, unless remarkable incidents quickly occur, not much will change within the next decade, in particular for privately owned vehicles for long-range travel. A high-level examination of the consumer centric mobility solution for AFS is given, not the specific technologies.

As multiple highly complex technological solutions are expected to converge closely together, new business models can be expected to evolve further to serve the immediate needs of the changing consumer. The problems with the growing social costs and environmental impact of the private vehicle paradigm look to need a more holistic approach for their solutions. This is particularly given the automotive industry's need to make major investment flows toward a less internally combusted future, when less will be owned and time and mileage will be more rent. Still, this should not be the end of the road for such legacy firms creating new services such as shared pooling and ride hailing.

Governments and local authorities will need new collaborative initiatives for data exchanges to enable optimal commercial and social solutions. A call for more qualitative changes in the research community to be able to match to the approaching need and thereby have high relevance is given. Those changes are suggested for a more fundamental and broad design of future research on mobility solutions.

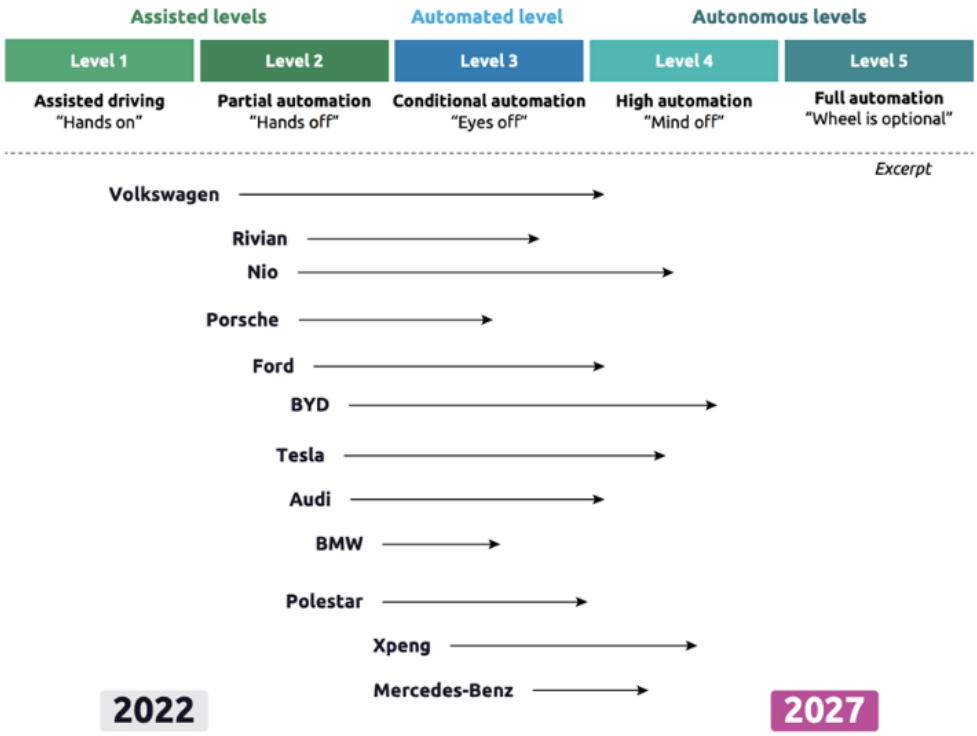

Fig 4.1: Customer-centric mobility

With rising social costs of the private vehicle paradigm and technological development of new solutions, cars have changed from otherwise owned assets to being shared along the methods of alternative chauffeured services. AFS could support these new business models by making consumers acquire a need and use service and thereby service AFS sales while increasing the lifetime and revenue for original manufacturers through lower abandonment. The changing mobility landscape from car ownership to need to complement existing ownership models looks to the option for the development of ongoing services and rental contracts. This requires consideration of the lack of consumer understanding of the pricing of cars and cost structures, data transparency, or holistic and seamless experiences. Governments and cities should consider the future of the vehicle to manage a more endeavor shared transportation system related to a digital connection to devices and a cloud-driven architecture for most mobile services from e-commerce to apps allowing peer-to-peer cooperation.

4.1.1. Research design

The main objective of this research is to analyze how automotive financial services can help automotive manufacturers leverage new mobility trends that focus on consumer-centricity. Taking into account the general trend of changes in the automotive landscape and the increasing relevance of new consumer-centric mobility solutions, the following research question is compiled: How can automotive financial services aid automotive manufacturers in providing consumer-centric mobility solutions? This research question offers a holistic analysis of consumer-centric mobility solutions as an overarching mobility trend, as well as a focused analysis of automotive financial services and their role in enabling these consumer-centric options.

A two-phase mixed methods approach is applied accordingly in order to address the research question. The first phase consists of exploratory qualitative research, which aims to provide an understanding of the overall mobility landscape and consumer-centric mobility solutions. Industry experts from the automotive and mobility services industries are recruited and involved in a semi-structured process asking multi-level questions about changes in consumer preferences and needs regarding mobility solutions and expectations regarding automotive manufacturers' response capabilities. The resulting insights are processed and synthesized until an overall model of consumer-centric mobility solutions is constructed, which describes key consumer-centric mobility solutions and differentiating capabilities recommended for automotive manufacturers. Additionally, this exploratory phase allows for insights to be gathered regarding how these manufacturers can respond to the aforementioned consumer-centricity trends, which are subsequently used to design the second phase of quantitative research.

This second phase consists of quantitative research designed to empirically assess the overall model and capabilities identified in the exploratory phase through a survey addressed at businesses and decision makers. This step allows us to describe capabilities needed for automotive financial services for enabling consumer-centric mobility solutions and to provide empirical substantiation for insights gained in the exploratory phase of the research. Finally, insights are provided for automotive financial service business and product development, along with contributions to the academic literature on mobility management.

4.2. Overview of Automotive Financial Services

The car and mobility market in the United States is undergoing a digital transformation. Easy access to information, combined with new digital services aligned with acquiring and using mobility services, are changing how a car is purchased and used. Consumers became accustomed to the convenience that so-called digital natives provide in

industries outside of automotive, and they are now demanding and expecting the same convenience from car and mobility services. Therefore, new mobility services are emerging, ranging from ride-hailing to subscriptions, but especially car-sharing, peer-to-peer car rentals, and ride-sharing/ride-pooling. Integrating mobility-as-a-service functions or services will also become crucial for traditional, more digitized manufacturers to fully capture the consumer, customer, or user wallet. And they have to build appropriate digital backends for this offer portfolio in the follow-on phase of the switch towards the comprehensive digitalization. Only those media providers that get it right will be able to help traditional competitors cope with the transition to the new digital world of mobility. Highly precise behavioral data and new interface formats are emerging for manufacturers to tap into consumers' needs more properly in the future. Failing to integrate these next-generation approaches and opportunities will seriously limit and restrict the disruptive transformation of the car and mobility business into a true digital world. For traditional automotive manufacturers in the United States, such as Ford, Chrysler, or General Motors, the established transactional supply chain and sales process in combination with the existing media formats and the absence of comprehensive consumer data would have limited chances to establish the early consumer, usage-centric connected service monetization playground and consumer experiences. However, the smart acquisition of the current mobility service players might overcome some of these constraints and bundle competencies with an existing car and mobility infrastructure. So far, however, no such expansions across both fields have been undertaken by leading manufacturers, despite the heavy combined involvement of car and mobility start-up companies in the U.S.'s large funding rounds.

4.2.1. Definition and Scope

In this work, the topic of automotive financial services is defined as services facilitating consumer purchase, leasing, and usage of vehicles in return for a pre-agreed payment to the vehicle seller. This definition encompasses automotive banks, auto finance subsidiaries of automobile manufacturers, captive finance companies set up by financers for automobile manufacturers, and automotive finance services offered by banks not specifically set for the automobile industry. The primary role of automotive financial services is to provide credit, defined as a loan where a product consumed can be pledged against the loan (vehicle purchase and lease financing). Other important services enabled by consumer financing include warranty extension, vehicle insurance, repair/maintenance services, and auto financing non-performing loan recovery (vehicle repossession). These services provide consumer assurances, reduce vehicle ownership barriers, and richer vehicle usage options respectively. The provision of these services has enabled a much larger consumption of vehicles by consumers via easier credit accessibility, provision of better financing options, consumer more assurances against

usage risks, and increased vehicle usage options. The scope of focus of this thesis is on the establishment of a consumer-centric digital platform in an automotive financial services context, rather than the establishment of automotive financial services in general. The consumer-centric digital platform is designed to showcase automotive vehicles to provide consumers, automotive dealers, and automotive financial service providers with vehicle selection/usage options in a consumer-friendly manner and common understanding. The scope of focus of the digital platform construction is concrete and actionable in that it only covers automotive financial services (not the automobile product or automobile dealer operations), as there are no in-depth academic studies on automotive financial services digitalization and with the expected inputs not being available to the author. The digital platform is designed through proper research of consumer feasible financing products coupled with paralleled propositions/financing options for proper vehicle selections. The validity of the designed digital platform and its constituent parts is assessed through a user experiment-based protocol and usability based performance requirement with up to mid-level automaker executions available to consumers. The contributions of this thesis work are in three streams: (i) automotive financial services product alternatives/forms, processes, and features/criteria for proper adoption/execution are defined over a high-level shared data—component design; (ii) employing vehicle/consumer data and consumer understanding in digitalization, solutions to designing public automotive financial services digital platforms are published, enabling consumer inquiries, selections, and usage options; and (iii) the first development test of using prototype automotive financial services to reform vehicle selection choices with much larger option availability upon execution is done with an explanation of consumer-centric digital usability.

4.2.2. Historical Context

Technological changes and societal trends have an impact on contemporary mobility services (CMS) (Gartner, 2024; MIT 2024). Innovation in telecommunications is pointed out as a requirement for CMS, on the basis that technological inventions such as broadband internet access, portable devices, web 2.0 applications, global positioning system (GPS) based technologies, etc. are the driving forces of the mobility service sector. Modes of transport comprising public transport vehicles as well as micro mobility options and personal vehicles are expected to become increasingly data-based services. Such developments are projected to render mobility as a service (MaaS) solutions viable and enable the use of vehicles independently from ownership and mobility on demand, e.g. through the provision of a private vehicle on request. Technological innovation is perceived as a means toward individual freedom and a better quality of life. Societal trends like rapid urbanization and associated challenges, (e.g. traffic congestion) and the increasing threat to the global environment are mentioned as drivers of a development

path toward more integrated and multimodal transport systems. The involvement of public authorities in achieving such systems is expected based on the belief that existing infrastructure and services alone are no longer adequate for achieving sustainable urban transport systems. Under this presumption, co-creation with a multitude of actors is pointed out as a new process by which the quality and efficiency of multiservice solutions is to be improved, resulting in a move toward integrated systems and advanced transport services. Preconditioned methods for public authorities to adopt the role of orchestrators in this new management paradigm are also outlined.

4.3. Consumer-Centric Mobility Solutions

Considering the competitive landscape for mobility services and solutions in urban environments, automotive manufacturers are required to seize growth opportunities where they exist and act quickly in order to avoid missing out on the revenues and profits that can be attached to them. Similar to how automotive manufacturers had to rethink their strategies and recognition of new threats and opportunities during the rise of electric- and driverless vehicles, they need to be aware of and seize the growth opportunities that are arising from the emergence of a new paradigm of consumer mobility. In this context, automotive manufacturers should utilize their automotive planning capabilities to assess which specific new mobility services and solutions they have a higher chance of succeeding with given their current portfolio of resources and capabilities and where they should invest further in so that they can be competitive at the macro-economic level when offering consumer mobility services and solutions. Automotive manufacturers should be cognizant of the fact that to be able to take the best opportunities they should seek to create new partnerships/alliances/joint-venturing arrangements with the key players and actors that have the assets and/or capabilities that complement their own in the consumer-centric mobility context. Lastly, automotive manufacturers should seriously assess whether their corporate culture and innovation climate need to evolve and become more like that of a mobility services and solutions company. It is paramount for OEMs to adapt before it is too late.

A consumer-centric mobility approach implies that the brand should be built around the need to deliver an engaging experience, which includes tangible and intangible elements, and that the service proposition should cater to that experience. Nevertheless, looking from a mid- to long-term perspective, the goal is for mobility service clients to become passengers, thus being engaged within the car brand ecosystem fully. In figuring out how best to engage and convert the consumer, automotive OEMs should consider that carsharing and ride-sharing solutions are commoditized from a consumer standpoint, and thus brands cannot differentiate themselves from incumbents by merely offering the same services under a different name. Services that enhance the experience as well as

provide additional value to consumers should be actively searched for, considered and developed. To achieve this it is paramount for car-sharing OEMs to gather information and intelligence on consumers willingness to engage on a wider variety of services beyond shared mobility as this could serve as a first step to the brands stakeholders' engagement with consumers.

Fig 4.2: Consumer-Centric Mobility Solutions

4.3.1. Definition and Importance

Within the automotive industry, companies are increasingly shifting from offering products—primarily cars—to providing solutions, services, and experiences to meet 'mobility' needs. Mobility is the capability of consumers to quickly and easily access transportation services with no need for ownership or long-term commitment. To operate in the evolving marketplace, manufacturers and suppliers must ensure the development of consumer-centric solutions, services, and experiences while maintaining acceptable profitability margins. As this business transformation unfolds, automotive financial services, which provide holistic financing and insurance solutions and services for all mobility offerings, will play an important role. While automotive financial services have thus far only enabled the financing of owned cars and the functionality of leasing and fleet management, they comprise the important enabling layer that ensures the operability and sustainability of the broader transformation of the automotive industry. The automotive financial services marketplace offers great potential for differentiation and growth and is not without challenges. Players must thus formulate strategies to target this multi-dimensional sandbox effectively.

Over the past decades, the automotive industry has undergone profound changes. Emerging software-driven digital automotive technologies are influencing the viability of consumer-centric mobility services by altering product values, performance, and consumption patterns, paving the way for opportunities and threats alike. To adapt to these changes, automotive manufacturers are going beyond conventional non-digital products and establishing omnichannel multi-brand business models, generating software-driven mobility solutions, services, and experiences across several automotive use cases. This transformation, however, is far from straightforward. The complexities of broad-spectrum digital transformation and the need to ensure a seamless interplay of products, services, operations, and relationships across the business ecosystem render the task challenging. In response, automotive financial services will have a key enabling role in ensuring the operability and sustainability of mobility solutions, services, and experiences.

4.3.2. Trends in Mobility Solutions

Mobility has been undergoing significant transformation in recent years. Factors such as digitalization and sustainability have prompted car manufacturers, mobility providers, and suppliers to come up with new and innovative solutions in order to remain competitive. Today, new players such as Uber and Lyft are expanding options for mobility and challenging car ownership, as are public transport providers as they continue to expand their serviced areas. On the one hand, consumers are now more than ever presented with multiple solutions to satisfy their mobility needs. On the other hand, there are greater expectations for service levels and a consumer experience comparable to what they experience in other industries. Since mobility is becoming a service rather than ownership, service and particularly payment for that service become more complex. New service solutions and payment methods are emerging that come with significant implications for service providers.

Carmakers, mobility providers, banks, and other players need to keep a constant pulse on how consumers expect to consume mobility over the medium and long term. The ability to track these needs and expectations and act on them will be key dimensions for success. In this section, the trends of consumer-centric mobility solutions are explored. These trends arise from how consumers, as individuals or organizations, expect to consume mobility in the future, given the constant evolution of their own needs and expectations and the shifting landscape in technology and innovation. A wide variety of trends have been identified based on a broader trend identification process. From this broader list, the eight trends most relevant to consumer-centric mobility solutions have been selected.

4.4. The Intersection of Financial Services and Mobility

The automotive industry is increasingly converging with the financial services sector. This convergence is a natural fit given the reliance of new mobility models on complex financing and servicing solutions. By 2030, OEMs are expected to generate about USD 1 trillion in revenues from mobility services and their related financing and subscription products. Automotive manufacturers are, therefore, investing heavily in the development of financial capabilities. Most have set up financial services organizations with global remits, handling a variety of complex pricing products and revenue streams, as well as active and complex risk and pricing management functions, which all integrate with other OEM central functions, like information technology. This has enabled bigger-ticket asset acquisitions for fleet operators and taxi companies, and the creation of additional channels for payment that circumvent other digital platforms, to name just a few examples.

Other major financial institutions also see mobility services as significant revenue opportunities. With less experience in the complexities of automotive mobility finance, they are hoping to adopt "plug & play" industrial solutions from automotive OEMs. While architectural integration should be relatively straightforward on a MIS, app and data analytic levels, there are challenges for FIs in integrating with recent acquisitions and existing software and data architectures at a significantly larger scale. Merger and acquisition activities are expected to further complicate this new service convergence model, since diversifying at this scale has proven problematic in the past.

Next-generation FIs and data analytics firms already have strong market positions in terms of data availability and analytic capabilities. Even though some have tried to diversify into offering narrowly defined automotive financial services, they remain some distance from full service convergence and truly dynamic risk and asset management. Data analytics ODMs recognize that many automotive pricing and risk management functions require deeper domain- and context-specific knowledge than what non-automotive data analytics firms can readily acquire or obtain. Unlike other transportation sectors, automotive manufacturers have the advantage of being able to facilitate both automotive mobility service operations and related simpler pricing and servicing integration options. Given these trends, incumbents both in the automotive industry and financial services sector can be expected to double down on positioning themselves as the facilitators of next-generation finance and risk pricing systems.

4.4.1. Key Financial Products and Services

Besides automakers' major role in creating consumer-centric mobility solutions based on carsharing, they will also have to focus on ancillary services. Carsharing players have

been using value-added services for some years and have often moved ahead of OEMs in this domain. This gives carsharing players an advantage when it comes to addressing possible new mobility solutions based on carsharing. As a response, automotive financial service providers could consider developing and implementing similar services in conjunction with mainstream mobility solutions and partners in collaboration with others in the freedom market, i.e., carmakers, services providers, and dealers. With the introduction of prominent new mobility solutions, some issues in relation to carsharing or mobility-as-a-service could already be tackled to some degree.

Many of them showed awareness of the competitive threat posed by mobility services or the possible decline in car purchases and ownership levels. New players' entry into the market for car-purchase and mobility revenues was seen as dangerous. In many cases, the challenges for OEMs were presented in terms of "existential threats" or "the Japanese show made cars disappear". This indicates high involvement and concern, driving the issue onto the agenda. However, the issue seemed to be framed in terms of negative consequences of new mobility services for the automotive industry. Aside from considering alternatives, possible positive synergies were also emphasized differently.

To overcome competitors' reluctance to own a complete mobility solution with flexibility and without using the complete fleet; carmakers could consider forming alliances. Possible partners could be OEMs with non-competing automotive brands, regulators for tax incentives, and public transport operators. Bundled offerings could solve issues with frustrating coordination, different payment schemes, and complicated contracts. In addition, traffic congestion reduction in busy cities could be compensated for joining the mobility ecosystem. This is in line with alliances between OEMs and carsharing player's collaboration, which could benefit automotive financial service providers at an early stage for entry into the new mobility market.

4.4.2. Case Studies of Successful Integration

Car2Go is a subsidiary of the car manufacturer Daimler AG focusing on B2C city carsharing. The business model consists of operating a fleet of Smart vehicles that are both owned and insured by Car2Go. Users download the Car2Go app to locate, reserve and rent a vehicle from the fleet of vehicles. A GPS located in each vehicle governs the free-floating parking stations, assuring that no special parking infrastructure is needed. The customer pays a price per minute, with additional fees for extra miles driven. Car2Go operation started in 2009 in Ulm, Germany, and rapid expansion into other cities has kept occurring since. In June 2014, Car2Go announced the choice of new locations and the overall intention to add around 15 cities in existing as well as new markets for the following two years. In June 2014 Car2Go entered into Vancouver and opened the first fleet with EVs. Two months later a new market in Sydney, Australia opened with

similar operations as in Europe . E-Car Club is an East Anglian start-up focused on B2C electric carsharing. The foundation of the business model consists of operating a fleet of Nissan Leaf EVs, which are both owned and insured by E-Car Club. Users, private individuals or small businesses, register with E-Car Club and then reserve a car. Production of the fleet started in September 2013, and in March 2014 the first two cars were introduced into the fleet. Prior to this B2C was considered an involvement that was only offered by large companies globally. The launch cities are London and urbanised towns in the South East of England and East Anglia. Solutions for toll payment/collection and vehicle entry restrictions in urban areas: road pricing, low-emission zones, and other market restrictions are becoming more common in industrialised areas because they are more in line with policy goals for sustainable traffic. These solutions have a fluctuating and market-based fee mechanism, often with the use of flexible-governed vehicles or time/section restrictions.

4.5. Impact of Financial Services on Consumer Behavior

Automotive mobility services and financial lending services are beginning to develop in parallel, and consumer financial services have an important impact on consumer behavior and vehicle purchase behaviors. Therefore, it is crucial to focus on exploring the impact of financial services provided by automobile manufacturers on consumer attitudes and behaviors. The semi-structured interview scheme integrates three parts: basic information, payment methods of the selected vehicle, and the influence of the payment methods. To further understand consumers' attitudes towards OEMs' financial services and vehicle-related financial products, consumers who have interest and experience in vehicle purchases were selected. The financial services focused on in this research include finance lease, operating lease, and self-owned vehicle installment. Financial products include financial insurance, guaranteed repurchase, vehicle warranty, extended warranty, and various types of vehicle-related insurance. It is found that consumers prefer OEMs' financial services more than their financial products, and they often use self-owned vehicle installments and vehicle related insurances. It is also found that consumers' attitude towards OEMs' financial services and behavior towards financial services do not directly affect their attitudes towards financial products provided by OEMs.

In detail, financial services provided by automobile manufacturers can help reduce the purchase cost. Operating lease and self-owned vehicle installment plan can reduce capital outlay, while financial insurance can prevent the loss caused by vehicle accident, missing, or theft. With the international taxation policies changing, taxation costs become a major concern for consumers and vehicle purchasing parties. Personal tax can be deducted by offsetting the leasing cost or vehicle related expense, while corporate tax

can be deducted by offsetting depreciation and interest expenses. Guaranteed repurchase and financial insurance can also help in this regard because they include vehicle valuation. It indicates that the current product supply of financial products in Chinese automobile manufacturers is not sufficient in terms of taxation. Since consumers have already owned one or more vehicles, they tend to purchase products that can offer more use value besides reducing purchase costs. They prefer vehicle valuation precisely because they are not familiar with the professional evaluating process and relevant agency but need this valuation to lower the sale price and pay less purchase tax on the second vehicle purchase.

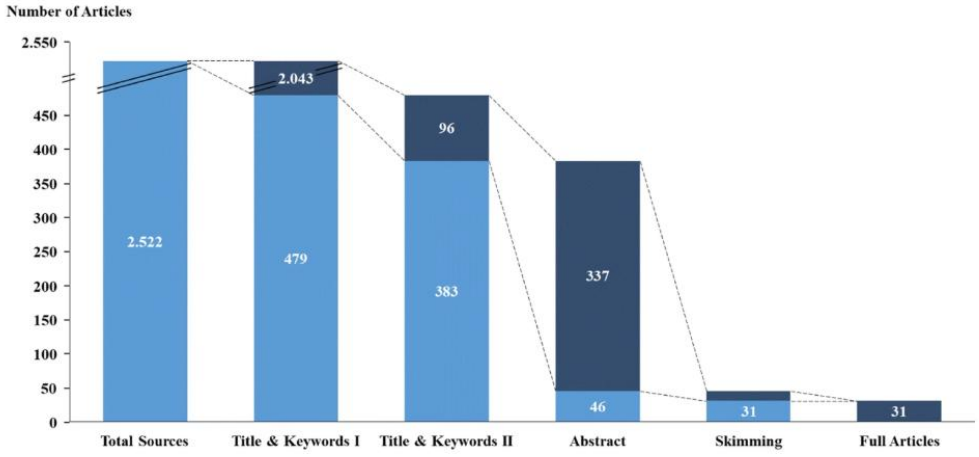

Fig : Customer-centric business models in the automotive industry

4.5.1. Consumer Preferences and Choices

Automotive manufacturers face an evolutionary road ahead with connected, autonomous, shared, and electrical developments bringing radical changes to their business models after more than 100 years of individual mobility revolving around private car ownership, vehicle sales, and repair revenue. The emergence of C.A.S.E. has created the potential for new players extracting lucrative profits from traditional automotive manufacturers. Mobility is evolving towards services around the car with complex ecosystems. Affordability is becoming key for young people unable or not willing to own high-cost items. Used-car ownership overprivileged in terms of value proposition does not meet the thirst for innovative mobility service. Young adults are the target customers. One-third of consumers access a shared mobility service. Mobility service players are initiating partnerships with private marketers and municipalities. The link between mobility services and car design has been eliminated. It is unsustainable for automakers to enter this market alone.

Emotional product attachment between the consumer and the automobile is still a strong imperative. With years of experience in branding and marketing, automotive companies have the power amplified by controlled data from automotive-based media streams to convert shared mobility consumers into prospective car buyers, as well as layout the future of consumer car commerce. Insights into why and how automotive manufacturers can leverage on sectors of C.A.S.E. Contributing with mobility service offers targeting young adults in this very competitive territory and thereby attending policy in regard to preserving cities and environments are essential. A consumer journey and considerations serve as a reference framework for key criteria for selecting an offer and design choice. Integrated offerings including real-time matching service, affordably structured fare, and strong environmental concern are favored. To be useful and actionable, the mobility service offer must be first sensed and tried by the consumer. To be competitive, the mobility service offer must cope with and match high continuity, convenience, and affordably structured fare criteria.

4.5.2. Accessibility and Affordability

Car ownership is decreasing in cities worldwide. Urban areas now account for 60% of the world's gross domestic product (GDP), and urbanization is projected to increase over 25% by 2050. Mobility demands change dramatically in highly populated urban regions where there is less space for vehicles but more demand for them. Hence, governments are devising policies to promote consumer-centric, affordable, and efficient mobility systems that avoid private vehicles use. To comply with regulations and societal expectations, car manufacturers are seeking a shift from the 20th to the 21st-century model, where consumers have the absolute power to choose how they want to travel. Car manufacturers are going back to a B2C market, serving not only as car producers but as mobility enhancers with vehicle ownership being optional.

Car manufacturers may leverage the trend of carsharing among millennials by taking some approaches. Firstly, they should focus on increasing awareness and making carsharing known as an alternative mobility offering among millennials. The establishment of partnerships with carsharing entities is an effective way of increasing awareness. In the 21st century, cars and brand manufacturers are not meaningful to younger generations. Carsharing represents the perfect mobility alternative that fits the life phases of today's young adult population. On the one hand, it provides a wide choice of cars tailored to individual needs, while on the other, it offers independence from rising costs by not requiring a financial commitment. Using the car is still part of desirable leisure activities, image aspects, or aged-based car needs anyway, but ownership and financial burden are no longer required to fulfil them.

Hence, the role of manufacturers must be in the area of mobility solution providers in a circuit where vehicular logistics are decoupled from vehicle ownership. Nevertheless, this new strategy should be executed without forgetting that changing mind-sets takes time, and this transition cannot happen suddenly.

4.6. Technological Innovations in Automotive Financial Services

In the last few years, the rapid evolution of innovative technologies has impacted entire national economies as well as all slices of daily life, including the way people interact with their cars and, in general, with the entire transportation ecosystem. The automotive industry is undergoing the most significant transformations in its history as foundational technologies such as electrification, connected cars, autonomous driving, and shared mobility are changing the industry landscape. While these new technologies shift the way people think about, utilize, and interact with their automobiles, it ultimately results in the emergence of new mobility ecosystems, in which cars will become part of interconnected fleets that operate with shared modes of ownership and use. By the same token, consumer automotive financial services, which traditionally facilitated the vehicle purchase and ownership experience, will undergo a radical transformation as they evolve towards a new consumer-centric paradigm that fosters an evolutionary adoption of mobility solutions. A first group of challenges related to consumer adoption phenomena emerged by literature review, followed by a second group of challenges derived from specific features of mobility solutions. This provides guidelines for industry stakeholders intending to design a more consumer-centric approach to automotive financial services in the age of mobility.

Consumer-centricity is more frequently seen as a desirable attribute of strategy and marketing processes. But, what do scholars and practitioners mean, exactly, when referring to consumer-centricity? A survey of these definitions reveals three core themes, namely, focusing resources on the consumer, consumer immersion, and consumer involvement. The focus of resources on the consumer appeals to the importance of understanding consumer needs and wants and then using that understanding to shape what an organization does, including strategy and marketing, in a manner which is congruent. In other words, consumer understanding should be the foundation of actions. Although possible on paper, adequately implementing this theme seems increasingly difficult in practice, especially given the challenges posed by the vastly increasing diversity of data sources, methodologies, and sources of error, biases, and deception.

4.6.1. Digital Platforms and Fintech Solutions

To build a platform or a new FinTech solution in this scenario, the FS should be capable of providing the following capabilities. These capabilities may include: a payment gateway and wallet (Fiat or crypto), vehicle registration linking and reputational model, providing a 3D map view, safety score and parameter prediction model, googlization and activities on chain confirmation, to view locations on 3D maps, etc., POI services, consumption-oriented recommendation and car service rating, subscription and share services, new vehicle sharing initiatives and feedback from users, through the activity log of each user, etc. To reach an agreement between cities, consumers, and car manufacturers, on a price model, sharing and capabilities feedback between service providers should be done through governance.

On top of this framework, cities, OEMs or FinTechs should be incentivized to enhance the public benefit of shared autonomous vehicle expansion. This includes on-chain data labeling, feedback collection from the data, cross-state data season for rare events, sharing of technology, algorithms, reports and routines. Government subsidies should support early plans and keep monitoring the model fabric. To enforce the agreement between clients, cities and OEMs, a punishment system on each side should be considered. For instance, if an OEM violates reputation, it cannot continue to public benefit profiting or accessing valuable information. If a city denies vehicles or vehicle modification, it should pay for big data.

Insurance is commonly considered a bottleneck for self-driving scenarios. Unlike visible metric models, autonomous vehicles observe inputs and parameters rather than intent. This raises a dilemma on compensation amount disputes. To provide a reachable insurance framework, those issues related to vehicles which apportion the responsibility proportion from the incoming 3D point cloud and semantic information should be taken into account. While reputation scoring and input labeling contribute to trustable data, an execution mechanism is required for high value in profit.

4.6.2. Blockchain and Smart Contracts

Blockchain technology, supported by a decentralized distributed ledger, provides a permanent, cryptographically secure record of transactions that have occurred over time across a peer-to-peer network. As a decentralized structure, the single entities do not own the data, and all the network participants share control over the data. Permissioned networks can be deployed to enable participant access control by means of her identification, which will also be stored on the ledger. Network participants belong to a close club whose identity and integrity need to be controlled. Conversely, permissionless networks do not require any kind of CAPTCHA, lotteries for network participation, mining, or other mechanisms to regulate their access. The basic tenets of all blockchain

systems are neutrality, pooled trust, and privacy, while on the other hand, the technical threats and associated failures need to be prevented to ensure reliability and security.

Blockchain technologies allow information to be stored in a public ledger accessible from any peer at all times. Blockchain technology is expected to have significant economic and operational impact on both private and public-sector organizations, while also creating opportunities for the establishment of entirely new markets and products. Blockchain technologies are expected to create an entirely different market scenario: transferability of the entitlement to use digital information, including physical objects such as cars. The solution would use off-the-shelf IoT components to leverage all precompetitive developments in connected vehicles and cloud services. The dynamic peer-to-peer architecture would interconnect, through secure cloud services, IoT-connected vehicles, autonomous vehicles, connected cars, car-sharing, ride-sharing or ride-hailing providers, and end-users via open platforms. Using this architecture, a blockchain-based platform would record, store, and execute agreements and monetary transactions to allow vehicle owners to monetize trips permitted by vehicles in an on-the-fly auction.

The invention also opens the door to dynamic ridesharing solutions in the context of smart cities. Marketplace, clearer contracts, and micro incentives will enhance the mobility industry's scalability in the existing ecosystem's current limitations. Ethereum has an advantage due to the growing literature on the subject, and smart contracts can foster the above-mentioned applications on EVM-compatible blockchains with a sufficient market share. In general, the use of a permissioned solution is preferred. Such protocols allow the implementation of confidential transactions. Only participants in a relevant agreement can access transaction data. With clever invitation policies, the registry of transactions could not be accessed by regulatory authorities.

4.7. Conclusion

The automotive industry is in the early process of a digital transformation as it begins moving its traditional sales-based business model to a service-oriented one. Enabling consumer-centric mobility solutions requires much deeper knowledge and understanding of the consumer that is not currently possessed by the OEMs. This change in business model enables OEMs to collect valuable and actionable digital data about mobility that can allow them to gain a more profound consumer insight that consequently enables innovative solutions relevant to the consumer. Automotive Financial Services should be at the forefront of this tenfold change within the automotive industry. However, they are mainly operational and heavily regulated in most markets. Thus, there is a risk that an opportunity regarding digital data about mobility is being missed, and hence, a significant competitive advantage is lost.

Financial services are essential in enabling consumer-centric and sustainable mobility solutions. Mobility Providers that only provide mobility need to collaborate with the traditional automotive manufacturers regarding ownership. OEMs should disclose relevant digital data. These financial services could be vital in gaining access and possess exclusive digital data on the current and potential consumer mobility behavior that can serve as a foundation for a more profound consumer insight. Much of this data cannot be or has not been Big Data-enriched to extract deeper insights to enable analytics, predictive and prescriptive modelling of behavior. These consumer insights can open new revenue sources by supplying them to stakeholders with use cases such as Early Warning System for OEMs, predictive maintenance for Mobility Providers, and potentially targeted marketing for Insurers. Furthermore, Payment services are necessary to minimize principal-agent problems between different Mobility Providers. Thereby reducing the risk of a fragmented Mobility Ecosystem where no single Mobility Provider can be the sole one-stop provider.

4.7.1. Future Trends

Since the financial crisis, with a few exceptions, the state of the automobile loan is generally positive. New car sales in Europe rose by almost 10% in 2016 compared to 2015, and in the United States, 2016 marked the seventh straight year of sales growth. Amid a favorable economic outlook, media attention has shifted to an anticipated increase in auto loan delinquencies, spurred by lower average subprime credit scores and higher average loan amounts. While there is some validity to this half-glass-empty view and a significant uptick in late payments is expected, it does not reflect growth post-crisis.

The political fallout surrounding the automotive industry in recent years means that the leading U.S. automakers' return to relative health after a long, recession-induced slump has not received the same attention as finance, housing, or other industries. The positive turn for auto loans underscores consumer's growing creditworthiness, acceptance of cars as a primary land transport means, and the automobile market's perceived safety by investors. The recent historical performance of the auto loan asset class is good news in a modern credit market that has seen a decline in outstanding auto asset-backed securities in favor of slower-growing securitized-asset classes.

It should be comforting that no subprime mortgage-like overdue rates were witnessed before the uncertainty. That loans are now being challenged as the market becomes saturated can be expected. Domestically, auto loan migration risk is concentrated in less-than-prime loans, the class with the fewest observations in each demographic, and slow growth is anticipated rather than absolute deterioration in portfolio performance. With

incentives from Fed policy, this lack of deterioration is expected for AAA-rated auto classes.

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