Cars on Demand: How Does Car Sharing System Work?

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Abstract: *On-demand car sharing services become increasingly prevalent in recent years. To understand how a car sharing system is intended to work, this paper investigates the business model of DiDi, the world's largest mobile-based transportation platform, from four dimensions in a perspective of practical operations: service pattern, operating mechanism, pricing model, and safety strategy. Four key elements that bring DiDi into growth and mark car sharing services in the context of sharing economy are identified by going through an insight into the nature of DiDi business model. This study will help DiDi-like collaborative ventures contrast and check their business models to form their own unique leading edge.*

Keywords: *Car sharing, collaborative consumption, sharing economy, business model, on demand*

I. INTRODUCTION

Collaborative consumption as an important socio-economic model in the context of sharing economy has been experiencing a rapid growth across the world. One of well-known examples of successful startups built on collaborative consumption conceit is car sharing service. Car sharing is a membership-based service that offers users short-term vehicle access from private car owners or professional car rental companies. Car sharing services represent a sustainable transport strategy through reducing private vehicle ownership in cities [1,2], CO_2 emissions[1,2,3,4], and energy consumption[2]. Car sharing also improves access to services such as employment, training and key services for people in areas of geographic isolation [3]. More and more professional car sharing networks like Uber, Zipcar, Turo, Buzzcar, Getaground, and GoCarShare are spreading over the world. Many traditional car manufacturers have also started to develop and commercialize their own car sharing systems, such as Car2go by Daimler, DriveNow by BMW, and Mu by Peugeot. These business practices illustrate how companies can establish or expand their business models to adapt to the innovative collaborative consumption scenario in sharing economy era.

Although the history of car sharing service can be traced to last century, for example, one of the earliest car sharing experiences in Europe known as "Sefage" initiated its service in Zurich, Switzerland in 1948 [5,6], the car sharing systems today supported by web and mobile technology make themselves very distinguished from the traditional car sharing models. In fact, car sharing today operates within two of different frameworks, including business-to-consumer (B2C) car sharing and peer-to-peer (P2P) car sharing [7,8]. The B2C car sharing can be further categorized by roundtrip models (e.g., Zipcar) and one-way (or point-to-point) models (e.g., Car2go). Similarly, the P2P car sharing includes the subclasses of P2P car sharing (e.g., Turo), P2P carpooling (e.g., GoCarShare), and P2P ridesharing (e.g., Uber). Several studies explored the business model characteristics of car sharing systems under these two frameworks. Reference [9] used six dimensions: temporality, anonymity, market mediation, consumer involvement, the type of accessed object, and political consumerism to examine the nature of so-called "access-based consumption" via an interpretive study of Zipcar consumers. Reference [7] characterized each major business model within the carsharing, ridesharing, and bikesharing segments with four business model building blocks: value proposition, supply chain, customer interface, and financial model, with the purpose of unveiling the optimal relationship between service providers and the local governments to achieve the common objective of sustainable mobility. Reference [8] examined the public perception of P2P carsharing through an intercept survey conducted in the San Francisco Bay Area, California. In this study, convenience and availability, monetary savings, and expanded mobility options are recognized as the three top reasons for P2P carsharing service using. Reference [10] discussed some critical elements of Uber business model including personal service, on-demand availability, immediacy and the cost shifting from users to service providers. It also pointed out the labor markets and regulatory policy issues cast on Uber-All Economy.

These existing studies examined the nature and the potential market features of car sharing systems from one or more sides through empirical evidence or interpretive analysis. But to our best knowledge, there is still a lack of studies thoroughly exploring what the car sharing system looks like from a practical-running point of view. This paper thus implements an investigation on DiDi Chuxing, the best practice of car sharing service in China, to answer the following research questions: *1) How does car sharing system work in practice? 2) What makes a new collaborative venture like DiDi keep growing and moving on its leading way?* Following the research agenda, this paper thereby contributes to theories on the nature of car sharing systems and gives a guide

on how to become a successful car sharing business. The remainder is structured as follows. Section II carries out a practical investigation and analysis on the business model of DiDi. Section III discusses the key elements marking a car sharing system in the context of sharing economy. The conclusion follows in Section IV.

II. DIDI CHUXING---THE BEST PRACTICE OF CAR SHARING IN CHINA

DiDi Chuxing (DiDi, http://www.xiaojukeji.com), recognized as China's and the world's largest mobile-based transportation platform, started its early online taxi-hailing service in June, 2012. It has expanded its car sharing service to more than 400 Chinese cities and 300 million users in less than five years. According to recent researches published by China Internet Network Information Center, DiDi holds more than 87% of private-car hailing market, 99% of taxi-hailing market, and 70% of other car sharing markets in China. DiDi developed its global business by establishing strategic partnership with other rideshare leaders over the world like GrabTaxi in Malaysia, Lyft in U.S., Ola in India, and 99Taxis in Brazil. Specially, DiDi and Lyft introduced the roaming product in April, 2016, allowing DiDi users to hail a Lyft ride from their DiDi app while travelling in the U.S., marking the launch of DiDi's overseas service. In August, 2016, DiDi acquired Uber China and Uber quit mainland China after its two-year service in China, which signals a new stage in the development of DiDi's rideshare business.

As a sharing economy leader deeply rooted in China, DiDi is constantly pushing the frontier of innovation to redefine the future of mobile-based transportation service. To outline how DiDi really works in practice, we will investigate the business model of DiDi from the following four dimensions: service pattern, operating mechanism, pricing model, and safety strategy to depict a comprehensive profile of DiDi.

2.1 Service Pattern

Within past four years, DiDi has transformed traditional way of travel into a world-leading innovative industry and quickly established market leadership across a portfolio that covers multiple services across taxi, private-car hailing , Hitch, carpooling, limousine, car rental, designated driver, test drive, bus and enterprise services. Table 1 summarizes the service pattern provided by DiDi.

Table 1. Service Pattern of DiDi

Business System	Service Type	Service Description	Launching Time
DiDi Dache & Kuaidi Dache	Online taxi hailing	Cooperating with taxi companies to provide online taxi-hailing and taxi calling services	Jun., 2012
DiDi Premier	Premium version of private car hailing	P2P ridesharing services for high-end passengers	Aug., 2014
		Private limousine services for business and leisure travelers on frequent and short journeys	Nov., 2016
DiDi Enterprise Solutions	Enterprise transportation management	Providing corporate customers with flexible, efficient and controllable one-stop transportation solutions	Jan., 2015
DiDi Express	Economic version of private car hailing	Providing affordable and lower-price P2P ride sharing services to a much broader passenger group	May, 2015
DiDi Hitch	Ridesharing	Helping private car owners and fellow travelers with similar routes share transportation resources	Jun., 2015
		Inter-city hitch service to expand on-demand mobility from urban areas to a national scale	Feb., 2016
DiDi Chauffeur	Chauffeuring	Providing on-demand designated drivers for private car owners when they are inconvenient	Jul., 2015
DiDi Bus	Public transportation	Providing public traffic query and commuter buses service to supplement the existing public transportation ecosystem	Jul., 2015
DiDi Express Pool	Carpooling	Allowing multiple passengers to share rides to reduce transportation cost	Nov., 2015
DiDi Test Drive	Test drive	Providing on-demand P2P test-driving experience to potential car buyers	Nov., 2015
DiDi Car Rental	Online car rental	Providing B2C car rental services through cooperating with existing car leasing firms	Aug., 2016
		Providing overseas B2C car rental services	Jan., 2017

From Table 1, new business systems have been developed by DiDi in the past a few years. Especially, DiDi expanded its business scale greatly in 2015. All the business systems here can be grouped into four segments: Taxi, P2P ridesharing, B2C car rental, and other value-added services.

2.1.1 Taxi

Taxi is the start-up business of DiDi. Now DiDi has partnered with over 150 taxi companies in China to collaboratively explore online car-hailing and taxi calling services to increase operational efficiency, reduce vacancy rate, improve convenience, and raise drivers' income for the taxi industry. 80% of all taxi drivers in China now use DiDi to find passengers.

Participating taxi companies can choose from a broad range of cooperation forms provided by DiDi such as intelligent request dispatching for taxi, receiving online car-hailing orders for taxi, joining DiDi Premier or joining DiDi Express. Taxi companies can have access to DiDi's internet technologies, its algorithm and big data capabilities, operations and management philosophy, to make full use of DiDi's advantages in "technology plus management" and to enhance service quality. DiDi also provides professional training for taxi drivers to improve their service capabilities, as well as certified solutions and vehicle financing solutions.

2.1.2 P2P Ridesharing

Although DiDi Premier, DiDi Express, DiDi Hitch, and DiDi Express Pool function a bit differently, they in fact belong to the same P2P ridesharing segment. P2P ridesharing involves private car owners as drivers to ride passengers who want a lift.

- DiDi Premier offers one-stop mobile premium transportation services which require drivers and cars to adhere to higher standards. Passengers can choose from three types of services – instant access, booking, and limousine – and opt for comfortable, business or luxury car model option.
- DiDi Express offers a more economic P2P ridesharing service than DiDi Premier. Usually the price of DiDi Premier is three to five times that of DiDi Express according to car models and regions. So DiDi Express is suitable for a much broader passenger group, e.g. commuters.
- DiDi Express Pool is a new function added to DiDi Express. It allows multiple passengers to share rides to maximize vehicle utility, improve driver income, lower passenger cost, and ease congestion. The ride overlap of carpooling requests is close to 70%. The price of Express Pool is about 20% lower than that of DiDi Express but passengers often need book at least 30 minutes in advance.
- DiDi Hitch matches drivers and passengers who share similar routes in a city or a national scale. It not only allows the drivers to make money to pay for their fuel and toll cost, but also gives them the opportunities to make friends with passengers during their rides. Compared with DiDi Express Pool, DiDi Hitch is driver-oriented and the ride sharing happens between private car owner and passenger. DiDi Hitch is the cheapest among all four types of P2P Ridesharing and its price is almost 50% lower than DiDi Express. Passengers usually need wait for 15 minutes or longer after making a DiDi Hitch appointment.

2.1.3 B2C Car Rental

B2C car rental is a car sharing model where customers access cars owned by companies and drive the cars by themselves. Different from Zipcar which is the world's largest B2C car rental platform operated in U.S., DiDi initiates its online car rental business through an asset-light model in cooperation with existing car leasing firms rather than owning cars by itself. A range of economy and utility sedans, SUVs and MPVs are available currently.

DiDi Car Rental is a new launched business in response to the boom in China's short-term and tourist car rental market as the population goes through a lifestyle revolution. It aims to redefine the car rental experience and free users from the procedural labyrinth of traditional offline rental firms. Once the user starts the vehicle-booking process 2 hours in advance, all the booking, payment and order modification can be done online before DiDi's service staff drop off the car at the user's designated location for free. In via of the data-driven rider-vehicle matching system and economy-of-scale advantages of DiDi, the existing car leasing firms will improve their operational efficiency, reduce operations costs, and better organize under-utilized social resources to meet travelers' dynamic demand.

2.1.4 Value-added Service

Apart from the mainstream Taxi, P2P ridesharing, and B2C car rental models, DiDi also established multiple value-added car sharing services including DiDi Bus, DiDi Chauffeur, DiDi Test Drive, and DiDi Enterprise Solutions.

- DiDi Bus lets passengers digitally inquire the real-time public bus lines and transfer schemes. Also, it provides commuter bus service for enterprises and individuals by customizing special bus routes.
- DiDi Chauffeur offers designated drivers for private car owners with intelligent location matching. It will gradually expand into four market segments: social chauffeur, business chauffeur, travel chauffeur, and automobile aftermarket.
- DiDi Test Drive provides on-demand P2P test-driving experience to potential car buyers. After a potential buyer books a car for test drive, the car owner who has registered on DiDi platform will drop off the car at the buyer's designated location. Then the buyer can ride the car for 30 minutes along the route that he/she wants to learn the actual running conditions of the car.
- DiDi Enterprise Solutions provide corporate customers with flexible, efficient and controllable one-stop transportation solutions. The solutions include the functions such as the vehicle management under multiple scenarios, expenses management, vehicle configuration for staffs, trip query and so on.

In summary, DiDi has been trying its best to establish a one-stop comprehensive platform to satisfy diversified transportation demands of users. Considering from the present status quo, P2P ridesharing has grown into the primary business of DiDi while B2C car rental is still in its infancy on DiDi platform. Thus, the analyses performed on operating mechanism, pricing model, and safety strategy next are largely oriented to P2P ridesharing services.

We have to say DiDi has built up a rather complete car sharing service system except that P2P car rental, another big cake (e.g. Turo engaged in) in car sharing market, is not included. Whether DiDi will develop its P2P car rental business or not, what DiDi should do at present is integrating and coordinating its existing business systems to avoid resource conflicts and make them keep balanced and sustainable development.

2.2 Operating Mechanism

DiDi, acting as an open and sharing-based intermediary platform, connects consumers and car providers to initiate a new mobile-based transportation mode. Consumer is the demand side and submits their car sharing service request (e.g. ridesharing) to DiDi system via their mobile terminal. DiDi then uses mapping data and intelligent dispatching technology to locate the best service provider (e.g. private car owners) according to their location, reputation or response speed to the service request. Once provider is dispatched, consumer will see the peer's information and vehicle details, and can track their arrival on the map. When the trip is ending, consumer will pay for it with a third-party payment platform. Currently, five online payment ways are available for DiDi: WeChat, QQ, Alipay, credit card, and debit card. WeChat and QQ are the two largest social media platforms in China. Their online payment systems are seamlessly integrated into DiDi platform and become the first choice for mobile micropayments. Alipay is an independent third party payment system launched by Alibaba Group who operates Taobao---the world's largest C2C e-commerce platform. Alipay goes into online payment business much earlier than WeChat and QQ and is very popular for DiDi transaction settlement too. Besides, DiDi cooperates with traditional bank online payment systems to charge consumer's credit card or debit card on file. These payment options offer a fast and secure payment mechanism to support DiDi's operations. Since DiDi makes its main revenue based on commission from consumer's trip fee, gain is automatically shared between DiDi and service provider with a predefined proportion, e.g. 20 percent commission on a trip. Certainly, both consumer and service provider can rate each other and give anonymous feedback about the trip as they want. Fig.1 outlines the operating process of DiDi.
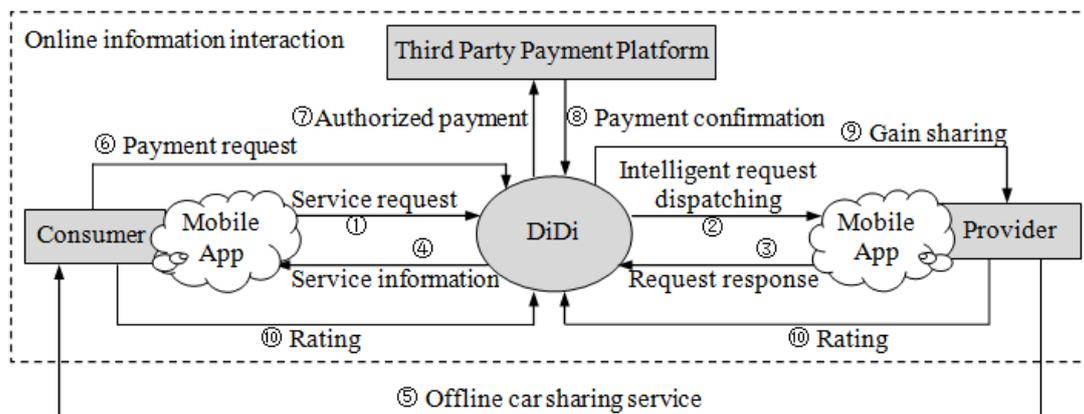

Figure 1. Operating Process of DiDi

In the operating framework manifested by Fig.1, two elements are critical to the DiDi's operations. The first is on-demand access at anytime, anywhere. DiDi supports fast access through robust mobile and location-based service technologies. Vehicles distributed around consumers are instantly designated to respond their service requests. For example, only 3 minutes or less leading time is needed for consumers to pick up their car hailing service. The on-demand instant service, no prior reservation is required, intends to provide consumers a more flexible and spontaneous car sharing usage, similar to a private car. Optionally, consumers also can make a short-term reservation (e.g. 30 minutes in advance) to allow an efficient control over the demand and time schedule. Specially, for complex carpooling, ridesharing and car rental services, booking in advance undoubtedly will help a smoother trip through a precise service delivery.

The second element of DiDi operation model is online to offline interactions. As shown in Fig.1, the operating process of DiDi is fractionized into two segments: online information interaction and offline car sharing service delivery. Online information interaction involves at least four parties. These are the user of a car sharing service, the provider of a car sharing service, the online sharing platform (DiDi), as well as the third

party payment platform. Information flow and capital flow are interactively passed on among the four parities to form an integrated digital transaction process. Offline car sharing service delivery seems simpler than online part since the interactions only take place between the user side and the provider side. The process combining online and offline components looks like traditional e-commerce exchanges performed by eBay, Amazon etc. However the essence is quite different. First, the car sharing service focuses on instant "nearby service" as we just mentioned and the location-based service is its core, which is contrary to the idea of getting rid of the space limit as much as possible considered by e-commerce exchanges. Second, the offline service of traditional e-commerce exchange is a logistics process where packages are sent and transaction partners are not bound to meet each other in person, but that of car sharing service is a consumption process where face-to-face interactions have to take place among peers. As a result of these two differences, the interactions from online to offline are intensive and on a more advanced social level in car sharing context. The online selection of providers directly and immediately influences the offline service quality and security.

2.3 Pricing Model

Price is often used as a kind of balance mechanisms to leverage demand and supply in a certain market period. The car sharing service is pricing for each usage rather than ownership. Usually, a usage rate is calculated based on time and distance of a trip. To guarantee the car sharing system operates in order, punishment mechanism for service cancellation is introduced in most cases. Collection of cancellation fee is a bit complex and depends on different conditions such as credit scores of responsible party, attitude of non-responsible party and order cancellation time. In some particular occasions, e.g. long-distance trip (usually over 15 kilometers), night-time service or long-distance dispatching, additional fee have to be charged to make up for a higher service cost. A minimum fare is applicable for private car hailing services to prevent private car owners from negative profits. Table 2 summarizes the pricing structure of P2P business operated by DiDi.

Table 2. Pricing Structure of DiDi P2P Business

Service Pattern	DiDi Dache	DiDi Premier	DiDi Express	DiDi Express Pool	DiDi Hitch	DiDi Chauffeur
Pricing Structure	Taxi hailing	Premium private car hailing	Economic private car hailing	Carpooling	Ridesharing	Chauffeuring
Base Fare	Yes	Yes	No	No	Yes	Yes
Distance Fare	Yes	Yes	Yes	No	Yes	Yes
Waiting Charge	Yes	Yes	Yes	No	No	Yes after initial 10-minute waiting
Long-distance Surcharge	Yes	Yes	Yes	No	No	No
Night-time Surcharge	Yes	Yes	Yes	No	No	No
Surge Pricing	No	Yes	Yes	No	No	Yes
Fixed Price	No	No	No	Yes	No	No
Dispatch Fee	No	No	No	No	No	Yes for a far-away driver
Cancellation Fee	Depending on user's credit score	Depending on cancellation time point	Depending on cancellation time point	No	Yes for 2-hour compensation limit	Yes
Minimum Fare	No	Yes for reservation case	Yes	No	No	No

Of all price components, surge pricing is a very useful tool to leverage supply and demand. Uber created its surge pricing system where the increase in price is proportionate to demand, e.g. the price rises in the rush hours or poor weather days. The surge pricing dynamically match supply and demand in any of three ways: by reducing demand for cars (less people want a car for a higher price), by creating new supply (providing an incentive for new drivers to hit the roads), or by shifting supply (drivers) to areas of higher demand [11]. DiDi does the similar work as Uber with a variant of surge pricing. In order to reduce the consumption cost of consumers and find a balance between efficiency and fairness, DiDi promoted a double capping mechanism which considers the multiple of normal rate and makeup quota simultaneously when the balance between demand and supply breaks down. For instance, suppose that the total price of a car sharing service from point A to point B is $100, the highest makeup multiple is 0.5 (namely $100*0.5=$50), and the highest makeup quota is $29, then consumers only need pay $129 rather than $150 for the trip owe to the double capping mechanism. In addition, DiDi established early-warning mechanism for supply and demand on the basis of big data analysis. DiDi forecasts the capacity of supply and demand before predictable imbalance between supply and demand occurs and then warns consumers via DiDi mobile app. In some exceptional occasions (e.g. holiday travel rush

or poor weather), to ensure that the supply meet travel demand, DiDi will temporarily adjust the capping mechanism of surge pricing against actual conditions and inform consumers in advance so that they can plan their trips ahead. Some people argue that the double capping mechanism may impose restrictions on the capability of surge pricing adjusting the balance between supply and demand since drivers are able to evaluate cost and benefit to determine if it is worthy to take orders in poor weather or congested roads. Nevertheless, double capping mechanism is a kind of innovative exploration for dynamic pricing. More price adjustment strategies should be tried to moderate the marketplace in car sharing settings.

2.4 Safety Strategy

Safety is a top issue in the car sharing context. An accident was reported on May 3, 2016 in China that a woman who rode a private car hailing service was robbed and murdered by the driver who used a fake vehicle license number. Another piece of news reported a similar case on September 13, 2016 but where the victim is the driver while passengers became the murderer. Such criminal cases happened now and then. Both riders and drivers are facing non-ignorable security threats.

To provide better protection for platform users and build an ever safer and friendlier ridesharing environment, DiDi created a series of safety measures as diversified services from Taxi to DiDi Private Car, Hitch, DiDi Bus, to DiDi Chauffeur, DiDi Test Drive, and Corporate accounts was added into its car sharing business. Nowadays, DiDi has built a comprehensive rider and driver safety framework that includes itinerary sharing, privacy numbers, one-touch button for emergency help, general accident insurance program, background check, biometric authentication, and safe driving system. Table 3 gives a brief summarization about the safety framework of DiDi.

Table 3. Safety Framework of DiDi

Participant / Safety Measure	Rider	Driver
Itinerary Sharing	Yes	Yes
Mobile Phone Number Protection	Yes	Yes
One-touch SOS Button	Yes	Yes
General Accident Insurance Program	Yes	Yes
Background Check	No	Yes
Biometric Authentication	No	Yes
Safe Driving System	No	Yes

All safety measures included in the safety framework of DiDi can be roughly divided into two categories. One provides protection and aid for both riders and drivers, such as itinerary sharing, mobile phone number protection, one-touch SOS button, and general accident insurance program. The other is used against safety violations, such as biometric authentication, background check and safe driving system oriented to the driver side.

2.4.1 Safety measures for protection and aid

DiDi applies advanced technologies to keep full tracking and recording of rides, and makes sure emergencies are reported and handled immediately and effectively through financial or physical assistance if necessary.

- Itinerary sharing: With the itinerary sharing function, riders and drivers can share their ride itineraries in real-time with family and friends via DiDi's app or automatically through WeChat, QQ and instant messaging. The shared information covers all details of a ride such as pick-up and drop-off points and time, distance from the destination, estimated time to arrive, vehicle license numbers and the vehicle's exact location. The app will also send alerts to the rider if the driver deviates from the suggested route, offering protection to users who may not be familiar with the area when traveling. The real-time itinerary sharing service is also available to DiDi's overseas users in addition to the safety measures provided by DiDi's global partners.

- Mobile phone number protection: "Hide-Ur-Number" is a function launched by DiDi that employs the virtual intermediate number technology to make riders and drivers communicate with each other seamlessly while remaining assured that their personal phone numbers are masked and protected. Once users click a "Secure Call" button embedded in DiDi app, they will communicate with their peers by a virtual phone number. The privacy of both riders and drivers is protected.

- One-touch SOS button: One-touch SOS button is a panic button for emergency help. When a user activates the "Emergency Assistance" button, the app will simultaneously begin to record and upload the sound recording to DiDi's platform, while sending alerts to the user's pre-set emergency contacts. A trained DiDi SOS Taskforce member will monitor the situation and recording in real-time, and subsequently contact the police and/or the users' emergency contacts if necessary.

- General accident insurance program: General accident insurance program is a national and comprehensive accident insurance program that offers as much as RMB 1.2 million in protection for drivers and riders on DiDi platform. The insurance covers injuries, disability or sudden death in case of an accident during the entire journey between pick-up and drop-off points, allowing payment before reimbursement and making the best effort to ensure the safety and reliability of each trip.

2.4.2 Safety measures against safety violations
DiDi applies rigorous driver and vehicle screening standards to reduce safety violations. At the same time, DiDi carries out full-course technological monitoring to prevent and reduce dangerous driving behavior as well as improve overall road safety.

- Background check: By cooperating with national and local law enforcement agencies and direct access to national criminal databases, DiDi conducts thorough background checks and screen drivers and car owners in order to remove anyone who may threaten the safety of passengers using the platform. When drivers or car owners register new accounts on DiDi platform, they need provide identity and vehicle certification documentation, including ID card, driver's license and vehicle registration license. Only when the three documents are verified to be true and valid can they successfully register.
- Biometric driver authentication: The biometric driver authentication processes rolled out by DiDi are based on facial recognition and voice recognition technologies. The processes are engaged in a second authentication of new drivers' identity information before their accounts are activated. The measure also is able to protect existing drivers from identity theft when an abnormal request for an account transfer is initiated.
- Safe driving system: Safe driving system uses real-time GPS data to track risky behavior during each ride, including drowsy driving, speeding, sudden acceleration, sudden U-turns and sudden stops. Drivers will receive safety reminders once signs of dangerous driving are detected. Additional broadcast on real-time traffic and weather also are updated to provide higher protection for drivers. In turn, drivers' safe driving data will feed into their overall service evaluation. Safer drivers will be rewarded with higher service credit scores, more ride assignments and higher income as a result. The real-time driving data collected across DiDi's platform will also be connected into machine-learning algorithms to inform a cloud-based safety database which will help improve overall road safety for cities and communities.

In short, both riders and drivers are the vulnerable group when they are faced with unknown risks from social interactions with strangers. The safety framework of DiDi provides a comprehensive protection mechanism for riders and drivers. Specially, DiDi developed driver-oriented personal information authentication and whole-trip behavior monitoring measures to help riders against safety violations. Similarly, drivers and private car owners are confronted with the risks of unauthenticated passengers. Therefore, the identity and credit authentication of riders may be the next step for DiDi to continuously improve its safety mechanisms.

III. CAR SHARING IN THE CONTEXT OF SHARING ECONOMY

The success of DiDi and of companies with a DiDi-like business model is particularly noteworthy in the context of a global economy struggling with slow growth. As a typical socialized innovative practice in the line of "Internet plus Transportation", DiDi has demonstrated a powerful and sustainable vitality. So, what makes DiDi grow into an industry leader in the global car sharing market from a small business which is completely unknown four years ago? The key may be discovered through an insight into the business model of DiDi below.

3.1 Value-driven
The central conceit of collaborative consumption is obtaining value from untapped potential residing in goods that are not entirely exploited by their owners [12]. On the one hand, Car sharing systems deeply integrate underutilized vehicle assets offline via online platform to provide services, alleviating the shortage of urban transport capacity in rush hours and specially improving the travel efficiency of commuters. In the meantime, decentralized and fragmented vehicle resources are activated and their underutilized parts are maximally exploited. The efficiency of resource allocation is promoted within the whole society and social value is created in this case. On the other hand, the short-term access replaces the long-term ownership of cars in the context of sharing economy. Consumers pay for per usage of cars and hence get rid of the cost of purchasing and maintaining cars. Moreover, car sharing platforms provide real-time matching between demand and supply as well as free access for consumers, cutting down the time and the cost of service acquisition of consumers. For private car owners who participate in car sharing platforms, they make extra money during their free time by executing service orders from car sharing platforms and some of them even take the car sharing service as their full-time job. Apart from the economic value, the social interactions between consumers and service providers help them develop more social ties and make like-minded friends. They are gradually accumulating their social

capital through car sharing trips. So, car sharing service also creates individual value both for consumers and service providers. Driven by social value and individual value, hundreds of millions of passengers and drivers participate in the DiDi platform. New business systems have been continually developed by DiDi in the past four years to meet different service demands of users. According to the aforementioned service patterns, P2P ridesharing is the main business run by DiDi. By directly connecting vehicle owners with would-be riders, P2P ridesharing is a more direct manifestation of collaborative consumption than B2C car rental because it promotes the socialized sharing of private-owned underused assets in contrast to a company-maintained vehicle fleet.

3.2 Technology and data-driven

The influences of technology and data are ubiquitous on DiDi car sharing services. Users employ mobile technology to get access to DiDi platform. DiDi platform uses big data computing, artificial intelligent and located-based service technology, by taking into account multiple factors including distance, traffic, supply and demand of transportation and driver's service evaluation, to fulfill the intelligent matching between supply and demand. The same technologies support DiDi's surge pricing mechanism against imbalanced supply and demand. In the driver and rider safety framework, technologies and data are utilized even more thoroughly. From big data algorithms, biometric identification, to full-course monitoring and cloud computing, so many techniques are leveraged to provide better and smarter protection for riders and drivers. DiDi even established its Machine-Learning Research Institute specially to attract worldwide talent to develop big-data and deep-learning capabilities for China's mobile transportation service.

Technology and data make everything possible. Technology and data-driven sharing economy is smarter and shapes so-called "sharing economy 2.0". To date, technology and data have been the backbone of car sharing business model. Each process and strategy innovation of DiDi is back against them. Without technology, DiDi business model is just a "model"---no intelligent dispatching capacities, no on-demand availability, no running, and no growth. For the next years, the specific technologies are sure to evolve to enable maximum efficiency of all DiDi business systems.

3.3 Cooperation-driven

Car sharing is a kind of business model constructed on mutual aid and mutual benefit. No employing relationship but only partnership exists in the car sharing services. The cooperation of DiDi with its partners has four levels. They are cooperation with drivers, cooperation with third party partners, cooperation with overseas counterparts, and cooperation with third party application vendors.

Taxi drivers and private car owners who participate in DiDi platform are the partners of DiDi. The feature of cooperation relationship in this level is two parties share benefits directly. Third party partners refer to those who provide their platforms, services, or resources for DiDi, such as third-party payment platforms, taxi companies, car leasing companies, insurance companies, social media platforms, government and so on. The relationship feature in this case lies in the reciprocity agreements between two parties. The reciprocation is not necessary money. It may be a kind of capacity, a chance or just a friendly work environment. Overseas counterparts are those strategic partners who are engaged in the same or related business with DiDi. DiDi relies on them to expand its overseas market. The relationship feature is the joint development of both sides. For example, DiDi formed a strategic partnership with LinkedIn in September, 2015 to expand the synergies between transportation and professional social networking. In 2016, DiDi officially launched its open source developer platform by making its SDKs (Software Development Kit) publicly available to third-party apps and individual developers. So the fourth cooperation level with third party application vendors is to permit third-party apps (e.g. Tencent map, Sina Weibo and www.58.com) and individual developers to get access to DiDi's open source developer platform. All third-party apps successful access to the open platform will have their own DiDi car sharing service interfaces to facilitate their customers to use DiDi's mobile transportation service.

3.4 Trust-driven

In the context of the sharing economy, trust is assumed to play a crucial role. When users consider that purchases on a sharing platform carry a certain level of risk, they will never make a deal with it. However, trust is a complex construct and often hard to build and manage. The picture is even more complex and difficult in the context of P2P collaborative consumption market where trust is extended from a dyad of relationship to a triad of relationship [13]. Three parties are directly involved in each P2P sharing transaction. These are the users of a sharing service, the online sharing platform, as well as the peers who provide car sharing service. Both users and providers are engaged in interactions with the platform operator and each other. The platform, however, acts as an intermediary between both market sides, and may also appear trustworthy or not. Moreover, even the shared object itself (e.g. a privately owned car) may be subject to trust concerns. Therefore, the trust in the P2P context of sharing economy are distinguished from three types, that is, trust towards peer (including both user and service provider), trust towards platform, and trust towards product[13].

As for car sharing service, P2P exchange processes bear a higher risk since the duration of social interaction is longer and the quality of previously used services is harder to pinpoint. DiDi has designed a series of strategies and mechanisms to establish and maintain trust between its users, toward platform, and toward cars. They include mutual review and rating schemes, and abovementioned a cavalcade of safety measures, e.g. drivers' profile authentications for building consumers' trust on drivers, or general accident insurance program for building users' trust on platform. However, the effect of these measures on trust building keeps uncertain. For example, a well-designed mutual rating system enables users to get knowledge-interests, whom users know, personal preferences, past actions-about strangers [14], offering the right tools and environment for familiarity and for creating trust between buyers and sellers in car sharing systems. However, if users don't rate each other after a trip, how about this case? Moreover, the number of positive rating is always far more than the negative rating is. Is this the true case? In short, trust is a multi-faceted and enigmatical issue, and car sharing platform still has a long way to explore it.

IV. CONCLUSION

Car sharing is an access-based service that offers users temporary vehicle usage rather than ownership. Although there are commonalities within existing car sharing practices, it is probable that most operators will make unique strategic decisions in framing their specific shared mobility business models. During the past four years, DiDi has developed into a one-stop comprehensive platform which provides diversified car sharing services from taxi hailing, private car hailing, to ridesharing, carpooling, car rental, to commuter bus, chauffeuring, test drive, and Corporate accounts. To guarantee these services running efficiently, DiDi established technology and data-based operating mechanism, pricing strategy, and safety framework. The business model of DiDi is evolving more and more effective.

Nevertheless, there still exist some issues to be further addressed for DiDi's business model. One is about the cooperation with government. On the one hand, DiDi is supervised by government; on the other hand, DiDi can work with government to improve processes, strategies, and even the macro-environment for mobile services. In fact, DiDi has cooperated with government authorities in its safety framework by direct access to national criminal databases to carry out drivers' background check. But the cooperation areas can be further developed. For example, Emergency may be directly reported to polices by connecting users to government's emergency alarm center with DiDi app, rather than transferred by a trained DiDi SOS Taskforce member with current One-touch SOS button function. Moreover, the pricing mechanism may be co-created with government to get policy support and stabilize the market. Another issue that should be concerned about is the benefit distribution between DiDi platform and drivers. It has always been a bottleneck problem besetting DiDi's development. The current benefit distribution mechanism where DiDi extracts 20% commission from riders' travel fee is controversial. Drivers argue that their income is decreasing with the reform of order dispatching manner. So, the benefit distribution mechanism should be adjusted according to the changes of other related policies.

From the viewpoint of research, this study only performed an investigation on DiDi's business model. The findings may be partial. Future work should be done on multiple car sharing cases with different service pattern to get more reasonable conclusions.

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