Development and Prospects of Mobility-as-a-Service in China

Wu Xiaoyue[1,*]

[1]*WUHAN UNIVERSITY OF TECHNOLOGY, SCHOOL OF TRANSPORTATION AND LOGISTICS ENGINEERING*
[*]*Email: 1097851309@qq.com*

Abstract

Under the background of continuous economic development, the number of private cars continues to rise, causing road congestion in some areas during peak travel hours. In order to alleviate traffic congestion and improve traffic efficiency, a new transportation concept has emerged in the city, namely "Mobility as a Service"(MaaS). By introducing the development and significance of MaaS, this paper shows its advantages and roles in China's transportation.Combined with the attempts made by other countries from the emergence to the development of MaaS, examples of existing MaaS applications are listed, and the opportunities and challenges for its further promotion in China are described.

Keywords: *Mobility as a Service,Shared Transportation, Urban Transportation, Travel, Transportation Planning.*

1.INTRODUCTION

In recent years,the level of motorization in various cities in China is rapidly improving, and the number of private motor vehicles is increasing year by year. According to the National Bureau of Statistics, the annual growth rate of private car ownership is significantly higher than that of urban buses. And in 2018, the number of private cars exceeded 200 million, and it is still growing[1].

The rapid development of urban transportation not only brings convenience to urban development and residents' life, but also brings a series of problems to the city. Problems such as traffic congestion, environmental pollution, and energy shortages will become obstacles to the continued development of cities. As the main problem of urban traffic development, traffic congestion is the focus of many scholars and city builders. For the traffic situation of urban road congestion, different scholars have proposed different solutions, such as restricting the license plate number, congestion charging, and charging high parking fees[2].While these methods solve the problem, they will also bring certain negative effects, which restrict the travel of residents.

Based on the existing mode of transportation, MaaS promotes the integration of all parts of the system through the optimization and improvement of various transportation services, forming a complete service system. To some extent, shared transportation has replaced private transportation to reduce the number of vehicles on the road and further alleviate traffic congestion and other problems. The proposal of this traffic concept will become an effective way to ease traffic congestion and facilitate people's travel.

2.THE CONCEPT AND SIGNIFICANCE OF MAAS

2.1 The concept of MaaS

As the originator of MaaS,Mr. Hitanen put forward the concept of "travel package" in 2006, which is to "package" the needs of travelers into a whole and hand them over to the service platform to deal with. This is also the motivation of MaaS at the beginning. In the 2014 ITS Conference of the European Union, he defined MaaS as a service: realizing the mobility service mode that meets users' needs through the interface of a service provider, and providing customized mobility "packages" for customers by integrating different modes of transportation[3].

The transportation concept of MaaS separates travelers' travel needs from the services provided by the transportation system. Therefore, travelers no longer need to provide transportation means for travel, but their way and process of travel are the process of providing services for the transportation system, which is completed by a unified platform. For example, people

need to get to and from work, and if their businesses and houses are located next to stops on a certain subway line, their commute is MaaS.

2.2 The significance of MaaS

At present, Chinese urban residents are highly dependent on private cars, so they travel mostly by private cars, which leads to more vehicles on the road, causing road congestion in some areas, and the exhaust gas emitted by vehicles makes the environmental pollution more serious. By directing travelers to use public transport, they can reduce congestion and carbon emissions by taking cars off the road. In addition, the emergence of MaaS satisfies travelers' personalized travel. In MaaS's system, the system plans the most appropriate path for travelers based on the traveler's information. Compared with traditional travel methods, MaaS focuses on serving travelers, which is more convenient for travelers and reduces the waste of time in travel planning, ticketing and transfer[6].

3.DEVELOPMENT AND CURRENT SITUATION OF MAAS

3.1 China's Development status

The first MaaS academic Salon in Mainland China was held in November 2018 under the organization of China ITS Association, attended by some Chinese sharing transportation enterprises and Internet enterprises. Since then,MaaS has begun formal research and development in China.

The development process of MaaS in China can be roughly divided into four stages. With the advancement of time and transportation technology, the connected places gradually expand from inter-city transportation to international transportation. The first stage is urban passenger transport, which is the process of moving within the same city through buses, subways and shared bikes. The second stage is the traffic between the city and the countryside; The third stage is intercity transport, where travelers can travel from one city to another by rail or air. The fourth stage is cross-border passenger transport, which allows travelers to travel further.

		Phase 1	Phase 2	Phase 3	Phase 4
Transportation services		Urban transportation	urban-rural transportation	Intercity transportation	Cross-border transportation
		Bus, subway, bike-sharing, taxi, e-hailing, water bus, parking, charging, time-sharing rental	Rural bus, long distance passenger transport	Civil passenger transport, railway passenger transport	International railway, international aviation,International road transportation
			Urban and rural intercity network booking taxi		
Support information		Map service, Traffic services, Space location, Computing resources, Storage resources, Network security			
Business		Transportation + tourism, Transportation + consumption, Tourist attractions, Restaurants and bars, Cinemas, Hotels, Museums			
Policy environment		Ticket price system, Trust system, Green points, Data sharing, Information security, Privacy protection			

Figure 1 Development stages of MaaS in China[4]

At present, there is not a complete study on MaaS in China, nor is there a MaaS system software that can be put into use. But there are also some cities in China that are being tried as pilot areas, such as Shanghai. Combined with other countries' advanced development technology, MaaS is expected to be put into practice in China.

3.2 Development status of other countries

In 2015, The MaaS-Alliance was established in Europe. In the same year, Mr. Tahinen joined MaaS Global as CEO. At present, there are nearly 20 MaaS related projects in research or pilot operation, most of which are concentrated in European countries. Most of these studies have successfully integrated road modes, and a few have incorporated aircraft and ferries into the MaaS system.

Since there is no uniform regulation on transportation between eu countries, a series of policies have been introduced to ensure the normal operation of MaaS system. In 2018, the European Commission published a passenger Bill of Rights for multi-mode travel services, which basically stipulates that travelers can adjust their trips while traveling and service providers cannot charge additional fees. Eu legislation attaches great importance to protecting the rights and interests of consumers. The EU Consumer Rights Directive also applies to travel as a service platforms. In 2014, the EU strengthened its protection of consumer rights, and in 2018, the EU updated its General Data Protection Regulation, requiring companies to equip themselves with systems to detect data breaches[4].Under the protection of these laws and regulations, THE MaaS in the European Union has shown a healthy development trend.

4.COMPOSITION OF THE MAAS SYSTEM

The traditional understanding of what constitutes a MaaS system is roughly divided into four parts: service provider, transportation operator, data provider, and traveler[5].However, the traditional division of MaaS system does not contain the policy content, and the content is not perfect, which makes the framework system slightly empty. Since then, some scholars have proposed a new division method, with a more comprehensive description and a clearer framework system.
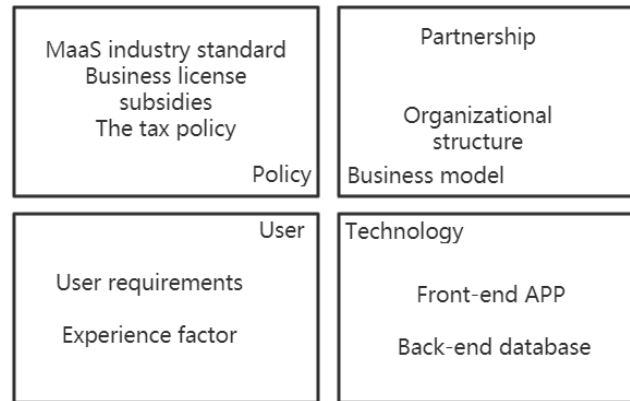

Figure 2 MaaS system architecture[6]

MaaS system architecture includes four aspects: policy, business model, technology and users. Among them, policies include promoting platform operation and ensuring user information security. Transportation operators with MaaS business model can choose different travel as a service platforms according to different environments. The user section refers to the section where users provide personal travel information and make reservation and payment through the client. The technical level includes data providers and service providers, and subsystems such as map services provide background data to support operations. In addition, it can obtain real-time traffic conditions, build route selection model, and carry out personalized route selection based on user information.

For the business model structure of MaaS, scholars have summed up four modes, namely Holding mode, Broker mode, Operator mode and multi-platform mode[7].
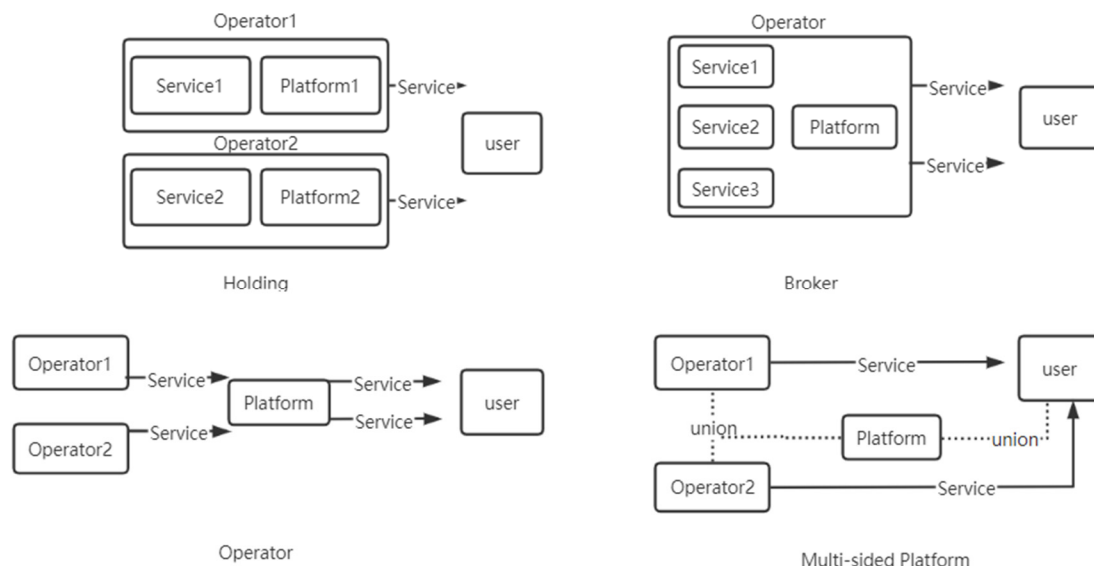

Figure 3 MaaS business model diagram[6]

Among them, services provided by various traffic operators in the holding mode are not interoperable, which can be understood as the current traffic mode. The agent mode only allows service modes of the same operator to communicate with each other, and has certain limitations. Both operator mode and multi-platform mode are more suitable for the business model architecture of MaaS system, which can provide users with more direct and convenient services.

5.APPLICATION EXAMPLES AND PROSPECTS

5.1 Application examples

Since MaaS was first proposed, a number of European countries have started trials, launching different platforms for travelers to use. Helsinki-based Whim, Finland, has devised four different formats for different users. Whim to Go is designed for temporary trips by those who travel less frequently; Whim Urban 30 is for consumers who travel monthly, such as commuters; Whim Weekend for Weekend travelers; This is a service created to completely replace a private car. These four different modes enable travelers to make choices according to their travel needs, and the platform formulates more appropriate travel routes for travelers according to their goals[8].
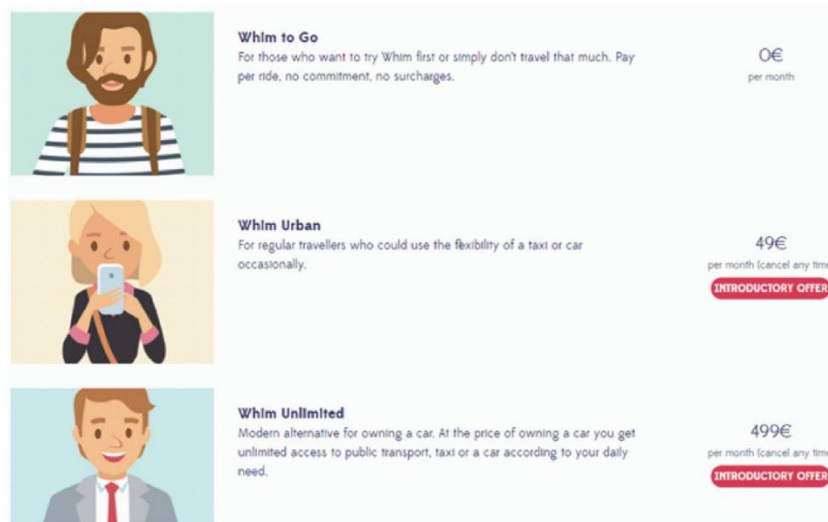

Figure 4 Partial pattern diagram[8]

In addition, some other countries are also actively promoting the pilot work of MaaS, such as MinRejseplan in Copenhagen, Moovel in Germany and so on. In the process of operation, there will be problems such as inconvenient payment and unsuccessful integration of different modes of transportation, which need to be improved after further study and practice.

5.2Prospects

With the advent of MaaS, the traditional bus system will change its appearance.In The MaaS system, buses can also design stops based on real-time conditions, rather than following the usual route and stopping at a stop sign[9]. To realize its sustainable development, it is necessary for the government, consumers and travel service providers to promote each other. The government guides consumers to use MaaS for travel through policies, and travel service providers provide data as a basis for the government to make medium and long-term plans and technical routes.
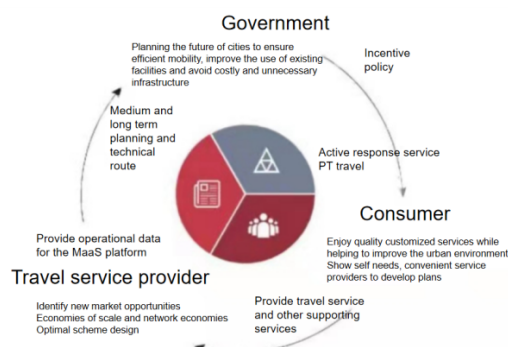

Figure 5 MaaSExample diagram of sustainability[8]

6.OPPORTUNITIES AND CHALLENGES

Data show that transportation industry is the world's second largest consumer market, the average annual transportation cost of Shanghai people is about 800 yuan, the national average annual disposable income is 25,974 yuan, the average annual transportation and communication consumption expenditure is 2,499 yuan, accounting for about 10% of the income[10].With the development of economy and the development of more regions, the per capita transportation and communication expenditure in China is likely to increase significantly in the future. Therefore, MaaS has a large market and great development space.

In addition, unifying payments is still a challenge, and some operating platforms have failed to do so. According to existing cases, legal and reasonable unified virtual currency can be created through the platform. Consumers can exchange virtual currency with other payment software and use this currency on the platform to use any vehicle connected to the platform. However, virtual currency has security risks, and consumers also need to pay twice, so there are certain obstacles in terms of security and convenience.

Another key issue is how much travelers trust the platform. In the era of big data, information leakage has become the focus of people's attention, and the development of tailored travel plans for travelers will inevitably require travelers to provide some relevant information, which will involve travelers' information security. If the security guarantee system of the platform is not enough to enable travelers to trust the platform and input relevant information, the trip as a service will not achieve the desired effect, which is a key issue for the promotion of MaaS in China.

7.CONCLUSION

Since the word MaaS was first proposed in 2014, after different attempts and development in various countries, it has become a new hot spot of urban transportation concept and plays a crucial role in many countries. In the context of continuous prevention and control of COVID-19, MaaS is a good direction for transportation development. A service-oriented urban transportation system is gradually taking shape. However, a perfect system cannot be separated from the support of laws and regulations. Only by legal constraints can people's concerns about information security in the era of big data be eliminated.

REFERENCES

[1] SHAO Yinglu,Ll Xinyang,YAO Li.Exploring the Influence of MaaS on Urban Space.Urban Development Studies,2019,26(S1):60-64.

[2] Liu Zhiyan,Yue Xiaoyan,Zhao Rui.The Cause of Urban Traffic Congestion and Countermeasures in China.Urban Development Studies,2011,18(11):90-96.

[3] YUE Jintao,Ll Ruimin.MaaSBrief Analysis on the Development Stage of MaaS.Journal of Transportation Engineering,2019,19(03):11-15.

[4] Wang Jian,Hu Minxiang,Wang Chengxiang,Guan Nina.European Policy framework for Travel as a Service (MaaS).China ITS Journal,2021(06):137-141.

[5] LIU Xiang-long,LIU Hao-de,Ll Xiang-jing,ZHOU Xiao-hang,YANG Xin-zheng.Framework and Developing Roadmap of MaaS (Mobility as a Service) in China.Transport Research,2019,5(03):1-9.

[6] YE Jianhong,Yl Fabin.Estimating the Development Level of Typical 'Mobility as a Service'Cases.Traffic & Transportation,2019,35(05):59-63.

[7] Wang Yang,Yu Dongjiu,Zhang Feng,Zhang Hequan.Product Service System Design of Mobility as a Service(MAAS) in the Post-COVID-19 Era.Urban Transport of China:1-16[2022-02-22].

[8] LONG Yuxi,SHl Jing,Ll Ruimin.Case Study and Future Prospect of MaaS.Journal of Transportation Engineering,2019,19(03):1-10.

[9] Ll Ye,WANG Mi,SHU Hanyu.A Study Review of Mobility as a Service (MaaS).China Transportation Review,2018,40(09):56-65.

[10] Wang Jian.Definition and development overview of Travel as a Service (MaaS).Transport Business China,2018(02):76-78