Research on UberEats by AI Self-Driving Cars

Siyu Cheng [1, *], Lingzhou Gu [2]

[1]Business School, Leeds University, Leeds, United Kingdom

[2]School of Management Science and Engineering, Central University of Finance and Economics, Beijing, China

* Corresponding Author Email: bn23sc6@leeds.ac.uk

Abstract: Driven by the relentless advancement of artificial intelligence technology, autonomous driving technology is progressively transforming the transportation industry, presenting unprecedented opportunities for pioneering companies in the ride-hailing sector such as Uber Eats. The deep integration of autonomous driving technology not only signifies a technological leap but also achieves a qualitative leap in cost structure optimization and operational efficiency. Through intelligent algorithms and precise dispatch systems, autonomous vehicles significantly reduce reliance on human labor, thereby substantially lowering operational costs. Simultaneously, their superior driving stability and accident prevention capabilities effectively mitigate traffic accidents and hefty maintenance expenses caused by human errors, further minimizing expenses throughout the vehicle's lifecycle. These cost optimizations empower Uber Eats with greater pricing flexibility and market competitiveness, allowing it to offer more attractive service packages and an enhanced customer experience. This, in turn, accelerates business growth, solidifies its market leadership position, and lays an unshakeable foundation for the company's long-term development in the intelligent transportation sector.

Keywords: Autonomous driving, UberEats, artificial intelligence.

1. Introduction

In the rapidly developing technology, artificial intelligence and autonomous driving are leading the transportation industry's future. This study explores the profound impact of autonomous driving technology on Uber Eats, the global food delivery giant, and its potential to optimize operating costs, improve delivery efficiency, and reshape consumer experience. Given the rapid growth of the autonomous driving market and Uber's ongoing challenges in achieving profitability, this research has important practical significance and strategic value. In recent years, with the continuous development of artificial intelligence, autonomous driving has gradually appeared in people's vision. The market size will continue to maintain a rapid growth trend and has broad market prospects and development space.

From the data in figure 1, it can see that the scale of China's autonomous driving market will be 289.4 billion yuan in 2022, with an average annual compound growth rate of 33.6% from 2017 to 2022. With the continuous advancement of technology and the continuous expansion of application scenarios, the autonomous driving industry will usher in more business opportunities and market share.

As autonomous driving technology continues to mature and its application scenarios expand, Uber Eats is expected to achieve business success through this innovation. Transformation and improving market competitiveness. This study not only analyzes how autonomous driving technology can help Uber Eats cope with its current operating losses but also evaluates its growth potential and development prospects in the global food delivery market. By deeply exploring the integration of autonomous driving technology and UberEats' business model, this study reveals the implications and impact of this change on the entire industry, providing valuable reference and insights for related companies and policymakers.

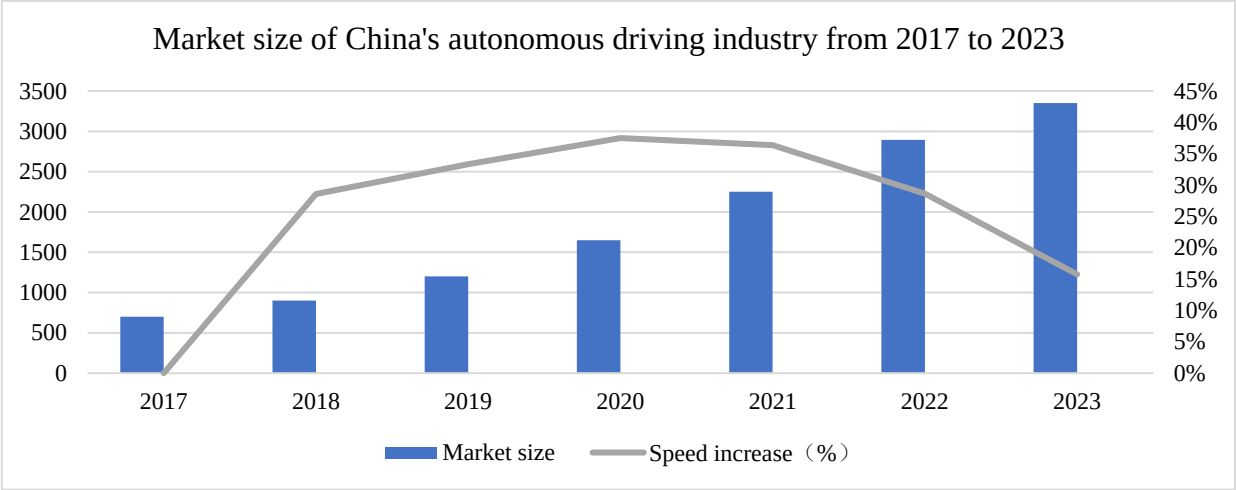

Fig. 1 Market size of China's autonomous driving industry from 2017 to 2023

Data from: https://new.qq.com/rain/a/20210612A01FFO00

2. The History of UberEats

2.1. Uber's Development History

Uber is a technology company that provides shared travel services. It was founded by Travis Kalanick and Garrett Camp in San Francisco, USA in 2009. Uber connects passengers and drivers through smartphone applications to provide convenient travel services. In the process of development, Uber has also faced many challenges, including conflicts with regulators, safety issues, and challenges from competitors. Despite this, Uber has grown into one of the world's largest shared travel platforms and successfully went public in 2019. Over time, Uber has also been exploring new business areas, such as food delivery service UberEats, and trying to enter the field of self-driving cars.

As shown in figure 2, on March 1, 2016, Uber officially launched its independent food delivery app UberEats, first launching its service in Los Angeles. In the next year, it will be launched in 100 cities in Europe, Africa, and the Middle East, including Romania, Kenya, Egypt, Ukraine, and the Czech Republic. By the end of 2017, Uber Eats had achieved profitability in 45 of the 200 cities where it was launched. In the fourth quarter of 2017, UberEats contributed 10% of Uber's revenue, about US$1.1 billion [1].

As the first entrant in the online car-hailing industry, Uber has fully gained the first-mover advantage. However, while Uber attracts users with low prices and gains a huge market share, its profit structure has become rigid, and its profit situation in recent years has been very unsatisfactory.

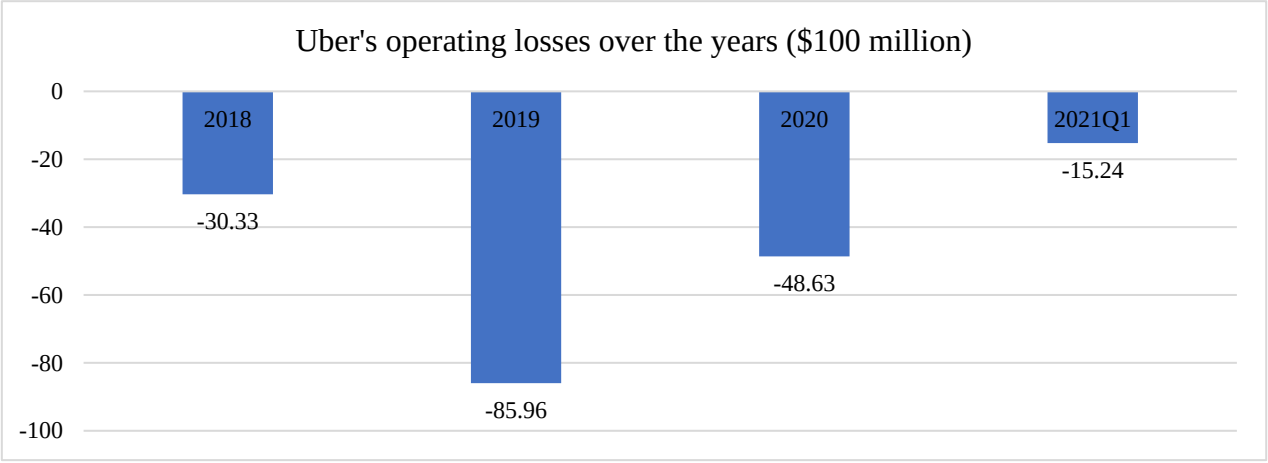

Fig. 2 Uber's operating losses (US$ billion)

From the perspective of profitability, Uber has been making losses over the years, and its operating losses from 2018 to the first quarter of 2021 are very serious. Therefore, to turn losses into profits while not losing the huge market share gained by the first-mover advantage, reducing Uber's operating costs through autonomous driving is an effective option.

2.2. UberEats' Financial Situation

Uber Eats has seen significant revenue growth in recent years, in part due to the COVID-19 pandemic increasing demand for food delivery services. The significant growth during the pandemic was primarily due to people's increased reliance on food delivery services as they stayed at home. This growth trajectory has helped Uber Eats maintain a strong presence in the food delivery market, although it now faces challenges maintaining growth as pandemic restrictions are eased. As can be seen in figure 3, Uber Eats' revenue has been steadily increasing since its inception, with the company's revenue in 2023 being $12.1 billion [2].

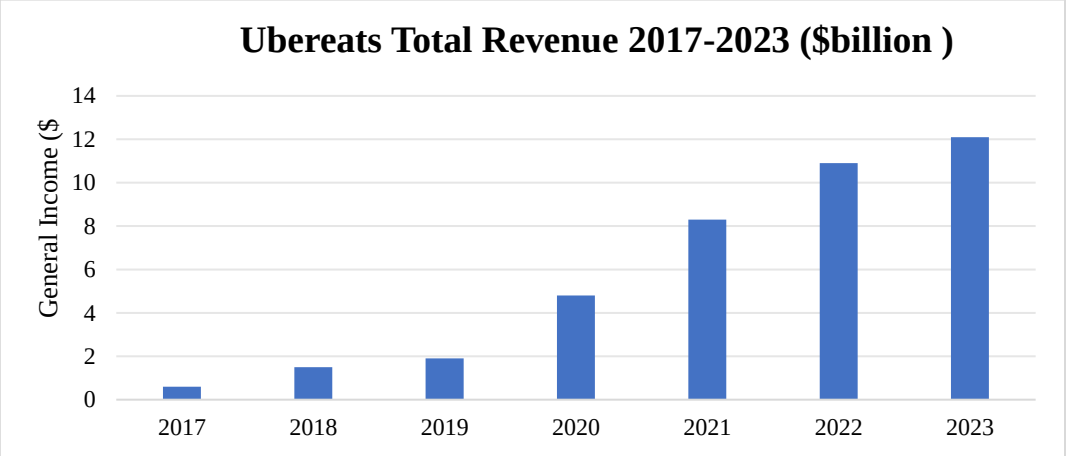

Fig. 3 UberEats total revenue 2017-2023 ($b)

Uber Eats ranked first in global online food delivery revenue in 2023 ($12.2 billion), about $2 billion higher than Delivery Hero. In many regions, it competes fiercely with other major players such as DoorDash, Grubhub, and local services. As of 2023, Uber Eats has a significant market share, especially in the United States, where it holds about 24% of the food delivery market share. Second only to DoorDash, which has more than 50% of the market share. Globally, Uber Eats has expanded its business to more than 45 countries and 6,000 cities, becoming one of the most widely covered food delivery services [3].

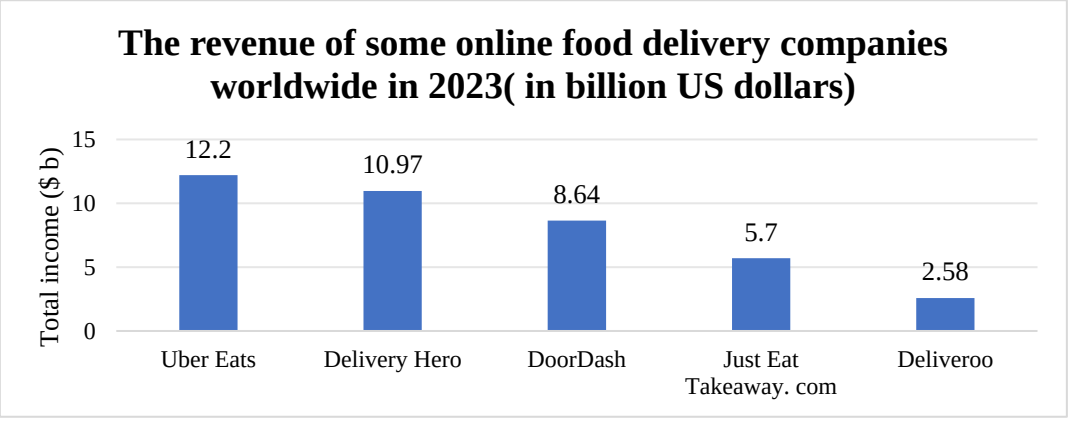

Fig. 4 Revenue of selected online food delivery companies worldwide in 2023

Uber Eats has seen significant revenue growth over the past few years and has become an important part of Uber's overall business model. As shown in figure 4, 2022, Uber Eats contributes significantly to Uber's overall revenue, accounting for nearly 40% of the company's total revenue. This is a significant increase over previous years, highlighting the growing importance of the food

delivery business. According to statistics, Uber's delivery service revenue has been growing year by year. From $280 million in the first quarter of 2018 to $2.5 billion in the first quarter of 2023, $3.09 billion, accounting for an increasing proportion of Uber's total turnover, and the total revenue can be stabilized at $3 billion in 2023.

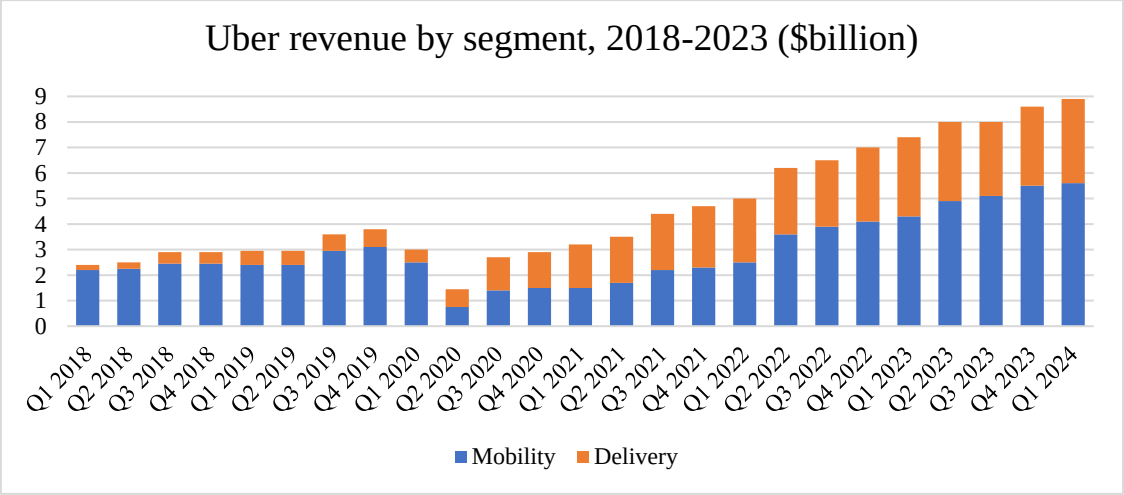

Fig. 5 Uber's revenue by division, 2018-2023 (in billion U.S. dollars)

Uber Eats accounts for an increasingly important proportion of all Uber's businesses. Using autonomous driving to reduce Uber Eats' operating costs will become a top priority for improving Uber's profitability. Figure 5 shows the Uber's revenue by division

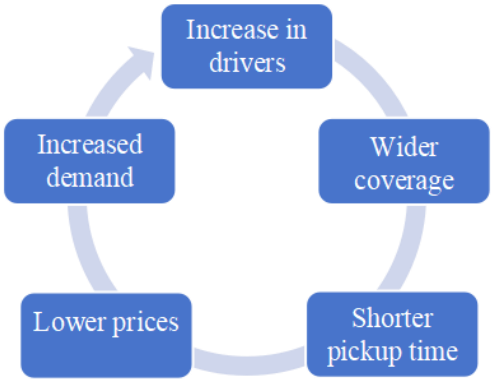

Fig. 6 UberEats positive feedback loop diagram

The UberEats platform uses the positive feedback loop shown in the figure 6 to enable UberEats to continuously attract users to join, thereby forming a strong network effect, combining the three participants to operate and give full play to its three-sided network effect [4].

Currently, driver costs are the main part of UberEats' operating costs. Autonomous driving technology can reduce reliance on labor, thereby reducing labor costs, reducing management fees and operating expenses paid to delivery partners, and transforming from a three-sided network effect to a two-sided network effect. Under this new network effect, UberEats is freed from its reliance on delivery partners in the middle, greatly reducing its operating costs and improving its operating efficiency. By using artificial intelligence technology to select and optimize routes for driving tools, merchants can deliver goods faster and customers can receive goods faster [5].

3. Application of Autonomous Driving in the Food Delivery Service Industry

Uber currently offers autonomous delivery services in Phoenix, Arizona, Fairfax, Virginia, Miami, Los Angeles, Mountain View, California, and Tokyo, Japan, where all-electric sidewalk robots and self-driving cars are delivering food to communities in these areas. Uber is also piloting a public

service in Phoenix, Arizona, and Las Vegas, where Uber customers can take all-electric self-driving cars.

In 2023, Uber announced a strategic partnership with Waymo and Cartken, enabling more users to use Waymo drivers and delivery robots through the Uber platform. In return, Waymo and Cartken will provide services within their business areas, including passenger transportation and Uber Eats delivery. In addition, Uber has signed a 10-year multi-market framework agreement with Motional to achieve the largest deployment of autonomous vehicles (AVs) in major shared travel networks [6].

Since its founding in 2009, Waymo and Uber have revolutionized transportation in unique ways. Now, they are working together to combine Waymo's world-class self-driving technology with Uber's extensive ride-hailing and delivery network. The integration, which will launch publicly in 2023, will initially roll out in Waymo's new expanded operating area in Phoenix, with local delivery and ride-hailing services provided by the Waymo fleet. Uber users will experience the safety and convenience of Waymo's self-driving cars directly through the Uber and Uber Eats apps, while passengers will still be able to book rides directly through the Waymo One app. Waymo's operating area in Phoenix covers more than 180 square miles, making it the largest fully self-driving service area in the world [7].

In February 2024, UberEats officially partnered with Mitsubishi Electric and delivery robot company Cartken to start using self-driving robots to deliver food in Japan. According to the two companies, the sidewalk robot food delivery service will begin in parts of Tokyo at the end of March, and this plan marks the latest collaboration between UberEats and Cartken. UberEats said that Japan will be the first international site for its autonomous food delivery business, which has so far been limited to a few cities in the United States. Previously, Uber Eats and Cartken provided sidewalk robot food delivery services in Miami and Fairfax, Virginia.

4. Impact of Intelligent Driving on Costs

The single largest expense in non-autonomous ride-sharing services, accounting for 80% of the total cost per mile, according to estimates by research firm Frost & Sullivan. By eliminating the driver, fully autonomous vehicles could significantly reduce the cost of a ride while expanding its potential market. Uber, which already provides software services, plans to further reduce the cost of a ride (human and robot cars are about the same cost) by making car ownership availble.

According to McKinsey, 2025-2027 will be the turning point for autonomous driving. Based on the estimated cost curve of the underlying technology for autonomous driving, this will be the point of economic parity between autonomous driving and human driving. In other words, the total cost per kilometer of autonomous driving will be roughly the same as the cost of driving a traditional car. After this turning point, the market demand for autonomous driving will steadily increase [8].

In addition, autonomous driving can use more efficient and advanced algorithms to calculate transportation routes, arrange vehicle itineraries, reduce empty driving rates, and improve the operating time and utilization efficiency of each vehicle; avoid

Fourth, the new operating model improves scalability. Self-driving cars enable Uber Eats to quickly scale up operations without being limited by hiring and training new drivers. The most obvious change is that the use of artificial intelligence can reduce carbon emissions. Driving cars, especially SD electric cars, can lead to a greener future. Artificial intelligence route opti congested areas, reduce driving distance and time, and thus reduce fuel or electricity consumption.

5. Advantages and Threats of UberEats Powered by Artificial Intelligence

5.1. Advantages

First, the application of artificial intelligence will enable Ubereats to reduce delivery costs and

reduce the demand for human couriers, which can significantly reduce Labor costs. In a world with fully self-driving (FSD) cars, Uber Eats' biggest cost could be largely eliminated, increasing profits.

According to research, the cost of each order delivered by robots is reduced by 40% due to lower labor costs [9].

Secondly, it can improve efficiency. Self-driving cars can optimize routes, shorten delivery time, and increase the number of trips, thereby improving overall efficiency. At the same time, Uber Eats can provide 24-hour uninterrupted service in terms of delivery, providing a solution to the problem of no delivery personnel at night.

Third, the addition of robots improves safety. Self-driving cars are designed to reduce accidents caused by human error, thereby reducing liability costs. It is estimated that 94% of car accidents are caused by human error. If the car is programmed to operate well within safety guidelines, it may be safer to follow all the rules. Advanced artificial intelligence and sensor technology (such as lidar) in self-driving cars can detect potential road hazards and adjust routes in real-time. Automatic object avoidance may make roads safer and have fewer accidents. In addition, using autonomous driving to deliver Uber Eats can also avoid problems such as takeaway theft, and use electronic passwords to store the delivered takeaway. Robots can achieve completely contactless delivery, which is particularly beneficial during health crises such as the COVID-19 pandemic.

mization algorithms play a vital role in ensuring efficient and timely transportation. By analyzing real-time traffic data, road conditions, and historical travel patterns, these algorithms can determine the fastest and most economical routes for drivers to get to their destinations. The integrated navigation system further guides drivers along optimized routes, reducing travel time and fuel consumption while improving overall service quality.

5.2. Threats

The first and foremost challenge that Ubereats faces is regulatory challenges. Different regions have different regulations on the use of autonomous vehicles on public roads and sidewalks, which may limit the deployment of delivery robots. The second is that technical risks pose a threat to Ubereats. Technical failures or cybersecurity threats may lead to operational disruptions and safety issues. Speed and stability are another aspect that requires special attention. As speed increases, the stability of the robot cannot be affected. This determines the optimal operating speed [10]. In addition, the high upfront costs have an impact on Uberetas' financial deficit. Developing, testing, and deploying delivery robots requires a large upfront investment in technology and infrastructure. The ongoing maintenance and updating of robots is costly and requires professional skills. Despite reducing operating costs, the utilization rate of robots is less than 10%. This inefficiency, coupled with the high initial investment, poses a huge financial risk and calls the overall return on investment into question. If the utilization rate of the robot system remains low, the huge costs involved in deploying the robot system may not be justified, thereby posing a considerable risk to achieving sustainable financial results [9].

Beyond this, there are significant concerns about legislative and regulatory barriers that could hinder the adoption of autonomous delivery robots. Furthermore, local acceptance of such technologies remains uncertain. For example, San Francisco has banned all food delivery robots from using sidewalks, highlighting the challenges these innovative technologies face in gaining widespread acceptance and integrating into everyday urban environments. This reflects widespread concerns that similar restrictions will be imposed in other cities, further complicating the deployment and expansion of autonomous delivery systems [10].

Finally, fierce competition already exists in the AV market. Other companies investing in AV technology could intensify market competition. If FSD cars become a reality, then Uber’s ride-hailing service may no longer be necessary, as software providers that develop the technology could simply create their self-driving or robotics services. This would be like the operating system that controls the new computing platform. In this case, the car would become a commodity [11,12].

6. Conclusion

Currently, many companies have begun to invest in driverless vehicles, such as Meituan, Didi Chuxing, and Uber. Unmanned transportation machines have also brought customers a new experience and provided people with more efficient and fast services. This revolutionary change will greatly change the business model of the future transportation industry. The new network effect can significantly reduce transportation costs and bring new vitality to the profitability of companies.

With the booming autonomous driving market and food delivery business, Uber Eats is expected to innovate its business model through this technology, improve market competitiveness, expand market demand, and set new service standards worldwide. Despite potential threats such as regulatory challenges, technical risks, and high-cost investments, the maturity and application of autonomous driving technology will reach an economic parity point in the future, bringing broader market opportunities to Uber Eats. Through cooperation with technology providers, Uber Eats will be able to expand its operations and improve service efficiency and safety through zero-contact transportation. The use of new energy vehicles will reduce carbon emissions and provide consumers with safer and more efficient services, leading the food delivery industry to a greener and smarter future.

In the future, driverless cars will be everywhere. Whether it is daily driving or express delivery, they will get rid of their dependence on manual driving. Technological breakthroughs will become the key to the core competitiveness of enterprises, and new business models will also bring more opportunities.

Authors Contribution

All the authors contributed equally and their names were listed in alphabetical order.

References

[1] Wang Z Y. The inspiration of Uber budget management model to the trend of comprehensive budget management in traditional industries. Business information, 2024, (12): 21-24.

[2] David C. Food Delivery App Report 2024. 2024.

[3] Lynn B. Revenues of selected online food delivery companies worldwide in 2023. 2024, 7, 4.

[4] Chen W, Lu S K, Gao Y. Research on the configuration of network effect factors in digital platform enterprises -- based on fuzzy set qualitative comparative analysis method. Business Research, 2024, (01): 30-37.

[5] Lou Y. Analysis of O2O e-commerce models——taking Meituan and Ubereats as examples. Proceedings of the 2nd International Conference on Business and Policy Studies (part 5). University of Bath, 2023:6.

[6] 2024 Uber Technologies Inc. Driving autonomous forward. 2024.

[7] Wang Z M, Li S. Competition between autonomous and traditional ride-hailing platforms: Market equilibrium and technology transfer, Transportation Research Part C: Emerging Technologies, 2024, 165, 104728.

[8] Wen X. McKinsey: China's auto industry is evolving rather than "internal volume". Intelligent connected vehicles, 2024, (02): 76-79.

[9] Schnieder M, Hinde C, West A. Land Consumption of Delivery Robots and Bicycle Couriers for On-demand Meal Delivery Using GPS Data and Simulations Based on the Time-Area Concept. Sustainability, 2021, 13, 11375.

[10] Yong C, BentFei L, KhimLeng T, et al. A new automated food delivery system using autonomous track guided center-wheel drive robot. 2010 IEEE Conference on Sustainable Utilization and Development in Engineering and Technology, Kuala Lumpur, Malaysia, 2010, 32-36.

[11] Sharma A, Zanotti P, Musunur LP. "Drive Through Robotics: Robotic Automation for Last Mile Distribution of Food and Essentials During Pandemics," in IEEE Access, 2020, 8, 127190-127219.

[12] Neil P. Huge Risk That Could Spell Trouble for Uber. 2023.