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AI AS AN APPROACH TO ANALYZING UBER'S BUSINESS ENVIRONMENT IN THE TRANSPORTATION SERVICES SECTOR

Abstract: *This study aimed to analyze the business environment of organizations that use artificial intelligence in the service industry through a SWOT analysis of Uber's global environment. The findings concluded that the company relies on artificial intelligence techniques to develop its services, such as the smart positioning system and the pricing algorithms that consider various price-determining factors, alongside a demand forecasting system to manage its customers. This reliance on AI has contributed to Uber's strengths, including its popularity, low costs, and user convenience. It has also created future opportunities for investment in self-driving cars, a broad geographical scope for expansion, and a promising outlook with the increasing number of internet users. However, these advantages do not overshadow the weaknesses, which include ease of use, traditional practices, limited customer profitability, biased pricing, and driver distribution systems. Additionally, the reliance on artificial intelligence exposes Uber to various threats, particularly in legal, regulatory, ethical, and security domains.*

Keywords: *artificial intelligence, SWOT analysis, transport services, Uber.*

JEL classification: *L25; L86; M15; O32*

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ხელოვნური ინტელექტი როგორც მიდგომა Uber-ის ბიზნეს გარემოს ანალიზისთვის სატრანსპორტო მომსახურების სექტორში

აბსტრაქტი: *ამ კვლევის მიზანი იყო იმ ორგანიზაციების ბიზნეს გარემოს ანალიზი, რომლებიც იყენებენ ხელოვნურ ინტელექტს მომსახურების ინდუსტრიაში, Uber-ის გლობალური გარემოს SWOT-ანალიზის საშუალებით. კვლევებით დადგენილია, რომ კომპანია ეყრდნობა ხელოვნური ინტელექტის ტექნიკებს თავისი მომსახურებების განვითარებაში, როგორიცაა ჭკვიანი პოზიცირების სისტემა და ფასების ალგორითმები, რომლებიც ითვალისწინებს სხვადასხვა ფასის განსაზღვრის ფაქტორს, ასევე მოთხოვნის პროგნოზირების სისტემა მომხმარებლების მართვისთვის. ეს დამოკიდებულება ხელოვნურ ინტელექტზე შეუწყვეტლად უწყობს ხელს Uber-ის ძლიერი მხარეების შექმნას, მათ შორის მისი პოპულარობა, დაბალი ხარჯები და მომხმარებლის კომფორტი. ასევე შექმნა მომავალი შესაძლებლობები ინვესტიციებისათვის ავტომატური მანქანების, ფართო გეოგრაფიული გაფართოების და ინტერნეტ მომხმარებლების მზარდი რაოდენობის თვალსაზრისით. თუმცა, ეს უპირატესობები არ მალავს სისუსტეებს, მათ შორის გამოყენების სიმარტივეს, ტრადიციულ პრაქტიკებს, შეზღუდული მომხმარებლის სარგებელს, სუბიექტურ ფასებს და მძღოლების განაწილების სისტემებს. გარდა ამისა, ხელოვნური ინტელექტის გამოყენება ამ exposes Uber-ს სხვადასხვა საფრთხეების წინაშე, განსაკუთრებით სამართლებრივი, რეგულატორული, ეთიკური და უსაფრთხოების სფეროებში.*

საკვანძო სიტყვები: *ხელოვნური ინტელექტი, SWOT-ანალიზი, სატრანსპორტო მომსახურებები, Uber*

JEL კლასიფიკაცია: *L25; L86; M15; O32*

Introduction and review of literature

The traditional industries rely on raw materials, transforming them through a series of processes into consumable products. In contrast, the service industry focuses on minimal tangible goods and a significant amount of intangible activities, such as skills, time, and processes that result in solving customer problems. For instance, transport services require a physical means (such as a car or bus) in addition to the driver's skill and the time dedicated to driving in order to provide a solution for a customer needing to travel from point "A" to point "B," without the customer retaining ownership of the transport vehicle (Nayyar, Hallward-Driemeier, & Davies, 2021).

The global economy has recognized that this economic activity, which depends on skill, physical effort, and time, presents a significant opportunity for economic growth and the incidental expansion of other economic sectors. Notably, services have increasingly contributed to national wealth, accounting for 55% of the gross domestic product (GDP) in 2019 and providing 45% of jobs worldwide.

With the advancements in technology, the term "artificial intelligence" has emerged, which relies on analyzing vast data sets to provide institutions and individuals with rapid-response tools for solving problems and delivering accurate, detailed information about their various needs. It also allows for sophisticated engineering of learning through machine language, with the potential to trigger another revolution in industry—one that could significantly accelerate production and provide information quickly and accurately, thus facilitating decision-making.

The rapid growth of service economies could be further amplified if a hybrid business model that combines traditional service delivery processes with digitization and artificial intelligence is adopted. Companies and public institutions are racing to optimize the use of AI technologies.

This study aims to present a case analysis of a leading company that employs artificial intelligence techniques in the design and engineering of its services—namely, the global transportation service provider Uber. The analysis will involve examining the business environment and identifying the strengths, weaknesses, opportunities, and threats associated with Uber's use of artificial intelligence.

The main research question arises from the discussion: What strengths, weaknesses, opportunities, and threats characterize the business environment of an organization utilizing artificial intelligence?

The study's hypotheses indicate that artificial intelligence serves as strength for service organizations while reducing their weaknesses. Furthermore, it plays a role in creating opportunities within the service industry, although its implementation does not eliminate the potential threats faced by the organization.

Understanding the dynamics of opportunities and threats, alongside the strengths and weaknesses of organizations employing artificial intelligence, is crucial, particularly in the service sector and transportation industry. Analyzing Uber's international business environment provides valuable insights into its experience with machine learning.

Methodology

SWOT is an acronym for "Strengths, Weaknesses, Opportunities, and Threats," and it is a strategic planning method employed by organizations to evaluate these four elements. This

analysis can be applied to a company, product, individual, or industry. Some authors attribute the development of SWOT analysis to Albert Humphrey, who conducted this work during the 1960s and 1970s using data from Fortune 500 companies (Rihan, 2023, p. 1).

This method is especially useful for informed decision-making based on evidence. It focuses on planning and developing strategic documents. The insights gained from SWOT analysis guide the formulation of strategies, projects, or policies (Shah, 2024, p. 87). SWOT analysis is a flexible tool designed to create and enhance strategies for products or services by capitalizing on available market opportunities and current developments, especially in technology, while also considering future risks and possible threats.

(Dudovskiy, 2021) observes in his study that Uber possesses strengths such as first mover advantage and low operational costs, while facing weaknesses related to a damaged brand image and low driver earnings. The study also highlights opportunities arising from the growing popularity of the sharing economy and the development of self-driving cars, alongside threats from legal challenges and increasing competition.

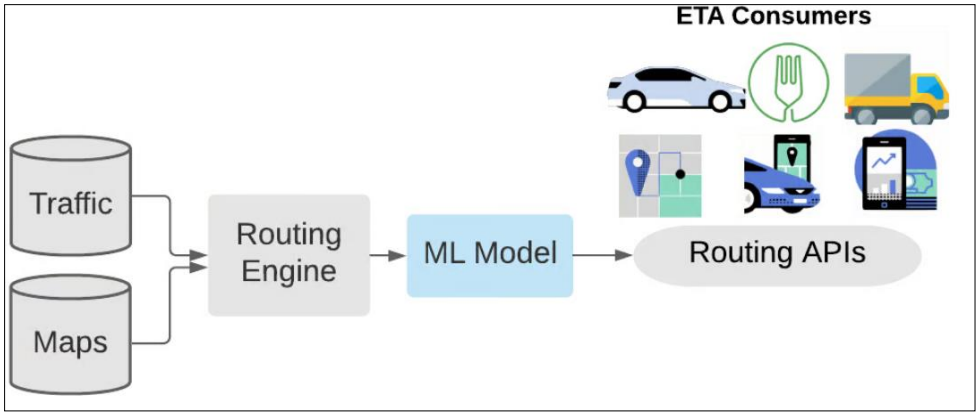
Results

Founded in 2009, Uber is a multinational company headquartered in San Francisco (Vultur & Enel, 2020, p. 16), Uber provides a digital platform supported by a vast network of transportation services, primarily acting as an intermediary between taxi drivers and customers (passengers). In addition to ride-hailing, Uber offers food delivery services, freight services, and new transportation options such as electric bicycles, along with electronic support platforms (UBER, 2019, pp. 3-5). Drivers pay Uber a commission based on their revenue (Angrist, Caldwell, & Jonathan, 2021, p. 272), which ranges from 20% to 30% (Vultur & Enel, 2020, p. 16). The company has entered numerous international markets, operating in 72 countries, with key services offered in the United States, Canada, Latin America, Europe, Asia, the Middle East, and select African nations (UBER, 2022, p. 4).

1. Areas of Uber's Use of Artificial Intelligence

1.1. Enhancing Location Accuracy through Sensing and Perception

Figure 1. Hybrid Model for Estimating Time of Arrival (ETA) Using Machine Learning Techniques



Source: (Hu, Binaykiya, Frank, & Olcay, 2022)

The GPS system has become a standard tool for Uber's team, especially as traffic congestion and peak hours have led to losses for e-taxi drivers and customer dissatisfaction. These issues arose from limitations in Uber's ridesharing platform (Sawhney, Shah, Yu, & Rubtsov, 2019, p. 1). In response, Uber's team developed a more accurate platform utilizing artificial intelligence, which enhances the ability to track taxi locations and facilitate customer pickup. This system also identifies critical routes to optimize arrival times while considering traffic conditions (UBER, 2019).

The figure 1 illustrates the processes of routing and pricing for Uber's taxi services through a hybrid model for estimating time of arrival (ETA) and subsequent pricing. This model is termed "hybrid" as it combines digital operations reliant on artificial intelligence with a set of algorithms that determine critical routing and pricing based on demand-influencing factors (such as traffic conditions, weather, time of day, peak hours, etc.). The process involves the following stages:

- Model Inputs: The inputs for the hybrid model consist of receiving requests and determining customer locations on the map. Subsequently, traffic conditions are assessed using intelligent recognition technology and marked on the map. In another phase, the locations of the nearest available drivers are identified for task assignment.
- Routing Processing: The trip route is plotted using a routing engine.
- Processing with Machine Learning Models: At this stage, the length of the trip and the estimated time of arrival (ETA) are predicted based on spatial characteristics (destination, traffic conditions, weather) and temporal factors (time of day, demand levels), which then inform the pricing.
- Routing via Application Interface: This phase represents the outputs of the hybrid model, directing both the driver and the customer to the appropriate meeting point (pickup location), along with all relevant information previously gathered (route, price, ETA, etc.).

It is important to note that these processes occur at extremely high speeds, measured in fractions of a second, and the models exhibit a high degree of accuracy, particularly as they are tested using the Mean Absolute Error (MAE) metric.

1.2. Pricing Prediction System

Uber employs an artificial intelligence system to predict transportation prices, particularly for its taxi services. This involves collecting data on various factors influencing pricing, such as historical trip data, trip length, current traffic conditions, time of day, and anticipated weather conditions. This information forms the basis for a Random Forest Algorithm, which utilizes statistical regression analysis and a connected set of decision trees. This approach enables data analysis and translates it into predictive metrics for trip pricing. In the future, this system will facilitate demand forecasting in specific locations to aid in trip scheduling (Vidhury, Kandwal, Aggarwal, Danishwaran, & Pande, 2023, p. 343).

1.3. High Dynamics in Market Prediction

Uber utilizes thousands of models to forecast supply and demand for its taxi services, varying by location and time. Each city represents a unique market for Uber, complete with its own specific forecasting models. The company's prediction project is based on time series analysis, real-time equations, and regression models, achieving high accuracy (MAPE = 10%) (Mean Absolute Percentage Error). These models are adapted to account for expected events and

holidays, and are equipped with a Model Health system that alerts the team to unexpected events impacting demand forecasts, sending signals to the support team to address any sudden deviations in the models (Sun, Nader, & Chintan, 2020, p. 482).

2. Business Environment Analysis of Uber

This section aims to highlight the strengths, weaknesses, opportunities, and threats of Uber through a SWOT analysis, as illustrated in table 1. This analysis provides insights into Uber's positioning in global markets.

Table 1. SWOT Analysis of Uber

Strengths	**Weaknesses**
Global popularity Reduced operating costs User Convenience Service Diversification	Service Diversification Ease of imitation Limited target audience Limited Driver Earnings
Opportunities	**Threats**
Self-driving cars Brand Strength Growth of internet usage worldwide Large geographic scope for expansion Supplier Negotiating Power	Legal and regulatory barriers Intense competition Lack of control over driver ethics Loss of customers

Source: (Dudovskiy, 2021)

2.1. Strengths

a. Popularity

The number of active Uber drivers reached 5.7 million in the first quarter of 2023, an increase of 35% compared to the previous year, 2022 (UBER, 2023, p. 1).

Uber operates in major cities and urban areas across 72 countries, including the United States, Canada, Latin America, Europe, Asia, the Middle East, and several African nations (UBER, 2022, p. 4).

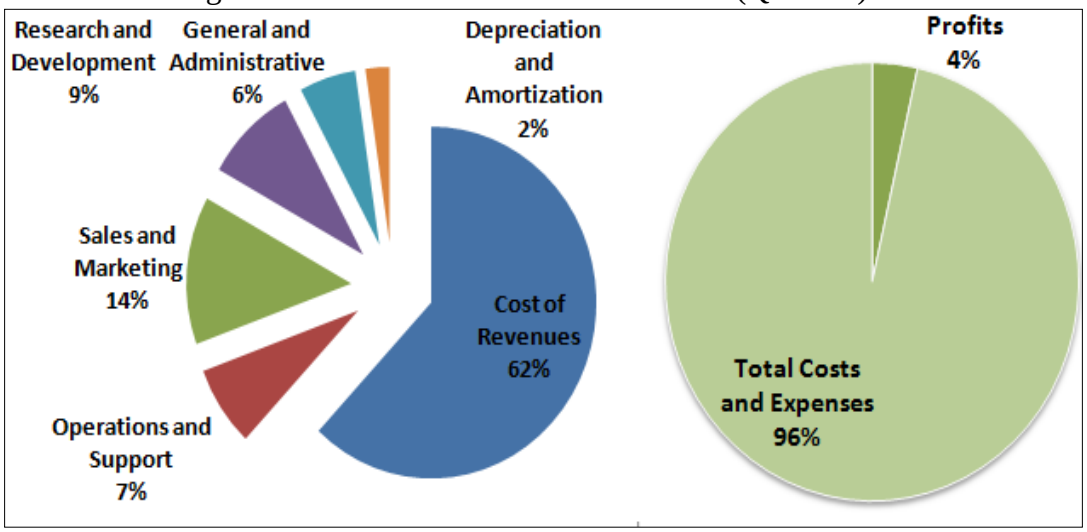
In 2023, demand for Uber's services exceeded supply levels, prompting the company to extend driver working hours by 10% compared to previous years (UBER, 2023)

Regarding the economic impact of Uber's popularity in international markets, it has captured a significant share of the taxi transportation market. A survey of over 29,000 taxis in Taiwan conducted by (Chang, 2017, p. 475) found a decline of 12% and 18% in traditional taxi revenues during the first and third years following Uber's entry into Taiwan, respectively. This indicates intensified competition in the transportation market in Taiwan.

b. Reduced Operating Costs

Figure 2 illustrates the cost and profit structure within Uber. As shown on the right side of the figure, the net profit margin is estimated at 4% of revenues during the second quarter of 2023, amounting to $326 million. This suggests that annual profits could reach approximately $1.304 billion, a substantial figure despite appearing relatively small as a percentage. This phenomenon can be attributed to the fact that the capital utilized for operations is owned by the drivers (customers), with revenue being generated from the company's, then, the drivers' payments are granted in a subsequent phase.

Figure 2. Cost and Profit Structure of Uber (Q2 2023)



Source: (UBER, 2023, p. 9)

On the left side, the specifics of the cost structure are outlined. According to Uber's published accounting results on its website, the cost of revenues amounts to $5.515 million, representing 62% of total revenues achieved during Q2 2023. Sales and operating costs account for 14%, totaling $1.218 million. Support operations and research and development represent 7% and 9%, respectively, with total amounts of $664 million and $808 million. These significant figures highlight the critical importance of these activities within the company and reflect its commitment to utilizing machine learning and artificial intelligence technologies. General and administrative services account for 6%, while depreciation costs represent 2%.

c. User Convenience

The ease of accessing Uber services with just a tap on its mobile applications has led to the completion of 2.3 billion rides during Q2 2023, averaging 25 million rides per day (UBER, 2023, p. 1). Researchers in this field (Bishnoi & Reetika, 2019, p. 1029) concluded that Uber has created intense competition in the Indian transportation market, noting that its hassle-free and comfortable rides constitute a competitive advantage that positions it as a leader, contributing to a decline in demand for public transportation.

d. Service Diversification

Digital platforms facilitate the easy diversification of services and the launch of new offerings. Uber requires minimal time to achieve this, as the operational principle of its taxi services closely resembles that of its food delivery service (Uber Eats). This involves identifying customer orders and connecting them with drivers (clients) and restaurants as meal suppliers, followed by the delivery process. The same model applies to its freight and mail delivery services.

2.2. Weaknesses

a. Service Diversification

Pricing Bias: Researchers (Pandey & Aylin, 2021, p. 822) analyzed a sample of 100 million

cars in Chicago using random effects models and found significant bias in AI-based pricing related to demographic characteristics (skin color, income level, age, and education). Although the study focused on Uber's pricing system, the lack of disclosure regarding the criteria used in its pricing algorithm hindered definitive conclusions.

Customer Distribution Bias: According to (Vultur & Enel, 2020), there is a need to "open the black box" of Uber's algorithm to ensure its rules are transparent and neutral. They noted ambiguity in the distribution rules for customers (drivers) under varying temporal and spatial conditions, favoring those deemed more productive. Additionally, (Kashyap & Anjali, 2018, p. 169) argued that Uber created an uneven playing field in the Delhi transportation market by allowing non-professional government employees to enter the rideshare market, thus disadvantaging traditional taxi drivers.

b. Ease of Imitation

Despite Uber's reliance on advanced technology and its pioneering status, it faces numerous competitors employing similar digital platform models due to the ease of imitation. For instance, Lyft, established in 2012, has become a strong competitor to Uber in the U.S. transportation market.

c. Limited Target Audience

Uber primarily targets a limited segment of tech-savvy users, which represents a weakness. The company could diversify by owning its own vehicles and delivery fleets operating traditionally, especially in the U.S., its home market. It could also explore modern rapid delivery methods, such as helicopters and drones.

d. Limited Driver Earnings

Despite Uber's efforts to enhance performance through AI, it faces criticism regarding its control over drivers' work lives. The AI-driven pricing policy lacks negotiation flexibility for driver-partners, and performance evaluations vary based on the ride offers provided by Uber (Ternullo, 2019). Consequently, drivers have little control over their performance and are subject to directives from Uber. Furthermore, Uber’s contracts prevent drivers from receiving any additional commissions in any form (Nowag, 2016, p. 96).

2.3. Opportunities

a. Self-Driving Cars

While Uber has not yet developed a fully autonomous vehicle, it has advanced certain technologies, such as cameras, radar, and GPS systems. The company has also created a self-driving computer and sensors capable of detecting people and utilizing remote control techniques within a range of 100 meters. These intelligent systems assist with parking and recognizing objects within a 5-meter vicinity (Gwak, Jung, Oh, Park, Rakhimov, & Ahn, 2019). The self-driving car market is still in its infancy, with few companies engaged, notably Tesla, Google, and General Motors. However, challenges such as high costs, safety concerns, and consumer readiness for machine-controlled projects hinder a clear future vision for autonomous vehicles.

b. Brand Strength

The factors contributing to Uber's brand strength include:

- It's pioneering role in technology-driven transportation, recognized by over 40 million individuals monthly.

- Extensive presence in 72 countries worldwide (Yunhan & Dohoon, 2022).

c. Growth of Internet Users

The increasing number of internet users globally presents a significant opportunity for Uber to attract more drivers and customers. Expanding internet coverage could open new markets, particularly in remote and non-urban areas. Elderly individuals, who often do not rely on technology for transportation, represent a demographic that has a high need for safe travel and reliable scheduling.

d. Geographic Expansion Potential

Uber's reliance on a digital platform allows for geographical expansion, especially internationally. Its services do not require substantial capital investment or physical offices to operate across borders. Instead, the establishment of authorized agents to oversee customer (driver) interactions and address issues locally can facilitate this growth. Therefore, Uber has substantial opportunities for expansion in densely populated urban areas, as well as potential entry into new transportation markets such as low-cost air travel and maritime transport, targeting groups like employees, sports teams, cultural groups, business travelers, and travel agencies.

e. Supplier Negotiating Power

In the future, Uber could possess significant negotiating power with suppliers in the Uber Eats segment, potentially securing preferential pricing for fast food from restaurants. This presents an opportunity for the company to enhance profitability while sharing those gains with customers and clients.

2.4. Threats

a. Legal Issues

Researchers have highlighted the contentious nature of Uber's contracts, particularly regarding their compatibility with labor and competition laws. Uber faces scrutiny over potential monopolistic practices, especially concerning pricing algorithms. According to (Nowag, 2016), Uber and similar companies using smart applications (such as Amazon and eBay) are seen as conflicting with traditional competition laws. Furthermore, Uber's services often evade consumer protection regulations. Researcher (Guido, 2016, p. 383) found that consumers perceive digital platforms as contracting parties, whereas they actually serve as intermediaries, indicating a lack of awareness regarding their legally granted rights. The researcher proposed increased transparency in contracting processes and clearer terms in transactions involving drivers, intermediaries, and customers.

b. Intense Competition

Table 2. Overview of Uber's Key Competitors

Services	Major Competitors
Ridesharing	Public transportation, traditional taxis, Lyft, Curb, DIDI, etc.
Delivery Services	DoorDash, Deliveroo, Glovo, Instacart, Gopuff, Rappi, iFood, Delivery Hero, Just Eat Takeaway, Amazon
Freight Services	C.H. Robinson, Total Quality Logistics, XPO Logistics, Convoy, Echo Global Logistics, Coyote, Transfix, DHL, NEXT Trucking

Source: (UBER, 2022, pp. 5-6)

Uber faces significant competition in the transportation sector, as its services are easily replicable, as mentioned previously. Given Uber's extensive global presence, traditional transportation providers are unlikely to stand idly by as Uber rapidly expands and attracts customers. Uber contends with numerous direct competitors (table 1).

In 2014, prior to entering the Chinese transportation market, Uber garnered $1.5 billion, representing 60% of its global revenue. However, it faced fierce competition from DIDI in this vast market, ultimately resulting in Uber exiting China after losing board positions. This failure was primarily due to DIDI's superior operational efficiency and its ability to diversify its service offerings, along with a favorable brand image (Yunhan & Dohoon, 2022).

c. Ethical and Security Threats

Despite a success rate exceeding 99.99% for Uber rides, incidents such as sexual and physical assaults, sometimes resulting in fatalities, have raised concerns. Uber is attempting to mitigate safety-related errors through new AI-driven initiatives, such as driver support programs ("911"), selecting safer routes that minimize sharp turns and high-risk areas, and implementing intersection alerts, as well as monitoring taxi routes through the "Trip Record" feature (UBER, 2023, p. 2).

Another threat arises in countries like Australia, the UK, and South Africa, where Uber's operations face governmental and traditional transportation sector resistance. This is evident through violence against Uber drivers identified by their branding on vehicles, and legal and regulatory frameworks in these regions often hinder the company's operational freedom, impacting employment mechanisms and taxation structures (Dinisco & Schachtebeck, 2018, p. 461).

d. Driver Attrition

The phenomenon of driver attrition poses a supply challenge for Uber, with a reported 4% turnover rate among drivers in 2023. Reports indicate that demand currently exceeds supply in Uber's economic model (UBER, 2023, pp. 1-2). This attrition may stem from the driver lifecycle, which typically sees initial active engagement followed by a decline in performance, particularly if the incentive structure does not meet their expectations, leading to inactivity and a lack of support from the company.

Conclusion

This study analyzes Uber's business environment, one of the world's leading transportation companies and a pioneer in the use of artificial intelligence (AI) technologies, utilizing the SWOT model. The company has focused on enhancing the accuracy of location mapping on its user platform, as well as improving sensing and perception through AI-driven algorithms. These advancements facilitate customer discovery and simplify the identification of meeting points. Additionally, Uber employs AI to predict prices accurately using historical ride data and various pricing factors, such as trip length, traffic conditions, time of day, and weather forecasts. An intelligent demand forecasting system also distributes drivers to manage increasing demand or reduce supply during downturns, relying on high-accuracy time series analysis and real-time equations that adapt to varying conditions.

The study concludes with a SWOT analysis of Uber's business environment, revealing several key findings:

- Uber's significant global presence is a clear strength, with 5.7 million drivers operating across 72 countries, representing a growth of 35% in 2023. The company's reduced operating costs allow for substantial profits, reported at $326 million during Q2 of the same year. User convenience is another strength, as customers require only a smartphone with internet access, eliminating the need to navigate crowded streets. Moreover, Uber's diversification into food delivery and freight services represents a strategic strength.
- Despite leveraging AI in its transportation services, Uber still faces weaknesses, particularly related to user experience, such as pricing biases and unequal distribution of drivers based on their activity levels. The ease of imitation of Uber's business model exacerbates competitive pressures. Additionally, targeting a limited segment of tech-savvy users and the issue of restricted earnings for drivers are notable weaknesses.
- Uber has opportunities to invest in the self-driving car sector, having initiated this journey by developing relevant technologies, including GPS systems and advanced sensing devices. The company can also leverage its brand strength for geographic expansion into new transportation avenues (e.g., air and sea), potentially entering untapped markets. Furthermore, the global increase in internet users presents a promising opportunity for Uber to attract more customers.
- Uber encounters various threats, including legal challenges stemming from its acceptance in multiple markets and the imposition of regulatory frameworks. Competition intensity poses a risk to its market share, as evidenced by Uber's exit from the Chinese market due to fierce competition. Ethical and security threats also loom, with incidents of misconduct and accidents occasionally resulting in fatalities. Moreover, the phenomenon of driver attrition poses a direct threat to Uber's future, particularly as many drivers cite insufficient income as a reason for leaving.

Based on these findings, the first hypothesis stating that "the use of artificial intelligence represents a strength for service organizations and reduces their weaknesses" can be rejected. Strengths and weaknesses are fundamentally linked to AI usage, which can directly impact a company’s performance and competitiveness. While AI may provide a competitive advantage in the service industry, it also introduces vulnerabilities.

The second hypothesis, "artificial intelligence contributes to creating opportunities for the service industry," can be accepted, as it reflects a pathway to the future of various industries, particularly in services.

The third hypothesis, stating that "the use of artificial intelligence in the service industry does not prevent the organization from facing threats in the business environment," is largely accepted, given that AI usage encounters numerous challenges, including legal, regulatory, ethical, and security issues.

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