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ANALYSIS OF TAXI SERVICE ORGANIZING AND REGULATION FOR BAKU CITY

Summary. With the expansion of the use of digital technologies, the nature of almost all service industries has changed. Taxi services are no exception. The use of mobile applications, and the creation of call centres, have simplified the access of passengers to taxis and created a new situation. Despite this, with the emergence of a new situation, new problems appeared. This article aims to study taxi services organization and regulation. Thus, surveys were conducted to study attitudes towards offered services for passengers and drivers, the main participants in the taxi market. The questionnaires are aimed at studying the satisfaction of passengers and the attitude of drivers to working conditions. The total weight of using a taxi in comparison with other types of urban transport is determined. The frequency and main reasons for requests for taxi services were identified. This paper also studied the degree of use of mobile applications for calling a taxi and the distribution of

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orders between taxi companies. Surveys among drivers were mainly aimed at studying the mode of their work and their attitude to the conditions offered by taxi companies. To solve the identified problems, an appropriate regulation method through a single digital platform was proposed.

Keywords: taxi service, mobile applications, passenger satisfaction, taxi drivers, digital platform

1. INTRODUCTION

Different service sectors have different characteristics for the formation of market relations. The taxi market is no exception. With the development and widespread use of information technology, the taxi market has assumed a new dimension.

According to the classical taxi concept, passengers use taxi services directly at the taxi rank or on city streets and roads. However, with the development of modern means of communication, a new era of taxi orders began. Favourable conditions arose for intermediaries (aggregators) who want to systematize their activities and turn this activity into a business. Intermediaries charge a fee for the services provided, directing orders received from the population for taxi services to drivers. Orders are accepted through call centres and mobile applications. Thus, a natural digital platform appeared in the taxi market. Under current conditions, companies with experience in relevant markets on the global market have been able to capture a significant share in meeting market demand by offering more flexible and efficient (material and physical) conditions. Offered mobile apps guide customers to find an empty vehicle closer to them.

Despite many similarities in the organization of taxi services in cities, there are some differences in the work of many taxi services in modern operations. These differences change the overall character of the taxi market. There are some differences in prices for taxi services for passengers in different cities. Some cities have an extensive public transport network. In this case, taxi services arise only when there is a special demand (faster or more convenient delivery) and becomes an expensive service.

The price of taxi services in the cities of the world is calculated for each landing, and additionally, per kilometre. According to the decision of the Cabinet of Ministers of the Republic of Azerbaijan [1], these prices in Baku should be calculated at the rate of AZN 1.5 (USD 0.88) per landing and from AZN 0.5 (USD 0.29) per kilometre depending on the distance. However, sometimes, taxi companies offer lower prices. Especially during the lockdown, some companies increased the number of trips per car per day and reduced tariffs below the market rates.

As a result of the growing demand for taxis, more than 50,000 taxi cars have appeared on the streets of Baku. The number of vehicles licensed by the Baku Transport Agency for the provision of relevant services over the past 6 years (2016-2022) amounts to 43,775 units [2]. In addition, there are taxis in Baku that serve passengers on fixed routes for a single ride charge. The activity of such taxi services is not officially allowed; however, the number of such fixed routes in Baku is no less than ten.

As can be seen from the above, the market for taxi services in Baku city is not well-regulated. An analysis of the current state of the organization is necessary to make decisions regulating the operation of taxi services. This is possible with a regular study of the situation in the taxi market.

2. LITERATURE REVIEW

In large cities, public transport and taxis complement each other. Therefore, when determining the demand for taxi services, the operation of public transport should be considered [3]. In some cities around the world, there is the practice of using minibuses as public taxis [4-6]. For a long time, minibuses were used as taxis in many cities. It should be noted that fixed-route taxis combine the features of taxis and bus transport. Studies show that a large number of such taxis have a negative impact on the accident rate and the environment [7]. There are experiences using motorcycles [8] and bicycles [9] as taxis. In Athens, taxi-sharing services are widely offered to passengers [10]. The essence of such a service is that a taxi serves several customers in one trip.

Researches show taxi services have many problems, including safety issues. Often, taxi drivers break the rules to deliver customers quickly, especially by speeding. The solution to this problem is regular training of drivers. In addition, the driver control system can be effective [11].

Several works have been devoted to the study of the influence of various factors on the work of taxi services. Ge et al. compared taxi trips in Shanghai and New York [12]. The relationship between the flow of passengers in Shanghai and land use, the number of permanent residents, the number of car owners, and employment in the city were analyzed. Al Ali et al. commented on the taxi service infrastructure in Dubai [13]. For comparison, the situation with the availability of taxis in European countries was analyzed, and a comparison was made of the number of taxis per capita. Steps with taxi service strategy discovery were estimated.

Taxi trajectory analysis shows that there is a direct relationship between mobility and urban structures in cities [14]. A study in Lisbon based on GPS taxi tracking examined urban mobility by identifying pick-up and drop-off locations for passengers [15]. It also allows for predicting the future of taxis.

Conducting surveys allows for identifying the attitude and satisfaction of users and even service providers in the organization of specific activities (including taxi services). Mensah and Ankomah conducted a study on taxi services and passenger satisfaction in areas of Accra where metro stations are located [16]. As a result of the studies conducted during the month, a factor analysis of the material value, reliability, trust, empathy and reactivity of indicators was carried out. Reliability and empathy scores were lower than the other indicators.

The study by Ziyad et al. is also based on a survey, and the results of the survey were processed and analyzed using the SPSS program [17]. Furthermore, a study by Pandya et al. examined the impact of private companies on the taxi market, considering factors of interest to customers [18]. The theoretical foundations of dependent and independent indicators have been developed. The survey results were processed using the SPSS and Minitab programs to test the null and alternative hypotheses.

The development and rapid spread of digital technologies have led to changes in the taxi industry, as well as in various service sectors. Customer satisfaction with taxi orders depends on socio-economic and service factors [19]. Currently, taxi services are ordered through mobile devices, choosing a payment method and a car class. The information system determines the location of the taxi and directs the nearest one to the client. Recently, alternative services to taxi services have become common. In some countries, the expansion of car-sharing services in major cities has slightly reduced the demand for taxis [20]. In Malaysia, the results of a survey conducted to study the attitude of drivers to the use of mobile applications for ordering a taxi were analyzed [21]. The target group in the survey was taxi drivers. The survey studied the demographic indicators of respondents and the level of use of smartphones. A study of mobile

app usage in Surabaya, Sidoarjo and Gresik found that the best three essentials in online mobile apps are route guidance, interaction and content quality [22]. At the same time, most customer dissatisfaction was caused by the quality of service and connection. A survey in Sri Lanka examining mobile app-based taxi bookings found comfort and service levels to be the key indicator of passenger satisfaction [23].

Mezuláník et al. compared Uber, Taxify, Liftago and standard taxi services for driver, vehicle and ride characteristics [24]. The study examined the characteristics of the taxi service in the Czech cities of Prague and Ostrava.

Hayder analyzed the factors that influence the level of customer satisfaction with the services provided by online taxi companies [25]. Reliability, price, quality of service and comfort are taken as independent factors, and passenger satisfaction is a dependent factor. The results of a survey of 100 respondents in Dhaka were analyzed using the SPSS program and the 5-point Likert scale. The author found that dependent and independent factors have a significant impact on each other. The correlation analysis showed that among the independent factors, the price has the most influence on passenger satisfaction with the service.

The stakeholders in the taxi market are the administrative management, operating companies, drivers and consumers [26]. When setting prices for taxi services in this system, it can be advantageous to increase the wages of drivers, order by phone, link tariffs to fuel prices, and introduce new opportunities to improve passenger satisfaction. Research by Deriugin et al. showed that consumer preferences are economical (fare), performance (speed), ergonomics (comfort), and safety requirements [27].

In many countries of the world, restrictions are being introduced on the entry of taxis into the market. However, the taxi market in many cities is not well-regulated. This is mainly due to the protection of the income of taxi drivers. However, many reforms have led to a further decline in the income of taxi drivers. In some cities, taxi licences are exceedingly expensive [28].

The main reasons for state intervention in the taxi market are safety, traffic congestion, market problems and the image of the city [29]. There are three main types of taxi market regulation: quantitative, qualitative and economic. Quantitative regulation of the taxi market is based on limiting the number of licences issued. While qualitative regulation is based on restrictions by imposing requirements on taxi cars and taxi drivers in their respective activities. And economic regulation is associated with the application of tariffs. Recently, in European countries, there has been a transition from quantitative regulation to qualitative regulation. Effective qualitative regulation requires sufficient monitoring of resources and the means to implement sanctions.

3. METHODOLOGY

This article is aimed at analyzing the organization and regulation of taxi services in Baku city. The source of the analysis is the results of a survey among passengers and taxi drivers. The survey was conducted in two stages to study the attitude of passengers and drivers towards the organization of services in the Baku taxi market. In the first stage, the attitude of passengers to issues of timeliness of service, payment method, frequency of access to services, etc., was revealed. The questionnaire included 40 questions. The survey involved 506 residents of Baku city. In the second stage, a survey was conducted among taxi drivers. A total of 475 drivers answered questions related to the mode of operation in a taxi. The drivers participating in the survey included drivers of a taxi fleet, drivers working with aggregators, and drivers working

independently, both on a call and specific routes. Both stages of the survey were conducted openly, maintaining the anonymity of the respondents. It was decided to choose a diagnostic survey method that allows respondents to comment on issues related to taxi services.

4. ANALYSIS OF PASSENGER ATTITUDE TO THE ORGANIZATION OF TAXI SERVICES

The questions included in the passenger survey questionnaires are mainly divided into three parts: questions about the level (compared to other modes of transport) and the reason for using taxis; questions related to orders using mobile applications; and questions about the quality of taxi service. Table 1 shows the distribution of surveys conducted among the population of Baku city by gender and age groups.

Tab. 1

Distribution of questionnaires by region, gender and age groups

Distribution	**Number**	**Percentage**
By gender groups		
Male	344	68
Female	162	32
By age groups		
18-25	111	22
26-35	152	30
36-45	116	23
46-55	61	11
56-65	66	14

a) b)

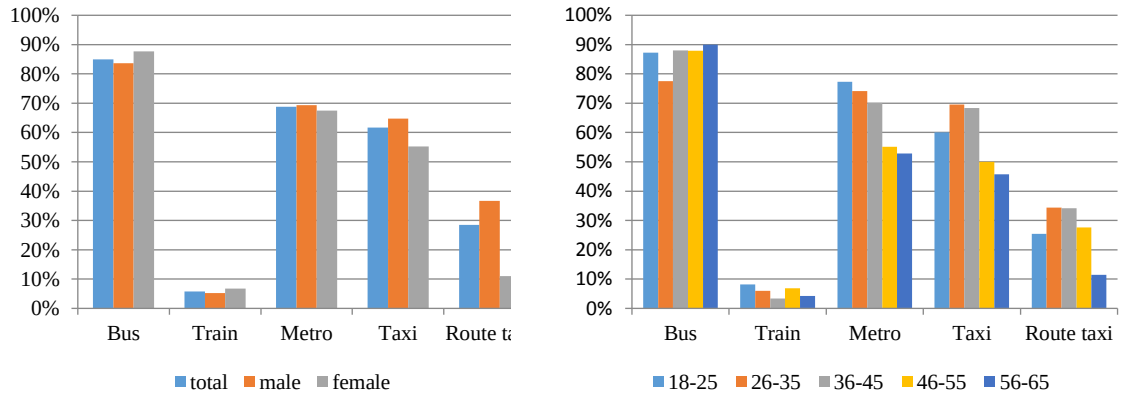

Fig.1. Distribution of movements using transport:
a) for gender groups, b) for age groups

As seen in Figure 1a, 85% of the population living in the regions of Baku city use regular bus routes, 69% - metro, 62% - taxis, 28% - fixed-route taxis, and 6% - trains. Men are more likely (37%) than women (11%) to use fixed-route taxis. Taxi services are more (70%) used by

passengers in the age group of 26-35 years. Only 46% of passengers in the 56-65 age group use taxi services.

Also, among respondents, 27% noted that they use a taxi several times a month, and 33% - several times a week (Figure 2). While 9% of respondents use taxi services several times a day, 5% once a day. Noticeably, the number of people using a taxi at least once a day is 14% of the total number of respondents. Furthermore, 35% of men and 29% of women use taxi services a few times a week. Taxi services are used several times a month by 31% of women and 26% of men.

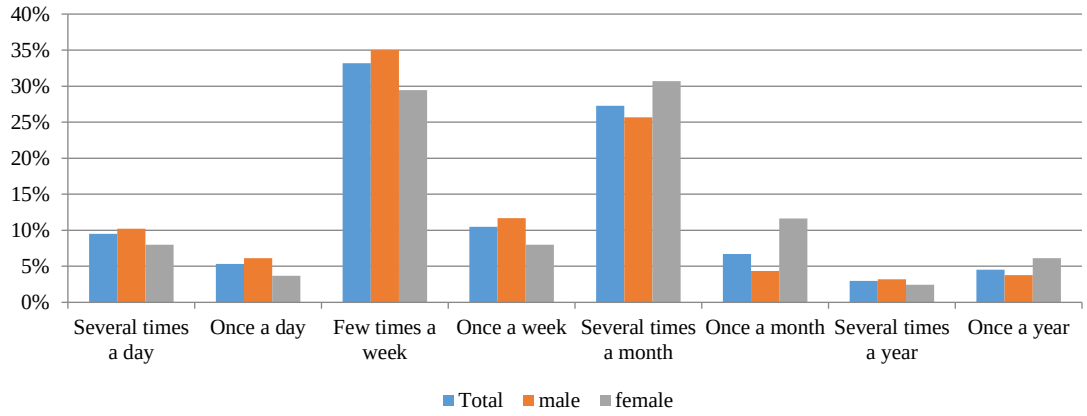

Fig. 2. Frequency of using taxi services

When asked: Why do you prefer to use taxi services? 37% of respondents answered that they prefer taxis because of convenience, 17% because of speed, 10% because of profitability, 10% because of the non-functioning of public transport during the COVID-19 pandemic, and 9% due to density in other types of transport (Figure 3).

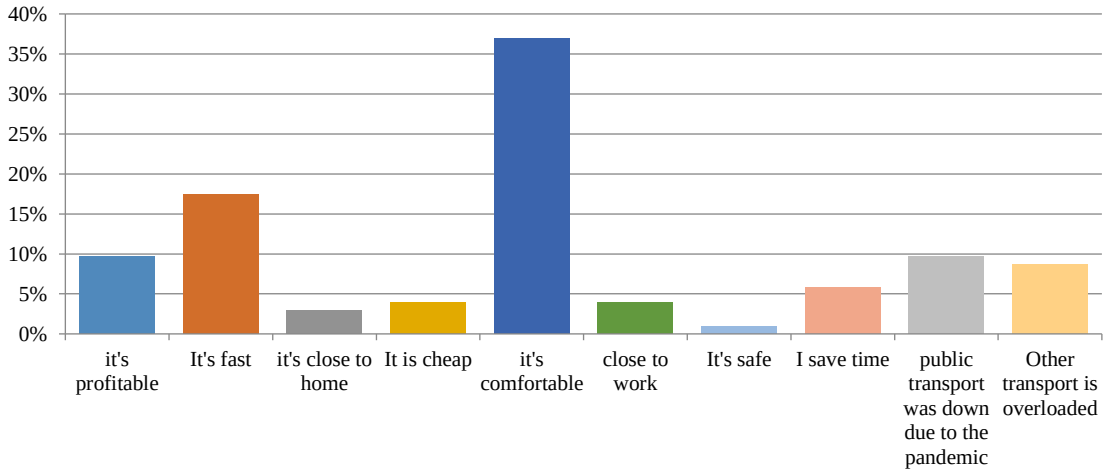

Fig. 3. Distribution of reasons why passengers prefer using a taxi

Currently, when choosing among the proposed taxi services, 69% of respondents consider the price of the service as the decisive factor, 35% - the timeliness of the service, 23% - the condition of the car, 22% - the presence of a mobile application, 14% - the availability of an online order. For the other respondents, 6% consider the image of the company offering

the service, 2% the professionalism of the drivers, and 1% the convenience of the trip. Most women (75%) choose a taxi based on the cost of the trip.

As shown in Figure 4, 66% of respondents said that the volume of taxi services was adequate during the COVID-19 pandemic, and only 34% thought that they were not enough. Most women, 70%, and 64% of men consider the volume of taxi services adequate for the COVID-19 pandemic period. As for age groups, people aged 18-25 (77%) are most satisfied with taxi services during the pandemic.

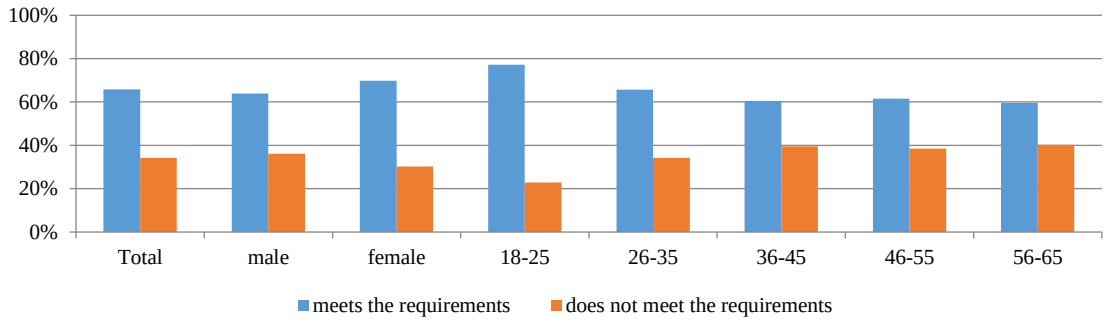

Fig. 4. Attitudes towards the adequacy of taxi services during the COVID-19 pandemic

Of the respondents surveyed, 65% prefer a mobile application to order a taxi, and 26% choose to order a taxi via a call centre (Figure 5). Only 9% of respondents do not care how they call a taxi, and they order a taxi directly. Passengers in the age groups 18-25 (85%) and 36-45 (70%) more than others prefer to order a taxi through a mobile application. On the other hand, respondents in the age groups 46-55 (43%) and 56-65 (49%) prefer to order a taxi through a call centre. The proportion of men who choose taxi services because of the possibility of ordering online is higher (17%) than women (10%).

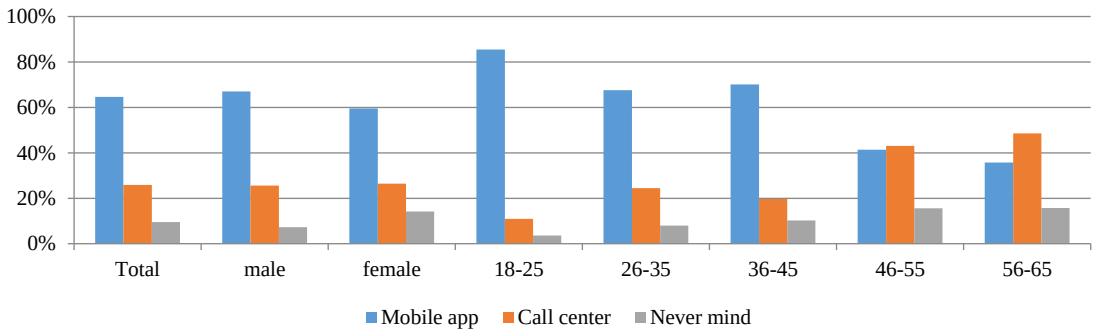

Fig. 5. Taxi calling method distribution

When asked; What form of payment do you prefer for taxi services? Most respondents (94%) answered in cash. Only 12% of respondents in the 18-25 age group prefer to pay with a bank card. Observably, despite the rather high popularity of mobile applications for ordering a taxi, non-cash payments are not yet common.

In Baku, passengers are offered economy, comfort and business class taxis. Most economy class taxi cars are Toyota Prius. For 40% of respondents, the brand of the taxi car does not matter. However, the survey showed that 33% of respondents consider it expedient to use Mercedes cars, 13% Toyota and 13% BMW as economy class taxis.

Furthermore, 53% of respondents consider the condition of the car as an indicator of the quality of the taxi service, 47% - the timeliness of the service, 46% - the professionalism of drivers, 30% - the presence of a mobile application, 21% - the presence of a professional call centre, 20% - payment transparency.

However, 69% of respondents are unsatisfied with the level of professionalism of taxi drivers, and 53% - with their behaviour towards passengers.

Among taxi companies, Bolt has a clear advantage. Thus, 67% of respondents stated that they use Bolt services (Figure 6). While 12% of passengers use Maxim taxi services, 9% use Uber services, and 5% use Salam services. In Baku, the use of private cars as a taxi is allowed. Subsequently, 54% of respondents rated the use of private cars as taxis as well, and 8% as very good. For 29% of respondents, this is indifferent.

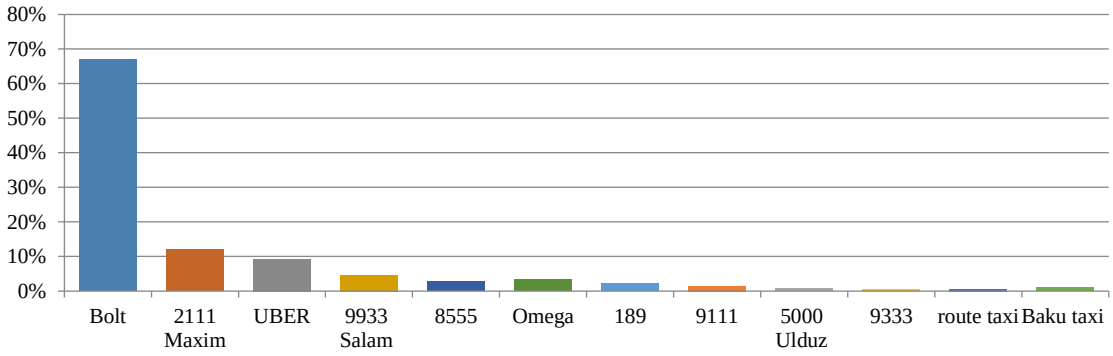

Fig. 6. Distribution of taxi orders between companies

The results of assessing respondents' satisfaction with taxi services on a 7-point scale showed that only 22% are completely satisfied with the taxi services.

Notably, the number of taxi users does not lag behind the number of bus and metro users. This can be mainly explained by the lack of competitiveness of public transport, which does not offer quality services, and the cheapness of taxi rides. Another reason for the increase in taxi uses in Baku is the lack of coverage and accessibility to the public transport system. In addition, long inter-zone travel by public transport also increases the number of calls to taxi services. The metro, with 26 stations and the bus network, with 173 routes, do not adequately cover all areas of the city. Hence, it is no coincidence that more than 70% of those surveyed consider it necessary to use an alternative type of public transport in Baku (BRT, LRT, etc.). The bus fare in Baku is AZN 0.3 (USD 0.18). However, 47% of passengers are generally dissatisfied with bus transport. At the same time, it should be noted that 33% of respondents called the taxi a dangerous mode of transport.

5. ANALYSIS OF TAXI DRIVERS' WORKING CONDITIONS

Surveys were conducted in taxi companies and taxi ranks (stations) to study the attitude of taxi drivers towards the taxi market situation. The questions included in the questionnaires for the surveys conducted among drivers were aimed at determining the performance indicators of the drivers themselves, as well as their attitude to their current working conditions.

Table 2 shows the main personal and performance indicators of the surveyed drivers. As shown from the table, a fairly large proportion of drivers (42.5%) have only 0-3 years of taxi experience. Almost half of the drivers are in the 25-40 age group. And 65% of drivers have secondary education.

Tab. 2

Personal and performance indicators of drivers

Indicators	**Percentage**
Driving experience	
0-3 years	42.5
3-5 years	17.4
3-5 years	16.7
More than 10 years	23.9
Age of drivers	
18-25 years	8.6
25-40 years	47.2
40-55 years	26.4
Over 55 years old	17.7
Education	
Secondary	65
Bachelor's degree	25
Master's degree	3
College graduates	7
Hours of work on the line	
06:00-14:00	24.3
14:00-22:00	19.8
22:00-06:00	7
From morning to evening	23.7
Not matter	41.5
Served passengers per day	
1-3	18
4-5	24
6-10	29
11-15	19
More than 15	10

From the analysis, 30.7% of drivers work with their own car, 39.3% work for rent with a taxi company, 25% with their own car and take orders individually, 4% with their own car and take orders individually, 1% serve passengers as a taxi along the route.

Most drivers, 68.7%, stated that they use an identification number to work in a taxi, and 38.9% use a special identification badge issued by the Baku Transport Agency. However, 29.3% of drivers do not have the appropriate taxi license.

Out of the taxi drivers surveyed, 39.7% work with Bolt. Then 26.6% of drivers do not cooperate with any company. While 23.5% of drivers work with Uber, 23.3% with 189 taxi, 18.8% with Maxim (2111), 12.1% with Economy (9111), 11.7% with Salam (9933), 6.1% c 8555, 3% c 5000 and so on (Figure 7).

Some drivers of the only taxi company in Baku, Baku Taxi Ltd, also cooperate with taxi aggregators, although this company has its own call centre.

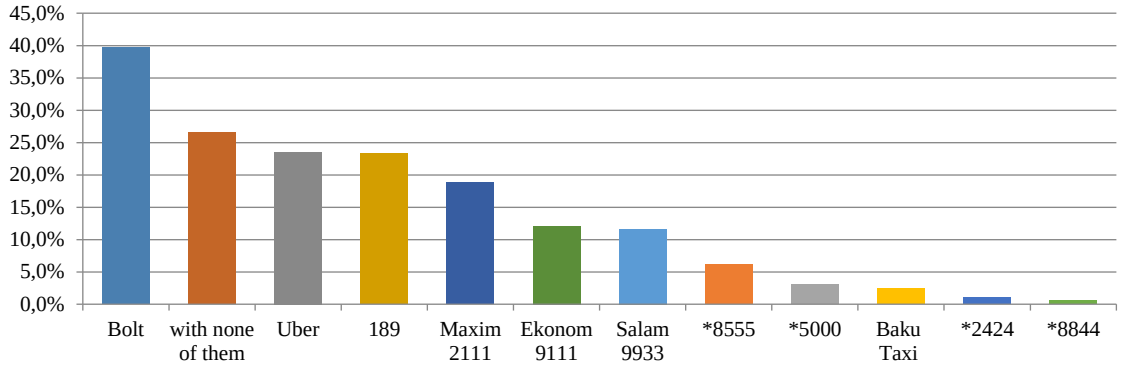

Fig. 7. Distribution of cooperation between taxi drivers and taxi companies

However, 40.1% of taxi drivers do not consider the terms of the cooperation of any company beneficial. While 25.3% of drivers deem 189 taxi conditions favourable, and 12.8% Bolt (Figure 8).

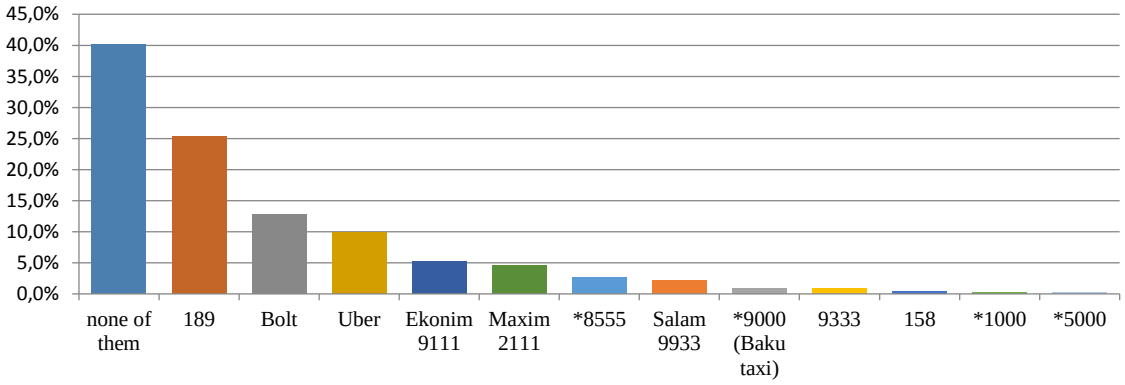

Fig. 8. Distribution of the attitude of taxi drivers about the benefits of cooperation with taxi companies

Most drivers (65%) believe that intermediary companies sending customer orders to drivers should change the conditions of mediation.

If training for taxi drivers is organized in the future, 12% of drivers would like to take a course on traffic rules, 8% - rules of conduct with passengers, 5% - a first aid course, and 3% - additional training to generate a large income. Few drivers, 1%, said they want to participate in training on getting to know the city and knowledge of the language. However, most taxi drivers, 56%, do not want to participate in driver education training.

The results of the survey show that 64% of drivers have had a medical examination within the last 6 months, 16% - 6-12 months ago, 5% - 12-36 months ago, and 15% - more than 36 months ago. Also, 38% of the surveyed drivers violated the rules up to 3 times, 5% 3-5 times, 3% 5-10 times and 3% more than 10 times in the last 1 month. Majorly, 52% of taxi drivers said they did not violate traffic rules.

An analysis of the organization of the taxi service in Baku city revealed that a large number of taxi cars operate in the taxi market without proper permits, leading to tax evasion. In addition, most fixed-route taxis are not registered as taxis. Taxi drivers do not undergo a daily medical examination. For drivers involved in violations, there is no mechanism of restriction. There is no certification system for taxi drivers or mechanism to control the insurance of taxi cars and their passengers. It should be noted that according to the "State programme for ensuring road safety in the Republic of Azerbaijan for 2019-2023" [30], there is a plan to improve the organization of work and improve the skills of taxi drivers.

6. DISCUSSION

The current organization of the taxi market in Baku city has some aforementioned elements, leading to certain problems such as tax evasion (29.3% of drivers do not have any documents for taxi driving), the use of substandard vehicles as taxis, and passenger safety. There is no mechanism for monitoring daily medical examinations. Taxi drivers are not required to have a certificate for the relevant activity. There is no mechanism to control the insurance of passengers and liability insurance of car owners.

Although the level of use of taxi services is high, only 22% of passengers are satisfied with taxi services. Passengers are generally satisfied with the prices of the services. However, they are dissatisfied with the level of professionalism and the attitude of drivers to passengers. In addition, a large number of consumers consider taxi rides dangerous.

Drivers are unhappy with the pricing policies of taxi companies. However, it should be stated that prices are dictated by competition in the market.

Also, it should be noted that economic regulation of the taxi market can be carried out simultaneously with both quantitative and qualitative regulation. Taxi services play a pivotal role in the mobility of a population. Limiting the number of taxi licences (quantitative regulation) in Baku city or fares (economic regulation) could worsen population mobility problems. The application of economic regulation (mainly limiting minimum fares) can only be considered after the required measures to ensure mobility in the city of Baku (improvement of the public transport route network, construction of cycle paths) are taken. According to the State programme for ensuring road safety in the Republic of Azerbaijan for 2019-2023, there is a proposition to develop a mobility plan for the cities of Azerbaijan, including the city of Baku. However, at this stage, it is advisable to control tax payments.

An analysis of the organization of the taxi service in Baku shows that there is a need for improving qualitative regulation of this activity (control over the certification and medical examination of the drivers, the technical condition of vehicles, passenger insurance and driver liability insurance). Considering the opportunities of information technology and the massive transition to digital orders, this regulation is proposed to be carried out parallel with the control of tax payments on a single digital platform using the appropriate technical means and software. Such regulation can improve the quality of passenger service by ensuring that taxi drivers work by the rules.

CONCLUSION

In recent years, as in several cities around the world, the number of taxi orders through mobile applications and call centres has increased in Baku. Many car owners and drivers work

with taxi companies personally. Consequently, this has led to certain changes in the taxi market. These new conditions have led to the emergence of specific conditions in the market of taxi services in the city of Baku. Based on this study, the attitude of both drivers and passengers towards the current situation indicates the need to improve the organization and regulation of taxi activities.

Most calls to taxis are mainly due to the low prices of services and quality problems in the types of urban public transport. Analyses show that passenger satisfaction with taxi services is not high.

Until the development of a mobility plan in Baku city (improvement of public transport, construction of cycle paths, etc.), full economic regulation of taxi services is not advisable. Nevertheless, at this stage, it is important to control tax payments. To improve the quality of passenger service, it is advisable to introduce qualitative regulation. It will cover control over the certification and medical examination of the drivers, the technical condition of vehicles, passenger insurance and driver liability insurance. Therefore, it is proposed to create a single digital platform through which control of the listed actions will be possible.

Such regulation through a digital platform can be applied by government agencies and large commercial enterprises as a system for controlling and organizing taxi services.

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