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Factor Analysis of Passenger Cars Using as a Taxi

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ABSTRACT. A procedure to select passenger cars has been proposed. The procedure helps substantiate choice of effective transportation means in accordance with taxi class to meet consumption requirements of those taking part in transportation process from the viewpoint of comfort, safety, and minimum expenditures in the context of such transportation type.

Introduction. Taxi transportations are the integral segment of urban passenger transportations. Over the recent years, the segment has demonstrated increase in demand. The fact promotes to rash emergence of a number of motor transport enterprises with various property categories in the market of transport services. Total satisfaction of consumer demands providing the fastest arrival during short period of time in terms of adequate comfort and safety as well as reasonable tariff is topical task for such transportations.

Statement of the analysis task. In the total volume of urban passenger transportation, a share of taxi services is up to 10% of the whole traffic flow [1]. According to data by All-Ukrainian Association of Transportation Organizations (AATO), 130-140 thousand drivers provide regular taxi services in Ukraine. Roughly speaking, it is almost every 50th car owner [2]. Annual returns of taxi driver are almost UAH 120,000 in Kyiv, almost UAH 80,000 in multi-million-strong cities, and almost UAH 56,000 in regional centers. Altogether, annual returns of Ukrainian taxi market are UAH 1.5 - 2 bln [3].

Analysis of research sources has shown that following problems are burning ones for taxi services: inadequate legal acts specifying demands concerning taxi services; inadequate legal acts specifying use of corresponding type of motor vehicles to provide taxi services; inadequate legal acts specifying demands concerning driver proficiency [3, 4].

The above helps conclude that regulation of corresponding norms aimed at improvement of quality indices concerning transportation management, motor vehicles, and proficiency of drivers engaged in the type of passenger transportations are quite important.

Objective of the analysis and its task. The performed analytical studies pursued an objective to determine a procedure of making managerial decision concerning choice of motor vehicle, which will meet the requirements of consumers.

Following problems should be solved for pursuing the objective:

- Determination of the most important indices of passenger cars taking into consideration their priority to improve quality as well as comfort and safety of taxi services;

- Determination of passenger car for taxi services having the best indices in terms of consumer demands of those taking part in transportation process.

Results of the research. Determination of effective passenger car to be used as a taxi should involve the analysis of a number of factors. Moreover, solution of the problem should take into consideration

basic requirements of the main participants of transportation process, namely a driver and a passenger. Marketing research was carried out with the help of questionnaire. In the context of passengers it covered various population segments with different income levels, social statuses, and ages. In the context of drivers it covered their places of employment including relevant taxi type driving.

Current laws do not govern standards concerning certain passenger car and its use as a taxi. Thus, the process is supposed in terms of available types of passenger cars. For example, following passenger cars of "C" class (where minimum perimeter is 11002mm) can be considered as taxis: Renault Logan, Daewoo Lanos, Citroen Berlingo, Chevrolet Aveo, Geely CK, Kia Ceed, Volkswagen Polo, and VAZ 2111. In terms of "Business class" following passenger cars of "D" class (where minimum perimeter is 12006mm) can be considered as taxis: Chevrolet Lacceti, Hyundai Elantra, Toyota Corolla, Peugeot 308, Skoda Octavia, and Renault Fluence. "Elite class" of taxis involves following passenger cars of "E"class where minimum perimeter is 12664mm: Volkswagen Passat, Toyota Camry, Nissan Teana, Mazda 6, Skoda Super B, and Ford Mondeo.

Diversity of the listed taxi classes has a number of negative factors. Deficiency of unified standards to provide adequate comfort and safety of passenger; various transportation tariffs; availability of illegalized drivers in the market of transportation services are among them.

The market research carried out by the Department staff has helped determine following advantages of consumer demands: economic (tariff), operating (velocity), ergonomic (comfort), and safe (safety). Modern passenger car is characterized by a variety of quality indices. Thus, it is expedient to unite them into above groups determined by consumers (Fig. 1). That makes it possible to select the most efficient passenger cars for corresponding operational environment or to create appropriate comfortable and safe conditions for those taking part in transportation process as well as to replace road transport vehicles of enterprise effecting such type of transportation.

The determined indices for every car class helped calculations of weighing coefficient. For this purpose, a matrix to compare groups according to corresponding quality indices has been developed depending upon consumer demands of those taking part in transportation process (Table 1). The data adequacy was evaluated relying on consistency of results of different experts. To do that, consistency index was determined [5]. Calculations of weighting coefficient according to the indices have shown that the consistency index is 0.05; it is less than critical value 0.1.

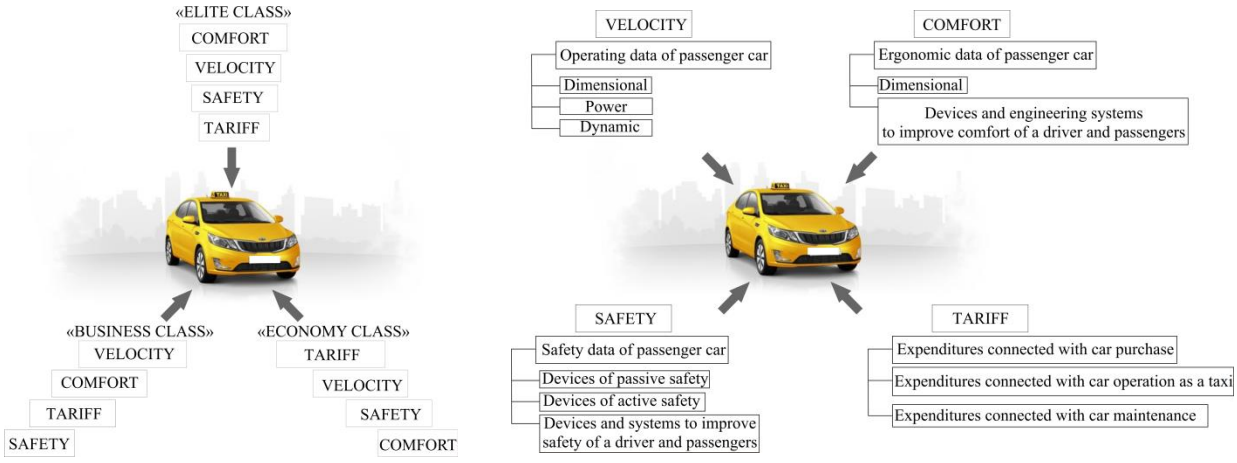

Fig. 1. Indices of advantages of effective passenger car selection for taxi services.

Profile method is the optimum approach to solve the problem. Its principle is to unite set of indices without weighing into integral quality index. Ease of use and possibility to integrate a great variety of indices are advantages of the method. Then, different characteristics of passenger car can be grouped on the assumption that they are equivalent in one group. Analysis of group properties should

be performed using weighing approach. That will help structure them basing upon effect on components of requirements of those taking part in taxi services. The algorithm is described appropriately in [5]. The method was applied to assess quality of fifteen models of passenger cars to determine the most effective taxi for certain class.

Table 1. Matrix of pairwise advantages of group of quality indices for taxis.

Criteria	Tariff	Velocity	Safety	Comfort	Component assessment	Weighing coefficient
"Economy-class"						
Tariff	1	2/1	4/1	4/1	0.06	0.5
Velocity	1/2	1	3/1	3/1	0.03	0.3
Safety	1/4	1/3	1	1/1	0.05	0.1
Comfort	1/4	1/3	1/1	1	0.05	0.1
"Business-class"						
Velocity	3/3	1	3/2	3/2	0.08	0.3
Comfort	2/3	2/3	1/1	1	0.06	0.2
Tariff	1	3/3	5/3	3/2	0.08	0.3
Safety	3/5	2/3	1	1/1	0.05	0.2
"Elite-class"						
Comfort	1	3/5	5/1	3/3	0.84	0.4
Velocity	3/2	1	5/3	1/2	0.28	0.2
Safety	5/3	2/1	1	1	0.41	0.3
Tariff	3/5	2/3	1/5	3/5	0.13	0.1

Calculations were performed basing upon the data from the sites of companies dealing with certain car makers. The calculations were carried out with the help of Microsoft Office – MS Excel 2010 software. The software was also used to calculate complex quality index according to the assumed four groups of properties determining the efficiency of passenger car use during transportation. Tables 2-4 demonstrate calculation results for integral quality coefficient in terms of the selected cars.

Table 2. Summary table of the determined advantages of "Economy-class" taxis.

Priority Index	Weighing Coefficient	Renault Logan (1.6 i)	Daewoo Lanos (1.5 i)	Geely CK (1.5 i)	Chevrolet Aveo (1.6 i)	VAZ 2111 (1.6 I)
Tariff	0.5	0.057	0.033	0.053	0.049	0.042
Velocity	0.3	0.211	0.215	0.215	0.219	0.205
Safety	0.1	0.068	0.061	0.068	0.046	0.047
Comfort	0.1	0.073	0.072	0.070	0.067	0.065
Integral index		0.800	0.798	0.785	0.786	0.774
Rating position		1	2	4	3	5

Table 3. Summary table of the determined advantages of "Business-class" taxis.

Priority Index	Weighing Coefficient	Skoda Oktavia (1.8 i)	Renault Fluence (1.6 i)	Hyundai Elantra (1.8 i)	Chevrolet Lacceti (1.8 i)	Toyota Corolla (1.8 i)
Velocity	0.3	0.221	0.195	0.205	0.202	0.178
Comfort	0.2	0.165	0.153	0.136	0.153	0.169
Tariff	0.3	0.044	0.030	0.038	0.005	0.032
Safety	0.2	0.193	0.193	0.108	0.122	0.193
Integral index		0.888	0.870	0.835	0.833	0.870
Rating position		1	3	4	5	2

Analysis of the calculations shows that in terms of "Economy class" and according to integral quality index value, passenger car Renault Logan (1.6 i) ranks first. Passenger car Daewoo Lanos (1.5 i) ranks second, and Chevrolet Aveo (1.6 i) ranks third. In terms of passenger "Business-class" taxis, Skoda Oktavia (1.8 i) is the best one while Toyota Corolla (1.8 i) and Renault Fluence (1.6 i) rank second and third respectively. In terms of "Elite class", passenger car Toyota Camry (2.4 i) ranks first as it is characterized by maximum level of comfort, safety, and velocity features as well as minimum economic indices of operating expenses in comparison with the listed passenger cars.

Table 4. Summary table of the determined advantages of "Elite-class" taxis

Priority index	Weighing coefficient	Toyota Camry (2.4 i)	Nissan Teana (2.5 i)	Mazda 6 (2.5 i)	Skoda Super b (2.0 i)	Ford Mondeo (2.5 i)
Comfort	0.4	0.342	0.333	0.316	0.328	0.285
Velocity	0.3	0.215	0.214	0.219	0.208	0.201
Safety	0.2	0.193	0.193	0.193	0.193	0.121
Tariff	0.1	0.006	0.007	0.014	0.017	0.005
Integral coefficient		0.932	0.930	0.928	0.930	0.884
Ranking position		1	3	4	2	5

Thus, the selection has helped determine the belonging of passenger cars to certain classes, which relatively correspond to consumer demands of transportation process. It should be noted that the determined integral quality indices of passenger cars differ slightly. The objective of the research is to demonstrate advantages of one passenger car over another one irrespective of the differences in their components. Such problem solving makes it possible to substantiate selection of effective passenger car according to criteria of consumer demands of those taking part in transportation process.

Summary. The proposed indices of consumer properties of passenger cars help substantiate choice of effective passenger car belonging to certain taxi class to meet consumer demands of those taking part in transportation process and to improve quality of transport services, comfort, and safety. The above also involves minimum expenses in the process of the type transportation.

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