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THEORETICAL ASPECTS OF TERRITORIAL LOCATION MODELING OF AUTOMOBILE SERVICE ENTERPRISES

SHARIPOV KONGRATBAY AVEZIMBETOVICH

Rector of Tashkent State University of Economics, Doctor of Technical Sciences, Professor, Email: rector@tsue.uz

POLVONOV ABDIJALIL SATTOROVICH

Teacher of Namangan Institute of Engineering and Construction, candidate of technical sciences, docent Email: aspolvonov@mail.ru

ABDUSATTOROV NODIRJON ABDUJALIL UGLI

Teacher of Namangan Institute of Engineering and Construction Email: nabdusattorov93@mail.ru

SOATALIYEV DIYORBEK BAHODIR UGLI

Namangan Institute of Engineering and Construction, student of the Faculty of Transport, Email: soataliyevdiyorbek1@gmail.com

Abstract:

The article developed the theoretical foundations for optimizing the territorial location of automobile service enterprises (ASE) and increasing the internal efficiency of the organization and their activities.

Keywords: automobile service, improvement method, environment, modeling, process, model, theoretical foundations, region, system, property, location, optimization method, objective function, environmental factor, organizational and technical, network, technological, mathematical optimization, optimization time, experiment, quality, chance, parameter, efficiency, retreat, iteration, stochastic parameter, function, ecology, environmental damage.

INTRODUCTION

According to research in the field of improving the car service system, the most effective ways to eliminate the technogenic impact of automobile service enterprises (ASE) on the environment are: optimization of locations of CSEs, organization of operation and increasing efficiency of ASEs.

The first way is to evenly distribute the impact of ASE on the environment, optimize the placement of car service enterprises in the scheme of the dealer and service network, taking into account environmental factors.

The second way requires reducing emissions of gaseous wastes, emissions and wastes into the environment through the use of organizational, technical, technological and environmental measures at ASE.

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One of the most pressing issues is the optimization of the territorial distribution of the ASE and the development of the theoretical foundations for the organization and internal efficiency of the ASE.

Automobile service enterprises are complex organizational and technical systems with a number of features that are unique to complex systems [1]:

1. Appearance - does not depend on the quality and properties of individual elements of the system, but the combination of these elements into a single system generates the entire system [2]. This ensures that the total effect exceeds the sum of individual effects of independently moving elements of the system as a result of the emergence of synergistic relationships between the elements of the system. Therefore, it is necessary to study and model organizational and technical systems as a whole.

2. The mass nature of phenomena and processes does not allow one to determine the regularities of processes on the basis of a small number of experiments. Therefore, modeling should be based on mass observations.

3. The dynamics of processes consists in changing the parameters and structure of the system under the influence of the external environment (e.g., external factors, such as time);

4. The randomness and uncertainty of the parameters of systems and processes require the use of probability theory, mathematical statistics, variant and scenario approaches.

Thus, the whole process without disassembling the system during the modeling process, the modeling period should be sufficient to determine the regularity of the processes in the system, the system changes its state under the influence of external factors and the model parameters must be stochastic.

Object And Method Of Investigation.

A car service enterprise can be considered as a multi-channel stochastic parametric public service system (PSS), which is a flow of requests for services. An analysis of research in the field of organization of car service systems [1, 3] shows that the Poisson distribution law can be used to calculate the intensity of the flow of applications. In this case, the Poisson process is non-stationary and is expressed by the following formula:

$k = 0,1,2, \ldots$ and $t, s > 0$ for

$$P[U(t+s) - U9t) = k] = \frac{e^{-b(t,s)}[b(t,s)]^k}{k!},$$

Where as $b(t,s) = \Lambda(t+s) - \Lambda(t) = \int_t^{t+s} \lambda(y)dy$,

According to the theory of scarcity theory (deficit) [4], the production process of enterprises is characterized by one of two conditions: the availability of resources and the amount of demand. Enterprises in the service sector are characterized by the following features:

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1. The production cycle of service enterprises is much shorter than in other sectors of the economy, and the available production resources are more liquid, which facilitates the process of redistributing funds and adapting to changing requirements;

2. Small capital intensity requires small resources to maintain a relatively simple production, which creates conditions for the formation of mobile reserves and makes it necessary to limit the form of exploitation. Therefore, this is a requirement that limits the production capacity of service enterprises, including car service enterprises.

Due to imperfect competition in the car service market, the process of choosing a car service for servicing automotive vehicles owners depends on many factors, such as

1. The need (or unnecessity) to service the car in a certain ASE to maintain the warranty.
2. Possibility of servicing a particular car in the ASE.
3. Ability to perform specific work in the ASE.
4. ASE availability level (cost associated with delivering an automobile to ASE).
5. The quality of the services provided.
6. Pricing policy in ASE.
7. Service queue.
8. Service time.
9. Mode of operation, etc.

In this regard, it is necessary to determine the factors that should be included in the model, since any model may not be universally sufficient (adequate) and the modeling process is limited in time and resources. For most systems, a factor of 20% determines 80% of the properties of the system, and the remaining 80% determines only 20% of the properties of the system [5]. In order to include this or that factor in the model, it is necessary to consider the goals and objectives of modeling, the detail and availability of input information, permissible errors, etc.

The techno-genic impact of the car service system on the environment is realized in the process of bringing the car to the ASE, maintenance and repair. In order to reduce the damage from pollutants, it is necessary to minimize the total time spent by car owners to bring vehicles to the ASE.

Theoretical Basis

In order to reduce the damage caused by waste at car service enterprises, it is necessary to place ASE in places where the concentration of pollutants in question does not exceed the maximum allowable standards. To identify such territories, the ecological analysis, creation of pollutant distribution maps. To do this, it is necessary to determine the harmfulness of the main sources of atmospheric pollution in the territory under consideration and to determine the background

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concentration of pollutants. In the presence of a homogeneous ("flat") base surface, the following formula is used to estimate the s-distribution of surface concentrations [6]:

$$c = c_{MU} \cdot s_1\left(\frac{x}{x_{MU}}\right) \cdot s_2\left(\frac{y}{x}, u\right)$$

Here x and y are the coordinates of the calculated point in a rectangular coordinate system with the abscissa axis oriented along the wind direction,

c_{MU} and x_{MU} - the value of the maximum (corresponding to y = 0) axial soil concentration on the wind speed u and the distance from the source that can be reached, s_1 - dimensionless function that describes the change in surface concentrations along the plume (flame) axis at different distances from the source and normalized by the condition c_1 (1) = 1, s_2-the dimensionless function describes the concentration distribution normalized to the condition s_2 (0) = 1 and transverse to the wind direction. Complex indices of priority air pollution substances (I_5 or ($KIZA_5$) - quantitative characteristics of the level of atmospheric air pollution by priority substances that determine urban air pollution according to the following formula:

$$I_5 = KIZA_5 = \sum_{i=1}^{5} \left(\frac{C_i}{CHREK_{CC}}\right)^{\beta_i}$$

3B priority can be calculated by the following formula:

$$I_i = \left(\frac{C_i}{CHREK_{CC}}\right)^{\beta_i},$$

Here β_i – 3B in the position of i constant for different classes of hazards to the level of damage, C_i –average concentration of 3B in the position of i[7].

An experiment plan should be developed to control the conduct of the experiment on a model that consumes less material resources and time. According to theory of planning an experiment, it may be divided active and passive experiment [8]. In a passive experiment, information about the object under study is collected through passive observation, that is, the information is obtained under normal operating conditions of the object, where the relationship between input and output parameters is established as deterministic functions. Active experiment is carried out by artificially affecting the object based on a special program. An active experiment demonstrates the ability to influence the direction of a process and the ability to select a factor level in each experiment. An increase in the number of observed factors leads to a sharp increase in the number of experiments, a decrease in which leads to a significant increase in experimental error. A factor is given if it specifies a set of values that can accept certain factors if it indicates its domain. The experiment usually uses a limited part of the field, which is usually given in the form of multiple discrete levels.

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An active experiment allows research problems to be solved more quickly and efficiently.

Full or partial factor experimental methods are used in active experiment.

In a full-factor experiment, the mathematical model of the object appears as a polynomial, part of the Taylor series that separates the unknown function. [86]:

$$y(x_1, \dots, x_k) = b_0 + \sum_{i=1}^{k} b_i \cdot x_i + \sum_{\substack{i,j=1 \\ i\neq j}}^{k} b_{ij} \cdot x_i \cdot x_j + \sum_{\substack{i,j=1 \\ i\neq j\neq\cdots\neq n}}^{k} b_{ij} \cdot x_i \cdot x_j \cdot \dots \cdot x_n,$$

Whereas b_0 – free term, b_i – linear effects, b_{ij} – effects of paired interactions;

b_{ijn} – Effects of tripartite interaction.

Experiment planning is based on changing factors on two levels. A combination of all possible factors is performed at the levels selected for the levels under research. Iteration number N_q is determined by following formula:

$$N_q = 2^{k_q}$$

Here k_q –number of elements. In this case, k_q is the number of car service enterprises in the system, x_i –is the number of i-positions in the ASK.

The fractional experiment is performed in a smaller number of experiments, while retaining all the features of a full-factor experiment (symmetry, compliance with standardization conditions, orthogonality). The possibility of reducing the number of experiments is provided by the fact that the number of experiments in full experiments is greater than the number of coefficients in the model. It is possible to conduct a fractional factor experiment when there is no interaction of factors or their effect is neglected.

Tactical planning of the experiment depends on the assessment of the accuracy and reliability of the results of modeling in the given values of the implementation of the modeling system at given values of accuracy and reliability or in the evaluation of the numbers given in the implementation. In the processing of the results of the simulation experiment cannot give accurate values of the efficiency of the system, in the best case it is possible to obtain only some estimates. At the same time, the economic issues of human and technical resources, which justify the expediency of statistical modeling, are closely related to the accuracy and reliability of the E assessment of system performance indicators in its model.

The number of implementations of statistical modeling of the system N should be selected based on two main assumptions: with the model (model creation and computer implementation) and with the system model (taking into account resource constraints) to assess the accuracy and reliability of the experimental results. Due to the conflicting requirements for better assessment and reduction of resource consumption, it is necessary to solve the problem

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of finding a consensus between the requirements in the planning of computer experiments based on statistical modeling.

The number of implementations N is $\tilde{E} \neq E$ in the general case due to the presence of stochastic and constraints. here E- absolute accuracy of assessment. The probability of realization of the inequality $| E-\tilde{E} | < \varepsilon$ is called the accuracy of the estimate, that is, $Q = P \{| E-\tilde{E} | < \varepsilon \}$.

$\varepsilon_0 = \frac{\varepsilon}{E}$ is the relative accuracy of the assessment. $Q = P\{|E - \tilde{E}| < \varepsilon_0\}$ is the reliability of the assessment.

Determining the number of implementations for a given E and Q cannot be done in all cases, because a priori data is limited or due to the complexity of probability calculations $| E-\tilde{E} |$, the law of probability distribution in many practical cases of the system under study cannot be determined. The main way to overcome this situation is to put forward a description of the law of distribution of random quantities $\tilde{E}$, that is, to evaluate the efficiency of the system.

There is a correlation between the accuracy and reliability of the results and the computer experiment, when the efficiency indicators as E are the probability –

p, the mathematical expectation – a and the variance – σ^2 are participated.

The purpose of the experiment is to obtain an estimate $\tilde{(p)}$ of the probability p = P (A) of the occurrence of an event A, which determines the state of the system under study with several systems of the model. $\tilde{p} = {}^{m}/_{N}$ Frequency participates as assessment of p probability, here m-the number of good results.

At the same time linking the accuracy and reliability assessment with the number of implementations of $Q=P\{|E - \tilde{E}|/E < \varepsilon_0\}$ ratio is as follows:

$$P\{|p - m/N| < \varepsilon\} = Q;\ P\left\{p - \varepsilon < \frac{m}{N} < p + \varepsilon\right\} = Q\,,$$

To determine the law of distribution $\tilde{p}$, this frequency can be thought of as follows:

$$\tilde{p} = \frac{m}{N} = \left(\frac{1}{N}\right) \cdot \sum_{i=1}^{N} x_i\,,$$

Because N is the random number of the occurrences of the event A in this implementation, which consists of the implementation ξ, it accepts $x_1 = 1$ value with p probability, and $x_2 = 0$ value with $1 - p$.

Mathematical expectation and random variable variance ξ is defined as follows:

$$M[\xi] = x_1 \cdot p + x_2 \cdot (1 - p) = 1p + 0 \cdot (1 - p) = p;$$

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$$D[\xi] = (x_1 - M[\xi])^2 p += (x_2 - M[\xi])^2(1-p)$$
$$= (1-p)^2 p + (0-p)^2(1-p) = p(1-p)$$

Here

$$M[\tilde{p}] = M[m/N] = \left(\frac{1}{N}\right) M\left[\sum_{i=1}^{N} x_i\right] = \left(\frac{1}{N}\right) N M[\xi] = p\,.$$

This ratio means that the $\tilde{p}$ estimate for the probability p does not interfere. Given the freedom of quantity - x_i, we obtain the following:

$$D[\tilde{p}] = D[m/N] = \left(\frac{1}{N^2}\right) D\left[\sum_{i=1}^{N} x_i\right] = \left(\frac{1}{N^2}\right) N D[\xi] = p(1-p)/N.$$

Proceeding from the central boundary theorem of probability theory, large enough frequency – $\overline{N}$, mathematical expectation – p and dispersion $p(1-p)/_N$ is seen as a random variable normal probability defined by the distribution of law. Therefore, the ratio can be rewritten as follows:

$$P\left\{p - \varepsilon < \frac{m}{N} < p + \varepsilon\right\} = \Phi_0\left(\frac{p+\varepsilon-p}{\sqrt{p(1-p)}}\sqrt{N}\right) - \Phi_0\left(\frac{p-\varepsilon-p}{\sqrt{p(1-p)}}\sqrt{N}\right) = Q\,.$$

$\Phi_0(-z) = 1 - \Phi_0(z)$, taken results from the formula, we have the following:

$$2\Phi_0(\varepsilon\sqrt{N}/\sqrt{p(1-p)}) = 1+Q; \quad \Phi_0\left(\frac{\varepsilon\sqrt{N}}{\sqrt{p(1-p)}}\right) = (1+Q)/2 = \varphi.$$

Here $\frac{\varepsilon\sqrt{N}}{\sqrt{p(1-p)}} = t_\varphi$,

Here $t_\varphi - \varphi = (1+Q)/2$ quantum of the law of normal distribution of order probabilities.

we obtain the accuracy of the $\tilde{p}$ estimate at the probability p:

$$\varepsilon = t_\varphi \sqrt{p(1-p)/N}\,,$$

That is, the accuracy of the probability estimate is inversely proportional to $\sqrt{N}$.

From the above ratio ε for the accuracy of the assessment, ε accuracy and Q with reliability $\tilde{p}$ the amount of implementation of the assessment can be calculated as $N = t_\varphi^2 p(1-p)/\varepsilon^2$.

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CONCLUSION

Based on the above, two methods are the most effective in solving the problem of negative impact of car service enterprises on the environment. Rational design of ASE network and establishment of ASE and internal efficiency of the action:

The first way involves the rational territorial location of car service enterprises, taking into account environmental factors, in order to evenly distribute the load of the ASE to the environment.: in the process of modeling the placement of ASE should be considered without breaking the whole system into individual components, the modeling period should be sufficient to determine the laws of system processes, the system must change its state under the influence of external factors, the model parameters must be stochastic;

- the second way requires the reduction of emissions of gaseous wastes and emissions into the environment through the application of organizational-technical, technological and environmental measures at car service enterprises. At the same time, it is necessary to develop and implement an environmental management system for the ASE.

LITERATURE

1. Мудунов, А.С. Система моделей прогнозирования деятельности предприятий и отраслей сферы услуг: дисс. докт. экон. наук: 08.00.13 / А.С. Мудунов – М.: РГБ, 2003. – 357 с.
2. Корнаи, Я. Дефицит / Я. Корнаи. – М.: Наука, 1990. 608 с
3. Варуха, П.В. Разработка методики обоснования специализации, мощности и размещения предприятий автосервиса в малых городах: дисс. … канд. техн. наук: 05.22.10 / П.В. Варуха – М.: РГБ, 2003. – 131 с.
4. Бусленко, Н.П. Моделирование сложных систем / Н.П. Бусленко. – М.: Наука, 1988. 400 с.
5. Генихович, Е.Л. Основные направления доработки нормативного документа ОНД-86 по расчету рассеивания в атмосфере выбросов загрязняющих веществ / Е.Л. Генихович // Охрана воздушного бассейна городов и промышленных регионов: сборник / НПК «Атмосфера». – СПб., 2007. – С. 362-373.
6. Генихович, Е.Л. Основные направления доработки нормативного документа ОНД-86 по расчету рассеивания в атмосфере выбросов загрязняющих веществ / Е.Л. Генихович // Охрана воздушного бассейна городов и промышленных регионов: сборник/НПК «Атмосфера». – СПб., 2007. – С. 362-373.
7. Sarvar, I. (2021). Application of Intelligent Systems in Cars. International Journal of Innovative Analyses and Emerging Technology, 1(4), 78-80.
8. Славутский, Л.А. Основы регистрации данных и планирования эксперимента: Учебное пособие / Л.А. Славутский. – Чебоксары: ЧГУ, 2006. – 200 с.