DEVELOPMENT OF MATHEMATICAL MODELS IN THE DEVELOPMENT OF INVESTMENT ACTIVITIES OF THE AUTOMOTIVE INDUSTRY IN UZBEKISTAN

Kasimova Nozima Omilovna*; Yakubova Dildar Muxamedjanovna; Ibragimova Kamola Saidboriyevna*****

*Basic Doctoral Student,
Tashkent State Technical University,
Tashkent, UZBEKISTAN
Email isd: Nozima050@inbox.ru

**Associate Professor,
Candidate of Economic Sciences,
Tashkent State Technical University,
Tashkent, UZBEKISTAN
Email id: Dildar1956@mail.ru

***Senior Lecturer,
Tashkent State Technical University,
Tashkent, UZBEKISTAN
Email id: Ibragimovakamola1980@gmail.com

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ABSTRACT

Development of economic-mathematical models of multifactor static analysis is one of the most reliable tools for research of activity of enterprise or industry as a whole, the impact on production for the purpose of increase of its efficiency. The decisive influence on labor productivity level has the growth of workers' qualification. Dynamics of labor productivity is mostly influenced by changes in the structure of industrial-production personnel.

KEYWORDS: *Economic And Mathematical Modeling, Investment Activity, Automotive Industry, Multifactor Static Analysis, Labor Productivity.*

INTRODUCTION

In the TRIAD countries (USA, Japan and EU) the automotive industry has developed into a high-tech network, while in the BRIC countries (Brazil, Russia, India and China) it started with simple products. The EU produces about 16 million cars a year, accounting for 26% of world production per year. Thus, cars are one of the most important products with an annual turnover of about 700 billion euros. The automotive industry, with 210 plants in Europe, exports net sales of 75 billion euros a year. It is also the largest sector investing in private research, with more than 5,800 patents a year. Germany, the biggest player in the European automotive industry, employs more than 750,000 people directly in the automotive industry in more than 45 plants. In the U.S., the auto industry accounts for 4-5 percent of the U.S. gross domestic product. In Japan, nearly 790,000 people work directly in the auto industry. **[1]**

By 2025, the share of global auto sales in the BRIC countries is expected to approach 50 percent, and the TRIAD and BRIC markets are expected to merge over the next 5-6 years in terms of consumer demand and behavior.

Uzbekistan's automotive market in 2020 shows positive dynamics: the market volume was 203 thousand cars in 2020, showing a growth of 72% over the previous year.

Material and methods

Today, Uzbekistan is the only country in Central Asia, which produces a full range of passenger cars and commercial vehicles. Currently, more than 85 enterprises in the country work in the automotive industry and cooperate with more than 200 foreign companies and organizations in this field. More than 28,000 people work in the industry today.

Generalized data on the development of the domestic automotive industry in general characterize the state of the industry. However for diversification of the branch and increase of competitiveness of let out production the deep analysis of technological level of the enterprises of automotive industry with the account of world tendencies and attraction of the approved in practice tools and methods is necessary.

In particular, multifactor mathematical models give an opportunity to reveal certain regularities in the development of an economic object and to visualize the relationship between various technical and economic indicators of its functioning.

It should be noted that to increase the accuracy of calculations related to economic and mathematical modeling of production efficiency at enterprises of the automotive industry, allows the use of multifactorial statistical models that characterize the change in economic indicators under the influence of determining factors.

When creating economic-mathematical models, statistical information was collected on LLC "Samarkand Automobile Plant" ("SamAvto"). The initial information covers the period from 2011 to 2021, as well as the project tasks for 2022. **[2]**

The standard program of linear regression analysis was used as a mathematical tool for the implementation of the static analysis.

The use of actual indicators reveals the real picture of the impact of a particular determinant on the outcome indicator.

Results

Statistical analysis of the data in creating multifactorial mathematical models was performed in several stages. In the first stage the factors that have the greatest impact on the value of the modeled indicator were selected.

Let's describe the obtained results for the economic indicator under study.

Labor productivity model.

Labor productivity is the efficiency of labor, the ability of a particular labor, depending on the social and technical conditions of production, to produce a greater or lesser amount of material goods per unit time.

This index serves as an integral indicator characterizing the level of organization of labor and production. Hence the necessity of research and inclusion of coefficient of productive capacity utilization into economical and mathematical model. The decisive influence on labor productivity level has the growth of workers' qualification. Dynamics of labor productivity is mostly influenced by changes in the structure of industrial-production personnel. At the present time the growth of number of engineering and technical personnel is conditioned by technical process, strengthening of laboratory base, creation of design bureaus, expansion of scales of scientific and research work, the increase in the complexity of work on the improvement of technology and organization of production.

The above-mentioned was the basis for the possibility of reflecting the factor of the share of engineering and technical workers in the total number of employees of the enterprise in the labor productivity model.

Taking into account the above said, the economic-mathematical model of the labor productivity includes:

y - labor productivity, mln.sum/person.

x1 - cost of introducing new technology, million soums.

x2 - coefficient of production capacity utilization, %.

x3 - share of engineers and technicians (ITR) in the total number of employees, %.

In a more general form a linear multiple regression is written as follows:

$y = a0 + a1\ x1 + a2\ x2 + ... + am\ xm$,

where y is the theoretical value of the resultant trait;

xi - arguments (factors);

m - number of the studied factors;

ai - particular regression coefficients, showing the degree of influence of each of the factors on the function;

a0 - residual term, characterizing the average value of the function.

In our study we obtained the following value in natural scale: linear regression model of the type:

$y=9.852+0.011\ x1 +0.057\ x2 +0.024\ x3$

Let us present the characteristics of the indicators of the regression equation.

The multiple correlation coefficient R, evaluating the total influence of all three factors, is high enough R=0,880. It testifies to the fact, that the general dispersion of the labour productivity on 77 % (R2=0,77) is determined by the variability of the factors, taken into account in the model.

Static reliability of the multiple correlation coefficients is usually checked with F criterion. This tests the hypothesis that there is no connection between the function and the set of considered factors-arguments in the general population, i.e. that in reality R=0. This usually uses a table F distribution, and the calculated value of the F-criterion at the 5% or 1% level of error is compared with the table ones. If at the given number of degrees of freedom the calculated value

appears to be greater than the tabulated value, the hypothesis is rejected and the multiple correlation coefficient can be considered statistically significant.

So, one can consider the multiple correlation coefficient in the labor productivity model to be reliable enough as the calculated value of F-criterion F -36,72 is much higher than the table one F tabl =4,45 with p=0,01.

After determination of significance of the multiple correlation coefficients, a confidence interval is constructed, which is determined as follows. Confidence interval for multiple correlation coefficient can be considered significant if calculated value of tR criterion significantly exceeds its tabulated value at a given confidence coefficient. In our case it is obvious, as the calculated value of tR - criterion: tR (calculation) =23.08 significantly exceeds the tabulated tR (tab)=2.80 at p=0.01. Significant confidence interval for the multiple correlation coefficient emphasizes the reliability of the selected by us initial information.

The reliability of the multiple correlation coefficient, determined by the Fisher criterion (F-criterion) characterizes the adequacy of the constructed model. The coefficients ai (i=1,2,3) show how much the value of Y increases when the corresponding xi increases by 1.

The economic-mathematical model of labor productivity on the natural scale shows that increasing the value of costs for the introduction of new technology by 1 million soums increases the average output of one worker by 0,011 million soums. Increase of coefficient of production capacity utilization by 1 % will promote increase of average output by 0.057 million soums. Increase of a share of engineers and technicians in total number of employees by 1 % leads to increase of average output of one worker by 0.024 mln. soums.

DISCUSSION

Significant contribution to the study of economic and mathematical modeling was made by foreign economists: Bem-Baverck, Walras, W. Parreto, J. Hicks, P. Samuelson, V. Leontiev, V.K. Dmitriev and others. At research of development of economic-mathematical modeling in our country authors relied on works of economists and experts in this area, such as S.S.Gulyamov, T.Sh.Shadiev, S.A.Salimov, A.A.Almuradov and others. **[3]**

At the same time, of the foreign scientists in the field of organization and management of road transport enterprises, Z.I. Aksenov, V.P. Bychkov, N.K. Gorshenin, Y.H. Guketlev, I. Demjanovich, V.I. Tabakov, and L.B. Mirotin made their contribution. Scientists of our country, such as G.A. Samatov, T.Yu.Kadyrov, M.N. Ravshanov, M.N. Irisbekova, M.B. Kalonov, G.A. Abdilakimov , E.A. Kamalova, Z.K. Usmanov, A.M. Merganov, R.G. Samatov conducted scientific research in the organization of innovative and investment processes in road transport.

CONCLUSION

On the basis of the developed models of the main technical and economic indicators of the enterprise operation the main reserves and sources of increasing of these indicators can be defined.

In order to achieve this goal, it is expedient to:

1. Additional capital investments and investments should be directed to the creation of new restructured enterprises.

2. Expand raw material base of the enterprise due to increase of total volume of production and release of export-oriented production.

3. The predictive model of labor productivity which we have developed testifies to the real possibility of increase of labor productivity which increases for the period 2011-2025 by 85 %.

Acknowledgement

The construction of multifactor correlation models of the most important indicators of automobile enterprises allows to apply the obtained results with sufficient substantiation for revealing the reserves of increasing the efficiency of production as well as for selecting the significant factors in the models of forecasting of these indicators.

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