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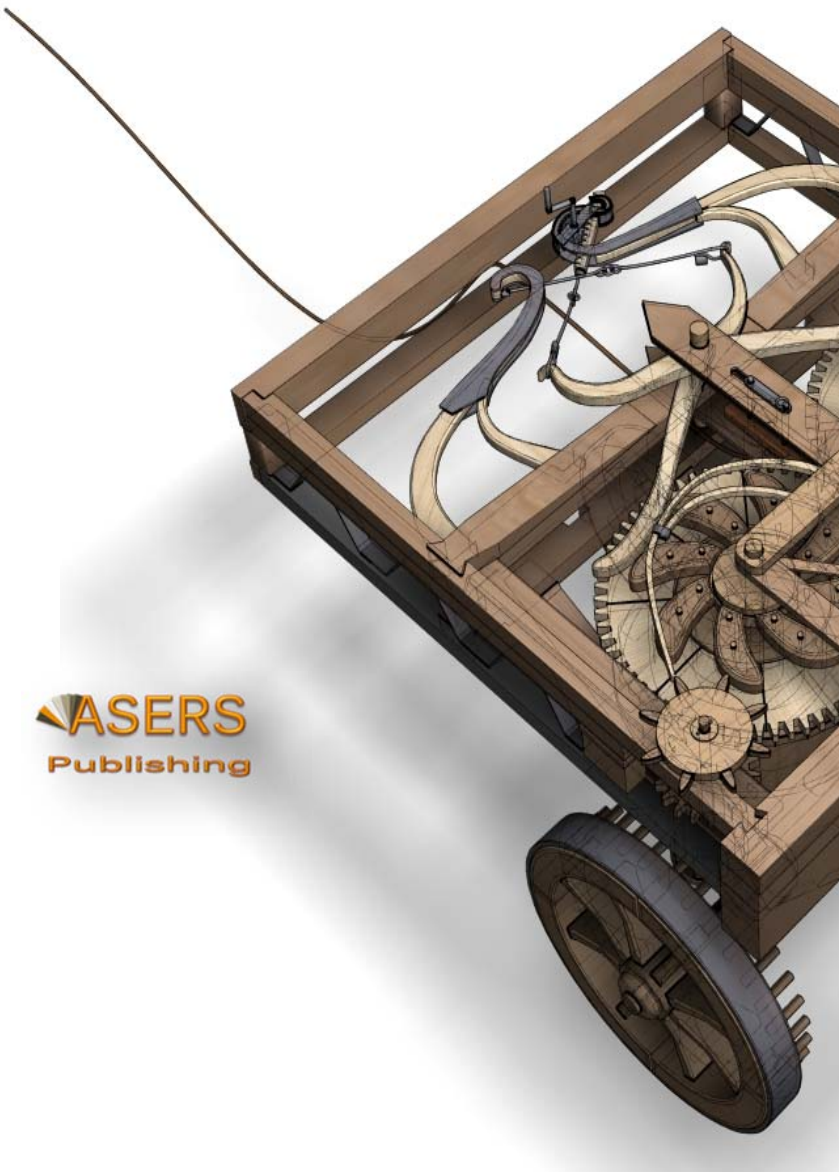

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Development of an Automated Model for Evaluating the Reproduction of Fixed Assets of the Enterprises of Hotel Industry

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Abstract:

The relevance of the research is due to the need of domestic enterprises of the hotel industry for periodically making managerial decisions to improve the profitability of their activities. In this regard, the aim of the article is to develop a comprehensive multifactorial and multiplicative model for evaluating the efficiency of reproduction processes of fixed assets of hotel enterprises. The main method of studying this problem is the method of econometric modeling which allows to evaluate the impact of the processes of use and reproduction of fixed assets of enterprises on the profitability of the business entity, develop ways of effective management and substantiate the prospective (forecast) indices of enterprise development. The building algorithm is substantiated and complex multi-factor multiplicative model for evaluating the impact of the state and effectiveness of fixed assets on the profitability of hotel companies is developed. The forecast values of profitability of hotel services given the indices of movement and efficiency of use of fixed assets at the enterprises of hotel industry are obtained for the short-term prospect. The presented model will allow the enterprises of hotel industry to determine ways of reproduction, renewal and modernisation of fixed assets for ensuring high quality of hotel services and increase of profitability of activity at large.

Keywords: main means; reproduction; analytical support; profitability; model.

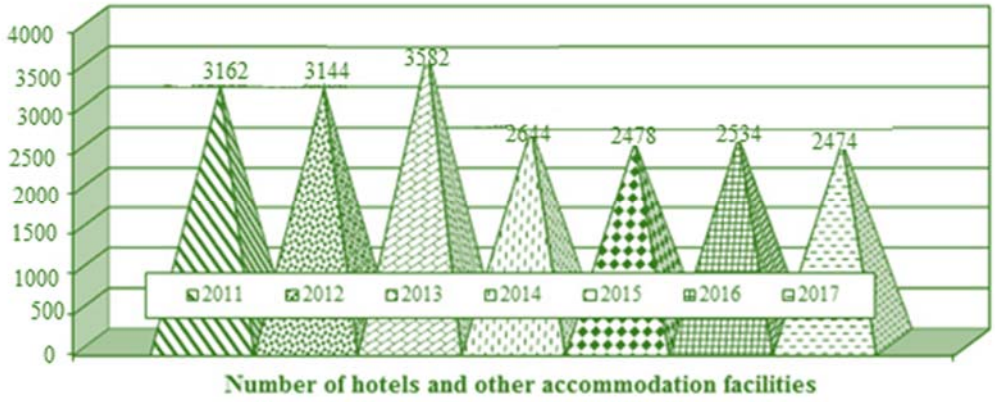
JEL Classification: M21; O14; Z32.

Introduction

The directions of efficiency increase of the process of reproduction and use of fixed assets at the enterprises of hotel industry depend on the presence of the operating management system, that is, a complex mechanism that combines the processes of accounting and analysis to create analytical support that allows to form objective information in accordance with the requirements of consumers and the directions of development of the industry. The development of economic relations of Ukraine based on market principles despite the increase of total amount of capital investments in the hotel industry in 2016 by 8.7% is the lowest index in Europe, requires the development of innovative methods of renewal of fixed assets and improvement of analysis and adaptation of its methods to the requirements of interested consumers in the conditions of automated information processing (Mikhalina 2014, Gillham *et al.* 2017, Seitova *et al.* 2018, Kryk 2017, Shabelnikova 2013).

The research of the hotel services market for 2011-2017 shows the decrease of number of hotels and similar accommodation facilities from 3162 enterprises in 2011 to 2474 enterprises in 2017, or by 21.7% (Figure 1). This tendency is due to many factors, both internal and external, but it is political factors, as well as military actions on the territory of Ukraine, that affect the dynamics deterioration most of all. Thus, since 2014, accounting of collective means of accommodation is conducted without taking into account the temporarily occupied territory of the Autonomous Republic of Crimea, Sevastopol City and temporarily occupied territories in Donetsk and Luhansk Regions, so the greatest mistake was found in 2644 hotels in the year of 2014 in comparison with the year of 2013 3582 hotels and similar means of accommodation, that is, 938 units less, or 35.47% (State Statistics Service of Ukraine 2017, Shaposhnikov *et al.* 2018).

Figure 1. Dynamics evaluation of the localisation of enterprises of hotel industry of Ukraine for the years of 2011-2017



Source: State Statistics Service of Ukraine, 2017.

The development of enterprises of hotel industry implies the introduction of new ones, liquidation of unusable and modernisation of existing fixed assets (Manyika *et al.* 2017, Bolgova *et al.* 2016, Kostruba 2018). Projecting the analytical support of the reproduction processes of fixed assets of the enterprises of hotel industry is based on the research of a large number of the facts reflecting production, social, financial and other processes occurring both at the hotel and beyond it. The main source of continuous development of the hotel industry is the income from the stable annual occupancy of hotel room capacity. The increase of the energy resources cost, higher prices for building materials, inventory of the hotel room capacity and inability to attract additional financial resources significantly complicated the process of technical reequipment of hotel industry. At the same time, the search of financial opportunities for the modernisation of the hotel room capacity will increase competitiveness in the market of hotel services.

1. Materials and Methods

In the process of research, the following methods were used: theoretical (analysis, synthesis, generalisation, abstraction and modelling), analytical diagnostics, empirical (observation, measurement and comparison), methods of economic and mathematical modelling and graphical representation of the results. Individual public joint-stock companies, which are engaged in hotel activity, were the experimental base of the research. The research was conducted in three stages:

At the first stage, the theoretical analysis of the existing methodological approaches in the economic, mathematical and technological scientific literature on the effective activities of hotel enterprises was carried out;

the method of modelling of complex economic processes is investigated; the problem, aim and methods of the research are singled out, the plan of analytical research is made and indices of reproduction of fixed assets of the enterprises for the implementation of economic and mathematical modeling are determined.

At the second stage, the database of indices of the use of fixed assets by a group of domestic enterprises of the hotel industry is formed; the model of evaluation of reproduction of fixed assets of enterprises of the hotel industry is developed; the statistical significance of the obtained results is checked to establish the significance of the impact of the factors under research on the profitability of enterprises, the adequacy of the mathematical model and the legality of its use for practical situations. At the third stage, theoretical and practical conclusions are specified, obtained results are generalised and systematised, proposals to producers of hotel services are formulated.

2. Results

2.1. Formation of Analytical Support System

The use of multifactorial models of analysis in domestic practice is introduced with the spread of Western integral evaluation of the financial condition and the probability of bankruptcy, namely the Altman Z score model, the Beaver model the Springate Score, etc. The measuring system of analytical support of reproduction of fixed assets of the enterprises of hotel industry is built on the basis of the indices which characterise movement, condition, efficiency of use of fixed assets, cost of hotel services and profitability of hotel industry (Figure 2).

The system of analytical indices is grouped into 5 units, each of which has a specific aim of analysis, namely evaluation of intensity and efficiency of reproduction of fixed assets, determination of the degree of depreciation of fixed assets, evaluation of areas of reproduction of fixed assets according to the cost of hotel services and evaluation of the impact of reproduction of fixed assets on the profitability of hotel services. Taking into account the above indices, a multiplicative multifactorial mathematical model is developed.

The research of the intensity of reproduction of fixed assets in the enterprises showed that at 70% of the enterprises of hotel economy under research, the coefficient of input of fixed assets is much less than that of the disposal of fixed assets (Markhonos and Turlo 2017, Podtserkovny 2018, Patra 2018). This indicates the decrease of the intensity of the process of renewal of fixed assets. The period of renewal of fixed assets at six enterprises of hotel industry is approximately two months, for eight enterprises the period of renewal is up to one year, and in six the above index is several years. The evaluation of the condition of fixed assets confirmed that at the enterprises of hotel industry, on average, the validity coefficient is 63%, and this indicates a high degree of depreciation of fixed assets and the need to renew them (Table 1). To generalise the results of the research in Table 2, we conditionally carried out the distribution of the degree of depreciation of the enterprises under research into four categories: I category – "low depreciation degree" (from 1 to 25%), II – "medium depreciation degree" (from 26 to 50%), III – "high depreciation degree" (from 51 to 75%) and IV – critical depreciation degree (from 76-100%) as of 2017.

Table 1. Evaluation of the condition and efficiency of the use of fixed assets by the enterprises of hotel industry in 2017

No.	Enterprise	Year	Profitability of hotel services Y	Validity coefficient of fixed assets, % x_1	Capital productivity coefficient x_2	Coefficient of return on fixed assets x_3
1	Teatralnyi Hotel PJSC, Kyiv City	2017	-0.0993	0.7667	0.3848	-0.0382
2	Hradetskyi Hotel PJSC, Chernihiv Town	2017	-4.8456	0.4939	0.0727	-0.3524
3	Hotel "Mir" PJSC, Kharkiv City	2017	-0.0209	0.3142	0.7435	-0.0156
4	Holosiivskyi Hotel PJSC, Kyiv City	2017	-0.0881	0.3052	0.5749	-0.0507
5	Dnipro PJSC, Kyiv City	2017	0.0022	0.5369	0.3184	0.0007
6	"Intourist- Zakarpattya" Hotel Uzhhorod Town	2017	-1.9524	0.1737	0.0261	-0.0510
7	Hoteli Truskavtsia PJSC, Lviv Region	2017	-0.1631	0.4554	0.1879	-0.0307
8	"Ternopil" PJSC, Ternopil Town	2017	0.1189	0.5496	0.6440	0.0766
9	Hotel Bratislava PJSC, Kyiv City	2017	0.0089	0.6365	0.1109	0.0010
10	Hotel Kharkov PJSC, Kharkiv City	2017	0.0060	0.3768	0.4245	0.0026

Figure 2. System of analytical support of reproduction of fixed assets of the enterprises of hotel industry

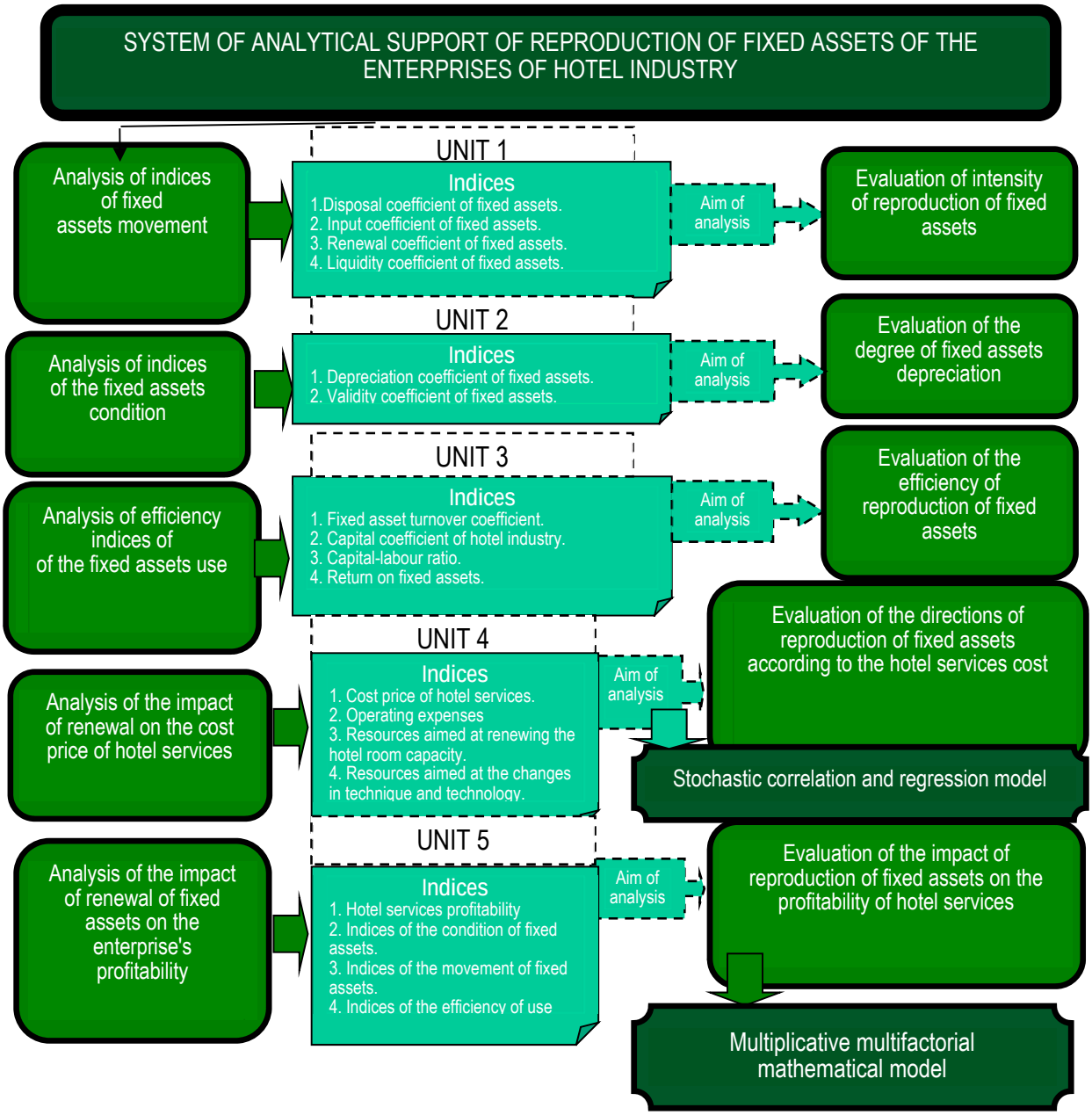


Table 2. Evaluation of depreciation of fixed assets of hotel industries

No.	Category of depreciation degree	Depreciation degree	Number of hotels	Structure (%)
1	Low depreciation degree (from 1 to 25%)	I	1	10
2	Medium depreciation degree (from 26 to 50%)	II	5	50
3	High depreciation degree (from 51 to 75%)	III	2	20
4	Critical depreciation degree (from 76-100%)	IV	2	20
Total			10	100%

According to the research results, low depreciation degree is prevailing at 10% of hotels under research, medium at 50% of hotels, the category of high depreciation degree includes 20% of hotels and 20% of enterprises

of hotel industry are in the category of critical depreciation degree. To solve this problem, hotels should upgrade outdated and physically depreciated fixed assets by their reproducting. The main source of reproduction of fixed assets of hotel industry is amortisation deductions and capital investments which, thanks to the effective policy of the enterprise, can be directed to the timely renewal of fixed assets and thereby contribute to the increase of the occupancy of the hotel room capacity and improve financial results. That is why, there arose a need to study amortisation as one of the sources of renewal of fixed assets in the operating expenses of the enterprises of hotel industry. The structure of operating costs of enterprises of hotel industries of Ukraine in 2017 indicates the growth of material costs to 5641.2 mln. Which is 37.8% in operating costs for service provision, and the lowest share (6.2%) is depreciation – 928.5 million UAH (Markhonos 2017, Akhmetshin *et al.* 2018, Aimagambetov *et al.* 2017).

2.2. Model Building

The complex, multifactorial and multiplicative model of the efficiency evaluation of reproduction processes, which allows to evaluate the impact of different factors on return on fixed assets of the enterprises of hotel industry, is developed. To this end, the impact of different factors that characterise profitability, the condition and efficiency of the use of fixed assets of the enterprises of hotel industry, the share of which in the assets of hotels ranges from 80%. The model is developed with taking into account the indices of the condition and efficiency of use of fixed assets in 10 enterprises of hotel industries in different regions of Ukraine (Table 1), the evaluation of the parameters of the linear model is carried out by the method of the smallest squares. In the result of calculations the coefficients of multiple correlation for indices which are given in Table 3.

Table 3. Correlation coefficients for the indices of condition, movement and efficiency of fixed assets of the enterprises of hotel industry of Ukraine

No.	Conditional value	Index	$R=\sqrt{R^2}$
1	x_1	Coefficient of validity correlation of fixed assets	0.161243
2	x_2	Coefficient of capital productivity correlation of fixed assets	0.560946
3	x_3	Coefficient of correlation of return on fixed assets	0.93172

Based on calculated coefficients one can build an equation that reflects the multifactorial, mathematical behaviour model of condition and efficiency of reproduction of fixed assets and its impact on return on fixed assets of the enterprises of hotel industry:

$$y = -1.073 + 1.179 \cdot x_1 + 1.042 \cdot x_2 + 11.724 \cdot x_3 \quad (1)$$

The coefficients presented in the model (1) characterise the significance of the impact of every factor on return on fixed assets of the enterprises of hotel industry. The value of the coefficient of determination for the developed model is 0.90, so the model can be considered efficient enough to describe economic processes based on the established interrelation. The check of the model according to F-test revealed its adequacy. Confidence intervals for the model's parameters:

$$a_0 \epsilon (-2.798; 0.651); \quad (2)$$

$$a_1 \epsilon (-1.649; 4.006); \quad (3)$$

$$a_2 \epsilon (-1.196; 3.279); \quad (4)$$

$$a_3 \epsilon (6.808; 16.641); \quad (5)$$

2.3. Model Approbation

Approbation of the developed model with the prediction of profitability for ten public joint stock companies, namely the enterprises of hotel industry in different regions of Ukraine as of 2020 is given in Table 4. If the dynamics of the index from period to period is positive, the situation with the reproduction of fixed assets in the enterprises of the hotel industry can also be considered positive and at this stage only supportive measures are required from the enterprise. According to the calculations in Table 4, such a situation is observed in 8 hotels under research, namely Teatralnyi Hotel PJSC, Kyiv City; Hotel "Mir" PJSC, Kharkiv City; Holosiivskyi Hotel PJSC, Kyiv City; "Intourist-Zakarpattya" Hotel, Uzhhorod Town; Hotel "Ternopil" PJSC, Ternopil Town; Hotel Bratislava PJSC, Kyiv City; Hotel Kharkov PJSC, Kharkiv City.

Table 4. The evaluation of predictable profitability of hotel services for 2020 given the indices of movement and efficiency of use of fixed assets at the enterprises of hotel industry

No.	Enterprises of hotel industry	Profitability of hotel services
1	Teatralnyi Hotel PJSC, Kyiv City	0.1022
2	Hradetskyi Hotel PJSC, Chernihiv Town	-2.2518
3	Hotel "Mir" PJSC, Kharkiv City	0.0544
4	Holosiivskyi Hotel PJSC, Kyiv City	1.3156
5	Dnipro PJSC, Kyiv City	1.3714
6	"Intourist- Zakarpattya" Hotel, Uzhhorod Town	1.0846
7	Truskavets Hotels PJSC, Lviv region.	-1.4719
8	Hotel "Ternopil" PJSC, Ternopil Town	1.4598
9	Hotel Bratislava PJSC, Kyiv City	0.8924
10	Hotel Kharkov PJSC, Kharkiv City	0.1055

If there is a negative dynamics of the index, the enterprises of hotel industry should reconsider the situation with the reproduction of fixed assets and make a decision on its improvement, such a tendency is observed in Hradetskyi Hotel PJSC, Chernihiv Town and Hoteli Truskavtsia PJSC, Lviv Region.

3. Discussion

The profit of the enterprises of hotel industry and its relative modification-profitability are the main criteria of efficiency of operational activity, criteria of the choice of investment projects and programs of optimisation of current expenses and financial investments. The production system of the enterprise of hotel industry is characterised by the dependence between the number of hotel services provided and the resources consumed for this purpose, and certain indices of this dependence have some random fluctuations. The dependence between them formalised in the relevant form of a regression equation is called the production function of the hotel. If the production function of the hotel is known, by the number of resources consumed, one can predict the number of hotel services provided and, vice versa, by the number of services provided, one can calculate the required number of relevant resources, in our case – fixed assets.

The economy of tourism enterprises with an emphasis on improving the material and technical base of hotel industry was studied by L.M. Mikhalina (2014), G.A. Yakovlev (2004), S.M. Markhonos (2017). Michelle N. Chibili (2016) substantiates the expediency of the introduction of automated systems in the hospitality industry without which it is impossible to make informed managerial decisions, and Jacques Bughin, James Manika, Jonathan Woetzel (2017) prove by their research unconditional impact of automation on the financial performance of the hotel business. Ye V. Mnykh (2003), B.A. Pysarenko, N.B. Protsenko and A.B. Pysarenko (2012) note that the research conducted indicates the absence of a systematic approach to the study of the efficiency of the use of fixed assets of the enterprise and the issues of their rational structure. The undeniable importance of the process of reproduction of fixed assets and its dependence on improving the efficiency of their use is determined by I.A. Marynych, O.V. Kot (2010).

M.I. Kovalchuk (2005), A.D. Sheremet, and O.S. Saifuin (2005), as well as foreign scientists Gustav Feichtinger, Raimund M. Kovacevic and Gernot Tragler (2018) argue that in the conditions of innovation and production intensification, a special role is given to the qualitative characteristics and quantitative composition of the main production facilities that make up the material and technical base of enterprises. So, the problem of analysing the efficiency of the use of fixed assets is closely related to the financial results of the enterprises of the hotel industry. The methods of generalising the results of the analysis of fixed assets include systematisation of the results, their grouping and generalisation; identification of lost opportunities and the calculation of the amount of unused reserves; identification of directions and development of economically substantiated measures to improve the efficiency of activity; managerial decision-making and control over their use.

When identifying the economic efficiency of the use of fixed assets, they apply natural and cost indices, the main among which are capital productivity, capital intensity and return on capital invested in fixed assets. Due to the enlarged analysis, the object is all production means, and for the purpose of its deepening – individual types of fixed assets of the main activity (Kindratska *et al.* 2008, Prodanova *et al.* 2017). The study of research papers in the field of reproduction of fixed assets indicates the presence of a wide range of methods and tools to improve its efficiency. Most methods are based on the approach, according to which at the enterprise at certain moment of time arise a need for the immediate reproduction of fixed assets that do not function or lost their validity. And then

the task is to assess the expediency and effectiveness of such measures at the enterprise (Ihnashkina and Shura 2011, Baigabylov *et al.* 2013).

Mainly, such researchers as H.I. Kindratska, M.S. Biblyk, A.H. Zahorodnii, O.L. Leshchynskyi, V.V. Riazantseva (Leshchynskyi *et al.* 2003), as well as A.D. Sheremet and O. S. Saifuin use economic and mathematical models for assessing the efficiency of reproduction of fixed assets, but little attention is paid to the development of the formalised expression of the general economic condition of reproduction of fixed assets. So, we consider that there is a need to develop a multifactorial model of efficiency of reproduction of fixed assets of the enterprises of hotel industry which would cover simultaneously all mass of fixed assets and not depend on any certain type of reproduction. So, the model can be build by applying correlation and regression analysis. V.V. Kovalov and O.N. Volkova note that the correlation analysis is a method of establishing a relation and measuring its density which can be considered random and selected from the set distributed over a multidimensional normal law. Regression analysis is a method of establishing an analytical expression of the dependence between the studied features (Kovalov and Volkova 2002).

In the result of correlation and regression analysis, the regression dependence is determined and the coefficients of closeness and significance are calculated. Such interrelation is a mathematical model of the economic phenomenon under research which is formulated in the form of a mathematical equation where the function and argument are interrelated. However, the regression line is a conditional expectation of the function under research for a certain behaviour of the arguments (Kovalchuk 2005). The developed model should be adapted to the automated information processing system because without innovative software an effective management policy of a modern enterprise is impossible, and this is proved by Jonathan Gilham, Lucy Rimmington, Hugh Dance, Gerard Verweij and Anand Rao (Gilham, Riminton, Tants,Vervey, Rao, 2018). The impact of information technology on modern management systems was also studied by Maziyar Ghasemi, Vakhid Shafeipur, Muhammad Aslani, Elham Barvaiekh (2011). The effect of the introduction of information technology in the management of the enterprise in the publications is revealed by J. Reardon and B. Coe (1996) and this confirms the article's relevance.

Conclusions and Recommendations

The proposed model can be used to calculate the forecast of profitability indices of hotel services based on the data on the movement, depreciation and efficiency of fixed assets by enterprises of the hotel industry of different ownership forms. The results of the forecast allow to evaluate the economic activity of hotels and make informed managerial decisions on the renewal, modernisation or modification of the material and technical base of the hotel. The materials of this article can be helpful for managers of enterprises of hotel industry, accountants, analysts, as well as scientists, teachers and students interested in the management of hotel enterprises. In the course of the research, there arose new issues and problems that need to be solved. One should continue the research of managerial processes taking place at the enterprises of the hotel industry, to determine the impact of various factors on the profitability of such enterprises.

The developed model can be widely used in analytical studies of internal and external users:

- the implementation of the model will help the management staff make effective managerial decisions;
- Economic Planning Department will be able to identify weak points in the mechanism of reproduction of fixed assets with the aim of their eliminating in the future;
- investors with the help of the model will be able to analyse the efficiency of the enterprise in the context of the use of invested capital, and credit institutions – to make decisions on financing the renewal of fixed assets;
- supervisory authorities will be able to identify the violations during the use of fixed assets of the hotel;
- statistical office will have an opportunity to identify the main regularities in the condition and efficiency of reproduction of fixed assets at the enterprises of hotel industry.

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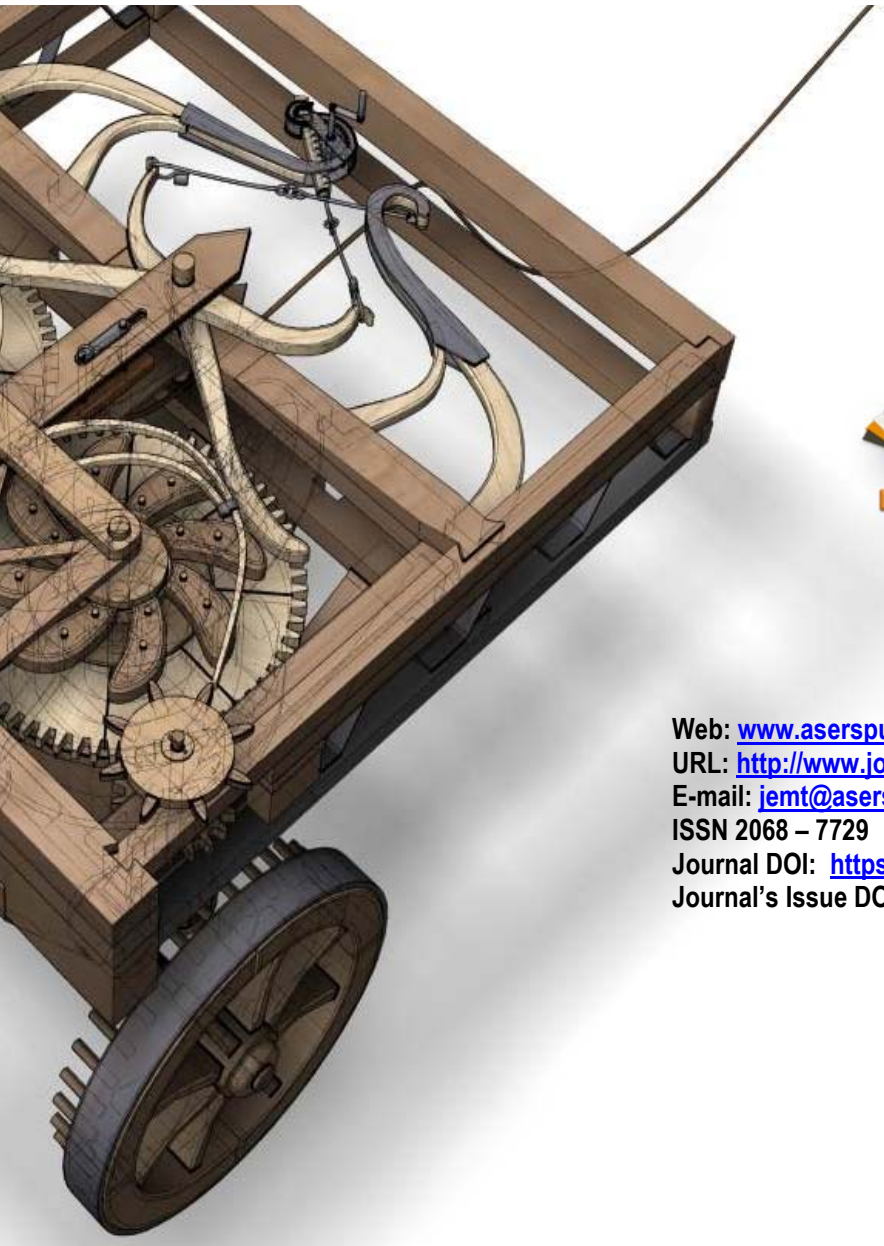

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