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Methodical approaches to forecasting tourist streams

Enfoques metódicos para predecir corrientes turísticas

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Content

ABSTRACT:

The paper found that at the present stage of economy development of the Russian Federation, the problem of the introduction of forecasting tourism business development elements and its effectiveness evaluation deserve special attention. Using the mathematical apparatus, the paper proved that the use of forecast models is the promising trend in the tourism development process modeling; based on such models we can determine locations for new tourist centers, evaluate the impact of these centers on the existing situation in the tourist market including competitive factors. Investigation of the tourist stream indicator dynamics allowed us to assay the tourism development, and to forecast its development in the near future for the city of Moscow and the Moscow region. These forecast values showed that, while maintaining the basic macroeconomic parameters of the tourist streams growth will increase; this generally indicates an improvement in the development of the tourism industry in the region.

Keywords: forecasting, tourist streams, potential, progress, industry, efficiency, trend.

RESUMEN:

El documento constató que en la actual fase de desarrollo económico de la Federación de Rusia, el problema de la introducción de los elementos de desarrollo de los negocios del turismo y su evaluación de la eficacia merecen una atención especial. Utilizando el aparato matemático, el papel demostró que el uso de modelos de previsión es la tendencia prometedora en el modelado del proceso de desarrollo del turismo; Basándonos en estos modelos podemos determinar las ubicaciones de los nuevos centros turísticos, evaluar el impacto de estos centros en la situación existente en el mercado turístico, incluyendo factores competitivos. La investigación de la dinámica del indicador de la corriente turística nos permitió ensayar el desarrollo turístico, y pronosticar su desarrollo en un futuro próximo para la ciudad de Moscú y la región de Moscú. Estos valores previstos mostraron que, al mismo tiempo que se mantienen los parámetros macroeconómicos básicos del crecimiento de las corrientes turísticas, aumentará; Esto indica generalmente una mejora en el desarrollo de la industria del turismo en la región.

Palabras clave: pronóstico, flujos turísticos, potencial, progreso, industria, eficiencia, tendencia.

1. Introduction

The current global economic situation requires both the developed countries and the majority of transnational corporations possess powerful research information and analysis centers that use information and computing technologies for the medium and long-term forecasting of trends in tourism.

One of the main objectives of forecasting in tourism is obtaining and analysis of the forecast trends of possible future changes, as well as ways of event direction to the desired course. As a possible idea of the future prospects of development, the forecast makes it possible to see the main landmarks of changes in the tourism sector.

The logical consequence of strengthening the role of forecasting in tourism is to increase the requirements for the validity and reliability of the forecast estimates. The use of traditional forecasting methods does not provide the required level of reliability due to the high degree of uncertainty and lack of stability in the tourism sector.

Practice has shown that the long-term forecast trend of changes in economic factors in tourism can not provide satisfactory results, since it is necessary to know not how the process develops, on average, but how the current situation will develop, i.e. its development trends in planning time horizon.

One of the main objectives of the tourist market analysts is forecasting its development trends. With regard to forecasting the short-term or medium-term development trends of the tourist market, there is a need to realize that we cannot speak about forecasting a particular level of price or value of the tourist macroeconomic indicator, as it would be incorrect. This may be a forecast of the system behavior (growth – decline – delay – stagnation), i.e. the possible scenarios are highlighted for the future behavior of the tourism industry.

Since the priority of one tourism market development scenario over the other one has a certain subjectivity, which should have its limits, the scenario selection can be left to market participants. At the same time we should not forget that the creation of the forecast models is a complex and time-consuming objective, for which it is necessary to conduct a thorough analysis of time series, not only for separate tourism enterprises, but also for macroeconomic indicators of tourism development in the state.

At the present time, the problem of the introduction of forecasting tourism business development elements and its effectiveness evaluation deserve special attention with the use of the mathematical apparatus, and more specifically with the use of economic and mathematical methods and models of management tasks in the field of tourism. With the help of these methods, the quantitative parameters of tourism systems are extrapolated, as well as quantitative characteristics of economic, scientific, service potential of tourism, indicators characterizing the effectiveness of scientific and technological progress, the ratio of its individual sub-systems and components.

The issues of forecasting the tourist streams were considered by E.S. Zharkova (2015), E.V. Zagalova (2014), D.A. Kozlov (2016), N.A. Platonova (2015), M.M. Ordzhonikidze (2013), V.N. Sharafutdinov (2011) et al. However, the theoretical analysis of scientific sources confirmed the fact that these problems are not studied fully, and that led to the need for just such an in-depth study.

In particular, the definition of methodological approaches to forecasting of tourist streams would solve such urgent and important problems for the domestic tourism industry including increasing efficiency and improving the management system of domestic facilities of tourist business.

2. Methods

The problem of the selection and application of economic and mathematical methods to forecast

evaluation of tourist streams is closely linked with the operation of tourism enterprises. To calculate the forecast values of tourist streams, the article applied forecasting methods, the essence of which is to construct regularities prevailing in prior periods.

These regularities allowed us to describe the actual average value for the future process in time. In our study, the forecasting methods were applied to the processes, when the development of the phenomenon is well described by a formed equation; and conditions determining the development trend in the past will not significantly change in the future. Adhering to these conditions, the forecasting was carried out by determining the values of the independent variable, which is consistent with the value of the forecast horizon.

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3. Results

If *f(t)* is a probability function of potential tourists acquiring a tour at time *t*, and *F(t)* is a probability function that describes proportion of the potential tourists of the total population in the same time. Then, *f(t) / [1 - F(t)]* is the conditional probability of arrival of a certain number of tourists in a certain moment of time *t*. It can be assumed that the conditional probability can be described by linear function *F(t)*, i.e. *f(t) / [1 - F(t)] = a + b F(t)*, where a, b are coefficients.

If we denote the total number of potential tourists by *K*, the number of tourists arriving in time *t* will be equal to *Yt = K f(t)*, while the number of potential tourists will be *Kt = K F(t)*. In this case, the total number of tourist arrivals is:

$$Y_t = a(K^* - K_t) + b \cdot K_t(1 - K_t / K^*) \quad (1)$$

K can be described as a function of factor variables in logarithmic form as follows:

$$\ln(K_t^*) = d_0 + \sum_{j=1}^{\kappa} d_j \ln X_{jt} \quad (2),$$

Xjt is factorial signs, *dj* is a regression coefficient.

Using (1), we can also note *Yt* as a quadratic function *Kt-1*

$$Y_t = aK^* + (b-a)K_{t-1} - (b / K^*)K_{t-1}^2 \quad (3)$$

Substituting (2) in (3), we obtain the following:

$$Y_t = \alpha \exp\left[d_0 + \sum_{j=1}^{k} d_j N_{jt} \right] + (b-a)K_{t-1} - bK_{t=1}^2 / \exp\left[d_0 + \sum_{j=1}^{k} d_j X_{jt} \right] \quad (4)$$

If we denote *α= a exp (d0)*, *β = (b - a)* и *γ = b / exp (d0)*, we obtain a formula for determining the total number of tourists as follows:

$$Y_t = \alpha \exp\left[\sum_{j=1}^{k} d_j X_{jt} \right] + \beta K_{t-1} - \gamma K_{t-1}^2 / \exp\left[\sum_{j=1}^{k} d_j X_{jt} \right] \quad (5)$$

The parameters *a, b* and *d* can be estimated while determining *d0* using values *α*, *β* and *γ*. Nonlinear methods should be applied in order to estimate the parameters of the model obtained, since there is a parametric nonlinearity. Here, the main model feature is its complete consistency in terms of lack of stationary data.

This model allows us to use the statistical data on the number of tourist arrivals for some retrospective period. The advantage of this model is the fact that the statistical data show the effect of absolutely all the factors including insignificant ones. Moreover, the model has the forecast properties as takes into account inertia and delay of influence of factor variables. By

the combination of features, this model can be attributed to the dynamic forecast models.

Studies show that one of the factors that affect the volume of the tourist market is seasonality. Demand swings for tourist services give the seasonality curve. Analysis of the tourist stream indicator dynamics allows us to assay the tourism development, and to forecast its development in the near future (Preez & Witt 2005; Nikolaeva, et. al. 2014).

With the seasonality wave we can build a forecast, which takes into account seasonal demand swings. However, before calculating the seasonal wave, actual data should be processed so that the overall trend is revealed. To do this, we propose to use the method of analytic fitting of the dynamics.

By using the analytical fitting, we propose the following seasonality index algorithm: the fit levels should be determined for the corresponding trend for each quarter at the certain moment of time; the relationship of the actual quarterly data should be determined according to the corresponding fit data. As initial data for evaluating the seasonality of tourist streams, we took data in Moscow and Moscow region from the first quarter of 2011 to the fourth quarter of 2015. The constructed trend allowed us to calculate the seasonality indices presented in Table 1.

Table 1. Seasonality indices of the tourist streams in Moscow and Moscow region of the Russian Federation in 2011-2015.

Quarter Year	I	II	III	IV
2011	0.982	0.917	1.381	0.947
2012	0.746	0.655	1.108	0.862
2013	1.176	1.174	1.915	1.426
2014	0.276	0.314	0.531	0.404
2015	1.004	1.168	2.099	1.488
Average values of seasonality index	0.752	0.762	1.268	0.931

Based on the resulting trend ($Y = 396161.2 - 41281.4t + 1242.2t2-7.5t3$), we can assert the existence of decline trend. The analysis of indices shows the presence of the seasonal wave in the studied dynamics. To build the forecast values, we suggest multiplying each month values by the corresponding seasonality index.

We used the average geometric value of the seasonality indices in 2011-2015 as the average seasonality index. According to the forecast values, the tourist stream in Moscow and Moscow region in the fourth quarter in 2016 will increase by 1.47 times compared to the same period in 2015, and in 1.76 times compared to the analogical period in 2014. In the third quarter in 2017 the tourist stream should increase by 1.8 times compared to the same period in 2015, and in 1.82 times compared to the same period in 2014.

These forecast values show that, while maintaining the basic macroeconomic parameters of the tourist streams growth will increase in Moscow and Moscow region; this generally indicates an improvement in the development of the tourism industry in the region.

We suggest expressing the demand for tourist services by the number of visiting tourists or costs incurred in the host country. The equation of demand for tourist services can be written as follows:

$$NR_t = \alpha_1 NR_{t-1} + \alpha 2 Y_t + \alpha 3 BR_t + \beta_t + \xi_t \text{ (6)},$$

NRt is endogenous variable that represents the logarithm of the number of tourists and tourism expenditures, depending on the model purpose; *NRt-1* is a process of the model autoregression; *Yt* is available income per person; *BRt* is a combination logarithm of the real effective exchange rate; *βt* is a seasonal component provided to the quarterly demand swings:

$$\beta_t = \gamma_1 \cos\frac{\pi}{2}t + y_1^* \sin\frac{\pi}{2}t + \gamma_2 \cos\pi t \text{ (7)},$$

ξt is a value, which has zero mean variation of σ2; *α1, α2, α3, γ1, γ*2, γ2* are parameters.

4. Discussion

Thus, the importance of methodical approaches to forecasting of tourist streams is confirmed by the degree of adequacy of accounting the major advantages of these approaches. Using tourist stream forecasting methods allows us to take into account all the elements of a dynamics, which equally affect the studied indicators (Goh, et. al. 2010; Li, et. al. 2008).

Further study in the field of forecasting the tourist streams should be directed to account of seasonal swings, which adversely affect the financial and economic activities of tourism enterprises. The demand seasonality hampers effective event planning in tourism, slows down its economic development.

The social consequences of the seasonal work of tourism enterprises include well hidden unemployment, the reduction of payments in the budgets of different levels. Among the strategic priorities of forecasting the tourist streams within certain enterprise, a set of measures should occupy a special place aimed at reducing the demand swings for its services and products, in particular the creation of a separate sub-section with functions of search, analysis and processing of business information.

5. Conclusion

The paper found that at the present stage of economy development of the Russian Federation, the problem of the introduction of forecasting tourism business development elements and its effectiveness evaluation deserve special attention with the help of the mathematical apparatus.

It is proved that a prospective direction in the modeling tourism development process is the use of the forecast models, based on which we can determine locations of new tourist centers, evaluate the impact of such centers on the existing situation in the tourist market, taking into account the competitive factors.

Investigation of the tourist stream indicator dynamics allowed us to assay the tourism development, and to forecast its development in the near future. These forecast values showed that, while maintaining the basic macroeconomic parameters of the tourist streams growth will increase in Moscow and Moscow region; this generally indicates an improvement in the development of the tourism industry in the region.

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[Index]