ASERS

# Journal of Environmental Management and Tourism

Biannually
Volume VIII
Issue 4(20)
SUMMER 2017

ISSN 2068 – 7729
Journal DOI
http://dx.doi.org/10.14505/jemt

ASERS Publishing

SUMMER 2017
Volume VIII
Issue 4(20)

Editor in Chief
**PhD Ramona PÎRVU**
University of Craiova, Romania

Editorial Advisory Board

**Omran Abdelnaser**
University Sains Malaysia, Malaysia

**Huong Ha**
University of Newcastle, Singapore, Australia

**Harjeet Kaur**
HELP University College, Malaysia

**Janusz Grabara**
Czestochowa University of Technology, Poland

**Vicky Katsoni**
Techonological Educational Institute of Athens, Greece

**Sebastian Kot**
Czestochowa University of Technology, Institute of Logistics and International Management, Poland

**Nodar Lekishvili**
Tibilisi State University, Georgia

**Andreea Marin-Pantelescu**
Academy of Economic Studies Bucharest, Romania

**Piotr Misztal**
Jan Kochanowski University in Kielce, Faculty of Management and Administration, Poland

**Agnieszka Mrozik**
Faculty of Biology and Environmental protection, University of Silesia, Katowice, Poland

**Chuen-Chee Pek**
Nottingham University Business School, Malaysia

**Roberta De Santis**
LUISS University, Italy

**Fabio Gaetano Santeramo**
University of Foggia, Italy

**Dan Selişteanu**
University of Craiova, Romania

**Laura Ungureanu**
Spiru Haret University, Romania

ASERS Publishing
http://www.asers.eu/asers-publishing
ISSN 2068 – 7729
Journal DOI: http://dx.doi.org/10.14505/jemt

# Contents:

| | | |
|---|---|---|
| 1 | **Integral Factor Assessment of Formation and Development of Finno-Ugric Tourist Cluster**<br>Svetlana E. MAYKOVA, Denis V. OKUNEV, Irina V. GVOZDETSKAYA | …703 |
| 2 | **Applications of the Concept of Territorial Marketing in Forming and Implementing Competitive Advantages for Tourist Areas**<br>Toskanay Aitmukanovna KUTTUBAEVA, Lyudmila Viktorovna ISHCHUK, Raisa Taanovna ADARINA, Andrei Vladimirovich GLOTKO, Tatyana Viktorovna FEDOSOVA | …713 |
| 3 | **Method to Evaluate Consumption of Tourist Services in Regional Markets**<br>Oksana V. TRETYAKOVA, Natalya I. NIKITINA, Natalia V. SPASSKAYA | …727 |
| 4 | **A Socio-demographic Study of Destination Management for Coastal Tourism in Phuket**<br>Chatchawan WONGWATTANAKIT, Manoj LOHATEPANONT, Pongsa PORNCHAIWISESKUL | …737 |
| 5 | **Potential of Health Resort Treatment of Cardiovascular Diseases**<br>Angela Sergeevna DAMADAEVA, Saida Alirzaena MAGOMEDOVA, Naida Radjabovna MOLLAEVA | …751 |
| 6 | **The Idea of Congruence between Image and Society Stereotype on Attitude toward Tourist Destination**<br>Sri RAHAYU, Sofjan ASSAURI, Ignatius HERUWASTO | …761 |
| 7 | **The Development of a Business-Processes Model for the Quality Management System in the Hotels**<br>Sergey Sergeevich SKOBKIN, Andrey Pavlovich KOVALTCHUK, Yana Andreevna BELAVINA, Gleb Vadimovich KALITA | …775 |
| 8 | **The Importance of Tourism in Regional Economic Development: A Time-Series Analysis**<br>Daniel Francois MEYER, Chané de BRUYN, Natanya MEYER | …784 |
| 9 | **The Dynamic Relationship between Economic Growth, Tourism Activity, and Real Exchange Rate in Indonesia**<br>Elvina PRIMAYESA, Wahyu WIDODO, F.X. SUGIYANTO, FIRMANSYAH | …798 |
| 10 | **Technology of Branding of the Territory's Recreational Potential based on Altai Territory**<br>T.V. PETROVA, T.P. DANKO, O.V. KITOVA, N.V. IVOLGINA, T.V. MURTUZALIEVA, O.I. KLIMENKO, V.D. SEKERIN | …811 |
| 11 | **The Impact of Inflation, Exchange Rate toward Unemployment and Poverty in Indonesia. Case Study of Small and Medium Enterprises at the Tourists' Area of Lombok**<br>Edy SUPRIYADI, Devi Roza Krisnandhi KAUSAR | ...825 |
| 12 | **The Concept of Neuroagents in Hospitality Industry and Tourism**<br>Dmitry Aleksandrovich KOZLOV | …835 |

SUMMER 2017
Volume VIII,
Issue 4(20)

Editor in Chief
**PhD Ramona PÎRVU**
University of Craiova, **Romania**

Editorial Advisory Board

**Omran Abdelnaser**
University Sains Malaysia, Malaysia

**Huong Ha**
University of Newcastle, Singapore, Australia

**Harjeet Kaur**
HELP University College, Malaysia

**Janusz Grabara**
Czestochowa University of Technology, Poland

**Vicky Katsoni**
Techonological Educational Institute of Athens, Greece

**Sebastian Kot**
Czestochowa University of Technology, Institute of Logistics and International Management, Poland

**Nodar Lekishvili**
Tibilisi State University, Georgia

**Andreea Marin-Pantelescu**
Academy of Economic Studies Bucharest, Romania

**Piotr Misztal**
Jan Kochanowski University in Kielce, Faculty of Management and Administration, Poland

**Agnieszka Mrozik**
Faculty of Biology and Environmental protection, University of Silesia, Katowice, Poland

**Chuen-Chee Pek**
Nottingham University Business School, Malaysia

**Roberta De Santis**
LUISS University, Italy

**Fabio Gaetano Santeramo**
University of Foggia, Italy

**Dan Selişteanu**
University of Craiova, Romania

**Laura Ungureanu**
Spiru Haret University, Romania

ASERS Publishing
http://www.asers.eu/asers-publishing
ISSN 2068 – 7729
Journal DOI: http://dx.doi.org/10.14505/jemt

| | | |
|---|---|---|
| 13 | **Analyzing the Effect of Electronic Word of Mouth towards Future Behavioral Intention of Tourists**<br>Arciana DAMAYANTI, Lili Adi WIBOWO, Aulian HUMAIRA | …843 |
| 14 | **The Effects of Financial Crises on Tourism in the Greater Mekong Sub-region: Panel ARDL Approach**<br>Sakkarin NONTHAPOT, Porowes SRICHAIYO | …853 |
| 15 | **Effectiveness of the Methods of Internal Financial Control as a Guarantee of Sustainability of Tourism Companies' Development**<br>Tatiana A. YUDINA, Olga G. VANDINA, Aleksei V. BOGOVIZ, Svetlana V. LOBOVA | …861 |
| 16 | **Determinant of Willingness to Pay and Economic Value for Tourism Object using Contingent Valuation Method: The Case of Sangiran Sites, Province of Central Java, Indonesia**<br>Sri SUBANTI, Arif Rahman HAKIM, BRM Bambang IRAWAN, Inaki Maulida HAKIM | …867 |
| 17 | **Tourism Development of Russian Territories: Competitiveness, Effectiveness and Sustainability**<br>Mikhail A. MOROZOV, Natalya S. MOROZOVA, Vladimir BELYANSKIY, Olga BELYANSKAYA, Tatiana YUDINA | …875 |
| 18 | **A Study of Factors Influencing Online Purchasing Intention within E-tourism Setting**<br>Leila MORADI, Yazrina YAHYA, Ibrahim MOHAMED, Komeil RAISIAN | …882 |
| 19 | **Crowdfunding as a Tool for Promotion and Development of Tourism-Related Innovation Projects**<br>Elena A. DZHANDZHUGAZOVA, Elena L. ILINA, Aleksander N. LATKIN, Ekaterina A. BLINOVA, Marianna M. ROMANOVA | …896 |
| 20 | **Analysis of the Development of Modern Agritourism Types in West Kazakhstan Oblast**<br>Aliya AKTYMBAYEVA, Yeldar NURULY, Bakyt AKTYMBAYEVA, Gulzhan AIZHOLOVA | …902 |
| 21 | **The Role of Social Institutions for Tourist Attractiveness Development in Respect of Russian Cultural and Historical Heritage**<br>Olga Vladimirovna ROGACH, Elena Victorovna FROLOVA, Tatyana Mikhailovna RYABOVA, Elena Evgen'evna KABANOVA | …911 |
| 22 | **Tourists' Expectation and Perception regarding Holiday in Jakarta, Indonesia**<br>Roozbeh Babolian HENDIJANI, L. Iswi Hapsari SULISTYO | …919 |
| 23 | **Tourism and Peace in Economic Development Perspective of India**<br>P. K. MISHRA, J. K. VERMA | …927 |
| 24 | **Features of Formation of Infrastructure of Digital Nomadism on Route of the Great Tea Road through the Western Siberia and Central Urals**<br>Natalia A. BALUK, Aleksey D. BALUK, Anatoly S. KUPRIN, Lidia Y. KUPRINA, Svetlana S. SITEVA, Marina L. BELONOZHKO | …935 |
| 25 | **Excursion Tours and the Possibility of using Augmented Reality Technologies for Improving the Local Tourist Attractiveness**<br>Irina Victorovna BOGOMAZOVA, Svetlana Gennad'evna STENYUSHKINA | …943 |

# Call for Papers
## Fall Issues 2017

# Journal of Environmental Management and Tourism

**Journal of Environmental Management and Tourism** is an interdisciplinary research journal, aimed to publish articles and original research papers that should contribute to the development of both experimental and theoretical nature in the field of Environmental Management and Tourism Sciences.

Journal will publish original research and seeks to cover a wide range of topics regarding environmental management and engineering, environmental management and health, environmental chemistry, environmental protection technologies (water, air, soil), pollution reduction at source and waste minimization, energy and environment, modeling, simulation and optimization for environmental protection; environmental biotechnology, environmental education and sustainable development, environmental strategies and policies, etc. This topic may include the fields indicated above, but are not limited to these.

Authors are encouraged to submit high quality, original works that discuss the latest developments in environmental management research and application with the certain scope to share experiences and research findings and to stimulate more ideas and useful insights regarding current best-practices and future directions in environmental management.

*Journal of Environmental Management and Tourism* is indexed in SCOPUS, RePEC, CEEOL, ProQuest, EBSCO and Cabell Directory databases.

All the papers will be first considered by the Editors for general relevance, originality and significance. If accepted for review, papers will then be subject to double blind peer review.

| | |
|---|---|
| **Deadline for submission**: | 25th September 2017 |
| **Expected publication date**: | October - November 2017 |
| **Website:** | http://www.asers.eu/publishing/index.php/jemt |
| **E-mail**: | jemt@aserspublishing.eu |

To prepare your paper for submission, please see full author guidelines in the following file: JEMT_Full_Paper_Template.doc, then send it via email at jemt@aserspublishing.eu.

DOI: http://dx.doi.org/10.14505/jemt.v8.4(20).12

# The Concept of Neuroagents in Hospitality Industry and Tourism

Dmitry Aleksandrovich KOZLOV
Plekhanov Russian University of Economics, Russian Federation
bwave@yandex.ru

**Suggested Citation:**

Kozlov, D. A. (2017). The concept of neuroagents in hospitality industry and tourism. *Journal of Environmental Management and Tourism*, Volume VIII, Summer, 4(20): 835-842. DOI:10.14505/jemt.v8.4(20).12

**Article's History:**

*Received* March, 2017; *Revised* April, 2017; *Accepted* June, 2017.
2017. ASERS Publishing©. All rights reserved.

**Abstract**:

*This study is aimed to develop a modern concept for forecasting in hospitality industry and tourism. Methods/Analysis: In this paper it is studied a current researches in neural network's technology and its implementation in hospitality and tourism. It is important to understand that classical methods of data analysis nowadays are not able to make best results. There is a need to combine them to some elements of artificial intelligence. Hospitality industry and tourism paid great attention to the implementation of neural network applications in the analysis and forecasting. Modern economy is very susceptible to the influence of many factors which complicates the application of classical statistical procedures; neuroagent is a complex method of forecasting and decision-making and can be a good solution in the analysis of hidden relationships and the search for optimal response to emerging threats in hospitality and tourism. This study can be used as a concept for creation of some decision-making systems in hospitality and tourism or early warning systems.*

**Keywords:** hospitality industry and tourism; neural networks; neuroagent; forecasting

**JEL Classification**: C530; E370; M39.

## Introduction

Forecasting in the hospitality industry and tourism is one of the major control tools. Classical prediction methods do not give high-quality results because of the increasing complexity of economic relations and the number of factors that influence the whole industry and particular enterprises. In these circumstances, it is necessary a tool to simplify the decision-making process, to obtain more accurate predictions, to warn of possible trouble and prevent them. The article reveals the method of application of neuroagent technologies and their opportunities in the hospitality industry and tourism.

## 1. Peculiarity of application of neural network technology

Recently neural network technology is becoming more wide spread in forecasting macro- and microeconomic processes, as they have a wide range of ability in the recognition and modelling of linear and nonlinear relationships among economic variables. The related neural network solutions shows that neuromodel be much more productive than classical linear models for complex economic phenomena and various economic indicators. But we should not consider neural networks as a panacea for all problems in forecasting, because they also have their drawbacks. Many researchers consider the neural network technology as a substitute for traditional econometric methods, but neural networks are a powerful tool that should be used together with modern methods of forecasting. The most

full potential can be used and consists in incorporating the entire set of forecasting techniques in the toolkit of the analyst of the hospitality industry and tourism.

Neural network (Artificial Neural Network, ANN) is a mathematical model and its software or hardware implementation, based on the principle of organization and functioning of biological neural networks – networks of nervous cells of a living organism.

The human brain is the most complex computer. In order to better understand its functioning, many researchers attempted to copy his work through the development of artificial intelligence. Part of the research in the field of artificial intelligence has gone the way of creation of artificial neural networks. In general, a neural network is a mathematical model, structured like the human brain, which aims to identify specific patterns in existing data. At the initial stage of development of neural networks, scientists have tried to reproduce the activity of the brain in order to study the learning process of the brain itself. However, studying the learning ability of neural networks has led to the fact that there are a number of possibilities of their application using the capabilities of neural networks to learn, for example, handwriting recognition, diagnosis of breakdowns of machinery, etc. A lot of research assumptions was determined possibilities of neural networks in forecasting volatile financial indicators whose behavior was difficult to simulate using existing statistical forecasting methods, such as exchange rates, stock prices, etc. Neural networks have been successfully applied to issues of macroeconomic forecasting, for example the indicators of economic growth, resource consumption, etc.

The advantages of neural networks include:

- successful modelling of nonlinear dependencies. Neural network with nonlinear activation function is apriori more effective than the regression model in case of nonlinear dependence. So some scientists believe that the application of neural networks is most effective for a large time horizon;
- no need of assumptions about the nature of dependence between variables. For classical studies and modelling is characterized by the presence of some assumptions of researchers about the nature of the test data, to be able to transform them correctly. In the case of neural networks, the researcher does not have to worry about the nature of the data and internal dependencies, since the neural network in this case is a «universal approximator», to be able to match the model to any data.
- high flexibility of the model. It means that for any existing model you can change the activation function, number of neurons per layer, number of layers, leaving the basic architecture that can substantially increase the predictive ability of the network without significant costs.

The disadvantages of neural networks include:

- the complexity of the interpretation of the weights («black box»). Any neural network, consisting of more than one neuron, is a complex nonlinear function, which complicates the interpretation of its results. In the case of classical regression, the values of its coefficients are a measure of the impact of each variable on the outcome of the model. In the case of neural networks, it is almost impossible to determine the impact of each factor on the overall result. Thus, the neural network uses the input dataset to define a response, but the researcher is not able to determine why it received such a forecast. Some scientists propose a sensitivity analysis as a solution to this problem;
- almost impossible to find the global minimum error. However, many local minimums give an adequate prediction;
- even quite simple neural network can contain a large number of internal weights. In the case of a small amount of historical data, this will lead to overfitting, even if you use the procedure of early interruption of training. The procedures require break the historical data into three sets, which reduces the amount of data used for training, and thereby reduces its quality. In this case, everything depends on the nature of the investigated indicator;
- developing the architecture of the neural network may take a long time. The creation and validation of a neural network is a much lengthier process than development of a simple regression model. Substantial assistance can provide the specialized products and preprocessoring data based on the same linear models.

Problems solved by using neural networks are directly relating to the main idea of identifying certain patterns in existing data. Accordingly, it is possible to specify three major groups of tasks: prediction, classification, and agents.

In Economics and management neural networks are applied more and more often (Çuhadar 2014, Popirlan and Ștefănescu 2011, 2013). The possible applications include the analysis and assessment of risks, detection of financial and other fraud, macro - and micro-economic forecasting, marketing research, prediction of customer behavior, forecast of cash funds, various economic parameters, indexes. At the enterprise level the maximum effect is achieved when the demand forecast, sales, downloads, identify market trends, existing correlations, patterns and exceptions in behavior, competitive analysis, quality control, forecasting resource consumption, security on the basis of the recognition of photo and video information, signature recognition and many other applications.

It is important to understand that the modern economic relations and the systems are very complex objects, so the creation of traditional mathematical models describing all the possible relationships between the factors becomes increasingly difficult despite the growth of computing and databases. In this situation it becomes apparent the application of simulation models on the basis of artificial intelligence, particularly neural networks, to which they are generally and historically focused.

In 2016 in the area of neural network theory and applications has been a number of significant events. However, in the first place you can put such a major event as the overwhelming win AlphaGo neural network artificial intelligence (developed by Google) on the world champion in the «go» game. In addition to this event, their developments in the field of recognition of graphic images showed Microsoft (projects How-Old.net, CaptionBot, WhatDog, *etc.*), as well as interesting services MSQRD, likemo.net, prism, Mlvch and others.

Some software for hotels are working on neural networks, solving such tasks as segmentation of the consumer decision-making for booking groups and to develop predictions of the performance of the hotels. Interest in artificial intelligence and neural networks stimulates the release of the leading producers of software standard statistical data processing additional modules to their systems. Thus, neural networks are one of the directions of modern development of artificial intelligence systems. They can be used in forecasting, classification and decision-making. There are a large number of existing modern developments in the application of neural network technologies, which allow to obtain significant results.

## 2. Overview of neural network research in the hospitality industry and tourism

In the hospitality industry over the last 10-15 years there has been a qualitative leap in the application of neural network technology to predict. Neural networks have been applied in different parts of the world, but in general has always given positive results. Consider the examples of application and some of the results and characteristics of studies.

Song and Li (2008) pointed out a huge number of studies on modelling and forecasting tourism demand. The study was actually conducted around the world; among the more than 100 studies, only the following were implemented with neural networks: Burger (2001, investigated South Africa), Cho (2003, Hong Kong), Kon and Turner (2005, Singapore), Law (2000, the Taiwan-Hong Kong 2001, Japan-Hong Kong), and Pai and Hong (2005, Barbados), Palmer (2006, Singapore).

In 2014, Murat Cuhadar, Iclal Cogurcu and Ceyda Kukrer (2014) conducted a study of tourist demand for cruises to Izmir, applying several neural network architectures. In the study they found that nonlinear and non-stationary nature of tourism demand makes forecasting very difficult and it is necessary to develop new methods, including emphasize neural network modelling as one of the most important tools of the researcher. By their opinion, first of all, neural networks do not require any initial hypotheses about models and problems, in addition, there are a set of neural network techniques that can be used to obtain the best result. In their work they used multilayer perceptron, radial basis function network and generalized regression neural networks for the analysis of monthly data on arrival. Experimental work showed that the best predictive model is RBF. Neural network with no problems (overfitting, structural error) managed the task of predicting, achieving good forecast for 2014. Authors state that to improve the methods of forecasting further development should be in the field of support vector machines

(algorithm, similar to supervised learning), fuzzy logic, genetic algorithms, and adaptive networks-based fuzzy inference systems.

In 2016, Edi Noersasongko, Fenty Tristanti Julfia, Abdul Syukur, Purwanto, Ricardus Anggi Pramunendar and Catur Supriyanto conducted a study on tourist arrivals using neural networks based on genetic algorithms. In this study, the authors point out that many scientists apply the network based on back propagation, but the result is not always satisfied. Based on historical data for the 1991-2013, the researchers conducted a comparison of three predictive models: back propagation, nearest neighbor method (k-nearest) and linear regression model. To optimize the neural network a genetic algorithm was used. As a result, the neural network showed a much lower error than other two methods. As an error measure RMSE was used (Noersasongko *et al.* 2016).

In 2016, Selcuk Cankurt and Abdulhamit Subasi conducted a study on data mining in modelling and forecasting tourism demand. They conclude that the study of such complex multi-factor tasks is necessary not just to learn a particular time series, but also to identify the interaction of several variables. The researchers analyzed arriving in Turkey, and 26 the most important source countries. The results were as follows: was the best model developed on the basis of the method of support vector. However, the authors conclude that at present there is no system in choosing an appropriate forecasting model, the management of tourism organizations feel the need for such methods and estimates in order to improve tourism management at the national level (Cankurt and Subasi 2016).

In 2008, Tugba Efendigil, Semih Onut and Cengiz Kahraman investigated the system of decision-making and forecasting based on artificial neural networks and fuzzy neuromodules. The authors point out that in any organization there is a need for decision-making based on indicators of current demand in order to achieve competitive advantage. In their work proposed a mechanism that combines neural network technology with the techniques of fuzzy systems for the purpose of developing forecasts of fuzzy or incomplete data on demand. The study showed that the performance of the proposed hypotheses and models of adaptive networks based fuzzy inference systems (Efendigil *et al.* 2008).

In 2013, Oscar Claveria, Enric Monte and Salvador Torra conducted a study on forecasting tourist demand of different models of neural networks. Were examined tourist flows in Catalonia from different countries for the period from 2001 to 2012 through three models: multilayer perceptron, radial basis functions and Elman network (recurrent neural network). Studied the different topologies of these types of neural networks. As a result, the best performance has shown MLP and RBF, and the most high-quality forecast has shown by the RBF. The researchers also suggest that it is need to identify dependencies between the growth rates of arrivals from different countries. In addition, one of the conclusions of the study was that best results neural network can show in long-term forecasting (Claveria *et al.* 2013).

In 2011, Chang-Jui Lin, Hsueh-Fang Chen and Tian-Shyug Lee conducted a study on tourism demand forecasting based on neural networks and multivariate adaptive regression splines. They analyzed monthly data on tourist arrivals to Taiwan based on the three methods: neural networks, ARIMA and multivariate regression splines. The results of the study were as follows: the worst performance – splines, the best – ARIMA models. Neural networks were in the middle but also demonstrated the high quality of the models and forecast (Lin *et al.* 2011).

In 2012, Huai Qiang Zhang and Jing Bing Li researched forecasting the number of tourists based on radial basis functions neural networks. They were able to build a forecast of the number of tourists in one of the China provinces – Hainan Island: according to the data for five years were based on a forecast for a sixth year. The neural network was successfully trained and give adequate predictions that, according to the authors, helps to create an International Tourist Island of Hainan (Zhang and Li 2012).

In 2011 Paula Odete Fernandes, João Paulo Teixeira, João Matos Ferreira, Susana Garrido Azevedo investigated tourist demand for rural tourism in two regions of Portugal. The study showed excellent results of neural network models for both regions. The authors conclude that the neural network necessarily to be used if the original data are non-linear. The neural network consisted of 4 neurons in the hidden layer, logistic activation function and learning algorithm of back propagation (Fernandes *et al.* 2011).

In 2016, Russian scientists K. Miloradov and G. Eidlina researched the mutual influence between outbound and domestic tourism in Russia based on neural network model. This paper analyzes the impact of changes in the

outbound tourist traffic related to the closure of Egypt and Turkey for Russian tourists (Miloradov and Eidlina 2016). Unfortunately, the technical details of the study omitted, the authors are limited to verbal description of what is happening in the Russian tourism changes.

Thus, the artificial neural network is very actively used in tasks of research, analysis and forecasting in the hospitality industry and tourism. At the level of specific enterprises neural networks can be used in a large number of applications: risk assessment, identify threats, help in decision-making that will be discussed later.

## 3. The concept of neuroagent for the hospitality industry and tourism

Researchers and analysts in the hospitality and tourism practice mainly quantitative causal analysis techniques for forecasting and time series analysis. However, neural network analysis allows the study of the interrelationships and influence of various factors on the state of the economy, much exploring large amounts of data and revealing hidden patterns is not always defined by traditional methods (Kozlov 2016, 2017).

The modern economy of hospitality and tourism is affected by many internal and external factors. For the assessment of tourist demand and other market parameters there is the necessary for modern tools of analysis and forecasting. Traditional methodological approaches do not always give positive results. There is a need for a new conceptual approach to the process of developing forecasts in hospitality and tourism based on the integrated use of quantitative, qualitative forecasting techniques, neuroagent and cloud technologies.

In addition, it becomes more and more performance indicators themselves. Modern economic theory promoted by the world tourism organization, for example, the concept of sustainable development, involve the study of a variety of indicators and there is the need to leverage on them. In these conditions, it is increasingly manifested the presence of distributed processes in the hospitality industry and tourism, making necessary the application of intelligent control. One of the important directions of the use of such intelligent control supports the automation of detecting and correcting a maximum number of negative developments in the industry by using modern hardware and software computer systems. The use of artificial intelligence elements in combination with cloud-based technologies allow to create situational advising systems that can react quickly to changing business conditions and offer solutions to arising negative economic situations.

The World Tourism Organization in 2008 released a document entitled «Handbook on Tourism Forecasting Methodology», which revealed the basic issues of forecasting in the hospitality industry and tourism, including a description of the forecasting methods and examples of such forecasting in different countries. The goal of forecasting is to predict the future. Sometimes it is easy to do, especially if the events recur regularly and follow simple models. But if the process is complex and depends on many factors, its prediction becomes difficult and sometimes impossible. Forecasting in the hospitality industry and tourism refers specifically to this type. Forecast strongly affects the development plans and their effectiveness. Employees of the tourism industry understand that the tourist demand (in the broadest sense of the word) affect a huge number of factors, so to predict this figure is the hardest. Forecast tourism demand can be carried out by different methods from the expert to the complex mathematical models that can greatly increase the accuracy of forecasts. The major methods of forecasting are simple enough: simple linear regression, decomposition, differencing method, random walk method, moving averages, exponential smoothing – quantitative; Delphi, scenario planning, expert assessment of quality. It is recommended to use mixed versions. Unfortunately, this approach is applicable more in macroeconomic research at the level of national economies, where the indicators are behaving quite stable and the accuracy of the predictions is quite large. On the microeconomic level, or even at the enterprise level, this approach is not always the most effective.

In this regard, it is proposed the following concept of forecasting: the key to predictive management in the hospitality industry and tourism is to identify a number of states that lead to other known states. For realization of such approach it is possible to use so-called agent technologies that can be implemented using different tools including artificial neural networks. In this case, they are called neuroagents.

The greatest application of agent and neuroagent technology is in managing computer networks. However, the economy also has a number of issues where the use of such technologies can benefit. These include analysis and forecast of various economic information at different levels of management, forecast demand based on multi-

factor models, the identification of the precarious economic situations or emerging economic threats, unusual risks, analysis of their possible consequences.

Neuroagent is able to perform a large amount of information, including a huge database collected at the level of the whole economy and at the level of specific companies, segments of companies or competitors. As a result of this analysis neuroagent is able to identify explicit and hidden dependencies in the data, a model of economic behavior in order to detect unexpected or implicit changes and to forecast development.

In order to neuroagent began to operate successfully, it needs training. Such training is to run a certain amount of data characterizing certain patterns of behavior of the economic system. This is done in order to recognize the existing in their model, and to determine causal relationships. This learning process goes on constantly: when new data appears neuroagent adds it to the database of training that leads to the updating or correction of the models and relationships. It may happen that neuroagent reveals a situation, which before him was unknown. In this case again, it will update its internal model, increasing their analytical skills. Ultimately, neuroagent uses growing adaptive training, which only leads to the growth of his abilities. In this sense, neuroagent can be used as a predictive system that identifies possible problems before they actually happen.

Briefly, the method of neuroagent as follows: after the creation of a unique individual profile of a controlled economic system it starts to monitor its activities; identifying and analyzing the changes of required indicators, taking into account existing experience; further developing neuroagent forecast spent economic system in the near or distant future; if there is a possibility of some negative or unforeseen situation that has never been caught in the process of training, neuroagent delivers context-oriented signal about the occurrence of such a situation.

Thus, neuroagent makes predictions of certain critical states of the economic system that allows you to manage them and produce the required actions to prevent them before they show a negative impact on the economy as a whole or on the activities of a particular company. Neuroagent does not require much material or intangible resources; it is not a problem in itself, he does not need the presence of highly qualified staff as is necessary when using classical prediction methods. Neuroagent can be adjusted to specific conditions under which the system enters the alarm state. Moreover, there is no need to review the forecast models in the emergence of some new, previously unknown data or situations, because their appearance neuroagent updates existing economic profiles, which increases the quality of the developed forecasts. Neuroagent is very quick to learn, but not to require superficially power. In addition, neuroagent is possible to load data for new factors affecting economic activity.

## 4. Discussion

As some discussion topics for implementing neuroagent concept in hospitality and tourism should be allocated such technical problem as definition of clusters (or states) in data. It is proposed the using of Kohonen network to create a map of common states of economic situation. But the number of such states is equal to the number of neurons in Kohonen network. So, first of all there is a need of methods to define the best network's topology.

It is possible that there are less states than neurons. In this case there is a need of methods to combine some neurons and to merge them to one state.

In addition, in neural networks it is difficult to interpret obtained states. If cluster analysis is used, there is no problem to identify and to describe the characteristics of states. But in the case of neural networks we have only weights, which is hard to understand.

## Conclusion

Hospitality and tourism in modern conditions is one of the world's leading industries, however, it is very much affected by number of internal and external factors. The number and degree of influence of each of these factors is constantly changing. In these circumstances, to assess economic conditions and development patterns prevent or respond to emerging changes are necessary some modern instruments for analysis and forecasting. Traditional qualitative and quantitative forecasting methods can be successfully applied in macroeconomic studies with simple models of the data behavior, however, the increase in the number of factors and their sudden changes, the traditional methods may not always provide positive results. Under these conditions, we propose a new conceptual

approach to the process of developing forecasts of hospitality and tourism based on the integrated use of traditional quantitative, qualitative forecasting techniques, and include neuroagent and cloud technologies.

Hospitality industry and tourism paid great attention to the application of neural network technologies in the analysis and forecasting; the modern industry is very susceptible to the influence of many factors, which is often nonlinear, which complicates the application of classical statistical procedures for the analysis and prognosis; as one of problem solution is the comprehensiveness and complexity of the data is the use of neural network technology; neuroagent as a complex method of forecasting and decision-making, can be a good solution in the analysis of hidden relationships and the search for optimal response to emerging threats.

## References


[1] Cankurt S., and Subasi, A. 2016. Tourism demand modelling and forecasting using data mining techniques in multivariate time series: a case study in Turkey. *Turkish Journal of Electrical Engineering & Computer Sciences,* 24: 3388 – 3404. DOI:10.3906/elk-1311-134

[2] Claveria, O., Monte, E., and Torra, S. 2013. Tourism demand forecasting with different neural networks models. *Research Institute of Applied Economics*. Working Paper 2013/21.

[3] Çuhadar, M., Cogurcu, I., and Kukrer, C. 2014. Modelling and forecasting cruise tourism demand to Izmir by different artificial neural network architectures. *International Journal of Business and Social Research (IJBSR)*, 4(3): 12-28.

[4] Efendigil, T., Onut, S., and Kahraman. C. 2008. A decision support system for demand forecasting with artificial neural networks and neuro-fuzzy models: A comparative analysis. *Systems with Applications*, DOI:10.1016/j.eswa.2008.08.058

[5] Fernandes, P.O., Teixeira, J.P., Ferreira, J.M., and Azevedo, S.G. 2011. Forecasting tourism demand with artificial neural networks. Book of proceedings Vol.II – Paper presented at the International conference on tourism & management studies – Algarve, 26-29 October 2011, Faro, Algarve, Portugal.

[6] Kozlov, D.A. 2016. Modelling and forecasting of Russian outbound tourism. *Actual Problems of Economics.* 181(7): 446-453.

[7] Kozlov, D.A. 2017. Agent technology in hotel business. *Journal of Environmental Management and Tourism*, Volume VIII, Spring, 2(18): 285-290. DOI:10.14505/jemt.v8.2(18).01

[8] Lin, C.-J., Chen, H.-F., and Lee, T.-S. 2011. Forecasting Tourism Demand Using Time Series, Artificial Neural Networks and Multivariate Adaptive Regression Splines: Evidence from Taiwan. *International Journal of Business Administration*. 2(2): 14-24.

[9] Miloradov, K.A., and Eidlina, G.M. 2016. Tourism market of the Russian Federation: Analysis of interactions between outbound and domestic tourism using neural networks. *Indian Journal of Science and Technology*, 9(27), DOI: 10.17485/ijst/2016/v9i27/97698

[10] Noersasongko, E. *et al.* 2016. A tourism arrival forecasting using genetic algorithm based neural network. *Indian Journal of Science and Technology*, 9(4), DOI: 10.17485/ijst/2016/v9i4/78722

[11] Popîrlan C.I., and Ștefănescu L. 2011. A mobile agents' system for intelligent data analysis, Proceedings of WSEAS Applied Computing Conference 2009 (ACC 2009), September 28-30, Athens, Greece, pp. 663-668.

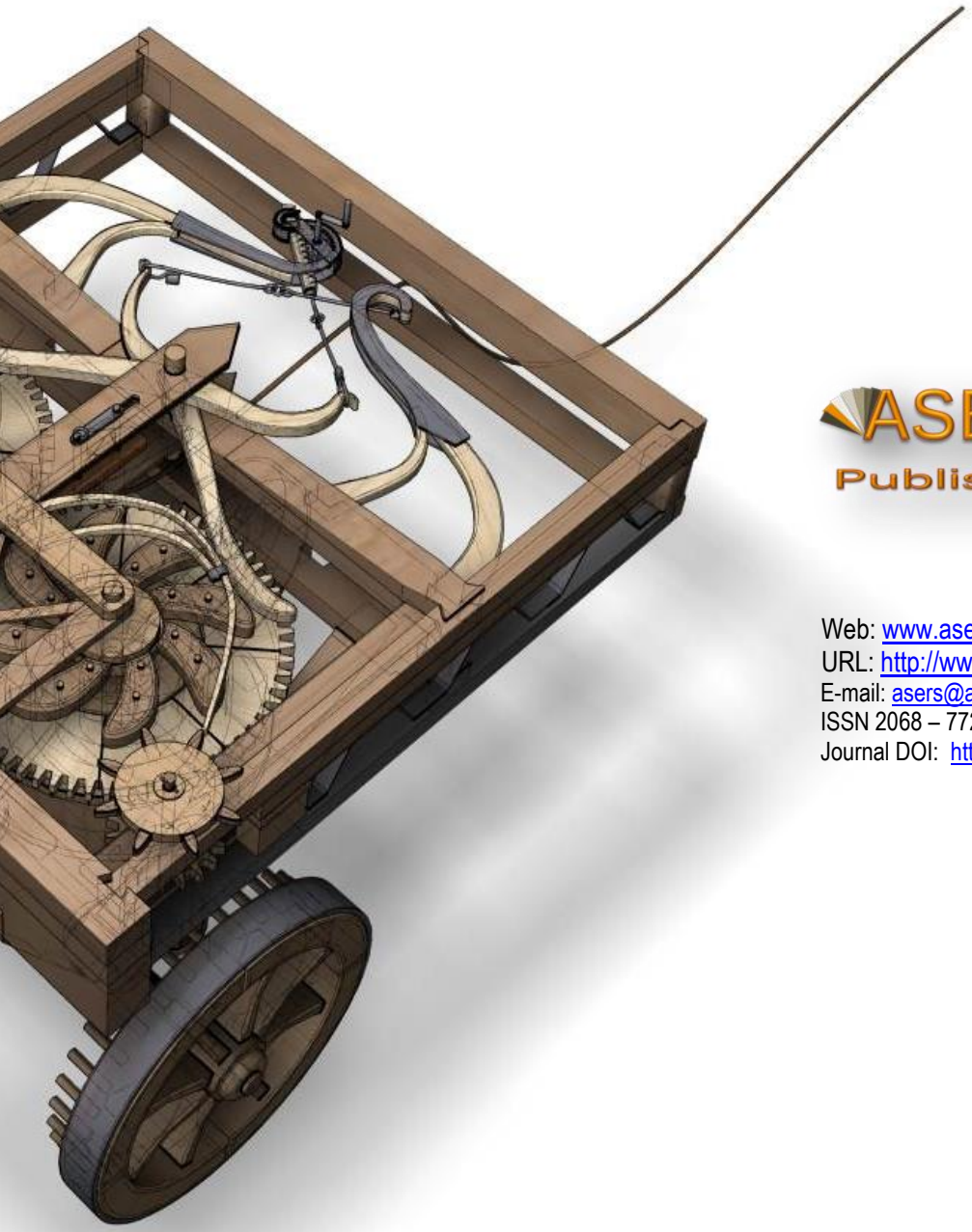
[12] Popîrlan, C.I., and Ștefănescu L. 2011. *A Multi-agent approach for adaptive virtual organization using JADE*, book chapter in Lecture Notes in Computer Science, Volume 6943, Adaptive and Intelligent Systems - Abdelhamid Bouchachia (Ed.) pp. 344 - 355.

[13] Popîrlan, C.I., and Ștefănescu L. 2011. *Intelligent software agents for data analysis in knowledge-based systems, in Intelligent Decision Support Systems for Managerial Decision Making*, Chapter 2, pp. 25-48, ASERS Publishing.

[14] Song H., and Li, G. 2008. Tourism demand modelling and forecasting – A review of recent research. *Tourism Management*, 29(2):203-220.

[15] Zhang, H., and Li, J. 2012. Prediction of Tourist Quantity Based on RBF Neural Network. *Journal of Computers*, 7(4): 965-970.

ASERS



ASERS Publishing

Web: www.asers.eu
URL: http://www.asers.eu/asers-publishing
E-mail: asers@asers.eu
ISSN 2068 – 7729
Journal DOI: http://dx.doi.org/10.14505/jemt