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<i>JRC activities in the field of monitoring sea-based oil pollution: from research to the operational use of satellite images</i>	
Grgurević Ivan, Stančić Adam, Kavran Zvonko <i>Augmented reality in carpooling systems</i>	▲
Gualandi Nicola, Mantecchini Luca, Paganelli Filippo <i>Integration and concentration: the evolution of air transport in the EU</i>	▲
Harsch Rick, Rožkar Edvard, Perkovič Marko <i>The shipbuilding economy in a coastal country without a shipyard</i>	▲
Ivaković Babić Morana, Babić Darko, Jurčević Marinko <i>Decision support systems in supply chain management</i>	▲
Ivaković Čedomir, Rožić Tomislav, Bajor Ivona <i>The concept of disposition of returned goods in reverse logistics channels</i>	▲
Jolić Natalija, Kavran Zvonko, Bukljaš Skočibušić Mihaela <i>Modernization plan for maritime ports in Croatia and their integration into the Short sea shipping (SSS)</i>	▲
Jolić Natalija, Stupalo Vlatka, Perko Nina <i>Social dialog development in the Croatian sea port sector</i>	▲
Jurkovič Violeta <i>From corpus analysis to online vocabulary exercises</i>	▲
Karničnik Igor, Švetak Jelenko <i>A survey of mariners' opinions on using electronic charts</i>	▲
Keglović Horvat Ana, Juričić Biljana <i>Air traffic controller licensing in Croatian and international air law</i>	▲
Klančič Armand <i>Potential of heat 3 pre ICTS 10</i>	▲
Klemenčič Jože <i>Analysis of incidents and oil spills in Slovenian sea</i>	▲
Kobojević Žarko, Kurtela Željko <i>Composting toilet, an contribution to sustainable development</i>	▲
Kos Serdjo, Brčić David, Ivče Renato <i>Structural analysis of possible applications of semi-swath catamarans in the Kvarner archipelago</i>	▲
Kovačić Mirjana, Glažar Darko, Jurić Vinka <i>Team work as the basic factor of functioning of SAR in Croatia</i>	▲
Krčum Maja, Gudelj Anita, Žižić Leo <i>Marine applications for fuel cell technology</i>	▲
Lindov Osman, Bjelica Damir <i>Implementation of software applications in the analysis of motor vehicle collisions</i>	▲
Lindov Osman, Čaušević Samir, Čekić Šefkija <i>Maps of risk elements to improve road safety and the implementation of the roads in FBiH</i>	▲
Longo Giovanni, Strami Stefano, Martone Diego <i>Qualitative survey methods in mobility management</i>	▲
Luttenberger Axel, Rukavina Biserka, Rak Loris <i>Challenges in regulating the air pollution from ships</i>	▲
Magister Tone <i>The small-scale unmanned aircraft airworthiness specifications development for injury minimization</i>	▲
Majić Zvonimir, Pavlin Stanislav, Škurla Babić Ružica <i>Diversified research on the influence of air transportation on a blood sample quality</i>	▲

Marin Jasenko <i>The Rotterdam rules - an overview of their key provisions</i>	▲
Matulin Marko, Pilko Hrvoje, Šubić Nikola <i>Influencing travel demand by the means of urban mobility management</i>	▲
Mirosavljević Petar, Gvozdenović Slobodan, Čokorilo Olja <i>The turbo fan transport aircraft air pollution emission footprint</i>	▲
Oberstar Miha, Vidmar Peter <i>Welding techniques and marine materials</i>	▲
Pangerc Damjan Janez <i>Planning paths in the transportation of freight by rail</i>	▲
Penko Ludvik <i>Road traffic noise levels in the municipality of Koper, Slovenia</i>	▲
Penko Ludvik, Bajt Oliver <i>Concentrations, spatial distribution and sources of polycyclic aromatic hydrocarbons (PAHs) in seawater of the gulf of Trieste</i>	▲
Perkovič Marko, David Matej, Vidmar Peter, Jure Barovič <i>Port of Koper; maritime transport and industrial risk analyses</i>	▲
Perkovič Marko, Gucma Lucjan, Przywarty Marcin, Gucma Maciek, Petelin Stojan <i>Nautical risk assessment for LNG operations at the Port of Koper</i>	▲
Perovich Slavica M., Bauk Sanja I. <i>Some numerical simulations of a new formula for the sea water level</i>	▲
Pevc Ludvik, Lenart Daniel <i>IT support for planning maintenance of railway vehicles</i>	▲
Počuča Milojka, Zanne Marina <i>The indicators of sustainable transportation: the case of Slovenia</i>	▲
Prevec Boris, Vidmar Peter <i>Kite system for cargo ships</i>	▲
Radulović Siniša, Stanković Ratko, Petar Saša <i>Selection of forecasting methods in decision-making process in logistics controlling</i>	▲
Ramšak Tomaž, Kolar Slavko <i>Cant acceleration tilting ratio on tilting trains</i>	▲
Rodica Jana <i>Towards the "genuine link" concept: A long way to sail</i>	▲
Rogić Kristijan, Bajor Ivona, Rožić Tomislav <i>Reverse logistics operations as element of warehouse management</i>	▲
Romih Denis <i>Traffic flow through trafficlight's intersection</i>	▲
Rovšek Vesna <i>Application of soft computing in logistics networks</i>	▲
Sajič Žarko, Švetak Jelenko <i>The historical view of Slovenian underwater activities</i>	▲
Skobir Zmago, Magister Tone <i>The quest for a formula for the impact kinetic energy based equivalency between unmanned and manned aircraft</i>	▲
Slavulj Marko, Ševrovič Marko, Šoštarič Marko <i>Voice license plate recording as a transit volume and travel time measurement method</i>	▲
Stojaković Maja, Tvrđy Elen <i>Opportunities for the increase of cargo handling capacity at the container terminal in the port of</i>	▲

<i>Luka Koper</i>	
Ščukanec Anđelko, Šafran Mario, Miličić Nikša <i>Analysis of methods for road markings retroreflection measurement as element of road traffic safety improvement</i>	▲
Šimunović Ljupko, Mandžuka Sadko, Missoni Eduard <i>Contribution of ITS to road transport and traffic safety</i>	▲
Škorput Pero, Binički Marijan, Vukadin Davorin <i>Postage stamps in the function of promotion of road traffic</i>	▲
Škurla Babić Ružica, Majić Zvonimir, Kovačić Ivica <i>Specificities and requirements of cargo revenue management</i>	▲
Šubić Nikola, Pilko Hrvoje, Matulin Marko <i>Analysis of roundabout capacities in the city of Zagreb</i>	▲
Teodorović Dušan, Šelmić Milica, Edara Praveen <i>Bee colony optimization approach to optimize placement of traffic sensors on highways</i>	▲
Tomašič Dubravko, Šafran Mario, Radulović Siniša <i>Strategic planning of information technology support for inventory optimisation in supply chains</i>	▲
Veselko Gregor <i>Port of Koper in the global logistic chain</i>	▲
Zavada Josip, Blašković Zavada Jasna, Abramović Borna <i>Possibilities of Reducing Diesel Engine Harmful Emissions for Euro 6 Standard</i>	▲
Zupančič Janja, Carli Iris <i>Operation of system "Hitra pošta" in comparison to other providers of express services on Slovenian market</i>	▲

BACK

SELECTION OF FORECASTING METHODS IN DECISION-MAKING PROCESS IN LOGISTICS CONTROLLING

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ABSTRACT

The logistic controlling provides an insight into the entire logistic chain. Through the decomposition of the chain into logistics processes and activities, the preconditions are created for successful identification and measurements of performances according to different dimensions. The logistic controlling enables a proactive decision-making method, in which the logistic system can build various business scenarios and be prepared for any situation by anticipating the future. Building and testing (simulating) various business scenarios that can or may become in future depends on predictions or in other words forecasting. Forecasting methods are complex statistical area, and usually seeking good knowledge of statistical methods and tests. This paper present forecasting methods usually used as support in logistics controlling.

1 INTRODUCTION

The main task of the logistics controlling is the acquisition of target-oriented coordination, management and the chain processes control in the logistics as well as providing the necessary information as the basis for accomplishing these tasks, i.e., the task of the logistics controlling is reduced to the control of economic parameters through comparison of existing and newly designed cost levels and logistics processes and systems performance.

Controlling is much more than the standard control logistic processes and systems and represents an integrated support of logistics management. In the literature, and logistics practices there are different formulations of the basic functions of logistics controlling, but most authors agree that those are planning, management, control and information functions.

Controlling is developed in the U.S. as the effective of management in the first half of last century, where it proved its efficiency especially in complex processes, so it has now become the subject of intense research and applications in countries with developed market economies. Intensive applications of controlling the logistics in the European countries came

relatively late, in early 90s, so it would now represent an integral segment of the logistics approach [1].

Through the function of planning, logistics controlling ensures that the management of logistics system is not based on the reaction of the market and other changes, but the prediction and anticipation of future events and appearance. The research, forecasting and planning of logistics performance is the starting point for defining the vision, mission and strategy of the logistics system. Logistics Controlling enables proactive decision making, where the logistics system through the anticipation of the future can be constructed in different business scenarios and be prepared for any situation.

The process controlling period of observation can be very different: the short-term observation at days, weeks or months, over medium to long-term observation. To create a general ability to manage a company there must be obtained the data from the previous period, current and planned or future information that are established through the planning process. By comparison of planned and existing results can be observed some discrepancies, so that by analyzing and identifying causes of deviations could reach the base for the selection of suitable control measures to enable the full realization of the goals [2].

2 FORECAST METHOD CLASSIFICATION

Forecasting methods are classified into several categories:

- Qualitative methods
- Regression methods
- Multiple equation methods
- Time series methods

Qualitative methods are used when there is no formal mathematical model, often because the data with which to predict are not sufficiently representative for the prediction of future developments (long-term planning)

Regression models are appropriate when it is possible to find the cause and effect relationship between variables.

Multivariable equations apply when it is possible to find a causal link in available data in the form that the mutual interaction of the dependent variables can be described by equations (mainly economic models).

Time series methods are suitable when there is one variable that changes in time period and whose future value can be somehow linked with data from the past.

Before the classification method for forecasting demand, following needs to be mentioned:

- Short-term forecasting is more accurate compared to the medium and long term forecasting. This is simply because there is a greater likelihood of an unplanned event for a longer period of time
- Aggregate forecasts of demand are generally more accurate than those for a one single product.

Generally, the forecasting approach can be classified into two major categories: quantitative and qualitative forecasting methods.

Qualitative methods are mainly based on work experience or observation, although they may use simple mathematical tools to combine different perspectives. Typically, these methods are used for long-term and medium term forecasts, when there is little historical data for the use of quantitative methods. This is the case, for example, when a new product or service is put on the market, when changing the product packaging or when it is expected that

future demand will be heavily influenced by political changes and technological improvements.

The most widespread quantitative methods are Delphi method, market research and sales force assessment methods.

The estimating sales force methods demand forecasts are made by traders, because he is closest to customers, and can estimate the actual expectations.

Market research is based on interviews with potential customers or users. The method itself takes time and a good knowledge of the sampling theory.

With Delphi method several experts get a series of questionnaires. Every time they answer the group of questions, it leads to a set of information. Then a new form is being made in which each expert is faced with new findings. This method is usually applied in assessing the impact of political and macro-economic changes in product demand.

Quantitative methods for forecasting can be applied whenever there is sufficient historical data on demand. These methods are divided into two main groups: ("casual") method of random variables and extrapolation of time series.

"Casual" method or methods of independent random variables are based on theories that future demand depends on the past or the present value of each variable. These include regression, econometric models, input and output models, life cycle analysis, computer simulation and neural networks models.

Random variables methods of to study a firm correlation between the future demand for particular products or services and past or current value of some casual variables. The main advantage of these methods is their ability to predict variations in demand, and are often used for medium and long term forecasting. Unfortunately there are times when it is very difficult to determine the independent ("casual") variable which has a strong correlation with future demand. It is even harder to find an independent variable that leads to predicted variables in time. For those reasons, these methods are less popular than extrapolation of time series methods . Of all the above methods "casual" method is most applied regression in logistics.

Regression is a statistical method that links the dependent variable y (which for example, represents the future demand d_{T+1}) with a ("casual") independent variable x_1, x_2, \dots, x_n whose value is known or can be estimated: $y = f(x_1, x_2, \dots, x_n)$. Such relations may be linear: $y = a_0 + a_1x_1 + a_2x_2 + \dots + a_nx_n$ or nonlinear. It is assumed that a set of observed values of random variables and corresponding values of dependent variables is available. Then the function f is selected as the one that best interpolates observed.

By establishing a firm correlation between the random and dependent variables, and the inclusion of known data in any of the statistical software program (manual calculation would take too long) calculates the coefficients of linear function ($f = ax + b$) and assuming that the established relationship between the variables still exist, can predict future demand.

Extrapolation of time series method assumes that the main features of the previous structure of demand will be replicated in the future. The forecast then is based on an extrapolation (projecting) the structure of demand. These techniques are good at short and medium term forecasts, when the likelihood of changes in the structure of demand is low. Extrapolation of time series can be done in many ways: by decomposition, the fundamental techniques of moving sections etc.

Other or residual oscillations: represent all those variations in demand that cannot be characterized as a trend, cyclical and seasonal variations. Very often they are the result of many causes, each of which has a small impact. If there are no predictable fluctuations in demand, the residual effect is a random variable within the expected unit value (assuming that demand is modeled as the product of four effects).

In the advanced extrapolation of time series methods the case is analyzed in which the historical structure of demand shows no significant seasonal or cyclical effects and the trend

is constant. Then the assumption is that forecasts should be generated only for the future period.

3 SELECTION OF FORECASTING METHODS

Forecasting methods can be evaluated through the measurement precision method calculation based on mistakes in the past. Such measures can be used to select the most precise approach. In addition, in the case of periodic predictions forecasting errors should be monitored in order to adjust the parameters, if necessary.

To evaluate the accuracy of forecasting methods, mistakes in the past must be calculated. Then the number of indices (mean absolute deviation (MAD), mean absolute percentage deviation (MAPD) and the mean square error (MSE)) in time period t can be defined:

$$MAD_t = \frac{\sum_{k=2}^t |e_k|}{t-1}, 1 < t \leq T \quad (1)$$

$$MAPD_t = 100 \frac{\sum_{k=2}^t |e_k|/d_k}{t-1}, 1 < t \leq T \quad (2)$$

$$MSE_t = \frac{\sum_{k=2}^t e_k^2}{t-2}, 2 < t \leq T \quad (3)$$

These three measures of accuracy can be used in time period $t = T$ to compare different forecasting methods, and assessing the quality of forecasting methods. Used forecast method is valid if the errors are random and not systematic. Typical systematic errors occur when the value of demand is constantly undervalued or overvalued, and seasonal variations are not taken into account. Control of prediction can be done by monitoring signal. Signal S_t , $1 < t \leq T$ is defined as the ratio between the cumulative errors and MAD_t ,

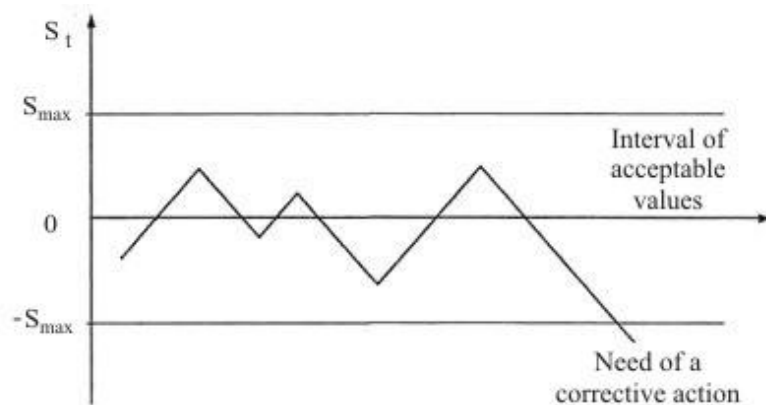


Figure 1: Use of a tracking signal for a forecasting control

Signal S_t is greater than zero if the forecast demand is systematically underestimated, conversely, a negative signal value indicates the systematically overestimated demand. For this reason, it is assumed that the forecast is objective when the signal is monitored in the range $\pm S_{max}$. If the signal is observed outside this interval, parameters of the forecasting methods should be modified or another method of forecasting should be chosen [3].

4 CONCLUSIONS

The selection and application of methods of forecasting is not easy, as shown. It requires good knowledge of methods, ways to check the previously set hypothesis about cause and effect relationships between available data and the impact of past relationships to future developments.

Knowing is the assumption of future trends in demand, inevitably has an important starting point for business planning, development planning and improvement of logistics processes and purpose pursuant to optimization of the same (financial resources).

The importance of forecasting as a support system of logistics systems is gaining in importance all the more. The logical sequence of the same can be found in globalization, worse situation in the world economy, not just one region, and the great pressure of competing operating systems.

Prognosticate the future, find flaws, weaknesses, strengths and opportunities, create the conditions for (re)taking what is to come and be willing to condition the sustainability of today's business.

Application of forecasting methods certainly finds its place in decision-making process in logistics controlling. Economic benefits derived from the predictions of different business scenarios is sufficient evidence of possible applications of forecasting methods in the planning and development of logistics controlling.

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