# FORECASTING OF THE NEEDS OF THE INFRASTRUCTURE POLICY IN TOURISM IN BULGARIA

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**Abstract:**
The infrastructure policy in tourism in Bulgaria is put under serious pressure by the abundance of new strategic documents which the country was obliged to adopt in connection with its membership in the European Union. The problem of forecasting in the strategic documents is crucial to the formation of proper innovation infrastructure policy for the future development of the tourism in the country. This paper is aimed at presenting the lack of real forecasting in many of the strategic documents adopted for the development of the infrastructure policy in Bulgaria (i.e. the National Strategy for Integrated Development of Infrastructure of the Republic of Bulgaria 2006-2015, the National Strategy for Regional Development of the Republic of Bulgaria for the period 2005-2015, the Strategy of Development of the Transport System of the Republic of Bulgaria until 2020, the Strategy for development of the Transport Infrastructure of Bulgaria until 2015, the Strategy for Development of the Transport Infrastructure through the Mechanisms of the Concession, the National Strategy for Sustainable Tourism Development in Bulgaria covering the period 2009-2013, the National Program for Development of Agriculture 2014-2020, National Environmental Strategy 2009-2018, the Innovation Strategy for Intelligent Specialization 2014-2020, and the EU Strategy on the Danube region). The paper provides a practical example for the use of the Halt-Winters method of exponential smoothing on the number of tourism arrival at the Sofia International airport. The achieved forecast value can be further used for setting more clear and achievable goals in above mentioned types of strategic planning documents.

*Keywords: strategic documents, tourism policy, infrastructure policy, exponential smoothing forecasting, Hal-Winters method*

# 1. INTRODUCTION

The infrastructure policy in tourism in Bulgaria is put under serious pressure by the abundance of new strategic documents which the country was obliged to adopt in connection with its membership in the European Union. The problem of forecasting in the strategic documents is crucial to the formation of proper innovation infrastructure policy for the future development of the tourism in the country.

In many of the strategic documents adopted for the development of the infrastructure policy in Bulgaria (i.e. the National Strategy for Integrated Development of Infrastructure of the Republic of Bulgaria 2006-2015, the National Strategy for Regional Development of the Republic of Bulgaria for the period 2005-2015, the Strategy of Development of the Transport System of the Republic of Bulgaria until 2020, the Strategy for development of the Transport Infrastructure of Bulgaria until 2015, the Strategy for Development of the Transport Infrastructure through the Mechanisms of the Concession, the National Strategy for Sustainable Tourism Development in Bulgaria covering the period 2009-2013, the National Program for Development of Agriculture 2014-2020, National Environmental Strategy 2009-2018, the Innovation Strategy for Intelligent Specialization 2014-2020, and the EU Strategy on the Danube region) there is a lack of real forecasting of the economic process that would bring to the achievement of the strategic documents set in these very same strategic documents. So a more practical approach is needed to provide a practical example for the use the statistical objective forecasting. A possible solution can be found in the group up of the exponential forecasting methods and in particular in the face of the Halt-Winter's method of exponential smoothing. This method is explicitly suitable for forecasting and planning of the of the air transport infrastructure, as it can provide considerably reliable forecast values on the number of tourism arrivals of some of the country's major aiports, such as the Sofia International airport which is under review in the present paper. The achieved forecast value can be further used for setting more clear and achievable goals in above mentioned types of strategic planning documents.

Most of the Bulgarian international airports are located in the central part of the country like the Sofia airport and Plovdiv airport. The Varna airport and Burgas airport are located on the Bulgarian Black seaside in the largest resort cities Varna and Burgas. Bulgaria is part of the rapid aviation growth during the 20s and 30s of 20$^{th}$ century, the first aircraft flights being performed from natural surfaces. The first airfield in the city of Sofia could be found on the territory of present Central Railway Station. 1922 marked the first commercial air transport service in Bulgaria. Bulgaria was among the first states to sign the Chicago Convention which established civil aviation rules.

Since the early 30s of 20$^{th}$ century, all flights were operated from the unpaved runway in the village of Vrazhdebna region, later chosen for the construction of a civil airport by a Decree of Tzar Boris III, dated 16 September 1937. This is considered to be the birth date of Sofia Airport. Airport construction was carried out under the governance of the Directorate of Civil Aviation to the Ministry of Railways, Posts and Telegraphs. In 1939 Sofia Airport opened its first passenger waiting-room, and two years later it was followed by a completely finished airfield with a paved runway. Nine years later, the first concrete runway was constructed of 1050 meters in length. On the 29-th June 1947 the first scheduled passenger flight from Sofia to Burgas was launched officially. In 1949 Bulgarian-Soviet Transport Aviation Corporation TABSO was established to merge together civil aircraft stock and commercial airports. TABSO set the beginning of scheduled international flights operating on routes connecting Sofia to other European capital cities. From 1951 to 1965 the passenger terminal and the runway were renovated by stages, the runway being extended to 2720 m to accommodate modern large turbo-jet aircraft.

The years that followed were characterized by rapid air traffic growth which required multifold capacity increase – a separate terminal was appointed for domestic flights to Varna, Burgas, Ruse, Gorna Oryahovitsa, Vidin, and Targovishte, and later a new building was constructed to accommodate passengers arriving from international flights. Meanwhile, the runway was under repair for several times, a new aeronautical equipment was installed corresponding to the dynamically changing requirements of modern turbo-jet civil aviation. In 1985 passenger halls were reconstructed and expanded, and a zone for transfer passengers was separated, who at that time formed about 20 % of Sofia Airport traffic.

The early 90's saw economic transformations in Bulgaria oriented to the economic principles of the free market. By a Decision of Council of Minister of the Republic of Bulgaria Sofia Airport EOOD was established as an independent entity, and later it was transformed into a sole owner joint stock company (EAD) with 100 % state participation. At the dawn of the new century, a new Master Plan for the extension and modernization of Sofia Airport existing infrastructure was adopted, with a main objective to prepare Sofia Airport for new market challenges and ensure the capacity necessary for the rapid aviation industry development through providing a contemporary airport services standard and high level of safety and security of flights.

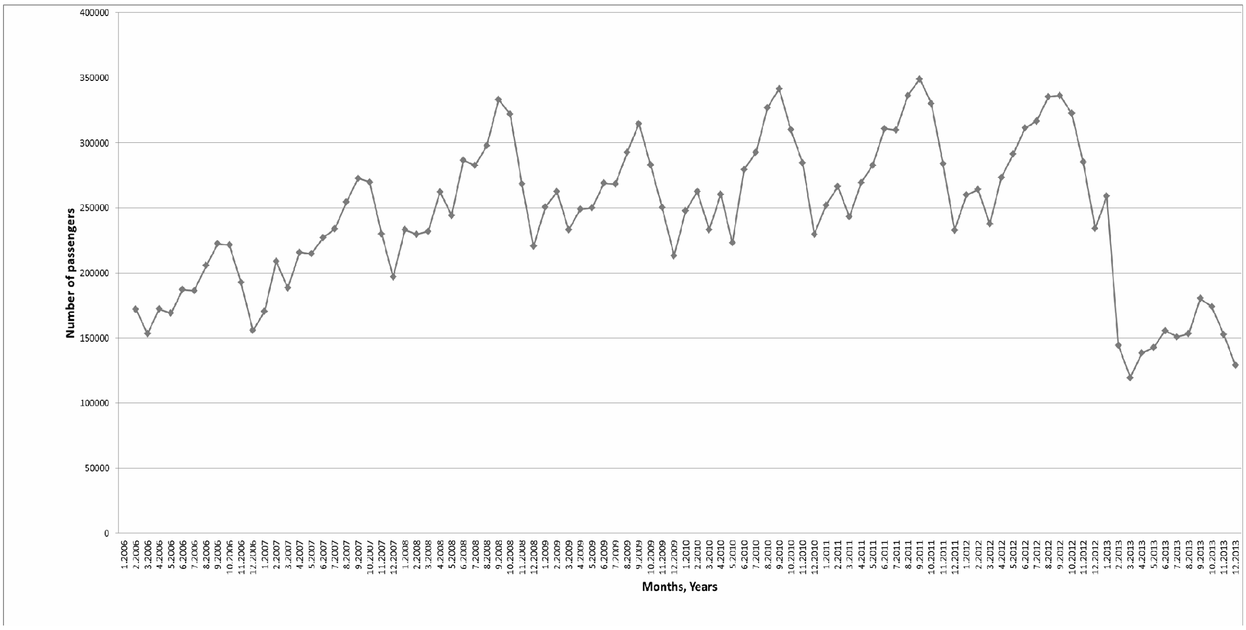
In 2011, on the territory of Sofia Airport, the construction of a new control tower of Directorate Generale "Air Traffic Control" began, the tower being located in near vicinity to Terminal 2. The opening of the tower, which should happen by the end of 2012, will result in the improvement of aeronautical services quality and efficiency in the airport zone. The 50 m high tower is characterized not only by great functionality, but also by a modern architectural design. Future infrastructure plans of Sofia Airport include the construction of new taxiways, aiming at aircraft movement optimization and reducing taxiing time after landing and before take-off, the extension of apron area, the delivery and installation of two additional passenger boarding bridges, some interior re-organization, such as Terminal 2 passenger gallery extension and building new bus exits, increasing the space for commercial purposes. The infrastructural modernization and improvements have resulted in a follow up increase in the number of the passengers serviced tough, of course, this increase has been affected also by other factors.

As it is seen from the statistical monthly records of the passengers flows on the Sofia airport, the number of passengers is slowly but steadily increasing within the period from 2006 to 2012 ( Table 1). This increase however is accompanied with a strongly expressed multiplicative seasonality (Chart 1).

**Table 1:** Passengers Traffic on the Sofia Airport within the period from 2006 to 2013

| Months | Passengers | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Years | | | | | | | |
| | **2006** | **2007** | **2008** | **2009** | **2010** | **2011** | **2012** | **2013** |
| **January** | 172 220 | 209 106 | 229 704 | 262 506 | 262 596 | 266 522 | 264 225 | 144 342 |
| **February** | 153 359 | 188 575 | 232 048 | 233 107 | 233 319 | 243 107 | 237 600 | 119 519 |
| **March** | 172 388 | 215 823 | 262 418 | 249 018 | 260 452 | 269 332 | 273 463 | 138 545 |
| **April** | 169 119 | 214 766 | 244 359 | 249 904 | 223 114 | 282 694 | 291 272 | 142 637 |
| **May** | 187 177 | 227 006 | 286 702 | 269 060 | 279 583 | 310 866 | 311 394 | 155 670 |
| **June** | 186 397 | 233 989 | 282 535 | 268 440 | 292 618 | 309 792 | 316 774 | 150 912 |
| **July** | 205 708 | 254 468 | 297 873 | 292 752 | 327 101 | 336 506 | 335 292 | 153 273 |
| **August** | 222 481 | 272 764 | 333 230 | 314 785 | 341 635 | 349 016 | 336 422 | 180 523 |
| **September** | 221 577 | 269 776 | 322 077 | 283 070 | 310 121 | 330 316 | 322 690 | 173 925 |
| **October** | 192 742 | 230 087 | 268 626 | 250 478 | 284 546 | 283 829 | 285 216 | 152 697 |
| **November** | 155 938 | 196 877 | 220 554 | 213 218 | 229 806 | 233 050 | 234 168 | 129 010 |
| **December** | 170 498 | 233 093 | 250 570 | 247 766 | 252 045 | 259 969 | 258 939 | 127 193 |
| **Monthly average** | **184134** | **228861** | **269225** | **261175** | **274745** | **289583** | **288955** | **147354** |

**Chart 1:** Number of passengers serviced on the Sofia International Airport




## 2. OBJECTIVES

As P. Dimitrov (2011, 2012) points out the task of creating an exponential smoothing forecast model for the long-run development of the tourism industry, and in a particular for an international airport, meets with solving of several major problems:

(i) Finding of a suitable general indicator, on the basis of which to build the long-run forecasts (the forecast for periods longer than 5 years);

(ii) Determining the time series pattern, or the so-called "forecast profile"(Gardner, 1987:174-175) (Hyndman, Koehler, Ord and Snyder, 2008:11:23) and the quality of the data in the pattern, on the basis of which to select the suitable forecasting exponential smoothing model.

(iii) Selecting and using of suitable forecasting techniques;

(iv) Calculating of long-run forecasts for the value of the above-mentioned general indicator (up to December 2014).

## 3. METHODOLOGY AND MAIN RESULTS

With regards to the **first problem,** i.e. the finding of a general suitable indicator, on the basis of which to make the forecast, it can be pointed out that the Sofia International Airport has published its monthly statistical records of serviced passengers , already presented in point 2 of the present paper.

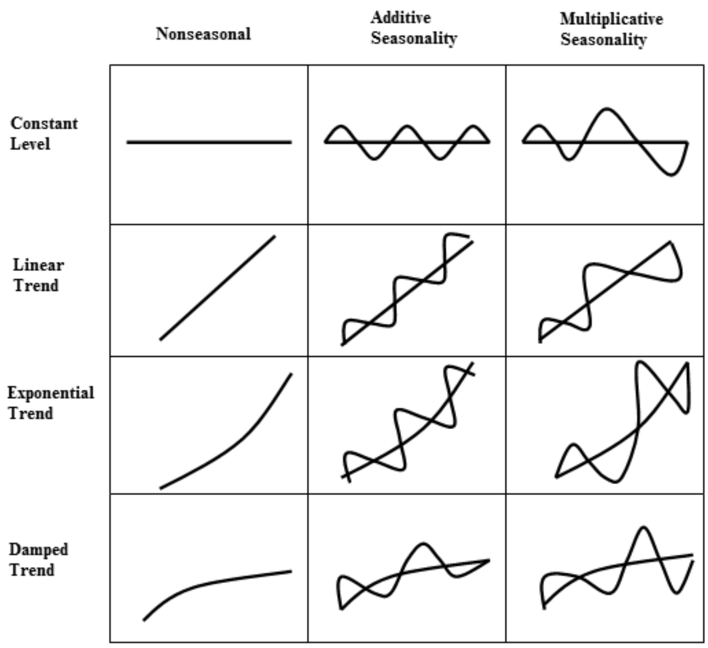
**The second problem of determining the times series pattern,** or the so-called times series' "forecast profile" is usually solved by comparing the times series in regard with a pre-set classification of exponential smoothing methods or the derived form them forecast profiles in terms of development curves. As Hyndman, Koehler, Ord and Snyder point out (Hyndman et al., 2008:11-12), this classification of smoothing methods originated with Pegles' taxonomy (Pegles, 1969:311-315). This was later extended by Gardner (Gardner, 1985:1-28) and modified by Hyndman et al. (2002, 2008) and extended by Taylor (Taylor, 2003:715-725) giving a classification set of fifteen models (Table 2). In the regarded time series, as it will become later clear, the Gardner's much simplified classification can also be successfully used for finding the best fit forecasting method or forecast profile (Chart 2).

**Table 2:** Classification of forecasting methods

| **Trend component** | **Seasonal component** | | |
|---|---|---|---|
| | **N** (None) | **A** (Additive) | **M** (Multiplicative) |
| **N** (None) | **N,N** | **N,A** | **N,M** |
| **A** (Additive) | **A,N** | **A,A** | **A,M** |
| $\mathbf{A_d}$ (Additive damped) | $\mathbf{A_d}$**,N** | $\mathbf{A_d}$**,A** | $\mathbf{A_d}$**,M** |
| **M** (Multiplicative) | **M,N** | **M,A** | **M,M** |
| $\mathbf{M_d}$ (Multiplicative damped) | $\mathbf{M_d}$**,N** | $\mathbf{M_d}$**,A** | $\mathbf{M_d}$**,M** |

Source: Hyndman et al. (2008), p.12, cited by Dimitrov, P. (2012, pp.104-114).

**Chart 2:** Forecast profiles from Exponential Smoothing Models by Gardner (1987), cited by Dimitrov (2012, pp.104-114).




A simple visual comparison of the times series of the passengers serviced on the Sofia International Airport for the time period 2006 – 2012 with the Gardner's classification shows out that these particular time series comes into the "linear trend, multiplicative seasonal" profile. Of course with the help of more sophisticated statistical analysis, such as the linear trend estimation by the use of the least squares method and etc., it can be also proved that these very same time series comes into the "A,M" variation of Taylor's patterns of forecasting methods that requires the presence of a trend but with no seasonal components.

The finding that the time series of the number of the passengers serviced on the Sofia International Airport for the time period 2006 – 2012 correspond to the "linear trend, multiplicative seasonal" profile and require the "A,M" variation of exponential forecasting methods makes **the third problem, the one of selecting and using of a suitable forecasting exponential smoothing method** much more predetermined and easier to solve. As both Gardner and Hyndman et al. point out this profile corresponds to the method of **triple exponential smoothing** in the presence of a linear trend and multiplicative seasonality, known as **the Holt-Winters method**. As Dimitrov (2012) and others (Hyndman, R. J. et Al., 2008) point out the mathematical notation of this method is as follows:

- The smoothing of **the level (the base) – "B"**:

**(1)** $$B_t = \alpha \frac{Y_t}{S_{t-m}} + (1-\alpha)(B_{t-1} + T_{t-1}) \qquad 0 \le \alpha \le 1$$

➢ The smoothing of **the trend – "T"**:

**(2)** $$T_t = \beta(B_t - B_{t-1}) + (1-\beta)T_{t-1} \qquad 0 \le \beta \le 1$$

➢ The smoothing of **the seasonal factor – "S"**:

**(3)** $$S_t = \gamma \frac{Y_t}{B_t} + (1-\gamma)S_{t-m} \qquad 0 \le \gamma \le 1$$

➢ The achieving of **the final forecast "$F_{t+m}$"** for **"t+m" periods ahead in the future:**

**(3)** $$F_{t+k} = (B_{t-1} + kT_{t-1})S_{t+k-m},$$

Where:

„α", „β" and "γ" are the smoothing constants for the level, the trend and the seasonality respectfully which could take values between 0 and 1.

In this situation, one can point out the most widely used values of the smoothing constants in the Halt-Winters method are: α=0.2, β=0.4 and γ=0.6. Of course they could be determined on the basis of testing of different sets of values in order to achieve a minimum mean absolute percentage of error (MAPE).

Further to the general mathematical notation of the Holt-Winters method, **it is need to present the possible ways of achieving of the initial values ("t zero" values) of the level (the base) "B", the trend "T" and the seasonal factor "S"**.

The initialization of the values of the level "B", the trend "T" and the seasonal factor "S" is achieved though the following set of equations (Dimitrov, 2013:143):

➢ For the level (the base) – "B0":

(9) $$B_0 = \frac{1}{L}(Y_1 + Y_2 + \ldots Y_L)$$

➢ For the trend – "T0":

(10) $$T_0 = \frac{1}{L}\left(\frac{Y_{L+1} - Y_1}{L} + \frac{Y_{L+2} - Y_2}{L} + \ldots + \frac{Y_{L+L} - Y_L}{L}\right)$$

➢ For the seasonal factor – "S0":

(11) $$S_0 = \frac{1}{N}\sum_{j=1}^{N} \frac{Y_{L(j-1)+i}}{A_j} \qquad \forall_i = 1,2,\ldots,L,$$

Where:

$$A_j = \frac{\sum_{i=1}^{L} Y_{L(j-1)+i}}{L} \qquad \forall_j = 1,2,\ldots,N,$$

and Aj is the average value of Y in the jth cycle of the regarded time series.

Based on equations , the seasonal indices for the regarded time series can be calculated (Table 3).

**Table 3:** Matrix of calculating of the initial seasonal indices

| time period | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | S | |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0,935299 | 0,913682 | 0,853206 | 1,005095 | 0,955782 | 0,920364 | 0,914417 | 0,979561 | 0,934676 | **S1** |
| 2 | 0,832868 | 0,823972 | 0,861912 | 0,892531 | 0,849221 | 0,839506 | 0,822275 | 0,811102 | 0,841673 | **S2** |
| 3 | 0,936211 | 0,943032 | 0,974718 | 0,953451 | 0,947978 | 0,930068 | 0,946387 | 0,94022 | 0,946508 | **S3** |
| 4 | 0,918458 | 0,938413 | 0,90764 | 0,956844 | 0,812078 | 0,97621 | 1,00802 | 0,96799 | 0,935706 | **S4** |
| 5 | 1,016528 | 0,991895 | 1,064917 | 1,030189 | 1,01761 | 1,073494 | 1,077657 | 1,056437 | 1,041091 | **S5** |
| 6 | 1,012292 | 1,022407 | 1,04944 | 1,027815 | 1,065054 | 1,069786 | 1,096276 | 1,024147 | 0,917884 | **S6** |
| 7 | 1,117167 | 1,11189 | 1,106411 | 1,120902 | 1,190564 | 1,162035 | 1,160362 | 1,04017 | 1,126188 | **S7** |
| 8 | 1,208258 | 1,191833 | 1,237739 | 1,205263 | 1,243464 | 1,205235 | 1,164273 | 1,225099 | 1,210146 | **S8** |
| 9 | 1,203349 | 1,178777 | 1,196313 | 1,083831 | 1,128761 | 1,14066 | 1,11675 | 1,180322 | 1,153595 | **S9** |
| 10 | 1,04675 | 1,005358 | 0,997776 | 0,959042 | 1,035674 | 0,980129 | 0,987062 | 1,036261 | 1,006007 | **S10** |
| 11 | 0,846874 | 0,860248 | 0,819219 | 0,816379 | 0,836435 | 0,804777 | 0,810397 | 0,875512 | 0,83373 | **S11** |
| 12 | 0,925947 | 1,018492 | 0,93071 | 0,948658 | 0,917379 | 0,897735 | 0,896124 | 0,863181 | 0,933578 | **S12** |

Source: Mirchova, S. (2013) based on data provided by the Sofia International Airport, calculations made by Dimitrov, P. (2013).

Having the initial values of the level (the base) “B”, the trend “T” and the seasonal factor “S”, one can proceed to the calculation of the forecast values themselves.

For the purpose of visualization of the results from the proposed forecast method for past and future periods, as well as the extent of achieved error, these results are presented in table and graphic form in Table 4 and Chart 3.

Table 4 and Chart 3 provide also a solution for the third and the fourth problems set for solving in the present paper, i.e. **iii “Calculating of long-run forecasts for the value of the above-mentioned general indicator (up to December 2014)”; and iv “Comparing the results of the forecast techniques (the forecast models) on the basis of the errors in the forecasts”**.

## 4. CONCLUSIONS

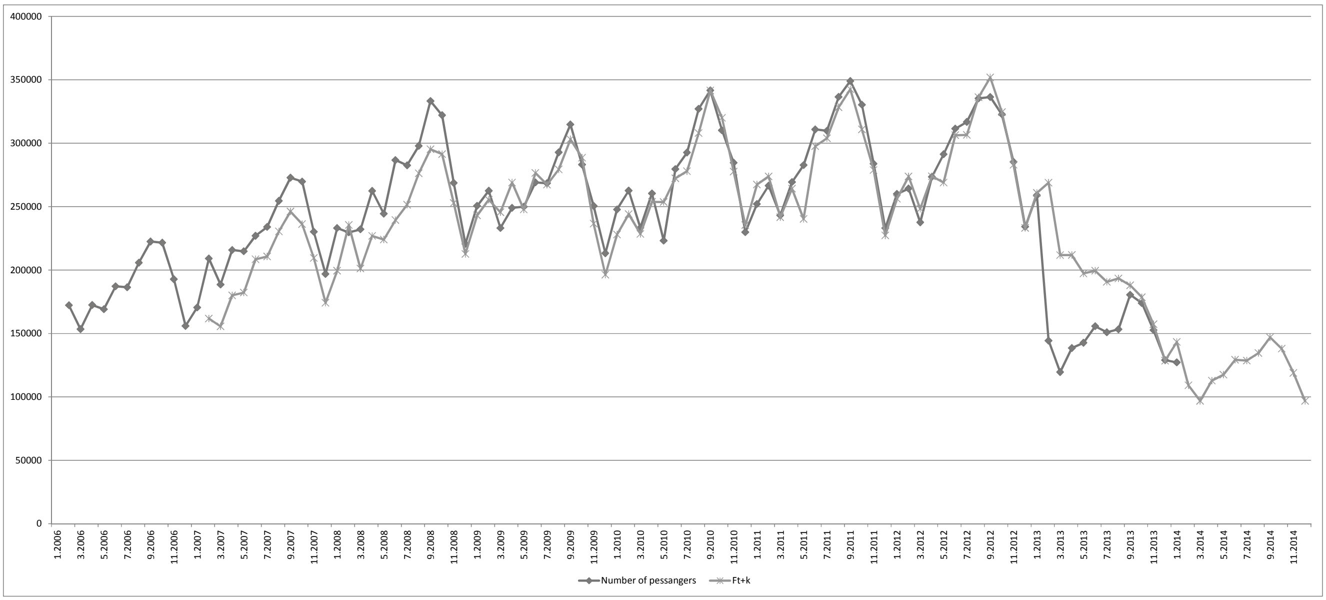
Based on the achieved forecast values in Table 4 and Chart 3, one can conclude that the seasonal variation in the number of the serviced passengers on the Sofia International Airport will remain approximately unaltered. This strongly requires a change in the policy of infrastructure investment of the airport authorities, if they would like to achieve a steadier trend of increase and overcoming of the high seasonal fluctuation.

**Table 3:** Calculating of the forecasts – through the use of a triple exponential smoothing (the Holt-Winters method)

| (α=0,2, β=0,4, γ=0,6) | | | T0 | 3727,264 | |
|---|---|---|---|---|---|
| Time periods (months) | Number of pessangers | Bt | Tt | St | Ft+k |
| 1.2006 | 172 220 | 172220 | 3727,264 | 0,928263 | |
| 2.2006 | 153 359 | 153359 | 3727,264 | 0,846041 | |
| 3.2006 | 172 388 | 172388 | 3727,264 | 0,947406 | |
| 4.2006 | 169 119 | 169119 | 3727,264 | 0,931095 | |
| 5.2006 | 187 177 | 187177 | 3727,264 | 1,038899 | |
| 6.2006 | 186 397 | 186397 | 3727,264 | 1,049010 | |
| 7.2006 | 205 708 | 205708 | 3727,264 | 1,138476 | |
| 8.2006 | 222 481 | 222481 | 3727,264 | 1,208009 | |
| 9.2006 | 221 577 | 221577 | 3727,264 | 1,149777 | |
| 10.2006 | 192 742 | 192742 | 3727,264 | 1,001684 | |
| 11.2006 | 155 938 | 155938 | 3727,264 | 0,827761 | |
| 12.2006 | 170 498 | 170498 | 3727,264 | 0,933578 | |
| 1.2007 | 209 106 | 178469,7 | 5425,057 | 1,074302 | 161727 |
| 2.2007 | 188 575 | 184372,2 | 5616,023 | 0,952093 | 155582 |
| 3.2007 | 215 823 | 190076,8 | 5651,433 | 1,060234 | 179996 |
| 4.2007 | 214 766 | 195211,5 | 5444,771 | 1,03254 | 182241 |
| 5.2007 | 227 006 | 196888,7 | 3937,724 | 1,107339 | 208462 |
| 6.2007 | 233 989 | 199140,5 | 3263,372 | 1,124601 | 210669 |
| 7.2007 | 254 468 | 201033,9 | 2715,367 | 1,214868 | 230432 |
| 8.2007 | 272 764 | 203004,6 | 2417,483 | 1,289385 | 246131 |
| 9.2007 | 269 776 | 206348,5 | 2788,062 | 1,244339 | 236190 |
| 10.2007 | 230 087 | 208037 | 2348,24 | 1,064268 | 209489 |
| 11.2007 | 196 877 | 211016,3 | 2600,678 | 0,890901 | 174149 |
| 12.2007 | 233 093 | 215766,7 | 3460,546 | 1,021612 | 199428 |
| 1.2008 | 229 704 | 211036,7 | 184,3351 | 1,082794 | 235516 |
| 2.2008 | 232 048 | 213081,3 | 928,458 | 1,034244 | 201102 |
| 3.2008 | 262 418 | 215445,8 | 1502,877 | 1,154907 | 226900 |
| 4.2008 | 244 359 | 215332,5 | 856,38 | 1,093895 | 224008 |
| 5.2008 | 286 702 | 220898 | 2740,016 | 1,221672 | 239394 |
| 6.2008 | 282 535 | 224353,9 | 3026,408 | 1,205436 | 251503 |
| 7.2008 | 297 873 | 226348,8 | 2613,777 | 1,275542 | 276237 |
| 8.2008 | 333 230 | 230833,3 | 3362,057 | 1,381912 | 295221 |
| 9.2008 | 322 077 | 234202,9 | 3365,095 | 1,322859 | 291418 |
| 10.2008 | 268 626 | 235964,6 | 2723,74 | 1,108757 | 252836 |
| 11.2008 | 220 554 | 236203,7 | 1729,887 | 0,916607 | 212648 |
| 12.2008 | 250 570 | 235248,4 | 655,8029 | 1,047722 | 243076 |
| 1.2009 | 262 506 | 236538 | 909,3388 | 1,098988 | 255436 |
| 2.2009 | 233 107 | 233565,4 | -643,446 | 1,01252 | 245579 |
| 3.2009 | 249 018 | 228773,5 | -2302,84 | 1,115058 | 269003 |
| 4.2009 | 249 904 | 228024,4 | -1681,36 | 1,09513 | 247735 |
| 5.2009 | 269 060 | 224275,3 | -2508,43 | 1,20848 | 276517 |
| 6.2009 | 268 440 | 221537,3 | -2600,25 | 1,209203 | 267326 |
| 7.2009 | 292 752 | 221041,2 | -1758,6 | 1,30487 | 279263 |
| 8.2009 | 314 785 | 219701,2 | -1591,15 | 1,412437 | 303029 |
| 9.2009 | 283 070 | 215865,6 | -2488,94 | 1,315938 | 288529 |
| 10.2009 | 250 478 | 215695,3 | -1561,5 | 1,140258 | 236583 |
| 11.2009 | 213 218 | 217695,6 | -136,766 | 0,954302 | 196277 |
| 12.2009 | 247 766 | 220928 | 1210,881 | 1,091976 | 227941 |
| 1.2010 | 262 596 | 223803,6 | 1876,787 | 1,143594 | 244128 |
| 2.2010 | 233 319 | 225644,4 | 1862,403 | 1,025415 | 228506 |
| 3.2010 | 260 452 | 229073,2 | 2488,965 | 1,128212 | 253683 |
| 4.2010 | 223 114 | 225350,3 | 4,185834 | 1,032098 | 253591 |
| 5.2010 | 279 583 | 228557,1 | 1285,259 | 1,217343 | 272336 |
| 6.2010 | 292 618 | 233324,4 | 2678,056 | 1,236156 | 277926 |
| 7.2010 | 327 101 | 238201,8 | 3557,794 | 1,345874 | 307953 |
| 8.2010 | 341 635 | 240209,6 | 2937,81 | 1,418317 | 341470 |
| 9.2010 | 310 121 | 241291,9 | 2195,598 | 1,297527 | 319967 |
| 10.2010 | 284 546 | 244191,8 | 2477,31 | 1,155257 | 277639 |
| 11.2010 | 229 806 | 243624,9 | 1259,655 | 0,947687 | 235397 |
| 12.2010 | 252 045 | 240094,3 | -656,446 | 1,066655 | 267408 |
| 1.2011 | 266 522 | 237185,3 | -1557,48 | 1,13165 | 273820 |
| 2.2011 | 243 107 | 235674,7 | -1538,76 | 1,029088 | 241616 |
| 3.2011 | 269 332 | 234293,5 | -1475,72 | 1,141015 | 264155 |
| 4.2011 | 282 694 | 242211,9 | 2281,934 | 1,11312 | 240291 |
| 5.2011 | 310 866 | 243814,2 | 2010,066 | 1,251945 | 297633 |
| 6.2011 | 309 792 | 243030,7 | 892,653 | 1,259284 | 303877 |
| 7.2011 | 336 506 | 241583,9 | -43,1286 | 1,374099 | 328290 |
| 8.2011 | 349 016 | 240132,4 | -606,48 | 1,439386 | 342581 |
| 9.2011 | 330 316 | 241264,1 | 88,8125 | 1,340474 | 310791 |
| 10.2011 | 283 829 | 240166,4 | -385,805 | 1,171184 | 278825 |
| 11.2011 | 233 050 | 240308,3 | -174,732 | 0,960953 | 227237 |
| 12.2011 | 259 969 | 241516,5 | 378,4423 | 1,072504 | 256140 |
| 1.2012 | 264 225 | 241156,5 | 83,06202 | 1,110055 | 273740 |
| 2.2012 | 237 600 | 240333 | -279,554 | 1,004812 | 248257 |
| 3.2012 | 273 463 | 241380,3 | 251,1803 | 1,136154 | 273904 |
| 4.2012 | 291 272 | 243613 | 1043,799 | 1,162628 | 268965 |
| 5.2012 | 311 394 | 243028 | 392,2776 | 1,269563 | 306297 |
| 6.2012 | 316 774 | 244018,4 | 631,5398 | 1,282607 | 306535 |
| 7.2012 | 335 292 | 244051 | 391,9393 | 1,373956 | 336173 |
| 8.2012 | 336 422 | 242471,2 | -396,753 | 1,408238 | 351848 |
| 9.2012 | 322 690 | 242051,6 | -405,903 | 1,336077 | 324494 |
| 10.2012 | 285 216 | 242655,5 | -1,9697 | 1,17371 | 283011 |
| 11.2012 | 234 168 | 243000,8 | 136,95 | 0,962572 | 233179 |
| 12.2012 | 258 939 | 242384,7 | -164,268 | 1,06998 | 260766 |
| 01.2013 | 144 342 | 219847,6 | -9113,4 | 0,837955 | 268878 |
| 02.2013 | 119 519 | 199891,1 | -13450,7 | 0,760677 | 211748 |
| 03.2013 | 138 545 | 184100,3 | -14386,7 | 0,905993 | 211825 |
| 04.2013 | 142 637 | 170982,2 | -13879,3 | 0,965584 | 197314 |
| 05.2013 | 155 670 | 160995,3 | -12322,3 | 1,087979 | 199452 |
| 06.2013 | 150 912 | 151823,1 | -11062,3 | 1,109442 | 190689 |
| 07.2013 | 153 273 | 143456,1 | -9984,16 | 1,190641 | 193399 |
| 08.2013 | 180 523 | 140720,4 | -7084,76 | 1,333004 | 187960 |
| 09.2013 | 173 925 | 138936,3 | -4964,54 | 1,285531 | 178548 |
| 10.2013 | 152 697 | 137170,1 | -3685,18 | 1,137401 | 157244 |
| 11.2013 | 129 010 | 136431,8 | -2506,43 | 0,952389 | 128489 |
| 12.2013 | 127 193 | 133051,7 | -2855,9 | 1,001572 | 143297 |
| 01.2014 | | | | | 109098 |
| 02.2014 | | | | | 96865 |
| 03.2014 | | | | | 112782 |
| 04.2014 | | | | | 117442 |
| 05.2014 | | | | | 129222 |
| 06.2014 | | | | | 128602 |
| 07.2014 | | | | | 134614 |
| 08.2014 | | | | | 146903 |
| 09.2014 | | | | | 138000 |
| 10.2014 | | | | | 118850 |
| 11.2014 | | | | | 96798 |
| 12.2014 | | | | | 98936 |

Source: Mirchova, S. (2013) based on data provided by the Sofia International Airport, calculations made by Dimitrov, P. (2013).

**Chart 3:** Plotting of the forecasts – through the use of a triple exponential smoothing (the Holt-Winters method)




Source: Mirchova, S. (2013) based on data provided by the Sofia International Airport, calculations made by Dimitrov, P. (2013).

One possible solution in this regard can be improvements aimed at attracting more low-cost budget carriers, such as: (i) providing of direct access of the passengers to the aircrafts without the use of transfer busses and/or gate connection arms; (ii) low-cost restaurants and food selling points; (iii) waiting areas furnished with armchairs and semi-folded beds and etc. and (iv) creation of a marketing department that will have a s a main task to attract the low-cost budget airlines to the Sofia International Airport.

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