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Model Comparison on Forecasting Tourist Arrivals to Sri Lanka from Western Europe

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Abstract: **There is a growth of tourist arrivals from all the regions to Sri Lanka. Increasing of tourist arrivals could cause either positive or negative effect on the country. Therefore, it is important to minimize the risk and maximize the benefits. To get the maximum benefits, it is vital to forecasting arrivals, hence, the study was focused on forecasting arrivals from Western Europe to Sri Lanka. Monthly tourist arrival data for the period of, January 2008 to December 2015 was obtained from Sri Lanka Tourism Development Authority (SLTDA). Time Series plots and Auto-Correlation Functions (ACF) were used for pattern recognition of arrivals. It revealed that the arrivals have both trend and seasonal patterns. As such, the Decomposition Techniques and Seasonal Autoregressive Integrated Moving Average (SARIMA) were tested for forecasting arrivals. The Residual plots, Anderson-Darling, Durbin-Watson, and Ljung-Box Q (LBQ)-tests were used as the goodness of fit tests in model validation. The best fitting model was selected by comparing the relative and the absolute measurements of errors. The results revealed that the SARIMA satisfied model validation criterion but not the Decomposition models. It is concluded that the SARIMA performed extremely well in forecasting arrivals. However, arrivals show wave-like patterns. It is recommended to test the Circular Model (CM), which is specifically developed to model wave-like patterns, in order to see whether the forecasting accuracy increases.**

Keywords: **Decomposition Techniques, Measurement of Errors, SARIMA.**

I. INTRODUCTION

Sri Lanka claims to a long history with one of the longest documented histories in the world. The rich culture of many different ethnic communities, cultural, linguistic and religious diversities is key attractiveness in Sri Lanka. Sri Lankan tourism industry is growing every year by volume and value. The tourism industry has boomed to a new high record of 798,380 arrivals in 2015, which is an increase of 17.8% over 1,527,153 arrivals in 2014 (SLTDA, 2015). Among the regions of the world, Western Europe is the second source of the Sri Lankan tourism market, with a share of 30.7%.

PROBLEM STATEMENT:

With the increase of tourist arrivals from Western Europe, it is important of forecasting arrivals for many benefits. Many researchers have attempted to forecast the total number of international tourist arrivals to Sri Lanka (Diunugala, 2013), (Konarasinghe,2014),(Kurukulasooriya and Lelwala,2014),(Kodituwakku, Hettiarachchi, Wijesundara, Dias, and Karunaratne, 2014),(Konarasinghe, 2016-1),(Priyangika,Pallawala, and Sooriyaarachchi, 2016), (Peiris,2016), Gnanapragasam and Cooray, 2016 -1),(Gnanapragasam and Cooray, 2016-2), (Ishara and Wijekoon, 2017) and (Nisantha and Lelwala , 2011).

However, studies focused on forecasting arrivals region wise are limited. It is a known fact that the expectations of the tourists are not same for all the regions. As such it is necessary to forecast the number of arrivals region wise, in order to satisfy the expectations of the tourist to obtain the optimum benefits to the country (Konarasinghe, 2016-2). The number of arrivals from the Western Europe is significantly different from the other regions (Konarasinghe, 2016-3). The

SARIMA and Winters method used on forecasting arrivals from India, United Kingdom (UK), Germany, Maldives, France, Australia, Netherlands, United States of America (US), Japan and Italy(Diunugala, 2013). The ADLM and Decomposition techniques were tested to forecast arrivals from Western Europe were successful up to a certain extent (Konarasinghe, 2016-2) and (Konarasinghe, 2016-4). The SARIMA is a powerful model in capturing seasonal patterns, but the model has not been tested in Sri Lankan context. Therefore the study was focused on comparing the forecasting ability of Decomposition techniques and SARIMA in forecasting arrivals from Western Europe to Sri Lanka.

THE SIGNIFICANCE OF THE STUDY:

The expectations of the tourists are varied from one to another. Retaining customer is important for a stability of a business. It can be achieved by satisfying their expectations. Sri Lankan economy expected more benefits from Western European arrivals due to their highest per capita and purchasing power (Pasquali, 2016). The results of the study could be applied to forecasting arrivals from Western Europe and to satisfy their expectations within the Sri Lankan cultural and legal bound. Hence, forecasting arrivals from Western Europe are important for various tourism product developments namely; adventure tourism, wildlife tourism, whale watching tourism, culinary tourism, cultural tourism etc. Also, industries; handicrafts, handloom textiles etc, will be benefited. In addition, it is helpful to ensure the sustainable development of the tourism industry in Sri Lanka.

OBJECTIVES OF THE STUDY:

- To forecast arrivals to Sri Lanka from Western Europe.
- To compare the forecasting ability of Decomposition Techniques and SARIMA.

II. LITERATURE REVIEW

STUDIES BASED ON FORECASTING ARRIVALS TO SRI LANKA:

Forecasting tourist arrivals to Sri Lanka is a timely research area in present economic development. The Univariate Statistical Techniques and Soft Computing techniques were used for the purpose in Sri Lankan context.

Short-term tourist arrivals forecasted using Exponential Smoothing by Nisantha and Lelwala (2011). They conclude that Holt – Winter’s exponential smoothing model with multiplicative is the best model. Diunugala (2013) forecasted arrivals from India, United Kingdom (UK), Germany, Maldives, France, Australia, Netherlands, United States of America (US), Japan and Italy during the period from January 1977 to April 2012. The Winter‟s Multiplicative Exponential Smoothing Method (WMESM) and Box and Jenkins Multiplicative Seasonal Auto Regressive Integrated Moving Average (SARIMA) have been tested. The results show that the WMESM is superior to the SARIMA (Diunugala, 2013). Trends of tourist arrivals forecasted by linear and non –liner models by Konarasinghe (2014). Their result of the study shows that the univariate causal model is suitable for the purpose. The Decomposition techniques were used for forecasting arrivals to Sri Lanka by Kurukulasooriya and Lelwala (2014); the study concluded that decomposition multiplicative approach is the most suitable one. Forecasting arrivals to Sri Lanka monthly, quarterly and annually was the scope of a study of Kodituwakku, et al, (2014). They used SARIMA and Holt-Winters exponential smoothing models for forecasting. Their results confirmed that the SARIMA models performed better than other models in monthly, quarterly and annually. Forecasting total arrivals for the postwar period was done by Konarasinghe, (2016-1), using Moving Average (MA) techniques, Exponential Smoothing (ES) techniques, and Winter's Methods. The study recommended the Holt's Winter's three parameters additive and multiplicative models for forecasting arrivals. The Auto Distributed Lag Model (ADLM) was tested to forecast arrivals from Western Europe by Konarasinghe, (2016-4). It was concluded that ADLM is good in forecasting arrivals from Western Europe. The Decomposition techniques also used to forecast arrivals from Western Europe to Sri Lanka by Konarasinghe (2016-2). It was concluded that both multiplicative and additive models are equally good in forecasting arrivals from Western Europe. Hybrid SARIMA- Generalized Autoregressive Conditional Heteroskedasticity (GARCH) used for forecasting arrivals by Priyangika, et al, (2016).The results revealed that hybrid approach was successful in forecasting arrivals. Peiris (2016) used SARIMA on forecasting arrivals and it was successful. Holt – Winter’s three Parameter techniques also performed better in forecasting arrivals in Sri Lankan horizon in the study of Gnanapragasam, and Cooray (2016 -1). Dynamic Transfer Function (DTF) modeling method is another approach used for forecasting arrivals to Sri Lanka used by Gnanapragasam and Cooray (2016 -2). It was successful in forecasting

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of tourist arrivals. Ishara and Wijekoon, (2017) say that Multiplicative Decomposition Approach performed better than ARIMA in arrival forecasting in the post-war situation.

Most of the studies concern on SARIMA and Holt – Winter's techniques in forecasting arrivals to Sri Lanka. In addition ADLM, Decomposition techniques and other linear and nonlinear trend models also used in forecasting.

III. MATERIALS AND METHODS

Monthly tourist arrival data for the period of January 2008 to December 2015 was obtained from annual statistical reports from 2008 to 2015; published by Sri Lanka Tourism Development Authority (SLTDA). Time series plots and Auto-Correlation Function (ACF) were used for pattern identification. The Decomposition additive and multiplicative models and SARIMA models were tested for forecasting. The Anderson–Darling test, ACF, Durbin-Watson test, and Ljung-Box Q (LBQ)-test were used to test the validation criterion and fit the model. Forecasting ability of the models was assessed by three measurements of errors, namely; Mean Absolute Percentage Error (MAPE), Mean Square Error (MSE) and Mean Absolute Deviation (MAD) in both model fitting and verification process.

DECOMPOSITION TECHNIQUES:

In Decomposition models; a time series is described using a multifactor model. The model is:

$$Y_t = f(T, C, S, e) \quad (1)$$

Where;

Y_t = Actual value of time series at time t

f = Mathematical function of

T = Trend

C = Cyclical influences

S = Seasonal influences

e = Error

Decomposition technique is to separate the time series into linear trend and seasonal components, as well as error, and provide forecasts. There are two general types of decomposition models; Additive and Multiplicative models. The Multiplicative models can be used when the size of the seasonal pattern depends on the level of the data. This model assumes that as the data increase so does the seasonal pattern. Most time series plots exhibit such a pattern. The multiplicative model is:

$$Y = T \times C \times S \times e \quad (2)$$

The additive model uses when the size of the seasonal pattern does not depend on the level of the data. In this model, the trend, seasonal, and error components are added. Model is as follows:

$$Y = T + C + S + e \quad (3)$$

AUTOREGRESSIVE INTEGRATED MOVING AVERAGE (ARIMA):

ARIMA modeling can be used to model much different time series, with or without trend or seasonal components, and to provide forecasts. The forecast profile depends upon the model that is fit. The advantage of ARIMA modeling compared to the simple forecasting and smoothing methods is that it is more flexible in fitting the data. The ARIMA model is given by:

$$\phi(B)(1-B)^d y_t = \theta(B)\varepsilon_t$$

Where; $\phi(B) = 1 - \phi_1 B - \phi_2 B^2 ....\phi_p B^p$

$$\theta(B) - 1 - \theta_1 B - \theta_2 B^2 ......\theta_P B^q \quad (4)$$

ε_t = Error term

D = Differencing term

B = Backshift operator ($B^a Y_t = Y_{t-a}$)

Analogous to the simple SARIMA parameters, these are:

Seasonal Autoregressive - (P*s*)

Seasonal Differencing - (D*s*)

Seasonal Moving average parameters - (*Qs*)

Seasonal models are summarized as ARIMA (*p, d, q*) *(P, D, Q)$_s$*

$$(1-\phi_1 B)(1-\varphi_1 B^s)(1-B)(1-B^s)Y_t = (1-\theta_1 B)(1-\theta_1 B^s)\varepsilon_t \quad (5)$$

IV. RESULTS

The data set was outliers free. Time series plots and ACF's were obtained

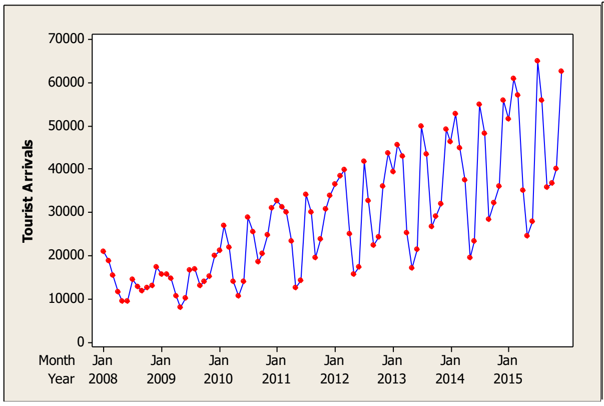

Figure 1: Time series plot of tourist arrivals

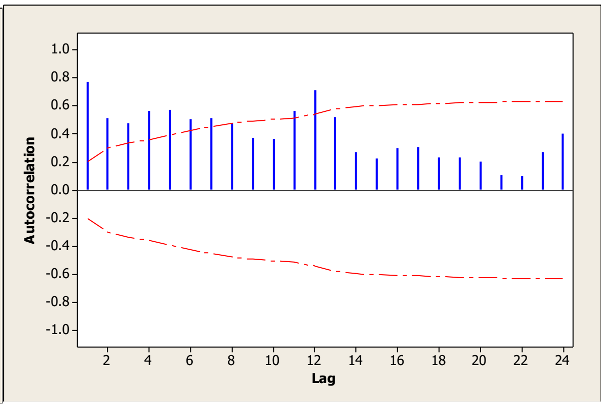

Figure 2: Autocorrelation function of tourist arrivals

Time series plot of arrivals (Figure 1), shows the arrival pattern from Western Europe. The behavior of the series clearly shows that there is an increasing trend. A series which has not constant mean and variance is known as non- stationary series. The ACF can be used to test the stationary of a series. Figure 2; the ACF of arrivals from Western Europe confirmed that the series is not stationary. The pattern of ACF suggests seasonal behavior in arrivals from Western Europe.

The data analysis is organized as follows;
1. Forecast tourist arrivals by Decomposition techniques
2. Forecast tourist arrivals by SARIMA

FORECAST TOURIST ARRIVALS BY DECOMPOSITION TECHNIQUES:

The Decomposition Multiplicative and Additive models run for Western Europe with four seasons; season 1 is January - March, Season 2 is April - June, season 3 is July - September and season 4 is October - December. For example; Figure 3 is the plots for the seasonal analysis of Multiplicative model;

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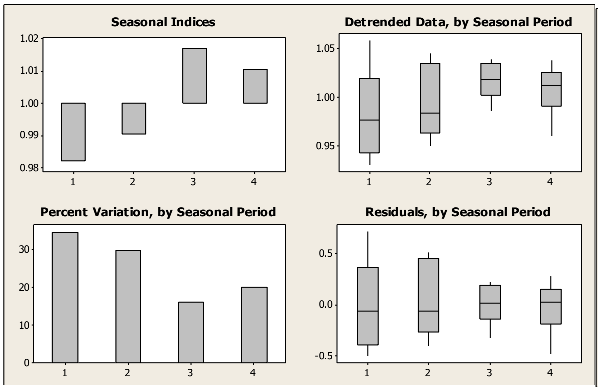


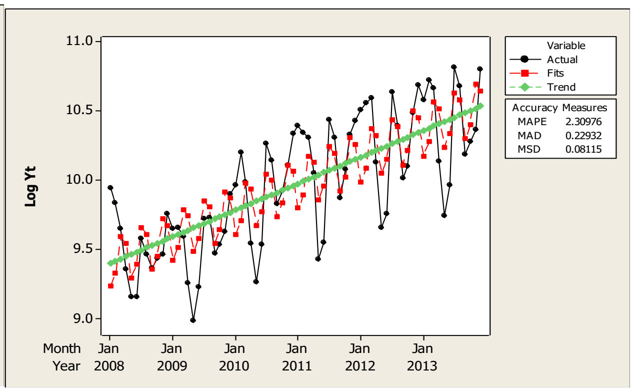
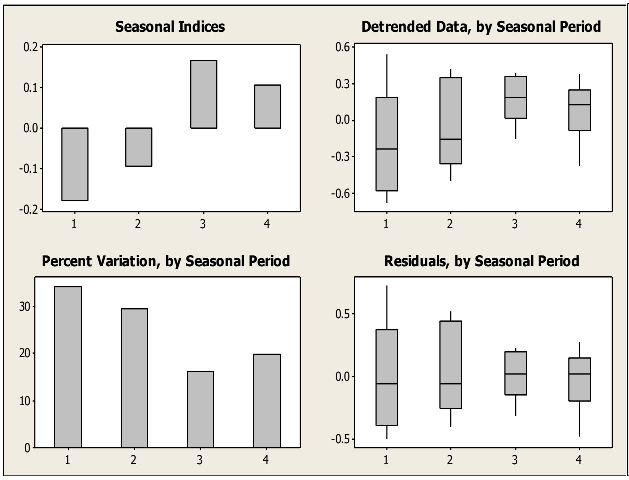


Figure 3: Seasonal Analysis- Multiplicative **Figure 4: Time Series Decomposition Plot- Multiplicative**

According to the above Figure 3; arrivals of seasons 1 and 2 are below the average, while the arrivals of the other two seasons are above the average. Figure 4 is the Time Series Trend model of decomposition plot of the Multiplicative model. It is clear that the pattern of fits is somewhat similar to the pattern of actual arrivals. Measurement errors of the model, MAPE, MSD, and MAD are satisfactorily small in model fitting. Figure 5 is the plots for the seasonal analysis of Additive model; Figure 6 is the Time Series Trend model of decomposition plot of the Additive model;



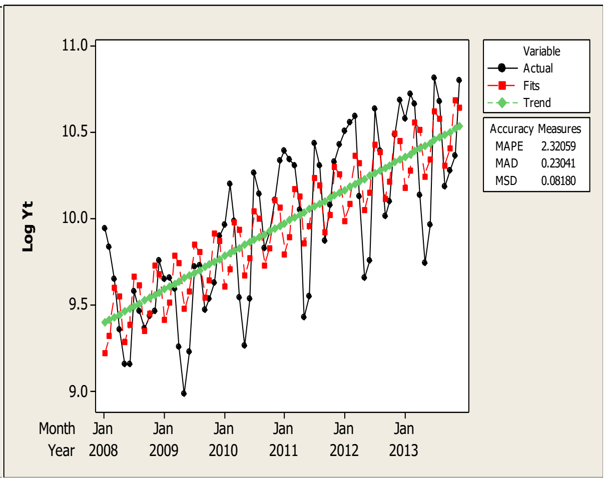


Figure 5: Seasonal Analysis- Additive Model **Figure 6: Time Series Decomposition Plot Additive Model**

The summary of seasonal indices is given in Table 1.

Table 1: Summary Results of Seasonal Indices for the arrivals of Western Europe

Multiplicative Model			Additive Model		
Trend Model	Season	Index	Trend Model	Season	Index
$lnY_t = 9.38417 + 0.0159678_t$	1	-0.98218	$lnY_t = 9.38280 + 0.0160068_t$	1	-0.178370
	2	-0.99057		2	-0.094521
	3	1.01685		3	0.166863
	4	1.01039		4	0.106029

According to the table 1, seasonal indices for the periods of 1 and 2 of the multiplicative model are -0.98218 and -0.99057 it means, the number of tourist arrivals for the seasons, 1 and 2 are (0.98218 and 0.99057) below the average number of tourist arrivals. Seasonal indices for the periods 3 and 4 are 1.01685 and 1.01039. It is clear that the number of arrivals for the seasons, 3 and 4 are above the average number of arrivals. The additive model also gave similar results. The Ljung-Box Q-test (LBQ), ACF and Anderson-Darling test were used for residual analysis. The residuals of both models are normally distributed but correlated. It confirms the models do not meet the validation criterion. Therefore these models cannot verify for forecasting. The summary measures of the model fitting of the multiplicative model are given in Table 2.

Table 2: Model Summary of Multiplicative Model

Trend Model	Model Fitting	
$lnY_t = 9.38417 + 0.0159678_t$	MAPE	3.1066
	MAD	0.3241
	MSE	0.1617
	Normality	P = 0.435
	Independence of Residuals	h =1

Both relative and absolute measurements are very low in model fitting. But those are not sufficient for model verification. The Anderson-Darling Normality test confirmed the normality of residuals; the LBQ test did not confirm the independence of residuals (h=1). The summary measures of the model fitting of the additive model are given in Table 3.The results of the additive model are similar to the multiplicative model. Both multiplicative and additive models show lower measurement of errors but they did not fulfill the model validation criterion, as residuals were not independent.

Table 3: Model Summary of Additive Model

Trend Model	Model Fitting	
$lnY_t = 9.38280 + 0.0160068_t$	MAPE	3.0821
	MAD	0.3214
	MSE	0.1584
	Normality	P = 0.478
	Independence of Residuals	h =1

FORECAST TOURIST ARRIVALS BY SARIMA

Table 4: Model Summary of SARIMA

Model	Model Fitting		Verification	
ARIMA $(1,0,1)(2,1,1)_4$	MAPE	0.92	MAPE	2.90
	MSE	0.01	MSE	0.16
	MAD	0.09	MAD	0.31
	Normality	P =0.97		
	Independence of Residuals	h = 0		

The results of SARIMA are given in Table 4. The model ARIMA$(1,0,1)(2,1,1)_4$ describes a model that includes 1 autoregressive parameter, 1 regular moving average parameter,2 seasonal autoregressive parameters and 1 seasonal moving average parameter and these parameters were computed for the series after no differenced with, and one seasonally differenced. Both relative and absolute measurements of errors of the model are very low in model fitting. The Anderson-Darling Normality test confirmed the normality of residuals; the LBQ test confirmed the independence of residuals (h=0). Under the verification also the measurements of errors were very low. Therefore, future arrivals can be forecasted by past arrivals, past errors and seasonal components. Figure 7 and 8 are the Time Series Plot of actual Vs fits and actual Vs forecast of the ARIMA $(1,0,1)(2,1,1)_4$ model. The fitted line of figure 7 follows the similar pattern of the series. Actual and fitted are closer to each other. The deviation of the actual and forecast is very less (Figure 8). The performance of the model shows the less deviation and captures the pattern of the series as much as possible.

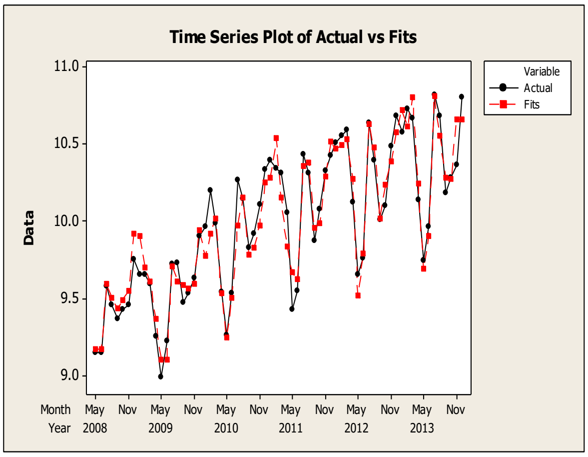


Figure 7: Actual Vs Fits

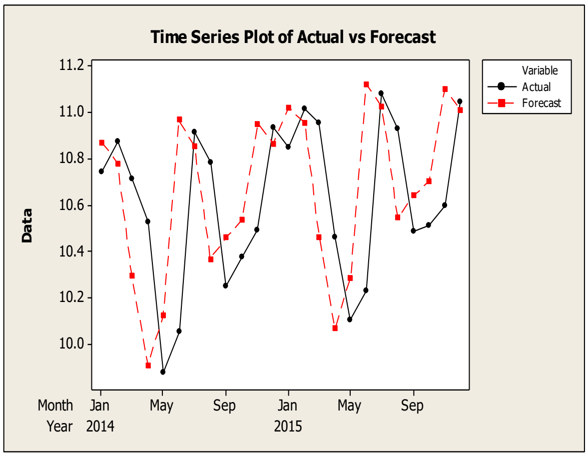


Figure 8: Actual Vs Forecast

The study tested Decomposition models and SARIMA models on tourist arrivals from Western Europe to Sri Lanka. According to the results shown in Table 5, Decomposition additive and multiplicative models were not fitted. It is very clear that the residuals of the model do not satisfy the model validation criterion. But the residuals of SARIMA satisfied the model validation criterion. The relative measurement of SARIMA is very low in fitting. Absolute measurements are same in fitting.

Table 5: Model Comparison

Model	Model Fitting					Verification		
	MAPE	MSE	MAD	Normality	Correlation of residuals	MAPE	MSE	MAD
ARIMA $(1,0,1)(2,1,1)_4$	0.92	0.01	0.09	P = 0.97	h= 0	2.90	0.16	0.31
Decomposition Multiplicative	3.12	0.16	0.32	P= 0.44	h= 1	Not Fitted		
Decomposition Additive	3.08	0.16	0.32	P = 0.48	h =1	Not Fitted		

V. CONCLUSION AND DISCUSSION

The purposes of this study were to test Decomposition techniques and SARIMA on forecasting tourist arrivals from Western Europe to Sri Lanka and comparison of the performance of these models. It was concluded that the SARIMA is suitable in forecasting arrivals from Western Europe to Sri Lanka.

Sri Lankan tourism industry had a heavy risk due to the situation during the civil war from 1983 to 2009.It was affected directly and indirectly for various products in tourism in Sri Lankan tourism market. After 2009, there is an increase of arrivals from Western Europe and other regions. Increasing arrivals is a good evidence for the growth of tourism industry in Sri Lanka. Western Europe is the second highest tourist producer to Sri Lankan market. Tourism is a business, therefore it is important to minimize the risk and maximize the benefits. Planning plays a vital role to minimize the risk. Successful planning needs forecasting. It could be useful to develop proactive strategies to minimize the risk of the business due to the dynamic changes of the environment. This study focused on forecasting arrivals from Western Europe which is the second highest tourist producer.

An arrival from Western Europe shows increasing trend and seasonal pattern. Therefore, the study used two univariate time series techniques namely; Decomposition techniques and SARIMA. The results of previous studies Konarasinghe (2016 -2) and Konarasinghe (2016- 4) revealed that Decomposition techniques and ADLM are suitable in forecasting arrivals from Western Europe, but the results of the present study revealed that either ALDM or Decomposition techniques are not suitable for forecasting arrivals from Western Europe to Sri Lanka.

Tourist arrivals from Western Europe show wave-like patterns. As such, the "Circular Model (CM)"; which is developed to model wave-like patterns can be tested to see whether the forecasting ability increases Konarasinghe, Abeynayake, and Gunaratne (2016).

REFERENCES

[1] Diunugala, H.P. “An econometric forecasting model for describing tourist arrivals process in Sri Lanka”,Conference Proceedings of the 1st International Research Conference on Humanities and Social Sciences, Faculty of Humanities and Social Sciences, University of Sri Jayawardanapura, Sri Lanka,pp134, ISSN: 2279 – 2309,2012.

[2] Gnanapragasam. S. R. and Cooray. T. M. J. A. “Tourist Arrivals after The Internal Conflict in Sri Lanka: A Time Series Analysis Using Holt-Winter’s method”, Conference Proceedings of the Annual Academic Sessions, 2016, The Open University of Sri Lanka, p123-126, 2016-1.

[3] Gnanapragasam, S.R. and Cooray, T.M.J.A. “ Forecasting Post-War Tourist Arrivals to Sri Lanka Using Dynamic Transfer Function Modeling Method ”, International Journal of Multidisciplinary Studies, Volume 3, Issue 2, pp111-122, 2016-2.

[4] Ishara, D.K, and Wijekoon, P. “Time Series Analysis for Modeling and Forecasting International Tourist Arrivals in Sri Lanka”, British Journal of Mathematics & Computer Science, Volume 20, Issue 5, pp1-9, 2017.

[5] Konarasinghe, K.M.U.B. “Forecasting Long -Term International Tourist Flows to Sri Lanka”,Conference Proceedings of the Annual Academic Sessions 2014, The Open University of Sri Lanka, pp.283, 2014.

[6] Kurukulasooriya, N., and Lelwala, E. “Time Series Behavior of burgeoning international tourist arrivals in Sri Lanka: The post-war experience, Ruhuna Journal of Management and Finance, Vol.1, No.1, 2014.

[7] Kodituwakku, W.H., Hettiarachchi, C., Wijesundara, D.M., Dias, G.K.A. and Karunaratne, D.D. “Forecasting Tourist Arrivals in Sri Lanka”, Conference Proceedings of the 2nd International Conference on Hospitality and Tourism Management, 2014.

[8] Konarasinghe, K.M.U.B. “Forecasting Tourist Arrivals to Sri Lanka: Post-War Period”, International Journal of Novel Research in Physics Chemistry and Mathematics, Vol.3, No.1, pp 57-63, 2016-1.

[9] Konarasinghe, K.M.U.B. “Decomposition Techniques on Forecasting Tourist Arrivals from Western European Countries to Sri Lanka”, Conference Proceedings of the 13th International Research Conference on Business Management (ICBM), Faculty of Management Studies and Commerce, University of Sri Jayawardanapura, Sri Lanka, p31. ISSN: 2235 -9773, 2016-2.

[10] Konarasinghe, K.M.U.B. “Time Series Patterns of Tourist Arrivals to Sri Lanka”, Review of Integrative Business and Economics Research, Vol. 5, No. 3, pp161-172, 2016-3.

[11] Konarasinghe, K.M.U.B. “Forecasting Tourist Arrivals to Sri Lanka from Western Europe”, Conference Proceedings of the Annual Academic Sessions 2016, The Open University of Sri Lanka, p19. ISSN: 2536- 8893, 2016 -4.

[12] Konarasinghe, W.G.S., Abeynayake, N.R., and Gunaratne, L.H.P. “Circular Model on Forecasting Returns of Sri Lankan Share Market”, International Journal of Novel Research in Physics, Chemistry, and Mathematics, Vol 3, No. 1, pp 49-56, 2016.

[13] Nisantha K. A., and Lelwala E.I. “Short – term forecasting of international tourist arrivals to Sri Lanka: Comparative evidence using exponential smoothers”,6th International Conference on Management and Finance, 2011.

[14] Priyangika J.H., Pallawala, P.K.B.N.M., and Sooriyaarachchi, D.J.C. “Modeling and Forecasting Tourist Arrivals in Sri Lanka”, Proceedings of the Symposium on Statistical & Computational Modeling with Applications, 2016.

[15] Peiris, H.R.I. “A Seasonal ARIMA Model of Tourism Forecasting: The Case of Sri Lanka”, Journal of Tourism, Hospitality, and Sports, Vol. 22, 2016.

[16] Pasquali, V.“The World's Richest and Poorest Countries. Global Finance”, July/ August 2016, URL: https://www.gfmag.com/global-data/economic-data/worlds-richest-and-poorest-countries,2016. Accessed 02.04.2017

[17] Sri Lanka Tourism Development Authority (SLTDA), “Tourism Research and Statistics”, URL:http://www.sltda.lk/sites/default/files/Annual_Statistical_Report_2015.pdf, 2015Accessed 02.04.2017