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ORGANIZATIONAL PROCESSES PERFORMANCE MEASUREMENT USING ARIMA TIME SERIES APPROACH

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Abstract

The main objective of this study is to provide a model to measure the performance of organizational processes using Auto Regressive Integrated Moving Average (ARIMA) time series approach, therefore, in order to achieve the main goal of the present study, a set of secondary objectives including: identify the organizational process, data collection and analyze data related to the organizational processes and performance measures using time-series ARIMA has been investigated. ARIMA time series method is one of the most widely used methods for linear prediction. In this technique, the number phrases and sentences moving average regression functions using partial autocorrelation and autocorrelation and usually the Box - Jenkins is calculated. That is an appropriate model which can predict the future performance of organizational processes and the results obtained from the above predictions can be used in planning then it is the great help for decisions that will be taken for the future and as predicted that in the next twelve days, it is to increase the profits of service and this process will have a good performance in the future. In addition, we have conducted a case study on the process of service delivery. The data for this process have been collected and then have been analyzed. In the next step, an appropriate ARIMA model has been presented so that the future behavior of the process has to be estimated or measured the results show that the performance is predicable.

Keywords: Organizational Processes Measurement, Organizational performance, Time series, ARIMA.

1. INTRODUCTION :

In recent years, organizations faced with the challenges of business environment rapidly changing, which is caused due to the interactions of their internal components and their interactions with the environment, many of the complexity of said. Organizations to adapt to the changing environment more attention to business process management capabilities (Wany and Wany, 2010). In this regard, the view is that performance management is an essential component in applying Business Process Management (BPM). Business process management and resources management on a series of evaluation systems rely on such systems, setting goals, controlling the flow and provide corrective action. Application performance management, business process through the correct performance causes the management through the development and growth of the organization (Alvandi and Mansoori, 2007).

Business process management suite that helps organizations their business performance improves. In fact, the process of organizational efficiency and effectiveness with which organizations optimize business processes are automated. Business Process Management (BPM) as Business Process Re-engineering (BPR) is also to be remembered. Companies use BPM effectively should not only focus on data and data management, but also adopt a process approach. This distinction between the work done by human and computer is not allowed (Pirouzfar, 2009). The degree of performance excellence that an enterprise can achieve the business process flow that the enterprise has been under its authority, it depends (Salt, 1998). Business process modeling is one of the business tools that can help an organization achieve competitive advantage and improve business performance and business process flow can be represented as powered by systematically analyzing the business process modeling is done (Evans et al., 1995).

In traditional literature has focused on the analysis of organizational processes with qualitative approaches, but less quantitative scale is used for the analysis of business process management. One of the few tools for managing the assessment process is the use of time series. Today, most manufacturing and service organizations to achieve better utilize the tools that process re-engineering is one of these tools. Offer a model for process management and performance measurement using a time series ARIMA and efficient business processes can help to improve the overall performance of the organization and business processes are ineffective and inefficient for any actions it should be avoided. Every organization has to be aware of the goals set in strategic planning, compliance and quality activities and operation results in complex and dynamic environments requires the establishment of appropriate monitoring system. Specific performance is controlled (Sadeghi et al., 2001).

The main objective of this research is to develop a model to measure the performance of organizational processes using ARIMA time series approach is therefore to achieve the main goal of the research sub-objectives include: identify the organizational processes, data collection and analyze data related to the organizational processes and performance measurement using a time series ARIMA approach is still being debated.

2. LITERATURE REVIEW

Today's business processes are keys to the success of any organization. So having a strong business process management approach in organizations is very important. Organizations have learned from experience that the business process, a strong investment in the face of rapid environmental change. Business process management requirements of organizations with multiple patterns and organized integrated approach to design, implementation and management of business processes, the organization provides. In each of the processes, people and systems involved. Since business processes management system provides admission to automatically perform

all the processes in the country, all solutions are leading business process management as a core organizational systems to improve organizational performance (Safarzadeh and Qureshi, 2011).

2.1 Process Definition: The process consists of a series of interrelated activities that are performed to achieve a certain goal. Process where each step can be seen as a value chain (each link) adds value to the stage. The main activities include the organization's business processes and functional boundaries are not limited, human resources, management skills and technology organizations focusing on strategies to create value for stakeholders, especially customers are connected. Business processes and business processes are different. Work processes are activities that are completely in control of a specific section in fact limited by the bounds of duty (Mahdavi, 2009).

2.2 Business Process Life Cycle: Business process management Business process management logic and change it. Each process must be implemented according to the desired status and then the process can be improved over time. This procedure may be performed repeatedly on each process. The life cycle management of business processes is an iterative and each iteration should be added to the value chain to the business process logic. Business process management projects as well as information about other projects in the organization is required, this can be done introduction of culturing included in the organization is necessary (Kordi and Najafi, 2006).

2.3 Performance Measurement systems: Each system includes a number of performance criteria. In the late Eighteenth century organizations to measure their achievement and also to get loans from banks and financial institutions have attempted to define financial metrics; based on financial measures to evaluate the performance of the late twentieth century has been continued.

But for some reason, such as short Negril and Negril past, these systems were known to traditional systems, was widely criticized. So scientists have developed a system that can monitor various metrics, began. The history of this part of the system has been studied since the late nineteenth century and the strengths and weaknesses of various scientists will be presented. It should be noted that the extensive descriptions of each model are available from the sources (Teimuri, 1997).

2.4 Table au de board: Epstein and Manzoni (1997) stated that the French began 40 years ago; the board received a performance measurement system to tables. The performance measurement system that acts as a dashboard, by process engineers who are looking for ways to improve manufacturing processes through a better understanding of causal relationships (relationships between activities and process performance) were created. In this way, managers could set indicators that would allow them to monitor their business and to progress can compare this progress with their goals and take the right action. This reflects two facts:

2.4.1 Table board is not a report, but considering that each administrator, has its own responsibilities and objectives for each director or board to create a subset of a table.

2.4.2 Table board used in an organization, but not limited to financial indicators should also be added operational criteria.

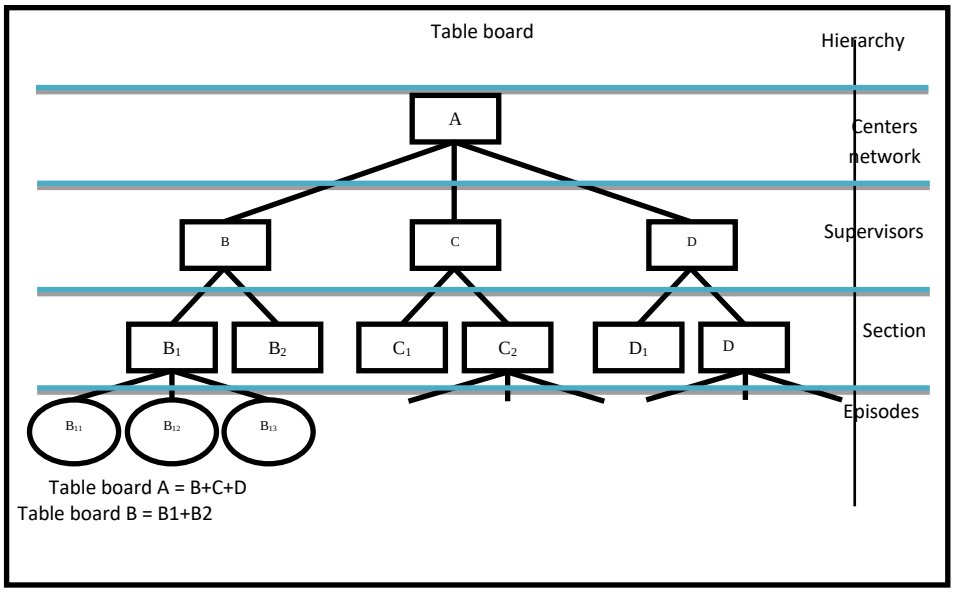


Figure 1 - Matrix performance measurement (Jones, 1989)

2.5 Performance measurement matrix: Eller and Jones (1989) offered a measure of performance matrices. This matrix, in terms of cost and non-cost criteria, and whether internal or external, can be classified. This simple framework, despite these measures, indicating the absence of any specification, must be able to comply with all performance measures. This allows organizations to define criteria outlined and, where required to be measured (Neely, 2002). The present model for the other points has been shown on the model. These include: (Keegan et al., 1989).

2.5.1 Performance criteria should be derived from strategy.

2.5.2 In order to maintain the integrity of the performance criteria in line with the organization's

2.5.3 Hierarchy both vertically and horizontally, as well as the organization's processes is defined.

Performance measures should be based on a thorough understanding of cost behavior and relationships are defined.

2.6 Results and Determinants Framework: Fitzgerald, Johnson, Brig hall, Silvestre and Voss in 1991, a study was conducted on 11 profit company services in England. It is based on observations and literature, its normative model that consists of three main components, in order to measure the performance of the service provider knows (Brig hall & Ballantine, 1991), these three components are as follows:

1. Control model: a model that controlled prospective / retrospective of the performance measure, it is offered as part of a retrospective controls that appropriate measures and organizational learning at the appropriate level and helping the decision-making process.

2. The proposed organizational analysis to measure the performance.

3. Dimensions of Performance Measurement

2.7 Declaration of the performance: In the late 1990s, the beneficiaries had increased, so that organizations have found, is not possible without creating value for stakeholders, in order to create value for shareholders (Neely, 2002).

In response to satisfy the needs of stakeholders, in 2002, at a conference in Cambridge, Neely and Kenner Charter of the performance -oriented view of stakeholders, to measure performance and includes five aspects are interrelated, provided that they are included from: Satisfaction of stakeholders, aspects of strategy, process aspects, the aspects of usability and stakeholder collaboration.

2.8 Integrated dynamic performance measurement system (IDPMS): Ghalayini, Noble and Rowe 1997, a task management system to integrate all three areas, improvement teams and provide factory floor. To achieve the integration of these three areas by specifying reporting and updating dynamic definition of success, performance measures and performance standards are linked together With the task of "managing" such as general management, marketing, engineering, manufacturing, finance and accounting.

2.9 Balanced Score Card (BSC): Most balanced scorecard performance measurement framework that has been proposed in 1992 by Norton and Kaplan. Garther America during research so that the research firm predicts the end of 2000 more than 40 percent of the old organizations can use to measure the performance of the BSC. Balanced scorecard has four aspects are: Customer perspective, internal process perspective, financial perspective and the perspective of stakeholders, each with their own specific objectives.

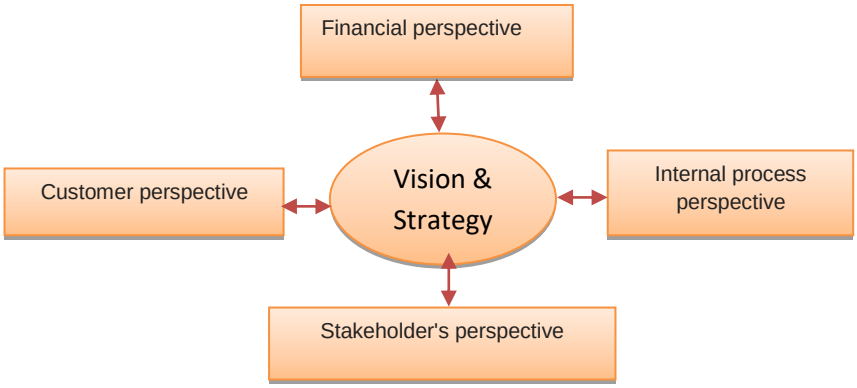


Figure 2 - Kaplan and Norton's Balanced Score Card (1992)

2.10 Review of studies: In one of the latest studies Quraish and Safarzadeh (2011) study entitled "The role of performance measurement system implementation and business process improvement approach organizations ARIMA" had done. Finally, the performance measurement system of aligning business processes with ARIMA models and strategic management are discussed (Safarzadeh and Qureshi, 2011).

Nahavandi Bejan (2005) entitled "Comparative study of linear ARIMA forecasting method for demand of urban gas feed" is presented as a way of taking notice of demand in each period to meet the needs of clients. Otherwise, no information will cause problems. In this paper, the demand for urban gas feed line ARIMA approach was evaluated using six criteria and their performances are compared. The results show that the ARIMA time series prediction is a suitable method (Nahavandi, 2005). Khaloozadeh and khaki Sadiq (1997) stock return nectar of Iran in Tehran Stock Exchange daily basis to predict them. In this study a model of logistic regression Auto- AR for prediction is used. Shows testing Dickey Fuller suggests that variable daily returns of a variable are static. and also based on the autocorrelation component - the AR been confirmed, and estimates have been made based on the results of this research were identified ARIMA model predicting high expected rate of profit Iran is now the nectar (Khaloozadeh and khaki Sadiq, 1997).

Ahmadi in 1992 prices of consumer goods and services in its monthly forecast. ARIMA methodology is used techniques based on static test was determined by the price index of non-stationary and stationary are making a difference. Based on ARIMA forecasting methodology is made of, the results indicate a long-term forecast is long term and appropriate (Ahmadi, 1992).

Papers of lam, Ip and Lau, entitled "Business process modeling and performance measurement using a time series analysis model ARIMA" in 2009 as one of the fundamental articles of the present study have been used. This article analyzes the traditional literature on organizational processes Emphasizing qualitative approaches, but less quantitative measures are used to analyze the business process management. The use of quantitative tools for evaluating management process is a time series. The results show that changes in organizational processes using ARIMA model can be quantitative and measurable impact on the business process management (Lam et al., 2009). Because these countries are competitive in the energy market and prices are determined by market forces. Hourly electricity prices in these countries are in the swing. Because it's they've hours. Study of the two models used to forecast. ARIMA model, the first and second pattern is the transfer function method. Predicted by the two models for both markets ARIMA procedure in children less error is the transfer function model (Neoga's-Contra's, 2002). Jonathan in the 1998 Review of the applications of ARIMA time series analysis of field experience and demonstrated ability of this technique to analyze the time series of two goals:

1. Understanding and the random observations in a series.
2. Forecast future values of the series takes place on the basis of its past (Jonathan, 1998).

3. Problem Description

Performance of an organization depends to a large extent it uses the lining process. To achieve better efficiency of the process, organizations need an integrated tool measured on measuring the performance of their organizations. Process re-engineering core and fundamental changes in the organization creates value-added activities that do not create a new process replaces.

Population studied in this research, experts and employees of the Department of Transportation of the Province of knowledge about the process and be familiar with the system. In order to determine the reliability coefficient of the test procedure is used again. This method is a statistical technique that measures the coherence of the observed data.

4. METHODOLOGY

Time Series: A time series is a sequence of observations ordered. Although usually a time, especially in equal intervals of time are arranged. But may also be due to other dimensions such as distance, time series comes in a variety of fields. Our annual agricultural yield and grain prices can be observed. In business and economics, prices at the end of the day, the weather, temperature, wind speed and daily quality control process and are given a certain amount of..., List of areas in which the time

series are observed and studied is endless (William, 1980). For time series, there are different purposes. These goals, in a speech production mechanism and predict future values of the optimal control system is included. Inherent nature of a time series, where observations are dependent or independent. So the observation is important (William, 1980). Validity of the scale and content validity of the instrument or the questions contained in the questionnaire measure the same parameters and the object of study. This study attempted to explain the observations that the basic assumption is collected. To be measured with the instrument, the researcher closer to the ultimate goal.

Reliability: a tool that is reliable and valid instrument to measure the reproducibility of the results. One of the most important goals of time series analysis forecast its future values. Even if the ultimate goal is to make a time series model for a control system. The operation is usually based prediction. Term time series forecasting in recent history, the term estimate is used. In time series analysis, most resolute steps to build a model based on knowledge and data. Six general procedures for modeling a Model ARIMA (p, d, q) there is a variable:

1) A preliminary study on the time series is stationary or not, if not then a stationary time series by differencing or other forms of processing can produce.
2) Generate a constant series of mean, variance and covariance of the time series are stationary.
3) Identify the difference
4) Estimate the parameters of the experimental model ARIMA.
5) Appropriate parameters.
6) The interpretation of adjusted ARIMA model

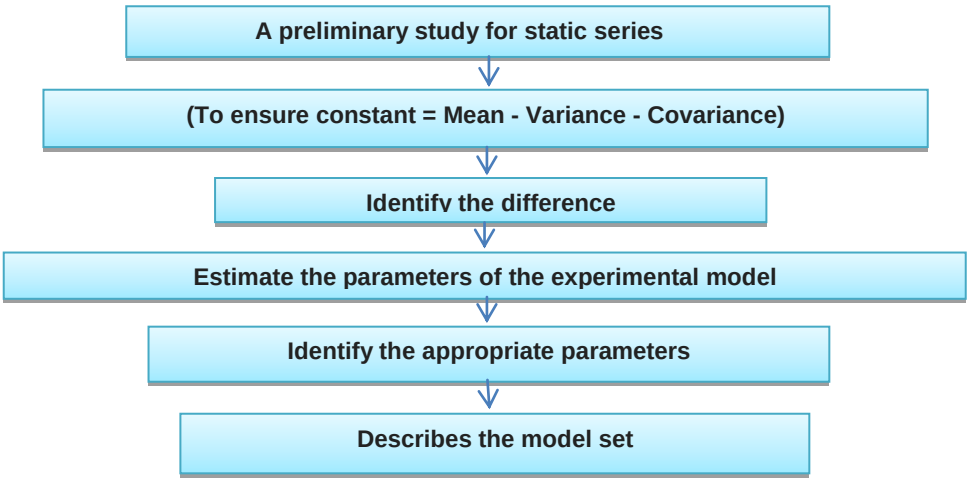


Figure 3- A framework for ARIMA modeling

Main research goals: Presentation a model for organizational performance process using ARIMA time series approach. Data analysis is a process of formulating, planning, infrastructure planning, and expressing the sense or meaning of a lot of the data collected. To investigate this hypothesis, we used the time series of the modes. Series of four long-term trend (T), Business Cycles (C), seasonal variation (S) and irregular variations (R) is. You may specify a time series of the four components or only some components are composed. A time series analysis, we observed that the constituent components. Classical time series model would assume that the time series of observed values A combination of T, C, S and R's. A combination of both forms of the particular model is usually used. The first model is a model in which the observed time series is considered equivalent to the sum of its components:

$$A = T + C + S + R$$

Formula 1 - the classical time series model

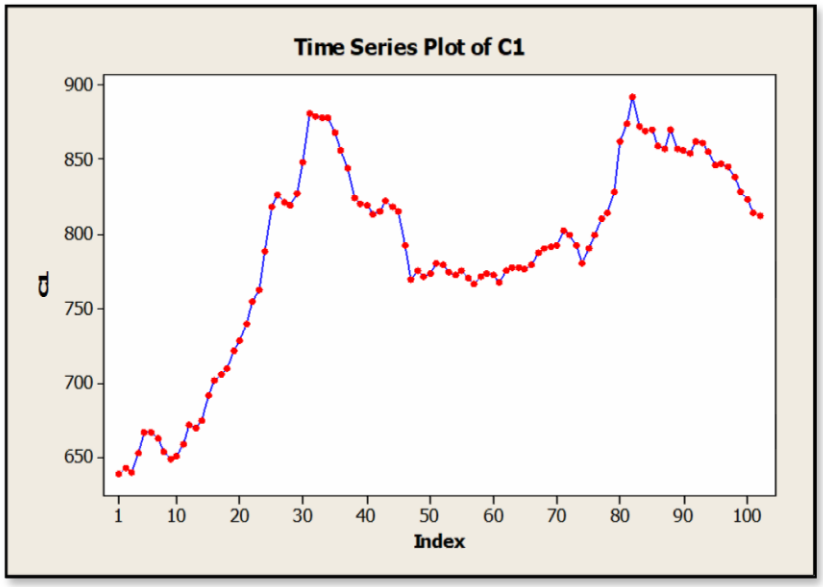
ARIMA time series method is one of the most widely used methods for linear prediction. In this technique, number of words and sentences mean regression using removable partial functions Autocorrelation and Autocorrelation usually the Box - Jenkins is calculated (Sadeghi et al., 1390). Explanatory variables in the model are assumed. Therefore the variables are stationary. Otherwise it will not be a reliable statistical results and conclusions. The mean and variance of the random process will be stationary during the fixed time period, and covariance between two periods depends only on the distance and estimated covariance is not real-time communication. This study will use the Dickey-Fuller test for stationary explanatory variables. The three will be tested at 1%, 5% and 10%. Data analyzed by E-views software.

5. RESULTS

For the ARIMA modeling data collected chart to draw up, to be sure of static or non-static series.

5.1 Time series chart is following:

Figure 4 - Diagram of raw time series data



The above diagram shows the observed trends or patterns that we have collected.

Making use of difference for stationary:

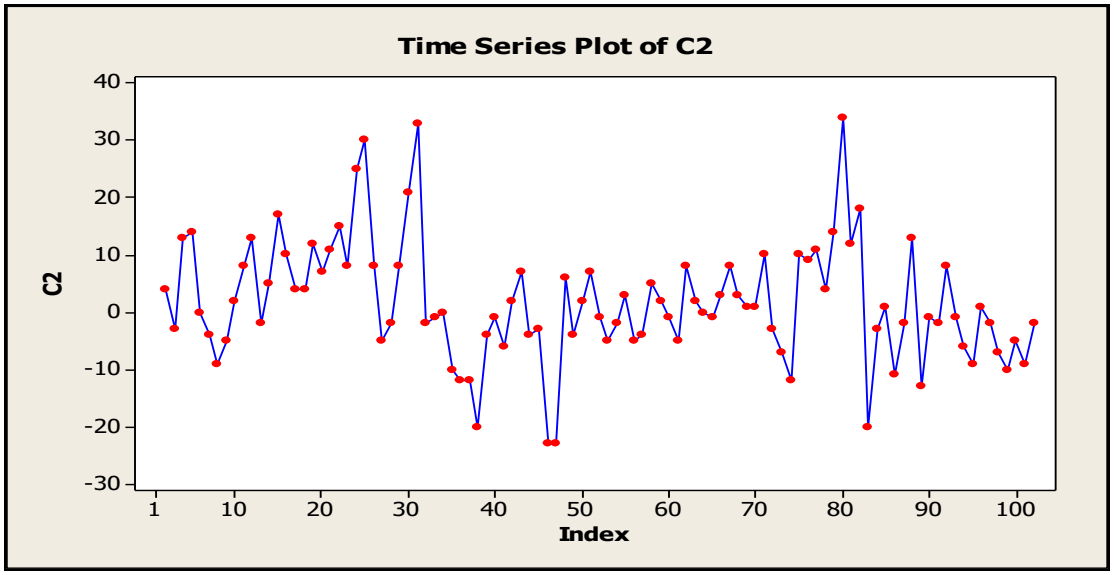


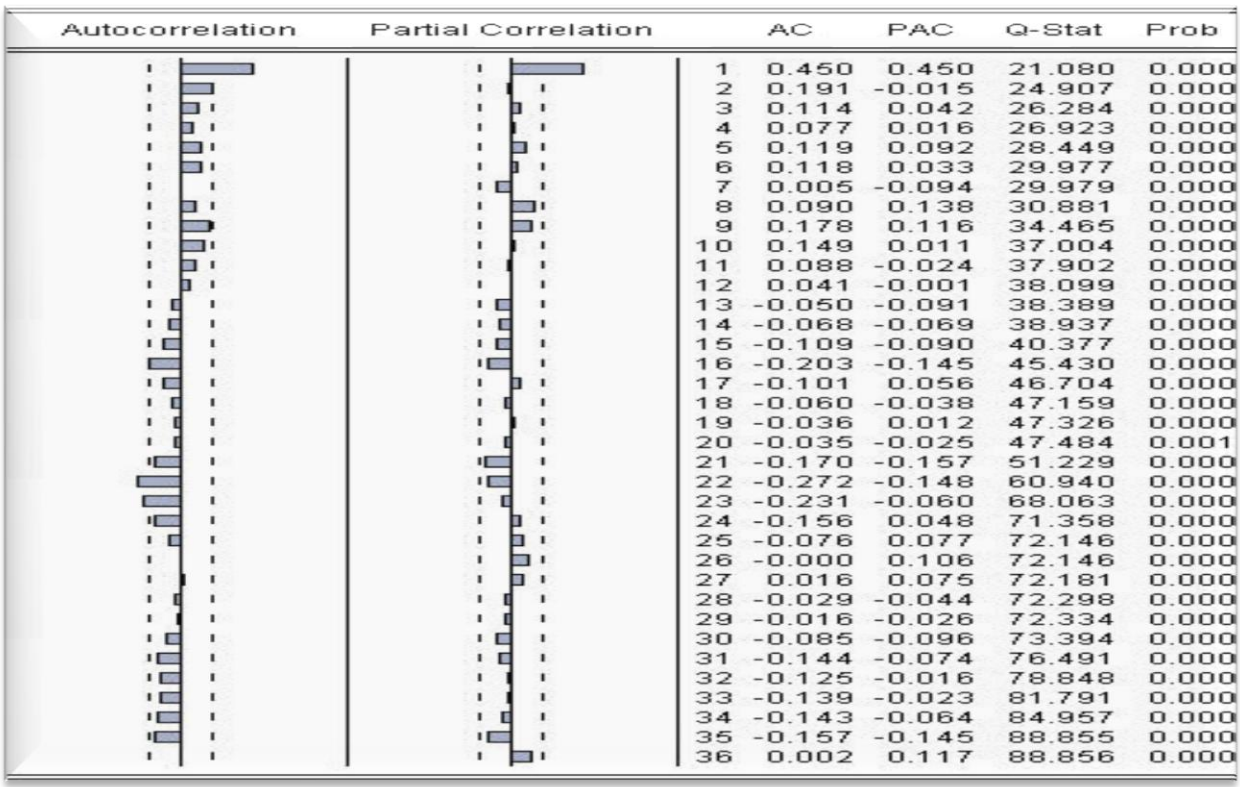
Figure 5 - Time series plot of the difference

Due to the shape of the static series is making a difference for most of the static Dickey Fuller test, we used. As can be seen a significant amount of statistics and probability t = -6.248838 p-value = 0.0000)), so the null hypothesis is rejected, so series is static.

Table 1 - Results of Dickey Fuller test

Dickey-Fuller test statistic		t-statistic	Prob*
		-6.248838	0.0000
Test critic values	1%	-4.052411	
	5%	-3.455376	
	10%	-3.153438	

Now we chart the partial correlation and to identify the appropriate model.



	AC	PAC	Q-Stat	Prob
1	0.450	0.450	21.080	0.000
2	0.191	-0.015	24.907	0.000
3	0.114	0.042	26.284	0.000
4	0.077	0.016	26.923	0.000
5	0.119	0.092	28.449	0.000
6	0.118	0.033	29.977	0.000
7	0.005	-0.094	29.979	0.000
8	0.090	0.138	30.881	0.000
9	0.178	0.116	34.465	0.000
10	0.149	0.011	37.004	0.000
11	0.088	-0.024	37.902	0.000
12	0.041	-0.001	38.099	0.000
13	-0.050	-0.091	38.389	0.000
14	-0.068	-0.069	38.937	0.000
15	-0.109	-0.090	40.377	0.000
16	-0.203	-0.145	45.430	0.000
17	-0.101	0.056	46.704	0.000
18	-0.060	-0.038	47.159	0.000
19	-0.036	0.012	47.326	0.000
20	-0.035	-0.025	47.484	0.001
21	-0.170	-0.157	51.229	0.000
22	-0.272	-0.148	60.940	0.000
23	-0.231	-0.060	68.063	0.000
24	-0.156	0.048	71.358	0.000
25	-0.076	0.077	72.146	0.000
26	-0.000	0.106	72.146	0.000
27	0.016	0.075	72.181	0.000
28	-0.029	-0.044	72.298	0.000
29	-0.016	-0.026	72.334	0.000
30	-0.085	-0.096	73.394	0.000
31	-0.144	-0.074	76.491	0.000
32	-0.125	-0.016	78.848	0.000
33	-0.139	-0.023	81.791	0.000
34	-0.143	-0.064	84.957	0.000
35	-0.157	-0.145	88.855	0.000
36	0.002	0.117	88.856	0.000

Figure 6 - Diagram autocorrelation and partial autocorrelation

As can be seen descending the autocorrelation function of the reduced time series model cannot MA.

Note that the partial autocorrelation function after an order has to be zero, so we conclude that the time series model with AR (1) is appropriate. Thus, we should to fit to AR (1) model, we have:

Where the residual sum of squares equal to 8651.98 and 87.39 times the mean square error is obtained.

5.2 Suitability of Models:

1. Our first diagnostic diagram can be inspected during the remainder of the model is appropriate, we expect the graph of the offer horizontal zero dispersion oblong without trend.

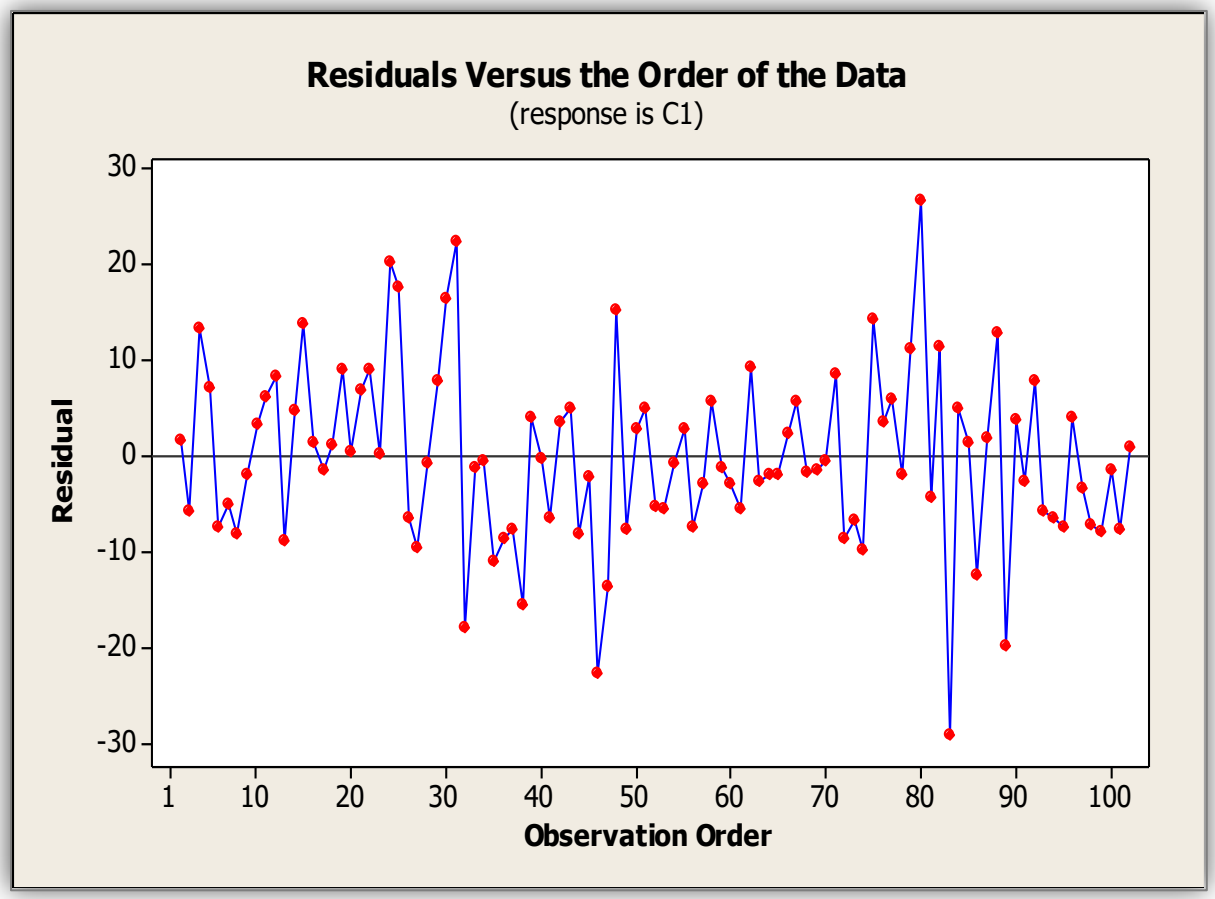


Figure 7 - Diagram residuals

6. NORMAL RESIDUALS

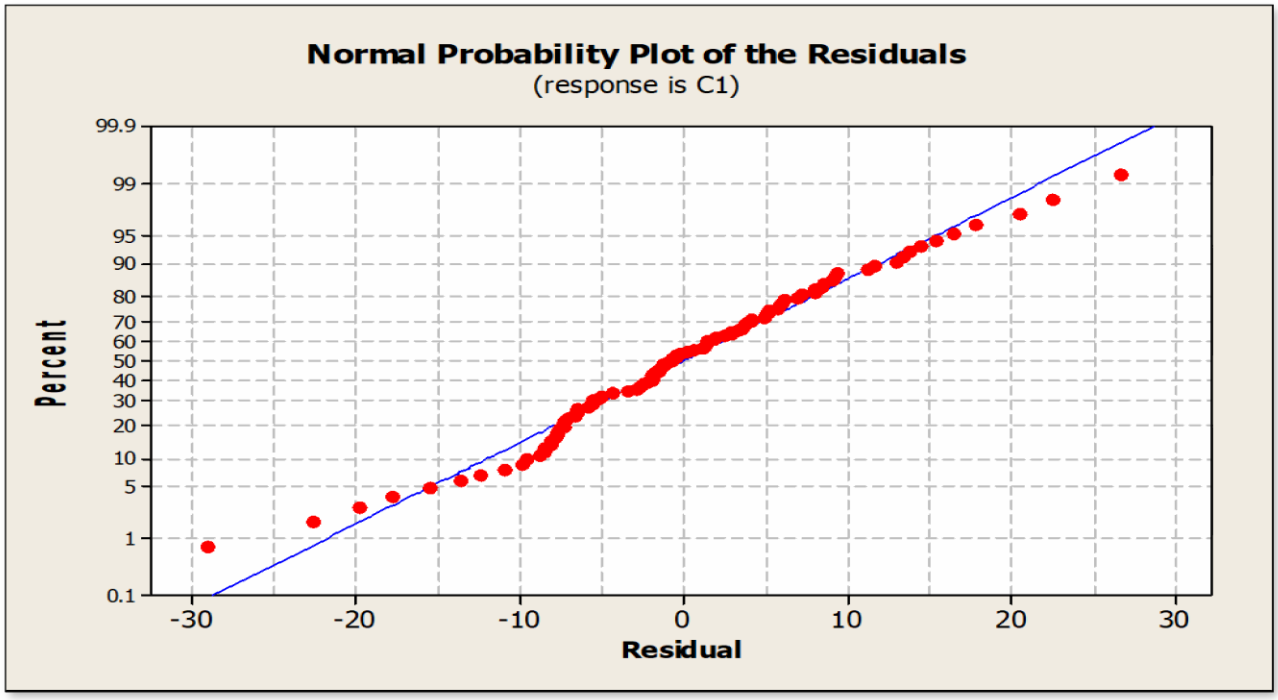


Figure 8 - Diagram of the normalized residuals

Test for normality
H_0=normal
H_1= not normal

Given the likelihood of significant assumption of normality is not rejected.

Tests of Normality

	Kolmogorov-Smirov[a]			Shapiro-Wilk		
	Statistic	**Df**	**Sig.**	**Statistic**	**df**	**Sig.**
resid	**.074**	**101**	**.200***	**.985**	**101**	**.297**

Table 2 - Results of normality test (Smirnov Kolmogrov - Shapiro - Wilkie)

Plot residuals against fitted values or projected, that no plan is found.

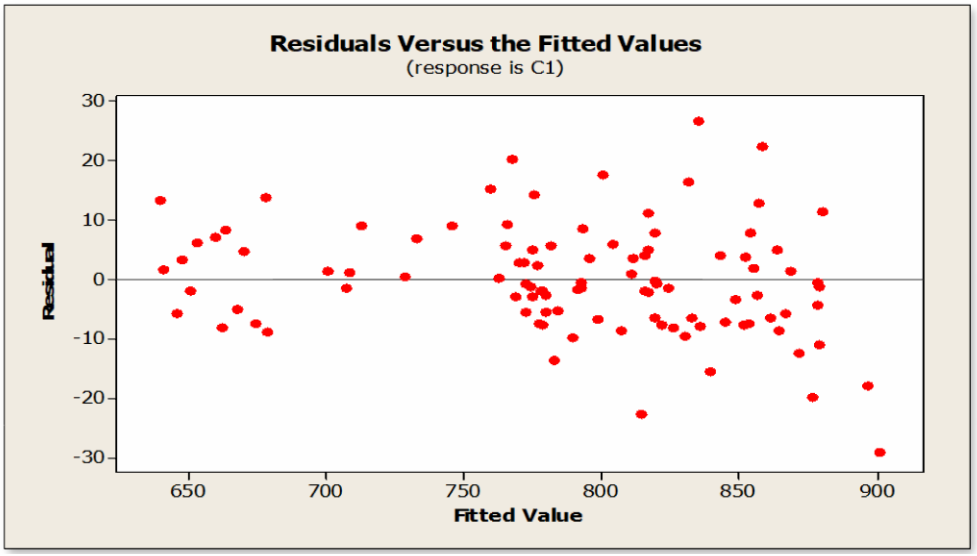
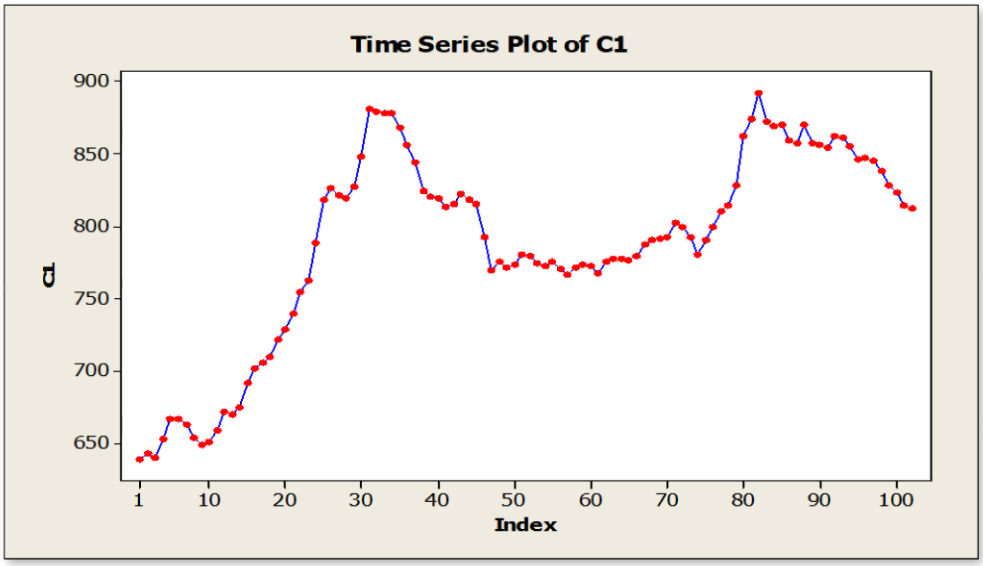


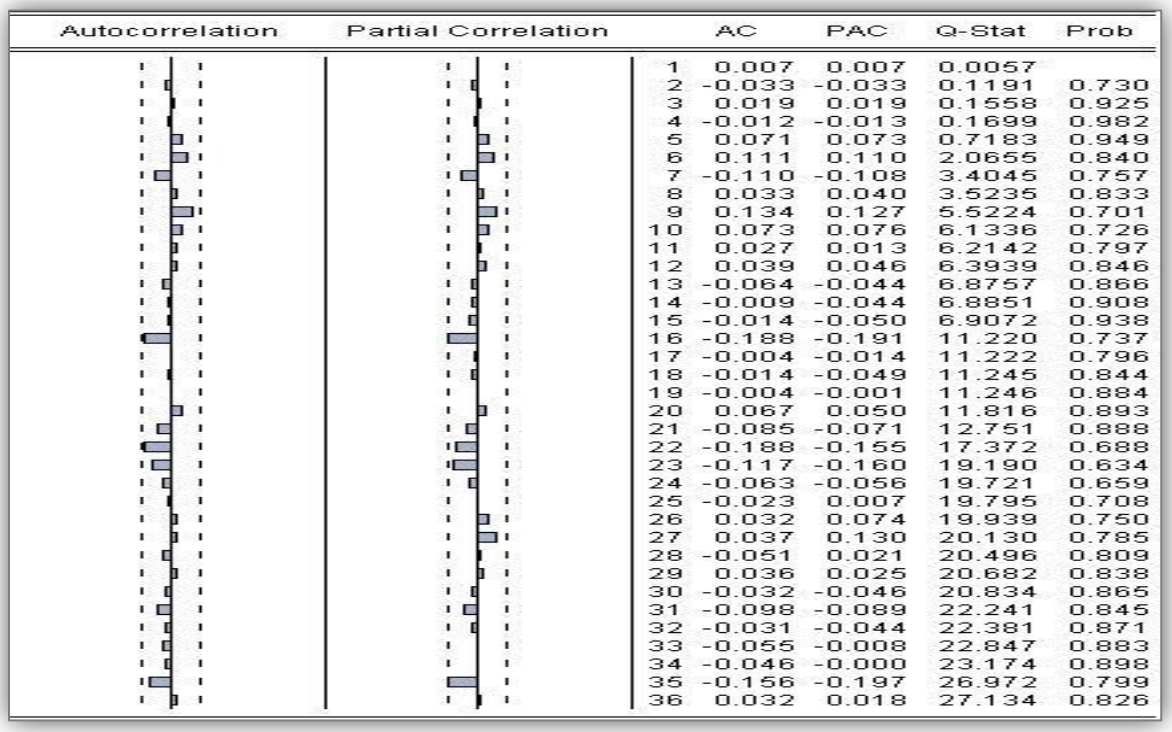
Figure 9 - A graph of the fitted or predicted

As you can see, it does not see any trend.

5.3 Residuals autocorrelation

Sample autocorrelation function AFC almost non-correlation and normally distributed with mean zero and variance 1 / n.





	AC	PAC	Q-Stat	Prob
1	0.007	0.007	0.0057	
2	-0.033	-0.033	0.1191	0.730
3	0.019	0.019	0.1558	0.925
4	-0.012	-0.013	0.1699	0.982
5	0.071	0.073	0.7183	0.949
6	0.111	0.110	2.0655	0.840
7	-0.110	-0.108	3.4045	0.757
8	0.033	0.040	3.5235	0.833
9	0.134	0.127	5.5224	0.701
10	0.073	0.076	6.1336	0.726
11	0.027	0.013	6.2142	0.797
12	0.039	0.046	6.3939	0.846
13	-0.064	-0.044	6.8757	0.866
14	-0.009	-0.044	6.8851	0.908
15	-0.014	-0.050	6.9072	0.938
16	-0.188	-0.191	11.220	0.737
17	-0.004	-0.014	11.222	0.796
18	-0.014	-0.049	11.245	0.844
19	-0.004	-0.001	11.246	0.884
20	0.067	0.050	11.816	0.893
21	-0.085	-0.071	12.751	0.888
22	-0.188	-0.155	17.372	0.688
23	-0.117	-0.160	19.190	0.634
24	-0.063	-0.056	19.721	0.659
25	-0.023	0.007	19.795	0.708
26	0.032	0.074	19.939	0.750
27	0.037	0.130	20.130	0.785
28	-0.051	0.021	20.496	0.809
29	0.036	0.025	20.682	0.838
30	-0.032	-0.046	20.834	0.865
31	-0.098	-0.089	22.241	0.845
32	-0.031	-0.044	22.381	0.871
33	-0.055	-0.008	22.847	0.883
34	-0.046	-0.000	23.174	0.898
35	-0.156	-0.197	26.972	0.799
36	0.032	0.018	27.134	0.826

Figure 10 - Graph of correlation and partial autocorrelation their residuals

According to the above chart residuals are free of autocorrelation.
LM test can also be used to check for residual autocorrelation.

In this test the following hypotheses;
H0= non autocorrelation
H1 = p Order autocorrelation (p = number of intervals)
Significant possibility is 0.8981, so there is no autocorrelation.

Another test of a model's port Mantoux test (Ljang Box - Pierce) in which the null hypothesis that the model is appropriate. If the statistic is greater than the critical value for the chi-square distribution model is rejected.

48	36	24	12	Lag
36.4	27.1	19.5	6.5	Chi-square statistic
46	34	22	10	Degree of freedom
0.843	0.792	0.613	0.776	Significant probability

Table 3 - Test results Ljang Box – Pierce

According results model is appropriate.

We fit the model with more parameters and we decided to check them out.

If the model AR (2) to fit the following result is obtained:

Table 4 - Values obtained from the model AR (2)

Probability	Statistic	Standard error	Coefficient	
0.000	4.53	0.1010	0.4572	AR(1)
0.891	-0.14	0.1016	-0.0140	AR(2)
0.312	1.02	0.9350	0.9496	Fixed

And according to the statistics and probability of significance, we can conclude that the model AR (2) model is appropriate.
If the model is MA (1) the following results can be fitted.

Table 5 - Values obtained from the fitted model MA (1)

Probability	Statistic	Standard error	Coefficient	
0.000	-4.52	0.0915	-0.4137	MA 1
0.196	1.30	1.332	1.735	Fixed

According to the model of the SS and MS AR (1) is more appropriate.
If the model ARIMA (1,1,1) we have the following result is obtained by fitting the parameters of the MA (1), we can conclude that the model is not appropriate.

Table 6 - Values obtained from the model ARIMA (1,1,1)

Probability	Statistic	Standard error	Coefficient	
0.000	-4.52	0.0915	-0.4137	MA1
0.196	1.30	1.332	1.735	Fixed

Thus the appropriate ARIMA model is (1,1,0)

If we want to predict the next 12 days to complete the order process, the following values are obtained.

Table 7 - Values obtained already predict the future performance of the process

DAY	VALUE
First day	812,032
Second day	812,981
Third day	814,343
Fourth day	815,892
Fifth day	817,524
Sixth day	819,194
Seventh day	820,882
Eighth day	822,577
Ninth day	824,275
Tenth day	825,976
Eleventh day	827,676
Twelfth day	829,378

6. Conclusion

As global markets have become more companies were keen to increase their competitiveness. Therefore, organizations must continuously improve processes and performance measurement models for benefit processes. Our aim of this investigation is presentation a model for organizational processes performance measurement using ARIMA time series approach, we present a case study on the work we've done, The data collection process And then the ARIMA model we provide an analysis Future behavior of the process in order to estimate or measure The results show that the performance is predictable. Traditional approaches to qualitative analysis of organizational processes with emphasis on literature, but slightly smaller scale is used for the analysis of business process management. One of the few tools for managing the assessment process is the use of time series. Thus, on the one hand, organizations tend to have a lot of business process management and the lack of an efficient tool to evaluate the management of business processes are. Of this study is an effort to using a quantitative model that uses an operational model for the analysis of business process modeling achieved. For future works

1. Assess and predict the impact of business processes reengineering on organizational processes using ARIMA time series approach.

2. Assess and compare ARIMA model and ARFIMA model in predicting the organizational process performance.

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