MEASURING IMPACT OF CONTINUOUS IMPROVEMENT COSTS ON COMPANY SALES

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Abstract

Contemporary business environment is characterized with high level of competitiveness and only fittest companies can survive. This raised the need for companies to invest in many different aspects of managing their businesses in order to remain their competiveness. Such required level of competitiveness can be provided through the continuous improvement processes that directly contribute to company profit. There is no difference if company invest in business management systems or services, crucial issue is that they can always be improved. The basic task of this research is to measure impact of the continuous improvement costs on company future profit. Moreover, we are testing the possibility through planning investments in continuous improvement to forecast company future sales' revenues. Using regression analysis we determine high level of correlation between continuous improvement costs and company revenues.

Key words: *Kaizen, TQM, regression, forecasting, business, competitiveness*

1. INTRODUCTION

Business processes and services do not improve on their own. There is a mechanism for improvement that consists of several phases: first, planning, second, implementation of planned activities, third, follow-up phase, where we can check whether intended goals were achieved as company expected and finally to act on the results to improve plan and to achieve required targets. However, the whole process need to be repeated continuously and that is in fact what continuous improvement means.

Organizations today are increasingly competing for market share and in order to reach their market and business targets they need to perform their businesses with a low cost, high quality, to reduce waste and speed their processes. This can be achieved through implementation of continuous improvement methods like Six Sigma, Lean Production, Total Quality Management (TQM), Balanced Scorecard, Lean Sigma etc.

Continuous improvement methods have evolved from traditional manufacturing focused systems primarily focused on steps how to improve production, reduce waste and improved product quality, into hybrid methodologies focused on all aspects of an organization. Modern continuous improvement methods also known as continuous improvement processes or tools, target a wide spectrum of organization activities and offer benefits that can be measured and evaluated financially. Not all are applicable for every organization, some suits better to particular organization and business, but almost all organization that implement continuous improvement processes report financial successes.

Basic task for every company is to try to forecast future sales in order to plan their assets (fixed and current assets) as well as financial resources needed to realize planned sales targets (liabilities and equity). Usually when make financial planning, companies use some well-known financial management techniques like "Pro-forma financial statement" (Pro-forma Balance Sheet), "Percent of Sales" technique or use some advanced statistical methods like linear interpolation, regression analysis etc. For the purpose of planning, companies use available data from their marketing analysis, like market analysis, macro economy analysis, historical data for company sales etc., in order to reach more objective and precise planning of future. There is no doubt that regression analysis can offer high

percentage of accuracy for forecasting future company sales especially when data for planned marketing activities and funds are already available.

On the other side, there are many studies that analyze financial benefits of continuous improvement methods and make financial valuation of continuous improvement processes for the companies. We have also investigated practical use of Kaizen and Lean management on several selected manufacturing processes and performed calculation of improvements' financial benefits. We have found and through analysis confirmed positive relations between the Kaizen and lean methods as independent variable, and financial impact as the dependent variable (Ivanovski, Radevski, 2017).

However, we did not find many papers that analyze possibility through use of data that are determined and planned in advance as a costs for continuous improvement processes in the company, to forecast future company revenues.

The basic task of these research is to analyze accuracy of regression analysis for forecasting company future revenues by using planned costs for continuous improvement processes in company. We are trying to determine if this model offer relevant and accurate forecasting of company future sales that can be used for other companies' planning activities. We are also testing accuracy of the linear interpolation tool used for future company sales forecasting and compare both techniques results with actual companies total operating revenues. High correlation coefficients between sales and costs for continuous improvement processes in company give us evidence that there is statistically significant relation between this two analyzed items.

Using regression analyses we try to identify the level of accuracy of company sales forecast and correlation between two variables (costs for continuous improvement processes in company and future sales) as well as statistical significance of costs for continuous improvement processes in company for future company revenues forecasting. Regression analysis can help us to identify problems in use of costs for continuous improvement processes in company, causes for differences between future company sales forecasting and to evaluate basic parameters for valuation of continuous improvement processes financial impact in company. This will also help us to determine predictive capacity of independent variables (costs for continuous improvement processes in company) on dependent variable (future company revenues).

In context of above mentioned aspects, this study can be viewed as a contribution for practical implementation of continuous improvement processes in companies in the Republic of Macedonia.

The remainder of this paper is structured into four sections. In first section we present theoretical review and tools of continuous improvement methods. The second section describes methodology and hypothesis framework. In third section we present research findings. The last section summarizes the main conclusions.

2. LITERATURE REVIEW

In only four decades after the end of World War II, Japan succeeded to recover from a destroyed economy and to become a leading economic power, with respective worldwide reputation for high-quality and value products. Moreover, Japan reached very high levels of GDP and its companies achieved dominance in the world market especially for highly technical products and overcome Europe and America. Such an impressive transformation has been called an economic miracle. Many countries, as well as companies as competitors on global market try to find the answer on Japanese challenge and to implement some of Japanese companies' best practices. They realized that behind Japan success lays management practices, essential for survival in rapidly changing world market. Those practices have many names, but one of them is most widely known and used as the continuous improvement process (CIP), and can be used as umbrella term to describe the process of managing for continuous improvement and success.

The continuous improvement process (CIP) is a means used by many organizations in order to create and sustain a culture of permanent improvement. It is based on creation of positive and dynamic

environment, by fostering team best practices, applying quantitative methods and analytical techniques and encouraging people creativity. This process is based on collective efforts and passion in order to meet customers' needs and to increase customers' satisfaction.

CIP implementation is focused on organization in order to improve the quality of services or products, through increased productivity and cost reduction. Companies that are dedicated to continuous improvement philosophy share positive experience and report improvements in quality, productivity, higher employee enthusiasm with significant reductions of costs, errors, waste and customer complaints. These leads to conclusion that continuous improvement methods in CIP oriented companies are keys for their long-term sustainability, competitiveness and business success.

Continuous improvement is a philosophy that Deming described simply as "improvement initiatives that increase successes and reduce failures (Juergensen, 2000). Another definition of continuous improvement argues that continuous improvement is a "company – wide process of focused and continuous incremental innovation" (Bessant and Caffyn, 1994). Other views suggest equality with quality initiative like Total Quality Management (TQM) or as a completely new approach towards enhancing creativity and competitive excellence (Oakland, 1999; Caffyn, 1997; Galagher at all., 1997).

Kossof (1993) argues that "total quality is defined as the unrelenting pursuit of CI which is realized by accessing and utilizing the concerted knowledge and experience of managers and employees at all levels".

The most famous and well known approach in the processes of continuous development is Kaizen (combination of two Japanese words "kai" that means "change" and "zen" that means "good"). In this translation Kaizen means a change for a good, and correlate with step-by-step, ordered and continuous incremental improvement (Salck at all. 2007). Moreover, it means also improvement in personal life, on private and business plan for all company employees (Averil, 2011). This approach meant that everything could be done better thanks to small steps planned effect, through everyday improvement, by everybody from worker to manager or from small improvements to big strategic changes. We can divide improvements into two groups: innovation (new management concepts and manufacturing techniques) and Kaizen (small but permanent improvement that really does not need complicated techniques or the newest technologies). Solutions for problem improvement can be seen at Ishikawa diagram, control cards and by common sense. Continuous improvement, implemented by Japanese companies as kaizen means culture of sustained improvement targeting for waste elimination in all systems and processes of an organization. Continuous improvement can be implemented not only thorough evolutionary or radical changes as result of an innovative idea or new technologies, but also on any scale of activities using a number of tools and techniques dedicated to searching for sources of problems, waste and variation, and finding ways how to minimize or overcome them.

The central concept of continuous improvement is Lean enterprise value. Lean is the process of eliminating waste with the goal of creating value for enterprise stakeholders (Murman at all., 2002). Lean can be used everywhere: export licensing, payroll, recruiting, proposal, program support, interface management, engineering order release, process definition, financial reporting. Beside Lean, major continuous improvement initiatives are Six Sigma, Total Quality Management (TQM), Lean Sigma, Reengineering, SMED, Quick Response Manufacturing, Balanced Scorecard etc.

3. RESEARCH METHODOLOGY

In this research we explore correlation of continuous improvement costs and company sales performance in order to determine mutual dependence and correlation between these two financial categories as well as to determine if company costs for continuous improvement can be used as a tool for company sales forecast. Using regression analysis tool we are trying to determine if there is a statistically significant relationship between the variables (continuous improvement method costs and company sales). We first analyze the Multiple R (coefficient of correlation) and R Square (R^2). The R^2 is the coefficient of determination and tells us the proportion of the total variation in the dependent

variable that is explained by the independent variable. If there is a stronger relationship (higher coefficient of determination), it indicates that this relationship is statistically significant and prediction of dependent variable will be accurate if we have a good forecast of independent variable. Using ANOVA, variance statistics, we determine f-test that confirms if regression analysis is statistically significant. Very low level of Significance F value confirms statistical significance of analyzed relationship. Next, we look at the t-statistics for our regression coefficients. We analyze whether a t-statistic coefficient is statistically distinguishable from zero (i.e., statistically significant.). If the coefficient for company sales is significantly different from zero, then we know that independent value (costs for continuous improvement processes in company) is useful in predicting other company sales. The t-statistic tells us how many standard deviations away from zero the coefficient is. Obviously, the higher this number, the more confidence we have that the coefficient is different from zero. When a t-statistic is greater than 2.00, it is significant at the 95% confidence level or more. We also use the p-value to determine the exact confidence level. We calculate p-value by subtracting the p-value from 1 to find the confidence level. This number is simply the best point estimate given our set of sample data. We also present result: Higher and Lower 95%. This gives us a range of values between which we can be 95% sure the true value of this coefficient lies. Since we are merely using this model for forecasting, the significance of the intercept is not important. In our regression statistics we asked for 95% level of confidence.

We use three companies' financial statements, especially focusing at Income Statements for five years from 2010-2014, extracting only data for company costs for continuous methods and sales. We provide data for our research from the web site of the Macedonian Stock Exchange (MSE, www.mse.com.mk) where all quoted companies are obliged to publish their financial statements.

We are also testing predictive capabilities of the linear interpolation techniques for company sales forecast. Having in mind many negative arguments for simplicity and non-consistency of that technique we proceed with regression analysis and compare our both findings for sales forecast made for 2015 and 2016 as well as with actual total operating revenues for two years.

This investigation explored following research problems: first, determination of costs for continuous improvement processes in company, second, future company revenues forecasting using linear interpolation and third, regression analysis of impact of costs for continuous improvement processes in company on future company revenues. The hypotheses that follow assumed that Kaizen and lean management are positively related to company revenues. Accordingly, the following hypotheses utilized the research problems mentioned above. The Kaizen and lean methods (costs for continuous improvement processes in company) are the independent variable, and company sales is the dependent variable.

The research questions are expanded with related hypotheses as follows:

$H_0$1: *Regression analysis provide accurate forecast of company future performance in terms of sales and revenues using costs for continuous improvement, having in mind that they can be predicted in advance as a result of discretionary decision of company management and can be used as additional tool for financial forecasting and planning beside traditional statistical techniques like linear interpolation.*

$H_0$2: *Costs for continuous improvement have financial impact on company performance and increase company revenues by improvement of production processes through standardization of activities and waste elimination, focusing on continuous development of production processes, engineering and business management.*

4. RESEARCH RESULTS AND DESCRIPTIVE STATISTICS

On next tables and figures we present results for sales forecasts performed by the linear interpolation as well as regression analyzes of continuous improvement costs and company sales performance for three quoted companies at MSE: Vitaminka AD, Prilep (VITA), Alkaloid AD, Skopje (ALK) and Granit AD, Skopje (GRNT).

We start with linear interpolation using VITA sales' historical data for 2010-2014 and forecast VITA future sales for 2015-2017. Results are presented on Table 1 as follows:

Table 1. VITA Sales forecasting 2015-2017

Years	Sales
2010	986.000
2011	1.084.000
2012	1.125.000
2013	1.334.000
2014	1.662.000
2015	1.718.800
2016	1.879.000
2017	2.039.200

Source: Authors' calculation

By using linear interpolation we forecast company sales for 2015-2017 (in red). Company historical sales data as well sales forecast can be seen on following chart where equation for sales forecasting can be seen:

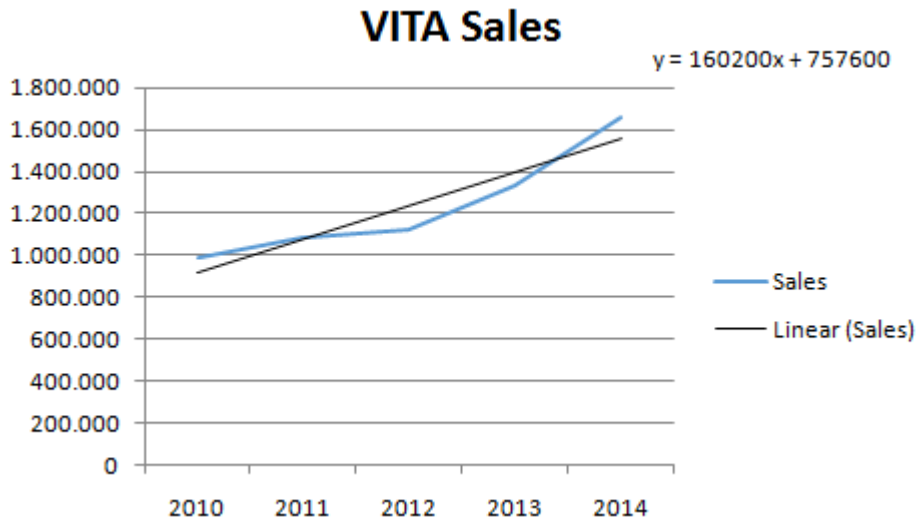


Figure 1. VITA Sales 2010-2014

On next Table we present derived data from VITA financial statements 2010-2014 for costs for continuous improvement (TQ Costs) and sales as well planned TQ costs for 2015. Using regression analysis we forecast VITA future sales for 2015. We can see that VITA sales forecast performed with regression analysis is very close to forecast made with linear interpolation presented at Table 1:

Table 2. Regression analysis VITA sales forecasting

Year	TQ Costs	Sales
2010	157.020	986.000
2011	169.569	1.084.000
2012	199.240	1.125.000
2013	286.400	1.334.000
2014	325.000	1.662.000
2015	362.685	1.708.654

Source: Authors' calculation

We are also testing the accuracy of future company sales forecasting by regression analysis. All analyses are performed using Excel ANOVA software. However, first we are testing correlation between continuous improvement costs and company sales.

We can see that VITA sales increases every year as well its TQ Costs. In order to determine dependence and impact of continuous improvement cost on company sales we calculate correlation coefficient that shows positive and very strong (almost +1) coefficient, as shown on next Table:

Table 3. Correlation Coefficient Sales - TQ Costs for VITA

	TQ Costs	*Sales*
TQ Costs	1	
Sales	0,961948	1

Source: Authors' calculation

In order to confirm our findings for high positive correlation coefficient between two variables we use regression analysis. Regression statistics confirms our findings (we ask 95% level of confidence). Values for Multiple R (coefficient of correlation) and R Square (coefficient of determination) are around 1 which follows us to conclusion that there is statistical significant relationship between analyzed variables.

Regression analysis were made by using both available techniques: first, scatter diagram and second, ANOVA software, as follows:

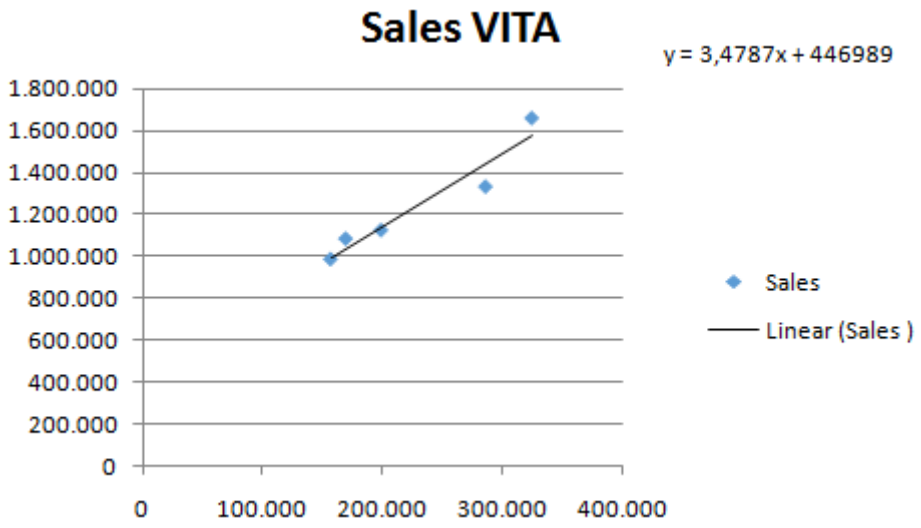


Figure 2. Scatter diagram for VITA

Table 4. Regression analysis VITA

SUMMARY OUTPUT

Regression Statistics	
Multiple R	96,19%
R Square	92,53%
Adjusted R Square	90,05%
Standard Error	84801,73781
Observations	5

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	2,67407E+11	2,67407E+11	37,18458473	0,008859326
Residual	3	21574004209	7191334736		
Total	4	2,88981E+11			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	446988,6105	135179,9393	3,306619405	0,045507173	16785,71214	877191,5
TQ Costs	3,478681029	0,570470434	6,097916425	0,008859326	1,663189504	5,294173

Source: Authors' calculation

Table 4 reports results of analysis for VITA sales forecast based on data for TQ costs. Values for Multiple R (coefficient of correlation) and R Square (coefficient of determination, variance) for VITA sale and Vita TQ Costs as independent value are around 1 (96, 19% and 92, 53% respectively) which gives us conclusion that there is statistical significant relationship between this two variables (company sales and TQ costs). In fact, there is almost 100% significant relationship between the outcomes and predicted value. The R^2 tells us that the proportion of the total variation in the dependent variable (VITA sales) can be explained by the independent variable (VITA TQ Cost). Using variance statistics, we determine f-test that confirms regression analysis significance. Very low level of Significance F confirms statistical significance of analyzed relationship. A t-statistics is high and

confirms significance. We can also see that p-value (probability value – that explains that results occur randomly) is zero, which means that we are 100% confident that our coefficient (VITA TQ Cost) is significant for predicting VITA future sales.

In order to check our forecast we use actual data for VITA total operation revenues in 2015 and 2016, presented at Table 5.

Table 5. Actual Revenues VITA 2015-2016

VITA		
	2016	2015
Total Revenues	1,728,096	1,668,552

Source: www.mse.com.mk

We can conclude that both techniques provide accurate forecasts and can be used from companies. We use same methodology and descriptive statistics for other two companies: ALK and GRNT.

Table 6. ALK Sales forecasting 2015-2017

Years	Sales
2010	5.354.000
2011	5.420.000
2012	6.203.400
2013	6.546.000
2014	7.233.000
2015	7.616.480
2016	8.104.880
2017	8.593.280

Source: Authors' calculation

By using linear interpolation we performed ALK sales forecast for 2015-2017. Graphical presentation can be seen on following figure:

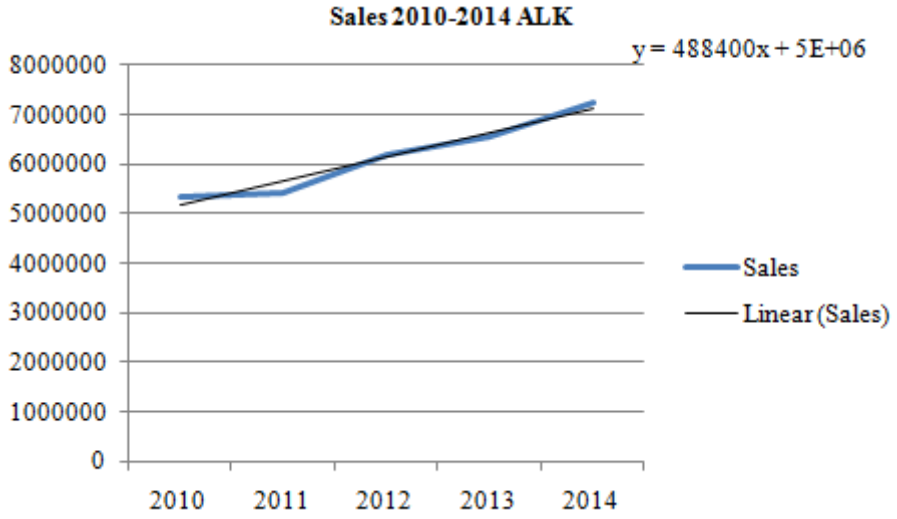


Figure 3. ALK Sales 2010-2014

Table 7. Regression analysis ALK sales forecasting

Year	TQ Costs	Sales
2010	815.000	5.354.000
2011	933.000	5.420.000
2012	1.223.000	6.203.400
2013	1.225.000	6.546.000
2014	1.251.300	7.233.000
2015	1.262.000	6.756.286

Source: Authors' calculation

Table 8. Correlation Coefficient Sales - TQ Costs for ALK

	TQ Costs	*Sales*
TQ Costs	1	
Sales	0,986874	1

Source: Authors' calculation

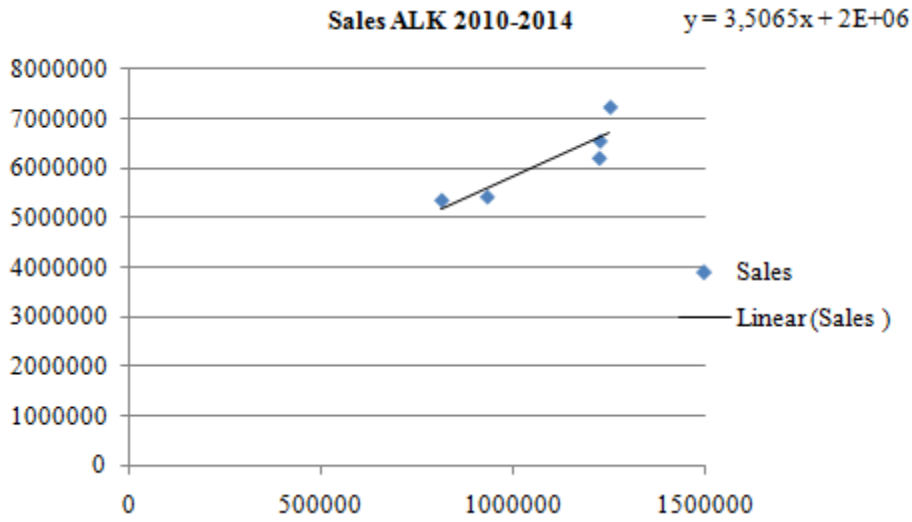


Figure 4. Scatter diagram for ALK

Table 9. Regression analysis ALK

SUMMARY OUTPUT

Regression Statistics	
Multiple R	89,33%
R Square	79,80%
Adjusted R Square	73,07%
Standard Error	410168,4765
Observations	5

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	1,99435E+12	1,99435E+12	11,85432368	0,041145572
Residual	3	5,04715E+11	1,68238E+11		
Total	4	2,49906E+12			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	2331126,012	1124599,439	2,072850058	0,129887437	-1247851,317	5910103
TQ Costs	3,506465577	1,018430012	3,443010846	0,041145572	0,265366748	6,747564

Source: Authors' calculation

Regression statistics confirms our findings (with 95% level of confidence). Values for Multiple R (coefficient of correlation) and R Square (coefficient of determination) are 89, 33% and 79, 80% respectively which implies that there is statistical significant relationship between the analyzed two variables. The R^2 tells us that the proportion of the total correlation in the dependent variable (ALK future sales) can be explained by the independent variable (ALK TQ Costs). A t-statistic is 3, 44 and is significant. We can also see that p-value is 0, 04, or we are 99, 96% confident that our coefficient is significant.

In order to check our findings we use actual data for ALK total operation revenues in 2015 and 2016, presented at Table 10.

Table 10. Actual Revenues ALK 2015-2016

ALK		
	2016	2015
Total Revenues	8,292,770	7,860,414

Source: www.mse.com.mk

We can conclude that research findings are very close to actual company sale performance. Finally we present our research results for third company GRNT:

Table 11. GRNT Sales forecasting 2015-2017

Years	Sales
2010	3.850.000
2011	4.110.000
2012	4.185.000
2013	4.220.000
2014	4.395.000
2015	4.512.000
2016	4.632.000
2017	4.752.000

Source: Authors' calculation

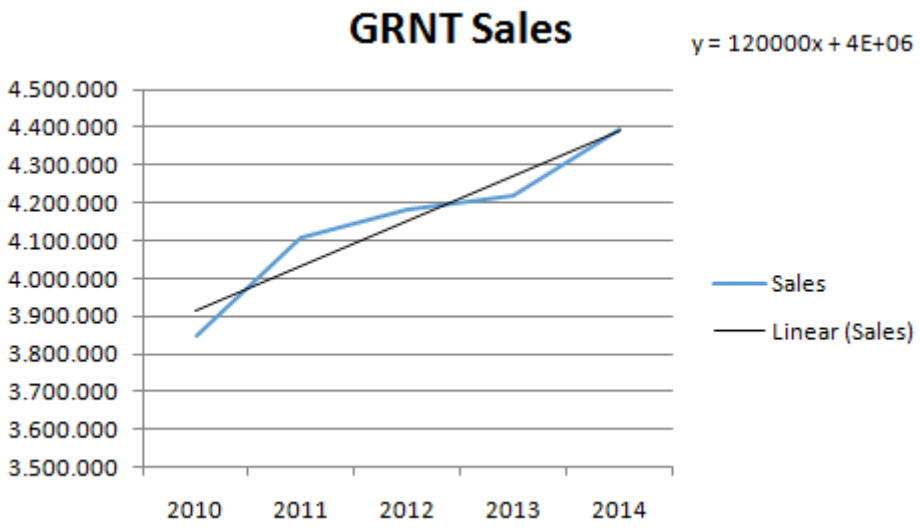


Figure 5. GRNT Sales 2010-2014

Table 12. Regression analysis GRNT sales forecasting

Year	TQ Costs	Sales
2010	624000	3.850.000
2011	715000	4.110.000
2012	733000	4.185.000
2013	775000	4.220.000
2014	751300	4.395.000
2015	762000	4.281.339

Source: Authors' calculation

Table 13. Correlation Coefficient Sales- TQ Costs for GRNT

	TQ Costs	*Sales*
TQ Costs	1	
Sales	0,890843	1

Source: Authors' calculation

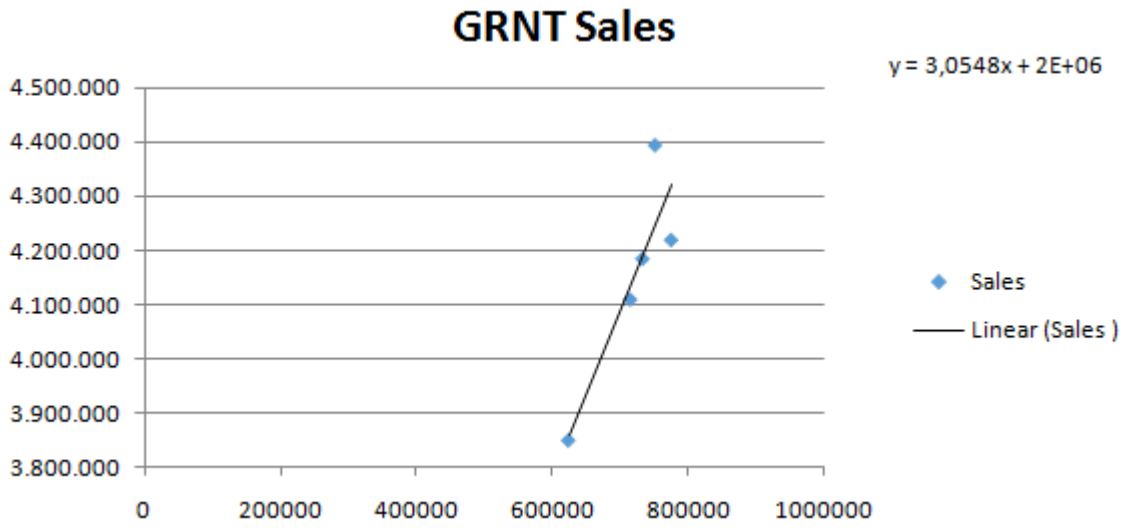


Figure 6. Scatter diagram for GRNT

Table 14. Regression analysis GRNT

SUMMARY OUTPUT							
Regression Statistics							
Multiple R	89,08%						
R Square	79,36%						
Adjusted R Square	72,48%						
Standard Error	104171,9458						
Observations	5						
ANOVA							
	df	*SS*	*MS*	*F*	*Significance F*		
Regression	1	1,25E+11	1,25175E+11	11,53492351	0,042576672		
Residual	3	3,26E+10	10851794293				
Total	4	1,58E+11					
	Coefficients	*andard Err*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95,0%*
Intercept	1953611,031	648961,8	3,010363804	0,057195188	-111674,9651	4018897,027	-111674,9651
TQ Costs	3,054760539	0,899435	3,396310279	0,042576672	0,192356756	5,917164321	0,192356756

Source: Authors' calculation

Regression statistics confirms our findings (with 95% level of confidence). Values for Multiple R and R Square are again 89% and 79% which confirms that there is statistical significant relationship between the TQ costs and company sales. The R^2 tells us that the proportion of the total correlation in the dependent variable (GRNT sales) can be explained by the independent variable (GRNT continuous improvement costs). This results are confirmed by t-statistic and p-value. A t-statistic is 3, 39 and is significant. We can see that p-value is 0, 04 which means that we are almost 99, 96% confident that our coefficient is significant.

On next Table we present actual GRNT revenues for 2015-2016 in order to compare and check accuracy of performed forecasts, as follows:

Table 15. Actual Revenues GRNT 2015-2016

GRNT		
	2016	**2015**
Total Revenues	**5,736,588**	**5,217,970**

Source: www.mse.com.mk

Finally, regression analysis results lead us to conclusion that there is statistical significance between two variables and that company future sales forecasted by linear interpolation as well regression analysis are useful tolls for predicting company sales that are quoted at MSE.

The first individual hypothesis $H_0 1$ is confirmed. Descriptive statistics results give us arguments to confirm that r*egression analysis provide accurate forecast of company future performance in terms of sales and revenues using costs for continuous improvement, having in mind that they can be predicted in advance as a result of discretionary decision of company management and can be used as additional tool for financial forecasting and planning beside traditional statistical techniques like linear interpolation.*

The results from previous figures show changes of processes, shorter time of order realization and financial benefit in terms of savings. We can conclude that inclusion of all employees starting from top management to line operators as well standardization of activities and processes improve processes flows and eliminate losses.

Beside confirmed statistical significant relationship between two analyzed variables we argue that company investments in continuous improvement increase their sales (as shown on Tables with actual data).

This lead us to conclusion that second individual hypothesis $H_0 2$ is confirmed. The results from previous tables and figures show that c*osts for continuous improvement have financial impact on company performance and increase company revenues by improvement of production processes through standardization of activities and waste elimination, focusing on continuous development of production processes, engineering and business management.*

In our research we have analyzed five years' time-series. Probably statistically more significant results can be expected with the use of larger, at least ten-year time-series. Moreover, we have analyzed time-period when MSE and Macedonian economy have slow recovery from the financial crises and debt crises in Europe, which is main Macedonian trade partner as well as period when country faced with deep political instability. This dominant trends significantly affects the movement of company sales and results of our research.

5. CONCLUSION

This study presents findings from analysis of three companies that are quoted at MSE, Vitaminka, Alkaloid and Granit, that use and invest in continuous improvement processes, like TQM, Kaizen concept and Lean management. Research was performed in order to test two individual hypothesis and to determine future sales forecast capability and accuracy by using data for planned costs for continuous improvement.

We can conclude that all three mentioned continuous improvement methods have significant financial impact and company sales increase as result of improvement of production processes through standardization of activities and waste elimination, focusing on continuous development of production processes, engineering and business management. However, it is important to emphasize the need of engagement of top management, management staff and all employees, especially line operators as well standardization of activities and processes. Using regression statistics we test our first hypothesis and findings (with 95% level of confidence). Values for Multiple R (coefficient of correlation) and R Square (coefficient of determination) for all three companies sales are around 1 which lead us to conclusion that there are statistical significant relationships between the companies sales as independent variables and companies costs for continuous improvement as dependent variable. The calculated R^2 tells us that the proportion of the total correlation in the dependent variables (VITA, ALK and GRNT sales) can be explained by the independent variable (their TQ Costs). This results are confirmed by t-statistic and p-value. We find a t-statistics value to be significant for all three analyzed companies. We confirm our findings with the use of p-value where calculated p-values show high percentage of confidence that our coefficients are statistically significant.

We can conclude that there is statistical significance between two variables which lead us to another conclusion that companies continuous improvement costs and investments in CIP are useful in predicting companies' future sales performance.

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