

APPLYING SIX SIGMA METHODOLOGY TO REDUCE THE LEAD TIME OF SERVICE PROCESS; A CASE STUDY BASED ON VISA PROCESS AT CATCH MY TOUR (PVT) LTD

RASA Perera

¹National Institute of Business Management (NIBM), Kurunagala Regional center.
shahein.aruna@gmail.com

Abstract - Business organizations make an attempt to apply many strategies to enhance the productivity by improving the process to face the changes in modern competitive market. Six sigma methodology is one of the strategies that can be applied to improve the processes by reducing the variation in process. It can be applied to both manufacturing as well as to service sector. This study makes an attempt to address the lack of research on applying Six sigma to services sector in Sri Lanka. The main objective of this study is to apply Six Sigma methodology to reduce the lead time of VISA process services in air ticketing service companies to increase the quality of the service. This study was conducted based on Catch my tour pvt ltd Wellawatta. To achieve the study objective primary data are collected by using direct observation method. 30 Malaysian VISA applications processes are considered as sample of the study. Six Sigma DMAIC Process was used as methodology to reduce lead time of the Malaysian VISA process in the considered organization. Statistical regression analysis and statistical Quality control charts and other statistical tools under DMAIC process used to analyse the data. Results revealed that lead time of the Malaysian VISA process lead time is reduced from 17 days to 9 days after applying Six Sigma Methodology in Catch my tour pvt ltd Wellawatta. It is clearly highlights that it is able and suitable to apply Six sigma methodology in service sector to reduce the lead time of a service process and improve the quality of the business to address the customer's requirement of speedy service.

Keywords— Six sigma, Air ticketing, lead time,

I. INTRODUCTION

It is argued that traditional management practices and its tools and the mentalities unable to address the current high competitive market demand and satisfy the customers in effective and efficient manner (Itkin, 2008; Chee, 2008). As a result of this many organizations make an attempt to develop new concepts to improve the business processes which address the customer's requirement Lean Manufacturing, Six Sigma are few systematic approaches that can be practice for reduce waste and improve value, make products with fewer defects, customer focus (high quality, low cost, short time), robust production operations, cost reduction (Fliedner, 2008, Pettersen, 2009, Kaushik et al 2012). Six Sigma methodology is considered as one of the most well-known, well recognized and very successful management tool (Industrial Engineer, 2008).

Six Sigma originated in 1980s as a corporate strategy in aim of improvement of manufacturing processes and the elimination of defects in the Motorola company. Six Sigma is a project driven management approach for reduction of defects in an organization process and develop the process capability to address the customers' requirements. Most researches highlights that the Six Sigma generates the benefits of defects reductions and improve capabilities but it's benefits deep rooted to many areas such as improve relationships outside and within the organization (Kumar et al, 2006). Therefore, it can be

applied not only in the industrial organizations but also in the area of services sectors such as health and public administration, both in the private and public field, where there is a highly customer oriented organizations which focus on time, quality and the performance etc. but this concept of Six Sigma is widely used in manufacturing organizations rather than service organizations. But many researchers made an attempt during last few years to apply this modern management technique in service sector; and proved that this can be used as service productivity tool which can be faced the highly dynamic modern competitive world (Alan 2006, Phillips, 2002). Sri Lanka is a service oriented country and it is need of the hour to look beyond the traditional management tools which use for service improvements. So this Six Sigma is optimal solution for services sector organizations to improve their service quality which address the customers' requirements. Therefore, this study is focuses on applying Six Sigma methodology in airline ticketing organization in aim of reducing the lead time of VISA process which addressing the customers' requirement of speedy delivery service.

II.LITERATURE REVIEW

Six Sigma initiated by Motorola University design in 1988(Watson and DeYong 2010).Six Sigma is a process driven approach in aim of reduce the defect in an organizational process of production products or providing services focusing the customers' requirements in greater value (Kwak and Anbari 2006). The name of Six Sigma methodology comes from statistical where sigma (σ) means Standards Deviation. Six Sigma means ability of higher capability process to produce output within specifications.

According to (Goh and Xie 2004, McAdam and Evans 2004) identified Six Sigma Methodology as a set of Statistical tools which can be used to process improvement under the quality Management framework. The objective of this methodology is to enhance the sig sigma level of performing measurement under the Critical to Quality (CTQ)which identify the customers' requirements. Statistically indicator of this methodology is parts per million opportunities (PPMO) of confirming products (Mitra 2004) and 3.4 defects per million opportunities within the range of 6 Sigma (Coleman 2008 , Anand et 2007).It was the mostly recognized process capability in the industries but it can be taken more Six

Sigma value in critical process such as airline industry and hospitals (Sehwal and De Yong 2003).This sig sigma methodology is defined as Operational philosophy of management which generates benefits to all stakeholders in an organization (Chakraborty and ten 2007).Six Sigma methodology process usually called as DMAIC process which stands each letter respectively Define, Measure, Analysis, Improve and Control. These five stages are defined my many researches (Antony 2006 Define stage is identified as the identify the problem, scope of the work effort of the project team. Measure stage is defined as measuring the current process of performance of problem identified company. Analysis stage is defined as the process of analysis the current performance data by using statistical analysing tools with quality control tools. Improve stage is defined as improve the process stages by selecting proper and critical solutions based on analysed data. Final stage control of Six Sigma methodology is defined as maintain and improve the process. This DMAIC process is widely used methodology to quality improvement and it can be extended to total quality Management (TQM) (Black and Reverer 2006).(Kumar 2007) identified that sig sigma methodology of Define, Measure, Analysis, Improve and Control has similarities to Deming's quality cycle (Plan, Do , Check , Act). Therefore we can use this sig sigma methodology in any organization without considering the size , or the nature of the business as it has inherent similarities with Deming's quality cycle which is used for continuous improvement. This PDCA Cycle or the Deming's cycle is very important in any quality aspects of any organization as it is the basis of ISO 9000 2015 new revision. (ISO) Sig sigma methodology generates both indirect and direct advantages to any organizations in the view point of cost reduction, reduction of lead time and most important advantage of increasing the productivity of an organization (Masoud 2008). He identified that there is a positive relationship between sig sigma methodology and productivity which can be make competitive advantage in competitive market. According to (Mahanthi ANTONY 2005) this sig sigma methodology can be applied to any organization not only manufacturing organizations but all so services organizations. Therefore, it is identified as multifaceted, customer focused systematic approach for quality improvement to accelerated the speed of service and cost reduction. Kumar et al 2008 challenge the myths of Six Sigmas that can be applied necessary only to manufacturing process rather than services organizations; reason based on that the manufacturing organizations widely use this Six Sigma approach and service organizations solver in adapting this methodology

(Furterer and Elshnnas 2005) But during the last decade so many researchers drew their attention towards applying this Six Sigma methodology and it was significant contribution towards to overall economy specially in increasing Gross Domestic Products in United States of America (Tjahjono et al 2013). According to (Stollzer and Halford 2004) identified that the application of more sophisticated and relevant quality and statistical method should be needed to increase the effectiveness of the overall air programs, as well as to gain more return on investment of particular air carrier organization. This DMAIC Process was used to eliminate the defect in airline industry specially to solve the safety issues such as tail striking during take-off and in a safety incensement programs which is one of the main goals in air industry as well as ground process.

Psychogios 2010 identify that lean Six Sigma practices can be applied in airline services industry to avoid unnecessary mistakes and costs provoked by employees which can led to continuous improved programs. Based on these facts it is suitable and need of the hour to apply applying Six Sigma in service sector specially in airline industry in Sri Lanka as Sri Lanka is a service oriented country. This this study is focused on applying sig sigma process to reduce the lead time of VISA processing in airline industry in aim of looking of adopting this Six Sigma methodology in services sector in Sri Lanka business context.

III. PROBLEM STATEMENT

A. Research questions

Catch my tour (pvt) ltd is a private air ticketing company constituted in 2014 under the company act in Sri Lanka. They provide air travel requirement services such as air ticket booking, VISA processing and operating tour packages to the outbound travellers. They cater these services to customers under the rules and regulations of immigration migrations procedure of the embassies. The critical issue they are currently facing is that they usually take nearly 17 days to process the Malaysian Tourist Visa from the date of customer contact the company to deliver the VISA embossed passport. This is a long duration when compares to the other VISA processing companies in Colombo area. Obtained data from 10 air ticketing companies to identify the industry average time taken for VISA process and it is recorded as maximum 10days without considering the customers delay of submitting

relevant documents. But catch my tour is taken nearly two weeks for that purpose. Therefore, they need a proper methodology to reduce this critical long time taken to provide service. Therefore, this study question is focusing on;

Is it possible to apply Six Sigma methodology to reduce the lead time of VISA process services in considered air ticketing company to increase the quality of the service?

B. Main objective

Based on research questions following research objective is derived. The main objective of this study is to apply Six Sigma methodology to reduce the lead time of VISA process services in air ticketing service company to increase the quality of the service.

IV. METHODOLOGY

A. Population and sample

Population is considered as all the VISA application received to Catch My tour private limited within the period of 30 days (month of December 2017) as it was the highest rate of applying VISA application in Catch My Tour pvt ltd. All the VISA Application made were considered as Population and 30 applications made for requesting for Malaysian VISA are taken into consideration as sample within this time period.

B. Data and data collection

Internal primary data were considered for the study. Direct observation method is used to collect data from the sample. Total time period taken to process Malaysian VISA from inquiry stage to the stage of handing over the customer passport with VISA approval emboss is considered. Therefore, time calculation is taken from each and every step of the process for each sample unit.

C. Data analysis

Sig Sigma DMAIC Methodology was applied to analysed the data in the Analysis stage. In the analyses stage Regression Analysis, Statistical Quality Control and Quality Tools were used to analyse the data.

V ANALYSIS

Analysis stage is described based on the stages in Six Sigma DMAIC Methodology.

A. Six sigma DMAIC STAGE 01. - Define Stage

Goal define - to apply Six Sigma methodology to reduce the lead time of VISA process services in air ticketing service companies to increase the quality of the service. SIPOC Diagram show the relationship between the parties involved with the considered organization.

Table no 01. SIPOC Diagram (Appendix 01)

Diagram no 01. Current process of getting VISA approval

(This was draft with the basis of SIPOC diagram discuss under table no 01.)

Diagram no 01- Current process (Appendix no 2)

Table no 02 Highlights the Opportunities and process time of the service. All the process activities are categorized into 06 stages such as – Inquire stage, Documents stage, Submission period, checking stage and final process stage

Table no 02 Opportunities and process time of the service. (Appendix no 3.a)

Yield calculation

$$\begin{aligned} \text{DPMO} &= \frac{(\text{Total Defects})}{(\text{Total Opportunities})} \times 1000000 \\ &= \frac{952}{4050} \times 1000000 = 235061 \end{aligned}$$

Sigma Level = between 1.1 to 1.2

Current sigma level is generating high level of defects in the service process.

Hypothesis testing variables are considered based on Diagram no 01.

- H1: Inquire stage steps can be effected to reduce the time period of the Malaysian VISA process time.
- H2: Documentation stage steps can be effected to reduce the time period of the Malaysian VISA process time
- H3: Submission period stage steps can be effected to reduce the time period of the Malaysian VISA process time
- H4: validate stage steps can be effected to reduce the time period of the Malaysian VISA process time
- H5: checking stage steps can be effected to reduce the time period of the Malaysian VISA process time
- H6: final process stage steps can be effected to reduce the time period of the Malaysian VISA process time

- X1 - Inquire stage steps time period
- X2 - Documentation stage steps time period
- X3 - Submission period stage steps time period
- X4 - validate stage steps
- X5 - checking stage steps time period
- X6 - final process stage steps time period

$$Y= \beta_0+\beta X_1+\beta X_2+\beta X_3+\beta X_4+\beta X_5+\beta X_6+\epsilon$$

B. Six sigma DMAIC STAGE 02 - Measurement Stage

Table no 03.-measuring criteria Highlights the measuring criteria of the Total quality of the system process.

Table no 03.-measuring criteria (Appendix 4)

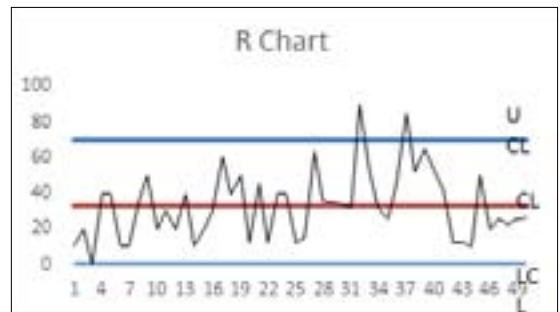
C. Six sigma DMAIC STAGE 03 - Analysis Stage

Table No 04. Highlights the descriptive statistics of measuring criteria mentioned in Table no o3.

Table 4. Descriptive Statistics

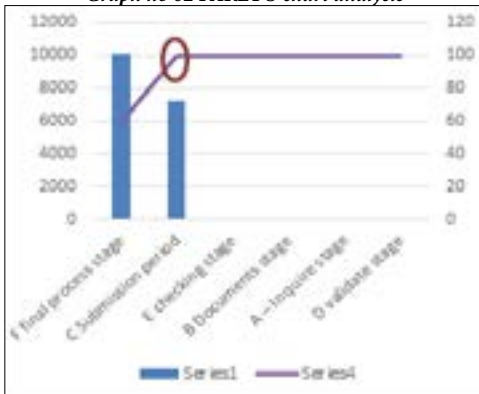
Stages	Mean in min	Standard Deviation	kurtosis	skewness
A	5	1	0	0
B	10	1.32	0	0
C	7200	37.9.3	0	0
D	1	11.3	0	0
E	20	8.3	0	0
F	10140	83.6	0	0
Total Time	17376	5.31	0	0

Graph 3. Pareto chart for cycle time



Graph no 02 PARETO chart analysis highlights that there is a special variation in the process by graphing a turned curve in the chart.

Graph no 02 PARETO chart analysis



To confirm the special variation Statistical Quality Control chart is used. Therefore, R chart is drawn and it confirms that there is special variation in the system process.

This shows that few points are out of control charts and it shows that there are few special variances in the current process. Special variances can be eliminated and that is what we going to reduce in cycle time.

When we consider about correlation coefficients it clearly shows that all the hypothesis variables are effect to reduce the lead time period of the VISA process it is easy to process the next stage of the DMAIC process.

Table 5. Correlation of considered variables in Hypothesis testing.

	X1	X2	X3	X4	X5	X6	Total time
X1	1						
X2	0.0854	1					
X3	0.1972	0.35	1				
X4	-0.1188	-0.32	-0.06455	1			
X5	-0.1152	-0.05	0.239046	-0.07715	1		
X6	0.0280	-0.27	-0.18257	0.353553	-0.10911	1	
Total time	0.833	0.64905	0.751446	0.55862	0.955153	0.6395	1

D. Six sigma DMAIC STAGE 04- Improve stage

Table No 06 Highlights the Value addition of the cycle time of the VISA process

Table no 06 Value addition calculation (Appendix 3.b)

It was realized that 9 days and 9 mins are taken in the process was Non value added. It was revealed that non value added actions are taken mostly in the re confirmation. therefore, it is going to apply thrice checking system which confirm only three time in the process

Diagram no 02 focus on new concept of having only three confirmation of the process which leads to less defects happened in the process.

Diagram no 02- Proposed New flow chart for VISA process (Appendix no 5)

E. Six sigma DMAIC STAGE 05 -Control stage

Following actions are implemented in order to control the redesigned processes as to gain more advantages in future.

Table no 06 highlights control actions implemented (Appendix 06)

VI. CONCLUSION

Results revealed Six Sigma methodology was supposed to reduce the lead time from 17 Days to 09 days of Catch My Tour pvt ltd Wallawatta.Reduction time was nearly 50% of the lead time prevailed before applying Six Sigma. If we identify the non valude added activities in each stage of process will lead to reduce the lead time of a process. According to the analysed data it is clearly revealed that Six Sigma methodology can be successfully applied into services sector specially in aviation industry in Sri Lanka to reduce the lead time of the process.

VII RECOMMENDATIONS.

This six sigma methodology can be applied to various services parts of the Aviation industry. It is need of the hour to practice this in to more services organisations in order to provide more customer oriented services.

VIII. ACKNOWLEDGEMENT

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