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Study and Analysis the Wastage Reduction of Fluorescent Powder in CFL 23 W in Philips Pvt Ltd Mohali, Using Six Sigma Methodology

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Abstract: ***This paper focus on the six sigma methodology for improve the efficiency, wastage reduction of fluorescent powder in industries. Work related to the wastage reduction of fluorescent powder in CFL 23 watt Quassi Fully Spiral and* increase efficiency. *This paper proposed the application of Six Sigma methodology for improving production efficiency in a CFL unit of a Philips plant. It is a management style that based on a highly regulated organization dedicated to managing project. The method is based on five main steps summarized in the acronym (DMAIC): Define Measure, Analyze, Improve and Control. In the proposed work, definition of problem, root cause analysis and correlation analysis has been done for finding the reasons behind the problem and what their affects are and in which percentage wastage of powder lies. The calculations provide the efficiency of production before implementation is 93.14%. After implementing the Six Sigma methodology the efficiency of production improved which is 97.55% against the targeted efficiency is 98%. Hence, this improvement results in saving cost to the industry.***

Keywords: Study and Analysis the Wastage Reduction of Fluorescent Powder in CFL 23 w in PHILIPS P.V.T L.T.D MOHALI, using six sigma methodology

1. Introduction

Six Sigma is a much disciplined process which enables the organization gives nearly perfect product and services. Six Sigma is beneficial to reduce the wastage and improve the quality of product. The figure of six sigma arrived statically current average maturity of most business enterprises maturity of most business enterprises. A term (Greek) used in statistics to represent standard deviation from mean value, it is indicator of the degree of variation in a set of a process. Sigma measures how far a given process deviates from perfection. Higher sigma value capability, better performance in results. According to the six sigma the possibility of defects 3.4 per millions. So as six sigma helps to reduce defects and reduce wastage, increases the profit of organization. The name six sigma that variation that exists plus or minus six standard deviation of the process output. The major benefits of Six Sigma to improve process flow, reduce total defects, improve production rate, reduce wastage and help to maintain quality .According to Ayadi youssouf et al. (2014**)** Lean Six Sigma is a method of improving the quality and profitability based on mastering statically of process and it is also a management style that based on a highly regulated organization dedicated to managing project. The method is based on five main steps summarized in the acronym (DMAIC): Define Measure, Analyze, Improve and Control. Application of the method on the maintenance processes with using maintenance methods during the five phases of the method will help to reduce costs and losses in order to strive for optimum results in terms of profit and quality.

In this paper DMAIC methodology is used to reduce the wastage reduction of fluorescent powder, save the cost of wastage of extra powder and to increase the efficiency

2. Literature Survey

Alexandra Tenera and Luis Carneiro Pinto (2014) proposes a Lean Six Sigma (LSS) project management improvement model supported by the DMAIC cycle and integrating an enlarged and adapted set of statistical tools, given the nature of the project management main variables and the involved processes. The proposed model was tested in a Portuguese telecommunication company context in which project management processes system are based on Project Management Institute (PMI) standards. The model allowed identifying company's main project management problems, associated causes and the selection of the causes to be first attended. The proposed model also permitted to systematically address the actions and solutions to be implemented in order to keep, in the long run, the continuous improvement of the project management processes in the organization [1]. **Ayadi youssouf et al. (2014)** research work focuses on the optimization of maintenance for industrial systems by the use of Lean six Sigma bases. Lean Six Sigma is a method of improving the quality and profitability based on mastering statically of process and it is also a management style that based on a highly regulated organization dedicated to managing project. The method is based on five main steps summarized in the acronym (DMAIC): Define Measure, Analyze, Improve and Control. Application of the method on the maintenance processes with using maintenance methods during the five phases of the method will help to reduce costs and losses in order to strive for optimum results in terms of profit and quality [2]. **Khaled Mili et al. (2014)** discusses how to route straddle carriers in port container terminals. This problem is solved in the context of optimizing transport operations. The contribution of the work lies in the formulation and subsequent development of a Six Sigma Approach solution for the problem. Generating and prioritizing the critical Six

Sigma transportation plans, however, are real challenges in practice. This study aims to develop a novel approach based on a combined ANP and DEMATEL technique to help container terminals determine critical Six Sigma transportation plans. An empirical case study is used to explore the effectiveness of the proposed approach [3].

Dyah Diwasasri Ratnaningtya and Kridanto Surendro (2013) studies reveals that Six Sigma could be used for reducing information variance in healthcare, especially information that used in Hospital Information System. Information quality is a key element to determine the level of healthcare in hospital. By the improvement of information quality, the quality of healthcare would improve to support the patient's satisfaction. A method used for information quality improvement is Six Sigma [4].

Lars Krogstie and Kristian Martinsen (2013) have done experimentation to analyze the link between an industrial case on improvements and an academic model (CLTE) for cross-collaborative engineering on variation and tolerances. The possibilities and limitations of these two approaches on Tolerance Engineering are discussed in this paper. The case describes cross-collaborative improvement work within industry on tolerance and variation management which is similar to work model called closed loop tolerance engineering (CLTE) [5].

Maha Yusr et al. (2012) studies reveals attempts to figure out the relationship between Six Sigma, innovation performance, and examine the mediating role of AC in the relationship matrix. A questionnaire was used to collect the data from the manufacturing companies in Malaysia and Partial Least Square (PLS) techniques were adopted to analyze the data obtained. Based on the literature review, the conceptual framework of this study was introduced. The hypotheses were tested and supported through the findings [6].

Abbas Saghaei et al. (2012) presented real case which illustrates the results of applying model upon the industrial production of electronic sets. The quality level measurement of a given process is essential to some phases of six sigma methodology. So far, different indicators have been applied to estimate the capabilities of a process such as classic yield, defect per unit, sigma quality level and rolled throughput yield. However, the examination of the efficiency of total processes in a certain organization is a recent study undertaken. The proposed approach called Enhanced Rolled Throughput Yield (ERTY), unlike other methods, pays particular attention to such factors as the difference between scrap and rework Cycles. The cost of scrap, rework and the sequence of stages. Moreover, the proposed approach is able to cover all previous methods [7].

Sudi Apak et al. (2012) research work was an initiative to implement the six sigma methodology in a Hydrogen power plant with the aim of encouraging governments to support the use of renewable energy i.e. hydrogen energy. The aim of research work is to assemble public and private sector officials in an international strategic planning process to advance the efficient development of a hydrogen economy infrastructure and to understand six sigma methodology and its contribution to energy efficiency [8].

Jonny and Jessica Christyanti (2012) have done research in Indonesia in which many housing constructors are using asbestos as roofing which is partly supplied by PT BBI among many other suppliers. Before the initiative was conducted, the sigma level was at 4.91 sigma with defects per million (DPMO) level at 200 units. By implementing six sigma methodologies, the team found that this condition was mainly caused by side flat as its dominant defect type due to speeding up the curing time without simultaneously increasing its temperature. To solve this problem, the team has proposed that the company should increase its temperature up to 350°C by DOE (Design of Experiment) if it needs to speed up the curing time from normally 5 hours to 4 hours. As the result, the quality figure was better with improved sigma level to 5.02 sigma and DPMO level at 180. This result might not be significant because there were still many other defect types found in the product that should be followed up by continuous improvement in the company [9].

Morgan Swink and Brian W. Jacobs (2012) assesses the operational impacts of Six Sigma program adoptions through an event study methodology, comparing financial data for 200 Six Sigma adopting firms against data for matched firms, which serve as control groups for the analyses. We employ various matching procedures using different combinations of pre-adoption return on assets (ROA), industry, and size as matching criteria. By comparing performance outcomes across a hierarchy of operating metrics, we establish a pattern of Six Sigma adoption effects that provides strong evidence of a positive impact on ROA. Interestingly, we find that the performance impact of Six Sigma adoption is negatively correlated to the firm's quality system maturity (indicated by prior ISO 9000 certification). Further analyses of manufacturing and service firms reveals that Six Sigma benefits are significantly correlated with intensity in manufacturing, and with financial performance before adoption in services [10].

Scott M. Shafer and Sara B. Moeller (2012) investigate the impact of adopting Six Sigma on corporate performance. Although there is a fairly large and growing body of anecdotal evidence associated with the benefits of implementing Six Sigma, there is very little systematic and rigorous research investigating these benefits. This research extends previous research in several important ways including utilizing a sample of 84 Six Sigma firms that represent a wide variety of industries and firm characteristics, utilizing rigorously constructed performance over a ten year period. To carry out this investigation, the event study methodology is employed. Benefits in terms of improved asset efficiency were not observed. Finally, there was no evidence that Six Sigma negatively impacts corporate performance [11].

Rodica Pamfilie et al. (2012) demonstrated that organizations can obtain individual and organizational performance by using well trained leaders focused on continuous improvement which use Lean Six Sigma in driving employee synergy. The findings of this paper revealed the key factors needed to create a special

framework which can lead the organization to business excellence through personnel improvement [12].

3. Methodology

DMAIC Methodolgy is used to reduce the wastage of fluorescent powder in CFL 23 Watt Quassi fully spiral. DMAIC technique is used to find out the causes of wastage, analysis and improvement. (DMAIC): Define Measure, Analyze, Improve and Control Every task is performed according to the DMAIC technique. The Problem Definition is wastage of fluorescent powder or Project Goals that needs to be addressed are to improve the Production Efficiency by reducing coating powder wastage of CFL tubes at Philips industry ltd. using six sigma methodologies. This phase defines the process using various types of charts e.g. flowcharts and spaghetti diagrams. Gather information on the nature and extent of the issues identified. To find the reasons behind the wastage of fluorescent powder, data is collected in several ways: Visual inspection of coating machine.Information from staff and line members, Constructing measurement plan provide affective reasons behind wastage On-line study of CFL line 12. Analysis of the problem statement. Its focus is to identify the root causes for the problem. Root cause analysis helps to determine the exact reasons behind the problem. For improvement before implementation Activities involved for implementation were shared by the team members. Well defined implementation plan was prepared for clear communication. After the new process was designed & tested thru trials both off & online, the team presented the case scenario for implementation to the stakeholders & got the green signal for the implementation of the new process. The team members conducted on-the-job training for the line operators. The performance of line was monitored on a continuous basis to fine tune the process. The primary objective of control phase is to ensure that the gains obtained during improve phase are maintained long after the project has ended.

Table 1: Sigma Levels (Zhang et al, 2011)

.Sigma Level Process Capability	*Defect Per Million Opportunities*
2	308,537
3	66,807
4	6,210
5	233
6	3.4

4. Result and Discussion

These are reasons for wastage of coating material of fluorescent powder are Pre Heating of Shell, Manual Operation Fast and Straight Rotation of shell, Manual Feed, Residual Moisture Content in Tube, Due to Unskilled Operator Correlation analysis Powder Waste (Coating Machine)

Table 2: Correlation good and bad coating

Good (mg)	Bad (mg)
610	680
615	672
612	665
625	670
648	675
635	672
624	667
625	669
635	685

Calculations in mg

Two-Sample T for Good vs. Bad

Table 5.4 Mean & Standard Deviation

Table 3: (for good and bad samples)

	N	Mean	St. Deviation	SE Mean
Good	9	625.44	12.36	1.047
Bad	9	672.77	10.45	1.024

Difference = mg (Good) - mg (Bad)
Estimate for difference: - 47.33
Good coatings are having weight 625.4 mg as compared to 672.7 mg in Bad coatings.

Table 4: (for solution)

Solution
Reduced Temperature at Pre Heating of Shell
Increased Pressure of Fluid
Design of blow gun
Slow And Inclined Rotation of Shell
Implement Skilled Operator

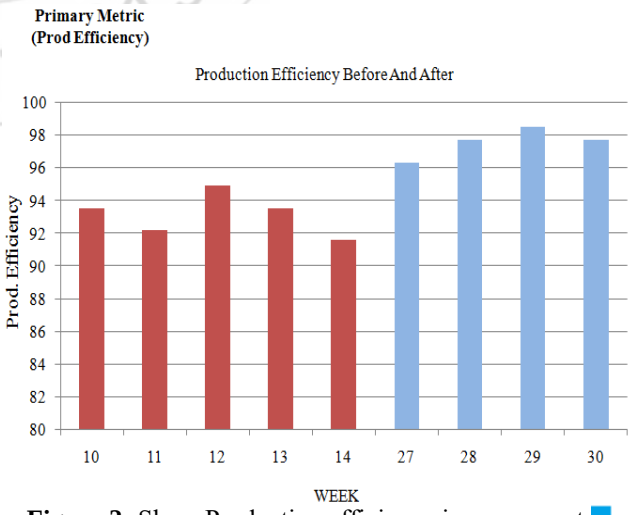

Figure 2: Show Production efficiency improvement

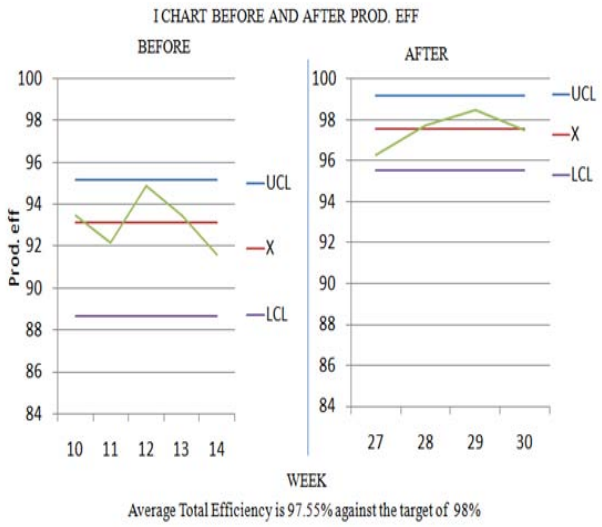

Figure 2: (production efficiency before and after solution)

Table 4: Total cost saving yearly

Project: Production Efficiency Improvement In CFL-12			
Project Start Month: Feb"15 Completed Month: July"15			
Saving Calculations	Pre Implementation	Post Implementation	Saving
Speed Line-12 (Current Speed) / Hr	1500	1500	
Total No. of Days / Annum	365	365	
Weekly Preventative Maintenance	52	52	
Annual Holidays	12	12	
Change Over Hrs	0	0	
No. of Hours / Annum	7189	7189	
Total Efficiency (%)	92.5	96.77	
Production Efficiency (%)	93.14	97.55	
Hourly Efficiency (%)	96.1	97.1	
Annual Production (K Pcs) Line 12	6000000	6000000	
Avg. wastage of Fluorescent Powder/tube(Mg)	47	15	32
Cost of Fluorescent Powder/Mg (Rs.)	0.002199		
Project Saving – Line 12 (Rs.)			422208

5. Conclusion

Production efficiency of line 12 is increased by week 30 is shown in bar chart. This is a result of implementing solutions to the problem. Now Total Average Production Efficiency is 97.55% against the Targeted Value of 98%. Most efficient solutions which increase production efficiency are inclined rotation of shell, increased pressure of fluid and implementation of skilled operator. Increased in production efficiency also saves cost to the industry.

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