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Review Article

A REVIEW ON SIX SIGMA IMPLEMENTATION IN TEXTILE INDUSTRIES

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ABSTRACT

At present productivity is the most important factor which every manufacturing industry focused on. In addition to increased productivity various other factors are also considered such as range of product variety, customer satisfaction, improved quality, return on investment, increased profit and global competition. Various strategies currently in use are Enterprise resource planning, 5S (seiri, seiton, seiso, shitsuke, seiketshu), FMEA (failure mode effect analysis), kaizen, lean manufacturing etc which is use for achieving quality improvement. This paper is an attempt to review six sigma methodology which has been implemented in Textile industries.

INTRODUCTION

Six sigma: Definition

Six sigma is a set of techniques and tools which is generally used to process improvement. It is a data-driven approach and methodology usually used to reduce defects. It was introduced by two engineers named Bill smith and Mikel J Harry while working at Motorola in 1986. The American retire business executive Jack Welch who was chairman and CEO of General Electric between 1981 to 2001 made Six sigma central to his business strategy at General Electric in 1995. By using Six sigma methodology in General Electric they produced more than US$2 Billion in benefits. At present six sigma is the most trending methodology in manufacturing and service industries which can be applied on purchase, production, management, quality management, design, administration etc. Six sigma is an long term commitment which won't work well without commitment from top management (Neha Gupta, 2013). Meeting customers requirement at minimum possible time and cost is the most important mantra of success for any sort of business (Darshak A. Desai, 2012). Six sigma mostly focused on the following.

- Productivity improvement
- Customer satisfaction
- Process improvement
- Defect elimination
- Cost savings
- Cycle time reduction
- Quality improvement.

Old belief in any industry is high quality is equal to high cost but whereas by using six sigma we can achieve high quality at low cost. Steps in six sigma methodology are shown in Figure 1.

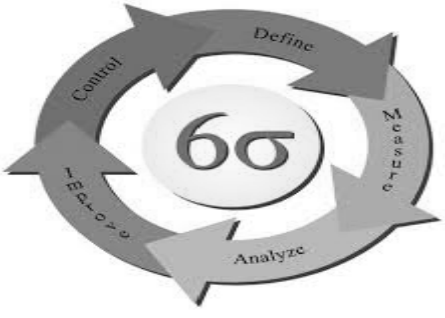

Figure 1 This is the steps in six sigma methodology

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Table 1 Various defects per million opportunities for each sigma levels

Sigma level	DPMO	Percent defective	Percentage yield
1	691,462	69%	31%
2	308,538	31%	69%
3	66,807	6.7%	93.3%
4	6,210	0.62%	99.38%
5	233	0.023%	99.977%
6	3.4	0.00034%	99.99966%

Table 1 Indicates the various defects per million opportunities (DPMO) in each sigma levels. Six sigma is a flexible system for achieving maximum business success.

Textile industry- An overview

In the era of globalization, producing good quality textile products as per the standards need multidirectional competitiveness. It is necessary to work in a systematic way and try to improve financial condition of the organization (Jitender Kumar, 2012) The development of transportation and communication facilities facilitated the path of transaction of localized skills and textile art among various countries. The Indian textile industry has the capacity to produce a wide variety of products suitable to different market segments, both within India and across the world (www.ibef.org).

Table 2 Various processes in DMAIC methodology

Define	• Define the problem • Define voice of customer • Define critical to quality
Measure	• Data collection • Mapping the processes • Recording the results in each processes
Analyze	• List and prioritize cause of a problem • Prioritize root causes
Improve	• Focus on best solutions • Testing the solution • Creating detailed implementation plan
Control	• Deploy improvements • Monitoring the improvements and controlling them

RESEARCH METHODOLOGY

The main aim of this study is to find out the various benefits achieved through six sigma methodology in textile industries such as defect reduction, quality and productivity improvement. This is an effort to show a road map for establishment of six sigma methodology in textile industries. The case studies had been taken from the established journals and publications. The study of cases is presented in following sequence.

1. General overview of research paper and publications
2. Methodology used by case industries
3. Various tool and techniques used by them in each phase
4. Improvements achieved by them.

General Overview of Research Paper and Publications

Methodology Used By Case Industries

Various Tool and Techniques Used By Them in Each Phase

Tools and techniques are the most important thing in six sigma DMAIC methodology. Various tools and techniques have been used in each phase of DMAIC methodology. General tools and techniques used in each phase of DMAIC methodology are given below

Define: Bar chart, Design of experiments, Flow chart, Prioritization matrix, Project charter, SIPOC

Measure: Data collection form, Bar graphs, Cause and effect diagram, Measurement system analysis, Pareto diagram, Process capability analysis, Process map

Analyze: Bar chart, Root cause analysis, Cause and effect analysis, Histogram, Hypothesis testing, Pareto diagram, Pie charts, why-why analysis

Improve: Design of experiments, Affinity diagram, Brain storming, Counter measure matrix, Process map

Control: Control charts, Control plan

Table 3 General overview of research paper and publications with title, author, journal year and product name

Preferred name	Title	Journal	Author	Products
A1	Lean six sigma implementation in Textile Industry[3]	International Research Journal of Engineering and Technology, Volume:4, Issue:4 , April 2017, PP.1670-1676	Rajat ajemra, Prabhuling umarani, K.G.Valase	Garment product: Baba suit
B1	Right-First-Time dyeing in Textile using Six Sigma methods[4]	International Journal of Scientific& Engineering Research, ISSN 2229-5518,Volume:4,Issue:8,August 2013,PP.1517-1525	Dr. Anupama Prashar	Terry towel
C1	An Application of DMAIC Methodology for Increasing the Yarn Quality in Textile Industry[5]	IOSR Journal of Mechanical& Civil Engineering, e-ISSN 2278-1684, Volume:6, Issue:1,March-April 2013, PP.50-65	Neha Gupta	Yarn
D1	Reduction in Defects Rate using DMAIC Approach-A Case Study[6]	International Journal of Enhanced Research in Science Technology & Engineering, ISSN 2319-7463, Volume:3, Issue:12 ,December 2014,PP.146-152	Jitender Kumar, Mukesh Verma, K.S.Dhillon	Thread
E1	Enhancing the Operational Effectiveness of Sewing Segment in Garment Industry by DMAIC approach[7]	International Research Journal of Engineering and Technology, ISSN 2395-0056, Volume:02, Issue:03, june 2015, PP.840-847	Varun, S.Appaiah, Chethan Kumar.C.S	Garment
F1	Applying Six Sigma Methodology Based on DMAIC Tools to Reduce Production Defects in Textile Manufacturing[8]	Recent Advances in Industrial and Manufacturing Technologies, ISBN:978-1-61804-186-9,PP.19-24	Mohammed T.Hayajneh, Omar Bataineh, Rami Al-Tawil	Textile manufacturing: Medical and Workwear Garments
G1	Performance Improvement of Manufacturing Industry by Reducing the Defectives using Six Sigma Methodologies[9]	IOSR Journal of Engineering, Volume:1, Issue:1,PP.001-009	Chethan Kumar C S, Dr.N V R Naidu, Dr.K Ravindranath	Garment: Shirt

Table 4 Shows the methodology used by case industries and their goals after implementing six sigma methodology in their industry

Name	Methodology	GOAL
A1	DMAIC	Reducing wastage and improving productivity in Baba suit
B1	DMAIC	Reduction in production cost and improving production
C1	DMAIC	Reduction of defects in final package of yarn
D1	DMAIC	Reduce the opportunities of defect in winding and to improve sigma level of the industry
E1	DMAIC	To reduce total defect percentage to minimum level, Improve quality, Reduce the wastages, Increase the productivity.
F1	DMAIC	To reduce Production defects
G1	DMAIC	To reduce defect percentage to minimum level and thereby improve quality, reduce wastages and increase productivity

The below table shows the various tools and techniques used by case industry in each Phase. Where D= Define, M= Measure, A= Analyze, I= Improve, C= Control**.**

RESULTS AND DISCUSSIONS BY CASE INDUSTRIES

The main aim of the industries is to gain benefits by applying any kind of tools and techniques. The most important technique from which we get benefits is six sigma methodology. The below table shows various benefits achieved by textile industries by using six sigma methodology. In six sigma methodology the most common benefits achieved are improved productivity, reduced defects, improved sigma level which all shown in the below table.

CONCLUSION

From the study of all research paper of Six sigma conclude that the methodologies have been used in various textile industries confirm that we get a minimum 60% improvement. Six sigma methodologies mostly focused on defects reduction and increasing productivity by reducing or eliminating root cause of the identified defects. It can also be concluded that six sigma DMAIC methodology in textile industries benefits in performance improvement. Textile Industry is the area which is at present should be taken care to improve the Productivity in a country like India. Because Textile sector is one of the largest contributors to India's Exports. So this study make an initiation for implementation of DMAIC methodology in textile industries for improving performance , productivity, quality products as well as customer satisfaction which results in financial benefits of organization.

Table 5 Shows various tools and techniques used by case industry in each phase.

Tools & Techniques	A1	B1	C1	D1	E1	F1	G1
Affinity diagram							
Analysis of variance							
Arrow diagram							
Bench marking							
Bar chart			D,A	M			
Brainstorming							
Cause and effect diagram	A	A	M	A	A		A
Control charts			C	C			
Critical to quality matrix							
Counter measure matrix		I					
Control plan	C	C			C		
Data collection plan	D	M	D,M	M	M	M	M
Design of experiments		D	I				
Flow chart						D	
FMEA							
Hypothesis testing		A					
Measurement system analysis			M				
Pareto diagram	A	A			A	A	A
Pie chart			A				
Prioritization matrix						D	
Process capability analysis	M				M,I		M,I
Process map		M				I	
Project charter		D					
Root cause analysis							
SIPOC diagram		D	D		D		D
Statistical process control						C	
Why- Why analysis		A					

Table 6 Shows various benefits gained by case industry after applying six sigma methodology.

Name	Benefits
A1	• Defects percentage was reduced from 8.25 to 2.63, • Sigma level is improved from 2.9 to 3.1, • Production time reduced from 5.18 to 3.90 minutes.
B1	• RFT improved from 94% to 98%, • Estimated cost saving of INR 2.951 million per month.
C1	• Overall percentage appraiser improved from 82% to94%, • Overall percentage attribute improved from 76% to 90%
D1	• Defects reduced from 13012 to 513 units per month, • Sigma level increased from 3.81 to 5.03
E1	• Defect percentage is reduced from 8.92% to 3.01%
F1	• Overall quality level is reduced from 7.7% to 2%
G1	• Percentage defective was reduced from 4.42 to 1.95

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