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IMPLEMENTATION OF DMAIC METHODOLOGY TO CASTING INDUSTRY

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Abstract:

SIX SIGMA approach is a business strategy used to improve business profitability and efficiency of all operation to meet customer needs and expectations. In the present research work, an attempt has been made to apply DMAIC (Define, Measure, analysis, improve, control) approach. The emphasis was laid down towards reduction in the defects (Blow holes, metal spread out, Surface cracks, uneven metal layer thickness) occurred in the castings by controlling the parameters with DMAIC technique. The results achieved show that the rejection due to defects has been reduced from 31.703% to 12.82%.

1. The Five Steps To DMAIC Approach

The DMAIC methodology has a core process: Define-Measure-Analyze- Improve-Control (DMAIC) methodology. The five steps to DMAIC approach are shown in Figure 1.

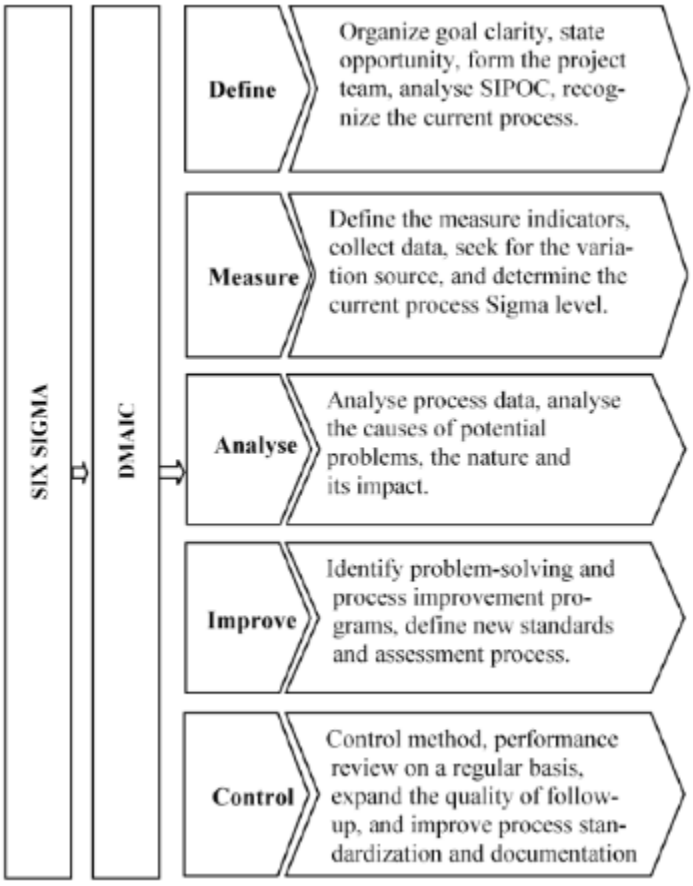


Figure 1 .The D-M-A-I-C process

The objectives for DMAIC approach implementation at **xyz casting industry of GUJARAT.**

1. To identify the root factors causing casting defects
2. To improve the quality by reducing the casting defects

The present work deals with elimination of casting defects in a foundry industry. DMAIC approach is justified when root cause of defect is not traceable. In the present work, an attempt has made to reduce the defects in castings in a foundry shop with the application DMAIC approach.

1.1 DEFINE.

In the primary step of the DMAIC approach, out of the no of products by considering the key component of CENTRIFUGAL CASTING, the main defects which reduce productivity of the component "bi-metallic grinding roller" is….

1. Blow holes
2. Metal raining
3. Surface cracks
4. Uneven layer of metal thickness.

2.MEASURE

s.no	***Type of defect***	***detection***	***Appearance***
1	Blow hole	Visual method	Rounded holes
2	Metal raining	Visual method	Metal out from die
3	Surface crack	Die penetrate testing	Cracks on surface
4	Uneven metal layer thickness	Visual method	Variation in thickness

Table – 1 Defect measurement

Month	**Production piece**	**Rejection pieces**	**Blow holes defect**	**Metal spread defect**	**Surface cracks**	**Uneven metal layer thickness**
March 2015	12	3	1	2	0	0
April 2015	15	5	1	2	1	1
May 2015	14	5	1	3	1	0
total	41	13	3	7	2	1

Table 2 Data collection before improvement

Total production of Three months = 41, Total rejection =13 pieces
% of rejection = 13/ 41 = 0.31707317 = 31.7073

3. ANALYSIS.

Cause-and-Effect analysis tool

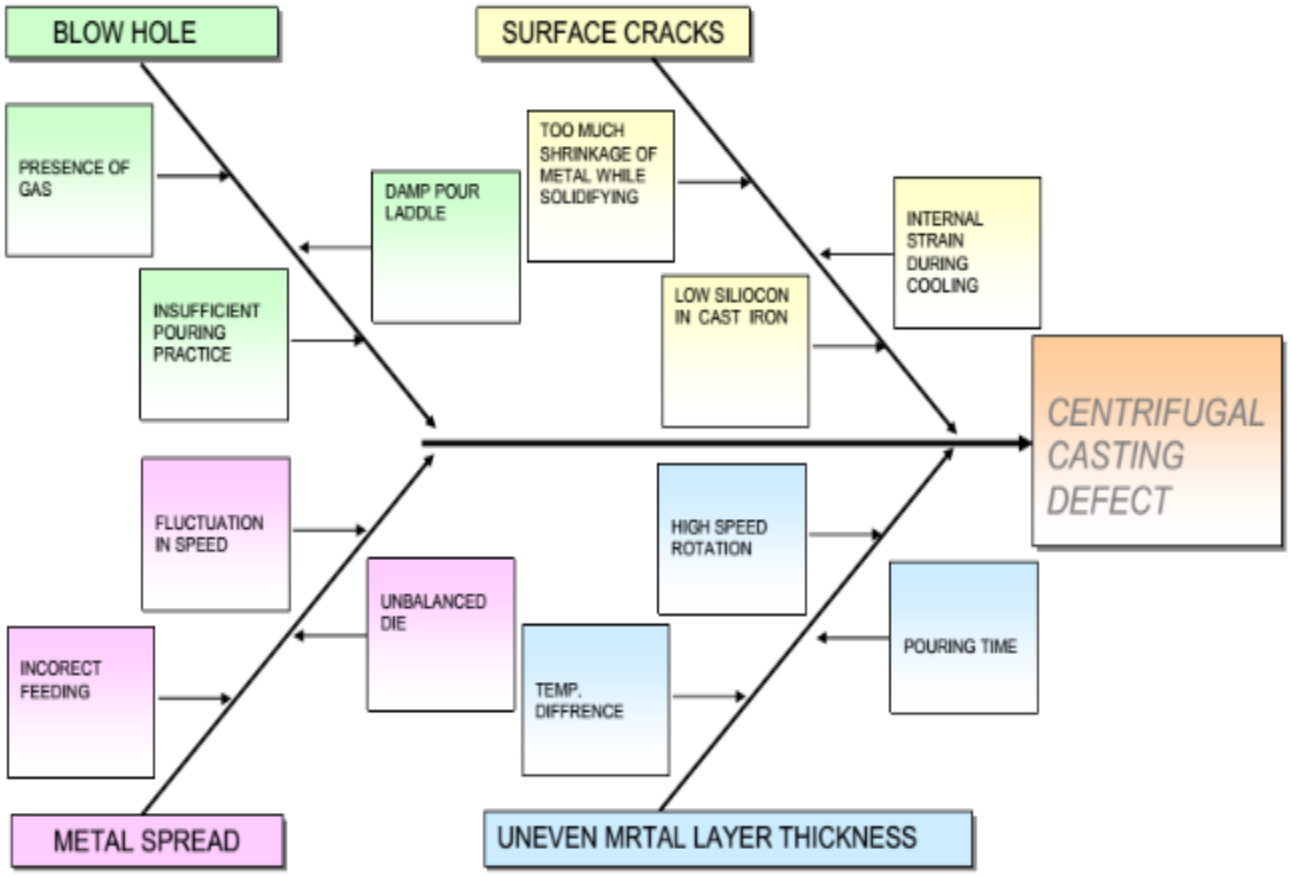
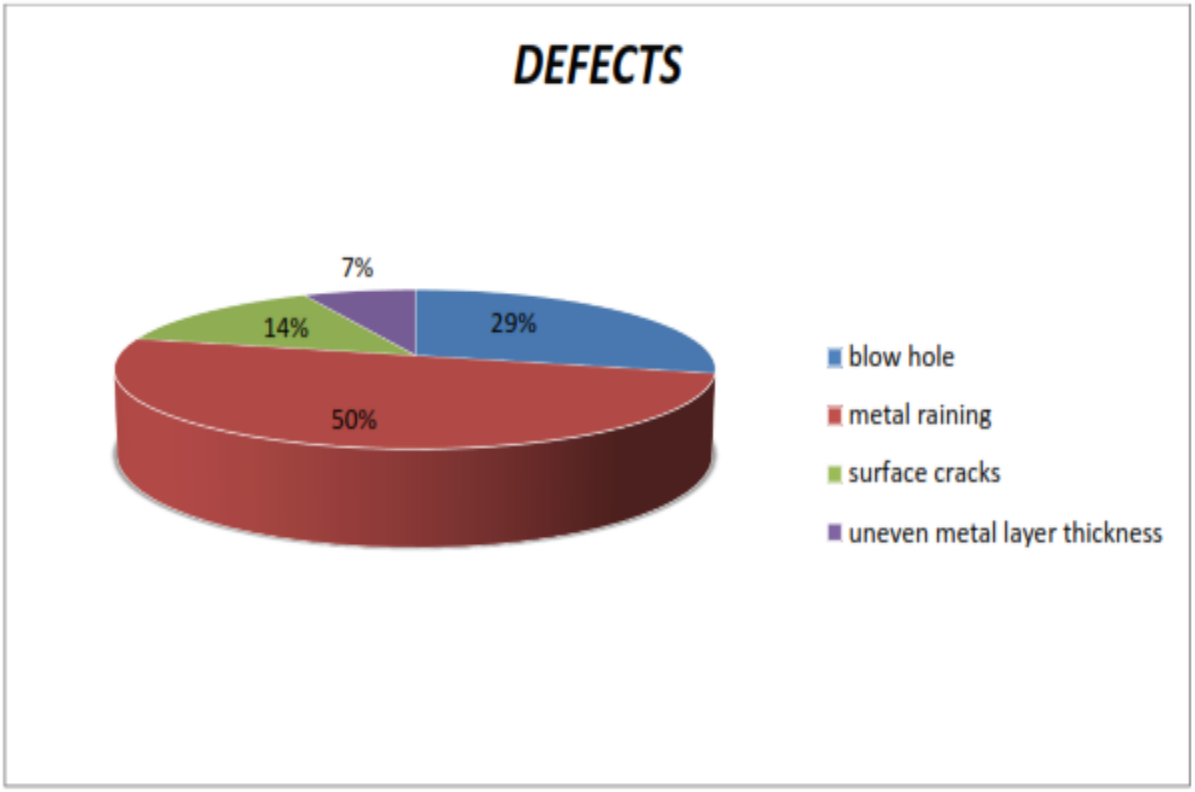


Figure 2. fishbone diagram

Defects	No. of defective pieces	Percentage of rejection
Blow holes	3	3/41= 0.07317 x 100 = 7.3170%
Metal spread	7	7/41= 0.17073 x 100=17.073%
Surface cracks	2	2/41= 0.04878 x 100=4.878%
Uneven metal layer thickness	1	1/41= 0.02439 x100=2.439%

Table 3 % defect of rejected pieces



After collecting the complete data it was clear that rejection was high due to METAL RAINING and BLOW HOLE casting defects. Therefore more stress has been given on these defects to reduce the rejection in the industry.

4. IMPROVE PHASE

Month	Production piece	Rejection pieces	Blow holes defect	Metal raining	Surface cracks	Uneven metal layer thickness
June 2015	10	1	0	1	0	0
July 2015	14	2	1	1	0	0
august 2015	15	2	1	0	1	0
total	39	5	2	2	1	0

Defects	Before improvement	After improvement
blow holes	9.756%	5.128%
Metal raining	17.073%	5.128%
Surface cracks	4.878%	2.564%
Uneven metal layer thickness	2.4390%	0.00%

Table 4 Data after improvement

Total production of Three months = 37, Total rejection =6 pieces, % of rejection = 5/ 39 = 0.12820 = 12.82%

Table 5 % reduction comparison

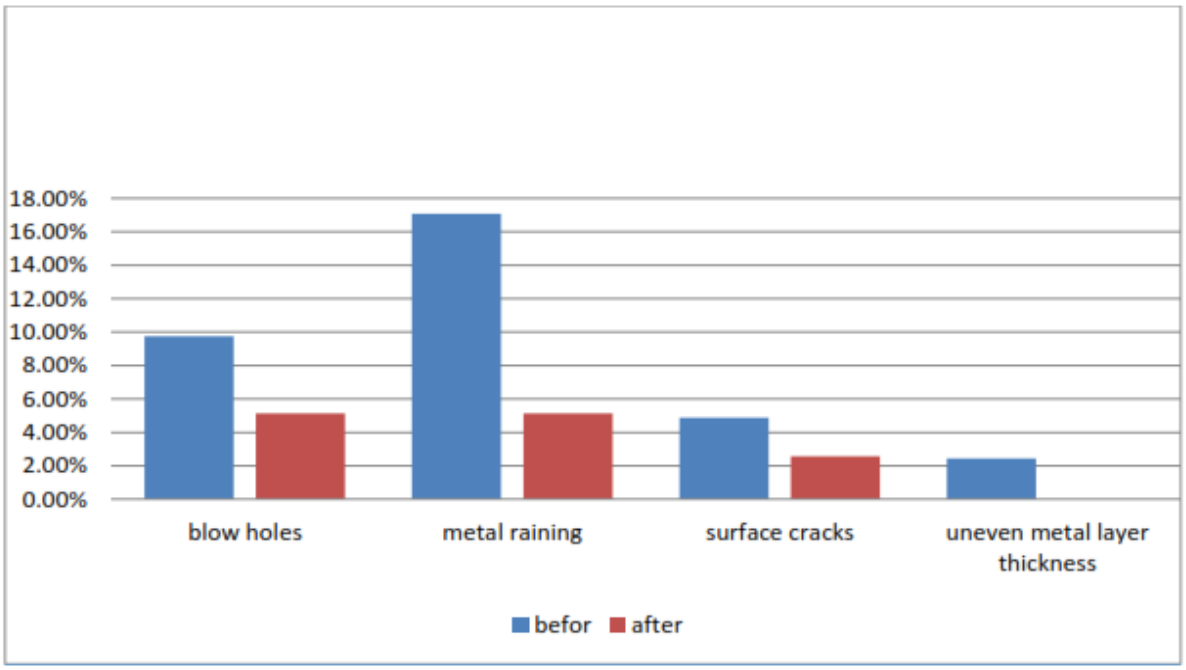


Figure 4 Comparison Histogram

Complete analysis it was found that rejection due to casting defects has been reduced. The DMAIC approach has been successfully applied and rejections due to casting defects have been reduced from 31.707% to 12.82%

7.Control.

Before applying six sigma:

$$DPMO = \frac{\text{Total no. of defect detected}}{\text{No. of unit produced X opportunity of defect}}$$

=13 X 1000000 / 41 X4
=77380.952

So the six sigma level =2.92sigma
After applying six sigma:
DPMO = 5 X 1000000 / 39 X 4
=32051.282

Six sigma level =3.35 sigma

CONCLUSION

These are some suggestion for control the losses. Use a digital weight machine in stand of simple weight machine for measuring weight of pouring metal. Use 400 KV power supply in stand of 350 KV, so we can use both furnaces together. Use both DG set of 750 KW in stand of 750 KW and 250 KW respectively, so we can give quick response against break down of electricity. With the implementation of DMAIC we can improve the productivity ,sigma level and reduces the wastes .

