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# Benefits and Challenges of Quality Circle – A Case Study of the Aluminium Industry

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**Abstract:** This research aims to comprehend the advantages and difficulties of quality circles among workers and organisations in the aluminium industry. The research also seeks to comprehend the advantages of the quality circle and how it affects the aluminium industry's standards for quality, productivity, and workplace atmosphere. In order to move forward with the research, pertinent questionnaires were created, and information was gathered from participants in the quality circle in a significant aluminium industry. The Cause-Effect diagram and Pareto diagram are used to thoroughly examine the observed data. The goal of this research is to comprehend the tangible and intangible advantages for workers and organisations. This research will comprehend issues with production, monetary losses, and difficulties for workers and organisations. While engaging in quality circles, it also aims to help individuals and groups comprehend their difficulties. A quality circle will aid an employee and their organisation in multi-fold growth, the research finds and hypothesises. Additionally, it will aid in developing their skills and enhancing organisational ethos generally.

**Keywords:** Quality Circle, Quality Control Tools, Problem Solving Techniques, The Cause-Effect Diagram, The Pareto Diagram, Case Study, Aluminium Industry, Benefits, Challenges.

## Introduction:

The Quality Circle (QC), also known as the Quality Control Circle, views workers as an organisation's most valuable resource. This is so because workers transform all sources or raw materials into finished goods. Through the concept of quality control (QC), which promotes interpersonal connections, employees carry out their duties in accordance with their expertise in the relevant field or department. As a result, they are better able to recognize, comprehend, and solve problems pertaining to their place of employment. QC serves as a concrete illustration of McGregor's theory Y, which states unequivocally that in an ownership culture, appropriate environment, and self-decision making, people love to work and feel proud of their job. This is reflected in their behavior, which enhances their ability to maintain a healthy work-life balance and live a quality existence.

A similar working group known as the Quality Circle consists of employees who meet freely once a week or at a predetermined interval to discuss quality-related issues related to production, material waste, energy use, scheduling, delays, maintenance, etc. Depending on the size of the work capability, these groups range in size from 4 to 15 members and perform comparable tasks. These teams, which are taught to recognize, assess, and resolve issues relating to quality, operate under the direction of their engineers or supervisors.

Dr. C. Krishnaraj and Anand Jayakumar A (2015), He thoroughly described the creation and application of quality rings in his research study. The goal of organisations is to actively involve all workers in ongoing improvement. This research provides guidance on how to create a quality circle in an organisation and how to put it into practise effectively. This study uncovered the fundamental requirements and established the criteria for creating a quality group within the organisation.

Lakshmi and Sucharitha (2019) talked about how QC affected the business. Any company's expansion relies on the productive efforts of its workforce. The function of QC in addressing workplace issues is crucial. It not only boosts drive but also fosters a sense of loyalty to the organisation. The majority of the employees, according to a survey conducted within the business, were not familiar with this idea. Therefore, public awareness campaigns will be arranged.

Kaur (2019) outlined the role that quality control played in boosting output. The concept may succeed if the given conditions are fulfilled. These included full participation from every participant, problems should be selected by the quality control team members, management must have a positive attitude towards this concept, members must receive appropriate training for problem-solving tools, and a higher authority must be appointed as the QC team's mentor. All of these will help the research succeed in the field.

Prior to the implementation of Quality Circle, only observable financial advantages were considered. In this research, we are also accounting for intangible gains for both the organisation and the workers. How Quality Circle is assisting staff in improving their ability to communicate and solve problems. This research will also aid in understanding the difficulties they encounter when using it. Through a series of questionnaires, a thorough poll of QC practitioners was carried out, and the results are documented.

**Research Methodology:**

**Aims of the research**

A. To research the advantages and difficulties associated with organisations and workers who practise quality in the aluminium industry.

B. To research the advantages of the quality circle in cost reduction and problem-solving with QC instruments in the aluminium industry.

In this research, a descriptive methodology is employed. A summary is produced based on what has occurred in the organisation and what will happen moving forward. In order to derive one specific purpose, the gathered data are critically examined and assessed. It involves questionnaire surveys and structured fact-finding at different organisational levels.

1. Sample Size: For this survey, 50 workers were chosen at random. On the basis of strength and a number of other factors, the population components are determined.

2. Probability sampling technique is used in place of the random sampling method so that each and every object in the population has an equal chance of being chosen and selected.

3. Questionnaire The data collection process makes use of standard structural methods. In order for informants to respond, a variety of written or verbal inquiries are posed. There are two categories for these questionnaires:

(a) Open-ended: The respondent has not offered any options or an acceptance answer option. They are allowed to reply in accordance with what they comprehend.
(b) Closed-ended: The respondent is offered options for their acceptance response.

4. Data Gathering: For the research, two categories of data are gathered:

(a) Primary Data: These data are located and gathered using a series of surveys that include both open-ended and closed-ended inquiries. By completing these surveys, informants are given a questionnaire sheet.

(b) Secondary Data: These kinds of information are gathered from sources and people who have been approved by the business.

The following steps are used in this research to solve problems:

(i) Employees using the record sheet to identify problems.
(ii) Issues that the QC staff has chosen to address.
(iii) Problem analysis using the Pareto and Cause-Effect Diagrams.
(iv) Finding alternatives by brainstorming
(v) The QC team's selection of the best feasible option.
(vi) A thorough action plan created by the QC staff.
(vii) Management endorsement through the QC team's presentation of the best option.
(viii) The QC team trails and implements the best option.

**Case Analysis**

With the assistance of authorised individuals, pertinent questionnaires are created and distributed to workers of A Large Aluminium Industry through random selection. Following are responses and factual results from data gathered from questionnaires:

**(A) Informants are categorised in accordance with:**

**Gender:** 90% of the sources are men, and only 10% of them are women.

**Age:** 38% of the respondents fall into the category of 36–40 years, 24% fall into the category of 30-35 years, 20% fall into the category of 26–30 years, and 18% fall into the category of 20–25 years.

**Education:** 36% of the informants possess a diploma, 26% have a B.E. or B. Tech., 20% have an ITI, and 18% have completed grade 10 in their educational pursuits.

**Designation:** Engineers make up 52% of the informants, followed by labourers at 18%, managers at 10%, and operators at 10%.

**Experiences:** 30% of the respondents have experience ranging from 16 to 20 years, 28% have experience ranging from 11 to 15 years, 26% have experience ranging from less than 5 years, and 16% have experience ranging from 6 to 10 years.

**Positive Elements Found in Management and Employee Open-ended Questions (Based on % Analysis)**

| Sl. No. | Factors | O | VS | S | US | D |
|---|---|---|---|---|---|---|
| 1 | The chance to take part in different QC events | 60 | 30 | 8 | 2 | |
| 2 | Colleagues' drive | 50 | 40 | 10 | | |
| 3 | Using novel methods | 70 | 20 | 8 | 2 | |
| 4 | Support from top management | 60 | 30 | 10 | | |
| 5 | Achievements & Publicity of QC | 80 | 10 | 10 | | |
| 6 | More chances for QC participants | 90 | 10 | | | |
| 7 | Rewards and widespread acclaim | 80 | 20 | | | |

(O- Outstanding, VS- Very Satisfactory, S- Satisfactory, US- Unsatisfactory, D- Dissatisfied)

**Open-ended questions from management and workers helped identify factors for improving employee skills and attitude (Based on % analysis).**

| Sl. No. | Factors | O | VS | S | US | D |
|---|---|---|---|---|---|---|
| 1 | Presentation and Communication Skills | 80 | 20 | | | |
| 2 | Leadership | 70 | 20 | 10 | | |
| 3 | Inventiveness in thought | 60 | 20 | 10 | 10 | |
| 4 | Skills in Scientific Problem-Solving | 50 | 40 | 10 | | |
| 5 | Sharing of Information | 80 | 10 | 10 | | |
| 6 | Relationships between people and the public | 60 | 40 | | | |
| 7 | More enthusiasm for group pursuits | 30 | 70 | | | |

(O- Outstanding, VS- Very Satisfactory, S- Satisfactory, US- Unsatisfactory, D- Dissatisfied)

**Major challenges recognised by management and employees through open-ended questions (Based on weightage Analysis)**

| Sl. No. | Factors | O | VS | S | US | D |
|---|---|---|---|---|---|---|
| 1 | The difficulty of the selected tasks | | | | ✓ | |
| 2 | A decrease in middle managers' assistance | | | | ✓ | |
| 3 | Non-application of recommendations | | | | ✓ | |
| 4 | Opposition from unions and work organisations | | | | | ✓ |
| 5 | Dispute between members and non-members | | | | | ✓ |
| 6 | Lack of team chemistry | | | | ✓ | |
| 7 | Manufacturing task | | | | | ✓ |
| 8 | Incapability/lack of training | | | | ✓ | |
| 9 | Disagreement regarding issues | | | | ✓ | |
| 10 | The negative attitude of members/non-members | | | | | ✓ |

(O- Outstanding, VS- Very Satisfactory, S- Satisfactory, US- Unsatisfactory, D- Dissatisfied)

**(B) The organisation and execution of this research took place in a sizable aluminium industry, where 2.5–3 KTPA of aluminium is produced. There were about a thousand Pots.**

**Production Issue:** There was a serious issue with metal production, where daily fluctuations in output were occurring. The metal's quality was varying. The overall procedure required a lot of specific energy. It causes 4 to 6 anode losses per day, production losses of 5 to 10 kilo grammes per pot, aluminium purity of less than 0.22%, specific power usage of more than 14500 kWh/T, R & M loss of 6 to 8 lakhs per month, and an average drop of 40 mV.

**Target:**

To boost metal production while reducing costs by Rs 100 million annually.

**Flow chart (Sequence of Operations)**

The procedures used to create the aluminium depicted in Figure were as follows:

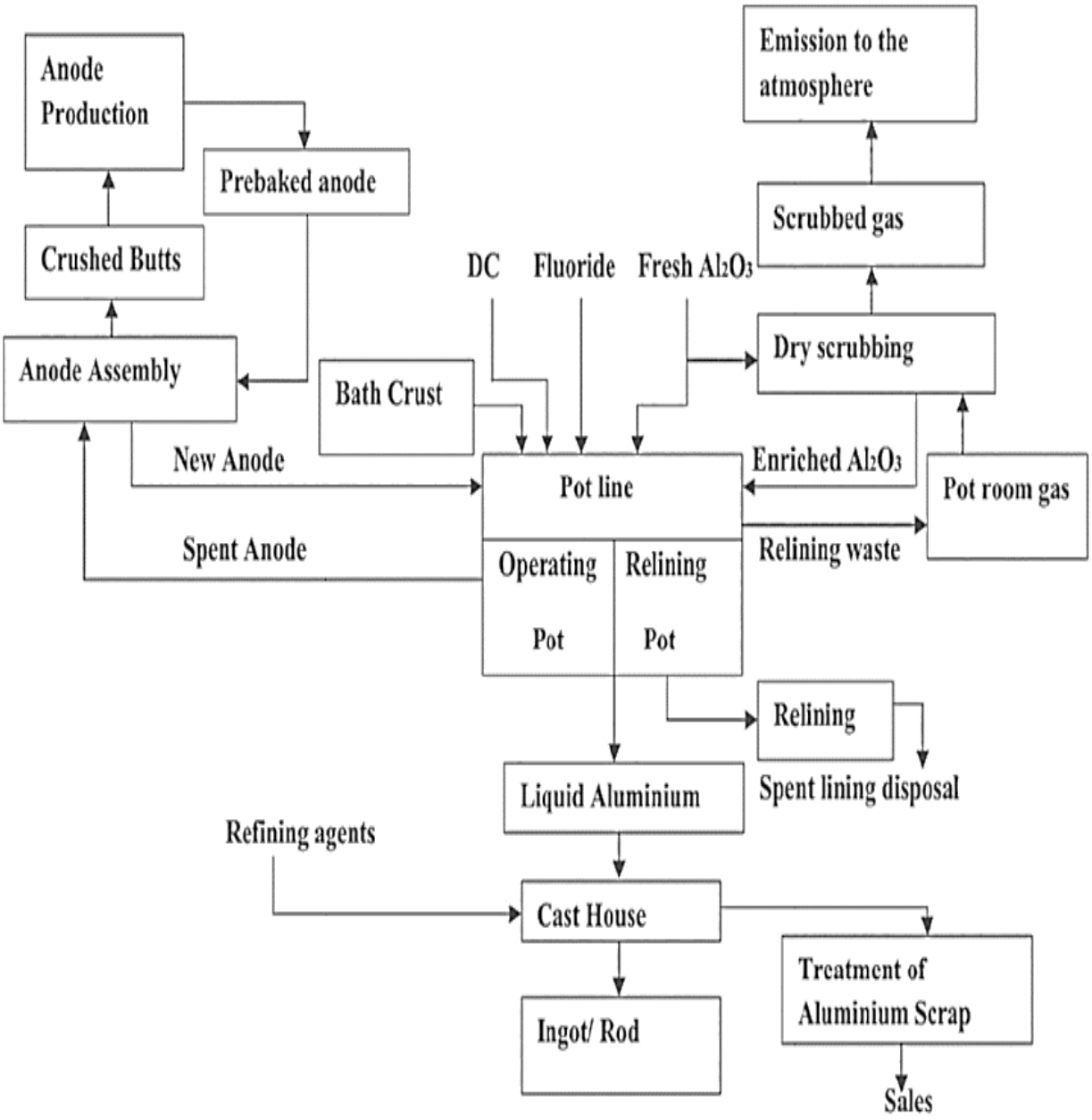


**FIG: FLOW CHART**

**Variations in metal production & their causes**

For the aforementioned manufacturing issues, a cause-and-effect diagram and Pareto chart are provided in detail:

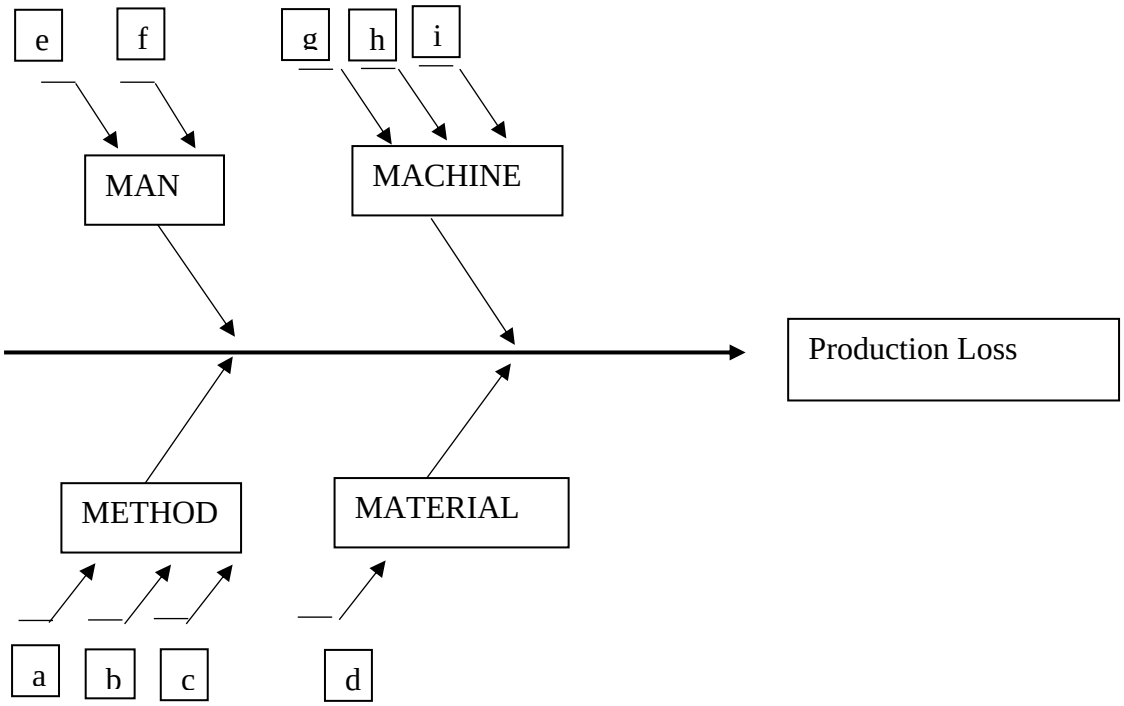


FIG: CAUSE-EFFECT DIAGRAM

**The following are the main factors that influence changes in metal production:**

(a) Bath taping

(b) Metal taping

(c) Anode changing

(d) Defective clamp

(e) Improper fastening of foundation bolts

(f) Improper fastening of clamps

(g) Broken connecting plate

(h) Fault in ABR

(i) Anode effect

**Here, the Pareto Chart is used to identify the two main issues-**

1. With Machine: Defect in ABR, Anode Effect, Broken Connecting Plate

2. Clamp that is defective in material

It is obvious that the problem will be decreased by more than 65% if the two aforementioned issues are managed and tailored.

The additional issues are connected to:

(1) Human-related

(2) Related to methods

With mutual and proper coordination, as well as the necessary skill training, the other two issues can be readily customised and controlled.

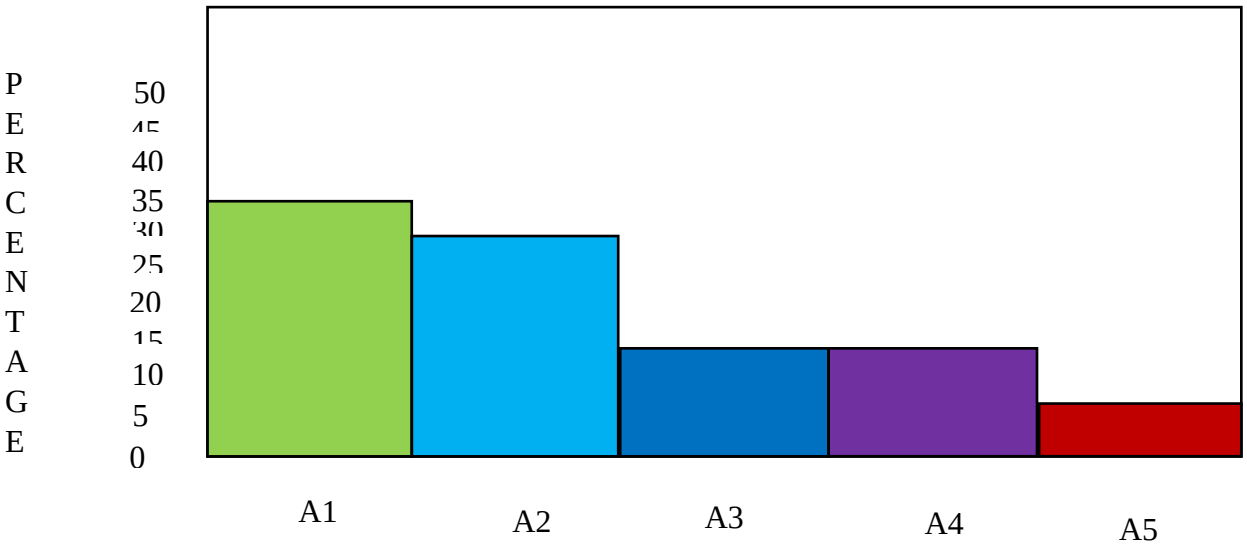


FIG: PARETO CHART

A1 – Problem related to Machine

A2 – Problem related to Material

A3 – Problem related to Man

A4 – Problem related to Methods

A5 – Problem related to Others

The image above displays the Pareto diagram. It highlights the numerous issues with the "Machine." "Machines" is an issue in 35% of the cases. Materials are a factor in 30% of issues. 15% of issues are caused by people or methods, respectively. 5% of the difficulties are other issues.

**The quality circle team suggests the following solutions after applying a Cause-Effect Diagram to the issue analysis:-**

(1) To be used is a calibrated load and tapping inventory.

(2) Tapping in accordance with suggestions.

(3) Clamp drop testing and SOP adherence.

(4) Recurrent upkeep for broken clips.

(5) Regular nut-bolt tightening must be carried out.

(6) Regular lubrication and securing of the schedule clamp.

(7) Machine inspection prior to ABR operation.

(8) A visual inspection of the hopper and breaker is required.

(9) Please provide insert packaging or dishes.

**Various ideas are discovered during brainstorming and executed in stages as follows:**

(a) All pertinent workers should be given access to a skill training programme for horizontal replication.

(b) OEM and standard vendors were used to purchase spare components and accessories.

(c) SOP must be ready for tapping, using calibrated loads, verifying clamp drop, routine maintenance, etc.

(d) Establish a schedule for tightening clamps and nut nuts.

(e) It is important to guarantee routine maintenance for broken clamps.

(f) Greater lubrication will be provided where necessary.

(g) It is important to urge staff members to follow fresh suggestions.

(h) Improving the area's cleanliness for improved outcomes.

**Cost Analysis:**

When the aforementioned recommendations were put into practice, the average decline was reduced from 40 mV to 23.5 mV, and the amount of energy used per unit of weight fell to under 14000 KWh/T. Every day, 5 anodes in total are preserved. Costs for R & M were also significantly decreased.

(a) The specific cost-benefit estimate is as follows:

**Gain from manufacturing (P)**

Profit with increased output (742.6 - 736) equals 6.6 kg

Daily output increased by 6.6 kg per pot.

An increase in daily output of 800 pots equals 800x6.6 = 5280 kg.

Daily profit at Rs. 30 is equal to Rs. 158400 (5280 times 30).

Monthly profit equals Rs. 158400 x 30 = Rs. 4752000

**Anode Damage Savings (A)**

One anode costs Rs. 35,000.

5 Anode per day saved equals 5 x 35000, or Rs. 175,000.

Savings in Anode per month equals 30 times 175,000, or Rs. 5250,000.

**Repair and maintenance (RM)**

Cost savings (Clamp & Repairing) per month equal Rs. 650000. (Approx.)

Monthly net savings in metal production are calculated as follows: P+A+RM = Rs. 4752000, Rs. 5250000, Rs. 650000, and Rs. 10652000.

Gain overall per year equals 12 times Rs. 10652000, or Rs. 127824000.

**Results:**

(a) The organisation has received approximately Rs. 127.8 million in financial benefits annually since Quality Circle's execution.

(b) Employee dependability and safety increased.

(c) Engineers and technicians experience less stress.

(d) A morale boost following implementation for the Quality Circle staff.

(e) Receiving praise from upper management raises work satisfaction.

**Conclusion:**

Employees and organisations must consider the effect of the Quality Circle's challenges when improving their processes continuously and remaining competitive in the global marketplace.

It aids in integrating shared objectives from top management to labourers as well as encouraging employees to make small changes for their organisations. It encourages team building, boosts individual and group skill development, and increases enthusiasm for team tasks. All participants receive more chances to work in other areas, and their acceptance among their coworkers increases as a result. It provides a platform to express an idea to present and discuss among the team and in front of top business leaders while also allowing for the improvement of critical thinking and scientific problem-solving abilities.

The quality circle is a tool used by an efficient and culture-rich organisation to handle both conventional and non-conventional issues. They offer a fantastic platform for their staff to learn different tools and methods to address their issues on various levels. They serve as a catalyst for their workers' empowerment and encourage their expressions of admiration and acknowledgment.

Higher management and workers both actively participate in the success and gains of the quality circle groups in a large-scale aluminium industry. It follows that Quality Circles are the most crucial quality tools for enhancing output, quality, and the working atmosphere.

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