

# COMPARATIVE ANALYSIS OF QUALITY IMPROVEMENT TOOLS & TECHNIQUES - A REVIEW

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## ABSTRACT

In this paper, comparative analysis is carried out for quality improvement tools and techniques in different kind of industries. The paper gives basic knowledge of different quality tools and their application at different sectors. This paper also gives an idea of using proper quality tools as per problem data available. Use of quality tools also varies as per size of industries. The paper includes review of case studies carried out at small, medium and large scale industries.

**Purpose-** The main purpose of this study is to capture the current trend of implementing different quality improvement tools and techniques in different industrial sectors. The papers is also useful for researcher and different organizations to understand and implement Quality Improvement techniques, to achieve new level of business competitiveness.

**Design/Methodology/Approach-** The methodology of this is to identify various Quality improvement tools & techniques such as Six-sigma, FMEA, 7 QC tools, Kaizen, Lean tools, ISO, TOC, PDSA/PDCA, TQM, QFD etc used in different types of industries like Manufacturing, Automobile, IT, Foundry as well as Service sectors and many other.

**Findings-** The study revealed that, most of manufacturing industries of different sizes has been implemented suitable quality improvement models. Other than Automobile, Foundry and IT sectors are also started implementing various quality improvement models. It is also found service sectors these days understands importance of quality and usage of different quality tools.

**Value-** This study provides value to researchers, students and organization of QUALITY IMPROVEMENT TECHNIQUES by providing insight into the implementation of these tools in different industrial sectors and helps them to understand role of quality in their business.

**Keywords:** Quality improvement models/tools/techniques, Six-sigma, Kaizen, 7 QC tools, FMEA, COQ, ISO, PDCA/PDSA

**Paper type:** Review paper

## I. INTRODUCTION

Since 19<sup>th</sup> century, world got a lot of industrial revolution because of rapid development in technology. Resources became available easily and this raised a huge competition in between the industries. Consumers these days has lot of option to go for anything. Though there is one thing which makes the product different from one to another is the Quality. Consumers these days are a lot smarter than before and are very well aware of quality. So for every industry, quality is the key to customer's loyalty. IT and service sectors has no exceptions. Number of quality improvement tools and techniques are developed by various industries and researchers. Every industrial sector is becoming more aware of quality which leads them to implement the quality improvement tools in the firm.

**I.01 Six-sigma:** Introduced by Motorola, six-sigma is customer focused and very efficient problem solving methodology. DMAIC is one of the widely used integral part of Six-sigma. Define, Measure, Analyse, Improve & Control are five main phases of this approach. These five phases projects basic general steps for solving any problem to enhance the quality of process/product. There is no specific or particular field to use Six-sigma. It founds well implementation in various small, medium and large industries.

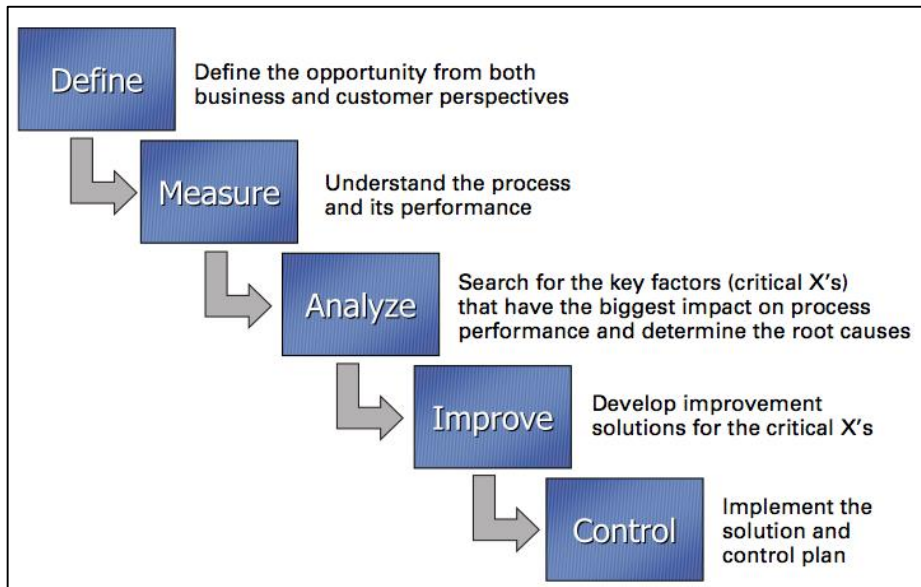


Fig 1 : DMAIC approach

**I.02 Kaizen:** Japanese term kaizen means “continuous improvement.” It focuses on improving quality by eliminating wastes (Muda, Mura, Muri). Kaizen has no specific tools to be implement. It uses various lean tools as per application. It is very impactful for small organizations as the small increments makes the process more efficient, effective, under control and adaptable. (Pramod and Vinit 2013). This continuous improvement leads to greater quality in process/product. Kaizen is adopted by various organizations worldwide.



Fig 2: Kaizen methodology

**I.03 PDCA/PDSA:** Popularized by Deming in the 1950s, PDCA is like continuous feedback from customer in loop to analyze, measure, and identify causes of variations from customer requirements to take corrective action. It consist of basic four steps as Plan, Do, Check/Study, and Action. The cycle of PDCA must be continuously repeated to achieve potential quality in process/product. It is broadly used from manufacturing industries to health care organizations.

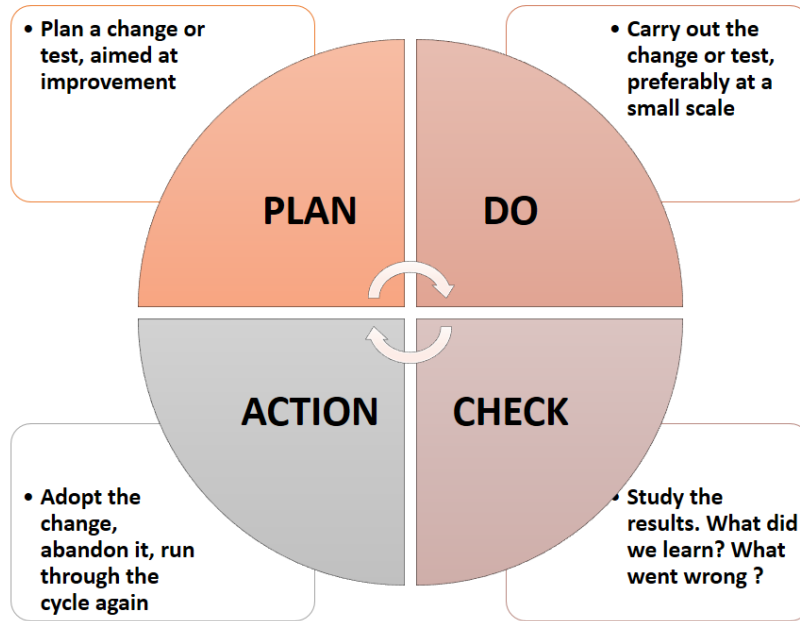


Fig 3: PDCA cycle

**I.04 7 QC tools:** Introduced by kaoru ishikawa, These 7 quality control tools are most commonly used systematic and scientific approach which can be solve up to 90 percent of problems. These tools are used to identify, examine and measure the cause of the problem. This makes problem solving more easy. Almost all type of organizations uses these tools to improve the quality of their product/ process/ service.

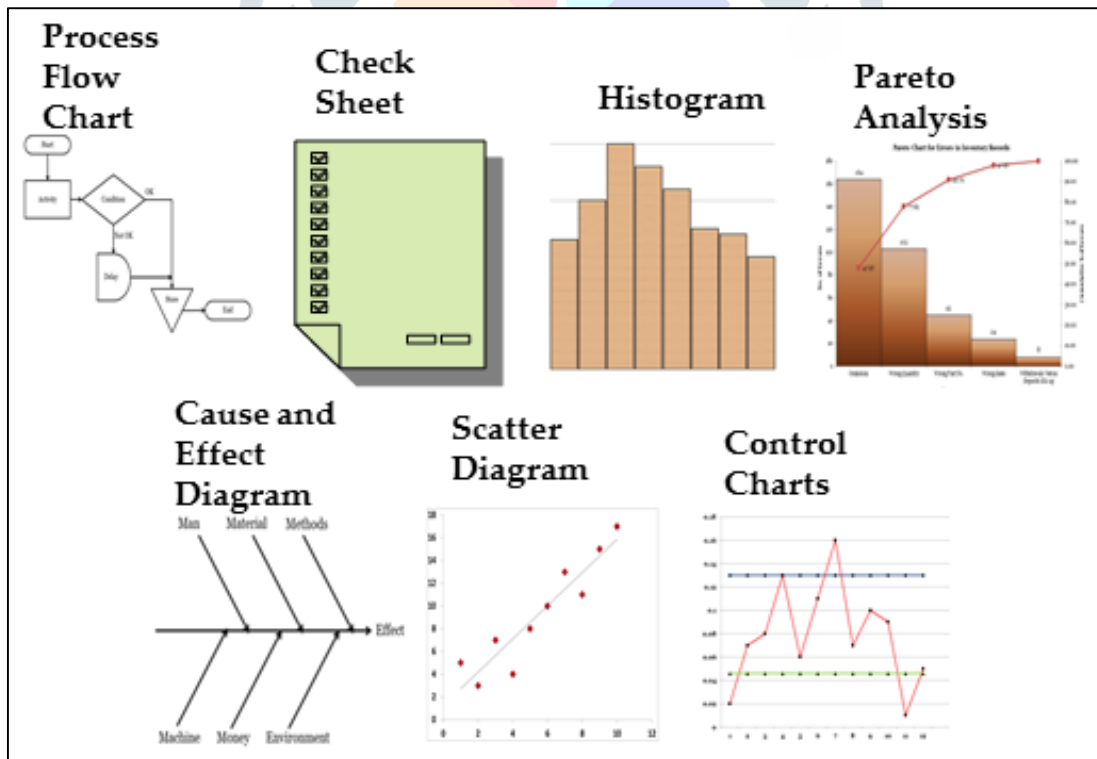


Fig 4: 7 QC tools

**I.05 ISO:** It can be defined as a benchmark for quality. It enhance the quality by upgrading current process through a defined quality management framework. ISO certification on the product attracts customers because of the enhanced level of quality. Also, continual change through target estimations brings in quality improvements. There are different ISO for different sectors but ISO 9000 deals with the Quality management.

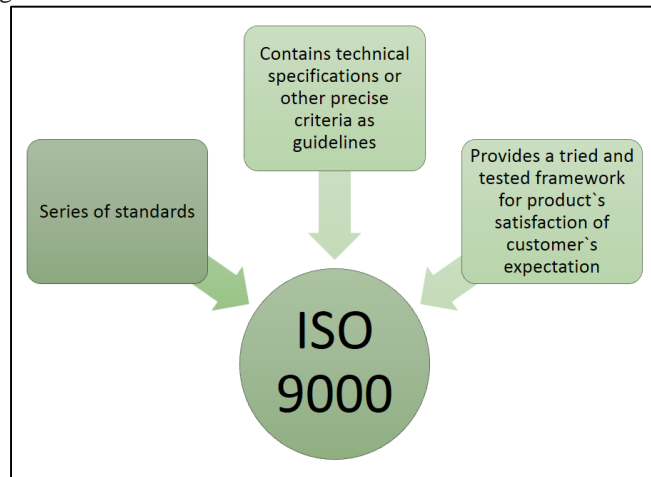


Fig 5: ISO 9000

**I.06 COQ:** It is one of the most effective ways to improve quality and reduce overall costs, there is very less research publication is available. Even it is effective, powerful quality improvement and cost cutting method, Implementation of COQ at SMEs is rare (Darshak Desai, 2007). It is often misunderstood by individuals as price of making quality product/service. It is actually cost of not making the quality product/service. Cost of quality increases when work is redone. This makes easy to enhance the quality by avoiding unnecessary work and costs in organization. It finds application from manufacturing to service sectors.

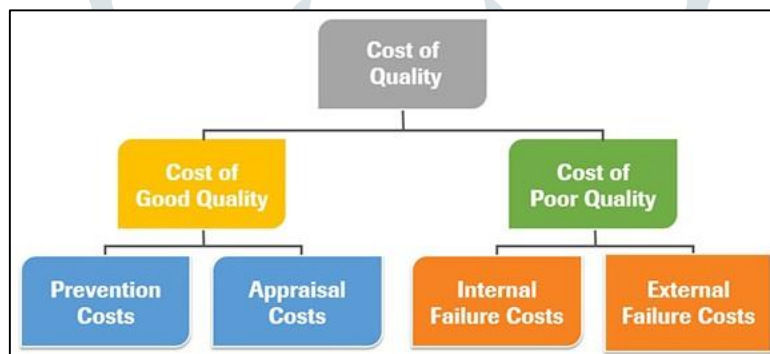


Fig 6: Cost of quality

**I.07 FMEA:** Failure mode & effect analysis is widely used by manufacturing and automotive sectors to identify the potential failure and its effect on product/ process (Jigar Doshi, 2017). It is a preventative tool, mostly used by small to medium scale industries. FMEA identifies the ways of product fail. Thus by avoiding these ways quality can be managed. It is risk management approach, used for new product development and research.

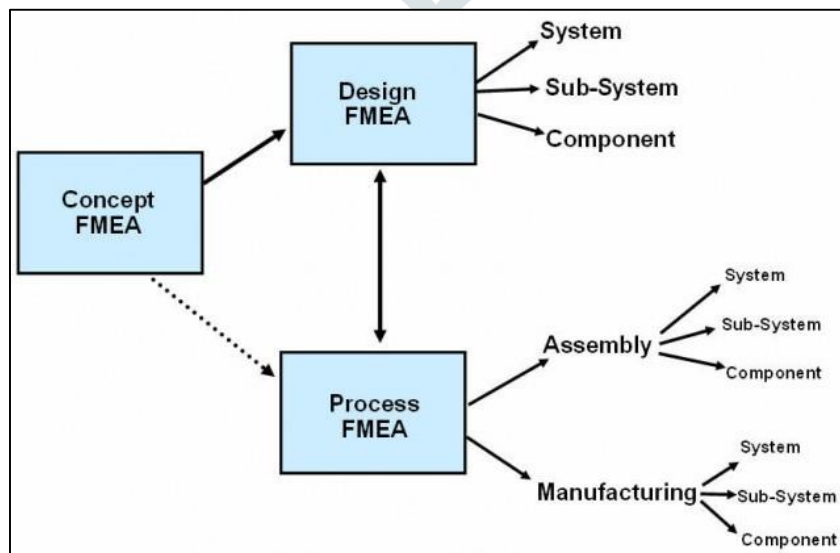


Fig 7: Failure mode & Effect analysis

## II. RESEARCH METHODOLOGY USED FOR THE STUDY

The main purpose of this review is to summarise application of different quality tools at different sectors. For this purpose, all the articles published in peer reviewed journals related to the quality improvement tools are reviewed. The included journals are from well-reputed publishers like Emerald, Taylor & Francis, Elsevier, Inderscience and Springer. These journals are well-known for providing high-quality articles and papers. Following are those 55+ research studies taken for the review and analyse the quality improvement tools;

(Vikas and Abhijeet, 2016; Anupama prashar et al., 2013; Vikas and Ming, 2013; Y.T Jou and C.H Hwang, 2009; Vikas and Rahul, 2017; Darshak Desai at al., 2012; Parth and Nikheel, 2014; Bernardo et al., 2013; Nicholaas and Matthew, 2010; Matthew and Pukhraj, 2013; Dinesh and steven, 2014; Kuo-liang lee et al., 2013; Vijaya and Jiju, 2017; Jiju and Abhijit, 2017; Fairul and Mohd, 2015; Sameer and Michael, 2009; Satya et al., 2009; Morgan and Brian, 2012; R prakash et al., 2016; Adan and Jaime, 2007; Pramod and Vineet, 2013; John and Marcus, 2013; Dusko and Mirko, 2009; Chan and Whee, 2012; Rajesh and abhimanyu, 2015; Jeff and Dustin, 2015; Jyoti Prakas and Murali, 2012; Vimal and Sharma, 2017; Tejas and Mihir, 2014; Shivani and Ravindra, 2013; Manja and Matjaz, 2013; Edly and Hood, 2018; Rohit and Ramakant, 2015; Sandeep and Rajkumar, 2015; Kalva and srinivasu, 2017; Shantanu and Arun, 2017; Talib and Ali, 2003)

### A. Classification of Reviewed Papers

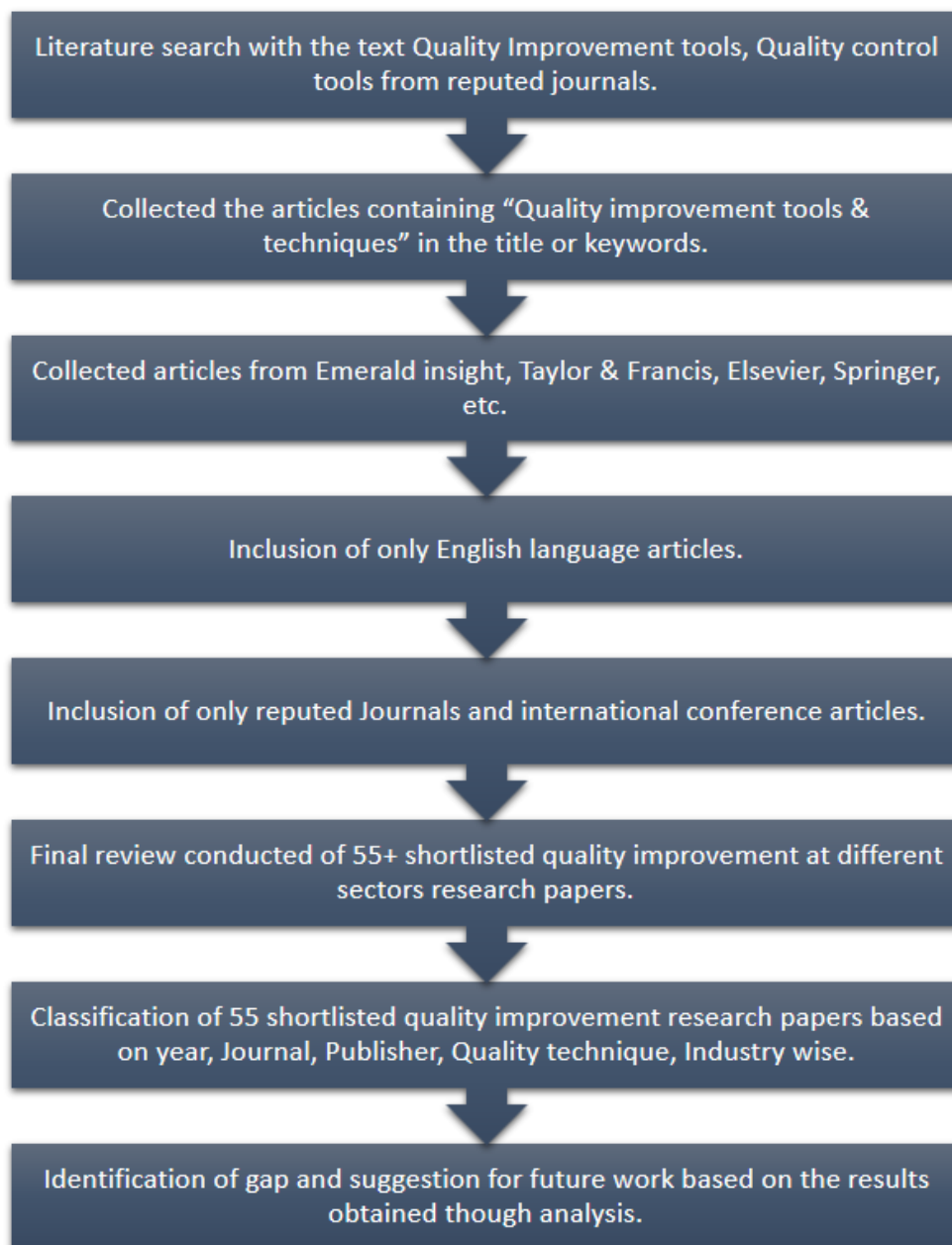


Fig 8: Classification Framework

The research papers reviewed are classified on following dimensions,

- 1) Classification based on publishers;
- 2) Classification based on year of publication;
- 3) Classification based on type of journals;
- 4) Classification based on type of article; and
- 5) Classification based on type of Industry;

**B. Classification based on publishers.**

It includes classification of 55+ Quality improvement techniques published articles up to the year 2018. One of the best publisher, Emerald contributes 38 percent, Taylor & Francis contributes 9 percent, Elsevier contributes 5 percent, Springer and Inderscience contributes 4 percent for this study study. The contribution by other publication which is 40 percent, but these were selected based on quality of articles.

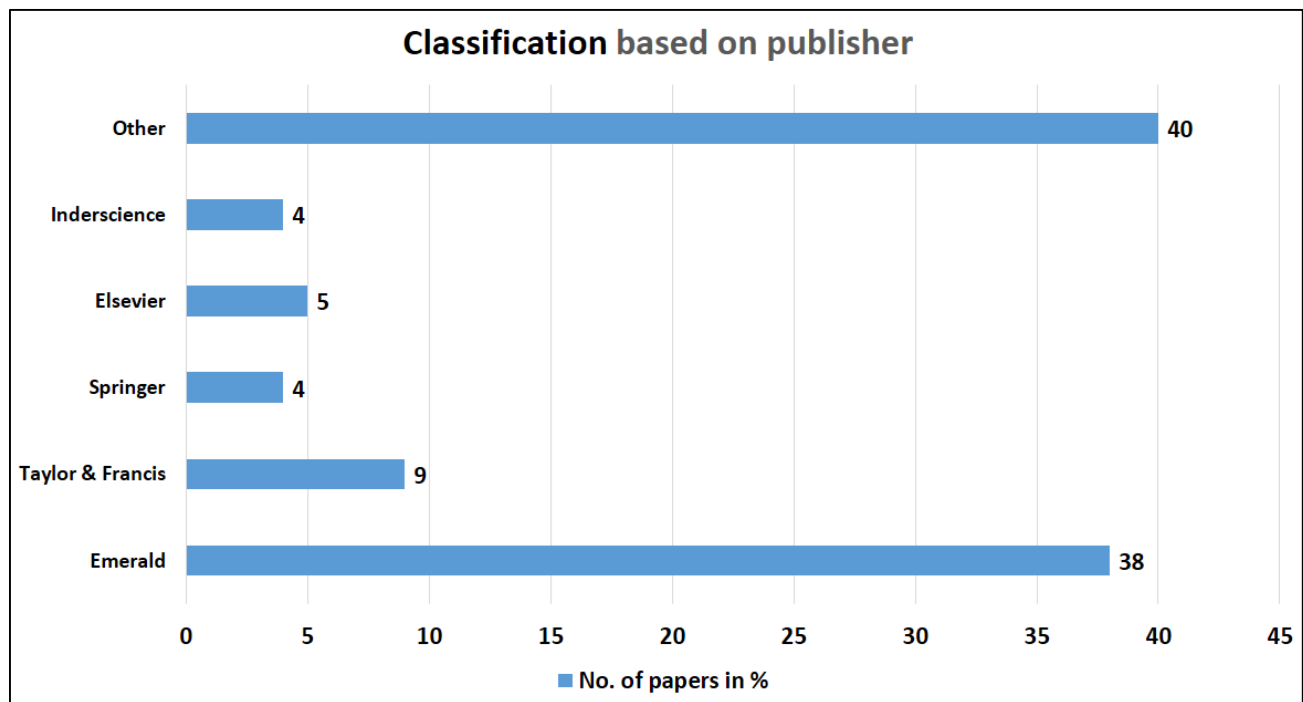


Fig 9: Classification based on publisher

**C. Classification based on year of publication:**

Figure shows the distribution of 55+ Quality improvement techniques published articles up to the year 2017. From the chart it seems that Quality improvement techniques implementation in various sectors was minimum until 2011, but since 2012 more and more industries have started using various quality improvement techniques as per their application. Papers published in year 2013 contributes 16.36 percent, while 23.64 percent were other for this study.

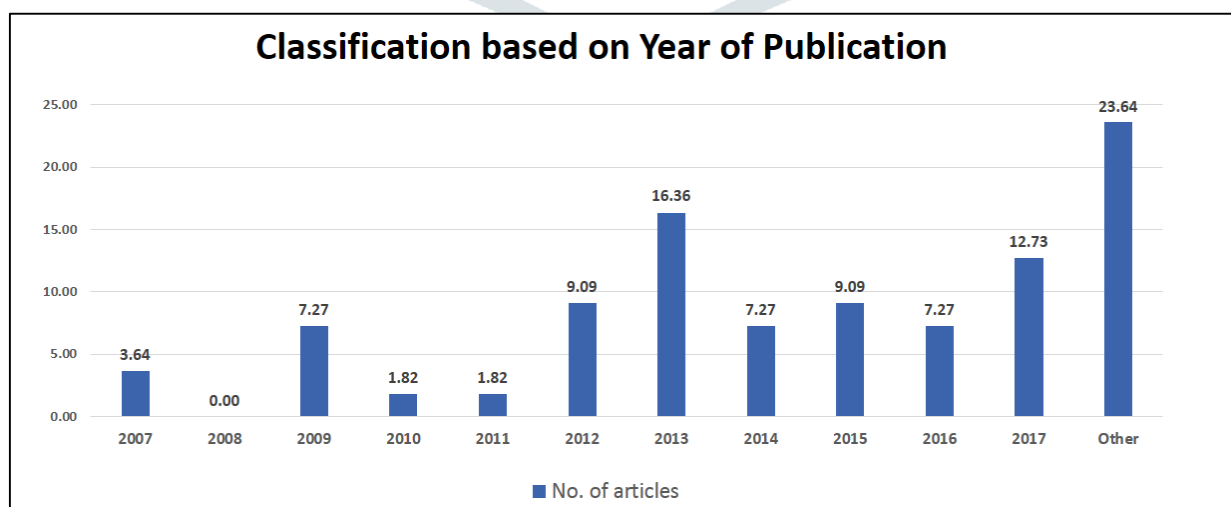


Fig 10: Classification based in year of publication

**D. Classification based on type of journals:**

The Number of articles were selected from many reputed and well-known publications. As seen in below figure, Articles from International Journals contribute the most in the list of reviewed articles which is 82 percent followed by conference at 5 percent and other with 13 percent contribution to the list.

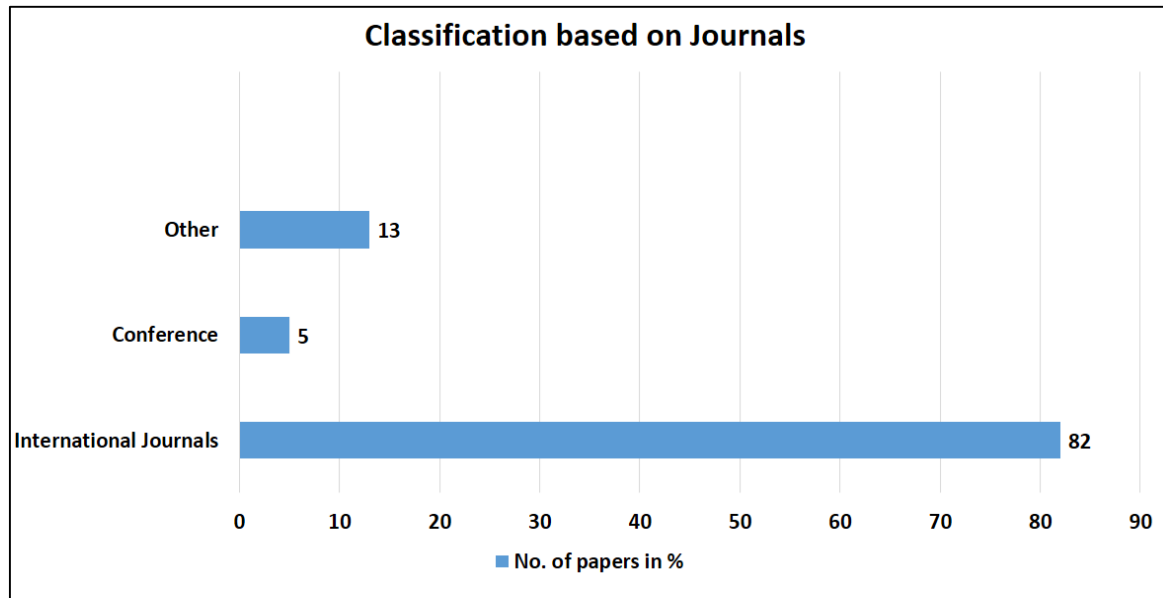


Fig 11: Classification based on type of journals

**E. Classification based on type of article:**

As the main focus of this study is to evaluate the implementation of Quality improvement techniques in all around the world, this study includes case studies of various sectors. Case studies contributes to 33 percent of reviewed articles followed by research papers at 58 percent and 9 percent of review paper.

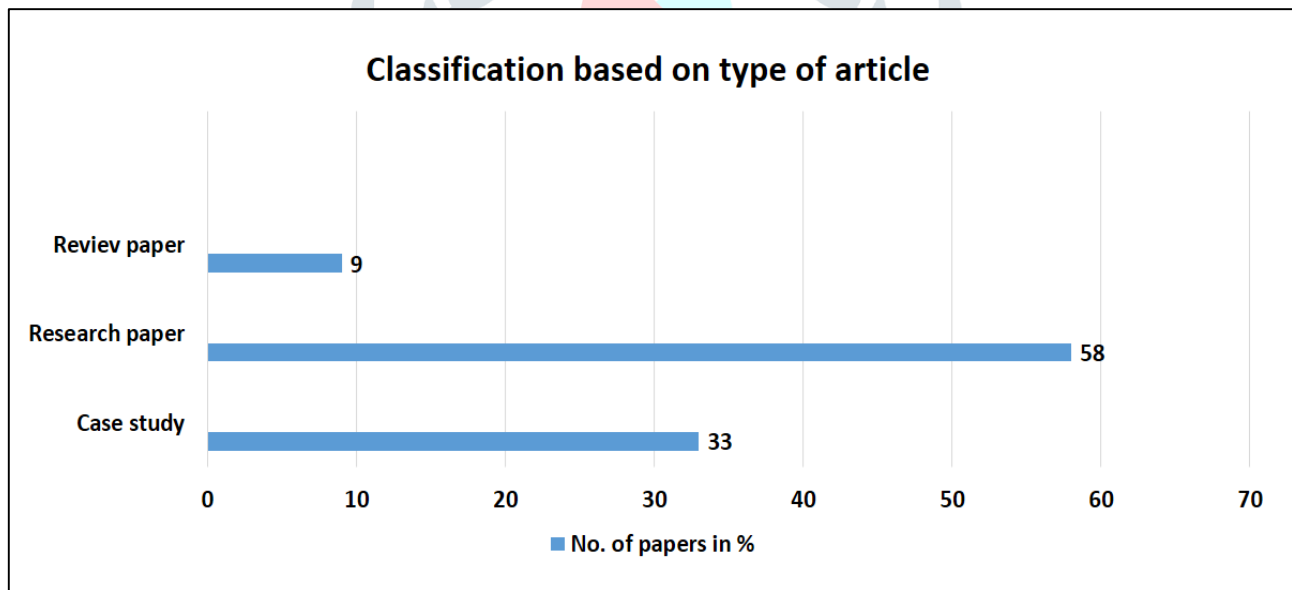


Fig 12: Classification based on type of article

#### F. Classification based on type of application Industry:

From below pie chart of various industrial sectors, it can be seen that manufacturing industries has majorly adopted different quality improvement techniques, which means most of the tools derived till now has greater suitability for these industries. Thus application of quality improvement techniques in manufacturing industry is 42 percent. Other than that various process industries contributes 16 percent. Apart from that it is also seen that various service and other soft branches of engineering like IT sectors also understands the benefits and usage of quality improvement techniques.

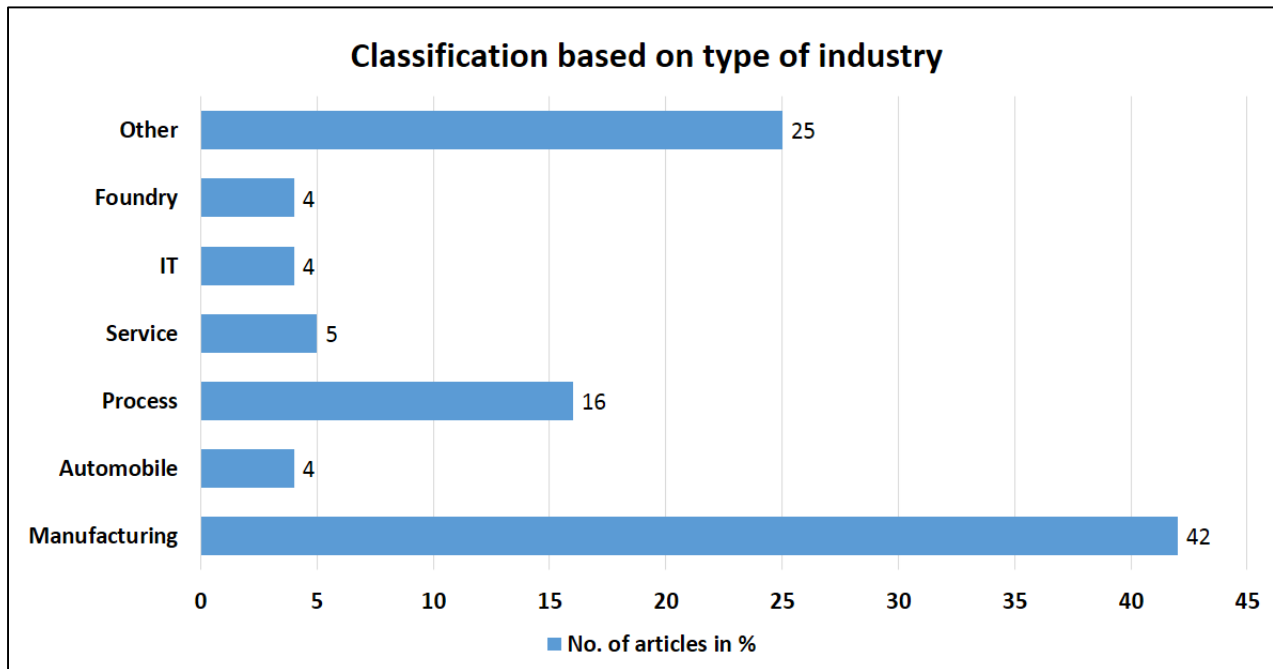


Fig 13: Classification based on type of industry

### III. CONCLUSION

From this study it can be conclude many organizations nowadays understands the usage and benefits of quality management tools. Application of different techniques and tools varies as per type of industry.

After reviewing 55+ research articles, the effectiveness of different quality improvement tools can be understand. Use of these tools and techniques helps the organization to build customer loyalty by making quality product and service. Some of the tools like FMEA and 7 QC tools are used to identify and measure the causes of poor quality which is half done for whole improvement process. Among all these quality improvement methodologies, Six-sigma is widely adopted by different organization and large number of research publication can be found on implementation or case studies. It is also found that still many organizations does not properly understands use of some tools like COQ. Organizations should spread the knowledge of different quality management tools inside the firm and the best way to do this is formation of quality circle team.

### IV. RESEARCH GAP AND FUTURE SCOPE

In this study number of industries using some specific tools is not identified on which researchers can focus, so use of specific quality improvement tool in specific industry can be obtained. This might help to make standard framework for industries to evaluate which quality management tool must be implement to solve the problem as per scale of industry. Also limited number of quality tools were identified in this study.

Modern organization are also combining the use of various quality improvement tools which converts in potential system such as Total quality management.



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