

# Critical success factors of Total Quality Management implementation in Indian Iron and Steel Industries (IISI)

K Shiva Shankar Reddy<sup>1</sup>, Haldhar Ram Chandrakar<sup>2</sup>

<sup>1</sup> Scholar Final year M.Tech (Industrial Engg & Management) CSIT Durg.

<sup>2</sup> Associate Professor Department of Mechanical Engg CSIT Durg, Chhattisgarh, India.

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**Abstract** - Over the past few decades, many organizations have implemented Total Quality Management (TQM) to create a culture of continuous quality improvement and improve business performance. Various QMS implemented in organizations are ISO 9000, Total Quality Management (TQM), Aerospace Standards (AS) and many others. These standards cover aspects such as management leadership, process management, teamwork, quality improvement, and relationships with suppliers and customers. It is expected that the implementation of TQM will ultimately improve the overall performance of the business.

The main objective of my project is to investigate and evaluate Total Quality Management (TQM) practices in steel production and also to determine their impact on their performance. In this regard, a TQM implementation questionnaire on business performance factors is prepared and a survey study is to be conducted with quality management and engineering professionals to collect their opinions on QMS implementation. A sample questionnaire is distributed to experts, managers and supervisors of various firms to study and cover the overall impact of QMS implementation on various business performance factors.

**Key Words:** Quality Control (QC), Quality Assurance (QA), Total Quality Management (TQM), Critical Success Factors (CSF), Indian Iron & Steel Industries (IISI).

## 1. Introduction:

Organizations that adopt a quality management strategy focus on achieving and maintaining high quality outputs using management practices as inputs and quality performance as outputs. Pioneers in TQM, such as Deming, Juran, Crosby, and Feigenbaum, emphasized the importance of quality philosophy as an essential competitive weapon for organizational transformation. Researchers define quality management (QM) as a set of guiding principles and management style adopted by managers in organizations to improve organizational competitiveness and performance. A study by many researchers identifies relationships between QM practices and examines the effects of these practices on performance, but finds inconsistencies and conflicting results among researchers. These findings suggest that

there is a positive relationship between QM or TQM practices and firm performance and among other variables such as product quality, product and process performance, perceived quality, quality drivers, reduced costs, more satisfied customers, and improved financial performance. In general, a large body of literature emphasizes the positive impact of QM practices on performance, but others have not found a relationship between QM practices—TQM—and performance.

Therefore, quality management (QM) plays an important role in the productivity and performance of an organization. Quality practices seem to be important for the continued survival of Indian organizations. Today, despite this debate, TQM is widely accepted and is the most important research topic in both academic and professional settings. However, there is a lack of agreement on the research and some results contradict the theories of quality management.

With increasing throat cut competition and the age of globalization, the concept of supply chain quality management is at the forefront of industry today. It requires coordination with suppliers and customers, rather than treating them as opponents, so that the flow of materials from the supplier to the end customer is smoother. It includes optimization of various concepts such as reducing product delivery times, supporting just-in-time concepts, improving product quality, etc. To be successful in their business, organizations need to control not only costs but also quality in the supply chain. Successful supply chain management largely depends on how quality is managed throughout the system. So it is not false to say that quality management is essential for success in today's competitive world. Different types of quality need to be managed both inside and outside of the supply chain system. This includes information quality, product quality, service quality, etc. This has resulted to the successful implementation of quality management systems in different organizations around the world. The implementation of QMS is used in organizations as one of the most effective tools for managing and improving quality and thus increasing the company's competitiveness. Organizations implement various quality management systems, the most well-known are the standards given by the International Organization for

Standardization (ISO) and Total Quality Management (TQM) tools. Other quality management systems implemented are AS standards typically implemented in the aerospace industry, TS standards implemented specially in the automotive industry and so on. The basis for organizations is that they want to improve business performance as a result of the implementation of quality management systems through the improvement of one or more intermediate factors such as information quality, operational performance, service quality, etc. This work examines the impact of the implementation of quality management systems on business performance through the improvement of various intermediate products.

### 1.1 Research Objectives

Plenty of organizations have already implemented a QMS as a rate controlling and expediting measure for change. QMS practices are expected to improve organizations performance by improving information quality, operational performance and quality of services, products etc. Many researchers have identified a strong relationship between various TQM practices and investigated their tangible and intangible effects on quality performance, financial and market performance through various models. In fact, most studies have identified a relationship between different quality management constructs and the impact of each on performance measures. There is a lack of research in the literature on the overall effect of QMS on business performance through the improvement of other factors and the examination of the overall effect of QMS implementation on various performance factors. Based on the analysis of past research, the aim of the project is to study the impact of TQM implementation in the steel sector.

My objective is to explore the relationship between Quality Management Practices (QMP) and Organizational Performance (OP) in the manufacturing sector by developing a conceptual framework and recognizing the importance of QMP Critical Success Factors (CSFs) to organizational performance, and to develop a quality management practice measurement tool for Indian manufacturing and service organization. To achieve this goal, a well-developed set of items to measure the QMP constructs had to be developed. The development of a valid tool for quality management practices that can be used in multiple countries and multiple organizations will be useful for practical and academic perspectives. In addition, the literature review promises to reveal a lack of research regarding some critical factors of QM practices. Therefore, current research proposes a holistic framework for QM practices based on a comprehensive overview of the factors that contribute to the success of QM practices.

## 2.0 Literature Review

Snezana Topalovic, 2014:- Implementation of total quality management to improve production performance and increase customer satisfaction levels. In the banking sector, the following four TQM variables, i.e. top management commitment, courtesy, responsibility, tangible values, have an impact on customer satisfaction and business improvement.

Bell & Omachonu, 2011: – A framework of quality management practices, recognized by organizations and governments worldwide and subsequently becoming the de facto standard for management systems.

Buttewort–Henemann: Total quality can be achieved by managing business processes that ensure total customer satisfaction at all levels.

Terziovski & Power, 2007, Arumugam et al., 2008, Suet al., 2008: However, many studies reveal that effective ISO implementation can benefit organizations through improved efficiency, management controls and productivity, leading to increased performance.

Magd, 2008: Quality has been identified as one of the competitive strategies for improving business performance in the global market. In order to increase efficiency, continuous improvement and performance of firms, many firms adopt quality management practices as a quality management tool.

Massoud M. Arshida & Syed Omar Agil: - Critical success factors for TQM in the Libyan Iron and Steel Company are continuous improvement, top management commitment, education and training, supplier quality management, employee empowerment, recognition and rewards, and customer focus.

## 3.0 Methodology

### 3.1 DATA COLLECTION

#### 3.1.1 PRIMARY DATA

Primarily the data is collected from some previous articles, websites and some other theoretical books which are related to my Total Quality Management project.

#### 3.1.2 SECONDARY DATA

In secondary data, as shown in the research flow diagram, two qualitative and quantitative approaches to collect data for research purposes. Two methods, questionnaire survey and semi-structured interviews are used to collect the data. The main intention of the questionnaire was to recognize the critical success factors of TQM

implementation in iron and steel industry in India. For better understand the implementation of TQM in iron and steel industry in India interview method is mainly used. Interviews with quality managers in steel industries were used for topics and problems that emerged from the findings of the questionnaires.

### 3.2 SEMI-STRUCTURED INTERVIEW

In semi structured interview, total of 140 copies of the questionnaire were distributed to the target quality managers who are working in Indian Iron and Steel Industries. In questionnaire Five-point Likert scales with the options of Strongly disagree, disagree, neutral, agree and strongly disagree were used. Ollis et al. (2003) reported that this scale gives respondents more comfort in choosing widely. The questionnaire contains 27 statements to identify critical success factors of TQM implementation.

The questionnaire was validated by distributing it to academics in India who specialize in TQM and quality management. They provide feedback on the content of the questionnaire; their comments were taken into account; a change was made and the document was revalidated.

Around 140 questionnaires sent to the target people, out of which a total of 130 have completed questionnaires and revert. The collected data were analyzed using Likert scale mean and standard deviation. Consultation with quality managers were used to elevate a clear understanding of the issues that resulted from the questionnaire and to obtain additional information on TQM implementation.

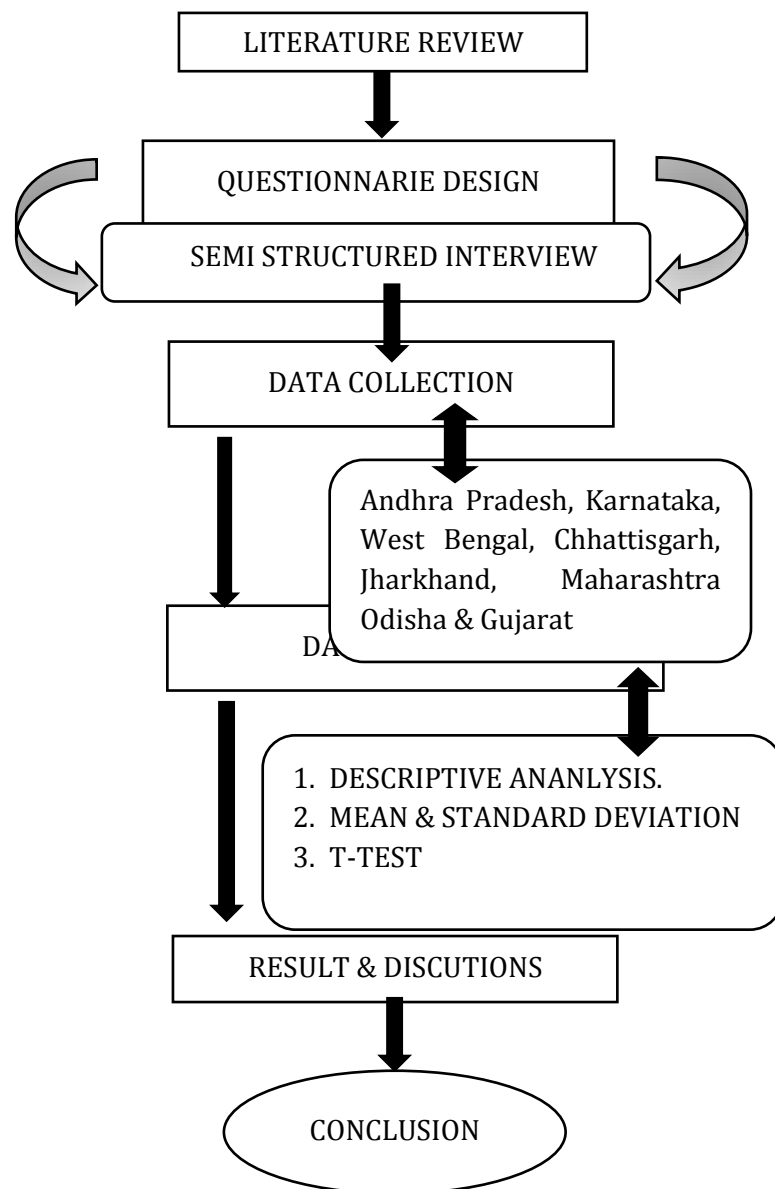


Figure: Research flow chart

### 3.3 DATA ANALYSIS

#### 3.3.1 Classification of respondents (demographic analysis)

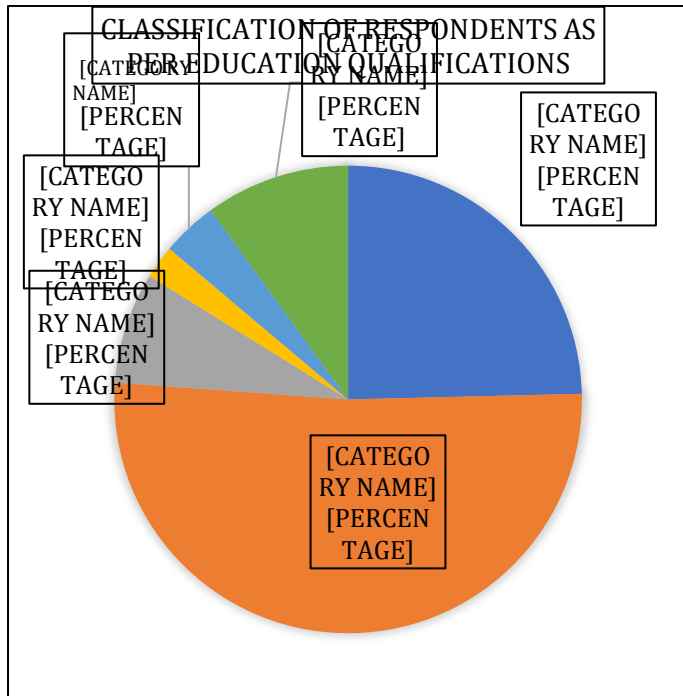


Figure : Classification of respondents as per education qualifications.

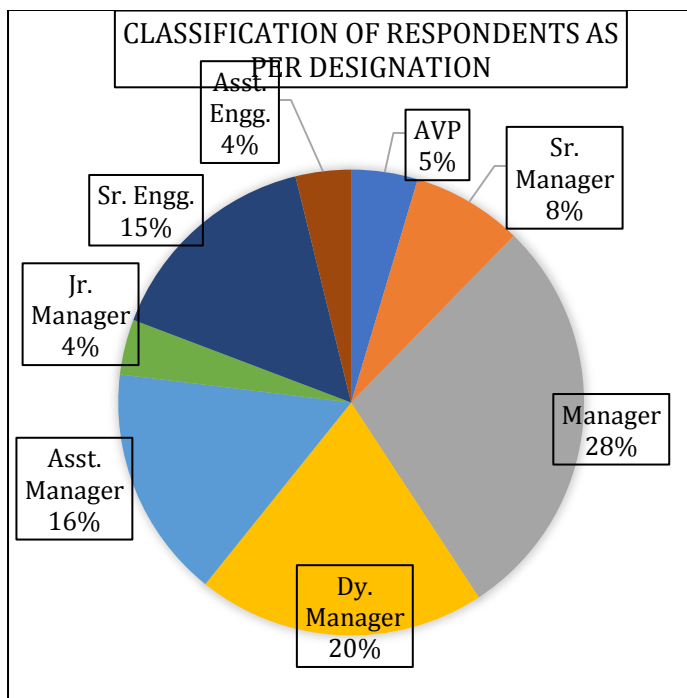


Figure: Classification of respondents as per designation

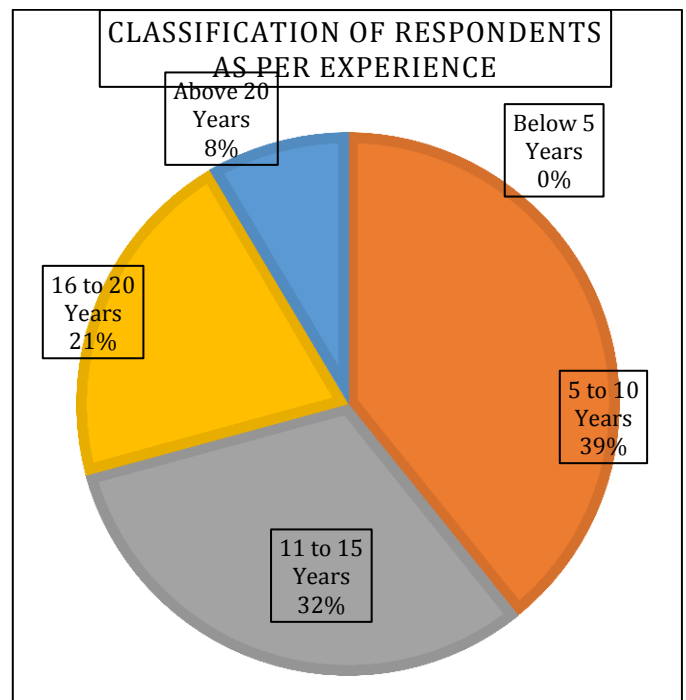


Figure : Classification of respondents as per experience.

The data, which were collected through a questionnaire design and a semi-structured interview, were analyzed using a five-point Likert scale method. In this method, five-point Likert scales (strongly disagree, disagree, neutral, agree and strongly disagree) were used in the TQM questionnaire. The questionnaire contains 27 statements to judge the critical success factors for TQM implementation.

A Likert scale is a type of rating scale which is used to measure attitudes or opinions of the people under review. Using this scale, respondents are asked to rate things on their level of agreement and knowledge.

A type of psychometric response scale in which respondents specify their level of agreement with a statement, usually on five points: (1) Strongly disagree; (2) I do not agree; (3) neither consent nor dissent; (4) I agree; (5) Full consent.

A Likert scale consists of a series of five Likert-type statements representing similar questions related to a critical success factor of TQM and combined into a single composite score/variable. Likert scale data can be analyzed as interval data, i.e. the mean is the best measure of central tendency. use means and standard deviations to describe scale.

### 3.3.2 Descriptive analysis

Five-points Likert scale method MEAN & STANDARD DEVIATION with T-TEST calculations with one example:

Opinion on statement	Rating	Agreed Managers in No.
A. Strongly Disagree	1	27
B. Disagree	2	43
C. Neutral	3	14
D. Agree	4	15
E. Strongly Agree	5	31
<b>Total</b>		<b>130</b>

Critical Success Factor	MEAN	MEAN 2	SD	T-TEST
Continuous improvement.	4.31	19.2	3.86	0.64
	<b>2.85</b>	10.45	2.76	
	4.42	20.33	3.99	
Top management commitment	<b>2.19</b>	6.18	2.00	0.32
	3.67	14.79	3.34	
	<b>2.49</b>	7.18	2.17	
	3.4	13.2	3.13	
	3.91	17.42	3.68	
	<b>2.62</b>	8.88	2.50	
	3.2	11.8	2.93	
	3.84	15.21	3.37	
Education and training	3.91	15.68	3.43	0.71
	<b>2.26</b>	6.75	2.12	
	<b>2.37</b>	7.03	2.16	
Employee Empowerment	<b>2.30</b>	7.27	2.23	0.63
	<b>2.85</b>	10.31	2.73	
	<b>2.48</b>	7.90	2.33	
Supplier Quality management	<b>2.22</b>	6.95	2.17	0.82
	3.92	17.05	3.62	
	<b>2.48</b>	7.88	2.32	
Recognition & Reward	<b>2.58</b>	8.11	2.35	0.79
	3.98	17.13	3.63	
Customer focus	3.35	12.38	3.01	0.27
	4.09	17.91	3.72	
	4.13	17.41	3.64	
	4.48	21.28	4.1	

$$\text{Mean} = ((27*1) + (43*2) + (14*3) + (15*4) + (31*5))/130$$

$$= 2.85$$

$$\text{Mean-2} = ((27*1^2) + (43*2^2) + (14*3^2) + (15*4^2) + (31*5^2))/130$$

$$= 10.31$$

Standard deviation (SD)

$$= \sqrt{(\text{Mean2} - \text{mean})}$$

$$= \sqrt{(10.31 - 2.85)}$$

$$= 2.73$$

#### T-TEST:

T-test is conducted by using excel in the following way:

All Mean values of individual critical success factor are selected for array-1

All Standard deviation of individual critical success factor values are selected for array-2

Two tail distribution and

Two sample equal variance (homoscedastic)

## 4.0 RESULT & DISCUSSION

### Critical Success Factors (CSF)

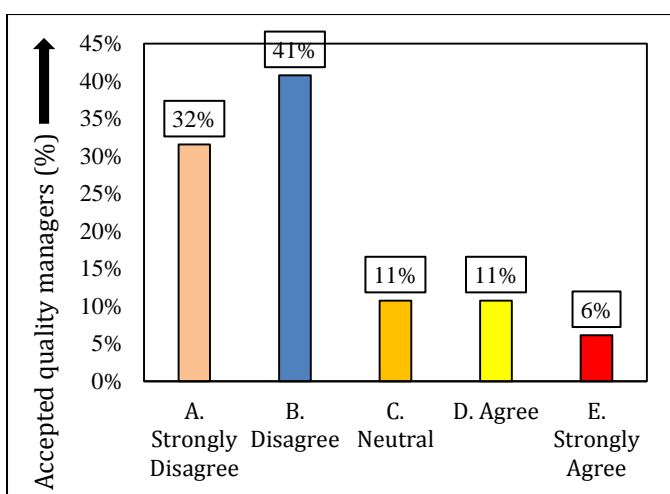
The weightage of each TQM factor was evaluated by using a set of questions and a five-point Likert scale. Quality managers were asked to rate their response from 1 to 5 whether they agreed or disagreed with the given statements. Using five-point Likert scale, the mean is measured as 3  $((1+2+3+4+5)/5)$ , therefore the mean is greater than 3, indicate that the statement is agreed. The above table shows the mean of each factor examined in the current study. Critical success factors are continuous improvement, top management commitment, education and training, supplier quality management, employee empowerment, recognition and rewards, and customer focus.

Most of the TQM managers were agreed that these factors play a significant role in achieving effective TQM implementation in an organization. This result is supported by parallel reaserch done in the same area. Top management commitment plays a significant role in promoting TQM implementation in steel sector. As far as Steel sector is concerned, top management commitment and customer focus play a significant role in the successful

implementation of TQM. For the win-win condition of TQM implementation, customer focus is a key element in addressing and resolving customer problems and complaints in companies that apply the TQM philosophy. The development of a quality policy must reflect the goal of the organization which includes corporate values, expectations and focus.

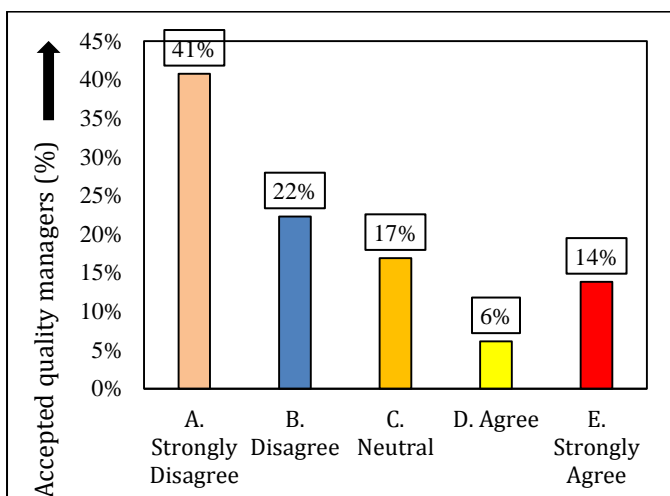
From the questionnaire survey, the following statements are identified as critical success factors for TQM implementation.

1. In your organization, TQM is implemented in all departments.



In the survey, in steel industries TQM is implemented in all departments. This statement is strongly disagreed by 32%, disagree by 41% only 11% & 6% quality managers are agreed & strongly agreed as shown in above chart.

2. Your organization is having competent TQM leaders.

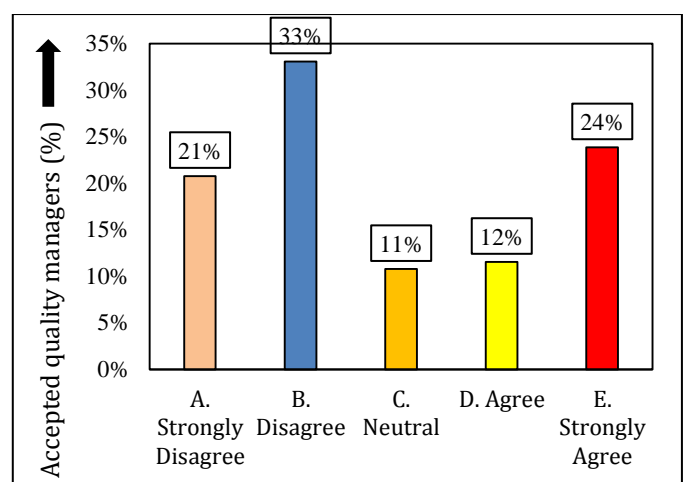


The above chart shows that, the steel industries are doesn't having adequate TQM leaders. Up-to 41% of

quality managers are strongly agreed and up-to 22% are agreed and 6% & 14% are agreed & strongly agreed respectively. It is shows that in steel industry there is no sufficient TQM leaders to implement TQM successfully.

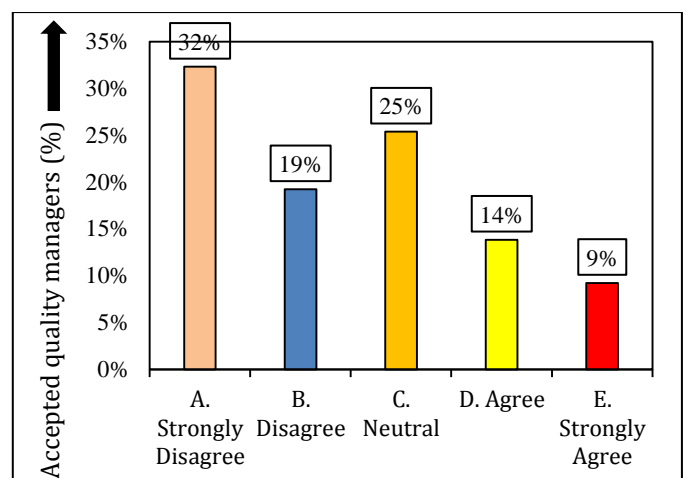
3. Sufficient TQM leaders are there in your blast furnace department.

In blast furnace department, TQM leaders are less in number 21% strongly agreed and 33% are agreed. As shown in above figure, more than 50% TQM leaders are saying that blast furnace department doesn't having sufficient TQM leaders to implement TQM successfully specially in small scale steel industries.



Due to insufficient of number of TQM leaders, the interaction level between TQM leader and the top management or the shop floor workmen is also not that much of efficient. It effects on contentious process improvement.

4. Excellent interaction between TQM leaders and shop floor workmen.



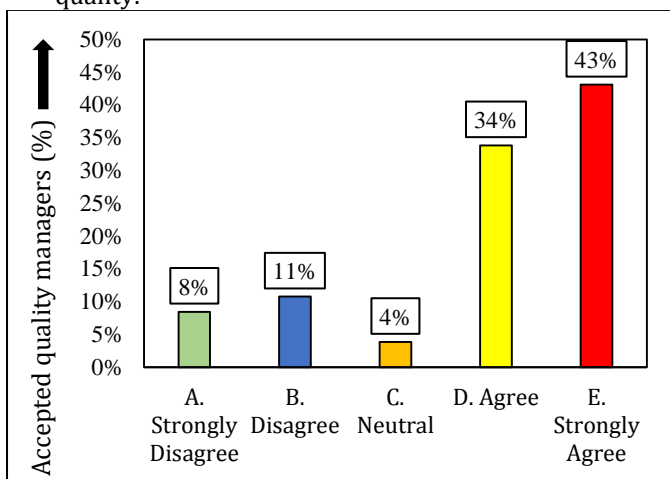
In survey, found that more than 50% of quality managers said that there is no good interaction between TQM leaders and shop floor workmen.

Interaction from shop floor workmen is most important to communicate the message or instructions top management to the shop floor workmen. And also finding the problems faced by the workmen, ideas collection from shop floor workmen to solve problems.

Interaction from top management is also most important to modify the process to solve the problems and continuous improvement in process technology.

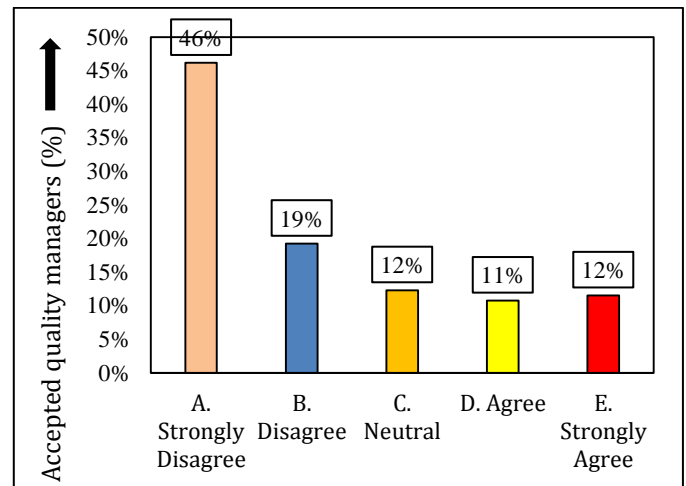
TQM leaders are having direct contact with top management and shop floor workmen. If the TQM leaders are not sufficient then the interaction from shop floor workmen will decrease as shown in the blow. The communication gap will create between top management and shop floor workmen it is most important for continuous improvement in process.

5. Short time breakdowns will deteriorate the product quality.



Short time breakdowns are deteriorating the quality of individual department product. It is strongly agreed by 43% and agreed up-to 34% of quality managers in the survey.

6. During short time breakdown time there will be a quick communication between internal customer and internal supplier.



During short time breakdown periods there will be a quick communication this statement is disagreed by TQM quality managers up-to 65% (strongly disagree 46% & disagreed 19%). Short time breakdowns will deteriorate the quality of product but the communication gap between internal customer and internal supplier shown in above figure.

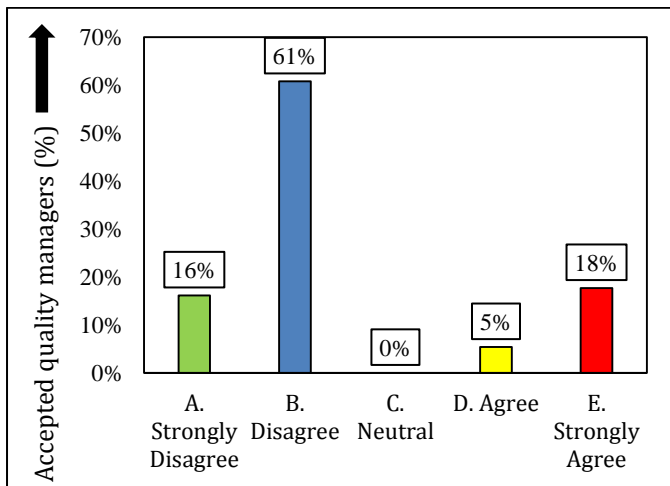
If there is a quick communication, then internal customer will take the necessary measures/actions to maintain same quality and avoid the problems. Poor quality of raw material, which are supplied by the internal supplier will reduce productivity and increase the cost of production.

In blast furnace process the raw material quality is most important (physical properties and chemical properties). The process is carried out by assuming the quality of raw material is good and constant. If any changes in raw material quality, rite action at rite time is most impotent to maintain product quality because whatever the actions are taken the reaction will start (minimum time to start reactions inside the furnace) after 2-3 hours. After starting reaction, result on quality will occur after 3-4 hours minimum sometimes 2-3 days (if rite action at rite time not taken).

7. In short time breakdown periods, internal supplier is storing the product (sinter/pellet/coke) separately till getting quality analysis report.

During short time breakdowns,

- a. The quality of internal supplier product (sinter/pellet/coke) will be deteriorated by short time breakdowns and
- b. Internal supplier will not be informing quickly to the internal customer.



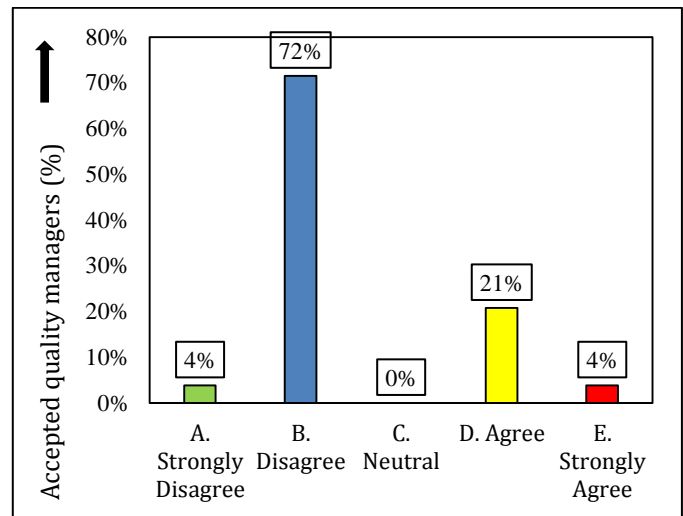
Even though “internal supplier is storing the product (sinter/pellet/coke) separately till getting quality analysis report” this statement is disagreed by 77% (strongly disagreed by 16% & disagreed by 61%) of quality managers as per my survey.

If poor-quality material is mixed with good quality this will create a problem in blast furnace. Most of the industries are stored separately till getting quality analysis when already internal customer i.e., Blast furnace is facing problems.

In some steel industries, every time during short time breakdown periods the poor-quality material is stored separately. After getting quality analysis it will supply to the internal customer by communicating with each other. The internal customer small amount of the poor-quality material is blended with large amount of good quality material by storing poor quality material separately in storage bins at stock house.

8. Well support of top management in investing capital for new technology.

Top management is well supported to invest capital for new technology implement this is disagreed quality managers by 72% & strongly disagreed by 4%. Only 21% are agreed & 4% are strongly agreed by quality managers.



Present market competition is mere so to give strong competition in the market for long term need to implement new technology is more important. It will give result that good control in quality, reducing production cost per unit is also reduce and increasing productivity.

### 5.0 Conclusion & Future Scope Of Work

#### 5.1.1 CONCLUSION

All the 7 parameters listed in the table above were identified by the quality managers who were interviewed as critical factors in the Indian iron and steel industry. These factors are continuous improvement, top management commitment, education and training, supplier quality management, employee empowerment, recognition and rewards, and customer focus.

Critical Success Factor	MEAN	MEAN2	SD	T-TEST
Continuous development.	3.86	16.66	3.53	0.17
Top management commitment	3.22	12.07	2.93	0.22
<b>Education and training</b>	<b>2.85</b>	9.82	2.57	0.37
<b>Employee Empowerment</b>	<b>2.54</b>	8.49	2.43	0.39
<b>Supplier Quality management</b>	<b>2.87</b>	10.62	2.71	0.37
Recognition & Reward	3.28	12.62	2.99	0.29
Customer focus	4.01	17.24	3.62	0.51

Table: TQM critical success factor’s average vales.



Through this research, I found that in the steel industry, each department should have at least 2-3 numbers. Head of TQM except HOD (Head of Department). TQM managers focus primarily on quality by finding the cause of poor quality, get feedback directly from the shop floor worker from time to time, and focus on continuous process improvement through the quality cycle, i.e. PDCA.

If the quality managers in each department are sufficient, in case of any problems (short-term failure or raw material change) in any department (sinter/pellet/coke oven), they immediately informed the TQM manager of the direct internal customer (blast furnace). Then this TQM leader (blast furnace) calculates the following

Answer: To what extent the physical and chemical properties of the raw material ie agglomerate/pellet/coke will change and how it will behave inside the furnace is calculated before affecting the final quality of the hot metal.

B. To what extent it will affect the quality of the blast furnace product ie hot metal and near SMS.

C. A constant quality of hot metal is maintained by

- i. Change of input raw material according to availability.
- ii. Change in load ratio (Sinter: Ore: Pellet)
- iii. Changing process parameters.

D. Sometimes TQM leaders in blast furnaces cannot control the quality, and if they refuse, they immediately report to TQM leaders in the superior department (SMS), then they go to PCM.

### 5.1.2 FUTURE SCOPE OF WORK

**Education and training** level in an organization and their instant feedback is improved by

- a. Motivating the worker who developing new plans to do work with friendly or who develops new process plans.
- b. Improvement in quality of daily routine work is enhanced through developing plans.

**Employee Empowerment** found to be improved by involving TQM managers in their departments by taking the following responsibilities in a lead role.

- a. Daily meetings with top management and HOD regarding how to achieve target production with quality by available raw material and their quality.
- b. Daily meetings with all other department TQM leaders regarding breakdowns (what is the problem?

Why occurred? Finding solutions doesn't repeat the same thing etc.) and what extent internal supplier quality is influenced on internal customer quality and finally external customer quality with respect to production cost.

**Supplier Quality management** has been enhanced by the organization by means of

- a. Fastest communication between departments (internal customer and internal supplier) regarding quality, to take rite action at rite time.
- b. Conducting institutional and on field trainings timely to all.

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