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## TQM AND QUALITY PERFORMANCE AT WORKING IRON AND STEEL FIRMS OF HYDERABAD-KARNATAKA REGION

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### ABSTRACT

*Steel production is considered as the forefront indicator of the economy in the contemporary world. India has been fetching an impressive share in the steel market. However, techno-economic efficiency has been somewhere pro-castigating competitive advantage of Indian iron and steel sector over competitors like China. As proved by Japanese, the left option for enhancing competitive advantage is quality management through Total Quality Management. The present study focused on extent of TQM practices and their impact on quality performance at iron and steel firms in Hyderabad –Karnataka region. The general objective of this research is to portray the picture of TQM at Iron and steel firms of India and also to address the quality issues of the firms at the backward region like Hyderabad-Karnataka. In this regard, study emphasizes relationship between widely used TQM practices and quality performance indicators using correlation and regression analysis.*

### KEYWORDS

steel, iron and steel industry, TQM, TQM practices, quality performance, quality performance indicators.

### 1. INTRODUCTION

**S**teel besides alloy is referred as the backbone of human civilization, as it has been serving mankind for its social, cultural, political and economic needs. At modern times, it is considered to be crucial for the development of any economy. Steel is shining up to the extent that any country's socio-economic development and standard of living is also determined by its per-capita consumption. According to World Steel Association, the global steel demand is estimated to realize 3000 million tons in 2025. The past growth in production and consumption of steel has largely been at the cornerstone of the heightened economic activity in the emerging economies, especially China, whose demand remains a pivotal factor driving the global steel industry.

The steel industry in India has also carved a rapid rise in production over the past few years through capacity enhancement. This resulted India becoming the third largest producer of crude steel (after China and Japan) and the largest producer of sponge iron in the world. However, India needs to further concentrate and improve its share in the major import markets, there are import markets where India has export competitiveness, but the exports are at relatively at lower levels. These markets are the potential growth drivers for iron and steel exports of India, which need to be strategically targeted.

However, the preceding facts in terms of techno economic efficiency of operations reveal that our steel making units are nowhere near their global competitors. In order to improve the sectoral performance and competitiveness there is an urgent need to address its basic structural and operational constraints irrespective of equity size and nature of operations. Therefore, in the epoch of buyer's market, irrespective of nature of organizations opened themselves to understand, learn and formulate a road map for quality is the only strategy left behind. This paved the way for the surge of quality and become the integral part of blood stream of the enterprises. The manifold competition of quality has pulled firms to search nitty-gritty to stay competitive. Accordingly, many enterprises made an attempt to adopt and implement a set of management practices that help them to improve the efficiency of organizational operations. One of the popular and effective management practices is TQM.

Though a lot of research work has been carried out in the field of ISO and TQM, it gives still an obscured picture of Indian iron and steel firms. This holds true too in case of regional industrial sector of Hyderabad- Karnataka region, where sponge iron firm's attrition rate is high. If no effort is made to assist the said firms especially at the Hyderabad- Karnataka region, attrition rate overtime can increase the casualties in the current business environment and make the region still weaker. Hence it is decided to carry out a detailed research with the help of a survey of iron and steel firms with a view to assess as to how are they managing the issue of Quality? And help firms to implement and practice TQM successfully and allow them to reap the benefits always been embraced by developed economies. At the outset, steel industry of Hyderabad- Karnataka region is having more than 30 registered units is competent with other developed regions of the country and have the capability to take away the tagline of backward region with the help of competitive advantage supplemented by implementing TQM in their systems of practice. Hence, the research was accepted to address these problems.

### 2. NEED AND IMPORTANCE OF THE STUDY

After all, the issue in Indian steel industry is not the shortage of resources, rich scientific and technical manpower but quenching the thirst of assistance and nourishment of firms through understanding and implementing TQM and allowing them gain the sustainable competitive advantage as that of the developed economies. The following two needs of the study to be accomplished are presented.

- a. Upgrade the total quality aspect of iron and steel firms in terms of organizational effectiveness so as to improve the economy by meeting the growing demands of domestic and global markets, domestic consumption and exports.
- b. Provide quality impetus of quality to the iron and steel firms of the economically backward regions like the Hyderabad- Karnataka region so as to debug the economy oriented regional imbalance.
- c. Contribute to the knowledge of TQM effectiveness.

### 3. STATEMENT OF THE PROBLEM

The study makes an attempt to know the extent of TQM implementation in iron and steel firms. Accordingly, this study is embodied as 'Examination of TQM influence on quality performance at Working Iron and Steel Firms of Hyderabad-Karnataka Region'

### 4. OBJECTIVES OF THE STUDY

1. To perceive TQM perspective of Indian Iron and steel industry.
2. To examine TQM influence on quality performance at working iron and steel firms in the select districts of Hyderabad-Karnataka region.

### 5. HYPOTHESIS OF THE STUDY

H0: There is no significant impact of TQM practices on Quality Performance.

H1: There is a significant impact of TQM Practices on Quality Performance.

## 6. SCOPE OF THE STUDY

The scope of the study encompassed working steel industry, iron and steel firms, Total Quality Management, Implementation, Organizational Effectiveness, Respondents of all the twenty-one working firms (out of 38 firms registered, 17 were locked out) in Ballari and Koppal districts of Hyderabad- Karnataka region. It also included the environment and ecosystem of steel industry in general and iron and steel firms in particular. Going further the causal relationship between TQM implementation and quality performance were measured by using established models and theories apart from scaling techniques. Specifically, the geographical region of the study was confined to Ballari and Koppal districts of Hyderabad- Karnataka region, as iron and steel firms are located in these two districts only.

## 7. METHODOLOGY

### TYPE OF RESEARCH

The proposed study adopted descriptive study, survey and cause and effect study.

### SAMPLING

Universe: i. Working iron and steel firms in Ballari and Koppal districts

Sample units: i. Executives.

ii. Non executives.

### COMPOSITION OF SAMPLES

Sl. No.	Categories of Respondents	Size	Sampling Technique
1.	Working iron and steel firms in Ballari and Koppal districts of Hyderabad Karnataka- region	21 firms	Purposive sampling
2.	Top Management and Executives. (05 respondents from each firm)	105	Judgemental Sampling
4.	Non- Executives (10 respondents from each firm)	210	Stratified Random sampling

### DATA COLLECTION

#### a. Secondary Data

The secondary data for the study included books, articles, reports, journals, magazines, newspapers, published and unpublished thesis, e-resources on the topic of the study.

#### b. Primary Data

The primary data was collected on the TQM implementation in the working iron and steel firms of Ballari and Koppal districts of Hyderabad Karnataka region under the study. It used the research instruments of questionnaire, schedule and personal interviewing of the respondents. E mail survey was also resorted to.

### PLAN OF ANALYSIS

The collected data was analyzed with the help of statistical tools and techniques such as averages, percentages, dispersion, correlation, multiple regressions, factor analysis, cluster analysis, Cronbach alfa and the like. Wherever necessary, tables, charts, graphs, diagrams and figures were used. SPSS and AAR software were also used for statistical analysis.

## 8. LIMITATIONS OF THE STUDY

- The validity and reliability assessment and analysis performed are based on 30 selected companies only.
- For measuring TQM examination time tested and universally acceptable measurement tools are very rare. Therefore, the measurement results under the study are only approximate are not accurate.
- At times "what is" (fact) is equated with "what should be" (value)

## 9. LITERATURE SURVEY

Zhihai Zhang (1993) in his research work investigated the effects of TQM implementation on overall business performance in Chinese manufacturing firms and obtained a TQM implementation model for Chinese manufacturing firms. The study was carried out by

- Developing TQM implementation constructs and TQM practices;
- Developing overall business performance constructs;
- Designing evaluation models, to measure the extent of TQM implementation, TQM practices and impact of TQM implementation on overall business performance.

The study found out that TQM implementation has positive effects on overall business performance and not necessarily all TQM elements to be present to ensure the success of the TQM programs and overall business performance

Shivraj Kumar (2014) in his research work tried to determine the extent to which TQM and organizational effectiveness are correlated to each other and expounded how TQM impacts various phases of business planning. The study considered very general constructs of TQM implementation and organizational effectiveness in its way. TQM constructs encompass commitment, culture, continuous improvement, co-operation, customer focus and control. As per their nature, some do not confirm the characteristics of construct

Yogesh A Chauhan (2013) in his research work gave a detailed picture of quality management issue of manufacturing SMEs in terms of TQM apart from ISO 9000 and other off –record practices. It emphasized the exploration, development and ranking of constructs in TQM, benefits and difficulties and help the SMEs to grow in terms of their business, working system, employee satisfaction, customer satisfaction etc.

Darshana S Shiroya (2015) surveyed on "TQM practices and performance in ISO certified manufacturing facilities". The researcher was curious in exploring, developing and examining TQM practices/ critical factors and their impact on quality, business and organizational performances. Extensive literature was reviewed in exploring and developing the plausible 16 elements of 10 TQM practices.

Saraph et al. (1989) conducted a study on "A Instrument for Measuring the Critical Factors of Quality Management". They explored, examined and developed eight CSFs of quality management referring to twenty-two manufacturing and service organizations in the USA.

Shekoufeh Nekouezadeh et al. (2013) conducted a research on 'the impact of TQM on organizational performance of telecommunication industry in Iran'. The principal aim was to determine the correlation between TQM practices and the organizational, quality and innovation performances. Researchers explored, examined and developed TQM practices and variables of package of performances.

Flynn et al. (1994) conducted a research on "A framework for quality management research and an associated measurement instrument". They explored and developed six CSFs of TQM which encompasses of quality information system, process management, product design, workforce management, supplier involvement and customer involvement. They expounded that top management support creates a congenial environment for quality activities to surge.

Ali Bakhit Jaafreh. (2012) in his research work 'the effect of quality management practices on organizational performance on Jordan banking sector' set an aim to examine the extent to which quality management practices and organizational performance are correlated and to determine the impact of the practices on organizational performance.

Powell (1995) made a study on "Total quality management as competitive advantage: A review and empirical study". He revealed that the successful implementation of TQM is dependent on certain tactics, behaviour, features and TQM tools and techniques like top management commitment, effective communications, employee involvement, training in quality, flexibility in manufacturing, process management, benchmarking and performance measurements for realizing competitive advantage.

S D Kalpande et al. (2013) conducted a survey on 'Business performance of SMEs in Vidharabha and Khandesh region of India: A TQM implementation'. Researchers aimed at identifying importance of factors and sub-factors for successful implementation of TQM in SMEs. They explored and examined TQM components and factors influencing TQM implementation from the existing literature followed by using Analytic Hierarchy Process (AHP) for prioritization and operationalization.

Fuzi Abusa (2011) conducted a study on ‘TQM implementation and its impact on organizational performance: a case study of Libya’. He examined the correlation among TQM elements, TQM and organizational performance, Size & ISO 9000 and TQM implementation. The result showed that none of the six TQM elements have correlated with all organizational performance indicators, except Supplier quality management.

Antony Jiju, et al. (2002) conducted a research study on ‘Critical success factors of TQM implementation in Hong Kong industries’. This is an empirical study on the identification of the critical success factors (CSFs) of TQM implementation in Hong Kong industries. Through a thorough and detailed analysis of the literature, 11 success factors with 72 elements were identified to develop a questionnaire.

Yogesh A Chauhan et al (2014) surveyed ‘Perceptions of SMEs towards the key elements of TQM’. They focused on examining and exploring the level of awareness and the importance SMEs have over key elements of TQM.

Bayazit (2003) conducted a study on ‘Total quality management practices in Turkish manufacturing organizations’. He expounded that upper management support, employee involvement and commitment, customer focus, quality education and training, teamwork and use of statistical techniques are the most critical factors for the successful TQM implementation in Turkish manufacturing organizations.

A Al Nofal et al (2013) conducted a study on ‘Critical factors of TQM: an update on the literature’ with an objective to present the most important factors of TQM implementation often emphasized by researchers, supported by the discourses of quality gurus. A wide range of comprehensive elements of TQM have listed.

Z. Irani, et al. (2004) surveyed on ‘Total Quality Management and Corporate Culture: constructs of organizational excellence’. In this effort, the researchers discuss the concept of corporate culture, place this social construct within the arena of TQM and highlight the relationships that exist among culture quality and competitiveness. T

Faisal Talib et al (2012) conducted a research on ‘Pareto Analysis of TQM factors critical to success for service industries’. They made an attempt to sort out critical success factors of TQM according to frequencies of their occurrences by applying Pareto analysis tool and list out vital few critical success factors of TQM.

Phan Chi Anh & Yoshiki Matsui (2006) made a research on ‘An empirical analysis of Quality management practices in Japanese Manufacturing Companies’. The aim was to investigate the utilization of quality management practices and its impact on quality performance and competitive performance.

Kanagi Kanapathy (2013) surveyed on ‘Critical factors of quality management used in research questionnaires: a review of literature’. He opined that quality expounders and gurus have used different combinations of critical factors or constructs of TQM to design questionnaires and to measure quality management practices in different parts of the world.

**10. RESULTS**

**1. DESCRIPTIVE STATISTICS ON TQM PRACTICES**

The following table shows the distribution of the responses against the list of TQM practices.

**TABLE 1: SHOWING FREQUENCY DISTRIBUTION OF RESPONSES AGAINST THE LIST OF TQM PRACTICES**

ID	TQM Practices	Frequency (Yes)	Percentage	Frequency (No)	Percentage
A	Top Management Commitment	311	98.7	4	1.3
B	Customer Focus	299	94.9	16	5.1
C	Employee Empowerment/involvement	301	95.6	14	4.4
D	Supplier Partnership	247	78.4	68	21.6
E	Continuous improvement	269	85.4	46	14.6
F	Quality Management	302	95.1	13	4.1
G	Recognition and Reward	266	84.4	49	15.6
H	Education and Training	262	83.2	53	16.8
I	Process Management	279	88.6	36	11.4

**CHART 1: SHOWING FREQUENCY DISTRIBUTION OF RESPONSES AGAINST THE LIST OF TQM PRACTICES**

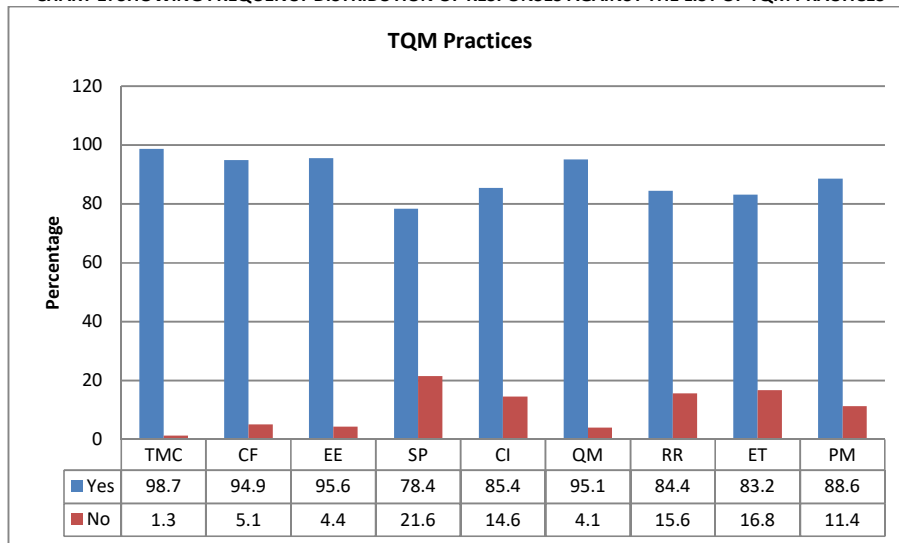


Table 1 illustrates the perception of respondents against list of TQM practices. On an average of approximately 90% of the respondents agreed that all the listed practices belonged to TQM. Among the practices, Top Management Commitment (TMC) led the response with 98.7% followed by Employee Empowerment (EE) and Quality Control (QM) with 95.6% and 95.1% respectively. The least response was given to Supplier Partnership (SP) with 78.4% followed by Education and Training (ET) and Recognition and Reward (RR) with 83.2% and 84.4% respectively. The remaining practices Customer Focus (CF), Process Management (PM) and Continuous Improvement (CI) placed in between with 94.9%, 88.6% and 85.4% respectively. This indicates most of the respondents are aware of TQM practices and have the ability to practically respond to the technicalities of TQM.

2. MEAN AND STANDARD DEVIATION OF TQM PRACTICES

TABLE 2

Variables	Maximum	Minimum	Mean	Standard Deviation
<b>TQM Practices</b>				
Top Management Commitment	5.00	3.14	4.24	0.35
Customer Focus	5.00	3.20	4.14	0.38
Employee Empowerment	5.00	2.25	4.07	0.42
Supplier Partnership	5.00	2.86	4.09	0.42
Continuous Improvement	5.00	3.00	4.18	0.40
Quality Control	5.00	3.00	4.34	0.52
Recognition and Reward	5.00	2.33	4.13	0.41
Education and Training	5.00	2.75	4.16	0.43
Process Management	5.00	2.71	4.08	0.36
TQM Practices (overall)	5.00	3.33	4.14	0.31

3. CORRELATION BETWEEN TQM PRACTICES AND QUALITY PERFORMANCE MEASURES

TABLE 3: CORRELATION BETWEEN TQM PRACTICES AND QUALITY PERFORMANCE MEASURES

TQM Practices (Independent Variables)	Quality Performance Measures					
	QP1	QP2	QP3	QP4	QP5	QP6
TMC	0.216**	0.247**	0.382**	0.157**	0.210**	0.195**
CF	0.407**	0.410**	0.398**	0.253**	0.195**	0.332**
EE	0.565**	0.358**	0.456**	0.464**	0.354**	0.576**
SP	0.356**	0.314**	0.341**	0.244**	0.319**	0.300**
CI	0.498**	0.335**	0.382**	0.241**	0.097	0.333**
QC	0.262**	0.285**	0.230**	0.129*	0.92	0.107
RR	0.528**	0.384**	0.413**	0.432**	0.262**	0.430**
ET	0.329**	0.211**	0.286**	0.233**	0.179**	0.264**
PM	0.307**	0.160**	0.176**	0.236**	0.253**	0.209**

\*\* . Correlation is significant at the 0.01 level (2-tailed).

\*. Correlation is significant at the 0.05 level (2-tailed).

(Qp1-Defect rate, QP2-Rework, QP3-Cost per product, QP4-Customer complaints, QP5- Cycle time and QP6-Delivery time)

Table 3 expounds that QP1, QP2, QP3 and QP4 led the preceding matrix by getting correlated with all the nine TQM practices followed by QP6 and QP5 with eight and seven TQM practices respectively. The Correlation matrix shows that highest correlation between variables is EE and QP1 with r=0.576. The second highest correlation is between EE and QP1 with r= 0.565. The third highest correlation is between RR and QP1 (r= 0.528). Among all independent variables TMC, CF, EE, SP, CI, ET and PM are correlated with all the six dependent variables. QC got correlated with QP1, QP2, QP3 and QP4 only.

4. REGRESSION ANALYSIS

To test the hypothesis first researcher has tested over all regression model by taking all the dependent variables (i.e. Defect rate, Rework, Cost per product, Customer complaints, Cycle time and Delivery time) and check that whether they are individually affected by conducting multiple regression analysis. The results are discussed below:

4.1 REGRESSION MODEL

H10: There is no significant effect of TQM practices on quality performance.

TABLE 4: SIGNIFICANT RELATIONSHIP BETWEEN TQM PRACTICES AND ORGANIZATIONAL EFFECTIVENESS IN TERMS OF QUALITY PERFORMANCE MEASURES

TQM Practices (Independent Variables)	Quality Performance Measures			
	B	Std. Error	B	t
Constant	-1.316	0.518		-2.541
Top Management Commitment (TMC)				
Customer Focus (CF)				
Employee Empowerment (EE)	1.086	0.147	0.564	7.372*
Supplier Partnership (SP)				
Continuous Improvement (CI)				
Quality Control (QC)				
Recognition and Reward (RR)	0.582	0.149	0.290	3.910*
Education and Training (ET)				
Process Management (PM)	-0.362	0.138	-0.160	-2.623**
R	0.639			
R2	0.408			
F	23.331			
Sign. (p value)	0.000			

Note: Significance: \* p<.001; \*\* p<.01; \*\*\* p<.05.

Table 4 shows that quality performance is explained by the regression model as evident from R-square value of 0.408. The model indicates that 40.8% of the variations in quality performance can be explained using TQM practices. The p-value is less than 0.05; it can be argued that the model is valid for using linear regression. Since p-value is less than 0.05, the null hypothesis has been rejected and there exists the relationship between quality performance and TQM practices. The regression coefficient expounds that the TQM practices are having capacity to predict quality performance and the extent of the contribution power. Employee Empowerment, Recognition and Reward and Process Management are statistically significant with p-value less than 0.05. So at 5% significance level of significance null hypothesis is rejected which shows that there is a relationship between these three factors and quality performance and alternative hypothesis is accepted which is as under.

H1: There is statistically significant impact of TQM practices on quality performance measures.

11. FINDINGS WITNESSED BETWEEN TQM PRACTICES AND QUALITY PERFORMANCE

In this study Quality performance improvement is measured by,

- a. Decrement in defect rates
- b. Decrement in rework

- c. Decrement in cost per unit
- d. Decrement in customer complaint
- e. Decrement in cycle time and
- f. Decrement in delivery time

Out of the nine TQM practices empirically identified in the study, the TQM practices which have influenced on quality performance are varied as discussed below:

**TABLE 5: REGRESSION COEFFICIENT BETWEEN SIGNIFICANT TQM PRACTICES AND QUALITY PERFORMANCE**

ID	Organizational Effectiveness Indicators	Regression coefficient (R Square)	Variance in%	Significant TQM Practices
QP	Quality Performance	0.408	40.8	EE, RR
QP1	Defects rate	0.4040	40.4	TMC, EE
QP2	Rework	0.219	21.9	CF
QP3	Cost per product	0.289	28.9	EE, PM
QP4	Customer complaints	0.297	29.7	EE, RR
QP5	Cycle time	0.195	19.5	EE, CI
QP6	Delivery time	0.400	40.0	EE, PM

1. TQM practice, Employee Empowerment has an effect on quality performance in terms of:
    - a. Decrement in defects rate (QP1)
    - b. Decrement in cost per unit (QP3)
    - c. Decrement in cost per product (QP4)
    - d. Decrement in cycle time (QP5)
    - e. Decrement in delivery time (QP6)
  2. TQM practice Recognition and Reward has an effect on quality performance in terms of:
    - a. Decrement in defects rate (QP1)
    - b. Decrement in rework (QP2)
    - c. Decrement in cost per unit (QP3)
    - d. Decrement in cost per product (QP4)
    - e. Decrement in delivery time (QP6)
  3. TQM practice Supplier Partnership has an effect on quality performance in terms of:
    - a. Decrement in cost per product (QP4)
    - b. Decrement in cycle time (QP5)
    - c. Decrement in delivery time (QP6)
  4. TQM practice Continuous improvement has an effect on quality performance in terms of:
    - a. Decrement in defects rate (QP1)
    - b. Decrement in cost per product (QP4)
    - c. Decrement in cycle time (QP5)
  5. TQM practice Process Management has an effect on quality performance in terms of:
    - a. Decrement in rework (QP2)
    - b. Decrement in cost per unit (QP3)
    - c. Decrement in delivery time (QP6)
  6. TQM practice Top Management Commitment has an effect on quality performance in terms of:
    - a. Decrement in defects rate (QP1)
    - b. Decrement in cost per unit (QP3)
  7. TQM practice Customer Focus has an effect on quality performance in terms of:
    - a. Decrement in rework (QP2)
  8. TQM practices Quality control and Education and Training have no an effect on quality performance.
- Thus, these findings show that out of nine TQM practices seven play role in improving quality performance of the organization. They are:
1. Employee Empowerment (EE),
  2. Recognition and Reward (RR),
  3. Supplier Partnership (SP),
  4. Continuous Improvement (CI),
  5. Process Management (PM),
  6. Top Management Commitment (TMC), and
  7. Customer focus (CF),

The overall regression model showing relationship of TQM practices and quality performance (Table 6.) shows that out of the above seven, TQM practices EE, RR and PM are significant. SP, CI, TMC and CF are not statistically significant. They explain 40.8% variance (F= 23.331, t= 2.541 p<.001).

**12. CONCLUSION**

TQM is not confined to production process and production & quality departments only; instead it is beyond all these. The employees of Indian iron and steel industry are aware of the holistic and strategic nature of TQM. Most of firms of the industry follow, quality management practices; but with different nature. Among the contemporary TQM practices, Top management commitment and Employee empowerment are popular ones in the industry; but the firms have no idea of the impact of practices supplier partnership in quality management. Among the contemporary TQM tools and techniques, the firms still are fond of traditional tools such as cause and effect diagram, quality circles; but the modern and advanced techniques such as quality function deployment, failure mode effect analysis are remote in their knowledge base. The TQM practices namely Employee empowerment and Recognition and reward jointly helps to improvise organizational effectiveness in terms of quality performance by reduced defects rate and rework, thereby reduced cycle time and improved delivery time and ultimately reduced cost per product and customer complaints. The study reveals that there is need for focusing over empowering and rewarding the employees of the iron and steel firms along with support in process management, which are acting as the nerves of quality management as per the study.

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