Analysis of Critical Parameters and Identification of Stakeholders in Steel Manufacturing Industries: A Pilot Study

RITU SHRIVASTAVA[1],Dr.(Mrs) SHIENA SHEKHAR[2]

PhD SCHOLAR BHILAI INSTITUTE OF TECHNOLOGY,DURG[1]
PROFESSOR BHILAI INSTITUTE OF TECHNOLOGY, DURG2

ABSTRACT

The purpose of this paper is to identify the stakeholders in steel producing industries. It also aims to find out the critical and subcritical parameters to evaluate the productivity improvement of manufacturing units in Chhattisgarh. To evaluate productivity various steps are involved development of questionnaires, data collection, and data analysis. Data analysis is done using different methods for finding reliability, validating and finding internal consistency of the data collected.

Keywords: Quality function deployment, stakeholders, reliability, steel industries

INTRODUCTION

Quality function deployment (QFD) is ‘‘an overall concept that provides a means of translating customer requirements into the appropriate technical requirements for each stage of product development and production (i.e., marketing strategies, planning, product design and engineering, prototype evaluation, production process development, production, sales)’’ (Sullivan, 1986b). Since its initial development in Japan in the late 1960s and early 1970s, especially since its rapidly spreading to the US in the 1980s and later to many industries in many nations, a vast literature on QFD has evolved. To suit the different needs of QFD researchers and practitioners, its literature needs categorizing and reviewing. This is a meaningful but difficult work that seems having not been done yet.

On-going period saw extraordinary changes in designing training. Prior training was thought of as a not-for-profit administration. The multiplication of globalization progression and the new victories of the ever-energetic modern rivalry relocated the field of designing instruction to a productive one. Specialized training assumes a significant part in the prudent advancement of any country. For a fast furthermore, supported improvement of a country, the pre-essential is to have areas of strength for a very capable specialized labour supply. The quantity of Steel and Iron industries were deficient to meet the prerequisites of specialized labour notwithstanding store deficiencies, the approach of privatization must be carried out. This brought about the expanding of countless self-funded private organizations. Presently the specialized training had extended quantitatively however the nature of instruction bestowed had been crumbling. To recognize the potential regions for development of value, an experimental review looking for the view of the partners of specialized instructive foundations has been directed. To direct the experimental review, basic boundaries and hence factors were recognized from conversations with specialists and writing audit and afterward

review surveys were created in two sections. The initial segment comprised of the foundations data and the subsequent part was on 'How the school is performing with regard to these factors'.

STRUGGLE OF INDUSTRIES

Latest thirty years have been the extensive stretches of cruel challenge for all of the relationship across the globe. The Indian endeavours likewise couldn't move away from this time of globalization. With the section of worldwide associations, Indian Manufacturing Industries are defying energetic challenge. Delivering organizations are contributing a ton towards the turn of events, improvement and extension in Indian economy. The serious contention has been found concerning negligible cost, chipped away at quality and things with high execution challenge. Additionally, more restricted lead times, more restricted progression times, and diminished inventories have provoked growing solicitations on the affiliation's preparation, adaptability and flexibility. (Rene van Berkel, et.al. 2007).

A part of the critical inadequacies of Indian collecting organizations are: sad responsiveness to changing business area circumstance, inferior quality, low effectiveness, less complement on prosperity limits, sad cost responsiveness of creation systems, less than ideal affiliation structure, low capacity and data on specialists, low creation motorization, unsupportive working environment, non-progression of safe practices, high work inflexible nature. (P. Duxson et.al.2007).
The Indian collecting organizations need to take on cost suitable gathering frameworks to be ferocious. While completing TPM programs, The Indian collecting adventures are facing hardships to get a handle on business monetary issues, aversion to developing practices, expert's hesitance to the change. (Irene J. Petricka et.al.2004).
It has been observed that there is no reasonable TQM system and need of preparing and self-awareness is the fundamental issue confronted. Additionally, representatives are not spurred as a result of absence of reward conspire and the executive’s system. Subsequently it is the need of hour that Indian assembling businesses need to move forward by embracing the proactive cycles and practices. The current concentrate fundamentally looks at the different variables which impact the working and monetary exhibition of fabricating enterprises, taking Quality, Productivity and Security together into account. In this situation, this study is legitimate and applicable.

DETAILS OF WORK DONE EARLIER

A large number of related works are available in the literature; a concise number of works are reviewed & summarized below:
Untawale S.P. et al. (2004) Seven (7) Critical Success Factors for performance improvement were identified in the study of the Indian manufacturing industries. Additionally, he created a model for Indian manufacturing industries to increase quality and productivity.

Shrivastava S. et. al.(2014) For the purpose of achieving the objectives of quality management, conducted study on the Indian cement industries and identified 9 (nine) Critical

Success Factors, each of which contains 43 qualities.carried out his research on Indian cement industries & has Identified 9 (nine) Critical Success Factors consisting of 43 attributes for attaining Quality management goals.

Manisha Lande et.al. In their study for Indian companies, identified 17 Critical Success Factors for Lean Six Sigma in Small and Medium Enterprises. She conducted exploratory study and determined characteristics for the TQM management approach's Critical Success Factors for Quality and Productivity Improvement.
Minhaj A.A. Rehman et.al. (2015) carried out his studies on Automobile industries. He identified 12 critical success factors with 42 variables for Green Supply Chain Management in automobile industries in Maharashtra, India.
Vinod S. Gorantiwar et.al. (2014) carried out his research in sponge iron industries for Quality-Productivity management and identified 50 attributes of prime consideration.

Amol Lokande(2014) has carried out his studies on Indian industries with respect to remanufacturing industries. He identified 10 Critical Success Factors including 74 variables for establishment of Remanufacturing Industry in India.

M.D. Singh et.al. (2006) have proposed Knowledge Management involves strategies & processes of identifying, capturing & leaveraging knowledge to enhance competitiveness. He collected data from 71 industries to access the impact KM practices in Indian manufacturing Industries.
Aleksander Janeset et al. (2013). The causal relationships between key performance measures that significantly contribute to the advantages of the business process exploitation have been examined and clarified.
Ahuja et al. in 2008. explains the difficulties faced by Indian industrial enterprises in transitioning to proactive Total Preventive Maintenance activities were assessed by They developed the Critical Success Factors to remove barriers and apply TPM in order to meet the global challenge. According to their proposed model, the key impediments to implementation are organisational, cultural, behavioural, technological, operational, financial, and departmental barriers.
Ayoob Ahmed Wali et al. (2000) presented the economic environment of liberalisation and globalisation. The Indian software business has gained recognition on a global scale for its competitiveness, which is based on quality characteristics including punctuality and delivery reliability. Critical Success Factors for TQM are identified through their case study work.
Darshak Desai et.al (2012) highlighted Critical Success Factors of six sigma implementation in Indian manufacturing industries. They carried exploratory research work with the help of questionnaire to study the impact of different CSFs of six sigma implementation in different sizes & sectors of Indian manufacturing industries.
Harjeev K. Khannaet.al. (2011) have evaluated basic achievement elements of Complete Quality Administration and positioned them for Indian Assembling Businesses. Research instrument utilized was an efficient poll. They presumed that cycle the executives, top administration authority, client center are the main three variables for execution of TQM in Indian assembling enterprises.

STUDY METHODOLOGY

The purpose of this pilot study was conducted to identify those stakeholders' voices of STEEL PLANTS in Chhattisgarh that have higher degree of satisfaction for the evaluation of improvement in productivity factors important for better quality. The following are the steps followed.

1. IDENTIFICATION OF THE STAKEHOLDERS OF STEEL PLANTS.

To develop a framework of the system design characteristics, considering only one stakeholder is insufficient. So, it was decided that four important types of stakeholders will be considered for this research work. The four stakeholders of steel manufacturing units identified were as follows:

- Owners
- Inventory Managers
- Operations Managers
- Stock Managers

Critical Parameters identified through Experts & Literature Review

S.No	Critical Parameters	Sub-Parameters
1.	Production Improvement	• High Capital Productivity • High Productivity of Each Employee. • High Productivity of Assets (Machines, equipment etc.). • Equipment availability for longer duration • Optimum human resource utilization. • Lower Product development time. • Low Machine line down time. • Low supplier lead time (Supplier Performance).
2.	Quality Performance	• Less Number of defects in the finished product • Less Rework and waste. • Optimum Inventory Utilization • Low Cost of Quality.
3.	Employee Satisfaction	• Higher Value addition per employee. • High job satisfaction of employees

		• Capacity building (competency improvement) of employees. • Better Environmental compliance. • Better Safety of employees. • Positive change in corporate culture. • Better Quality of work life.
4.	Financial Improvement	• High Return on Investment (Profit Margin & Reserves) • Top line (revenue & gross sales) growth. • Sustainable increase in market share. • Bottom line (net profit) growth. • High Processes efficiency. • Less Variation in process. • Higher process accuracy rate.
5.	Time Dimension	• Reduced Material procurement time. • Low Order – process time. • Low Process through time. • High Inventory turnover (Material Productivity). • High flexibility in operations / system.

In-depth analysis and discussions of these critical parameters led to the realization that these parameters almost identified with all steel manufacturing industries' parameters and hence they are finally were adapted as critical parameters. These critical parameters were also used to evaluate the productivity improvement of manufacturing units in Chhattisgarh where the store manager was considered as the stakeholders. In this case during the filling up of the questionnaires, the store managers were unable to answer certain variables related to Financial Resources, R&D, HR, O&G etc. They had to consult with Owners, Operation Managers. Also, to get the overall critical success factors of steel producing Plants considering only one stakeholder was not sufficient. Hence it was concluded that the steel manufacturing industries' parameters can be developed to analyse the owners and operation managers' views. The critical success factors/ parameters for analysing the store managers, inventory managers and operation managers' views were also identified separately for each of them through discussion with experts and from survey. The critical success factors thus identified are as follows:

A. For OWNERS/administrators as stakeholders, the critical success factors identified

- Organization and Governance - (O&G)
- Financial Resources - (FR)
- Physical Resources (Central facilities) - (PR)
- Human Resources (EMPLOYEES) - (HR (E))
- LEADERSHIP -(L)
- Research and Development and Interactions Efforts - (R&D)

B. For INVENTORY MANAGERS stakeholders, the index developed was

- STORE –(S)
- GOODS Content -(GC)
- WAREHOUSE Structure –(WS)
- ORDERS PLACED --(OP)
- EVALUATING ARRIVALS –(EA)

C. For OPERATIONS MANAGER stakeholders, the index developed was

- PLANNING–(P)
- CONTROLLING/IMPROVING –(C/I)
- ORGANIZING–(O)
- STAFFING –(SI)
- DIRECTING- (D)
- HOLDING INVENTORY—(HI)

D. For STOCK MANAGERS stakeholders, the index developed was

- MOTIVATING SALES TEAM –(MST)
- CREATING BUSINESS STRATEGIES – (CBS)
- COST MINIMIZATION–(CM)
- TEAM LEADERSHIP–(TL)
- BUDGETING AND FORECASTING—(B&F)

2. DEVELOPMENT OF QUESTIONNAIRES

Based on the steel manufacturing industries' parameters and the variables /items identified the questionnaires for owners were developed. In addition, the critical success factors for the stakeholders – store managers, inventory managers and operation managers', were also identified for each of them separately according to their requirements. For owners, inventory managers, operation managers and stock managers' perspectives, one set of questionnaires in each were developed. Thus, a total of four sets of questionnaires were developed separately with consultation with experts like owners, managers of different divisions, supervisors and rest employees.

3. DATA COLLECTION

For the pilot study, 50 respondents in total of stakeholders were selected from various steel producing plants for the survey. They were asked to respond on a scale ranging from 1-5 Likert scale. The priorities were quantified by assigning weightings 1,2,3,4 and 5 for the reactions "strongly disagree/No idea" (0%), "Disagree" (1-25%), "Moderately Agree" (26-50%), "Agree" (51-75%) and "Strongly agree" (76-100%) respectively. Of the total send, 50 questionnaires (100%) were found to be complete and considered in case of the stakeholders. The data was collected across India through postal/ e-mail/ personal contacts by attaching a sample questionnaire comprising of questions.

Summary of details of Data Collection- Sample Size

Mode of obtaining Responses	Stakeholders – Responses			
	owners	Inventory managers	Operations managers	Stock managers
Postal	5	5	4	2
E-mail	5	2	2	2
Personal Contacts	6	3	2	2
TOTAL	16	10	8	6
GRAND-TOTAL	50			

Summary of details of Respondents from different steel plants of Chhattisgarh

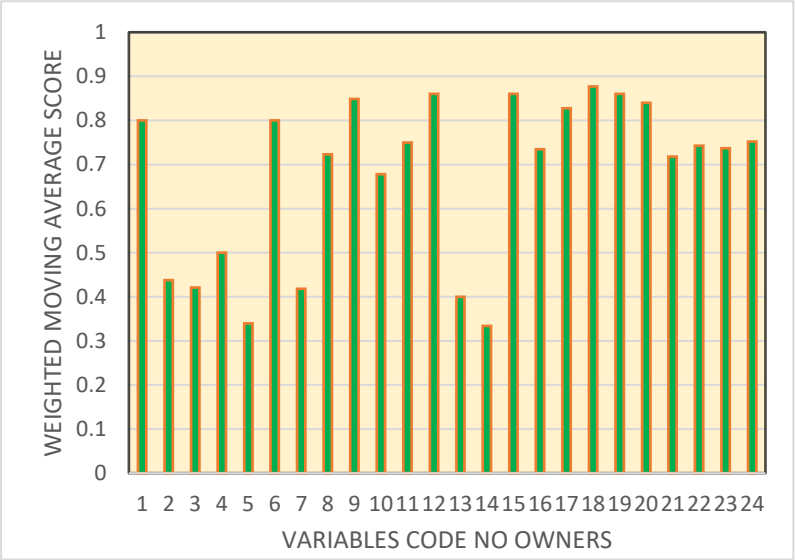
S.No.	Stakeholders	Total Respondents Considered				
		Steel plants in Durg	Steel plants in Bhilai	Steel plants in Raipur	Steel plants in Raigarh	Total
1.	OWNERS	5	4	5	2	16
2.	INVENTORY MANAGERS	5	2	2	3	12
3.	OPERATIONS MANAGERS	4	2	3	3	12
4.	STOCK MANAGERS	3	2	3	2	10
Total		17	10	13	10	50

The data from different categories of stakeholders were collected through different modes. The details of the sample size, distribution to the different steel manufacturing plants and summary of the questionnaires survey is given.

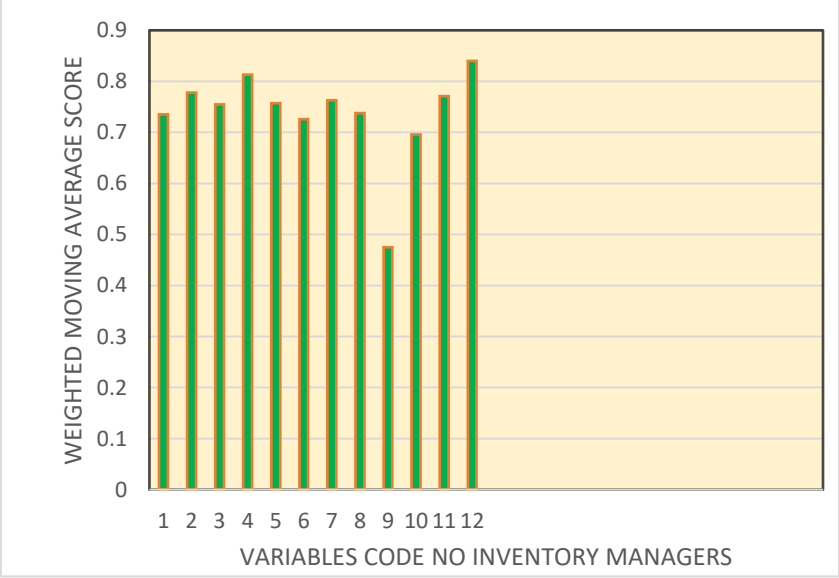
4. DATA ANALYSIS.

To obtain a quantitative and statistically proven identification of the requirements of the stakeholders the fifty useful responses were tested for validity and reliability by finding Cronbach alpha, weighted moving average, KMO, Bartlett test.

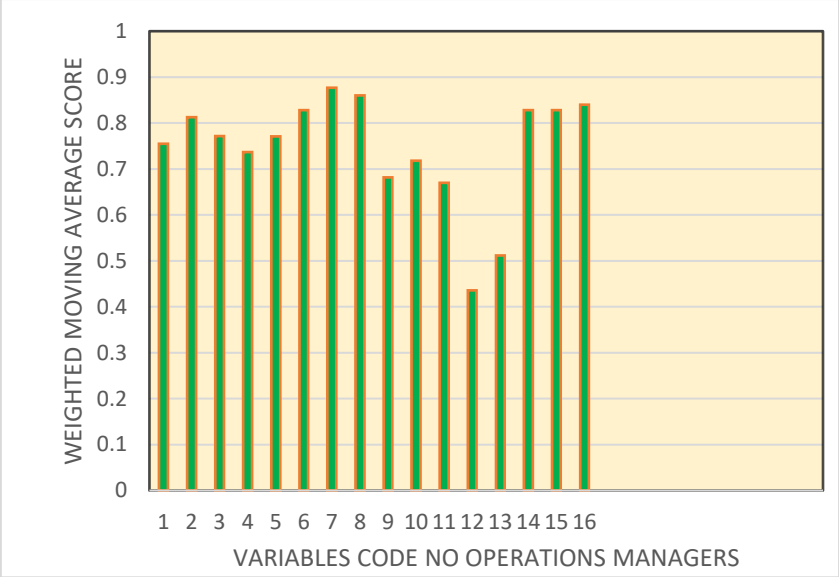
Weighted Average Score of Administrators for the Critical Success Factor – OWNERS Perspective



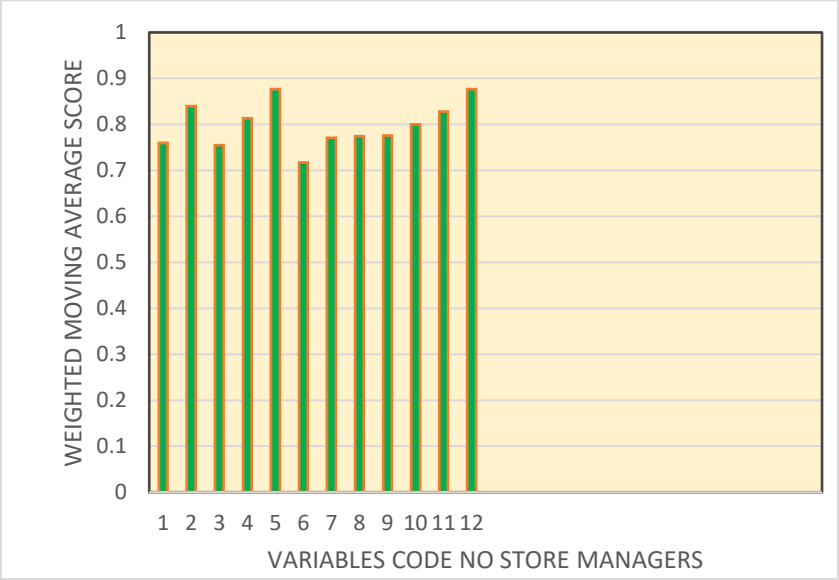
Weighted Average Score of INVENTORY MANAGERS for the Critical Success Factor – INVENTORY MANAGERS Perspective



Weighted Average Score of OPERATIONS MANAGERS for the Critical Success Factor – OPERATIONS MANAGERS Perspective



Weighted Average Score of STORE MANAGERS for the Critical Success Factor – STORE MANAGERS Perspective



RESULT ANALYSIS AND DISCUSSIONS

The significant discoveries of this exposition work are summed up as follows:

TQM is treated as helpful approach to taking on constant improvement techniques for upgrading nature of item and additionally administration proposed to clients by an association. Thus, thorough writing overview on help quality came about into the resolution that assistance area is a possible region for research and subsequently, it is chosen to zero in on the quality examinations for administration area in this exploration work. A precise coordinated approach for demonstrating client assessment interaction of administration quality applied to STEEL INDUSTRIES. To resolve the issue of framework configuration,

regularly embraced dynamic strategies known as Quality Function Deployment (QFD) has been utilized. At first a pilot study was led that is summed up as follows: The four partners were distinguished - OWNERS, INVENTORY MANAGERS, OPERATIONS MANAGERS and STORE MANAGERS. The pilot study has recognized the factors that have more significant level of partners' fulfilment. The basic achievement factors distinguished for the exploration work were:

A. For OWNERS/administrators as stakeholders, the critical success factors identified

- ORGANIZATION AND GOVERNANCE - (O&G)
- FINANCIAL RESOURCES - (FR)
- PHYSICAL RESOURCES (CENTRAL FACILITIES) - (PR)
- HUMAN RESOURCES (EMPLOYEES) - (HR (E))
- LEADERSHIP -(L)
- RESEARCH AND DEVELOPMENT AND INTERACTIONS EFFORTS - (R&D)

B. For INVENTORY MANAGERS stakeholders, the index developed was

- STORE –(S)
- GOODS Content -(GC)
- WAREHOUSE Structure –(WS)
- ORDERS PLACED --(OP)
- EVALUATING ARRIVALS –(EA)

C. For OPERATIONS MANAGER stakeholders, the index developed was

- PLANNING–(P)
- CONTROLLING/IMPROVING –(C/I)
- ORGANIZING–(O)
- STAFFING –(SI)
- DIRECTING- (D)
- HOLDING INVENTORY—(HI)

D. For STOCK MANAGERS stakeholders, the index developed was

- MOTIVATING SALES TEAM –(MST)
- CREATING BUSINESS STRATEGIES – (CBS)
- COST MINIMIZATION–(CM)
- TEAM LEADERSHIP–(TL)

- BUDGETING AND FORECASTING—(B&F)

The internal consistency or the reliability of the actual survey data of owners, inventory managers, operation managers and store managers is computed by calculating the Cronbach's alpha. The values of alpha for the eleven critical parameters are 0.889, 0.803, 0.855, 0.811, 0.759, 0.768, 0.969, 0.764, 0.753, 0.752 and 0.711. Since the value of alpha well exceeds the mandatory value of equal or greater than 0.7, it means that there exists an internal consistency of the established scale.

The sampling adequacy test is done by Kasier-Meyer-Oklin. This is found to be 0.732. This indicates that the factor analysis test has proceeded correctly and the sample used is adequate because the minimum acceptable value of KMO is 0.5.

The Bartlett test of sphericity shows highly significant (sig. =0.000) implicates the correctness and suitability of factor analysis process for multidimensionality. Thus the statistical and factor analysis tests have resulted in the proposed critical success factors and variables.

CONCLUSION

Any unit of production in the manufacturing sector, regardless of size or type, can identify the variables that have a higher level of satisfaction with its stakeholders by using weighted averages, analysis, and adopting self-improvement techniques. The pilot study described here clearly shows that the analysis can be applied to any service sector, especially the STEEL INDUSTRIES sector. In this study, the relationship of factors / variables that affect the quality of PERFORMANCE can be determined, as well as the relative importance of the factors. These variables with small values are areas that need more concentration for growth. In this way, variables that require special attention can also be identified. Through this pilot study, variables with values greater than 0.6 identified quality issues / customer requirements in the TQFD analysis performed.

REFERENCES

1. Sullivan, L.P., 1986b. Quality function deployment. Quality Progress 19 (6), 39–50.
2. P. Duxson, A. Fernandez- Jimenez, J.L. Provis, G.C.Lukey, A.Polomo and J.S.J. van Deventer, 2007, " Geo-polymer technology : the current state of art" , Journal of Materials Science, Vol. 42, No. 9, pp 2917-2933.
3. Irene J. Petricka and Ann E. Echols, 2004, "Technology road mapping in review: A tool for making sustainable new product development decisions", Technological forecasting & social change, Vol. 71, pp 81-100.
4. Rene van Berkel, 2007, "Eco-efficiency in primary metals production: context, perspectives and methods", Resources, conservation & recycling, Vol 51, No. 3, pp 511-540.
5. Ayoob Ahmed Waali, A.D. Gupta, S.G. Deshmukh , 2000, " Quality Initiatives in an Indian software organisation, A case study" , vol 49, No.7, pp 285-291.
6. Darshak A. Desai, Jiju Antony, M.B.Patel2012, "An assessment of Critical Success Factors for six sigma implementation in indian industries.

7. Harjeev K. Khanna, D.D.Sharma, S.C. Laroiya, 2011, " Identifying and ranking Critical Success Factors for implementation of total quality management in indian manufacturing industries using TOPSIS,", Asian Journal on Quality, Vol. 12, No. 1, pp 124-138
8. ManishaLande, R.L.Shrivastava, Dinesh Seth, 2015, " Critical Success Factors for Lean Six sigma in SMEs" , The TQM Journal, Vol 8, Issue 4, pp 613-635
9. Minhaj A.A. Rehmaan , Tushar A. Aneyrao and R.L.Shrivastava, 2015, "Identification of Critical Success Factors in Indian automobile industries : a GSCM approach", Int. J. process management and bench marking, Vol5, No. 2 ,pp 229-243
10. S.P.Untawale S.P. ,S.S.Akant, 2004, " Quality and productivity linking Methodologies for Industries using SPSS(Statistical Package for Social Sciences)" , Journal of production planning & control, pp386-403.
11. VinodGorantiwar andR.L.Shrivastava, 2014, "Identification of Critical Success Factors for quality- productivity management approach in differentindustries" ,Int.J. Quality and Productivity, Management, Vol 14 , No 1, pp 66-106.
12. M.D.Singh , Ravi Shankar, RakeshNarain and Adish Kumar ,2006, " Survey of Knowledge management practices in Indian manufacturing industries" , Journal of Knowledge Management, Vol 10, No. 6 , pp 110- 128
13. S.N Siddique,S.K Ganguly,2019,"Critical Success Factors for Manufacturing Industries in India: A Case Study Analysis", International Journal of Applied Engineering Research ISSN 0973-4562 Volume 14, Number 8 (2019) pp. 1898-1905.

Author 1

RITU SHRIVASTAVA Research Scholar Mechanical Engineering Department Bhilai Institute of Technology (BIT), Durg. *M.Tech.*Specialization in M.E. Production Engineering *Bhilai* Institute of Technology, Durg. CSVTU, Bhilai. *B.E.*Specialization in B.E. Mechanical Engineering. Published 7 papers in national and international journals.1 paper in Scopus indexed Taylor and Francis through an International Conference. Attended 9 conference.

Author 2

Dr. (Mrs). SHIENA SHEKHAR Professor & HoD (Mech).Mechanical Engineering Department Bhilai Institute of Technology (BIT), Durg. *Ph.D. (Mech. Engg.)* Thesis Defense 2010.Research Centre Bhilai Institute of Technology, Durg. CSVTU, Bhilai. *M.E.*Specialization in M.E. Production Engineering Year of pass: 2000 PSG College of Technology, Coimbatore, Tamil Nadu. *B.E.*Specialization in B.E. Production Engineering; Year of pass: 1990 PSG College of Technology, Coimbatore, 33 international journals 3 National Journals publications. Has attended 5 International Conferences and Sympoisms and 38 National Conferences and Sympoisms. Also the member of various professional bodies. She has completed various courses through Swayam Portal. She has attended and organized 50 FDPs and SDPs. Has received Lady Engineer Award from IEI, Research Excellence Award through Institute of Scholars. Also granted 3 patents.