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Critical Success Factors for Cement Industry in India: A Case Study Analysis

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Abstract

Purpose: The purpose of this paper is aimed at development and validation of an instrument for factor analysis implementation in cement industries of India. It provides consolidation of the quality literature by identifying 09 Critical Success Factors for analysis.

Design/methodology/approach: The paper presents the case study approach of current green manufacturing strategies of cement companies and provides the Industrial Environmental Impact Data Collection, Design & Control of Manufacturing Systems and Integration-Product & Manufacturing system with questionnaire with employees, top and middle managers in fourteen cement factories.

Findings: It has been found that the fourteen factories under investigation have low productivity and production levels when compared with the design values. There is no clear TQM strategy and it has been found that the lack of training and personal development is the main cause of this problem. In addition, employees are found not to be motivated because of the lack of a management strategy and reward structure.

Research limitations/implications: Based on the findings, a new framework for GM has been developed. A broad range of survey and research was reviewed, and all revealed the methods to recognize the key influences for development of green technology. The characteristics examined are firm size, the degree of capital intensity, the degree of diversification, the timing of TQM implementation, and the maturity of the program. We find that smaller firms do significantly better than larger firms do.

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Practical implications – The current challenges have been identified and comparative analysis is developed into a model for the implementation of Green manufacturing.
Originality/value: The paper highlights limitations in some of the cement factories in relation to GM and production strategies. The importance of adopting a realistic strategy and framework by managers is discussed. The results for size and capital-intensity validate the importance of TQM practices for smaller firms and environments that are more frequent intensive. Investing to achieve a broader, deeper, and more mature TQM implementation (possibly by targeting an independent TQM award) should also result in higher benefits from TQM implementation. These measures can be used to assess the status of factor analysis, in order to imply further development.

Keywords: Green Manufacturing; Cement Industry; Total Quality Management; TQM; Critical Success Factors; CSFs; Quality Management.

Introduction

The world consumption of cement is rising at an increasing rate creating significant levels of pollution and recently, there is a growing scepticism among consumers about the validity of "green" product claims (R H Williams, *et al.* 1987). The issue with environmental destruction has been one of the main problems both social and political in recent times and concerns about the sustainability and the protection of the natural environment have become increasingly significant issues amongst regulators, environmentalists and society in many countries (Joel Ramírez-Salgado, *et al.* 1987) (M. Z. Soguta, *et al.* 2009). Sustainability is a significant issue, which has been discussed in recent years, and a large number of sustainability reports, exhibiting the increased significance of sustainability issues and environmental management programs were organized to ensure the implementation of the environment friendly concept by employees (Ibrahim Dincer, *et al.* 2004) (Juan Cagiao, *et al.* 2011). So, companies can earn a green passport for a greater market and the use of such environmental management practices presents new needs of information for public organizations and they need information about their environmental impacts and the results of the initiatives that are developed (Goitom Tesfom, *et al.* 2006) (R. Rehan, *et al.* 2005). The environmental management becomes our every day's care and increasingly numerous people care for the environment we live in and implementing an EMS can aids corporations improve their performance and also the purpose of the ISO 14001 standard is to guide environmental improvements worldwide through a systematic approach to environmental management and ISO 14001 is a systemic requirement directed to changing business processes and procedures (Paul S Phillips, *et al.* 2001) (Paul B. Stretesky, *et al.* 2009). This research defines the concept of environmental management systems for the cement industry and in this study; we have used TOPSIS method to recognize the most

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effective criteria of ISO 14001-based environmental management system (EMS) and ranking cement industries in Iran. This paper is organized as follows: Section 2 discusses the basics of sustainability, ISO 14001 and its benefits and EMS systems in cement industries, Section 3 discusses the important success factors of ISO 14001 implementation, Section 4 discusses the methodology, Section 6 discuss the study and Section 7 concludes the study.

Challenges For TQM Implementation In Indian Manufacturing Industry:

As the organizations across the globe have faced stiff cutthroat competition in the last three decades, the Indian industry too could not escape the brunt of globalization. Indian manufacturing industry has also witnessed irrepressible competition in the recent times, predominantly due to the entry of multinational companies in the wake of liberalization, since early 1990's. Owing to opening up of the Indian economy from merely a regulated economy, the manufacturing industry has been faced with uphill task of competing with the best in the world (P. Van den Heede *et al.*, 2012). The intense competition has been witnessed in terms of low costs, improved quality and products with high performance, competition. Moreover shorter lead times, shorter innovation times and reduced inventories have led to increasing demands on the organization's preparedness, adaptability and versatility (Rene van Berkel, *et al*. 2007).

Traditionally, Indian manufacturing organizations have suffered from inherent deficiencies like poor responsiveness to changing market scenarios, low productivity, poor quality, poor cost effectiveness of production systems, stubborn organizational character and structures, uncertain policy regimes, low skill and knowledge base of employees, low production automation, non-motivating work environments, high customer complaints, high utility rates, high wastages associated with production systems, high labour rigidity, high internal taxes, and infrastructural glitches (P. Duxson *et al.*, 2007). The Indian industry is faced with the challenge of adopting cost effective manufacturing strategies for staying competitive. While implementing effective TPM programs, the Indian Manufacturing organizations have often been plagued with teething problems and challenges like difficulties to understand business economics, reluctance to changing practices, vague worker's apprehensions, inability to realize the same level of benefits as reaped by developed countries by imitating the TPM implementation procedures and practices adopted abroad (Irene J. Petricka *et al.*, 2004). Thus Indian manufacturing organizations need to shed the sluggish character and move forward aggressively to develop adapt proactive processes and practices for overcoming the inherent deficiencies in manufacturing systems for harnessing distinct competencies in comparison to their global competitors (Nimawat Dheeraj *et al.*, 2012). The present study critically examines the factors influencing the implementation of TPM practices

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in Indian manufacturing industry. Currently many models are undergoing failures. In this scenario, this study is relevant.

The rest of the paper is organized as follows: a brief review of researches related to the proposed technique is presented in section 2. Section 3 describes proposed method for ANN based leak detection in pipeline. The detailed experimental results and discussions are given in section 4. The conclusions are summed up in section 5.

Related Work:

Though a plenty of related works are available in the literature, a concise number of works are reviewed just below.

M.D. Singh *et al.* [21] have proposed Knowledge management (KM) involves strategies and processes of identifying, capturing, and leveraging knowledge to enhance competitiveness. In this proposed method, knowledge-based organizations was distinguished from the organizations of the last millennium by its emphasis on monitoring and controlling the organization by shared knowledge derived from internal and external data sources. It believes in continual transformation of the knowledge-based according to changing business strategy. The objective of this paper is to understand the KM practices in Indian manufacturing organisations, which are going through a major transition in this area. In this approach was reported the findings of a postal survey carried out to access the impact of KM practices in Indian manufacturing industries. Data were collected and analysed for 71 industries under this category. Aleksander Janes *et al.* [23] have explored and clarified the cause and effect relations between key performance indicators (KPIs) which significantly contribute to the benefits of the business processes exploitation. In this proposed method, they developed a single equation microeconomic error correction model (ECM) with the Engle and Granger two-step method. With the ECM approach, the performed method application on the KPIs and estimated short- and long-term effects between them. They were recognized that the total turnover has been increased, by increased maritime throughput. In this research study: sample size and quality of the data that were available and the quantitative analysis in the four perspectives of the Kaplan and Norton's balanced scorecard (BSC). They presented quantitative approach was useful in combination with a qualitative approach, which was a common practice in determining the causal relations resulting in the strategic map of BSC. Simulations of the developed model are possible on all levels of management, by combining the KPIs, and consecutively acquire new knowledge about their relations. Sushil Kumar *et al.* [23] have proposed a method to discuss and analyse the entrepreneurial process in Indian seed business and factors affecting entrepreneurship in this sector. In this proposed work, they were described descriptive and relational data-analytic methods were adopted such as frequency distribution, cross tabulation, and correlation analysis. These study findings have implications for

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policy makers as well as for prospective entrepreneurs. It will help in designing appropriate policy instruments promote and foster entrepreneurship on one hand and provide suggestions for new entrepreneurs for creating sustainable new seed ventures on the other. They proposed original and value loaded in the sense that this provides the practical implications for understanding the entrepreneurial process in a very critical segment of the agriculture sector. I.P.S. Ahuja *et al.* [24] have evaluate the challenges before Indian manufacturing organizations for adapting to proactive total productive maintenance (TPM) initiatives. They introduced Indian manufacturing organizations to formulate the critical success factors and enablers for overcoming obstacles to successful TPM implementation with regard to its preparedness to face global challenges. The study highlights the difficulties faced by Indian manufacturing organizations in their attempt to implement TPM initiatives in order to improve organizational efficiency. In this proposed method, they implemented TPM was by no means an easy task, which is heavily burdened by organizational, cultural, behavioural, technological, operational, financial, and departmental barriers. They need to study stresses the need for improving the synergy between the maintenance function and other organizational quality improvement initiatives in the organizations, to establish maintenance as a competitive strategy for meeting the challenges of a highly competitive environment. Ayoob Ahmed Wali *et al.* [25] have presented economic context of liberalization and globalization, Indian organizations face many challenges. The Indian software industry has been recognized globally for its competitiveness built upon quality attributes such as timeliness and reliability of delivery. In this proposed method, they studded carried out in one of the leading software organizations in India involved in developing a range of application software for banks, insurance companies, and financial houses. The case study work involved a survey identifying the critical success factors for TQM, and identifying how the company adopts various principles and techniques of quality management. Darshak A. Desai *et al.* [26] have purposed the results from an empirical investigation of Six Sigma status in Indian industry, especially to highlight critical success factors (CSFs) of Six Sigma implementation in a developing economy like India. In this proposed work, they was studied based on survey questionnaire suitable for Indian industries. The results of this exploratory empirical study reflect the impact of different CSFs of Six Sigma implementation in different sizes and sectors of Indian industries. In this proposed method, they was provided value to academics, researchers and practitioners of Six Sigma by way of providing insight into the CSFs for Six Sigma implementation, especially in Indian industries. Moreover, a detailed impact of different CSFs of Six Sigma implementation in Indian industry by means of semi-structured interviews could not be executed due to above constraints. Harjeev K. Khanna *et al.* [27] have reviewed critical success factors (CSFs) of total quality management (TQM) to rank these in the Indian manufacturing industry. In this proposed method for CSFs, Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) was used. The data were collected using questionnaires as the research instrument. To process management, top management leadership and customer focus are the top three factors for implementation of TQM in the manufacturing industry in India.

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Quality citizenship is a relatively low-ranked factor. In this proposed work, they used of TOPSIS approach to rank the CSFs of TQM.

Table 1: List Of Csfs As Recommended By Various Authors For Total Quality Management In Green Manufacturing For Indian Cement Industry

Authors/critical factors	Roles and responsibilities of Top Management	Infrastructure and facility in Cement institutes	Human Capital	Research and development and consultancy	Green Infrastructure / Policies / Practices	Legal / Regulatory Framework	Process Management
M.D. Singh *et al.* [21]	X		X	X			X
Aleksander Janes *et al.* [22]		X	X		X		X
Sushil Kumar *et al.* [23]	X	X		X	X		X
I.P.S. Ahuja *et al.* [24]	X		X	X	X		
Ayoob Ahmed Wali *et al.* [25]	X	X	X	X		X	X
Darshak A. Desai *et al.* [26]			X		X	X	
Harjeev K. Khanna *et al.* [26]	X	X		X	X		X

Table 2: List of Items as CSFs that influence TQM implementation

Critical Success Factors	

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CSF Top Management for GM Process Cement Plant	ISO certification, clarity of vision, mission, and Strategic direction for Company, take responsibility for continuous improvement in Environment.
CSF Human Capital	Employee Involvement, Work-Life Balance, Employee Growth & Development, Health & Safety, Procurement Policy (Personnel), The organization searches for new green products/services, Any competitiveness in relation to other organization measures
CSF Organizational Practices / Culture	When the firm promises to do something by a certain time, it will do so. Employees in the firm will always be willing to help customers; Materials associated with the service will be visually appealing in the firm.
CSF Customer Requirements	Motivation to the employees for implementing Green Environment
CSF Green Infrastructure / Policies / Practices	Legal, ethical and societal responsibilities, bring tangible and intangible benefits to the cement community, Long term performance; Extent to GM products have competitive quality with good reliability, durability and reusability, Ensures brand value enhancement and better regulatory compliance, Good Management information System (MIS), Measurement of total cost for GME. Empowerment, involvement and dedication for achieving GM objective, Environmental System (ISO 14000). ISO 14001; 2004 Environmental Management System.
CSF Process management	Life Cycle Assessment, Favourable Government Policies, rules & regulations, Spreading Risk of Environmental Problems.
CSF GM - Legal / Regulatory Framework	Mentation of new technologies and practices in manufacturing, Energy Management System, Solid Waste Management System, Environmental auditing, activity assessment, Measurement of carbon footprint in organization to ensure GM. Participation in Environmental Initiatives, Certification Programs, Applying product innovation, end of life (EOL), cradle to cradle and close loop approach for GM.

4. Research objectives and methodology:

The basic objective of this study was to analyse the critical success factors (CSFs) of factor analysis implementation in Indian cement industries. The objective was to carry out exploratory empirical investigation of a cross sectional study of CSFs of factor analysis implementation for different sizes and sectors of Indian

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cement industries. To make the study exhaustive, entire spectrum of Indian cement industries were considered as population for the study (Breno Nunes, *et al.* 2010). The study was not designed just to look at different issues of existing methods but also find out the importance of existing method's review practices. Rather than considering researcher alone, the study aimed to survey outcome of correction and regression analysis for cement industry. The CSFs used in this study were derived from existing literature review of Total Quality Management and factor and recreation analysis. In this paper, we are presenting the list of 9 major CSFs factor with their sub elements as generated from the literature review.

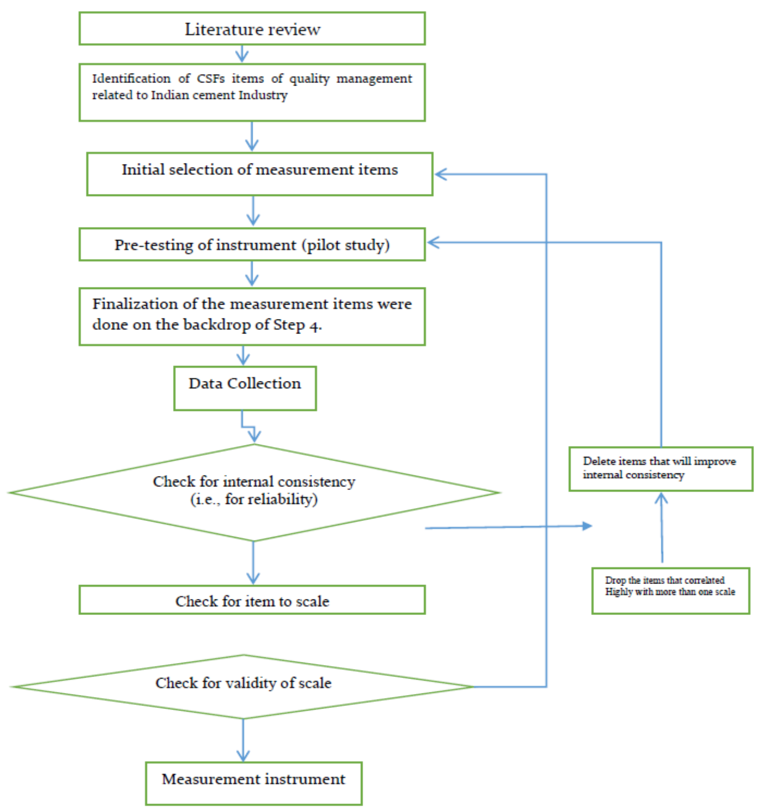

Figure 1: Proposed Flowchart for Green Manufacturing

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In this section, we discuss about the proposed a new CFS model building a new rule based on a belief structure and for inference in the rule based system green manufacturing. The methodology is referred to as a proposed CSF model using the evidential reasoning approach.

Data Source

The data has been collected from both primary and secondary sources. The primary source consists of a questionnaire survey 450 structured questionnaires had distributed to the respondents throughout the world for gathering needed data. The questionnaire is included questions to address the stated research objectives. All the questions have designed in such a way that the responses generated on the crucial issues, which are directly and indirectly focused on the research goals. This data helps in making projections in this research investigation in cement industry. The secondary source is also included scanning and searching of related past works in print form and electronic form on websites.

Sampling Data Procedure

In the present research, a sample size of 500 (collected from all over India) was chosen for the final survey. However data collection through questionnaire method has several advantages but it also have so many disadvantages like Low rate of return of the duly filled in questionnaires; bias due to no-response is often indeterminate; It can be used only when respondents are educated and cooperating; The control over questionnaire may be lost once it is sent; There is also the possibility of ambiguous replies or omission of replies altogether to certain questions; interpretation of omissions is difficult and last but not least this method is likely to be the slowest of all. To overcome all above difficulties following care has been taken to ensure good response. The questionnaire was mailed along with prepaid envelop in order to facilitate quick reply. Close friends and associates were identified in each area and the questionnaire was explained to them. They were entrusted with the responsibility to answer the queries of the respondents and to do follow up. To start with, the rate of return of the complete questionnaire was very fast, but when the rate of flow slowed down, reminders were sent to them for an early reply. Telephone calls and e-mail were also made besides personal

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contacts with the organization. The hectic efforts and the support of the friends and institutes generated a good response representing 48% response rate, which was quite encouraging.

Reliability of Experiential Process:

In this section, we have to analysis the respondent to questionnaire were organized, fed into a variable computer data and analysed for internal consistency analysis (D. B. Desai, *et al.* 2013). The data was analysed using IBM SPSS Software. The factor analysis of a questionnaire determines its ability to yield consistent results. Reliability was operational as internal consistency, which is the degree of inter correlation among the item which comprise a scale. Internal consistency can be established using a reliability coefficient such as Cronbach's alpha. Alpha is the average of the correlation coefficient of each item with each other item. The Cronbach's alpha of questionnaire with 81 attributes/items was found to be 0.992, implies that the questionnaire is reliable. Also the reliability of individual scales was tested found to be varied 0.892 to 0.895. Since the reliability coefficients of all the individual scales are above 0.7 considered adequate, all the developed scales indicated acceptable reliability

Factor no.	Factors based on survey result	Cronbach's α	KMO	Average variance explained by these factors (cumulative)
Fac-1	Top management's clarity of vision, mission, and Strategic direction for GM	.920	.670	4.45703125
Fac-2	Human Capital	.892	.696	0.410351563
Fac-3	Organizational Practices / Culture	.962	.777	4.380208333
Fac-4	Customer Requirements	.972	.500	4
Fac-5	Green Infrastructure / Policy / Practices	.937	.661	4.10546875
Fac-6	Process Management	.895	.500	3.8359375
Fac-7	Legal Regulatory Framework	.992	.888	4.142361111

The collected data was analysed (using SPSS 18.0 software) by following factor analysis procedure as suggested by (Chun-Jen Chung, *et al.* 2008). Factor Analysis is a general name denoting a class of procedure primarily used for data reduction and summarization. In research survey, there may be a large number of variables, most of them are correlated and which must be reduced to a manageable level and interpretable. The first step, prior to running the factor analysis, the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and the Bartlett's test of sphericity were conducted. The KMO value was found to be 0.787, which is

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sufficiently large (>0.5), which indicated sample adequacy for factor analysis, and supporting the appropriateness of using factor analysis to explore the underlying attributes. The Bartlett's test of sphericity was highly significant ($p < 0.000$) significance value of Bartlett's test is 0.000, rejecting the null hypothesis that the 72 important attributes are uncorrelated in the population.

Communalities

The communalities of the data is reported greater than 0.6 for all the items of the scale. Community referred to as the percentage of total variance explained by the common factors. Communalities represent the proportion of the variance in the original variables that is accounted for by the factor solution (M.B. Alia, *et al.* 2011). The factor solution should explain at least half of each original variable's variance, so the communality value for each variable should be 0.60 or higher. This term may be interpreted as a measure of 'uniqueness'. A low communalities figure indicates that the variable is statistically independent and cannot be combined with other variables. In our instrument the communalities value is more the 0.70 (Table 6). Hence we can conclude that all the initial items selected which are responsible for TQM in technical education are dependent with each other and focusing on common issue.

Table 3: Communalities for CSF

S. No.	Attribute:	Initial	Extraction
1	Top management's clarity of vision, mission, and Strategic direction for GM	1.0000	.754
2.	Top management's ability to take responsibility for continuous improvement in Environment	1.0000	.752
3	Adequate budgetary allocation for Green improvement initiatives	1.0000	.747
4	Recognition of constructive efforts of employees by management	1.0000	.751
5	Management's commitment for providing good GM work environment.	1.0000	.744
6	Employee Involvement	1.0000	.748
7	Work-Life Balance	1.0000	.758
8	Employee Growth & Development	1.0000	.755
9	Health & Safety	1.0000	.755
10	Employee Recognition	1.0000	.757
11	Planning and implementation	1.0000	.746
12	Procurement Policy	1.0000	.748

13	Employment Generation	1.0000	.752
14	Employee Cost as % of Total Cost	1.0000	.754
15	Performance Incentives to Employees	1.0000	.752
16	Skill Enhancing Training	1.0000	.753
17	Certification to Plants (Health And Safety)	1.0000	.752
18	Loss Due to Labor Unrest	1.0000	.753
19	The company make the best use of the employee skills to develop better products/services	1.0000	.752
20	The organization search for new green products/services	1.0000	.748
21	your organization search for new markets for existing products	1.0000	.749
22	Any competitiveness in relation to other organizations measured	1.0000	.741
23	Clear objectives	1.0000	.747
24	Responsibility for performance	1.0000	.748
25	Staff training and awareness programmers	1.0000	.747
26	When the firm promises to do something by a certain time, it will do so.	1.0000	.745
27	Employees in the firm will always be willing to help customers	1.0000	.751
28	Materials associated with the service will be visually appealing in the firm.	1.0000	.755
29	The firm will have employees who give customers personal attention	1.0000	.748
30	Employees in the firm will always be willing to help customers	1.0000	.748
31	Conducive environment for implementation of Green Environment	1.0000	.749
32	Motivation to the employees for implementing Green Environment	1.0000	.746
33	Disposal planning and Scientific management of all types of wastes is critical	1.0000	.751
34	Green disposal by identifying different ways of reuse, recycle & remanufacture	1.0000	.749
35	Life Cycle Assessment (Environmental Impacts)	1.0000	.746
36	Environmental Mission Statement	1.0000	.751
37	Promoting automation for Green Product	1.0000	.754
38	Favourable Government Policies, rules & regulations.	1.0000	.751
39	Green Packaging	1.0000	.758
40	Elimination of CFC's & HCFC's in production	1.0000	.754
41	High solids paint program	1.0000	.745

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42	Ultra-violet/infra-red curing process	1.0000	.758
43	High particulate filtration	1.0000	.754
44	Waste integration program at Factories	1.0000	.753
45	Closed loop water system/ processing_Grey/black water system	1.0000	.760
46	Spreading Risk of Environmental Problems	1.0000	.756
47	GM will have strong influence on the entire cement industry, especially in India	1.0000	.752
48	Legal, ethical, and societal responsibilities to its key communities.	1.0000	.761
49	Successful transformation into GM will bring tangible and intangible benefits to the cement community	1.0000	.754
50	Long term goal setting on the basis of current performance	1.0000	.763
51	Extent to which GM products have competitive quality with good reliability, durability and reusability	1.0000	.754
52	Accountability by top management in GM ensures brand value enhancement and better regulatory compliance	1.0000	.744
53	Establishment of good Management information System (MIS) for Indian cement industry.	1.0000	.752
54	Measurement of total cost for GME.	1.0000	.748
55	Regular evaluation of GM suggestions.	1.0000	.760
56	Empowerment, involvement and dedication of employees is crucial for achieving GM objectives	1.0000	.751
57	Noticeable rewards motivate employees for generating innovative GM ideas	1.0000	.749
58	Company specific training program for GM is crucial	1.0000	.760
59	Training for environmental problem identification & solving technique	1.0000	.747
60	Processes are systematically designed and managed, through standard system standards, such as Environmental System (ISO 14000)	1.0000	.759
61	ISO 14001; 2004 Environmental Management System	1.0000	.753
62	Certified Carbon Neutral organization under NCOS	1.0000	.740
63	Faster adoption of new technology for continuous improvement.	1.0000	.754
64	Promoting R&D and innovation for product development.	1.0000	.752
65	Well Defined organizational structure and governance system	1.0000	.750
66	Well Defined rules, regulations & operating procedures	1.0000	.752

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67	Supplier's involvement and assessment system for successful GM	1.0000	.747
68	Extent to which technical assistance provided to suppliers so as to improve their green commitment and responsiveness	1.0000	.749
69	Supplier's involvement and assessment system for successful GM	1.0000	.746
70	Environmental Standards for Suppliers	1.0000	.751
71	Environmental Audits of Suppliers	1.0000	.756
72	Substituting Environmentally Problematic Materials	1.0000	.752
73	Remanufacturing	1.0000	.744
74	Applying product innovation, end of life (EOL), cradle to cradle and close loop approach for GM	1.0000	.746
75	Environmental Department/Teams	1.0000	.749
76	Participation in Environmental Initiatives, Certification Programs	1.0000	.749
77	Environmental auditing , activity assessment , measurement of carbon footprint in organization to ensure GM	1.0000	.753
78	Water Use Management System	1.0000	.754
79	Pollution/Chemical Management System	1.0000	.752
80	Solid Waste Management System	1.0000	.753
81	Energy Management System	1.0000	.752

Interpretation of TQM factors and its representation:

To measure CSFs of green manufacturing, following main factors are considered.

In Factor 1, accounting for 5.417547 of common variance, is named as 'Top Management for GM Process Cement Plant', which accounts for all those items that form unique resources for a Top management for green process. This include ISO certification, clarity of vision, mission, and Strategic direction for Company, take responsibility for continuous improvement in Environment for total quality practice all the above mention supportive items are very important for performance/excellence of green manufacturing. These resources create asymmetry and differentiating advantages with respect to other company.

The factor 2, 'Human Capital', accounts for 6.2014375 of common variance and includes such elements as employee Involvement, Work-Life Balance, Employee Growth & Development, Health & Safety,

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Procurement Policy (Personnel), The organization searches for new green products/services, Any competitiveness in relation to other organization measures employee performance monitoring system, By observing all the items of capacity building initiatives it is clearly implicit that training centre and finishing regular curriculum is not sufficient for cement industry to be withstand in this competitive environments but it is also required to providing knowledge beyond the syllabus and training students as per the need of stakeholders.

In the factor 3, 'Organizational Practices/Culture', explaining 5.007196093 of the common variance, signify an important of role of top management and it includes management commitment, well defined long and short term goals, Open and transparent system, budgeting and resource allocation, and well defined organisational structure and governance system. When the firm promises to do something by a certain time, it will do so. Employees in the firm will always be willing to help customers; Materials associated with the service will be visually appealing in the firm.

		F 1	F 2	F3	F 4	F5	F6	F 7
1	CSF Top Management for GM Process Cement Plant					5.417547		
2	CSF Human Capital						6.2014375	
3	CSF Organizational Practices / Culture					5.007196093		
4	CSF Customer Requirements				4.328			
5	CSF Green Infrastructure / Policies / Practices						5.5566875	
6	CSF Process management					4.80259		
7	CSF GM - Legal / Regulatory Framework						5.758546875	
8	CSF Suppliers Involvement & Supply Chain Management					5.020484375		
9	CSF Technology Management						5.680140625	

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Table 4: Items to scale loaded under different factor

	CSF 1	CSF 2	CSF 3	CSF 4	CSF 5	CSF 6	CSF 7	CSF 8	CSF 9
CSF 1	1								
CSF 2	0.645107473	1							
CSF 3	0.602869777	0.676666	1						
CSF 4	0.221987971	0.24423	0.070877159	1					
CSF 5	0.156656664	0.086126	0.057289821	0.6914683	1				
CSF 6	0.164651659	0.100681	-0.064267846	0.5068726	0.561498	1			
CSF 7	0.167231746	0.006861	-0.0607391	0.50650568	0.616153	0.606450896	1		
CSF 8	0.036196639	0.016812	-0.100208212	0.61010681	0.592774	0.528067155	0.72011464	1	
CSF 9	0.145496374	0.080679	-0.074279873	0.64136169	0.566747	0.615364881	0.7784183	0.795837072	1

In the factor 4, ‘Customer Requirements’, accounting for 4.328 of the common variance has loading of such items as motivation to the employees for implementing Green Environment.

In the factor 5, ‘Green Infrastructure / Policies / Practices’, accounting for 5.5566875 of the common variance has loading of such items as life cycle assessment, favourable government policies, rules & regulations, spreading risk of environmental problems.

In the factor 6, ‘Process management, accounting for 4.80259 of the common variance has loading of such items as consultancy and testing, corporate trainings, collaboration of institute/linkages/networking and also on

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non-teaching staff skill. In present scenario for over all development of any students the exposes to real life training is very much essential and it is only possible when they get corporate training and able to solve their problems.

In the factor 7, ‘GM - Legal / Regulatory Framework’, accounting for 5.020484375 of the common variance has loading of such items as extension activities focus, faculty participation, institute brand image creation mechanism, and curriculum design and revision. In the legal, ethical and societal responsibilities for bring tangible and intangible benefits to the cement community. In the term of long-term performance for GM, products have competitive quality with good reliability, durability and reusability, Ensures brand value enhancement and better regulatory compliance.

In the factor 8, Suppliers Involvement & Supply Chain Management’, accounting for 5.020484375 of the common variance has life cycle assessment, favourable government policies, rules & regulations, spreading risk of environmental problems.

In the factor 9, ‘Technology Management’, an accounting for 5.680140625 of the common variance has mentation of new technologies. Practices in manufacturing, Energy Management System, Solid Waste Management System, Environmental auditing, activity assessment, Measurement of carbon footprint in organization to ensure GM. Participation in environmental initiatives, certification programs, applying product innovation, end of life (EOL), cradle to cradle and close loop approach for GM.

Detailed item analysis

In this paper, we have discusses the method to evaluate the assignment of items to scales. The method considers the correlation of each item with each scale. Specifically the item-score to scale score correlation are used to determine if an item belongs to the scale as assigned. If an item does not correlate highly with any of the scales, it is eliminated.

Table 5 reports the correlation matrix for the seven scales. All item has correlations of 0.645107473, 0.676666, 0.070877159, 0.6914683, 0.561498, 0.606450896, and 0.795837072 with the nine scales in nine factor. Since scale 9 represents the average score obtained from all 81 items; the high correlation between scale 9 and item number 81 was expected. In addition, since item 81 showed relatively smaller correlations with the other scales it was concluded that it had been assigned appropriately to scale 9. As seen in Table 5, all items have high correlations with the scales to which they were assigned relative to all other scales. Hence, it was concluded that all items in this instrument had been appropriately assigned to respective scales (Shonali Pachauri, *et al.* 2002).

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Conclusion:

In this paper, a challenge has been made to explore green process responsibility for initiating quality management and planning for CSF in cement industry by evaluating percent analysis. With the analysis result, we are getting a model and result for cement organizational requirements to achieve quality management goals in various arms of cement industry. (Benjamin C. McLellan, *et al.* 2011). In this paper, an attempt has been made to explore CSFs responsible for initiating quality management in green manufacturing and author has offered a set of 09 CSFs for quality management in green manufacturing by performing factor analysis. The measure proposed were empirically based and shown to be consistent and effective. The recreation coefficient (alpha) of the initial selected 81 items measure 0.95, which is above 0.7, are considered passable also the communality value for each variable is greater than 0.60 interpreted as a measure of 'uniqueness'. Hence, the study results indicated that seven scales, such as Top Management for GM Process Cement Plant, Human Capital, Organizational Practices / Culture, Customer Requirements, Green Infrastructure / Policies / Practices, Process management, GM - Legal / Regulatory Framework, Suppliers Involvement & Supply Chain Management, Technology Management are the most important CSFs to be explored to achieve excellence in green manufacturing. The proposed research instrument is expected to provide momentum for further research aimed at gaining a more comprehensive understanding of the quality related issues and implementation of TQM for achieving excellence in green manufacturing. This research instrument/questionnaire will provide impetus for further research aimed at gaining a more comprehensive understanding and better result for Indian cement industry.

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