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Indian Cement Industry: Status and Challenges on Adaptation for Green Manufacturing

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Abstract: - The purpose of this research is to explore the operational performance of green environment in the cement industry. It explores the current green manufacturing strategies of cement companies and provides the Industrial Environmental Impact Data Collection, Design & Control of Manufacturing Systems. A broad range of survey and research was reviewed and all revealed the methods to recognize the key influences for development of green technology. By understanding, each case study approach and conducting proportional analyses in order to develop insights into the evolution of green technology projects. This research paper describes the drawbacks of global warming, gas, water and other wastage emissions at the time of cement manufacturing and puts forward the green manufacturing styles and prospect of this method which are very different from earlier methods. The main objective of this paper is to highlight the new green manufacturing evolution process as well as a discussion on potential ways to covers the entire product life cycle from conceptual design to disposal in a benign, harmless manner causing no or minimal adverse impact on environment by optimum use of resources and reduction of waste and pollution.

Keywords: ***Green Manufacturing; Green Design; Cement Industry; Green technologies, Carbon, global warming, Environmental Management.***

1. INTRODUCTION

The Indian cement industry has evolved significantly in the last two decades, going through all the phases of typical cyclical growth process. After a period of over-supply and a phase of massive capacity additions, the industry is currently in a consolidation phase. With sound economic growth and infrastructure development, the demand for cement is on an upward trend (R. Rehan, 2005).

Being one of the basic elements for setting up strong and healthy infrastructure, Cement plays a crucial role in economic development of any country (M.Z. Soguta, 2009). Having more than a hundred and fifty years history, it has been used extensively in construction of anything, from a small building to a mammoth multi-purpose project (Qinghua Zhu, 2009). The manufacturing process of cement consists of mixing, drying and grinding of limestone, clay and silica into a composite mass (M.B. Alia, 2011). The mixture is then heated and burnt in a pre-heater and kiln to be cooled in an air-cooling system to form clinker, which is the semi-finished form. This clinker is cooled by air and subsequently ground with gypsum to form cement. There are three types of processes to form cement - the wet, semi-dry and dry processes (Chun-Jen Chung and Hui-Ming Wee, 2008). In the wet/semi-dry process, raw material is produced by mixing limestone and water (called slurry) and blending it with soft clay. In the dry process technology, crushed limestone and raw materials are ground and mixed without the addition of water (Rajiv K. Srivastava, 2012.).

The Beginning of Indian Cement Industry The attempt to produce cement in India dates back to 1889 when a Calcutta firm attempted to produce cement from Argillaceous (D.B. Desai, 2013). The factory could not succeed hence it failed. However, it was in 1914 that the first commissioned cement-manufacturing unit in India was set up by India Cement Company Limited at Porbandar, Gujarat, with an installed capacity of 10,000 tonnes and production of 1000 tonnes. Subsequently two plants; one at Katni (M.P.) and another at Lakheri (Rajasthan) were set up. The First World War gave positive stimulus to the infant industry (M. Ziya SÖGÜT, 2012.). The following decades saw increase in number of plants, installed capacity and production. This period can thus be called the Nascent Stage of Indian cement industry (Darshak A. Desai, 2012).

Over a 5-year period, capacity has grown at six percent as against eight per cent growth in cement consumption. Major players in the industry are in fact, operating at 90 to 100 per cent of capacity (Wee-Kean Fonga, 2009). Many have announced expansion plans to meet the growing demand. Major capacity additions will be completed by the end of the year 2008-09.The increase in demand for cement has attracted global majors to India (Leif Gustavsson and Roger Sathre, 2006). In a short span of one year (2005-06), four of the top five cement companies of the world entered into India either through mergers or acquisitions or joint ventures or green field projects (Sunil Luthra, 2011). These include France's Lafarge, Switzerlands' Holicm, Italy's Italcementi and Germany's Heldelberg cement (Nilesh Vijay Fursule, 2012). The industry has witnessed flurry of mergers and acquisitions among domestic players also, bringing smaller players under the umbrella of large players, such as ACC, Gujarat Ambuja, Grasim Industries, Ultratech and India Cements which in turn have come under the leadership of global players like Lafarge, Holicm, Italcements and Heldelberg (Sabuj Kumar Mandal and S. Madheswaran, 2010).

There are different varieties of cement based on different compositions according to specific end uses, namely, Ordinary Portland Cement, Portland Pozzolana Cement, White Cement, Portland Blast Furnace Slag Cement and Specialised Cement (Sabuj Kumar Mandal and S. Madheswaran, 2010). The basic difference lies in the percentage of clinker used.

- ✓ Ordinary Portland cement (OPC): OPC, popularly known as grey cement, has 95 per cent clinker and 5 per cent gypsum and other materials. It accounts for 70 per cent of the total consumption.
- ✓ Portland Pozzolana Cement (PPC): PPC has 80 per cent clinker, 15 percent pozolona and 5 per cent gypsum and accounts for 18 per cent of the total cement consumption. It is manufactured because it uses fly ash/burnt clay/coal waste as the main ingredient (Ahmed M. Deif, 2011.).
- ✓ White Cement: White cement is OPC - clinker using fuel oil (instead of coal) with iron oxide content below 0.4 per cent to ensure whiteness. A special cooling technique is used in its production. It is used to enhance aesthetic value in tiles and flooring. White cement is much more expensive than grey cement.
- ✓ Portland Blast Furnace Slag Cement (PBFSC): PBFSC consists of 45 percent clinker, 50 per cent blast furnace slag and 5 per cent gypsum and accounts for 10 per cent of the total cement consumed. It has a heat of hydration even lower than PPC and is generally used in the construction of dams and similar massive constructions.
- ✓ Specialised Cement: Oil Well Cement is made from clinker with special additives to prevent any porosity.
- ✓ Rapid Hardening Portland cement: Rapid Hardening Portland Cement is similar to OPC, except that it is ground much finer, so that on casting, the compressible strength increases rapidly (Kuo-Chung Shang, 2010).
- ✓ Water Proof Cement: Water Proof Cement is similar to OPC, with a small portion of calcium stearate or non-saponifibale oil to impart waterproofing properties.

The development of different types of concrete will not necessarily result in an increase in the number of cement types to be produced, but it will require that the quality of the cement be much more consistent than at present (Youjuan Wang, 2011). In the future, cements will have to fulfill tighter specifications (Breno Nunes, 2010).

The development of numerous high-tech concretes will also not necessarily result in an increase of the overall consumption of cement or binder used in a cubicmetre of concrete because cement and binders will be used more and more efficiently: in the best-case scenario, in developed countries, it will be possible to make more concrete with the same amount of binder (Chun-Jen Chung and Hui-Ming Wee, 2008).

The aim of this study is to design and test a diagnostic instrument relating to a set of factors affecting TQM and to critically examine whether these factors have linkages with the factors affecting organizational performance. We propose a more involved analysis that includes structural, external and internal factors in case of Indian organizations who have implemented TQM during the last decade.

Literature Review:

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

Guofei Ren *et al.* [21] have proposed a method for cement industry changed tremendously with economic development of China. In this paper, they reviewed the history of Chinese cement industry and analyzes the current situation of cement industry from the political, environmental, and the other aspects by using the PEST analytic method. The challenges for the evolution of Chinese cement industries are also clarified.

Sadhana Chaurasia *et al.* [22] have proposed a research work for data of the ambient air quality status of Nambahera district of Chittorgarh Rajasthan, India. The Air quality was assessed based on New National Ambient Air Quality Standard. The selected parameters were SPM, PM10, SO2, NOx. The average value of PM10 was found beyond the permissible limit at near power plant and near coal mill. The outcome of the study has been presented in the form of Air Quality Index. AQI was found moderate for PM10 and SO2 & NOx were observed in good range.

Mohsen Attari *et al.* [21] have discussed a technique "how environmental evaluation of the cement industry in Iran can be facilitated". In this proposed method, they have developed cooperating with experts from university, industry and policy makers. The importance of the indicators was determined with the help of the cooperating industrial partners. By using the TOPSIS method, indicators were prioritized and improvement strategies for this industrial sector were derived. 15 indicators were introduced; among them seven are for the intensity of consumptions during production of cement and emissions production, three for control of emissions to air, four for capacities of control of water pollution and one for the inefficiency level in the execution of ISO 14000. It shown that the last indicator has the highest priority followed by the intensity of CO2 emission.

Y. Pontikesa *et al.* [25] have presented in depth review of these cases by providing a critical overview of the on-going research over the last forty years. To facilitate the transition from laboratory to industrial scale, a barriers and drivers analysis was also presented for the case of BR addition in the raw meal of cement clinker, following both BR and cement producers' perspective. It was demonstrated that tangible results can be achieved with present-day technology and that one of the major barrier is economic. A number of clear actions were suggested to accelerate the transition towards a more sustainable management of BR.

C. Meyer *et al.* [24] have proposed a method for increasing use of cementationsmaterials that can serve as partial substitutes for Portland cement, in particular those materials that are by-products of industrial processes, such as fly ash and ground granulated blast furnace slag. In addition, the substitution of various recycled materials for aggregate has made significant progress worldwide, thereby

reducing the need to quarry virgin aggregates. The most important ones among these were recycled concrete aggregate, post-consumer glass, scrap tires, plastics, and by-products of the paper and other industries.

Objective

- To study the progress of Indian cements industry since 1991, in terms of its growth in installed capacity, production, exports, and value additions.

We developed a survey to explore issues regarding different existing report in cement industry throughout the world for Indian market. 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. Company from different region of the world.

Research Methodology

The research methodology is a way to methodically solve the research problem. The proposed study is based on exploratory research, with purposes of finding issues, screening of various alternatives, and discovering new paradigms.

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 the purpose of 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 Procedure

In the present research, a sample size of 450 (collected from all over India) was chosen for the final survey. However data collection through questionnaire method has several advantages but it alsohave so many disadvantages likeLow rate of return of the duly filled in questionnaires; bias due to no-response is oftenindeterminate; It can be used only when respondents are educated and cooperating; Thecontrol over questionnaire may be lost once it is sent; There is also the possibility ofambiguous replies or omission of replies altogether to certain questions; interpretation ofomissions is difficult and last but not least this method is likely to be the slowest of all (Stephan Vachon and Robert D. Klassen, 2010).To overcome all above difficulties following care has been taken to ensure goodresponse. The questionnaire was mailed along with prepaid envelop in order to facilitatequick reply. Close friends and associates were identified in each area and thequestionnaire was explained to them. They were entrusted with the responsibility toanswer the queries of the respondents and also to do follow up. To start with, the rate ofreturn of the complete questionnaire was very fast, but when the rate of flow sloweddown, reminders were sent to them for an early reply. Telephone calls and e-mail werealso made besides personal contacts with the organization. The hectic efforts and thesupport of the friends and institutes generated a good response representing 48% responserate which was quite encouraging. Table 3 gives details about the profile of therespondents.

Analysis:

After collecting all the data, the process of analysis had done. To summarize and rearrange the data several interrelated procedures has been performed during the data analysis stage. For quantitative data analysis, statistical tools of Microsoft excel and SPSS has been used for data input and analysis. The statistical results presented in graphical form with a detailed description. Statistical tools like tables and percentages applied for analyzing the data for the study. Thus the validation of data has been scientifically established.

The only cement markets that should experience a spectacular expansion in the years to come will be in developing countries, and this raises further questions:

- ✓ What is the future of the cement plants in industrialized countries?
- ✓ Will developed countries become cement exporters?
- ✓ Where will developing countries find the money to buy these cement imports or build the cement plants they will need to face their internal cement needs?

The collected data was analysed (using SPSS IBM software) by following percent analysisprocedure as paper requirement. Percent Analysis is a general name denoting aclass of procedure primarily used for data reduction and summarization. In researchsurvey, there may be a large number of variables, most of them are correlated and whichmust be reduced to a manageable level and interpretable.

Table 1: Instrument receipt mode details

Sl. No.	Data Collection mode	Number of Respondent
1.	Personal Interaction	110
2.	Postal mail	40
3.	Email	300
4.	Total	450

In Table 1: This is sufficiently encouraging result in receiving 450 valid instruments out of 500 with the response rate 95%. In this table response rate and data collection mode. The response rate is quite encouraging.

This valid response from the first section dealt with gathering information, such as designation of response, name of organization, performance improvement program pursued by the organization, number of employee,

type of industry, location of industry, age of the industry and annual sales of the company.

Sl. No.	Contents	Frequency	Percentage
1.	MD/CEO/ VP/ Director	14	5.6
2.	GM	3	1.2
3.	Manager	16	6.4
4.	DGM/ Asst. GM	10	4
5.	Enng./Sr. Engg.	136	54.4
6.	Executive officer	30	12
6.	Supervisor	41	16.4
		250	100

Figure 1: respond Experience in Year

Has your company engage in any of these activities

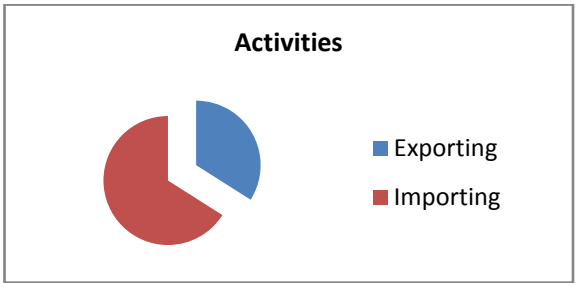

Figure 2: Company Exporting and importing

Zonal Location of your firm in India

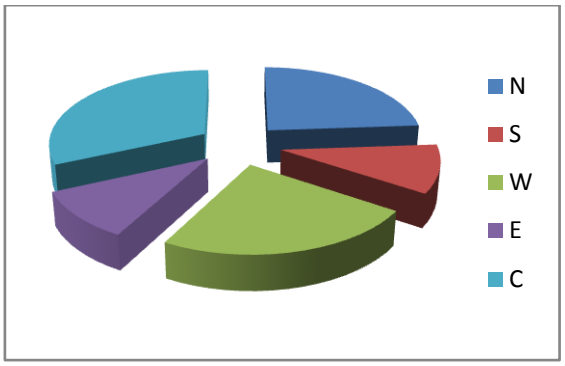

Figure 3: Company located in all regions

- Which of the following management styles are prominent in this plant.

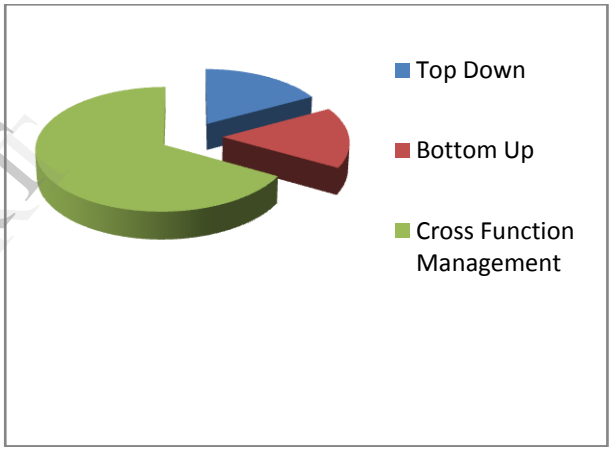

Figure 4: company management Style

Which of the following are characteristics of organization structure in your company?

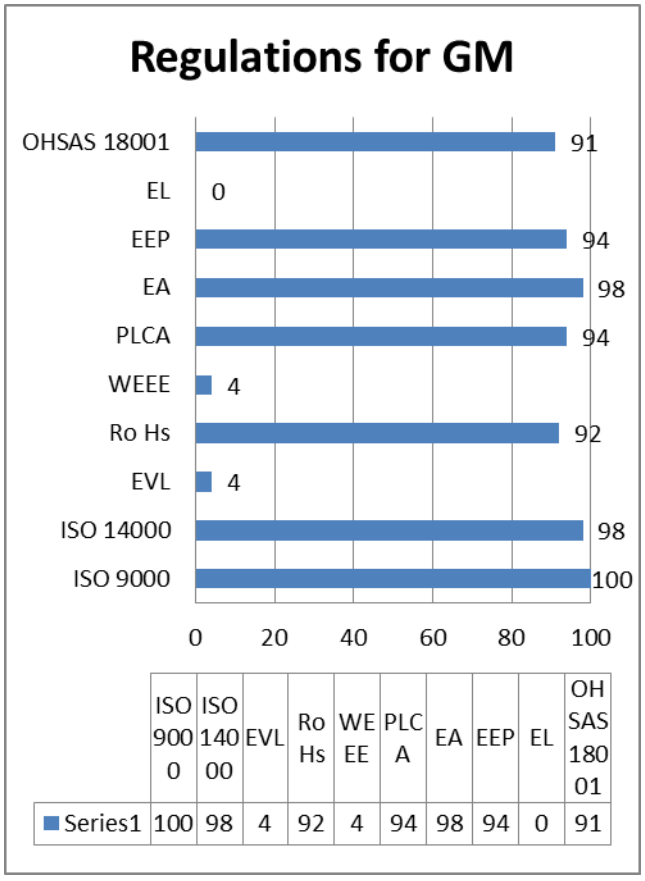

Figure 5: GM Initiative Taken by firms

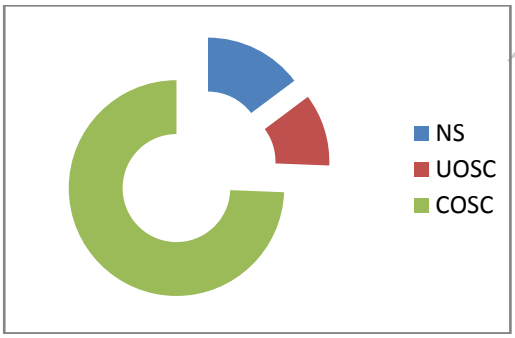

Figure6:

Challenges for India as compare world market:

The increasing growth of the Indian cement industry can be evaluated from the statistic fact that for creating more than 100 million tonnes capacity, prior to partial decontrol era, the industry took 83 long years, whereas to reach the second and third 100 million tonnes mark, the period had substantially shrunk to 11 years and less than 4 years, respectively. Cement capacity that was 64.55 million tonnes in 1990-91 reached 340.44 million tonnes in 2011-12. Similarly, cement production went up from 48.90 million tonnes to 247.32 million tonnes during the same period. India is the second largest cement producing country in the world. It produces about 7% of the global production. In 2010, world production of cement was 3294 million tonnes.

Key Issues and Challenges of Green Manufacturing for Indian Cement Industry:

- Modelling sustainable, environmentally conscious manufacturing processes, systems and analytical tools for assessing the impact of processes.
- Energy, transport, medical/health, life style, dwelling, defines and food/water supply systems based on increasingly precise elements for an energy and environmentally aware consumer
- Issues beyond the designing process like Green purchasing, marketing, and packaging are more in focus. Aspects like Process planning reverse logistic, Green disposal are further explored.
- It promotes Green culture in organization by conveying advantages of being Green. Manufacturers and designers are forced to adopt environmental directives.
- Issues that need more emphasis with reference to GM operational technologies are Green innovation of product and process, material reclamation, optimisation of raw material selection and manufacturing process.
- Dust emissions during cement manufacturing have long been accepted as one of the main issues facing the industry. The industry handles millions of tonnes of dry material.
- Key components of a supply-side strategy include remanufacturing for example of vehicle components – and the recycling of heat waste through combined heat and power installations.
- Green-investment-scenario modelling for manufacturing suggests considerable improvements in energy efficiency can be achieved.

Discussions:

In this paper, we have made basic change in the way green product, gas estimation, green supply chain management; wasted materials are recycled by integrating environmental manufacturing model. We are dealing with deployment of different GM tools insight process. This paper can help reduce the environmental impact of cement industrial activity without losing quality, reliability, performance, cost, etc. This study completes theories by using the literature survey for green manufacturing, so that this study can observe the energetic change of environmental organizational culture, green organizational identity and green competitive advantage in the different stages of the development of the cement manufacturing industry. However, in this paper, we found that investing resources and efforts to raise environmental organizational Green cement organizational identity in world culture and environmental leadership could not only foster green organizational identity, but also in time improve their green competitive benefit in the cement manufacturing industry.

CONCLUSIONS:

In this paper, an attempt has been made to review the literature on GM in cement industry. The authors have presented a literature classification and categorized content related to cement industry. This paper will assist researchers and cement industrialist to understand and integrate GM in cement industry. However, few of them focus on studying the life cycle and green product design by the help of GM process. Available resources should be used effectively and efficiently to achieve Green productivity with Green industry. In this paper, a challenge has been made to explore green process responsibility for initiating quality management in cement industry and planning for performance management in cement education by evaluating percent analysis. With the analysis result, we are getting a model and result for organization structure, company management, and regulation of GM for all cement industry in India. We get the better survey result for green manufacture in cement industry. This research instrument/questionnaire will provide impetus for further research aimed at gaining a more comprehensive understanding and better result for Indian cement industry. Here we have intended to propose a proper changed in perspective of GM. The information obtained in the current study will be invaluable not only for finding all gases emissions, but also for assessing the most practicable ways of making improvements to dust air quality, waste utilization and environment protection.

REFERENCE:

[1] R. Rehan, M. Nehdi, (2005) "Carbon dioxide emissions and climate change:policy implicationsfor the cement industry", Environmental Science & Policy, 8,pp. 105–114.

[2] M.Z. Soguta, Z. Oktay and A. Hepbasli, (2009) "Energetic and exergetic assessment of a trassmill process in a cement plant", Energy Conversion and Management, 50(9), pp. 2316–2323.

[3] M.B. Alia, R. Saidur and M.S. Hossain,2011 "A review on emission analysis in cement industries", Renewable and Sustainable Energy Reviews, 15(5), pp. 2252–2261.

[4] Chun-Jen Chung and Hui-Ming Wee, "Green-component life-cycle value on design and reverse manufacturing in semi-closed supply chain", International Journal Production Economics, 113(2), pp. 528–545.

[5] Rajiv K. Srivastava, Subramanian Chidambaran, (2012), "Make to Order Manufacturing in Indian Context: A Case Based Study", UDYOG PRAGATI - The Journal for Practising Managers, 36(1), pp. 49-64.

[6] D.B. Desai, A.K. Guptaand Pradeep Kumar, (2013)"Green Concrete: Need Of Environment ", International Journal of Advanced Science, Engineering and Technology, 2(2), pp. 134-137.

[7] M. Ziya SÖGÜT, (2012) "A research on exergy consumption and potential of total CO2emission in the Turkish cement sector", Energy Conversion and Management, 56, pp. 37–45.

[8] Darshak A. Desai, (2012), "Increasing Bottom-Line Through Six Sigma Quality Improvement Drive: Case of Small Scale Foundry Industry", UDYOG PRAGATI - The Journal for Practising Managers, 36(2), pp. 11-13.

[9] Wee-Kean Fonga, Hiroshi Matsumoto and Yu-Fat Lun, (2009) "Application of System Dynamics model as decision making tool in urban planning process toward stabilizing carbon dioxide emissions from cities", Building and Environment, 44, pp. 1528–1537.

[10] Leif Gustavsson and Roger Sathre, (2006) "Variability in energy and carbon dioxide balances of wood and concrete building materials", Building and Environment, 41(7), pp. 940–951.

[11] Sunil Luthra, Dixit Garg, Abid Haleem, (2011)"Analysis of Enablers to Implement Green Supply Chain Management of Indian Automobile Industry", UDYOG PRAGATI - The Journal for Practising Managers, 37(1), pp. 37-46

[12] Sabuj Kumar Mandal and S. Madheswaran, (2010) "Environmental efficiency of the Indian cement industry: An interstate analysis", Energy Policy, Vol. 38, No. 2, pp. 1108–1118.

[13] Nilesh Vijay Fursule, Satish V. Bansod, Swati N. Fursule, "Supply Chain Management, Six Sigma and Lean manufacturing – Basics, Overview, Pros and Cons", UDYOG PRAGATI - The Journal for Practising Managers, 36(3), pp. 18-31, 2012.

[14] Youjuan Wang, Weibin Lin and Qian Wan, (2011) "Green Growth: Constructing a Resource-Saving and Environment-Friendly Production Pattern", China Green Development Index Report, pp. 31-48.

[15] BrenoNunes, David Bennett, (2010) "Green operations initiatives in the automotive industry: an environmental reports analysis and benchmarking study", Benchmarking: An International Journal, 17(3), pp.396 – 420.

[16] Chun-Jen Chung and Hui-Ming Wee, (2008) "Green-component life-cycle value on design and reverse manufacturing in semi-closed supply chain", International Journal Production Economics, 113(2),pp. 528–545.

[17] Ahmed M. Deif, (2011), "A system model for green manufacturing", Journal of Cleaner Production,19(14), pp. 1553-1559.

[18] Kuo-Chung Shang, Chin-Shan Lu and Shaorui Li, (2010), "A taxonomy of green supply chain management capability among electronics-related manufacturing firms in Taiwan", Journal of Environmental Management, 91(5), pp. 1218–1226.

[19] Stephan Vachon and Robert D. Klassen, (2006), "Green project partnership in the supply chain: the case of the package printing industry", Journal of Cleaner Production, 14(6), pp. 661-671.

[20] Qinghua Zhu and Joseph Sarkis (2009), "Relationships between operational practices and performance among early adopters of green supply chain management practices in Chinese manufacturing enterprises", Journal of Operations Management, 22, pp. 265–289.

[21] Guofei Ren and Kazuhiro Fukuyo, (2014)"Chinese cement industry Transition, Status quo,Policy trend and Challenge", RISUS - Journal on Innovation and Sustainability, 5(2).

[22] Sadhana Chaurasia, Iqbal Ahmad, Anand Dev Gupta and Sanatan Kumar, (2014)"Assessment of air pollution emission from Cement Industries inNimbahera, Rajasthan, India",Int.J.Curr.Microbiol.App. Sci, 3(3), pp. 133-139.

[23] Mohammad JafarOstad-Ahmad-Ghorabi and Mohsen Attari, (2013), "Advancing environmentalevaluation in cement industry in Iran", Journal of Cleaner Production, 41, pp. 23-30.

[24] Y. Pontikesa and G.N. Angelopoulosc, (2013), "Bauxite residue in cement and cementations applications: Current statusand a possible way forward", Resources, Conservation and Recycling, 73, pp. 53–63.

[25] C. Meyer, (2009) "The greening of the concrete industry", Cement & Concrete Composites, 31(8), pp. 601–605.