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Study of Determinants of Proactive Environmental Strategies in Power and Cement Sectors

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ABSTRACT:
Any emerging economy like India depends on the growth of the infrastructure for its economic development. Power sector and cement sector are two critical sectors which are essential for the development of infrastructure of a country. Not only these two sectors are the leaders in contribution to infrastructural growth, but they are also responsible for damage caused to the environment due to their emissions. The damage caused to the environment from these two sectors has compelled the environmentalists to raise their voice against them. Such opposition has forced the government to formulate laws for the environmental protection. The environmental regulatory bodies enforce these laws. The waste from one industrial process has become the raw material for the other thus reducing the environmental damage. The blending of cement with fly ash by the cement sector has restricted the environmental hazard caused by this highly toxic waste from the power sector. Several studies have been carried out to identify the determinants of PES in different sectors. However, no such research has been carried out specifically for the power and cement sectors. PES are considered to be more stringent than required by extant laws, Companies adopting PES ensure transparent environmental reporting and fore sighting of any prospective change in environmental legislation which has the potential to harm the financial interest of the companies. Pressure from the stakeholders, local communities, judiciary, market, and media may decide the environmental behaviour of the polluting companies. Statistical tools SPSS and AMOS were used for the statistical analysis. Exploratory factorial analysis (EFA) was carried out for the validity and reliability of the constructs. The research was implemented using a combination of confirmatory factor analysis (CFA) and structural equation modelling (SEM). The empirical analysis uses a two-stage process in which the measurement models are first developed and confirmed using CFA to obtain latent constructs of PES. In the second stage, the measurement model and the SEM are estimated jointly to examine the determinants of PES using path analysis. Business practices, performance improvement, market pressure and benefits, and institutional pressure were observed as determinants of adoption of PES in the power sector. On the other hand, organisational capability, market benefits, environmental risk management, and stakeholder pressure were found to be determinants in the cement sector. Observed determinants were ranked using path analysis. Performance improvement and institutional pressure were observed to be key determinants of adoption of PES in power sector. Organizational capability and market benefits emerged as key determinants of PES in the cement sector.

Keyword: Proactive environmental strategies Environmental vanguard Statistical analysis Power sector Structural equation modelling

1. INTRODUCTION

Power and Cement sectors are considered to be the most vital sectors for the growth of infrastructure of a nation. However, with the infrastructure development, the issue of CO2 emission comes into consideration. The government regulatory bodies and the local communities along with judiciary, media and other stakeholders have been raising their voices against the CO2 emission from these two sectors. Due to strict environmental norms, these two sectors are forced to adopt the strategies for reducing the emissions. However, some firms are proactive in environmental strategies adoption in comparison to others. The factors which are responsible for the PES adoption beyond regulatory compliance are required to be investigated. Do factors like business practices, performance improvement, market pressure & benefits, institutional pressure, organizational capability, market benefits, environmental risk management or stakeholder pressure drive the adoption of these PES?. Even as power and cement sectors are the core of the development of infrastructure of a nation the CO2 emission from these sectors is a major cause of concern for the environmentalists. Infrastructure development activities and environmental damage go side by side. Better technologies should be adopted to minimize environmental damage caused by the development activities.

The PES are considered to be more rigorous than required by law. Efforts at the firm level for the establishment of the environmental policies and targets, training employees, setting environmental benchmarks for the suppliers, environmental auditing and transparent environmental reporting of information are considered as PES. According to McCloskey and Maddock (1994), "to date, few organisations have achieved a truly "green" strategy, in part because many companies lack a systematic approach to recording, monitoring and measuring factors which could have a deleterious effect on production and resourcing". The environmental impact of the thermal power generation is very serious regarding the health of human beings living in the vicinity of the power plant. The pollution from the thermal power plant affects the air, land and water resources equally. The fly ash generated from the thermal power plant is highly dangerous for human life. Taking into consideration the adverse impact of the pollution from the thermal power plants, the government has taken keen steps to ensure that without compromising the development of infrastructure the environment must be conserved. The damage to the environment can be controlled through a participatory process, including the stakeholders with a methodology that would create a conducive atmosphere for environmental planning & management and effective decision making. The main fuel for the power generation was coal as it was readily available and there were no regulations related environmental concerns due to the burning of fossil fuels and CO2 emissions.

The quality of Indian coal was not good as compared to coal available globally. The Indian coal had higher ash content and lower calorific value and therefore caused more emission as more fuel is burnt to get the desired thermal energy. As the concern for the environment gained momentum, voices against the emissions from the power sector found the platform with the support of the environmentalist. It became a daunting task for the government to fulfill the demand for electricity along with addressing the environmental concern. The use of renewable energy was considered as a viable solution for generating more power with reduced or no emissions. Out of the options available for renewable energy, solar energy, and wind energy were considered to be viable. However, solar energy was considered

acceptable, and huge investments were made in the solar energy sector. The government has set up a target of 100 GW of power generation through solar energy by 2022. . The government has taken serious steps towards the adoption of renewal energy sources. Extensive policy guidelines have been framed to minimize the use of fossil fuels in power generation and maximization of renewable energy sources. Even the clean source of power like hydropower is unable to provide electricity throughout the year. With adverse climatic conditions, the rainfall is getting affected resulting in non-availability of water for hydropower generation. Use of renewable energy sources is strongly advocated as due to its geographical location ample solar radiation is available throughout the year in India. The supply-demand gap of electricity can be filled through the potential renewable energy sources along with conservation of natural environment.

Concrete is considered to be the second most consumed material after water. Cement is the key ingredient for the production of concrete. Use of cement is essential for the infrastructure development. Due to abundant availability of the main raw material, i.e. limestone through out . The use of pre-heating of the raw meal before calcination and use of vertical ball mills and roll presses for grinding has been adopted widely due to better results and better efficiency. Several alternatives are being worked out to reduce the clinker ratio. Usage of discarded concrete as a clinker replacement is also in the pipeline. However, market acceptance of such products is still a cause for concern. Other options available for clinker replacement are fly ash, ground blast furnace slag and other blending materials like Lead-Zinc slag, copper slag, Jarosite, Kimberlite, and marble slurry some other materials which can be used as clinker substitute. However, their availability at an affordable price has to be kept in consideration. Some other technologies which are available for reducing the CO2 emissions are, the addition of mineralizers to the raw material entering the kiln has the potential to reduce the kiln temperature by 50oC without any loss of quality in clinker production resulting in the consumption of fuel and subsequent reduction of CO2 emission. Another technology available is raw material replacement by using Magnesium Oxide in place of limestone. Carbon capture and storage though in its nascent stage is considered as a potential CO2 reduction technology. The high cost involved and lack of specific guidelines from the government has prevented this technology for major penetration into the cement sector.

2. LITERATURE REVIEW

Proactive Environmental Strategies

It is an accepted fact that general level of strategic proactivity of a firm is related to its environmental strategic proactivity (Buysse and Verbeke, 2003; Aragon-Correa, 1998; Worthington and Patton, 2005). PES are mentioned as strategies which are beyond compliance but are different from over compliance, Prakash (2001).

“Role of the characteristics of the firm to explain the adoption of 'beyond compliance' strategies” has been looked at by other researchers, including “the influence of organizational context and design” (Ramus and Steger, 2000; Sharma, 2000; Sharma et al., 1999; Smart, 1992) along with “organizational learning” (Marcus and Nichols, 1999)

Larger firms have focussed on studying the pressure of stakeholders on the firms for the adoption of PES (Delmas, 2001; Henriques and Sardorsky, 1996, 1999; Sharma and Henriques, 2005). Several researchers have argued the role of PES in the smaller firms (Lepoutre and Heene, 2006; Noci and Verganti, 1999, Roome and Hinnells, 1993). It is observed that the stakeholder pressure varies with the

size of the firm (Darnall and Henriques, 2010). Considering the reputation, small firms are more inclined to adopt PES addressing to the stakeholder's concern (Besser, 1999). Pressure from the local stakeholders and legitimacy makes smaller firms more flexible PES adoption as compared to larger firms considering the ownership of the products and processes (Perrini, 2006; Sharma and Henriques, 2005). Considering the strong financial position, the larger firms can afford to resist the stakeholder pressure towards the environmental concerns (Bowen, 2002). Larger firms have been observed to prefer investing in lobbying and litigation rather than to succumb to stakeholder pressure (Meznar and Nigh, 1995). The regulatory authorities have to incur high costs towards litigation while imposing penalties on the larger firms as larger firms prolong the litigation process.

Sl. No.	Author(s)/ Reference	Country and sample firms	EMP practices	Determinants	Analysis method
1	Henriques and Sadorsky (1996)	Canada's largest firms	Formulation of an official plan to deal with environmental issues	Customer, shareholder, regulatory and community pressures; positive and statistically significant.	Regression (logistic)
2	Anton et al. (2004)	US and Non-US S&P 500 firms	Formal written policy and code of conduct on environmental issues; Environmental certifications; Principleof TQEM; Environmental audits; Environmental regulations; Environmental disclose reports	Liability threats and pressures from consumers, investors, and the public.	Regression
3	Darnall et al. (2009)	OECD countries (Canada, US, France, Germany, Hungry and Norway) manufacturing firms	Environmental policy; Competitive environmental performance; Environmental accounting; Environmental report disclosure; External environmental audit; Internal environmental audits; Environmental training program; Environmental performance indicators/goals	Pressure from stakeholders	Regression
4	Liu et al. (2010)	China	ISO 14001 certification; Cleaner technology adoption; Recycle of waste; Innovation; Environmental information discloser; Environmental cooperation with	External market pressures, internal factors (learning capacity and environmental strategy orientation)	Regression

			stakeholders		
5	Vazquez-Brust and Liston-Heyes (2010)	Argentinean firms	Environmental plan; Environmental impact assessment; ISO 14001; Environmental training; Environmental audit; Environmental disclosures, Collaboration with Environmental NGOs; Investment in environmental R&D; Environmental policy.	Managers' core values, basic assumption, and belief; policy and principle of governance; pressures from internal and external stakeholders	
6	Prajogo et al. (2012)	Australian ISO 14001 certified firms	ISO 14001 certification	Perceived environmental, social and market benefits	Path analysis
7	Zhu et al. (2012)	China	ISO 14001 adoption; TQEM adoption; Eco-compliance and eco-auditing	International institutional pressures, domestic institutional pressure, foreign owned or joint venture	Regression (logistic)

MATERIALS AND METHODS:

Power and Cement Sectors

The power and cement sectors are two very critical sectors essential for the development of the infrastructure of a country. The power sector in India is mainly state-dominated sector. Majority of the power generation, transmission and distribution are controlled by the government. High technical and commercial losses are a major concern for the policymakers. A sizeable amount of power generated gets wasted due to these losses. Due to the mounting losses of the state electricity companies, the government took major steps to make the sector more accountable. The government trifurcated electricity boards into three entities, generation, transmission, and distribution. Revolutionary changes were introduced to not only increase the power generation capacity but also to ensure that there are no adverse effects on the natural environment

History of Indian Cement Sector

Cement production first started in India in 1914, when a single plant of 1000 tonnes per annum was commissioned at Porbundar in Gujarat. With rapid infrastructure growth, India has become the second largest producer of cement in the world after China. Presently there are around 81 cement companies with 206 major cement manufacturing plants with total capacity of around 360 million tonnes per annum. Cement sector has seen a long journey since the days of scarcity, tough regulations, and imports. The government announced partial decontrol policy in 1982, which boosted the growth of cement sector. A fixed quota under the levy cement quota was fixed for the cement manufacturing plants.

Cement Manufacturing Process

1 Mining/quarrying of raw materials

2 Crushing
3 Pre-homogenisation and raw meal grinding
4 Coal grinding/kiln fuel preparation
5 Preheating
6 Pre-calcination
7 Clinker production in the rotary kiln
8 Cooling and storing
9 Blending

Emission standards for cement plants with co-processing of wastes

Concentration not to exceed, PM10 (30 mg/Nm3), sulphur dioxide (100, 700 and 1000 mg/Nm3 when pyritic sulphur in the limestone is less than 0.25%, 0.25 to 0.5% and more than 0.5% respectively) and nitrogen dioxide (600, 800 for rotary kiln with In-Line Calciner (ILC) technology, 1000 mg/Nm3 for rotary kiln using mixed stream of ILC, Separate Line Calciner (SLC) and suspension pre-heater technology or SLC technology alone or without calciner)

Major countries in worldwide cement production from 2011-2016 (Million metric tonnes) (The statistics portal, 2016) (Website: https://www.statista.com/statistics/267364/world-cement-production-by-country/)

Country	2011	2012	2013	2014	2015	2016
China	2100	2210	2420	2480	2350	2450
India	240	270	280	260	270	290
USA	68.6	74.9	77.4	83.2	83.4	85.9
Turkey	63.4	63.9	71.3	75	77	77
Brazil	64.1	68.8	70	72	72	60
Russia	55.6	61.5	66.4	68.4	69	56
Iran	61	70	72	65	65	53
Indonesia	30	32	56	65	65	63
South Korea	48.3	48	47.3	63.2	63	55
Vietnam	59	60	58	60.5	61	70

Strategies for environmental proactivity in the cement sector

India is the second largest producer of cement in the world. The cement industry plays a vital role in the country's economy by employing more than a million people. Huge investments both from the Indian as well as foreign investors have been attracted after deregulation of cement industry in 1982. Heavy investment in the infrastructure development is going to benefit the cement industry largely. Development of smart cities is going to provide a big opportunity for the cement industry. The current annual production of cement is approximately 350 million tonnes. Cement industry has been the target of various stakeholders for the emissions emanating as a result of the production process. The damage to the environment by way of mining, waste generation and emission of CO2 and fierce protest from the stakeholders has forced the cement industry to have an environment-friendly approach at the production process. Several environmental strategies have been adopted to ensure minimum damage to the environment. The role of both internal and external stakeholders has changed the scenario on the

environmental front. The companies have started becoming proactive towards the environment. The adoption of PES has resulted in product & brand differentiation, increased efficiency, reduced emissions, efficient waste management and relief from disruption in production process resulting in a long-term profit for the industry (Hoeffler and Keller, 2002). The Indian cement Industry has reached a stage where it can compete with high global standards. The Indian cement industry has set very competitive environmental goals for themselves. Sustainable development is the primary concern of the government. Several cement manufacturers have implemented waste heat recovery system along with a reduction in clinker ratio. A major manufacturer of cement declared in its annual report that its energy consumption of coal and other fuels (K.Cal./Kg. of clinker) was 741 as compared to industry norms of 800.

Alternative Raw Materials Use of fly ash as a silica and alumina source has been extensively adopted in cement production process (Canopolat et al., 2004; Sahu and Majling, 1994). Gypsum is another alternative raw material used in cement manufacturing process (Anonymous, 1996). Fluxes in the form of gypsum, feldspar and a blend of both have been mentioned in studies as a possible measure to reduce the temperature by 150-200°C from 1450°C in the ordinary portland cement manufacturing (Darweesh, 2001; El-Didamony et al., 2010; Helmy, 2003; Kwon et al., 2006; Wirsching, 1978). Energy consumption can be substantially lowered, and sustainability of 70 cement manufacturing process can be potentially improved by adopting these practices. However, these practices are adopted by very few manufacturers.

Innovative Quarrying Methods

Raw materials required for cement manufacturing are quarried from various sites. By adopting advanced explosives and novel quarrying methods, the sustainability of the cement manufacturing process can be improved.

Improved Milling and Grinding The average electrical energy consumption for manufacturing 1 tonne of cement is 110 kWh (Stoiber, 2003). Milling of raw meal components along with clinker and gypsum grinding consume more than 50% of the total electrical energy consumption (Kohlhaas and Laban, 1983; Theisen, 1993). Conventional ball mills are used however much-advanced roller mills, and pressure mills are available. Use of these advanced mills can result in higher grinding and electrical energy efficiency. Table 3.5gives the electrical energy consumption breakup of cement manufacturing process

Table 3.5: Electrical energy consumption breakup of cement manufacturing process (Stoiber, 2003)

Process	Energy Consumed (kWh/t)	%
Extraction and Blending	5.5	5
Raw material grinding	26.4	24
Raw meal homogenization	6.6	6
Clinker production	24.2	22
Cement grinding	41.8	38
Conveying, packaging, etc.	5.5	5
Total	110	100

Survey Instrument Development

The first step of questionnaire development is to generate specific items to meet objectives of the study.

Item Generation An extensive literature review was conducted for developing a scale for the survey, scales were identified from previous studies having strong reliability and validity. The main objective of the questionnaire was to collect information regarding constructs of the environmental vanguard, industry dynamics, business and profitability, natural resource conservation and emission reduction, cleaner technology, and sustainable vision. The questionnaire method was preferred because it allows collecting a relatively large sample in a short period. The questionnaire was pre-tested and validated by a pilot study. Following the pilot study, a survey questionnaire was finalised, including a covering letter, which described the purpose of the study and assurance of anonymity to the respondents.

Dimensions Considered In The Model

Environment Vanguard Oriented (EVO) For measurement of Environment Vanguard, the questions are based on innovation, improved profits, proactive corporate policy, Building firms reputation through sincere environmental stewardship, effective approach to identify future environmental liabilities, product and brand differentiation, prior assessment of future environmental legislation, customer concern for environment and cost saving and liability reduction. These eight questions were marked as 88 EVO1 to EVO8. A detailed description of all the items in the questionnaire is given in table 4.1.

Table 4.1: Nomenclature of Items for Environment Vanguard

Construct	Code	Item
		The key driver for adoption of PES
Environmental Vanguard Oriented (EVO)	EV01	Innovation
	EVO2	Building firms reputation through sincere environmental stewardship
	EVO3	Proactive corporate policy
	EVO4	Effective approach to identify future environmental liabilities and ability to tackle them without cost consideration
	EVO5	Product and brand differentiation
	EVO6	Prior assessment of future environmental legislation
	EVO7	Customer concern for environment
	EVO8	Cost saving and liability reduction

Natural Resource Conservation and Emission Reduction (NRCER)

For measurement of Natural Resource Conservation and Emission Reduction, the questions were based on improved efficiency due to reduced energy use, alternative fuels, resource conservation technology, raw materials, emission reduction, and environmental impact of the product and pollution control. These eight questions were marked as NRCER1 to NRCER8.

Business and Profitability Oriented (BPO)

For measurement of Business and Profitability Orientation, the questions were based on fear of market rejection of the product, the high cost of restoring the environment, product market domain, relationship with regulatory authority, waste reduction, the influence of contractors, improved profits and competitive advantage etc. These nine questions were marked as BPO1 to BPO9.

Cleaner Technology (CT)

For measurement of Cleaner Technology, the questions were based on the ability of the organization to develop novel approaches to long-term challenges like Climate Change, repositioning itself to acquire new technology competencies and repositioning its skill set for development of emerging markets.

Sustainable Vision (SV)

For measurement of Sustainable Vision, the questions were based on organisation's sustainable vision which, directs it towards the solution of environmental problems, guides the "development of new technologies, markets, products, and processes, creating a shared roadmap for future business and developing economically sound solutions for future environmental problems.

Data Collection Instruments

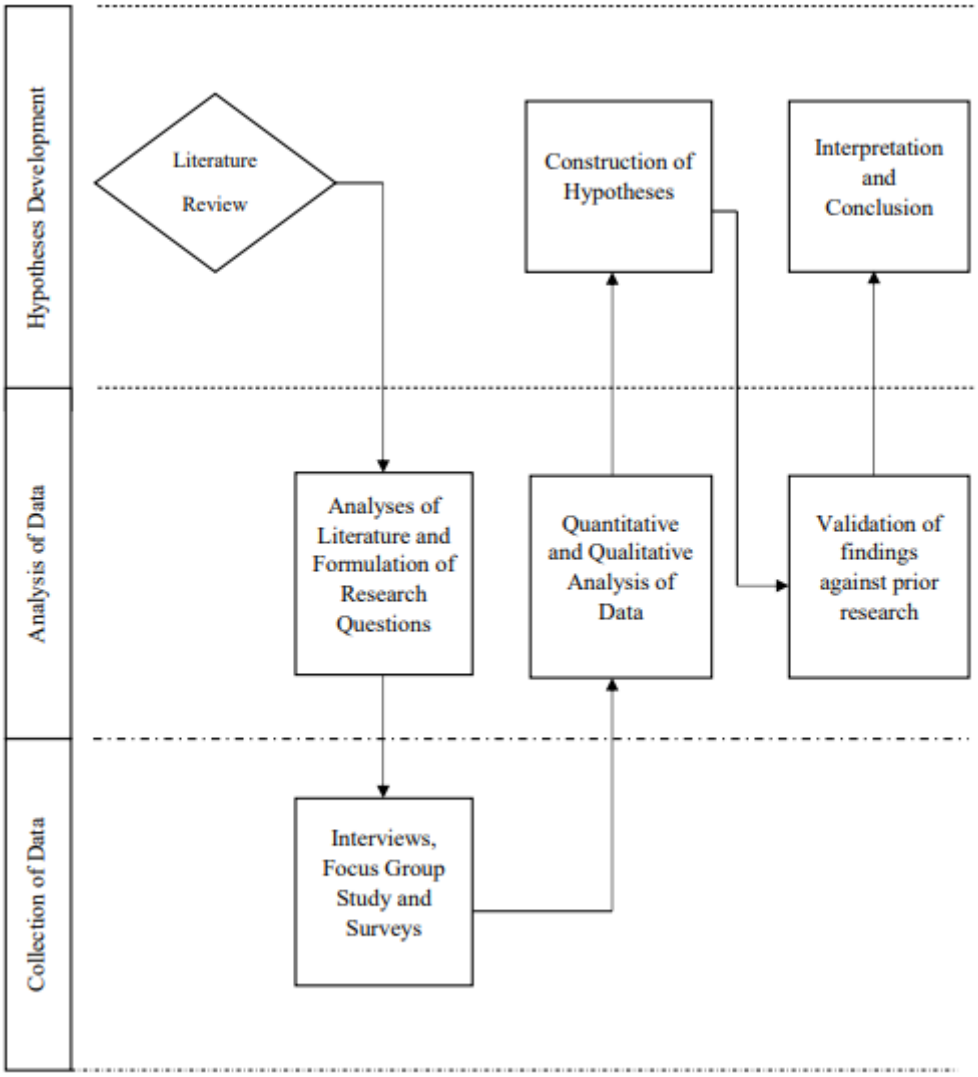
Both sources of information, secondary and primary were considered for the study. Secondary sources of information like sustainability and environmental reports by the companies were used. As secondary sources cannot provide the information needed on the determinants of adoption of PES in power sector in India, primary sources which provide the first-hand information and are the only source for beliefs, personal preferences, ratings, and attitudes etc. were used. Different variables were identified under different dimensions through primary sources like discussions with focus groups, in-depth interviews with experts, observations and survey methods were used. The design of questions ensured to analyse the key drivers for PES adoption in power sector in India. Two focus group studies were carried out to have an understanding of the key dimensions for the adoption of PES in power and cement sectors in India. The focus groups involved experienced persons from both the sectors having expertise in environmental management.

Content Validity The sufficiency with which a specific construct is sampled is called content validity (Churchill Jr, 1979; Ahire et al., 1998). The instrument was then checked by four academicians in environmental management and sustainability departments for comprehensibility and accuracy. Then, the expert opinion was sought from four experts in the area of sustainability and environment practices for checking the content validity and applicability of these variables in the Indian context.

Reliability Analysis

The appropriateness of the measures used for measuring concept is checked by two parameters, Reliability and Validity (Sekaran, 2003). The reliability measure indicates that a particular measure measures a particular concept consistently across time and geographical boundaries. This consistency of measure is determined by calculating the inter-correlation between the variables, considered for measuring the concept. The coefficient of α is popularly used as an indicator for determining the goodness of fit of a measure. The coefficient of α, i.e. (Cronbach's α) is a coefficient that indicates inter-correlation among the items.

Figure 4.1: Flow diagram showing the details of research methodology.



3. DATA ANALYSIS

Respondent Profile

A total of 450 respondents from the cement sector and 425 respondents from the power sector were approached. 365 responses were received from the cement sector out of which 55 responses were rejected as they were incomplete, randomly marked or repetitive. Similarly, 328 responses were received from the power sector out of which 48 responses were rejected as they were incomplete, randomly marked or repetitive. The mode of contacting respondents was both online and offline, out of the total 310 responses from the cement sector and 280 responses from the power sector were taken for the analysis s. The data of 310 responses from the cement sector and 280 responses from the power sector were taken for analysis on which Exploratory Factor Analysis was done.

Table 5.1: Level wise classification of respondents (Power Sector)

Management Level	Numbers	Percentage
Junior Level	63	22.50
Middle Level	110	39.28
Senior Level	107	38.22
Total	**280**	**100.00**

Descriptive Statistics of Business and Profitability Oriented (Power Sector)

	N	Range	Minimum	Maximum	Mean		Std. Deviation	Variance
	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic
BPO1	280	6	1	7	5.01	.111	1.855	3.441
BPO2	280	6	1	7	4.46	.105	1.757	3.088
BPO3	280	6	1	7	4.31	.106	1.780	3.170
BPO4	280	6	1	7	4.42	.116	1.935	3.743
BPO5	280	6	1	7	4.76	.102	1.713	2.935
BPO6	280	6	1	7	3.99	.101	1.686	2.842
BPO7	280	6	1	7	3.60	.112	1.881	3.538
BPO8	280	6	1	7	3.63	.103	1.716	2.943
BPO9	280	6	1	7	3.79	.097	1.620	2.624
Valid N (list wise)	280							

Table 5.26: Descriptive Statistics of Natural Resource Conservation and Emission Reduction (Power Sector)

	N	Range	Minimum	Maximum	Mean		Std. Deviation	Variance
	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic
NRCER1	280	4	3	7	5.46	.067	1.119	1.253
NRCER2	280	6	1	7	5.17	.105	1.755	3.079
NRCER3	280	6	1	7	4.51	.125	2.084	4.344
NRCER4	280	6	1	7	3.96	.109	1.825	3.332
NRCER5	280	6	1	7	4.17	.106	1.768	3.125
NRCER6	280	6	1	7	3.91	.113	1.895	3.591
NRCER7	280	6	1	7	3.90	.109	1.831	3.352
NRCER8	280	6	1	7	4.11	.101	1.684	2.834
Valid N (list wise)	280							

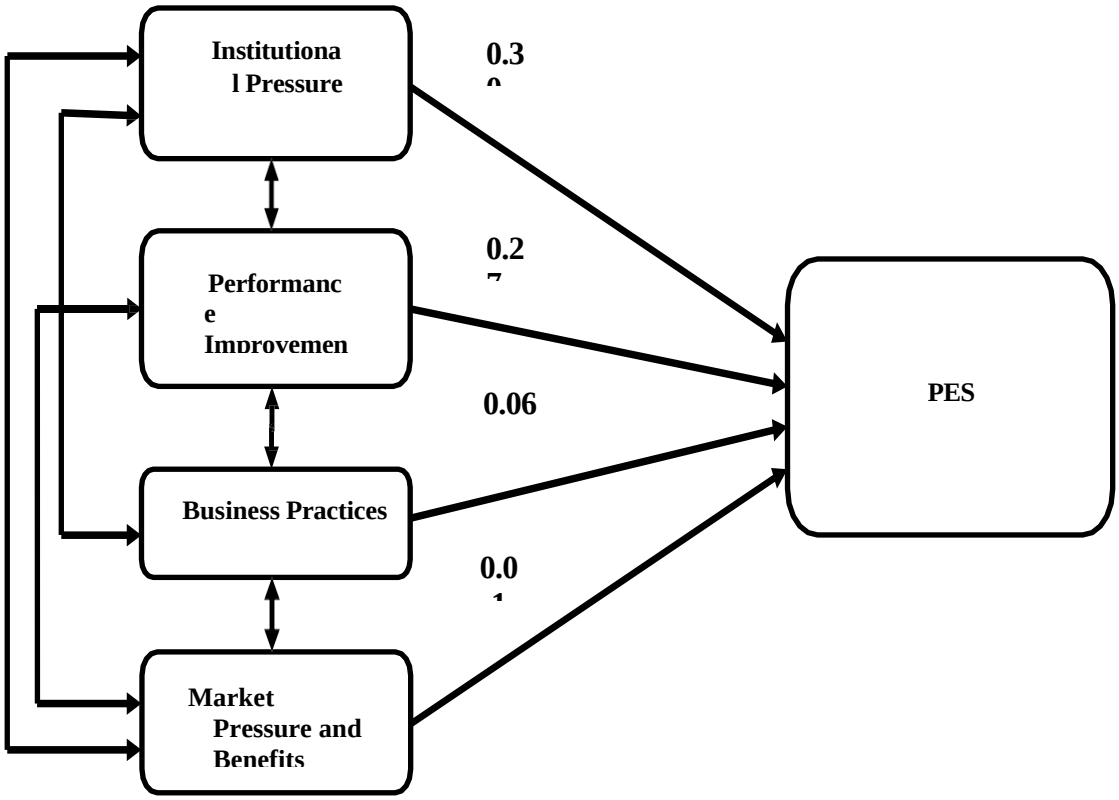
RESULTS AND DISCUSSION:

After the evolution of new structure post EFA, CFA was carried out on the newly evolved constructs. The CFA was carried out on the remaining 40 items for the power sector and 43 items for the cement sector to test the model fit of the new constructs.

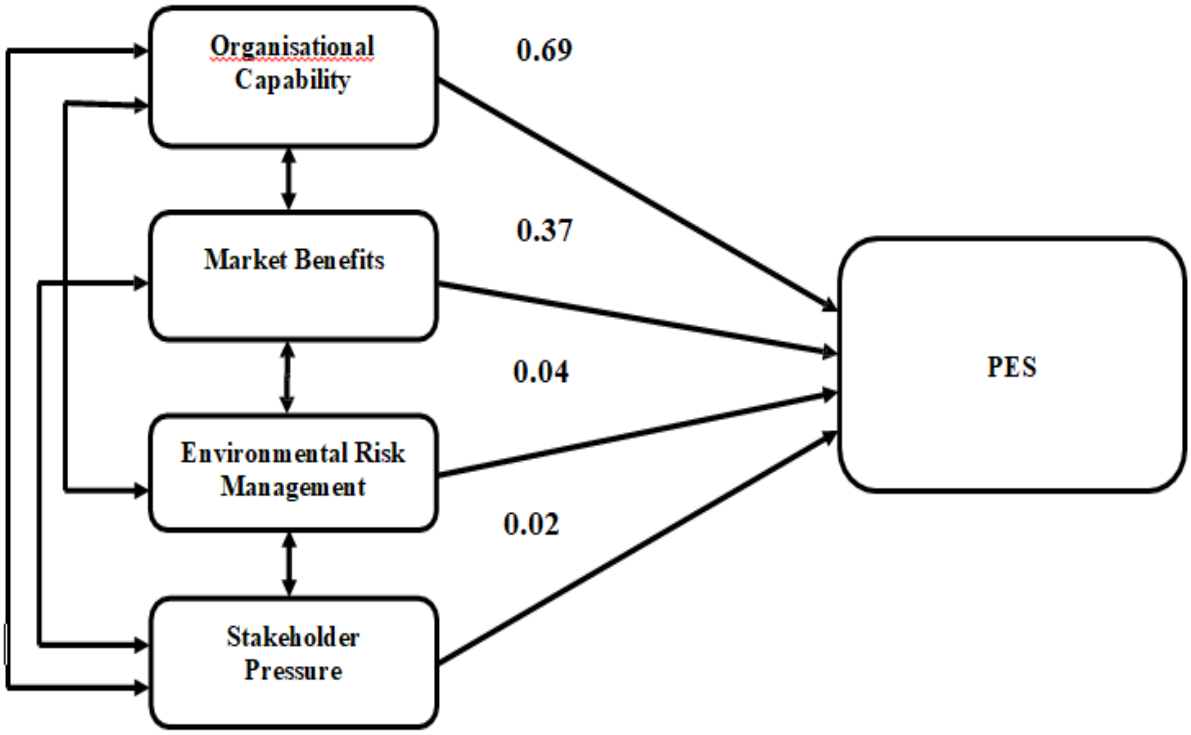
The values of the measurement model were Cmin/df: 2.703, CFI: 0.907, RMSEA: 0.078 for the power sector and Cmin/df: 2.695, CFI: 0.900, RMSEA: 0.074 for the cement sector and were found to be in the threshold limits as suggested by Hair et al., 2010. These values of fit indices indicate stability among the items and the constructs measured during the CFA analysis. Nine items for the power sector and six items for the cement sector were deleted during the CFA analysis.

Hypotheses Testing (Power Sector)

Determinants	**Values**				
	Estimate	**S.E.**	**C.R.**	**p**	**Label**
Proactive Environmental Strategies ↑ Institutional Pressure	**.162**	**.067**	**2.430**	**.015**	**Supported**
Proactive Environmental Strategies ↑ Performance Improvement	**.139**	**.056**	**2.476**	**.013**	**Supported**
Proactive Environmental Strategies ↑ Business Practices	**.029**	**.068**	**.424**	**.672**	**Not supported**
Proactive Environmental Strategies ↑ Market Pressure and Benefits	**.018**	**.101**	**.175**	**.861**	**Not supported**



SEM path analysis (Power Sector)



SEM Path analysis (cement sector)

The damage to the environment can only be prevented through the adoption of PES. The mandatory norms set by the regulatory authority has not helped enough to contain the damage caused to the environment. Why should a company adopt a proactive behaviour towards environment conservation when it fulfils the mandatory requirement? What prompts the companies to go for that extra mile to incorporate proactive environmental policies into their business strategies? There can be various reasons for doing so. Some may go for it go gain a competitive advantage over their competitors by creating a benchmark which is difficult to follow. The companies may develop unique capabilities which are difficult to imitate by their competitors. Apart from this various internal and external pressures also play a critical role in deciding the proactive environmental behaviour of the companies. Fear of market rejection due to a boycott of their products which have high carbon footprints. Pressure from the NGOs, judiciary, media, shareholders, local community and various other stakeholders has forced the companies to not only prevent the damage to the environment but also take measures to conserve the environment. Transparent environmental reporting has become a regular trend in business reports. Pollution oriented companies are publishing their sustainability reports annually which provide information about the efforts taken by the companies to not only minimise the damage caused to the environment but also the social initiatives taken by them for the upliftment of the society. Industrial by-products and wastes from the manufacturing process are being utilised in the manufacture of the cement helping in cost reduction along with sustainability. These hazardous wastes can efficiently be destroyed due to the high temperature of the kiln. Wastes like discarded tyres, municipal or industrial solid waste, paint solvents or oils etc. can be used efficiently as they provide the alternative for the fossil fuels. Further, they can be safely destroyed to heat the cement kilns thus making effective use of the environment damaging wastes

These waste transfer their energy content in the form of heat for the heating of kilns. Industrial by-products like gypsum, granulated ground blast furnace slag, silica fume, metakaolin (natural clay), concrete etc. are being blended efficiently to produce cement. In fact, now the majority of the cement available is the blended cement. Through blending not only the clinker component is reduced, but there is also no adverse effect on the quality of the cement.

The Indian power and cement sectors have witnessed a major turnaround. Several companies voluntarily are adopting stringent environmental strategies even though the law does not require them. The determinants observed were in conformation with the studies carried out by various researchers. The determinants observed were for power and cement sectors were different. There is a fundamental difference between the power and cement sectors. The power sector is service oriented sector on the other hand cement sector is a product oriented. Institutional pressure and performance improvement were the important determinants of the power sector which were different from the key determinants observed for the cement sector. Organisational capability and market benefits emerged as key determinants for the cement sector as it is not a service-oriented sector but has a product to offer. Business practices and market pressure and benefits were not observed as strong determinants for the power sector because Indian power factor is still under the regulatory control of the government . The power supply companies have to submit their proposals for the tariffs which are approved by the regulatory bodies restricting their profits. Factors related to market pressure emerged strongly for the cement sector. As cement sector is controlled by major multinational conglomerates, who already have a system in place for the protection of the interest of the company, not much importance is given to environmental risk management and stakeholder pressure. Accordingly, these determinants do not emerge as strong determinants for the cement sector.

SUMMARY AND CONCLUSIONS:

Due care was taken to design and conduct the study. However, potential bias cannot be ruled out. More extensive sample size may throw more light at some of the unexplored dimensions of the power and cement sectors. As the respondents formed a collective group, the study may be subjected to common source bias. Focus group inputs, detailed interviews, and available literature was taken into consideration to have a better understanding of determinants of adoption of PES in power and cement sectors in India. The power sector in India is still controlled by the government policies as the majority of the power distribution is done by the state-owned power supply companies. Considering the fact that 70% of the population lives in villages or small towns, the supply of electrical power to these locations has not attracted any private companies considering difficulties in commissioning power supply infrastructure. The other major issue is the tariff decided by the government. According to government directives the power supply has to be provided to the villages at a very minimal cost which does not even recover the cost of generation. Due to these factors, the private power supply companies are reluctant to enter the rural areas. Due to less recovery of the actual cost of generation, the quality of the power supply is affected and results in load shedding. The logic behind this is less power supply will result in a lesser loss to the power supply company.The urban areas and the industrial areas are the zones where power supply company can compensate for the losses due to supply at subsidised lower rates in rural areas. In the urban areas the customer who is capable of paying demands better quality power supply, i.e., there should be no interruptions. To fulfil the demand-supply gap, the power supply companies purchase the power from the surplus producers at low rates and supply at the rates as per the tariff. The requirement of the additional power occurs during the summer season as air conditioning demand is very high.

Several power producers have installed solar and wind power generation facilities at the remote location due to easy availability of land. The output from these facilities are fed to the national power grid, and power is transmitted to the desired locations. The power supply system is divided into three units, generation, transmission, and distribution. Mostly the state-owned companies have the infrastructure to generate, transmit and distribute the electrical power. The private companies are still involved in trading power through franchisees. The results of the study show institutional pressure as the strongest determinant of the PES adoption. As the power supply system is bound by an institutional regime, the result is as per the expectations and actual situation of the power sector. Another determinant which is prominent is the performance improvement. With the entry of private companies in the power sector, the state sector has to improve in order to survive without causing the damage to the environment.

With the high cost of fossil fuels and concern of the stakeholders, the power supply companies have to be proactive towards the environment, which can be achieved only through performance improvement. Adoption of new technologies, innovation, and pressure from the competitors force the companies to become environmentally proactive. Business practices and market pressure and benefits are other determinants responsible for proactive environmental strategy adoption by the power sector. As power sector is driven by a defined set of regulations where tariffs are decided by the regulatory bodies, it is not much scope to earn profits as profit, and returns on investment are decided by the regulatory bodies. Due to these factors, determinants like business practices and market pressure and benefits are not observed as strong determinants of proactive environmental strategy adoption. In the cement sector, the majority of the cement production is controlled by the private companies. In fact, major global cement producers have started acquiring big cement companies in India through merger and acquisition. Organizations which are better organised and managed are known to be more proactive towards the environment. The

results of the study support the observations.

Market benefits is the second strongest determinant for proactive environmental strategy adoption by the cement sector. A company will ensure that its manufacturing process is not disrupted due to any action by the regulatory authority on account of uncontrolled emissions from its process. A disruption in production will lead to loss of profit and a bad reputation in the market. Thus market benefits have correctly emerged as a strong determinant of adoption of PES. Environmental risk management and stakeholder pressure are not observed as prominent determinants due to the fact that as cement sector is controlled by big global cement manufacturers who have a very strong legal network to protect their interests in case of any legal issues.

This study draws on the theoretical and empirical research to determine the key determinants of adoption of PES in power and cement sectors in India

The determinants observed in the power sector are:

- Institutional Pressure
- Performance Improvement
- Business Practices
- Market Pressure and Benefits

The determinants observed in the cement sector are:

- Organizational Capability
- Market Benefits
- Environmental Risk Management
- Stakeholder Pressure

The empirical findings have suggested that Institutional Pressure and Performance Improvement are the most influential determinants of adoption of PES in the power sector and Environmental Risk Management and Stakeholder Pressure are the most influential determinants of adoption of PES in the cement sector. The study also indicates that determinants Business Practices and Market Pressure & Benefits for the power sector and determinants Environmental Risk Management and Stakeholder Pressure also plays an important role in the adoption of PES. For the rapidly developing economy like India, power and cement sector are two important sectors for the economic development through infrastructure development. Better infrastructure will create a conducive atmosphere for the investors resulting in nations' growth. Effective environmental regulations will ensure the sustainable development by conserving the environment.

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