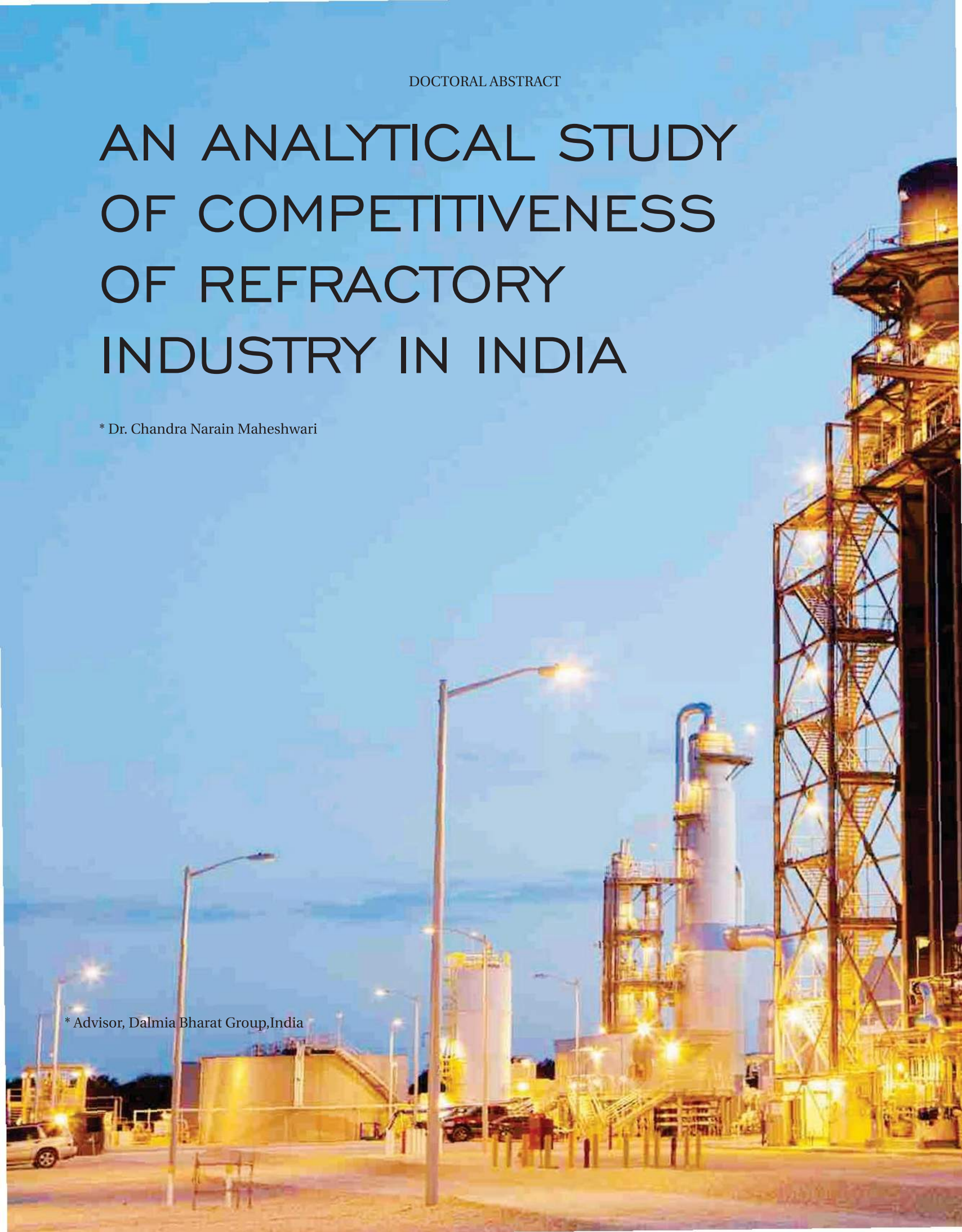


DOCTORAL ABSTRACT

AN ANALYTICAL STUDY OF COMPETITIVENESS OF REFRACTORY INDUSTRY IN INDIA

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I NTRODUCTION

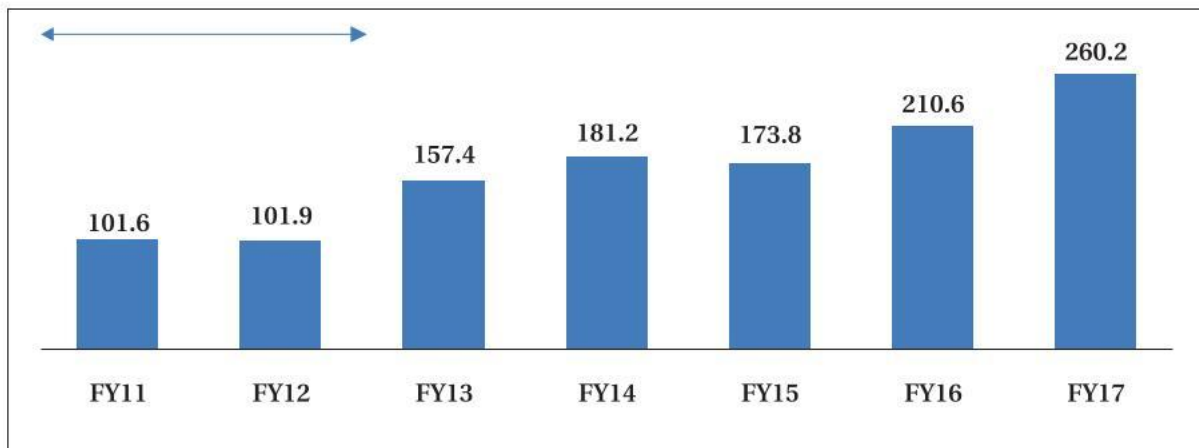
Steel and Cement sectors contribute maximum for the growth of any country's economy. These sectors assume special significance in the Indian economy which is poised for significant growth. Refractories are one of the most important constituent in production of steel and cement.

It was estimated by Niti Ayog, that spending on total infrastructure has increased significantly to around 9 percent of GDP during the 12th Five Year Plan (2012-17), up from 7.2

The principal raw materials used in the production of refractories are magnesite, bauxite, graphite, quartzite beside different types of clays. The main types of refractories which are popular are fire-clay bricks, costables, ceramic fiber and insulating bricks that are made for diverse applications.

The global industry has also forecasted that demand in the world's third largest producer will grow at 5.4 per cent to 88.3 MT in 2017. It clearly shows that with 140 mil tones of crude steel production in the year 2020, the Indian refractory industry has a decent scope to grow.

FIGURE1:INFRASTRUCTURE SPENDING IN PERCENTAGE



Source: CMIE Database, Tech Sci Research

percent during the previous plan. The current year (FY22) also saw a significant increase to around Rs 5.6 lakh crs. from Rs 4.4 lakh crs. in the previous year. Without application of refractories, the production of steel, cement & glass etc. cannot take place. With the push for infrastructure growth in India, demand for core sector like Steel & Cement will increase substantially which will also result in growth in refractory demand.

It has been observed that the Indian Players in the Refractory Industries are facing a stiff challenge from the global majors who have entered the India refractory market and are finding it difficult to compete with them because of their brand image, strong R & D, service orientation, changing domestic service dynamics, and challenges of environmental sustainability. However the growth in global steel industry provides a lot of opportunities for refractory industry.

Understanding Refractory Industry

Refractories are used for protecting the furnaces from high temperature and used for the internal linings of furnaces, kilns, reactors and other vessels for holding and transporting metal and slag. The refractories are also installed in fired heaters, hydro reformers, furnaces incinerators, boilers, catalytic, coke calciner, sulfur furnaces, air heaters, ducting, stacks, etc. They operate under high pressure and a wide range of temperature (approximately 900°F to 3000°F).

Table1: Projected Crude Steel Production

Year	THF(MT)	BOF(MT)	EAF(MT)	IF(MT)	Total
2015-16	2.5	42.5	23.5	31	98
2016-17	0	50	26	34	110
2020-21	0	66	34	40	140

Steel industry is the major user segment for refractories consuming around 3/4th of its total annual production. The refractory industry has to keep up with technical upgradations done by steel industry from time to time & keep on upgrading its products to keep pace with its demand both in terms of quantity & quality. There are huge technological progresses through different innovation but on the other hand there are deflationary raw material prices of iron ore, coal and oil. In the Indian scenario, 15% excess capacity has been seen as 89 million tonne of crude steel which was produced but bonne only 78 million tonne was consumed. In the last six years there bonne has been a dwindling capacity utilization which reduced by 20% during this period. Government of India has imposed safeguard duties on certain grades of imported steel.

Challenges Faced by The Refractory Industry

High dependence on imported raw materials – Refractory industry is highly dependent on imported raw material mainly

from China. Except naturally occurring clays, some grades of graphite, chromite, sintered dolomite and fused Alumina, all materials like magnesia-sintered or fused, graphite, sintered alumina, and fused composites are imported.

Reuse, Recycle and Waste Elimination – Refractory makers along with steel industry are facing issues of generation of waste and hence to continuously work on improving reuse, recycling and waste elimination in refractories application.

Payment terms- Refractory industry off and on face crucial issue of payment terms not followed by the customers.

The study has been conducted to understand the present status of the refractory industry in India particularly regarding its competitiveness in domestic and global market. The objective of the current research is to design a comprehensive framework for the refractory industry in India so as to maintain its long term sustainability and global competitiveness.



REVIEW OF LITERATURE

Desai and Joshi (2015) studied the impact of financial restructuring on corporate performance of Steel Industry in India.

Secondary sources of data were considered for the study. Financial statements of steel sector firms, both large and medium scale firms, were analyzed by taking sales, gross profits, net profits, gross assets, taxes paid and current ratio as parameters, before and after the restructuring. Results of the study indicated that financial restructuring had a significant impact on the financial performance of large and medium sized firms in the long run.

Manasa B.R., Krishnanaik C.N. (2015) study regarding Employee Welfare Measures in CCI units at Thandur and Adilabad has indicated that the welfare measures taken were commendable. Further it would result in improvement in efficiency and effectiveness leading to better productivity of the employees to accomplish the organizational goals.

Burja (2011) highlighted the factors which can influence the profitability of companies. These factors can lead to increase the company's competitiveness and would satisfy shareholders' interests. The study was based on the company performance analysis models which highlights the influencing factors of profitability. The multi factor regression analysis was used to analyze the performance models. The results showed a strong relationship between the profitability and the management of available resources.

Bhanawat (2010) evaluated the share of raw material cost in the cost structure of the manufacturing industry. A sample of 58 companies engaged in manufacturing activities was selected covering pharmaceutical, textile, cement, metal, oil, automobile, consumer goods and electrical industries. The study concluded that there was no significant difference among different sectors of the Indian manufacturing industry regarding raw material cost as percentage of gross sales. The results revealed that, on an average, raw material cost as a percentage of gross sales was 46.46 per cent for Indian manufacturing industries.

The present research aims at analyzing the competitiveness of refractory industry in India with reference to human resource variables. Most of the refractory players in the organized sectors are multi nationals and have bulk of the operations outside India affecting competitiveness. Similarly, the procurement of raw materials from their own associate companies & the transfer pricing at which such materials are procured also greatly affect the results of these companies in India. The disclosure practices of human resource variables has also been limited to the operations as recorded in the Indian entities only.



OBJECTIVES

The study aims to achieve the following objectives:

- Identify the factors affecting the competitiveness of refractory industry in India.
- Compare the competitiveness of Indian firms manufacturing refractories.
- Compare the competitiveness of Indian firms operating in refractory industry vis-à-vis the leading refractory firms at international level.
- Suggest measures to enhance the competitiveness of Indian refractory industry.
- Get acquainted with the disclosure practices adopted by the industry with respect to human resource variables.
- Understand the behavior & impact of human resource variable in the organized & unorganized sector.



RESEARCH METHODOLOGY

Methodology of the Study:

Data relating to number of such organizations in terms of their sales, market size, market share and their strength and weakness was collected. The appropriate statistical tools and procedure were followed to process the data and derive meaningful conclusions. The study has made use of both primary and secondary data based on review of literature and through verbal interview and factors affecting competitiveness of Indian refractory industries.

Further primary data was collected through survey among user industries with questions asked through formal and informal interview on type of refractory used, prices paid, decision making process in procurement, challenges faced and openness to the new suppliers. Annual Reports of Companies in both organized and unorganized sector were analysed to understand disclosure of practices regarding the human resource variables.

Hypothesis:

- H01: The unorganized sector is more competitive than organized sector in the refractory industry considering the cost and performance.

- H02: The rate of disclosure of human resource variables is non-significantly different among unorganized sector companies.
- H03: The rate of disclosure of human resource variables is non-significantly different among organized sector companies.
- H04: The rate of disclosure of human resource variables is non-significantly different among organized sector and unorganized sector companies.



DATA ANALYSIS & INTERPRETATION

The Companies which were selected from unorganized sector for the purpose of this research were –

- SKG Ltd.
- Rassi.
- ORL
- Siam
- Resco Ltd.

The Companies which were selected from organized sector were –

- TRL
- Dalmia
- Calderys
- IFGL Refractories Ltd.
- Vesuvius India Ltd.
- RHI

Brief description of major domestic players in organized sector is given below:

TRL Krosaki- TRL Krosaki Refractories Limited has pioneered refractory production in India. It is the No.1 refractory company in India with a wide range of products like Basic, Dolomite, High Alumina, Monolithic, Silica, Flow Control and Tap Hole Clay Refractories having an annual installed capacity of 466 KMT. Its key customers segment are Steel, Cement, Glass, Copper and Aluminum industries. Its main work is located at Belpahar in the State of Odisha. During the year 2018-19, the Company crossed a consolidated turnover of Rs. 1600 Crores. Tata Steel continues to hold a 26.62% equity stake in TRL Krosaki, even after the acquisition of majority share holding of Tata Refractories Limited by Krosaki Harima Corporation (KHC), Japan from Tata Steel. With the association of KHC, a leading refractory player with global presence and advanced technology, TRL Krosaki is able to access the latest technology. KHC and TRL Krosaki have jointly emerged as the 5th largest refractories manufacturer in the world.

Dalmia Group- It is one of the oldest supplier of refractories in the organized sector in India. With OCL refractories becoming a part of the Dalmia group, it is able to offer complete refractory solutions. It has four manufacturing plants catering to cement, steel, glass and non-ferrous industries having annual installed capacity of 240 KMT with total turnover of Rs

900 Crores in FY 19.

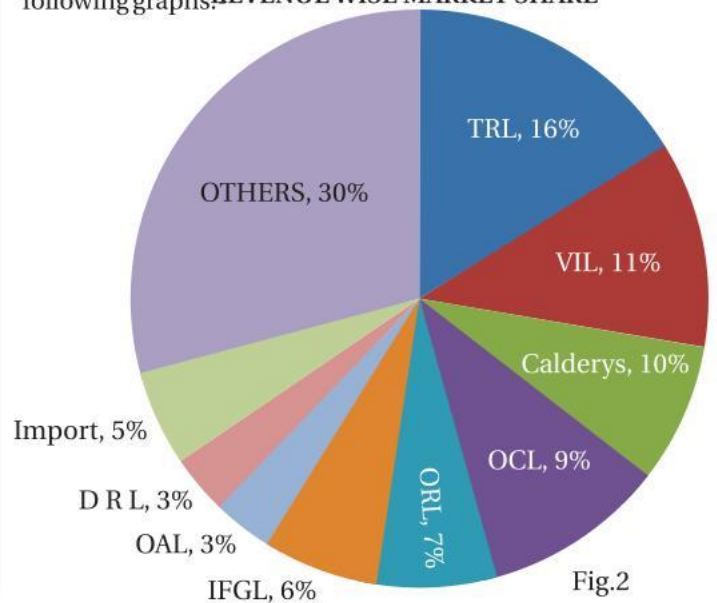
Calderys- Calderys, a subsidiary of IMERYS, is a multinational company specialized in producing heat resistant monolithic refractory products. Calderys is headquartered at Paris, with over 2,000 employees and 18 plants in more than 30 countries. The Company achieved turnover of Rs. 665 Crores in FY 19.

IFGL - IFGL Refractories Ltd. is a manufacturer of Specialized Refractories and requisite Operating Systems for Iron and Steel Industry. IFGL has a large pool of trained engineers and application specialists to offer customers Total Solution for Refractory for flow control in Steel Teeming and Continuous Casting of Steel. In 2006, company acquired Monocon group with production facility in many countries and in 2018 company acquired Hoffman group with manufacturing plant in Germany and Czech Republic. Currently IFGL have manufacturing facilities in India, Brazil, China, Czech Republic, Germany, UK and USA. The turnover of the Company in India was Rs 480 Crores in FY 19.

Vesuvius - Vesuvius India Limited is a subsidiary of Vesuvius Group Limited, U.K. and was one of the earliest to be given approval by the Central Government for green-field project in West Bengal under the liberalized industrial policy of 1991, in the then changing economic scenario. At present the company has four factories one and one manufacturing arrangement. It achieved a turnover of Rs. 900 Crores in FY19.

RHI- The RHI group is a globally operating supplier of high grade refractory products, systems and services. RHI serves customers in the steel, cement, non-ferrous metals, glass, energy and chemical industries in nearly all countries in the world. It produces more than 2 million tons of refractory products annually and supplies customized product and system solutions. To enter into Indian market, RHI acquired two major Indian companies – Clasil refractories and Orient refractories and increased its presence in India. The Company achieved turnover of Rs. 1025 Cr. in FY 19.

The market shares of domestic players in the Indian Market and also their share in Steel & Cement is depicted by the following graphs: **REVENUE WISE MARKET SHARE**



- It is observed that TRL Krosaki is the leading player in the Indian Refractory Market having about 16% share. Eight Players together have 65% share. Remaining 90 players enjoy 35% share of refractory market in India. This shows the highly fragmented character of refractory industry in India.

MARKET SHARE IN STEEL SEGMENT

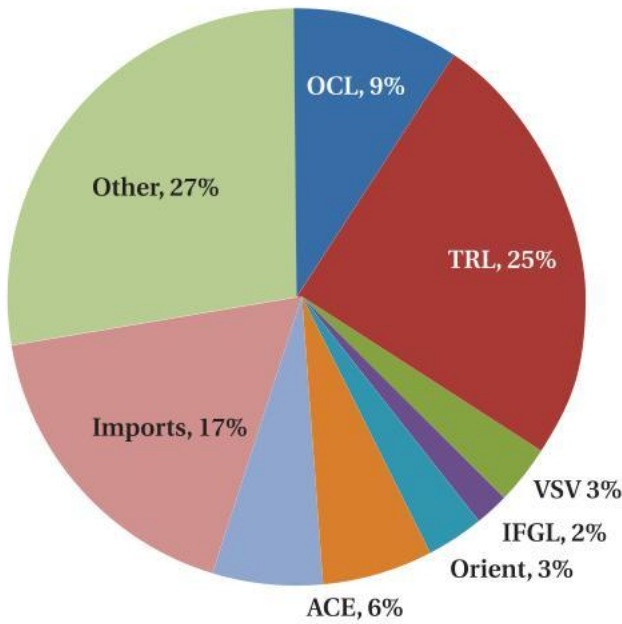


Fig. 3

MARKET SHARE IN CEMENT SEGMENT

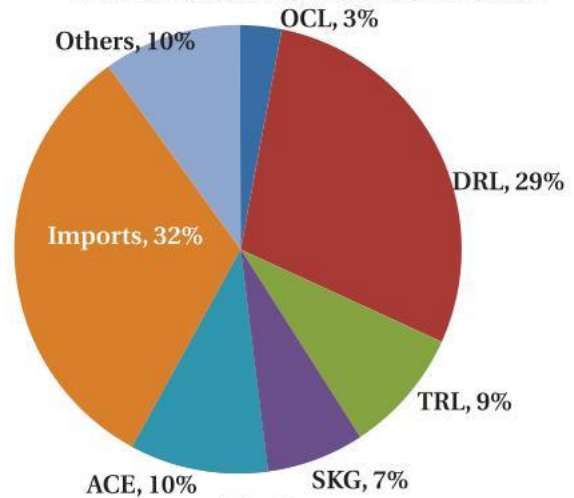


Fig. 4

TRL & OCL(Dalmia) are the major refractory players for Steel Industry. DRL is the market leader in Cement followed by ACE, TRL & SKG. ACE is market leader in monolithic type of refractories. Vesuvius, ORL & IFGL are mainly manufacturing refractories of special category and command higher margin.



D ATA ANALYSIS AND INTERPRETATION

The Financial data of key players in organized & un-organized sector is summarized below:-

Table 2: Financials - Domestic Organized Players

PARTICULARS	DALMIA		TRL	Calderys	VIL	RHI	IFGL
	D R L	OCL					
Revenue (Rs. in crores)	584	313	1593	665	887	1025	479
EBITDA (Rs. in crores)	58	18	161	122	150	85	72
Raw Materials	60%	55%	56%	59%	57%	55%	52%
Power & Fuel	8%	8%	7%	3%	3%	5%	4%
Selling Expenses	3%	4%	6%	5%	4%	4%	11%
Other Variable Cost	5%	7%	3%	4%	7%	7%	11%
Employee Cost	13%	14%	7%	9%	8%	8%	9%
Other Admin & Fixed Cost	6%	6%	11%	4%	6%	5%	9%
Misc. Income	4%	3%	0%	2%	2%	1%	1%
EBIDTA	9%	6%	10%	18%	17%	17%	15%

Source: Compilation from Annual Reports FY 2019

Table 3: Financials - Domestic Un-organized Players

PARTICULARS	SKG	Rassi
Revenue (Rs. in crores)	70	41
EBIDTA (Rs. in crores)	4	2
Raw Materials	55%	72%
Power & Fuel	8%	8%
Selling Expenses	6%	2%
Other Variable Cost	9%	4%
Employee Cost	10%	7%
Other Admin & Fixed Cost	3%	2%
Misc. Income	1%	0%
EBIDTA	6%	5%

Source: Compilation from Annual Reports FY 2019



INDINGS

- 10 players in Organized sector generate about 60% of revenue of the total Indian refractory market, whereas > 90 players of un-organized sector generate about 40% of refractory revenue. The unorganized players like SKG & Rassi are mainly in the commoditized range of products which are not used in critical applications. These are low value items and hence the freight plays a major role in cost competitiveness for the user industry.
- The margins are much higher (15 – 20%) for the refractory players who are operating in the niche product segments. Vesuvius, RHI & Calderys fall in this category.
- They have innovative products which are difficult to replicate and thus impart greater pricing power to such producers. The resultant higher gross margin levels enable the provision of higher level of services without compromising on margins.
- Global players have advantage of access to technology & benefit of R & D on global basis and process improvements in the operations of end users. Vesuvius is technology leader in metal flow control.
- Players like Calderys, TRKL & RHI are having advantage of economies of scale and hence are more competitive. RHI has wide range of product segment.
- Dalmia, major Indian player in organized sector has advantage of multi-location plants. However, they are not having the advantage of technology access as available to global players. Moreover, their overheads costs as a % of revenue are higher as compared to global players as also the players in the unorganized sector.
- Raw material cost is one of the important constituent of total cost of production, which varies from 40% to 60%. Hence raw material cost is an important factor in determining its competitiveness. Global players,

particularly the units which are engaged in specialized product have distinct advantage over the others because of control and certainty of raw material supplies as a major value driver. RHI and magnesia both have about 80% self-sufficiency in raw materials.

- Some of players have established an alternate outsourcing based business model. In India, TRL Krosaki Refractory is getting some products manufactured from third party sources under their technical supervision and marketed through their distribution network.
- Raw Material Access, Technology Collaboration, R & D are the three most important elements for competitiveness.

To study the disclosure of practices of Human Resource Variables.

The Companies which were selected from unorganized sector were–

- SKGLtd.
- Rassi.
- ORL
- Siam
- Resco Ltd.

The Companies which were selected from organized sector were–

- TRL
- Dalmia
- Calderys
- IFGL Refractories Ltd.
- Vesuvius India Ltd

Disclosure of Human Resource Variables in Organized / Unorganized Sector

- The rate of disclosure of Human Resource variables was compared among selected unorganized sector and organized sector companies.
- The data reveals that the average rate of disclosure of human resource variables was 50.83% for Organized sector companies, which was significantly higher than the rate of disclosure for Unorganized sector companies. The average rate of disclosure for unorganized sector companies was 37.34%.
- Hence, it is concluded that the significant variation exists in the rate of disclosure of human resource variables between Organized sector and Unorganized sector companies.

Variable wise Analysis

The following differences have been observed in the HR disclosure practices of Organized and Unorganized sector companies.

Table 4: Disclosure of Human Resource Variables in Organized Sector

		Name of Company					
Year		RLL	Dalmia	Calderys	IFGL	Vesuvius	
Total Number of Variables Disclosed	Year	N	9	13	12	13	15
	2011	%	37.50	54.17	50.00	54.17	62.50
	Year	N	9	12	12	13	15
	2012	%	37.50	50.00	50.00	54.17	62.50
	Year	N	9	12	12	13	15
	2013	%	37.50	50.00	50.00	54.17	62.50
	Year	N	9	12	12	13	15
	2014	%	37.50	50.00	50.00	54.17	62.50
	Year	N	9	11	12	13	15
2015	%	37.50	45.83	50.00	54.17	62.50	
Average Rate of Disclosure			37.50	50.00	50.00	54.17	62.50

Table :5 Disclosure of Human Resource Variables in Unorganized Sector

		Name of Company					
Year		SKG	Rassi	ORL	Siam	Resco	
Total Number of Variables Disclosed	Year 2011	N	8	7	8	8	20
		%	33.33	29.17	33.33	33.33	83.33
	Year 2012	N	9	7	8	8	20
		%	37.50	29.17	33.33	33.33	83.33
	Year 2013	N	9	7	8	8	8
		%	37.50	29.17	33.33	33.33	33.33
	Year 2014	N	9	7	8	8	8
		%	37.50	29.17	33.33	33.33	33.33
	Year 2015	N	10	7	8	8	8
	%	41.67	29.17	33.33	33.33	33.33	
Average Rate of Disclosure			37.5	29.17	33.33	33.33	53.33

Table 6: Categorization of variables according to rate of disclosure in Unorganized Sector Companies

HR Variable	Overall Disclosure
As given in the Table 5 in the case of unorganized sectors the least disclosure of 0-20% range has been in the areas of Human Resources Development Fund, Value Added per employee, Age wise distribution, Gender wise distribution, Group wise distribution, Human capital in balance sheet, Separate HRA statement, Valuation Model used, Value of Human Resources.	0%-20%
Turn over per employee, Economic value Added(EVA), Brand Valuation, Value Added	20%-40%
Employee Cost, Recruitment Cost, Ten years at glance, Discount rate used	40%-60%
Training and Development expense, Qualification of the employees	60%-80%
Highest disclosures of 80-100% have been in Capital Employed, Employee Remuneration benefit, Retirement Benefits, Awards and Rewards given for good performance, Man power in numbers.	80%-100%

Table 6 and 7 demonstrates that HR variable is Discount rate utilized, Training and development cost, Awards and Rewards given for good performance, Capital Employed, Employee Remuneration advantage, Group wise distribution, Man power in numbers, Retirement Benefits, were most, every now and again disclosed with 80-100% rate of disclosure. Variables which were disclosed with 60-80% rate of disclosure were

Training and Development cost, Qualification of the employees and Value Added.

Employee Cost, Recruitment cost, Ten years initially, Discount rate utilized, Human Resources Development Fund, Recruitment cost, Value Added per employee variables were disclosed with 40-60% rate of disclosure.

Table 7: Categorization of variables according to rate of disclosure in Organized Sector Companies

HR Variables	Overall Disclosure
Brand Valuation, Human capital in balance sheet	0%-20%
Age wise distribution, Economic value Added (EVA), Separate HRA statement , Turnover per employee, Valuation Model used, Value of Human Resources, Employee Cost, Gender wise distribution	20%-40%
Human Resources Development Fund, Recruitment cost, Ten years at a glance, Value Added per employee	40%-60%
Qualification of the employees, Value Added	60%-80%
In the case of organizational sector companies' disclosure practices, the lowest of 0-20% disclosure has been brand valuation, human capital in balance sheet and in the case of highest disclosure of 80-100% is in the areas of Discount rate used, Training and development expense, Awards and Rewards given for good performance, Capital Employed, Employee Remuneration benefit, Group wise distribution, Man power in numbers, Retirement Benefits	80%-100%

Table 8: Categorization of variables according to rate of disclosure in Organized Sector & Unorganized Sector Companies-Comparative

Rate of Disclosure	Unorganized Sector		Organized Sector	
	N	%	N	%
0%-20%	9	36.50	2	8.34
20%-40%	4	16.68	8	33.34
40%-60%	4	16.68	4	16.68
60%-80%	2	8.34	2	8.34
80%-100%	5	20.84	8	33.34
Total	24	100.00	24	100.00

Table 8 demonstrates that in unorganized sector 37.50% variables were disclosed with disclosure rate extending from 0% to 20% though in Organized sector just 8.33% variables were in this class. 16.68% HR variables disclosed 20% to 40% occasions in unorganized sector though 33.34% variables fall in this classification. In 40% to 60% territory both in organized sector and unorganized sector 16.68% HR variables were disclosed. Additionally, in 60% to 80% classification 8.34% variables in each Organized and Unorganized sector companies were disclosed. At long last in 80%-100% class 20.83% HR variables were disclosed while in organized sector companies' 33.33% HR variables were disclosed.

H₀₁: The unorganized sector is more competitive than organized sector in the refractory industry considering the cost & performance.

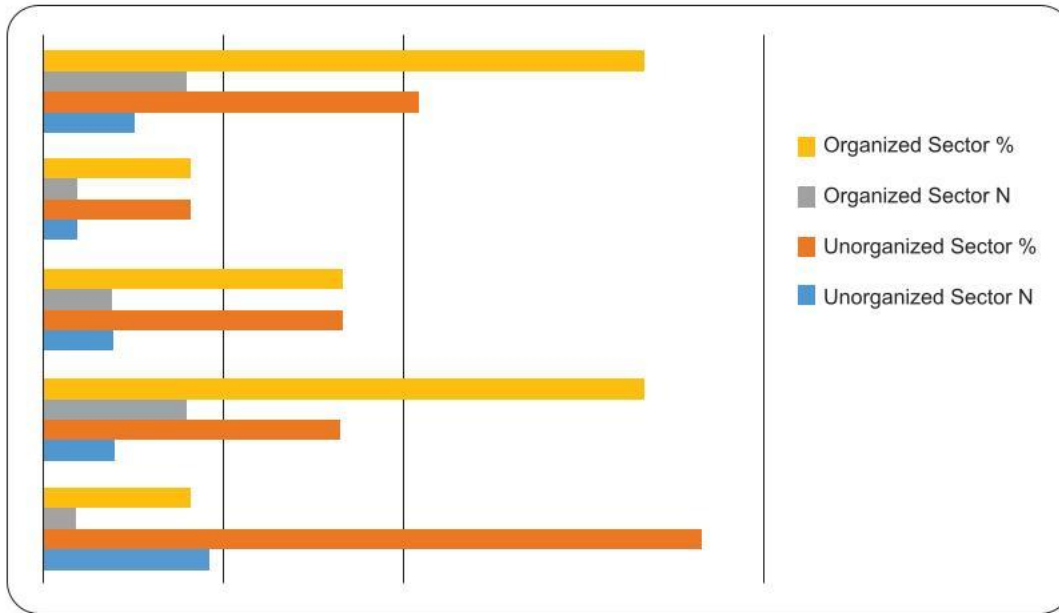
- The market share of unorganized sector in Cement & Steel is only 10% & 27% as against 90% & 73% share for organized sector respectively. EBITDA % was much higher in the range of 10-15 % in organized sector as against 5-6% in unorganized sector.
- Hence the null hypothesis that “The unorganized sector is more competitive than organized sector in the refractory industry considering the cost & performance” is rejected.

H₀₂ The rate of disclosure of human resource variables is non-significantly different among unorganized sector companies.

- The test results revealed that the rate of disclosure of HR variable was significantly different among unorganized sector companies.
- Hence our null hypothesis that “The rate of disclosure of human resource variables is significantly different among Unorganized sector companies” is accepted.

H₀₃ The rate of disclosure of human resource variables is significantly different among organized sector companies

- The test results reveals that the rate of disclosure of HR variable is significantly different among organized sector companies.
- Hence our null hypothesis that “The rate of disclosure of human resource variables is significantly different among organized sector companies” is accepted.



Figures 5: Categorization of variables according to rate of disclosure

H₀₄ The rate of disclosure of human resource variables is significantly different among organized & unorganized sector

- The test result shows that significant difference exists in the rate of disclosure of human resource variables among Organized sector and Unorganized sector companies. The data reveals that the average rate of disclosure of human resource variables was 50.83% for Organized sector companies, which was significantly higher than the rate of disclosure for Unorganized sector companies of 37.34%.
- Hence, the null hypothesis of no difference in the rate of disclosure of human resource variables among Organized sector and Unorganized sector companies is rejected



CONCLUSION

- Refractory business industry in India is a highly fragmented industry & require technology up gradation to meet the customer changing needs. It is also highly dependent on skilled labour.
- The growth of business is directly linked with growth of Steel & Cement Industry as its accounts for about > 85% of its demand.
- Expansion in cost of raw materials, coal & oil prices has influenced the profitability & continues to be a cause of concern.
- High Dependence of the industry on Imports mainly from China for its Raw Materials requires immediate efforts to look for other alternatives including better utilization of domestic resources.

- Competitiveness is also dependent on plant locations, & effective use of recycled materials.
- Refractory being crucial to the production of Steel & Cement. “Make In India” campaign for production of cost effective refractories in India is a must to counter any precedent issues in imports, particularly from China
- The myth that unorganized sector is more competitive than organized sector in the refractory industry considering the cost & performance is not found to be correct.
- The rate of disclosure of human resource variables is significantly different among Unorganized sector companies. However, there is significant difference in the rate of disclosure of human resource variables among Organized sector and Unorganized sector companies.

The refractories industry is going to grow at a faster pace than recent years as there is high potential for Steel and Cement Sector to develop in India. In any case, it needs to deal with different parameters including imaginative arrangement, cost viability, R&D and so forth and most importantly on raw material security to be competitive with the Global Players.

In addition, the development in domestic market, trade will be a noteworthy drivers of development for the industry. One needs to attempt to be world wide as quickly as time permits and likewise search forward for setting up production facilities and in order to exploit raw material sources.

The industry in India, despite increase in automation is likely to be labour intensive in future also & hence the emphasis has to be given for the training & development of the work force. Practice of human disclosure variances also need to be standardized more so in unorganized sector as the industry is also heading for consolidation.

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