

Indian Cement Industry – The business environment

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India has emerged to be an attractive destination for foreign investments in the manufacturing sector which was estimated to be one of the high growth potential sectors. By 2020^a, India is projected to be the fifth largest manufacturing country globally (IBEF, 2017). Indian manufacturing sector has the potential to reach US\$ 1 trillion by 2025 and be able to contribute approximately 25 percent to the GDP, generating approximately 90 million jobs (Samal & Raju, 2016). Among the major manufacturing sub-sectors, cement and gypsum products attracted Foreign Direct Investment (FDI) worth US\$ 3.117 billion between 2000 and 2016 (IBEF, 2017). Indian

cement industry has witnessed many investments and developments in recent time sowing to consistently growing demand due to increased construction and infrastructural activities, and ensured profit margins. A good number of foreign players as well as investors are expected to enter the Indian cement industry since 100 percent FDI is allowed into the industry. However, investment decisions are generally based on market potential, which is a direct result of the business environment. Thus, the business environment plays strategic role in the development of the sector through facilitation foreign investments.

^aAccording to the Global Manufacturing Competitiveness Index published by Deloitte

The cement industry in India uses the most modern and world-class technology. Also, because India has a high quantity and quality of limestone deposits throughout the country, the cement industry promises huge potential for growth. The government of India has set ambitious plans to increase the production of cement in the country, and to attain the target the government has made huge investments in the sector. The Department of Industrial Policy and Promotion, which falls under the central Ministry of Commerce and Industry, is the agency that is responsible for the development of the cement industry in the country. The agency is actively involved in keeping track of the performance of cement companies in the country and provides assistance and suitable incentives when required by the company. The department is also involved in framing and administering the industrial policy for foreign direct investments in the sector. Apart from formulating policies, the department also promotes the industry to attract new foreign investments in the sector. The Department of Industrial policy and promotion plays an active role in promoting foreign investment in the cement industry by providing useful information to the investors about the investment climate and opportunities in

India. The department also provides advice to prospective investors on various policies and investment procedures.

The cement industry in India has been attracting several top-notch cement companies worldwide, which reflects the fact that this industry holds huge potential for investment. Also, due to the boom in the housing sector world-wide and the increased activity of the development of infrastructure, the demand for cement is set to increase globally. Thus, the investors having nothing to lose and are all set to benefit from investing in India's cement industry.

The state investment promotion board of Andhra Pradesh has approved proposals by Chettinad Cement and KCP to build cement plants in the state. Chettinad Cement plans to spend US\$210m towards building a grinding plant in Vizag and a plant in Guntur, according to the Economic Times newspaper. These projects are scheduled to start production in March 2019. KCP has allocated US\$83m towards its project in Krishna with the first phase of operations due to start in mid-2018. However, media commentators have noted that the south of India is facing cement production over capacity.

Beginning 2016, the hundred plus years old Indian Cement Industry had been experiencing hard times due to the hostile business environment with declining consumption rates and an over-built capacity. Even though the industry had consistently been witnessing a cumulative annual growth rate (CAGR) of 7.8 percent during the past two decades ending 2016 (Karkun, 2017), the industry had started witnessing a steep decline of about four to five percent per annum during 2016-17, consequent to the slowdown of the economy. Adding to the woes, an abrupt decline of sales volumes by 20 to 50 per cent in month-on-month basis, in the trade segment, the major demand driver, had been taking place against the backdrop of demonetization. During November 2016, the national government demonetized currency bills of INR500 and INR1000, which made up about 86 percent of country's cash in circulation. This led to postponement of the usual demand for cement by major segments. The national economy experienced a churning during demonetization and the cement industry was no exception to the disruption. Less availability of currency bills for circulation had warranted the construction activities to a status quo situation. Particularly the demand

from rural individual house builder segment was badly affected, which compelled the cement dispatches to come off by 10 percent approximately (Engineer, 2016). The industry witnessed its first decline in sales volumes, since 2001, by 13 percent year-on-year in January 2017 following a nine percent decline in December 2016 (Singh, 2017). The individual housing sector contributes to about 60 to 65 percent of the overall demand which is suspected to come down to about 55 percent over the next three to four years. However, a stable outlook is projected in the infrastructure and industrial sectors – the non-trade segment, on the back of a sustained and even an enhanced government spending in both the sectors. It is believed that the government's decision to increase the allocation of funds towards the housing sector by 38 percent and 23 percent on highways would sustain or even increase cement demand by a marginal 10 percent in the ensuing financial year. Around 30 to 40 per cent reduction in the margin levels is expected to prevail across the industry (Engineer, 2016). This adds to the woes of an industry already facing challenges from multiple facets of the external environment such as technology, regulatory, shortage of raw materials, logistics, excess capacity, etc. The growth estimate for the next financial

year was revised to 3 to 3.5 percent from the earlier 4 to 6 percent, citing the negative impact of demonetization (Mandavia & Vijayraghavan, 2017). The capacity utilization rate was 70 percent during 2015 - 16 and likely to decrease to 65 percent following the effects of demonetization.

Industry profile

Being the essential basic raw material for creation of strong infrastructure, cement plays a central role in economic development of any country. The history of the cement industry in India can be traced back to 1889 when a Kolkata-based company started manufacturing cement from Argillaceous (Indian Mirror, 2016). The industry started evolving into an organized one during the early 1900s when India Cements Company Ltd, was established under public sector, with a capacity of 10,000 tons in 1914 in Gujarat. However, appreciable growth could be witnessed only after the partial decontrol in 1982 which concluded into total decontrol in 1989 and further de-licensing in 1991 initiated by the national government's thrust on infrastructure development in the country. The industry has evolved in to various clusters across the nation, based on the availability of limestone reserves, the key

raw material, in certain states, providing employment to more than a million people, directly or indirectly (GOI, 2016). With an estimated 420MTPA^b production capacity at present (Sharma, 2017), Indian cement industry stands at a global second position, next to China, in terms of installed capacity, and accounts for about seven percent of the global production (EMIS, 2014). The cement industry is valued at approximately \$450 billion (McKinsey, 2015) and has been showing an inconsistent financial performance over the past 30 years. Production has increased at a CAGR^c of 9.7 per cent during 2006-2013 and projected to reach 550 MTPA by 2020 and 600 MTPA by 2025. The country's per capita consumption stands at around 190 kg (Mohan et al., 2015). Of the total installed capacity, private sector accounts for 98 per cent and the rest with the public sector. The top 20 companies account for around 70 per cent of the total production (IBEF, 2017) .

The business environment

The cement manufacturing is mainly process driven. The widely adopted manufacturing processes are: wet, semi-dry, and dry. The Indian cement industry records an impressive transformation in process

^bMillion Tonnes Per Annum

^cCompound Annual Growth Rate

technology from about 97 percent wet-process technology in 1950s to about 77 percent dry-process production in 1990s and by 2000s, the same had radically moved to 89 percent (Kumar, 2015). By 2006, dry process (**Exhibit-1**) accounts for about 96 percent while three percent is made through wet-process and only one percent follow semidry process (ICRA, 2006). In addition to process technology, other major issues are energy efficiency and the carbon emissions, due to the dominant use of carbon intensive fuels such as coal. Cement industry is the third largest energy consuming and CO₂ emitting sector in India (IIP, 2017). The share of the industry in total CO₂ emissions by India has increased from 3.3 to 4.8 percent while the global average stands at about four percent (ICRA, 2006), which prompts the industry to resort to emission mitigation processes. The global environmental experts compel the industry towards reduction of carbon emissions by embracing the cutting-edge Carbon Capture and Storage (CCS) technology as early as possible. But, such technology is not likely to be commercially available before 2020 (WBCSD, 2010) and not even viable in the present cost economies (**Exhibit-2**) of the industry. However, the industry started experimenting with the use of alternative

and waste fuels. Indian cement industry conforms to the environmental parameters set by international and national statutory bodies regarding environmental pollution by opting for efficient environmental management systems. The Central Pollution Control Board (CPCB) and the respective State Pollution Control Boards (SPCBs) regularly inspect the plants to ensure compliance with emission norms and the charter on Corporate Responsibility for Environment Protection (CREP) and various acts such as Water (Prevention & Control of Pollution) Act, 1974; Water (Prevention & Control of Pollution) Cess Act, 1977; Air (Prevention & Control of Pollution) Act, 1981; Environment (Protection) Act, 1986 (EPA); Hazardous Waste (Management Handling & Transboundary Movement), 2008; The Forest (Conservation) Act, 1980; The Factories Act, 1948; The Wildlife (Protection) Act, 1972; The Mines Act, 1952 etc. Further, the Ministry of Environment and Forests (MoEF), requires the plants to submit 'Environmental Statements' (ES) since 1992, a self-appraisal report by the manufacturer, to the respective State Pollution Control Boards, to be used serve as environmental performance indicators. Further, The World Business Council on sustainable development (WBCSD) forces

the industry to implement the eco-efficiency measures at four levels – optimized processes, recycling of wastes, eco-innovation and new services. The universal standards for quality, environmental health and safety accreditations through ISO 9000, ISO 14001 and OHSAS-18001 certification have become imperative for the industry. It is estimated that each tonne of cement produced requires 60 to 130 kilograms of fuel oil and about 110 KWh of electricity, depending on the cement variety and process used, (Chaudhary & Shah, 2013). A number of mega plants have invested in latest process control equipment and new kiln system to turn energy efficient. The industry is also facing other environmental disapproval due to release of oxides of nitrogen, sulphurdioxide, particulates of carbon dioxide, heavy consumption of natural resources, especially primary raw material, fossil fuels and generating large quantities of waste. The Competition Commission of India (CCI) imposed fines worth a total of \$ 1.1 billion, in 2012, on eleven manufacturers for price fixing by colluding to underuse their plants and create an artificial shortage of cement. Despite a high volume and low value product, cement is one of the highly taxed commodities, around 30 percent of the selling price or

around 70 percent of the ex-factory price, by both the central and the state governments, even more than luxury goods, compared to 19 percent in China and almost negligible in Thailand (Pareek & Pincha, 2015). The tax structure comprises of central excise duty, sales tax by respective state governments, royalty and cess on limestone and coal, and duties on power tariff, etc. The tax on cement in India is relatively higher than Asia-Pacific nations and still higher when compared to the developing economies like Pakistan and Sri Lanka. The cost of freight transportation, further, accounts for about 20 per cent of the operating cost. The cement sector was liberalized and 100 percent foreign direct investment (FDI) is permitted in the cement industry. By March 2016, the foreign direct investments flown into the cement and gypsum products is INR14,776.62 crores which stands at 1.08 percent of the total inflows during 2000 to 2016.

Industry structure

Since cement is a bulk commodity, the industry has developed into a fragmented structure over the years as manufacturing units are located in ‘clusters’ around the limestone reserves and hence the manufacturing and sale is largely regional in

nature and fragmented into seven clusters serving five regional markets - North, West, Central, East, and South. There are around 188 large cement plants and about 365 mini^d and white cement plants in India, producing an approximate 400 MTPA. Large plants alone constitute up to 97 percent of total installed capacity. Further, 98 per cent of the total capacity lies with the private sector and the rest with the public sector. The top 20 companies account for almost 70 per cent of total production. The installed capacity of 400MTPA spreads among three categories namely companies with all India presence, regional presence and marginal presence. Two major groups form the first category, accounting for approximately 33 percent of the total installed capacity. Aditya Birla group controlled UltraTech Cement, with an installed capacity of 69.3 MTPA from 12 plants across India, holds around 22 percent of the market, and Lafarge-Holcim, the second largest, controlling 63.62 percent in Ambuja cements, and 36.3 percent in ACC Ltd, holds a combined capacity of more than 60 MTPA. The regional players, account for about 52 percent of the capacity and geographically confined to one or two local

^dThe plant capacity to produce cement will determine whether it is a large or mini cement plants. Usually, a large one have a daily capacity of 10000 tons to 15000 tons per day of clinker and a mini plant has a daily capacity of production between 100 and 500tpd of clinker.

regions they operate in and usually dominate sales within their particular regions, include firms like Jai Prakash Associates (North and Central), Lafarge (concentrated in the East), India Cements (South), Shree Cement (North), Binani Cement (North), Kesoram Cement (South), OCL (East), Chettinad Cement (South), Dalmia Cement (South) and Madras Cements (South) etc. The third category, holding approximately 15 percent of the installed capacity, consists of standalone players such as Panyam Cement, Penna Cements, CCI, and J&K Cement etc, concentrate and operate only in one region. Thus, there exist regional imbalances, cost inflation and region specific over capacity concerns in the fragmented industry. The industry, at present, suffers an approximate over capacity of 100 MTPA with the southern region being the largest surplus region. As a result, the industry capacity utilization rate is around 70 to 75 percent only (**Exhibit-5**), with considerable regional variations. Hence, the industry has been witnessing significant mergers and acquisitions leading to reorganization of capacities as large number of foreign players are looking at the Indian cement industry, owing to the huge demand forecasted.

The cement industry, with use of large quantity of natural resources as raw

materials and fuels, is considered to be a 'resource intensive' industry. The energy consumed by the global cement industry is about 5 percent of the total global industrial energy consumption (CII, 2011). The necessary raw materials used for cement production are limestone, clay, sand, gypsum and energy in the form of coal and electricity. Coal is an important input in cement manufacturing and accounts for 20 to 25 percent of clinker production in a typical dry process. The industry consumes about 10 million tonnes of coal annually which constitutes around 4.5 percent of India's coal demand. The government controlled pricing and distribution of coal has been deregulated in 2000 and a rational system of linking supply sources with consuming units as per their requirement by the Standing Linkage Committee (SLC)^e was implemented. The Indian coal companies are able to meet approximately 60 percent of the total industry demand for coal. The shortage in domestic coal production coupled with the allocation of poor Useful Heat Value (UHV)^f content coal

and rise in the price of domestic coal has forced the cement companies to go for open market purchase or import coal besides using alternative fuels such as lignite or petcoke, several types of sludge, biomass, used tyre chips, rice husk, etc. The cement industry can reinforce its competitiveness even by co processing wastes as alternative fuels and raw materials, and at the same time contribute to society's waste problem, to some extent, in a way which valorizes the waste and is beneficial to the environment. Many countries have been exploring the usage of alternative fuels in cement industry for several years. Replacement of conventional fuels with alternative sources is on the rise, reaching two percent (Exhibit-7) of the total usage, in Indian cement industry, in 2014.

Another equally important raw material is limestone which accounts for about 10 percent of the input cost, as 1.6 tonnes of limestone is required for producing one tonne of cement. The location of cement plant is determined by the location of limestone mines and the result is the fragmented industry into clusters around the

^e Linkage of coal was extended to Cement Industry, next to Thermal Power sector, in 1973, by the Union Government, through Resolution No.CI-21(20)/72 dated 19.11.1973, to decide Long term Coal Linkages as well as Short Term Linkages for Power Stations and Cement plants.

^f UHV - Useful Heat Value in kilocalories per kilogram (Kcal/Kg), means the heat value of coal determined on Equilibrated Basis by the formula: (Kcal/Kg) UHV= 8900-138(A+M), deriving the figure 8900 in the formula

from highest dmmf CV of coking coals of Jharia coalfield; figure 138 is applicable to low range of moisture and ash., and A + M stands for ash (20-25) and moisture (2-5) percentages. In UHV system the coal is classified into seven grades ranging between 600 to 1100 kcal/kg and UHV is employed in India only for coal grading.

limestone reserves. Cement is the biggest limestone user in India, accounting for over 75 to 80 percent of limestone produced in India. Cement manufacturing companies have to shed large sums of money by way of royalty and cess on royalties levied by the central and state governments which control the allocation rights and royalty rates. Royalty on limestone alone constitutes around 3.5 percent of cement value and five percent of clinker value (CMA, 2014). The prevailing royalty rates for a tonne of coal produced, in all States and Union Territories except the State of West Bengal, as per the Ministry of Mines, GOI, vary between INR50 and INR250, based on the product type and grades (Exhibit-8). Linkages of raw materials like limestone and energy sources like coal, which is heavily governed by the political agenda of the governments, is crucial for the new operators to step into the industry. Most cement companies, to avoid such barriers, pursue backward integration model through captive mines to limestone. Another critical ingredient, gypsum as a retarding agent, a domestically inadequate natural resource, is added to the extent of five percent during the clinker grinding stage. Blast furnace slag - a byproduct from iron-smelting furnaces, and fly-ash—a byproduct from thermal power generation,

are other alternative raw materials used in the process. By 2012, around 190 MTPA of fly-ash is being generated from the Indian thermal power sector, which is estimated to rise to 450 MTPA by 2021 and 900MTPA by 2031. But only about 100 MTPA, less than 50 percent of the total fly ash generated, is being utilized in cement and other building materials (Singh, 2012), leaving a huge scope for the cement industry to explore the possibility of substitution to the maximum permissible levels. Fly ash conforming to standard IS: 3812 (1) 2003 can be used (up to 35 percent maximum) in the manufacture of PPC^g and OPC^h as per IS: 1489 (part 1) 1991, while European standard - EN-197, permits maximum 55 percent. As a result of the prevailing state of essential and bulky raw materials availability and supply, cement companies are looking to secure access to coal, either through joint ventures with overseas players or through the acquisition of overseas mines or buying from overseas markets.

The cement industry is a highly energy intensive sector. Energy and raw materials together form the most critical component in the production of cement. Power accounts for 15 to 20 percent of the variable cost of

^g Portland Pozzolana Cement

^h Ordinary Portland Cement

cement manufacturing as each tonne of cement produced requires approximately 120 to 130 units of electricity. Cement industry consumes about 5.5 billion units of electricity annually. Since state governments supply electricity in India, through State Electricity Boards (SEBs), power tariffs vary according to the location of the plant since different states have different tariff structures. Further, allocation of electricity by the respective state governments also is another issue of concern. Adding to these troubles, the deficient supply of power due to shortage of production and the public welfare priorities of the governments is another biggest hurdle the industry to deal with. Most of the cement producing clusters in eastern and central regions experience 25 to 30 percent power cuts during peak demand season, causing substantial production loss. The quality of power supplied, frequency of power cuts, and the ever increasing power tariffs for industrial usage are some other issues making the industry lose cost advantage. Hence, most of the manufacturers arrange to meet around 60 to 100 percent of their power requirements through captive facilities. Approximately, more than 50 percent of the total production is undertaken during 2015, using captive power as against only 21

percent during 1995, which shows the necessity of captive power facility. Further, cement has an average lead of around 535 km. hence; companies have to rely on extensive transportation service for moving coal from the mines to plants and for dispatching cement from plant to markets. Transportation cost (Exhibit-3) accounts for around 20 to 25 percent of sales cost as the industry is logistics driven. Around 55 percent of the industry's transportation needs are catered by the railways. Being the crucial service offered by the government department, the problem of inadequate and delayed supply, increasing freight tariff, and the quantum of transit losses, put the companies under great pressure to look for alternative modes. For coal transportation, the dependence on rail network is still very high and accounts for around 70 percent of coal movement while road transport takes major share of cement dispatches at around 66 percent whereas railways amount for about 33 percent and the balance one percent is accounted by sea transportation. Cement companies have started preferring road transportation even for longer distances because of multiple reasons referred and the share of road over rail has been going up over the years even though rail transportation is more economical for

distances beyond 300 km. Around 70 percent of the cement movement worldwide is by sea compared to the meagre one percent in India, by 2015. Thus, the energy and freight costs are under pressure and diesel prices, which record nearly 12 per cent increase on Y-O-Y¹ basis, leaving little scope for cost reduction and all the big companies are already working at high level of efficiencies and have almost reached to the best feasible levels.

Cement is a fragmented commodity business and sales volumes mostly be influenced by the distribution reach of the company. Cement is sold in two segments – trade, sold through dealer network as Business to Consumer market, and non-trade - sold directly to institutional bulk buyers as Business to Business model. The trade segment is relatively larger and profitable than the non-trade segment. Hence, companies having a strong distribution network and retail presence tend to have better cement realizations. But, the changes in the economy, owing to demonetization in 2016, has led to a significant shift in the consumer mix as the share of non-trade segment has increased currently to 70 percent from 30 percent. The B to B

segment is well organized and always price taker leading the cement industry to cost-pressure. Various state chapters of the Confederation of Real Estate Developers Association of India (CREDAI) have continuously been resisting the price hike attempts by the Cement Manufacturers Association (CMA). Similarly, other non-trade customer organizations such as the Builders Association of India, Construction Federation of India, and National Highways Authority of India etc. have also been protesting the price rise and regularly appeal to the Competition Commission of India (CCI) for intervention.

Given the sky-rocketing cost of land, its unavailability, and troubles in acquisition or allocations due to the interference of various pressure groups dominated by political agenda, and rising costs of equipment and engineering services, the capital cost of setting up a Greenfield capacity (**Exhibit-4**) has been rising beyond feasibility levels. It is estimated that the cost of setting up a cement plant is around US\$ 120 to 140 per tonne, which adversely affects the breakeven point, stretching around three to four years at an operating level of 70-75 percent (Khandelwal, 2014). In other words, a new cement capacity must earn a minimum of

¹Year-On-Year

US\$ 21 breakeven EBIDTA^j per tonne in order to provide for depreciation and interest costs. But the most profitable pan India players, given their brand strength and economies of scale, currently could realize only around US\$13 to16 EBITDA per tonne. The ROCE^k for new plants is calculated to be less than 10 percent or US\$14 per tonne. Even if the limestone reserves are established, getting the mining rights, railway siding, etc. can reportedly take up to 7 to 8 years, with only 25 per cent chance of striking enough limestone reserves to last for the entire economic life-span of the plant. Lower cost of raw materials (Exhibit-2) will also boost margins, but there is a lesser likelihood of this happening, plus this is something that is not under control of cement companies. This will most likely fuel a greater drive towards mergers and acquisitions in the industry leading to a more dynamic competitive situation. The industry economics and the regulatory system may prompt the marginal players to consolidate, based on the factors of either access to resources or proximity to markets or both.

^jEarnings Before Interest, Taxes, Depreciation and Amortization, is one indicator of a company's financial performance and operating profitability as a percentage of its total revenue, and widely used as a proxy for the earning potential of a business.

^kReturn on capital employed (ROCE) is a financial ratio that measures a company's profitability and the efficiency with which its capital is employed.

Due to the rapid pace of growth, the Indian cement industry has witnessed a good number of major mergers and acquisitions (M&As). In fact, out of the top five largest deals announced in 2016, two were in the cement space. Even though, consolidation among the domestic cement manufacturers started during the mid-1990s, the foreign players started looking at the industry during the late 1990s. By 2005, global majors such as the Swiss-based Holcim Group, French industrial major - Lafarge, and Italcementi SpA of Italy had entered the Indian cement industry. During 2013 to 2016, seven major M&As have taken place involving a total capacity of 41 MTPA or 10 per cent of total installed capacity, with a value of \$4.3 billion (Indian Cement Review, 2017). In fact, two out of the top five largest deals announced in 2016, were in the cement sector. The Indian government has gone the extra mile, to facilitate faster development of the sector, by amending the MMDR Act^l, allowing transfer of mines obtained through non-auction routes.

Interestingly, the wave of consolidation is restricted to the top three cement producers – Lafarge Holcim controlled ACC Ltd and Ambuja Cement Ltd, Aditya Birla Group's

^lThe Mines and Minerals Development and Regulation Act, 1957, amended in March 2015.

UltraTech Ltd, and Dalmia Cement, together hold about 41.66 percent of the market. However, the cumulative capacity of the top 10 manufacturers, at around 280.93 MTPA, remains largely unaffected even after the consolidation wave (Pillay, 2016). Further, consolidation had confirmed that 180 large players produce as much as 95 percent of the overall output, of which, as much as 70 percent of it is produced by top 20 companies. In cement industry, competition primarily occurs at the local and regional levels owing to high transportation costs. It is less likely to compete on price, as price discounts are easily spotted since the scope for product differentiation is bleak and the pricing decisions are made at the industry association level. Rivalry also intensifies when firms try to enhance their respective competitive advantage on the basis of improved product quality or reduced production costs.

The road ahead

The home-grown Indian cement industry is large, growing and, has the capacity to grow significantly as the economy develops. The Confederation of Indian Industry (CII) projects the demand for cement to grow to 2.5 to 2.7 times the current volumes as the per capita consumption is estimated to increase from 185 kg to 415 kg, while the demand from housing sector is projected to reach around 42 to 45 percent of the total demand by 2025 (CII, 2014). Even though the year during 2016-17 would be a flat year for the sector due to the hostile impacts of demonetization on real estate and construction activities, the situation is likely to improve from 2017-18 onwards, driven by increasing urbanization. Despite the multi-faceted challenges, both external and internal, it is left to the intellectual competence to analyze and make a strategic forecast of the road ahead for Indian cement industry.

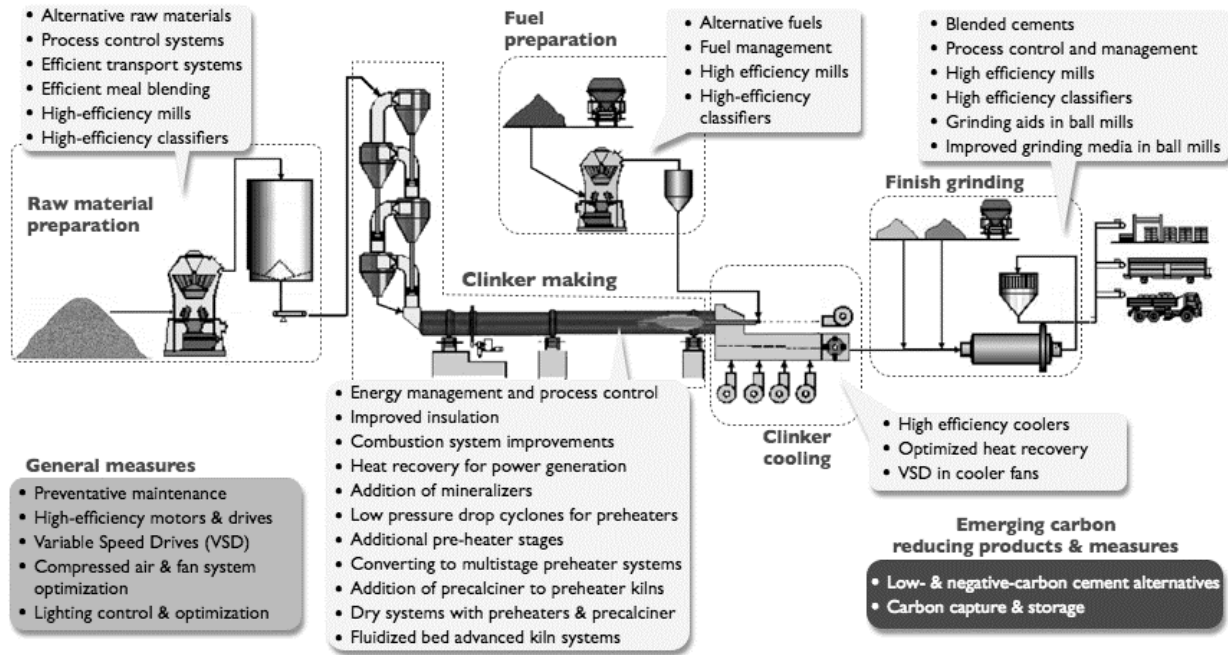
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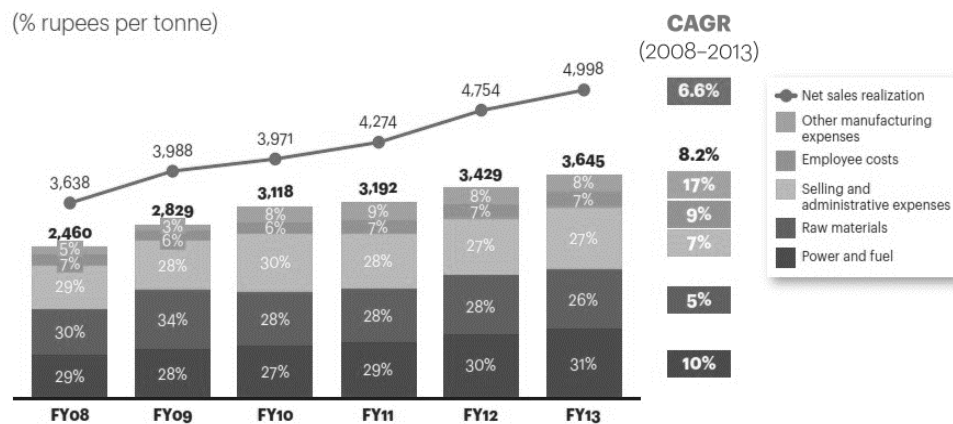
Exhibits

Exhibit-1: The dry-process of cement manufacturing

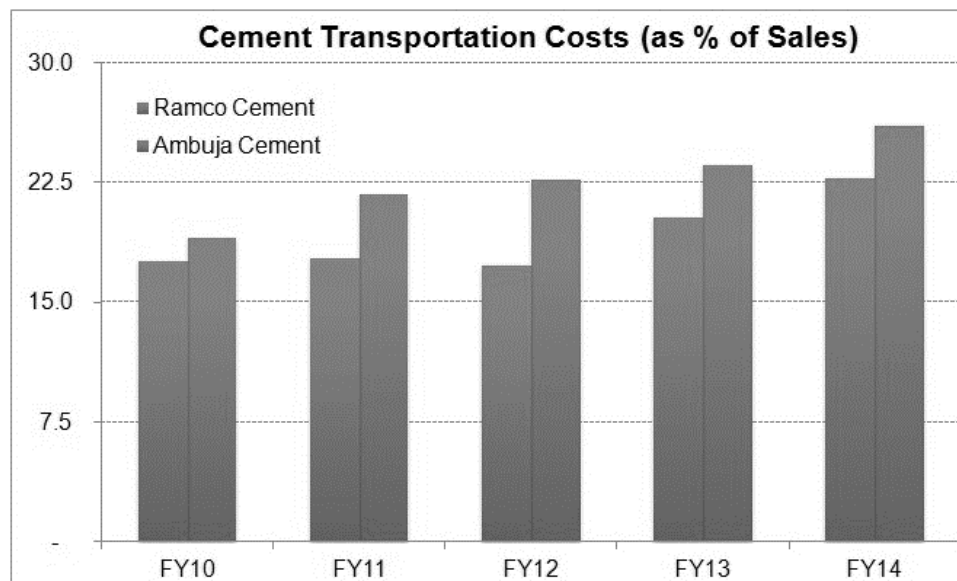


Source: Industrial efficiency technology database at <http://ietd.iipnetwork.org/content/cement>

Exhibit-2: The cost structure



Source: CII's Cement Vision 2025 Report

Exhibit-3: Cement Transportation Costs as % of Sales for Ramco and Ambuja

Source: Ramco's and Ambuja's Annual Reports during FY2010 to FY2014

Exhibit-4: Capital Cost to Set Up 1 MTPA Cement Capacity

Particulars	USD/tonne
Land and mining rights	28
Plant and machinery	55
Civil works	15
Erection and commissioning	9
Others	18
Captive power plant	15
Total capital cost	140

Source: Avendus Research, 2014.

Available at <http://www.safalniveshak.com/industry-analysis-cement-part2/>

Exhibit-5: Cement capacity (MTPA) and utilization rate (%)

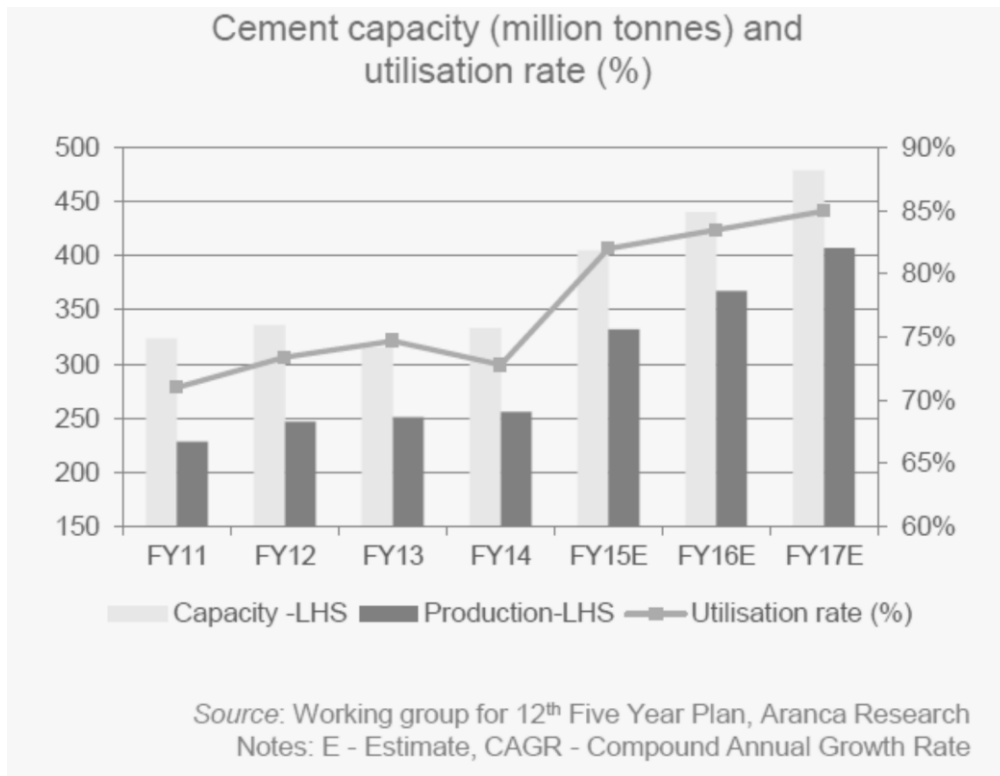
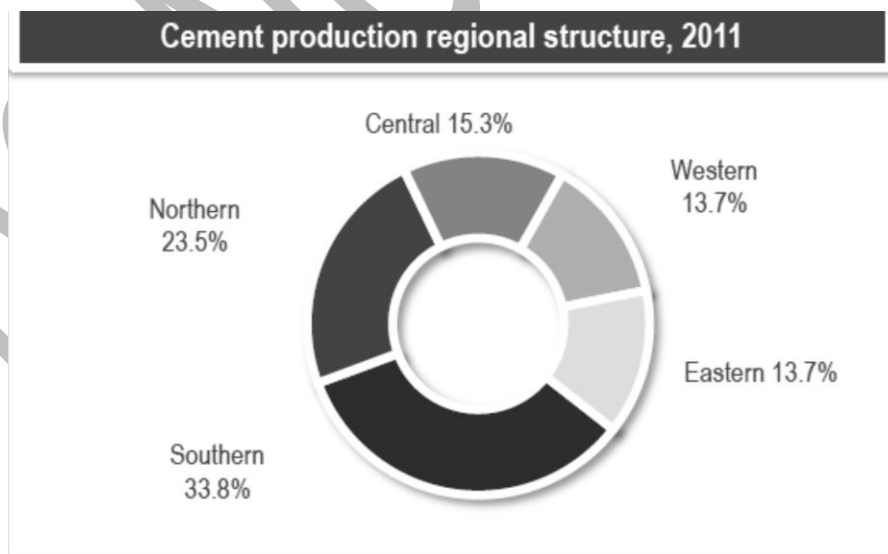


Exhibit-6: Cement production regional structure in 2011.



Source: EMIS Report- Cement Production India, 2014. Available at <https://www.emis.com/sites/default/files/EMIS%20Insight%20-%20India%20Cement%20Production%20Report.pdf>

Exhibit-7: Worldwide usage of alternative fuels

Country	Replacement level in %
Belgium	30
Germany	42
France	34.1
Great Britain	06
India	02
Japan	10
Korea	50
Netherlands	83
Switzerland	47.8
USA	8.8

Source: NBM&CW, April 2011. <https://www.nbmcw.com/other-articles/22766-use-of-alternate-fuels-in-the-cement-industry.html>

Exhibit-8: Prevailing rates of Royalty on coal

Type & Grade	Rate per tonne in INR	
	Applicable in all states and union territories except the state of West Bengal	Applicable to the State of West Bengal
Group I Coals	250.00	06.50
Group II Coals	165.00	05.00
Upgraded run of mine coal produced in the States of Arunachal Pradesh, Assam, Meghalaya and Nagaland	115.00	---
Group III Coals	85	04.50
Group IV Coals	65	02.50
Non- Coking Coal Grade – D	50	---
(b) Non- Coking Coal Grade – E	90	---
Group V Coals	07	---

Source: Indian Bureau of Mines, Ministry of Mines, Govt Of India, 2017. retrieved from <http://ibm.nic.in/index.php?c=pages&m=index&id=236>