

Cement Industry (B): The demand - supply dynamics

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Abstract

The case aims to highlight the understanding of the basic concepts of demand and supply in the Indian cement industry. In terms of the demand structure, the relevant segments contributing to demand, the profitability of different segments etc. On the supply side, manufacturing clusters make it difficult to transport the product to distant markets, resulting in underutilization of capacities in specific regions, effecting the financial viability of some companies. The case begins with narration of the industry in the foreign investor's perspective to enquire into the industry sustainability through demand-supply scenario, to take investment decisions. The case highlights the demand – supply mismatch and the ability of the businesses to strategically combat with the competition and turn profitable.

Keywords: *Demand, supply, business environment, Indian cement industry, clusters, capacity utilization, foreign direct investment*

The Indian cement industry has been attracting several top-notch global cement companies reflecting a huge potential for

investment. The cement and gypsum products attracted FDI worth US\$ 5.24 billion between FY 2000 and FY 2017 (IBEF, 2017). Persistent demand growth due to increased construction and

infrastructural activities and ensured profit margins entice the global investors into the cement industry. Further, a good number of foreign players as well as investors are expected to enter the Indian cement industry as 100 percent FDI is allowed in the revised regulatory framework. The German building material producer Heidelberg Cement had seriously been contemplating to triple its capacity by adding around nine million tonnes per annum (hereafter referred to as MTPA) production capacity in India by 2017, through both organic and inorganic routes, by investing up to INR. 8,000 crores. Speaking about the next phase of investments, Ashish Guha, Managing Director and CEO of Heidelberg Cement India had shared their expansion plans in Indian cement industry with the media. Dr. Bernd Scheifele, Chairman of the Managing Board of Heidelberg Cement believed that the long-term outlook for the Indian cement sector was positive given the country's infrastructure requirements and the government's commitment to invest huge amounts in infrastructure projects over the next five years (Cement News, 2013). Guha said that the company

would focus on acquisitions or the inorganic route to hike capacity to 15 MTPA by exploiting the right opportunity at a right price. Heidelberg Cement Group with its activities in around 60 countries, operates 139 cement plants with a capacity of 176 MTPA, more than 1,500 ready-mixed concrete production sites, and over 600 aggregates quarries, is one of the world's largest building materials companies and holds first position in aggregates production, second position in cement, and third in ready-mixed concrete globally.

The home-grown Indian cement industry has the capacity to grow significantly as the economy matures. The demand for cement has turned bullish since 2010 with booming real estate and construction sectors. The domestic demand for cement is projected to reach 550 - 600 MTPA by the end of 2025, around 2.5 to 2.7 times the current volume, as the per capita consumption is estimated to increase from 185 kg to 415 kg for the same period. Further, the demand from housing sector is estimated to reach around 42 to 45 percent of the total demand by

2025 - truly the *California Gold Rush*¹ of the new Century (CII, 2014). However, the industry is characterized with relatively high barriers to entry, captive customers, relatively little scope for product differentiation and absence of proper product-level substitutes for cement, the industry is inherently prone to low competition.

The Indian Cement Industry

India's cement industry has grown faster than the nation's economy. In fact, its noteworthy evolution has made India emerge as the world's second largest cement producer (see **Exhibit-1**). Further, the industry has evolved to become one of the most effective industries in the world in terms of thermal and process effectiveness. The choice of technology mainly depends on the state of raw materials used to produce cement. The industry has rapidly adopted to the modern

'dry process' manufacturing process surpassing the wet, semi-wet and semi-dry process routes. The industry is undergoing technological changes due to up-gradation and assimilation taking place during the present decade. Currently, around 93 percent of the total capacity is dry process based and only the rest uses the wet and semi-dry process technology. Shifting to energy efficient technologies, use of alternative raw materials and fuels, and reducing the clinker content of cement via increased use of other blends, are the remarkable advancements that have led to the effectiveness of the manufacturing process (see **Exhibit-2**).

While achieving manufacturing and technological advancement, the industry has also been a strong contributor to employment, fiscal revenue, and community development. Since the initial inception of a manufacturing plant in Kolkata in 1889, the establishment of India Cements Company Ltd in 1914, with a capacity of 10,000 tonnes in the public sector has made the industry more organized. Later, partial decontrol in 1982, total decontrol in 1989, and total de-licensing in 1991 have led to an

¹ The California Gold Rush (1848–1855) began on January 24, 1848, when gold was found by James W. Marshall at Sutter's Mill in Coloma, California.[1] The news of gold brought some 300,000 people to California from the rest of the United States and abroad.[2] The sudden influx of immigration and gold into the money supply reinvigorated the American economy, and California became one of the few American states to go directly to statehood without first being a territory.

appreciable growth, which was further initiated by the national government's thrust on infrastructure development in the country. However, the industry has evolved in the form of clusters across the country based on the availability of the key raw material, limestone, reserves, in certain states.

With the production capacity of nearly 400 MTPA (IBEF, 2017) as of 2016, Indian cement industry accounts for around 6.7 per cent of the global output. The cement industry is valued at an approximate \$450 billion (Michael et al, 2015). Production has increased at a CAGR² of 9.7 percent (see **Exhibit-3**) during 2006 to 2013, and production capacity is expected to increase at a CAGR of 6.1 per cent during FY 11-20 (see **Exhibit-4**). Further, the quantum of production is projected to reach 550 MTPA by 2020 and 600 MTPA by 2025. In 2015, the country's per capita consumption was around 190 kg (Mohan, Safer, & Bhanu, 2015) and the year-over-

year (YOY)³ growth rate stood at an attractive 6.8 percent (see **Exhibit-5**).

Of the total installed capacity, private sector accounts for 98 percent and the rest lies with the public sector. The total installed capacity is spread over around 129 plants operated by 54 companies. Some of the world's top cement companies have entered the industry and the top 20 players (see **Exhibit-6**) account for around 70 percent of the total production. However, around 54 major companies operate around 129 plants across the nation.

The industry accounts for around 1.5 percent of the total GDP and five percent of total tax revenue collected by central and state governments; provides direct employment to more than 1.5 million people; and contributes to the society by improving basic facilities such as providing vocational training, setting up hospitals, and providing support to farmers through community centers in several villages (Mathur, Unni, & Jain, 2016). Several transnational cement majors such

² Compounded Annual Growth Rate

³ Year-over-year is a financial term that means a comparison of one period to the same period last year. The period is usually a month or quarter. The year-over-year growth rate calculates the percent change during the past twelve months.

as Lafarge-Holcim, Heidelberg Cement, and Vicat, have invested in the growth oriented industry through mergers and acquisitions and foreign direct investments (FDIs) anticipating to benefit from the future potential for development in the infrastructure and construction sectors owing to the government initiatives such as development of 100 smart cities across the nation. Some more corporates are looking forward to enter the industry. For example, a global engineering company-FLSmidth, based in Copenhagen, has approached India's Larsen & Toubro Limited for engineering, procurement and supply of equipment for a cement plant of a capacity of 3,000 TPA in Tamil Nadu. Even some of the domestic business houses are attempting to diversify into the cement industry. The Nirma group, a successful brand in detergent, soap and chemicals sector, has bought a 11 MT production capacity of Lafarge India for US\$ 1.4 billion whereas the FMCG major, Emami Ltd, plans to invest up to US\$ 1.32 billion (equal to INR 8,500 Crore) to expand its existing production capacity from 2.4 MTPA to 20 MTPA by 2022.

However, investment decisions are generally based on market potential, which is a direct result of the business environment and demand dynamics of the specific industry. The business environment impacts the demand dynamics which in turn influences the profitability of the industry. Given the crucial role of this industry in India's economic and social growth, it is pertinent to analyze what the future holds for the industry and how will it be affected by the changes in the market landscape in terms of changing demand patterns, supply dynamics, consumer preferences and its relevant challenges.

The Demand Supply landscape

Demand

The cement demand has been seeing a robust growth rate at 7.2 percent CAGR, since deregulation in 1982, faster than the overall economy growth rate of 4.8 percent CAGR. The sustained growth rate has motivated a good deal of private sector into the industry in terms of huge investments. The long term oriented demand for cement in India, spurred largely by rapid growth in the housing sector, has attracted many global as well as

Indian cement majors into the industry, particularly after deregulation in 1991. The cement demand is projected to touch 550 to 600 MTPA by 2025, due to fast urbanization. To meet the projected demand, cement companies are expected to add 56 million tones capacity by 2020 (IBEF, 2015). The current production level of 366 MTPA shall reach 395 MTPA, registering a growth rate of eight percent in 2016 and may further increase to 421 MTPA by the end of 2017. The considerable capacity addition efforts to match the projected demand would, in turn, present challenges in terms of resource scarcity.

The contours of demand for cement in India, different from other similar markets, are determined by many sectors such as infrastructure, housing, the national economy and GDP, government welfare oriented rural development programs etc. The demand structure is shaped by the end usage pattern and highly correlated with cyclical activities like construction and infrastructure development etc. The major categories of cement buyers are retail buyers, institutional buyers, and convertors into

ready mix concrete (RMC)⁴ or other concrete products. The retail customers from the individual housing (trade) segment accounts for a significant 67 percent (see **Exhibit-7**) of the total demand whereas the same in USA is 22 percent and China at 25 percent only. **Error! Bookmark not defined.** Dominance of demand from the residential sector is similar to that of emerging markets such as Brazil (56 %) and Indonesia (72 %). However, the same segment in China, another emerging economy, contributes only 25 percent of the total demand. Within the retail segment, urban and semi-urban markets contribute around 60 percent of the total demand owing to increasing number of nuclear families, rising affordability, and faster pace of urbanization. Cement, to this business to consumer (B2C) segment, is supplied largely in bagged form through the traditional trade and retail channels.

⁴ Ready-mix concrete, or RMC, as it is popularly called, refers to concrete that is specifically manufactured in a factory or batching plant, according to a pre-set recipe, for delivery to the customer's construction site by truck mounted in-transit mixers in a freshly mixed and unhardened state.

Institutional and converter categories comprise of the infrastructure and commercial segments accounting for the remaining 33 percent of the total demand. Institutional buyers include the builders and contractors in real estate and infrastructure sectors, and commercial projects that purchase directly from cement companies. Among the business to business (B2B) segment, transformational channels such as RMC accounts for less than 10 percent of total sales, relatively much lower than emerging markets such as Indonesia and Brazil. The commercial segment consists of the demand from construction of retail space, office buildings, hospitals, educational institutions, and industrial construction such as plants, warehouses, and depots. The growth rate in infrastructure segment is much lower than expected due to the lower rates of usage in two sub-segments-roads and irrigation, owing to the derived nature of demand in infrastructure. However, a much higher share of demand, up to 80 percent, from infrastructure and commercial segments is seen in other emerging markets such as China, and developed markets like the United States.

During the first quarters of 2017, the sales volumes in the individual house builder segment, called the trade segment, the major demand driver, declined. This was due to the national government's decision of demonetization of the currency bills of Rs 500 and Rs 1, 000, which accounted for about 86 percent of the country's cash in circulation (Manish, 2016). The demand was badly affected forcing the commodity dispatches to reduce by 10 percent approximately. During January 2017, the industry witnessed the steepest decline since 2001, in sales volumes by 13 percent Y-O-Y, following a nine percent decline in December 2016. However, a steady demand is projected in the infrastructure and industrial sectors (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 in highways would sustain or even increase cement demand by a marginal 10 percent during FY 2017-18. Consequent to the recent developments, around 30 to 40 per

cent reduction in the margin levels is expected to prevail across the industry. This adds to the woes of an industry already suffering from multiple challenges such as technology, regulatory pressure, scarcity of raw materials, logistics, excess capacity, etc. The industry capacity utilization rate which has been slowly advancing to 70 percent during 2015-16, may decline to 65 percent during 2017-18, following the effects of demonetization.

Another significant change observed during the past couple of decades is the shifting preference from commodity product - Ordinary Portland Cement⁵ (OPC), to customized product – the blended cement⁶, as the sales volumes of

⁵ Ordinary/Normal Portland cement is the most commonly and widely used type of cement as a basic ingredient of concrete, mortar, stucco, and most non-specialty grout. The name Portland cement was given by Joseph Aspdin in 1824 due to its similarity in colour and its quality when it hardens like Portland stone. Portland stone is white grey limestone in island of Portland, Dorset.

⁶ Blended cement is obtained by mixing OPC with mineral admixtures or additives like fly ash, granulated blast-furnace slag, or silica fumes such as pozzolan, hydrated lime, etc. Blended cements are now being considered superior as compared to conventional OPC category of cements. Presently in India about 30% of the total production is blended cement. This figure is likely to increase sharply with the increase in awareness of use of

blended cement has been increasing steadily to gain dominant share. The demand for OPC, at around 70 percent in 1990s, has gradually been declining and now accounts for less than 30 percent of total production while the share of blended cement increased from 29 percent to more than 70 percent at present. However, despite the shift in product mix, about 95 percent of the product is sold in bagged form, in sharp contrast to the bulk form in the developed countries, due to the underdeveloped infrastructure such as bulk terminals, bulk carriers, and silos etc. restricting the segment's share. However, this migration to blended cement has been enabled through strong industry-level efforts in view of the product quality, environmental impact, technological advances and process control etc. India's per capita consumption of cement at 207 kg is well below the world average of 540 kg (Badami, 2016), and expected to reach around 385 to 415 kg by 2025 (Global Cement staff, 2014). However, the brighter side is that the consumption has been growing at 5.4 percent CAGR. The growth

blended cement. In UK & USA, the usage of blended cement is nearly 90% of the total production.

of demand for cement can be estimated through 'end-user model' - analyzing the cement intensity in various end-user sub-segments of the key demand drivers such as housing, industrial, infrastructure, and commercial sectors. The housing sector contributes up to 67 percent of the overall demand and is estimated to sustain as the high push factor owing to the spending target of 9 percent of the GDP on infrastructure during the plan period from 2012 to 2017 by the national government. Among the infrastructure segments, demand from road projects was anticipated to increase at 15 to 16 per cent CAGR during 2011-12 to 2016-17 and further projected to increase to almost 36 per cent over the next 5 years (Salgaonkar, Dasgupta & Srinivasan, 2013).

Another noteworthy issue of the cement demand profile is that the demand is seasonal as well as regional. The demand for cement is usually sluggish during monsoons and picks up post monsoon, making the demand seasonal. Historically, demand is strongest in the quarter ending March and weakest in September. Further, the regional nature of the demand is mainly due to the

development of manufacturing clusters upon the availability of bulk raw material. Among the five regional market segments (see **Exhibit-8**), the regional balance of demand differs based on the regional socio-political factors.

Region-wise demand drivers:

Cement consumption is expected to increase gradually over the medium term, largely spearheaded by the government's focus on infrastructure development and regional development initiatives. CRISIL (2013) estimates that housing sector would be the major demand driver of cement during 2013 – 2018, supported by the regional major infrastructure projects.

- The demand in *central region* is projected to grow at a CAGR of 7.5 to 8.0 percent during 2013-18, primarily driven by infrastructure projects such as road projects in Madhya Pradesh and hydel power projects in Uttar Pradesh, supported by the surge in rural housing through key central infrastructure projects (CRISIL, 2013).
- In the *northern region*, demand is likely to sustain around 7.0 to 7.5 percent during 2013-18, led by housing and

infrastructure projects in major consuming centers like Rajasthan, Punjab, Haryana and Delhi. CRISIL (2013) further estimates that demand would primarily be driven, in northern region, by major inter-state highway projects as well as cement-intensive hydel power projects in states like Himachal Pradesh; urban infrastructure projects in Delhi and Chandigarh, and semi-urban and rural housing projects in Punjab and Haryana.

- However, demand in the *southern region* is projected to grow at a relatively subdued 5.0 to 5.5 percent CAGR, led by massive investments in irrigation projects in Andhra Pradesh and power projects in Tamil Nadu, supported by independent housing projects in semi-urban and rural areas (CRISIL, 2013).
- The *eastern region* is projected by CRISIL (2013) with a healthy CAGR of 8.5 percent during 2013 - 18, driven by investments in infrastructure and industrial projects in the mineral resource-rich states of Orissa, Jharkhand and Chhattisgarh, supported

by a spurt in individual housing projects in Bihar and West Bengal.

- The demand in *western region* is expected to grow at 8.5 to 9.0 percent during 2013-18, led by real estate boom in cities such as Mumbai, Pune, Ahmedabad and Surat and infrastructure and commercial construction segments in Mumbai, Ahmedabad and Pune, supplemented by urban infrastructure projects, roads and metro rail project in Mumbai (CRISIL, 2013).

Segment-wise demand drivers:

The segment specific demand has been estimated through the end-user model. The demand for cement during 2013 – 18 is expected to be primarily driven by urban *infrastructure* projects and independent housing projects in both urban and rural areas. The infrastructure segment is projected to grow at a robust CAGR of 10 to 11 percent during 2013 - 18, owing to the government's thrust on infrastructure development. Increasing spends on urban infrastructure and irrigation projects and ongoing investments in sectors such as power and railways are also expected to

supplement this trend. In absolute terms, road projects are expected to account for about 36 percent of the total infrastructure segment by the increased demand at a CAGR of 15 to 16 percent.

Though the *housing* sector continues to be the dominant segment of demand, CRISIL (2013) expects its share to drop marginally to about 58 percent during 2013-18 from 61 percent during 2008-13. Within this segment, demand from rural housing projects is estimated to decline to a CAGR of 4 to 5 percent during the projected period, from the past rate of 6 to 7 percent while urban housing demand is estimated to hover around 5 to 6 percent, dropping from a CAGR of 8 to 9 percent during the same timeline.

The share of the *commercial construction* segment is expected to remain stable around 12 percent during 2013-18, of which, the sub-segment of office space accounts for a substantial portion of overall demand from the commercial construction segment, as per CRISIL (2013).

Cement is a commodity product which is easily traded without specific restrictions in most of the key trading

countries. The industry has gradually established a good export market due to competitiveness in quality and state-of-the-art technology, matching with the world's best. During the past two decades, Indian cement industry has made its strong presence among 35 countries across the globe. India has exported about 2.81 million tons of cement valued at \$141 million (Rs 37 Crore) in 2012-13 (GOI, 2015) to neighboring countries like Bangladesh, Nepal, Sri Lanka, Bhutan, Maldives, Madagascar, and South Africa etc. During 2015, India could export cement worth of \$ 213 million, accounting for a share of 2.2 percent of the global exports (Workman, 2016). The growth in Indian cement export has also been the result of the varieties that are produced and some companies have even gone an extra mile to launch committed jetties to promote exports. Even though the quality and technology of Indian cement is world-class, and there is low capacity utilization rates due to austere domestic demand, the exports have been diminishing continuously owing to high level of State levies and royalties, infrastructure

constraints, and high transportation cost etc.

Supply

On the supply side, the industry is confronting a situation of excess capacity since the beginning, resulting in underutilization of capacity of the manufacturing units. The average capacity addition has been growing at 4.4 percent CAGR between 2011 and 2016 and the industry, presently, has a production capacity of 431 MTPA, an increase from the 328 MTPA in 2011, showing a growth rate of 5.7 percent CAGR. The production quantity, during the same period, increased from 210 MTPA to 274 MTPA, at a CAGR of 5.5 percent. Cement production grew by 4.7 percent Y-O-Y in 2016 compared to 5.6 percent during 2015 and 3.1 percent in 2014 (Sabnavis et al, 2017). Therefore, capacity has been ahead of demand and the result is surplus capacity in the industry (**Exhibit-9**). Another defining feature of the Indian cement industry is that it has been clustered around the lime stone reserves, and hence the market has is regional and fragmented.

Cement, being a low-value, high-volume commodity product transporting it over long distances of more than 300 kilometers from the plant, increases freight cost. The total cost of logistics considering both inbound and outbound movement makes up 20 to 25 percent of the production cost. The cost can even go as high as 30 percent (Vohra, 2014) for companies that do not hold bulk infrastructure such as rail sidings catering to transport 40 to 60 percent of the total produce. This makes it imperative for companies to have cement plant either near limestone reserves or near the end-user market. Each cluster is a combination of mini and large capacity cement plants, where about 94 percent of the production is contributed by large plants. The entire capacity is spread across seven clusters – i) Satna in Madhya Pradesh, ii) Chandrapur covering North Telangana and Maharashtra, iii) Gulbarga utilizing the resources across North Karnataka and East Telangana, iv) Chanderia exploiting the raw material in South Rajasthan and v) Neemuch in Madhya Pradesh, vi) Bilaspur in Chattisgarh, Yerraguntla, covering South Andhra Pradesh, and vii) Nalgonda,

from Central Andhra Pradesh region. The consumption levels also vary across these regions. South accounts for the largest share of consumption, around 27 percent; west with around 21 percent; north at around 20 percent; east - around 17 percent, and the central region consumption stands at around 16 percent, of the total demand. Hence, capacity addition also has been region-specific.

In addition to the issue of fragmentation, another glaring supply difficulty is the seasonal nature of the demand, which declines during monsoon period from June to September, due to slowdown in construction activity. Consequently, demand slides down during the quarter ending by September, and rises high during the January-March quarter. Only large players can withstand this cyclical nature of demand and supply, due to their operational efficiencies, production economies, wide spread distribution systems and geographical diversification. Adding to the seasonal nature of demand, there are some other exogenous factors affecting the realization of cement in northern and southern regions. Ban imposed on sand mining in Punjab and

Haryana in 2013, has made the critical construction ingredient quite expensive. The Supreme Court of India has ordered the closure of brick-kilns not having environment clearance, resulting in a huge shortage of bricks. Further, shortage of feasible logistical means has been barring the over capacity ridden southern region to supply to eastern and northern regions.

Another facet is the threat of imports. Cement has traditionally not been among India's major trade profile and India is 44th largest cement-trading economy in the world. However, the onslaught of imports from neighboring countries like Pakistan, China and Bangladesh, at lesser prices, is wielding pressure on the industry which has been operating much below the installed capacity due to weak demand. The import duty rate for importing a bag of cement into India is 10 percent and during FY16, Pakistan, with 1.35 million tons, accounted for 64 percent of the total imports.

The future of demand and supply

A major shift in the customer mix is expected as the share of large institutional buyers shall increase from 30

percent to 40 percent by 2025, while the share of individual housing sector, about 60-65 percent of the demand, shall largely be affected as 30 per cent of urban and semi-urban housing demand and 15 percent from organized real estate could see a downfall. Thus, the demand structure might get reversed as the share of direct buyers would increase up to 65 to 70 percent of total demand, throwing the trade segment to a secondary position, due to an upsurge in commercial and converter segments. This could lead to a modification in the present product mix and the mode or form of delivery as the commercial and converter segments prefer the customized product delivered in bulk with less number or no channels. Thus, infrastructure will become the cement industry's growth engine for the next decade since Indian government plans to spend roughly \$650 billion on infrastructure development in the 12th Five Year Plan, and close to \$1 trillion and \$1.4 trillion, respectively, in the 13th and 14th Plans. Further, about 55 to 60 percent of the estimated spending would likely go to cement-intensive activities such as roads, bridges, power, and irrigation, which

together would represent 80 to 85 percent of the infrastructure sector's total cement demand. Demand from residential sector would be influenced by an increasing trend in urbanization, rising number of nuclear families, and the upgrade of non-pucca houses to pucca houses. These anticipated changes in end-usage segments will require several adaptations to cement companies' operating and business models as the institutional customers, emerging as the major segment, need customized product and solutions than standardized commodity product. Hence, the future of the industry is much contentious as India is expected to become the world's third largest construction market by 2025, adding 11.5 million homes a year. Given the demand conditions and supply constraints, it is up to the managerial prowess to premise the future avenues for the industry. With major companies investing in this industry it is to be seen what the future holds for the industry, and how these companies fare.

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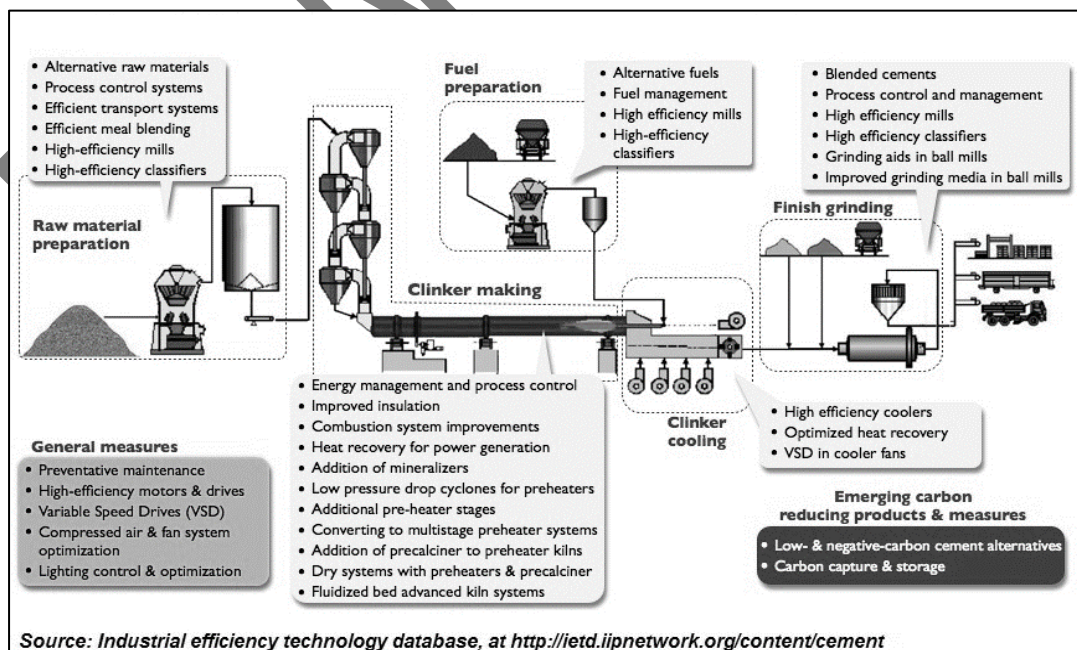
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Exhibit-1: Major countries cement production 2011- 2016 (in million metric tons)

Year	2011	2012	2013	2014	2015	2016
China	2,100	2,210	2,420	2,480	2,350	2,410
India	240	270	280	260	270	290
United States	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
Saudi Arabia	48.4	50	57	55	55	61
Japan	51.3	51.3	57.4	53.8	55	56
Egypt	44	46.1	50	50	55	55
Mexico	35.4	35.4	34.6	35	35	NA
Thailand	36.7	37	42	35	35	NA
Pakistan	32	32	31	32	32	NA
Germany	33.5	32.4	31.3	32	32	NA
Italy	33.1	33	22	22	23	NA

Source: US Geological Survey

Exhibit-2: Cement manufacturing process schematic diagram



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

Exhibit-3: Production of cement FY 07- 17 (million tonnes)

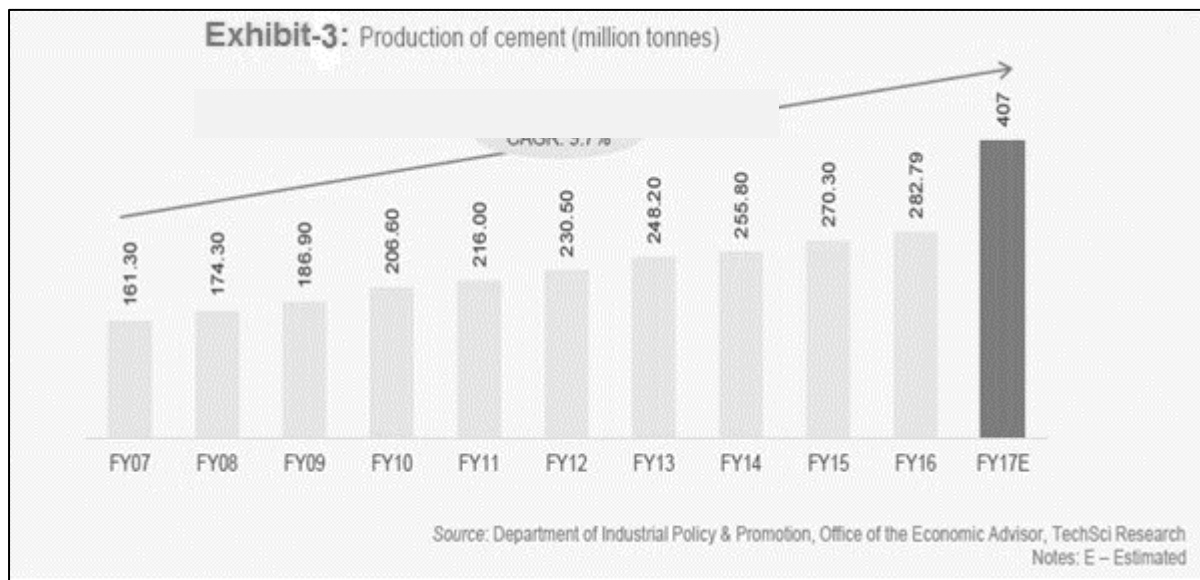


Exhibit-4: Cement Production Capacity FY 11-20 (million tonnes)

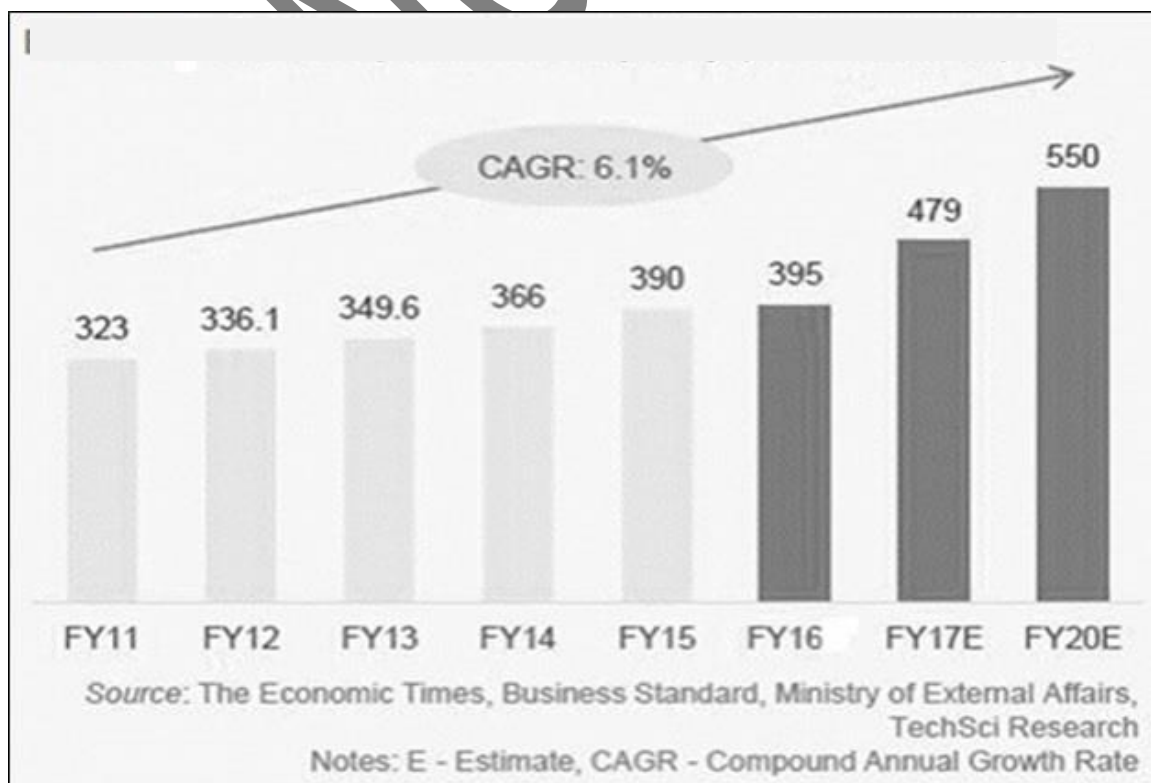
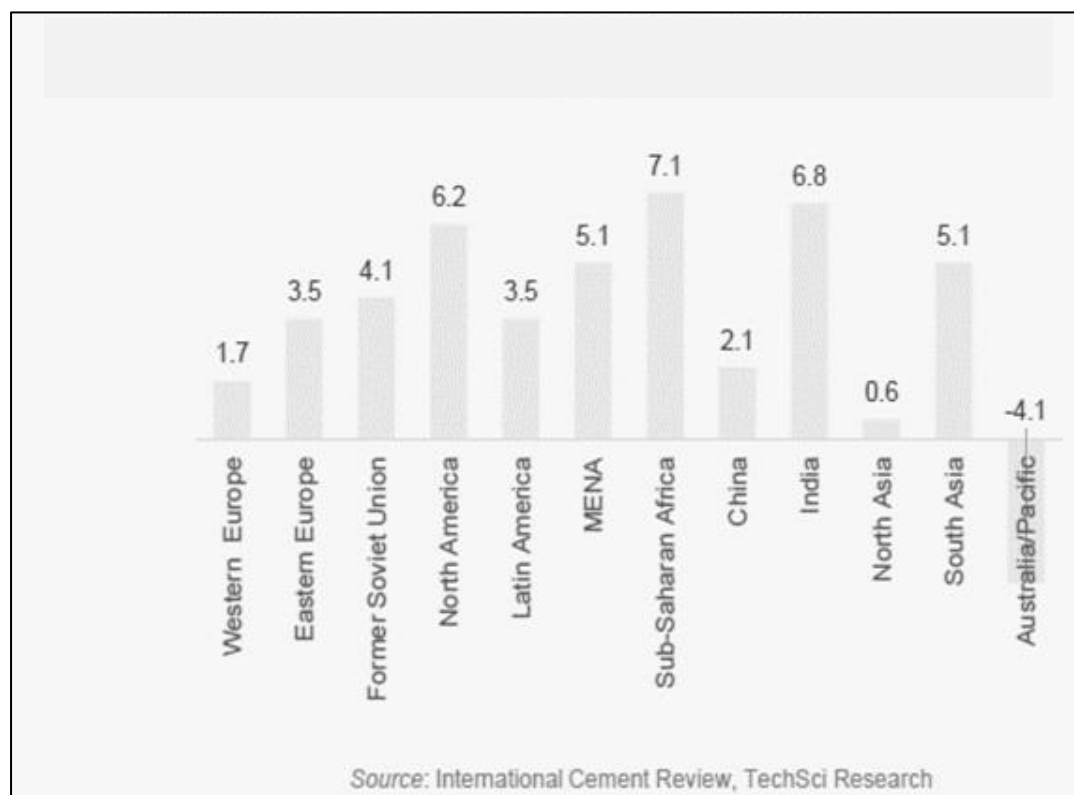


Exhibit-5: Cement consumption growth by region Y-O-Y (%) 2015**Exhibit-6:** Top 10 Players in Indian Cement Industry with installed capacity

Sl No	Company	Production (in 2015)	Installed Capacity (In Tonnes)
1.	ACC	17,902	18,640
2.	Gujarat Ambuja	15,094	14,860
3.	Ultratech	13,707	17,000
4.	Grasim	14,649	14,115
5.	India Cements	8,434	8,810
6.	JK Group	6,174	6,680
7.	Jaypee Group	6,316	6,531
8.	Century	6,636	6,300
9.	Madras Cements	4,550	5,470
10.	Birla Corp.	5,150	5,113

Source: Major players in Indian cement industry, at: <https://business.mapsofindia.com/cement/>

