1. Introduction

1.1 Cement Industry Overview
1.1.1 Indian Scenario

The cement industry plays an important role in the economic development of country like India. Cement is a binding agent which is one of the most important constituent for construction Industry. Historically the growth rate of cement industry has remained higher than overall economic growth. The Indian cement industry is second largest in the world after china and accounts for around 8% of overall volume. The Indian cement industry has passed through different phases. In the initial phase there was total Government control and it lasted till 1982. After this quota system came and it was the period when government had partial control till 1989. Than on it is free market scenario. Now the overall production capacity as of last financial year is 347 million metric ton. The industry is dominated by private players and the 98% of the total capacity lies with private players and rest 2% with public sector. Also the large share is with large cement plants which together accounts for around 97% of the total installed capacity. The cement industry is known to be cyclic in nature which has high co relation with the GDP of nation. Cement industry growth is normally taken as 1.2 x of GDP growth rate. The housing sector is the highest demand driver and contributes around 67% of total consumption. Other contributors are infrastructure, commercial construction and industrial construction which have 13%, 11% and 9% share respectively.

The Industry has grown at a very high rate in the last decade and compounded annual growth rate (CAGR) between FY’06 to FY’13 was 9.7%. However in recent years the global as well as domestic economic conditions are not that supportive and putting pressure on capacity utilization. Though the capacity utilization is low but if we see the per capital consumption in India, it is much lower than world average. This shows that still there is a lot of growth potential in the industry in India. Seeing this growth potential, almost all world top cement manufacturers have ventured into Indian market.
Consolidation too has taken place where top two groups have almost controlling one third of total domestic capacity.

Year 2014 is the centenary year for Indian cement industry as the first plant was set up in Gujarat with 1000 MT capacity per year in the year 1914. It took India eight decade to reach first 100 million MT marks however the next 100 million metric ton addition took just one decade. As per the Indian cement review (June’2014 Mumbai), in the period 2006-2013 the production capacity grew by 9.7 % CAGR and reached 340 million MT. Production is expected to touch 500 million MT by 2020 in which JNNURN and Indira Awas Yojana of government of India will be the key contributors as per the 12th five year plan. As per the report titled “ Indian Cement Industry Outlook 2016” by market research consulting firm the growth between 2013-2016 is expected by more than 8% CAGR.

Though lot many cement brands are available but still cement is largely considered as commodity. This industry is freight intensive and so the priority of each company is to sell it at the nearby areas only as long distance transportation generally makes it non economical. This makes it regional dominant industry and broadly Indian cement market is divided into five regions namely east, west, north, south and central. Among these the south zone has the largest installed capacity which accounts for almost one third of total capacity. As far as overall demand and capacity is concerned, the capacity in India was always more than the demand and during sluggish period it gives a lot of pressure to margins of cement companies.
The cement industry is an organized and structured industry. If we see in north India, mini cement plants have almost gone away and it is major cement manufacturers who are not only controlling the market but are near to totality. The industry is dependent on limestone which is the primary and main raw material for cement manufacturing. Almost all the major companies have backward integration to limestone in the form of owning captive mines. Maximum limestone mines in India are located in Madhya Pradesh, Rajasthan, Andhra Pradesh, Chhattisgarh, Karnataka, Tamilnadu and Gujarat and so the cement plants have concentrations in these areas. There are basically seven clusters namely Satna, Chanderia, Guibarga, Bilaspur, Chandrapur, Yerraguntla and Nalgonda. In capacities there is a regional imbalance with southern region having the maximum

Source: CII cement vision 2025 report.

Figure 1
demand supply gap. The additions of capacities are likely to be highest in eastern region where around 15 million ton is expected to be added in around three years time. Consolidation in the industry is also taking place for operational efficiencies.

The cement industry is also a very high energy intensive industry. It contributes around 35% of total production cost. The issues involved are the technology used, fuel efficiency and power efficiency. There is only a little scope of cost reduction on this front as all the big companies are already working at high level of efficiencies and have almost reached at best feasible level. The industry is also high capital intensive. As per World Bank report (2002) the cost of a new cement plant is equivalent to three years of revenue.

Another most important feature of the industry is that it is cyclic in nature. The market and consumption is closely linked with the climatic and economic conditions. In northern the demand peaks around March where as it remains at its lowest during August/September. The impact of these aspects have made the strong players more strong as they only can with stand this situation as economies of scale, operational efficiencies and geographical diversification plays an important role.

The cement industry is highly energy intensive. Coal is the primary source of energy in the Indian Cement Industry and it is expected to continue. It accounts for more than 80 percent of total energy consumption while renewable and wastes accounts for less than 2 percent which shows as a huge potential of its growth. As per the reports, we generate over six million tons of hazardous waste and about 50 million ton of non hazardous and municipal waste, apart from a huge quantity of agro waste. However to take the best advantage of this industry needs to sharpen its focus and harness its supply chain infrastructure. Government also needs to play its role by facilitating through favourable policies.

Though the industry is highly efficient in India, when it comes to energy consumption, rising fuel cost push the industry for lower consumption so that it could save more. The data on specific electrical energy consumption and specific thermal energy consumption
shows that India is much better than the rest of the world (source: Indian Cement Review, September 2013). Though the industry in India has made a significant improvement in energy efficiency, use of alternative fuel and raw materials is a major area seen for improvement. Another area is waste heat recovery addition stage in preheater.

This industry has a significant role in the climatic change debate and on the issue of sustainability. It produces 5% of total man made carbon dioxide which is a major gas contributing to climatic change (WBCSD 2005). The industry is also facing the environmental challenges due to release of oxides of nitrogen, sulphur dioxide, particulates of carbon dioxide, use of resources especially primary raw material, fossil fuels and generating waste (Environment Agency 2005). Lot of work is being done in this field and India is doing much well as compared to other several nations.

As per the Cement Manufacturing Association estimates (Indian Cement Review February 2014) there will be 8-9 % rise in cement consumption in the financial year 2013-14. The body estimated the consumption to reach a figure of about 280-285 million MT from around 260 million MT in 2012-13 fiscal. There was a concern of approximately an over capacity of approx 100 million MT. Southern region accounts around 150 million MT out of total capacity of approx 350 Million MT with a demand of just around 70 MT making it a largest surplus region (Construction Business Today, February 2014). The reasons of lower capacity utilizations were due to the dried up investments in infrastructure due to economic slower down etc.

If we see the region wise demand, there seems to be a good potential in eastern region in coming years. The per capita consumption in eastern region was 105.5 kgs against the northern region 240.6 Kgs and western region 242.9 kgs as per the report of standard charted Research for the year FY’11. Though the pipe line capacities are high in that region however the most of the capacities are grinding capacities. Overall for FY’15 stable to week outlook is predicted for the cement sector by Indian Rating & Research (Construction Opportunities, February 2014). The cement demand growth for FY’13 was 5.6 percent and the expected demand growth is expected by the agency is around 5-6 per
cent. The demand may be cushioned by rural sector and Tier II and Tier III cities. Capacity addition would be moderate however incremental demand will be lower than incremental supplies. The suppressed demand and slowdown in construction activities would keep the capacity utilization in the range of 70-75 percent in FY’15. Southern India will continue to have the lowest capacity utilization in the range of 56-58 per cent, in eastern region at 80-85 per cent, in central region around 70-75 per cent and in northern and western India at 70-80 per cent. However there may be some marginal increase in demand after the election, depending upon shape of the Government, and the visibility will come in the second half of FY’15.

It is expected that the consolidation would continue in the Industry. The same was seen in the past and in FY’13 approx $3.3 billion worth deal were done in the Indian domestic market. There are regional imbalances and cost inflation. Possible consolidations would be done eyeing the companies which have cost effective access to raw materials and energy or a location advantage to optimize freight cost. In this process the facilities which have fewer such advantages would hardly get any taker.

As the industry requires huge land bank to create and run green field projects, it will be tough to create green field project by new players. Many companies planning to add their capacities have already acquired land however they are going slower seeing the existing capacity utilization and demand supply imbalance. On long term basis, with the GDP growth back on track and thrust on infrastructure development, the growth in cement demand is expected to be 9-10 per cent in future. The total investment target for the infrastructure sector during the twelfth five year plan is about one trillion dollar which is double than the proposed spend in eleventh five year plan. Industry is cyclic in nature and is looking at its bottom of cycle. The focus on infrastructure and improvement in economic conditions are likely to result in shortening the down cycle time for the industry and peak capacity utilization levels could be reached earlier than expected.
1.1.1. (i) Notable trends in the Indian cement Industry

There are 185 large cement plants in India and 365 mini and white cement plants in India. Large plants alone constitute 97% of total installed capacity. Out of total large plants 37 are located in Andhra alone followed by 21 in Rajasthan and 19 in Tamilnadu. North has second largest Installed capacity zone wise after south zone. In the Industry the presence of small and medium players across zone is increasing and they are constantly increasing their capacities. On the cost front, as fuel is highest contributor to the cost, major manufacturers are increasingly using alternate fuels, especially bio energy. The proportion of blended cement is also increasing and in 2011 the production of Portland pozzolona cement accounted for 75% of total cement production. The 12th five year plan shows a great growth potential for the cement Industry in India.

As the demand for Cement surges, the Indian cement industry will have to enhance capacity of production to compete against the multinationals which are entering the Indian market. Success for a company will also include adapting Business strategies, to compete against the global players. The growth of this sector can be determined by analyzing industry trends and governmental data. We will look at the business strategies specifically in terms of consolidation, globalization, targeted customer strategies, R&D, corporate governance, innovation and branding. In emerging economies, particularly in Asia, demand will increase more significantly. Therefore, expansion will be there in growing economies and this is an important aspect of global strategy. There are three major macro-level overhauls that conglomerates need to integrate. Most large global as well as domestic players have multi-product businesses in the building materials segment and a key focus is to maintain the strategy of vertically integrating core activities like supply chain management.

All major cement companies in India are producing world class cement and among so many factors supply chain management is one of the most important factors for the success of any cement company. This Industry is logistics driven and delivery of material from plant to the consumer contributes a significant component of total cost.
1.1.2 Global scenario

The demand of cement depends upon the industrial activity, real estate and construction activity. Since activities are taking place in all these sectors hence demand too is increasing globally. As per the ICR- Global cement report 8th edition, China is the largest consumer of cement and in 2008 accounted 48.7% of overall world production. With increasing demand in emerging economies, Asia is accounting 67% of global demand. K E Daugherty, University of Pittsburgh, in a research paper found that cement consumption has a higher degree of correlation with the gross national product per capita than any other of the indicators examined. Among the related economies India has the lower per capita consumption. Though it has increased from 28 kgs in 1980-81 to around 147 kgs in 2008-09 but still it is very low as in the similar period the per capita consumption in Saudi Arabia was around 1245 kgs, Japan 491 kgs, US 285 kgs, China 1040 kgs, Brazil 271 kgs and Russia 378 kgs.

As per US geological survey, Cement is produced in almost 156 countries across the globe with top ten countries contributing almost 70% of the total volume. Besides Asia’s contribution of 67%, western Europe had about 8% output, middle east and north America nearly 6% each, Africa, rest of America and common wealth of independent states around 4% each and eastern Europe around 2%. As per the report of ITC Geneva (2008) the US was the largest trader of cement followed by Germany, Belgium and Netherlands. Despite being the second largest producer of cement in the world, India is not the major trader of cement. India has a great potential for exports in the Middle East and South East Asia. Its strengths are sufficient lime stone and coal reserves and adequate capacity to produce world class quality with latest technology. However on cost part it is not as competitive as China. Companies stand on this is the higher direct and indirect taxes and the freight component in transporting it to port. Besides this the facilities at port are not good enough to handle the material properly. This creates a huge difference as world wide 70% of the cement movement takes place through sea route compared to 1% in India.
The maintenance cost of cement is very high and the maintenance activities cost is approximately 20-25 % of total cost of production (Al-Muhisen and Santarisi 2002). Repeated attempts were made to enhance and strengthening the maintenance system. Eti et al (2004) emphasized the need for preventive maintenance instead of reactive maintenance. It stressed on maintaining high performance and strengthening maintenance so that there is reduction in unplanned down time. The opportunity of applying the Automatic Downtime Monitoring System was discussed by Stephens et al (2004). As the component is high, it is a matter of great importance in the competitive business environment.

In India the margins of cement companies were impacted in the first half of FY’14 due to high volatility in foreign exchange rate. One of the main components for power, higher calorific coal, is largely imported. The impact of cost can not be easily passed on to the customers due to capacity utilization pressure and so volatility towards higher side would make a direct impact on the Industry.

### 1.2 History of Cement

Since from beginning of civilization there was a need of man made bonding material. During Paleolithic age man was totally dependent on nature but during the Bronze Age there was the use of clay based building material. Egyptians used gypsum and lime for building structures like pyramids. Greeks and Romans found that certain volcanic ash and tuff mixed with lime, silica and water gives good strength on hardening. Romans used volcanic tuff was found near Pozzuoli village near Mount Vesuvius in Italy. This tuff or ash was mostly siliceous in nature and so acquired the name the name Pozzolana. Romans also used powered tiles or pottery as pozzolana in the absence of natural volcanic ash. In India surkhi was used in mortar. Romans even used blood, milk and lard in mortar for better workability. Hemoglobin has a property of plasticizer and is a powerful air entering agent which perhaps was known by Romans but certainly it was one of the reasons of durability of structures.
In eighteenth century lot of studies were done in this field and the work done by John
smeaton was undoubtedly remarkable. Hydraulic cement was made in 1776 and the
cement made in 1800 was called as Roman cement till 1850. L J Vicat conducted the
work on artificial hydraulic lime by calcining intimate mixture of clay and limestone. On
21st October 1824 Joseph Aspdin took the patent of Portland cement. The name Portland
was given owing to the resemblance of this substance to the upper Jurassic rock found at
Portland in southern England. In 1845 Isaac Charles Johnson burnt clay and chalk till
clinkering stage to make cement and factories were established in 1851.

1.2.1 History of Indian cement Industry

In the year 1904 the Portland cement was first manufactured in India by the South India
Industries Ltd near Chennai but the venture failed. The Indian Cement Co. Ltd was
established near Porbander between 1912 and 1913 and by 1914 the company was able to
deliver about 1000 MT of Portland cement. Later on two plants were set up, one at Katni
(M.P) and another at Lakheri (Rajasthan). These three industries together were able to
produce 85000 MT of cement per year.

Before India started producing Portland cement, it was imported from UK and few RCC
structures were built with it. It included a three storied building at Byculla, Mumbai,
masonry building on mount road Chennai, Har ki pauri bridge at Haridwar and the cotton
depot at Mumbai to name a few. In the initial period there was the pressure on the
industry as some players started selling the material below the cost price due to capacity
issue. The government of India than intervened and referred it to the tariff board. The
board recommended the protection of government and the cooperation among the
existing players. These situations resulted into the formation of Cement Manufacturer’s
Association in 1925. Between 1969 and 1982 cement industry was under strict
government control however industry faced a lot of difficulties. To overcome the issues
the government introduced a system to partially decontrol it in 1982. A levy quota
mechanism was introduced where companies were allowed to sell a limited quantity in
open market and rest of the material on government directives. A ceiling price on open
market sales was also introduced to safeguard the interest of consumers. In 1987 government decided that price ceiling is no more required. Finally in 1989 the cement industry was considered for free market competition and in July 1991 the industry was de licensed. After this decontrol the industry really moved towards globalization. Hence the role of the government was highly influencing in Indian cement history.

1.3 Evolution of supply chain management

There have been three major revolutions in the field of supply chain management. The first one considered in the period 1910-1920 which was staged by the automobile major Ford Motor Company which managed to build an integrated supply chain. Its tightly integrated chain managed the whole journey from the starting item till the finished automobile however in this process there was a lot of rigidity as it was not able to offer choice. It was a highly managed chain but at the same time it was inflexible which could not handle the variety of product and so it was non sustainable. General motors understood the requirements of market and offered the variety in models with colour choice. In case of Ford motor company the set up required a longer time and so the changes and so it had to work with high level of inventory. After this many companies in manufacturing industry saw several changes which included an obvious trend towards variety of products. This brought up the need for efficient and flexible supply chain where high inventory level was not desired. The second revolution in the chain was considered between 1960-1970 when Toyota motor company focused on final assembly and manufacturing of only key component on their own and bulk of the other components were outsourced from the variety of suppliers which were part of Keiretsu system. These suppliers were located in close vicinity of Toyota plant which resulted into reduction of lead time. It involved tight linkages, long term relation ship with suppliers and it served the objective of low inventory however at the later part some problems started coming. When some Japanese firms and Toyota planned their assembly set up at different geography, they realized that they would have to take up their suppliers also. They also realized that some of their suppliers were not cost effective and had become complacent over a period of time which came up as a real liability. After this tightly linked supply
change the third revolution came up with loosely held network of suppliers. It focused on the customer demand and chose the components accordingly. It was during the period 1995-200 when Dell adopted the model with the help of advancement in information technology. With the help of information technology Dell integrated the suppliers electronically. The biggest help to Dell was to keep the minimum inventory level and preparedness for any change. With the advancement and dynamic nature of market and economy the role of supply chain is increasing day by day. The focus is on all the components including product and services, customers demand and expectations, efficiencies and economies and availability of choices etc.

1.3.1 Supply Chain Management Definitions


The Global Supply Chain Forum (GSCF) defines supply chain management as “the integration of key business processes from end user through original suppliers that provides products, services, and information that add value for customers and other stakeholders.”

Kotzab and Schnedlitz describe SCM as strategic partnership between retailers and suppliers with positive impact on the overall channel performance. Integration is the key activity in supply chain management. The positive impact on business examples includes the supply chain of Dell computers, Wal-Mart, Digital Equipment Corporation, HP
Corporation and the personal computer supply chain. All these are the examples of reduced cost and improved customer service.

Uncertainty is the key issue which impacts the effectiveness of supply chain (Davis, 1993). During a research at Intel (Oliver and Houlihan, 1986) found that equilibrium between demand and supply were for 35 minutes in ten years.

As per the study done on 200 large manufacturers in USA and Canada by Deloitte consulting (1999) “No longer will companies compete against another companies, but total supply chains will compete against other supply chains.” Other excerpts from report “while supply chain management has received considerable attention in recent years, more companies have become increasingly aware of the importance of an effective supply chain to corporate success, and ultimately, to survival. Two forces driving this recognition are the desire to improve customer satisfaction and the need to cut costs.”

D Smagalla (2004, 2013) in its studies suggested that the local culture plays an important role while doing business and it is important to adept the prevailing practices of the region. It discussed that Japanese total quality management and just in time concepts are world wide taken as a golden rule in the manufacturing business however Japanese owned logistics and operation firms in Europe (2004) struggled to meet the expectations. “Neither the Western focus on logic and fairness nor the Japanese focus flexibility and quality of service is well balanced,” says Shinohara. “Both need to be taken into account to improve logistics management.”

The council of supply chain management professional (CSCMP) formerly known as council of logistics management developed two alternative definitions of supply chain management. (Gibson, B. J., Mentzer, J. T., & Cook, R. L. (2005).

Alternative A – “Supply chain management encompasses the planning and management of all activities involved in sourcing and procurement, conversion, and all Logistics Management activities. Importantly, it also includes coordination and collaboration with
channel partners, which can be suppliers, intermediaries, third party service providers, and customers. In essence, Supply chain management integrates supply and demand management within and across companies.”

Alternative B – “Supply chain management encompasses the planning and management of all activities involved in sourcing and procurement, conversion, demand creation and fulfillment, and all logistics management activities. Thus, it also includes coordination and collaboration with channel partners, which can be suppliers, intermediaries, third party service providers, and customers. In essence, supply chain management integrates supply and demand management within and across companies.”

Finally CSCMP adopted alternative A as the official definition as survey participant’s belief was that it is a combination of strategy and activity and does encompass collaboration. Though the definition B generated slightly stronger support but the higher rating was not consistent with the perception of participant’s w.r.t. the role of marketing and sales. Thus the demand creation and fulfillment was not included.

The supply chain management and supply chain in construction industry was defined by Tommelein et. Al. (2003) as “the practice of a group of companies and individuals working collaboratively in a network of interrelated processes structured to best satisfy end customer needs while rewarding all members of the chain.” This implicit the definition of supply chain as a group of companies and individuals working in collaboration of an interrelated processes in a network.

Rother and Shook (1998) described the value system in supply chain as “all the actions (both value added and non-value added) currently required to bring a product through the main flows essential to every product: (1) the production flow from raw material into the arms of the customer, and (2) the design flow from concept to launch”. As supply chain is related to the network of companies working collaboratively, value stream is related to the process across the network.
Almost fifty years back Peter Drucker referred logistics as “economy’s dark continent”. As per his description the logistics was the most neglected but the most promising area of business.

1.3.1. (i) Reverse supply chain management

It is the reverse flow of material to the manufacturer either from the end point or from the intermediary point. It may be with respect to the part product or may be the full product. Take the case of bottled cold drink or milk where the empty bottles are brought back to the manufacturing/bottling plant for the filling. At times the product is lifted back due to some defect or for any other reason. In case of products whose life end and are sensitive to environment, companies prefer to lift it back for various reasons including compulsions. In some businesses it is equally important as forward supply chain and the classical example is Mumbai dabbawala. The same is not common with respect to grey cement in northern markets in India as most of the material is sold in packed bags of fifty kilograms each however in case of dispatches through jumbo bags to certain industries, empty bags are returned back to the factory. The concept as such is not common to many industries in India and is in its initial stage. Reverse chains are comparatively difficult to manage as in most of the cases the timing and quantity remains uncertain.

There are some specific issues in grey cement trade when the material is not accepted by the consignee. This includes

1. Quality issue in part or full.
2. Transit damages.
3. Late arrival and fulfillment of demand by competitor.
4. Damage of approach road especially in heavy rain season.
5. Any other incidental issue.

In these cases the material does not come back to the factory but certainly reaches to different place than originally destined. In majority of such cases it is diverted to different place. In case of damages due to various reasons almost all the companies disposes off
the material as early as possible through the laid down policies of their respective companies. Largely the process adopted in most parts is through auction on as is where is basis. As the inventory cost is high and the movement of such material is much low as compared to fresh material, it is always advisable to dispose off such material immediately after it is noticed. Also with the passage of time the quality gets deteriorated and so the value too goes down with each passing day.

1.3.1. (ii) Branding and Strategy

In the present Indian business scenario when it comes to supply chain management immediate name comes in mind are e commerce companies and precisely e-tailing companies. You can see the strong statements like “we want you to have an absolutely headache free shopping experience…In case there is an issue with the product you have received, our Free & Easy Returns promise has got you covered.” on Flipkart poster. Lifestyle products portal Jobang.com touts a “30-day no question asked return policy.” Its website says “Though we strive to give you a great customer experience each time you shop with us, if et all you are not 100 percent satisfied with your purchase, you can return your order for a full refund of paid price.” The website of snapdeal.com says “Guaranteed resolution of complaints within a maximum of 30 days/full refund if not resolved.”

1.3.1. (iii) 3PL Logistics

Traditionally the companies used to manage their supply chain on its own. Like any other activity, supply chain was also thought to be outsourced so that focus and energy could be used in the core business. This brought the emergence of third party logistics (3PL). In developed countries approximately ninety percent of the activities are outsourced and are being managed by 3PL companies. The advantage with these companies is natural as they have their focus and expertise in these activities and have largely reached to the economies of scale in their operations. They pool the demand across their various customers which give them sizable volume to operate in cost effective manner. In India
the concept of 3PL is at its nascent stage. Only a few businesses have entered into it and freight forwarders are one of the majors into this. International players like Toyota too asked Mitsui and company to take care of its logistics requirements when they came to set up their plant in India.

1.3.2 Challenges in Rural India

Larger population in India lives in rural part. It becomes difficult and challenging for the companies to make a reasonable reach into these markets. Penetration in these markets is the dream of all companies however it is a very challenging task. Fast moving consumer goods (FMCG) companies’ growth largely depends on rural reach as masses live in rural part. In the name of Project Shakti, a rural initiative was taken by Hindustan Uniliver Limited. It partnered with the self-help groups (SHGs) to extend its reach to rural India. This was done to cover those areas where HUL distributors did not have the proper reach and penetration. A Shakti dealer is a member of SHG, who works as a direct-to-consumer HUL distributor, selling primarily to villages in her neighborhood. Due to such challenges lot many small companies create niche in their respective geographies and poses challenges to bigger players.

No discussion of supply chain can be completed in India without discussing Dabbawalas of Mumbai. They collect about two lac dabbas every day in the morning deliver it for lunch, again collect it and delivers it back home. The beauty of it is that it is that it qualifies the six sigma standards which means that no more than one dabba per six million deliveries gets a miss. Another important part is that it is highly cost effective where public transport like local trains are used and normal coding system works. This is a perfect example of high quality service at an affordable cost. Recently they have also started the value added services. Even the forgotten items are delivered along with dabba as a value added service. This shows the level of trust and goodwill earned over a period of time.
1.3.3 Supply Chain Integration

It is generally observed that there are significant wastages at departmental as well as at organizational interfaces. With the help of integration in supply chain, these wastages can be reduced. It may require the changes in organization structure process.

1.3.3. (i) Internal Integration

A typical firm is functionally organized and material as well as information flow takes place through multiple departments across internal supply chain. As each function focus on its own performance, it creates inefficiencies especially at boundaries. Certain decisions may be optimal if it is seen in isolation however when we see it collectively, it may show some different picture. In case of inventory level as well as transportation cost, we may reach efficiency individually this may not be optimal collectively. To overcome this issue firms may have centralized system or decentralized system or may be hybrid system where few key activities may be centralized and rest may be left decentralized.

1.3.3. (ii) External integration

In an integrated supply chain there is seamless flow of material and information across the organizational boundaries however it is found that in practice the information flow gets distorted. There may be one or multiple reasons but it affects the whole supply chain. There could be the demand volatility or may be a flaw in demand forecasting. There may also be batching issue for economies of scale or may be some incentive involved on bulk orders. Behavior of supplier or inefficiency of supplier may also impact the overall efficiency. Unlike internal integration, the external integration is more challenging. In case of internal issues, things may be imposed by the involvement of top management however in case of external issues it has to be negotiated so as to make business sense for both the parties. It is difficult to find external integration in supply chain where two parties have genuine differences and it is important to eliminate the issues.
1.4 Role of Supply Chain Management in Cement Industry

Supply chain management manages the network of business activities which involves the delivery of various products and services from its origin to the customer. It includes movement and storage of raw material, intermediary products storage and movement and finished goods storage and movement. As per Stock & Lambert “Supply Chain integrates the key business processes of an organization from end user through original suppliers that provides products, services and information that add value for customers and other stakeholders.”

R P Mohanty and S G Deshmukh in its book writes SCM as “A supply Chain is a network of facilities and distribution options that performs the functions of procurement of materials, transformation of these materials into immediate and finished products and the distribution of this finished products to customers. Supply chain exists in both service and manufacturing organizations, although the complexity of chain may vary greatly from industry to industry and firm to firm.”

In the past there have been consistent efforts to manage the construction supply chain effectively and efficiently (Arbula et. al. 2003). Achieving excellence gives the competitive advantage in the market. The fact is that supply chain participants are still exploring for improved understanding of supply chain management so that they may take competitive advantage by applying it. Construction industry is known to be ruled by schedules. In this the supply chain process should be the network of interrelated process which should be designed to fulfill the customer requirements.

There are mainly two stages of cement production. At first stage the clinker is made. Raw material is transported to the cement plant where it is crushed and homogenized to enter in kiln. The kiln is heated at a very high temperature and it is inclined in such a way that material rolls to other end when it is cooled quickly. This result to the formation of solid grain called clinker. The second step is to transfer this clinker into cement through grinding mill process after adding additives like gypsum etc. The final powder thus
obtained is called cement. Many times grinding process takes place at different locations which are called grinding units. In such cases the clinker is transported to such units and then final production of cement takes place there.

Logistics accounts for a big component of overall delivered cost of cement. As per Indian cement review (April 2011) the inward logistics cost was about three percent of gross revenue and outbound was close to fifteen percent. Clinker going for grinding was considered in outward. With respect to the out bound logistics there are three modes of transportation namely rail, road and waterways. Among these the waterways is not significant in India so far due to various reasons and accounts for around 1% volume only. The structure of cement industry in India is based on the processing units which are close to resource mines and that too in clusters largely where as the distribution centers are close to consumption markets. For the long distances the railways are relatively better and cheaper mode however in spite of that benefit the railway’s share of transportation in India is going down. The same has gone down from approximately 57% to about 35% in the last decade. The reason of this could be many including the availability of rakes, insufficient infrastructure at terminals, high loading and unloading time etc. The road transportation is also very fragmented. There are only limited large transporters which offer high service level. The road transportation cost is also increasing due to increasing diesel price, congestion at highways, manual loading and unloading which results into high turn around time. In spite of high capacity as compared to demand pressure in the last almost two years the overall cement prices have not come down much because of increased logistics cost.

As per the equity research of Standard charted (11 April 2014) price fluctuations in southern region were relatively high in the past years as compared to other regions. Logistics constraints were quoted as a major region of price disparity. The uneven distribution of lime stone reserves means the concentration of clinker production capacity development in those areas. These regions have significantly over capacity and produce the need of transportation of cement and clinker to other areas. Companies have started
creating grinding units at other locations however it is just a partial solution (Refer Table). As per the research estimate Rajasthan will have the largest surplus in FY’15.

With the economic growth in seven top cities in the country beginning to saturate, a number of tier II and tier III cities have come into reckoning as the growth drivers for the construction Industry. The skyscrapers are finding its ways in non metro cities and the multi storey buildings are becoming a common phenomenon elsewhere. With the availability of new technology and the growing property demand, skyscrapers are seen as the most fitting solution to any city which is spatially challenged. The concrete is the most common material to construct such buildings and so the role of cement, which is one of the most important ingredients, becomes very important.

Rajesh Turakhia, Director-CEO, Pashmina Developers (Construction Business Today, October 2013) says “High-rise buildings are not only lifestyle statement but also the need of the hour where the demand for commercial and residential space surpasses the land supply.” As per the estimates approx 50 percent of Indian population is expected to live in urban areas by 2030 resulting in less of space. This will make the construction of tall buildings inevitable.

K N Rao, ACC, Director (Energy & Environment) during its interview to Indian Cement Review (July 2013) says that the amount of logistics involved into the cement industry, it is practically impossible to make cement manufacturing process totally green however certain initiatives were taken by them like the transportation of limestone from mines to plant through closed conveyors in stead of open conveyors. They are also migrating to bulk transportation modes like using high capacity vehicles, use of railways lead to reduction in the scope-III type of CO2 emissions etc.

1.4.1 Role of Labour

The role of labour is very important in the supply chain of cement industry. If we see it for out bond supply chain the role starts at the time of packing point. It starts from the
stacking of empty bags at packer. In most of the cement plants in the industry it is a manual operation when the bag is manually picked and placed on the packer nozzle. Than it is filled automatically and in automatic plants the bag is released automatically once it is filled as per the pre calibrated machine. Majority of the grey cement bags are of 50kg capacity which is used both in trade as well as non trade segment. Some of the material also travels through bulkers and at some location even loose cement is dispatched but the facility to handle such material is limited to only few places and customers.

Once the bag is released from the packer it is placed on the conveyer belt directly and the material is loaded on Lorries or rakes. Many of the plants have automated loaders but at some plants still the partial operations are done manually by the labour. The unskilled labour is required to handle cement bags and not much training is required for handling it. The next place where the role of the labour comes is railway yard or ware house.

1.4.1. (i) Role of labour at Railway yard

At most of the rail yards there is permanent arrangement of labours. The traffic at all stations is not similar and so the arrangement of labour. The railway sidings like Ghaziabad where there are huge arrivals of rakes and hardly there is any day when there is no arrival have good amount of labour always available on rake point. At most ok the sidings there is single or multiple labour contractors with whom the handling agents needs to contact to handle their respective rakes. They enter into permanent kind of long term contracts as the companies normally do not deal directly with these people. Contractors too have a set up with the labour in such a way that some people are engaged on permanent basis and they keep some tie ups for the need based arrangements. Main contracts too have tie ups with sub contractors who provide them the desired labour on pre decided rates. Normally at railway sidings the labour amount is paid to the workers on the basis of operations done by them however the handling agent charge from the company on fixed rates basis. The logic behind this is the fluctuating rate of labour on time to time and the companies too try to find it difficult due to monitoring and accounting issue. Labour contractors are fixed at most of railway sidings however at big
places they are more than one but even at these places much of the labour is common and work as per the requirements of different contractors. Railways have its own norm of demurrage and wharfage which gives standard time for loading and clearing the rail yard at specific timing. Beyond this the money is charged as a penalty and the railways allow lifting the material only after the amount is paid for it. As all the operation is manual at all the rail yard available in entire western UP and Rajasthan where the study is done the role of labour is imaginably crucial. Normally each bag is handled by a combination of three labourd. Two people place the hook one from each side on the bag and lift it to the level of the back of third labour that holds and carry it and place it to the stacking point of yard or into the vehicle. Though it is clearly mentioned on grey cement bags as use no hooks however at no place the handling is being done without the use of hooks.

1.4.1. (ii) Role of labour at ware house

Once the material arrives at ware house it is either transshipped to another vehicle or kept in the ware house. At both the situations the bags are handled manually by the labours in a similar manner as it takes place at siding. The handling operations at ware houses are managed by the handling agencies directly through the labours or through some sub contractors depending upon the size of operations. Unlike railway yard where at a time the volume is very high, warehouse operations have no such time limitations. Here also the companies who handle large volumes, their agents generally keep some permanent labour and some labour on tie up basis, pooled labour. The method of remuneration by the companies varies from company to company. Some keep a fixed package where as some pay it on the basis of operations depending upon their own business model.

1.4.1. (iii) Role of labour at construction site

The construction sites may broadly be divided into two categories. One is large construction site where labour stays at site and the other sites where they reach daily for the work and return in the evening.
1.4.1. (iii a) Large construction site

Large construction sites are normally handled by the contractors who manage the show of material handling as well as construction activity. For construction activity semi skilled, skilled as well as non skilled labour is required for different activities. At bigger sites normally the material handling department and construction department remain different however the cement handling method remains more of less similar to the ware house operations. The additional part required is to take care of the safety of bags and storage at proper place. Finally the labour cuts or opens the bag for the usage of cement.

1.4.1. (iii b) Small construction site

For the construction sites which are managed by the individuals and many times by the owner itself have different approach. At small towns and at villages, people know each other personally and so they can engage the work force by directly contacting the relevant person as per their requirement however in semi urban and urban town the labour is generally engaged at labour chowks. In such sites normally construction does the dual role of doing construction activity as well as handling the bags till it is used.

1.4.1. (iv) Role of labour chowks\textsuperscript{1}

It is a very important place where there remains a big crowd of all kind of construction labour and the place is found at almost all urban and semi urban towns in North India. This is kind of hub where the requirement of both hirer and labour is met. Even the truck drivers while reaching to any such towns, approach labour chowk to pick the unloading labour so that it does not loose time at unloading point. In today’s time when use of mobile phone is common, drivers make an enquiry in advance about the availability of labour at construction or unloading site which at times remains common. At bigger cities

\textsuperscript{1} Labour chowk is a place where labour assemble in the morning to explore the day’s work.
and towns there remains the multiple labour chowks. Rates and jobs are discussed at decided on the spot and hiring takes virtually no time. Generally in an hour or two in the morning the place becomes crowded to deserted. Those who find the job go for work and those who do not go back.

1.5 Customer segmentation in Cement Industry

In the industry the customers are broadly divided into two categories namely trade and non trade customers. There is further classification between these two categories however the major requirements of each category and the handling pattern remains common with in the segment.

1.5.1 Trade segment

This is the segment in which normally there is no direct dealing between the customer and the company and there is always some intermediary between them. Different companies have different layers of intermediaries. This starts from company to sales promoter or market organizer to Dealer to retailer and finally to customer. Some companies have different layers and different nomenclature between layers however the broader chain is like this only. It does not mean that material physically moves between these chains but this is perhaps the biggest chain in which some of the material actually passes through. It skips one or different layers in actual movement which means that material actually reaches to end customers directly from cement plant however in that transaction there remain the role of at least one layer of middle man or channel. Part or complete channel facilitates each transaction till the material reaches to end customer from the plant. Different kind of vehicles and handling takes place at each level and the cost component also vary from transaction to transaction. The expectations of customers as well as of each layer in the channel are increasing day by day which is posing a challenge and opportunity to supply chain management.
In each transaction with in the chain, in actual terms, the receiver of material becomes the customer of sender. It means the dealer behaves like a customer of company or the sales promoter, whatever is the case. Similar way the retailer becomes the direct customer of dealer and so on. Every body requires the desired quality, quantity at minimum cost and on expected time.

1.5.2 Non trade segment

This is the segment where there is a direct transactional dealing between the company and the customer. Some agency or individual may play the role of mediator or facilitator but final deal remains between the company and the customer. There is ample scope of further classification with in non trade customers like ready mix concrete players, builders, housing societies, government agencies, private companies, tile and block manufacturers and the list is endless however the broader definition remains as stated earlier. Some of the companies have divided it further between key customers and other non trade customers. As a practice the price and other terms of business vary from customer to customer with in the same company. The most important parameter other than price in this segment is timely delivery of material as per the requirements of customer. Many customers work on risk purchase clause under which they can buy the material from actual market if the deliveries are not done as per the agreed terms and the differential cost is recovered from the primary vendor. Since the customers in this category are normally big in size there remains a risk of loosing the bulk quantity order and so comparatively better services demand always remains there from logistics. Certain companies have relatively bigger focus on this category and so they need to develop their supply chain focusing the expectations of this segment.

Many of the customers in this segment require cement in bulk packing and not in normal 50 kgs cement bags. This includes many ready mix concrete players and those who have mass consumption of material for slightly longer duration. This requires specific infrastructure and facilities at plant, for transportation and at customer site too. If it is a jumbo packing requirement than crane facility is required at customer end. Also if loose
cement is required by the customer than bulkers are required for transportation and bulker loading facility is required at plant and unloading facilities are required at customer’s site. In both the cases storing facility like silo is also required at customer’s unloading site.

There are many end users which uses cement as a raw material and are permanent consumer however due to the small size of business they are catered many times from trade segment in spite of being genuine non trade customers. In a similar way there are some mid size builders and other such customers which are catered through trade channel due to their own requirements, limitations and compulsions however they too require similar service standard.

1.6 Future trend in Cement Industry: Ready Mix Concrete Business

It is a forward integration in Indian cement industry. The concept is not very old in India and is just around a decade old. This business purely is Mixing, Transporting and Pumping Business. The limitation of this business is the nature and behaviour of concrete. The life of the product makes the business confined to major urban cities only. Initially it started with major metro cities and its suburban towns. The business is controlled by large cement companies only which have kept the bargaining power to themselves. Cost wise it is high as compared to site mix concrete however the convenience and the quality makes it viable for bigger sites. However for small individual house builders and small sites, the preference remains with the site mix concrete only. The overall RMC business is growing as the concept is well understood by users and so number of plants as well as new geographies is being added continually.
1.a Variate structure

It is a multivariate structure in the study. Thorough study of subject was done with available literature and discussions with various industry resources and stake holders. Finally a study was done with fifty industry experts’ by which thirty two factors came up with respect to the study with different frequencies. Each of these factors was analysed by using different methods and techniques to meet the objective of the study.

1.b Rationale

The Indian cement industry is the second largest in the world and it is one of the matured industries in India. There are several national as well as international players in India in cement industry with world class quality available throughout. In spite of such a large volume and positioning, there is still ample scope of growth as the per capita consumption is much lower (less than 200 Kgs) than world average (around 400 Kgs). This is one of the major reasons of multinationals eyeing the Indian market and world leaders have already entered the Indian market with their manufacturing capacities. This industry has seen consistent year on year growth irrespective of economic conditions. This industry is logistics driven where logistics contributes a good component of total cost and the same is increasing year after year. On one hand so many companies have grown consistently and at the same time others have hived off their cement business. The acquired plants are running successfully and contributing well to the overall business. Since the impact of supply chain management is too big on the total cost of material, it makes a significant impact on the bottom line of the balance sheet of any company as the cement price is market sensitive. An improvement in supply chain management will make an overall positive impact to the company and business.
1. Objectives

1. To study what are the critical factors in successful supply chain networks.

2. To build the strategy on outward supply chain management aspects as well as strong channel networking for the improvement in existing supply chain practices and also considering the sustainability in line with expected growth in the industry.

3. To make an analysis of supply chain cost in light with prevailing practices and expected level of different stake holders.