Aligning operational and growth strategies with Supply Chains in Cement Industry

Shailendra Chouksey*

Abstract:

Globally, cement industry has very large per Capita consumption. Per capita consumption of cement as compared to other products is the highest in all countries of the world . Thus, it is an important industry for a country as well as for the world. In India, per capita consumption of cement is still not significantly large in comparison to other countries. This is due to constraints existing in infrastructure of the supply chains which hinders the effectively supply to the final consumer. There are some industry specific characteristics of the industry which traditionally efficient shaped the scale of operation and expansion plans of the industry only in large scale. Cement industry itself is highly pollutant and needs technological innovation to reduce pollution. Basic input of the industry is lime stone which is bulky. Hence, earlier industry's location used to be chosen near the supply site of lime stone. Globally, the nature of cement industry is changing from large scale operation to small scale due to change in the nature of production through product differentiation. Now, the choice of location of the industry is not to the bulky raw material sites, but to the customer base/ market. Indian Cement industry is adopting modern practices. Yet in order to reach the end user, infrastructure of supply chains of Indian Cement industry needs to improve.

Introduction

Cement is the most commonly used construction material which touches human lives everywhere. In fact, the use of cement is common in the world today and it would not be an exaggeration to state that this is the second mostly used commodity by human after water. Given the fact that cement is among the commodities which are consumed in bulk, the manufacturing, storage, transportation, distribution etc., all integral part of supply chain management, assume significant importance in overall operational and growth strategies for the industry.

According to Geological survey of US, 2011 and Global Cement Report , 2010, per capita cement consumption in the world is 450 kg per year. China tops the list of per Capita Cement Consumption in the world with 1281 kg consumption per year , followed by Korea, Turkey . Their per capita consumption is higher than world average. Annual per capita Cement Consumption is 180 kg in India,

Mr. Shailendra Chouksey
PhD student at Amity Business School, Amity University, UP.

273 kg in Brazil, 230 kg in USA and 330 kg in Russia. Cement is not only an important sector for all economies, but this also creates both forward and backward supply chain effects in terms of input demand for the industry and the supply of final product from the industry. This paper has taken initiative to study the entire supply chain of the industry.

Manufacturing Strategy

Cement manufacturing is characterized by factors such as natural resource intensity, high energy consumption and also this industry creates high pollution.

Natural Resource Intensity – approx. 1.6 to 1.7 MT of raw materials have to be mined and processed to produce one MT of clinker, which is base for producing all varieties of cement. The table (1) below summarizes the various types of natural resources that are required to produce a ton of clinker.

Table 1 : Natural Resources required to produce one MT of clinker

Lime Stone	1.40 - 1.60
Clay	0.10 - 0.15
Coal	0.12 - 0.20
Total	1.60 - 1.70

Date Source :

1. Author's own estimates based on annual reports of various cement companies.
2. Gupta, Arjun, 2011 March, Carbon War Room, Cement Primer Report

Above inputs are bulky and location specific and hence manufacturing activities inclusive of supply chain considerations of inputs and outputs can either be performed close to the sources of input materials or close to the markets. Inputs required to produce one MT are bulky in weight and lose weight in processing. It is natural that production units are operated in areas where material inputs are available. Hence traditionally, the cement industry has been developed close to the sources of the key bulky input material i.e. lime stone.

Energy Intensity – Clinker is the basic raw material required to produce cement. Both clinker and cement require a lot of thermal and electrical energy. Thermal energy is needed to burn lime stone at very high temperature of 1400 Deg. Celsius in kilns and electrical energy is needed for processing and conveying of raw materials. It is estimated that approx. 1 MT of CO_2 is released in all activities related to manufacturing of cement and this makes cement manufacturing a highly polluting manufacturing process in the world which accounts for nearly 6% of the total CO_2 emissions due to human activities and thereby necessitating deployment of sophisticated technologies.

The manufacturing strategy in the industry have been changing in order to take into considerations that natural resources for the industry are limited in supply and there is rising concern about environment. The industry has been largely focussing on following two key drivers for sustainability & growth of the industry as well as environmental protection.

- Reducing consumption of raw materials
- Reducing consumption of energy

Both of above have close linkages with Product, Marketing, and Distribution strategies in this industry and these in turn are influenced by Supply Chain considerations.

On standalone basis, the industry over years has invested heavily in energy saving measures such as multi stage pre-heaters and waste heat recovery systems which have helped reduce energy consumption of the industry by approx. 20%. About 40% of cement plants globally have invested in these measures and the rest are in process of doing so. In India, close to 80% of the cement plants have invested in modernization.

Product Strategy

Modern day cement was invented nearly about 200 years ago and since then there have not been much changes in basic chemistry of the product.

Cementing properties of “Pozzolana” such as volcanic ash when mixed with slacked lime was

known to Romans. These mixes hardens when mixed with water, Most of the roman structures used these blends.

Pulverized Fuel Ash also is known as Fly ash. A by-product from the burning of coal in large boilers typically used in thermal power plants too displayed properties similar to natural "Pozzolana". By mid 1900s there was exponential growth of such coal based thermal power plants and the fly ash was available in abundance. The trials of mixing this ash with Ordinary Portland Cement (OPC) gave promising results and thus blended cement was discovered. Granulated Blast Furnace Slag (GBS), once again, a by product from the steel industry was also found to have similar properties when mixed with OPC.

Thus, apart from OPC, now two more varieties of cement are known e.g. Portland Pozzolana Cement (PPC) and Portland Slag Cement (PSC). Both of these cements though have slow process of hardening i.e. have lower initial strength but are known to have higher strength over a long period of time and hence are more durable.

Since fly ash and GBS both are available in abundance and the disposal of these industrial wastes by itself is the challenge, the use of these in blending of cement is gradually gaining pace and it is estimated that approx. 70% or more of the total cement produced in India is now blended cement with PPC accounting for approx. 90% of total blended.

The table-2 below shows the trends of growth of blended cements in India since their first introduction in late 1970s

Table 2 : Trends in growth of blended cement as % of total cement since 1990s

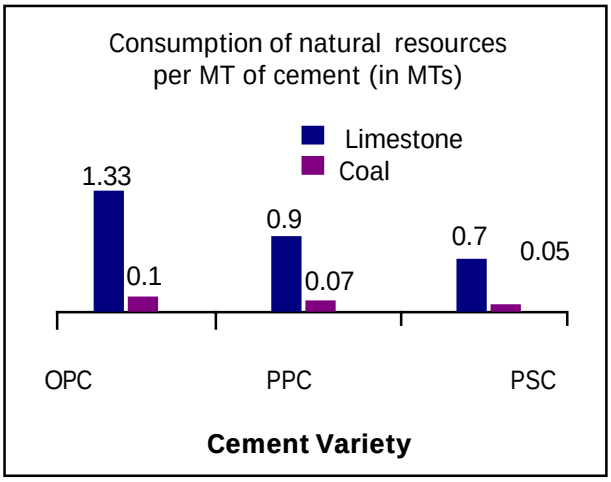
1990	28.1
1995	28.3
2000	32.6
2005	56.6
2008	74.1
2010	69.6

Data Source : Annual CMA Publications

The use of fly ash or granulated blast furnace slag reduces the requirement of clinker per MT of cement produced. The Indian standards allow the use of fly ash to the extent of 35% and slag to the extent of 65% in cement by weight. Globally higher percentage of fly ash and slag are used in masonry cements, but these cements are commercially not produced in India.

Increasing use of blending materials or higher proportion of blended cement in the Product Mix significantly reduces the consumption of natural resources used in cement production and in turn it also helps in reducing the energy consumption. This can be seen from the graphics as below :

Diagram : 1



Data Source : *Author's own estimates based on annual reports of leading cement companies*

Impact on Growth Strategies

Leading cement manufacturers have successfully integrated both Product Strategy as well as Manufacturing Strategy in their growth plans. These growth plans are combination of the following two operational strategies

1. Integrated Plants – These plants have manufacturing facilities for both clinker and cement. Till such time when the blended cements were not so popular, this was the only growth strategy in cement industry where the leading manufacturers would set up large cement manufacturing capacities close to the source of key natural resource i.e. lime stone.

Growth strategy for the firms in the industry was owning mines or mining rights, and better control over logistics for movements of output. All major cement manufacturers in their early growth period during 1980s and 1990s had adopted the strategy of building integrated cement plants having large capacities

2. Grinding / Blending Units – With the use of blended cement gaining acceptance and with increasing limitations in acquisitions of new lime stone mines, the cement companies in last two decades are moving away from building integrated cement plants. Instead, today the focus is on producing cement close to the customer by bringing in clinker or bulk OPC and mixing it with blending materials like fly ash or blast furnace slag as may be the case.

The table-3 below shows the shift in growth strategy in cement industry from large integrated plants towards smaller Grinding/ Blending unit.

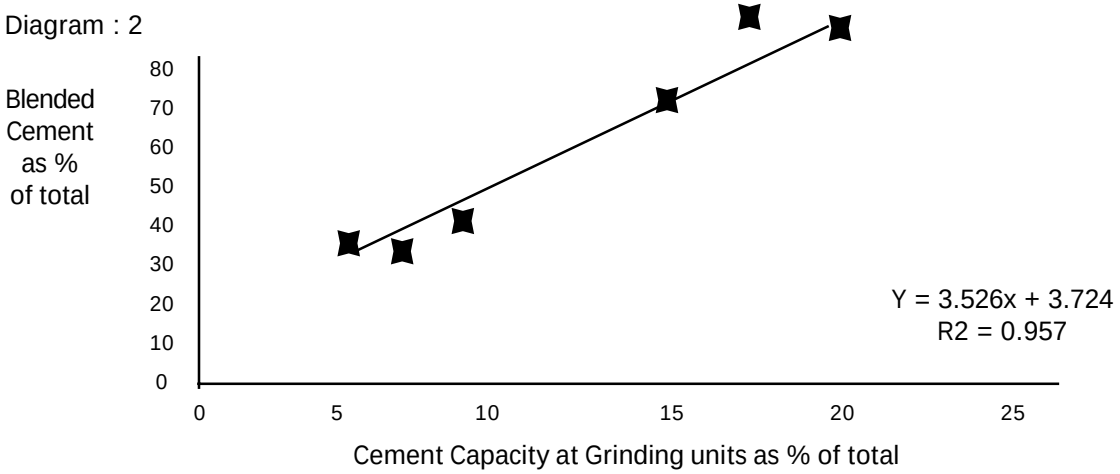
Table 3 : Changing Patterns of Growth in Cement Industry

Year	% of Total Capacity in Integrated Plants	% of Total Capacity in Grinding/ Blending Units
1990	93.7	6.3
1995	92.6	7.4
2000	91.6	8.4
2005	83.7	16.3
2006	83.8	16.2
2007	84.4	15.6
2008	82.2	17.8
2009	81.5	18.5
2010	80.5	19.5
2011	80.2	19.8
2012	79.0	21.0

Data Source: Annual CMA Reports

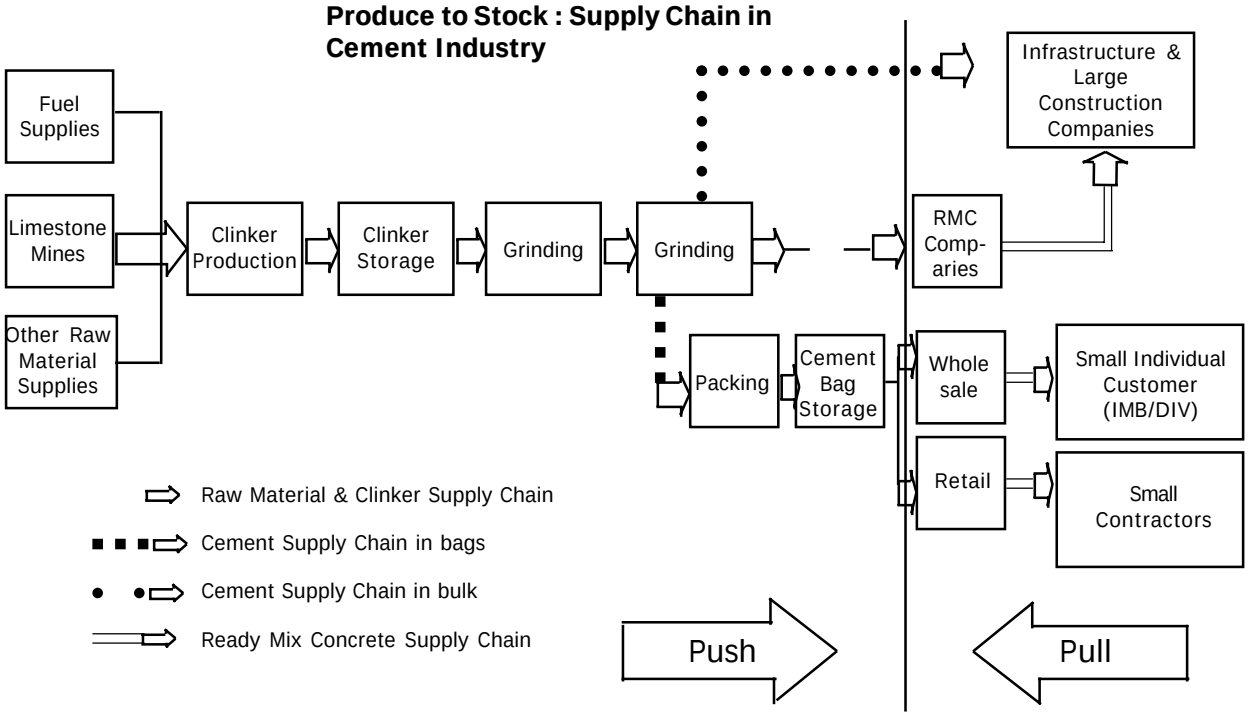
It may also be worth noting that the increase in Blended Cement is linked to the growth of Grinding / Blending Units as evident from the diagram 2.

Diagram : 2

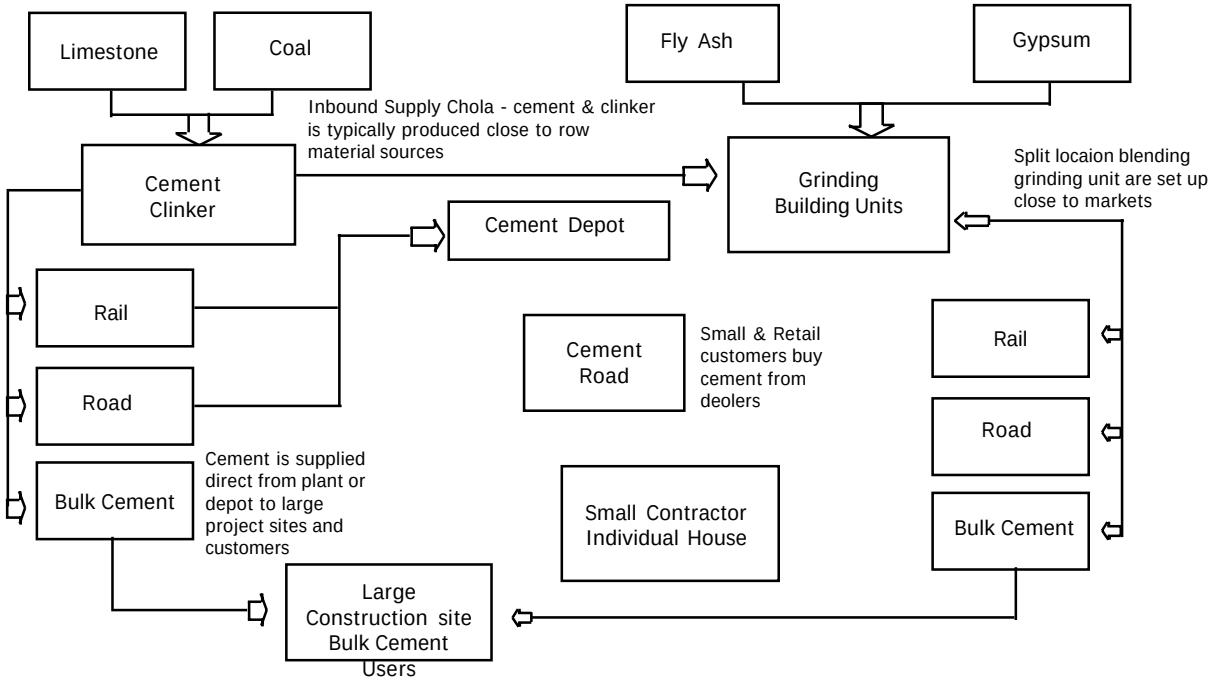


Influence on Supply Chains

In general, supply chains are combination of two strategies i.e. Produce to Stock (PTS) and Produce to Order (PTO) strategies.



An overall view of the complete supply chain or cement starting from raw materials till delivery of finished products to the ultimate users is given below.



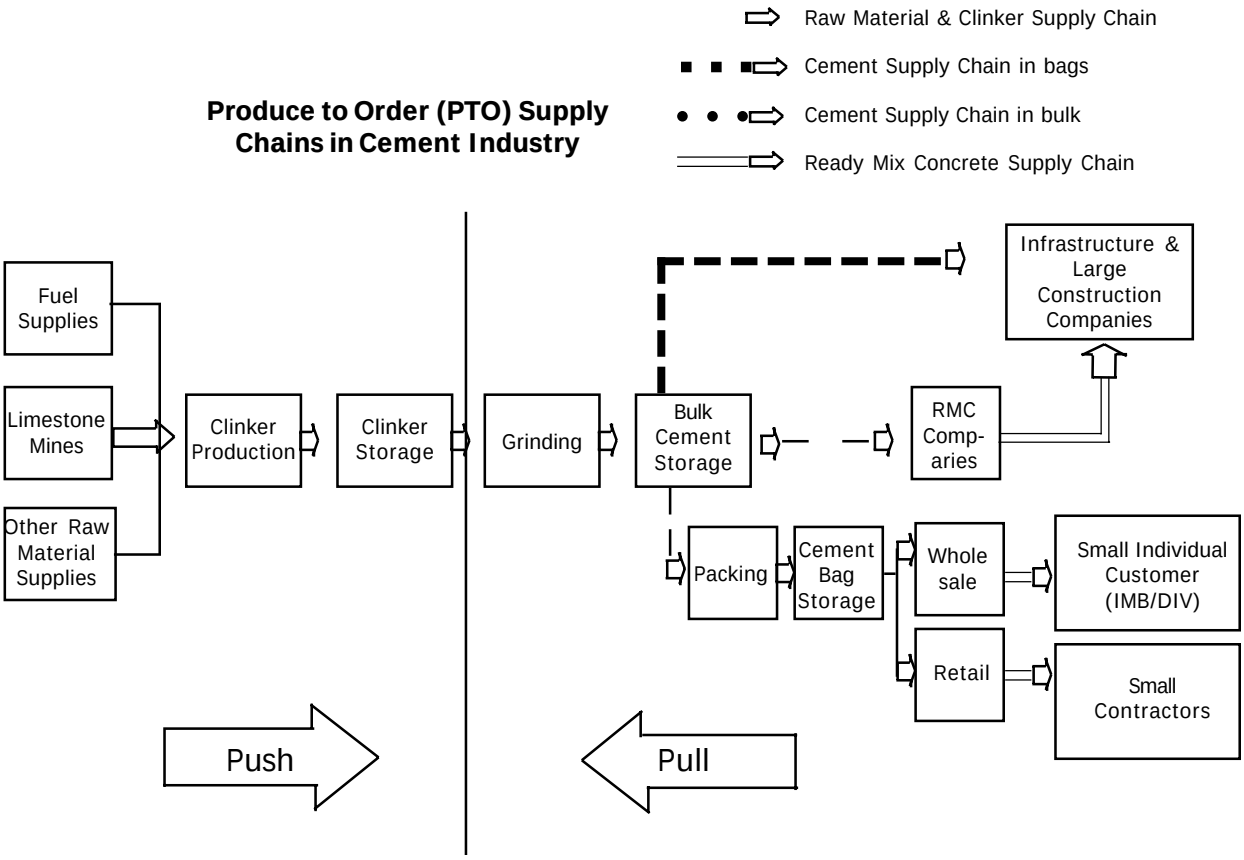
Typically, the industry practice in India has been to deliver cement till the final point of consumption i.e. to the customer sites; hence it is vital for the industry to have complete visibility and control over the supply chain as the costs of supply chains account for more than 20% of total value in the entire value chain.

As long as there was not much variation in the product strategy of various cement firms and there was only one variety of cement i.e. "Ordinary Portland Cement" (OPC), supply chains were relatively simple. Cement was produced in large integrated plants, stored in silos, and was packed and dispatched in trucks or rail wagons as the case may be. The choice between rail or road was a function of cost and availability typically rail being preferred for long and road for short distances. In any case, the last mile delivery was by road as not all the customer was connect by rail system though majority of the customer could have access to rail at their construction sites.

Within the limited boundaries in which the industry could operate, there were a few supply chain innovations in terms of bulk transportation by rail, sea route and bulk terminals. At these bulk terminals, cement was brought in bulk either by large barrages through sea route or by special rail wagons, was stored in silos and finally was packed or delivered to customer as per order & requirements. Delivering of cement was possible only through development of supply chain in bulk to large users of cement though it constitutes only less than 2% of total cement in India.

Since early 1990s, a Shift towards the use of blended cement brought changes in manufacturing strategy and this in turn has now completely transformed the cement supply chains strategy now to Grind & Pack to Order method. Following flow diagram depicts new development in the supply chain.

Produce to Order (PTO) Supply Chains in Cement Industry



With increasing variations in the product mix – i.e. different varieties of blended cements being produced, the industry trend is now shifting towards Produce to Order supply chain strategy where the cement is produced and packed close to customer and as per requirements. Customers also have preference for the cement that is freshly produced and is delivered on construction sites in bags which do not go through multiple handlings. It is also now possible to deliver cement in bulk to a large cross section customers because the bulk transportation in special tanker trucks over short distances is economically viable. It may be worth mentioning here that while a large cement plants have typically 500 – 1000 KMs as their area of influence for distribution, a typical grinding unit generally caters to markets up to distances not exceeding 200 KMs.

Emerging Opportunities in Supply Chain

Cement still is largely seen as a commodity characterized by so called "Commodity" mind set in the industry. There have been little attempts to product differentiation though changes in manufacturing strategies have made it possible to produce different variants of cement as per customers needs and wants. Of late, some cement manufacturers have attempted to introduce different variants of cement suitable to specific needs of the customer but these are viewed as more of a sales or marketing gimmick than any real product differentiation. Even if the Cement industry has not been going for product differentiation, there is scope for innovation in supply chain responsiveness for meeting emerging customer needs.

For instance, the penetration of bulk cement in India is far behind the global trends. Globally, best record in the industry is delivery of more than 80% of cement in bulk. But in India, this record is still a small fraction mainly due to infrastructure constraint in the delivery system for the end user.

Similarly, the good old 50 KG HDPE bag has remained what it was even 2 or 3 decades back though there has been sufficient advances globally in terms of packaging cement in more environment friendly paper bags or in laminated bags of the same or smaller size. Recently, multi layer PP bags using FFS technology have been introduced in packing of cement in sizes varying from 10 Kg to 50 Kg.

Globally, bulk cement is delivered mainly to industrial user such as RMC maker or makers of precast concrete and bag cement is considered as innovative delivered to DIY (Do it yourself) customers.

The Cement industry in India is progressing along with the best in the world in terms of manufacturing and product strategy and hence it is just a matter of time before the industry also comes to the same level in terms of cement Supply Chains and innovations in this sector.

References:

Agudelo, Isabel (2009, June). Supply Chain Management in Cement Industry, Massachusetts Institute of Technology.

Fisher, M.(1997, March). What is the Right Supply Chain for your Product? Harvard Business Review, 75(2), 105-116

Ghemawat, P., Matthews, J.L. (2002). The Globalization of Cemex. Case Study. Harvard University.

Lee, H. (2004, October). The Triple A Supply Chain. Harvard Business Review, 82(10), 102-112.

Porter, M (1979, July – August). How Competitive Forces Shape Strategy. Harvard Business Review, 57 (2), 137-145

Lafarge, Holcim, ACC, Ambuja Cement, Ultratech Cement etc. Annual Reports

CMA Year Book, (2011), Cement Manufacturing Association of India.