A Comparative Study of Traditional Vs. Modern Supply Chain Models in Cement Industry

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***Abstract*—Cement business is a crucial infrastructure component, but it has such challenges as high energy use and complicated logistics. This paper will offer a comparative view of traditional and the modern model of a supply chain and the strategic move that occurred in the replacement of cost and volume-based manual system to the application of technology, integrated and sustainable models. The research uses secondary data in the form of industry reports and scholarly literature to assess the performance using parameters like cost efficiency, lead time and sustainability. The result indicates that the modern models due to the application of such technologies as ERP and GPS tracking performance much better than the traditional ones, and they are more agile and provide a competitive advantage in the long run.**

I. INTRODUCTION

The cement sector is a structural basic infrastructural fund of the entire world and a top cause of economic growth. The industry supplies the second most consumed material in the world after water and therefore houses, transport systems and other important public amenities require the industry to be in place. In rapid-growing economies such as India (the second-largest producer on the world) the industry is now being driven by giant processes initiated by the government such as the projects of Smart Cities and affordable housing. But the industry has a complicated sphere of new challenges. Customarily, cement supply chain has been driven by a logic of production-push, which pay virtually no attention to high volume production and cost-minimization. These ancient modes are usually manual based, have no real time visibility and have a large buffer stock of excessiveness to counter the risk associated with kiln unavailability. As the current market is becoming highly competitive, these conventional practices often result in high inventory carrying cost, logistic delays and failure to respond to the fluctuating demand quickly, which are the reasons why a structural change towards the modern supply chain paradigms is imminent. These are new systems, which combine sophisticated technologies, including Enterprise Resource Planning (ERP), GPS tracking, Internet of Things (IOT) sensors, and data analytics to from an agile, transparent and data-driven network. Additionally, with the increasing global awareness on carbon emission, the modern supply chain models are involving itself with sustainable practice, including optimized route planning, use of alternative fuels, to make the industry environmentally friendly. This research project will seek to give an extensive comparative analysis between the traditional and modern supply chain models in the cement industry. Through the analysis of major parameters of operation, the cost efficiency, the speed of delivery, inventory and sustainability, this study determines the strategic benefits of supply chain modernization and offers perspective to companies interested in remaining competitive in a highly flexible industrial environment.

II. ABOUT COMPANY

A few of the large Indian cement players are leaders in the industry and have extensively embraced the modern supply chain models:

(1) UltraTech Cement Ltd.:
It is the largest manufacturer in India that is a part of the Aditya Birla Group which was established in 1983. It Relies on state-of-the-art digital logistics applications and distribution centralization.

(2) Shree Cement Ltd.:
It was established in 1979 and is recognized as operationally worldwide excellence, energy efficient and consistent leadership on cost due to its progressive analytics.

(3) Ambuja Cement Ltd.:
The firm is a member of the Holcim group, which was established in 1983 and is known to apply innovative logistics such as coastal shipping and bulk terminal.

(4) ACC Ltd.:
It is one of the oldest cement companies in India which was established in 1936 and it is specialized in automation and real time monitoring in order to keep the level of service the highest possible.

(5) JK Lakshmi Cement Ltd.:
It is one of the units within JK Organization that has integrated modern technology of manufacturing and automation in order to enhance environmental sustainability.

III. LITERATURE REVIEW

(1) Dr. Arshdeep Singh:
Determined that the common production-push models result in secondary freight costs 22 percent greater since scheduling and absence of real-time transit visibility is done manually.

(2) Robert J. Vokurka:
Re-evaluated the legacy of traditional philosophy of Buffer-Stock, stating that when the practice of putting clinker in open-air stockpiles is utilised, the capital is locked-up and quality deteriorates due moisture.

(3) S. K. Sharma:
Analysed volatility of demand model and established that the old methods of forecasting demanded astronomical volatility at every minor change in consumer demand that hence resulted in astronomical swing in production schedules.

(4) Dr. Markus Lindemann:
He has proved that contemporary supply chain 4., with IOT sensors and cloud-based control towers, is capable of eliminating 18 percent of Dead Mileage.

(5) Alice Smith:
Researched how the concept of Blockchain could be applied to the contemporary model to produce a new type of a Digital Brith Certificate used with cement batches to be able to see the footprints of the curing strength and the carbon.

IV. RESEARCH OBJECTIVE

(1) To know the major elements and framework of the both the traditional and modern supply chain models in cement industry.

(2) In order to determine significant challenges and limitations associated with the use of traditional manual systems by companies.

(3) To find out the advantages of the contemporary technologies like ERP, IOT and automation.

(4) To make a comparison of the performance of the two models in regard to cost-efficiency, speed and customer satisfaction.

(5) To give strategic recommendation on how to address the supply chain performance within the cement industry.

V. RESEARCH METHODOLOGY

(1) Research Design:
The research design to be used is descriptive and analytical research design in comparing conventional and modern operations.

(2) Source of Data:
Annual reports of large companies (UltraTech, ACC etc.), government publications (NITI Aayog) and scholarly journals were used to provide the information.

(3) Comparative Analysis:
Comparison was done on Models on various factors such as lead time, adoption of technology and inventory management.

(4) SWOT Analysis:
SWOT analysis has recognized the strengths, weaknesses, opportunities and threats of both the models to assess their strategic positions.

(5) Trend Analysis:
There was an analysis of the historical trends of technological uptake in the industry in the past 10 years.

(6) Triangulation of Data:
Comparison of data that was obtained with the data of several other sources was done to determine the reliability and accuracy of the information.

VI. HYPOTHESIS

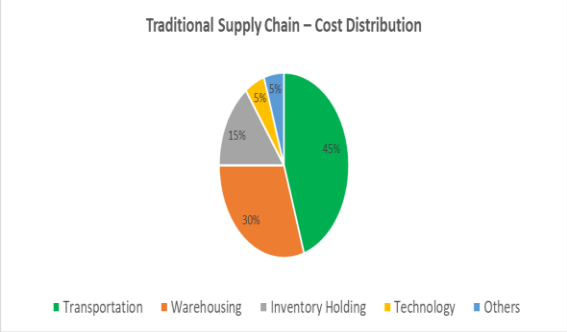
(1) Null Hypothesis ($H 0$):
There does not exist any significant difference in the performance of the traditional and modern models of the supply chain in the cement industry according to the secondary data analysis.

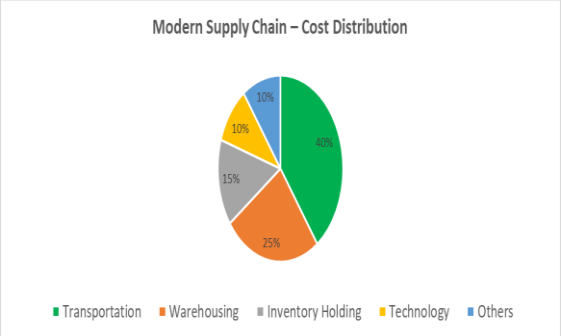
(2) Alternative Hypothesis (H1):
The modern models of the supply chains are much efficient, cost effective and responsive compared to old models.

VII. DATA ANALYSIS

Based on the comparative evaluation of operational parameters:

Parameter	Traditional SCM	Modern SCM
Inventory Level	High (risk of overstocking)	Optimized
Lead Time	Long	Short
Visibility	Limited/Manual	Real-time (GPS/IOT)
Sustainability	Low fuel efficiency	Strong focus/Reduced emission



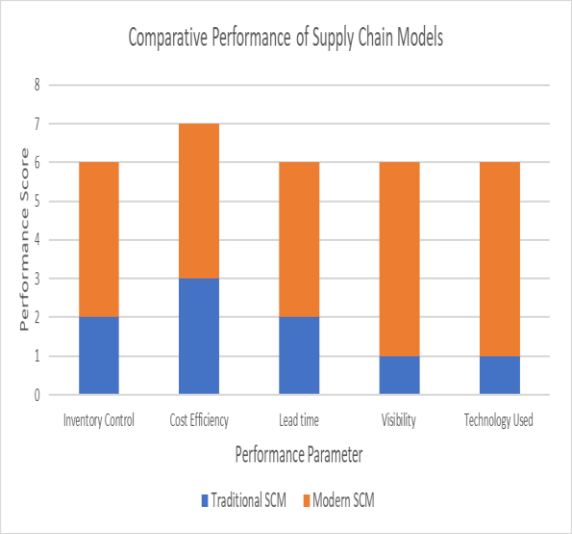


Cost Distribution Insights:

(1) Conventional Model:
45 percent of the expenses are assigned are assigned to transportation and 30 percent to warehousing as it is incompetent in planning.

(2) Modern Model:
Has a more balanced approach and a greater investment in technology (10%) resulting in lower costs of transportation (40%) and warehousing (25%) costs.

(3) Technology Trend:
According to data, there is an impressive rise in technology adoption since it was around 20% in the year 2018 and is projected to go above 80% in 2023.



It is shown in figure that modern models of supply chain are better than traditional models in all parameters considered especially the visibility, cost efficiency and sustainability.

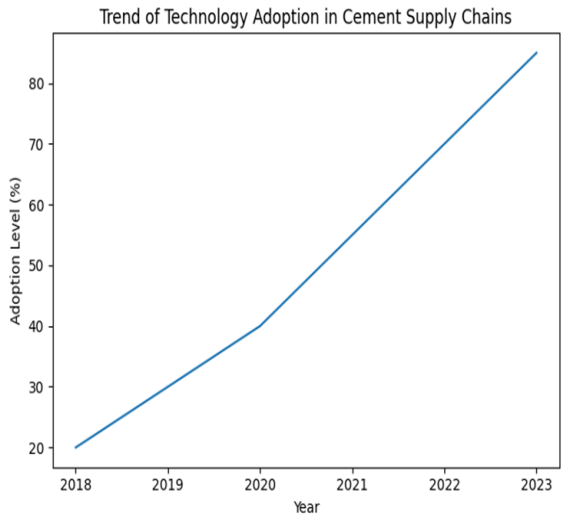


Figure depicts that the number of modern technologies that are being adopted by supply chains is increasing dramatically reflecting the gradual change of the cement industry.

VIII. LIMITATION OF STUDY

(1) Reliance on Secondary Data:
The paper uses published reports and literature rather than the primary survey data.

(2) Thin Internal Information:
Internal cost structure, internal logistics plan is frequently kept secret and not available publicly.

(3) Specific to Industry:
The result can be limited to the cement industry and do not relate to other industries with varied supply chain designs.

(4) Quick Technological Shift:
New technology such ass AI can be advancing more at a rate that academic literature cannot keep us with.

(5) Time Constraints:
The small-time span of the study did not allow it to have an in-depth longitudinal examination of the long-term effects.

(6) Lack of Stakeholder Viewpoints:
The study does not explicitly provide the thoughts of any stakeholder in the supply chain or logistics people on the ground.

IX. CONCLUSION

The research concludes that modern business environment that is competitive and demands innovation supply chain models is no longer adequate with traditional supply chain models. Although the traditional system has had a flow of stability in the past in terms of the operations, they are characterized by high inventory prices, slow delivery and lack of visibility. In their turn, recent models use technology to facilitate the work of planning, minimizing the waste of operation and promoting and promoting environmental sustainability. Cement companies would need to embrace such technology-oriented practices to both grow their businesses and excel in their operations in the long run.

REFERENCES

[1] Annual Reports: UltraTech Cement, ACC, Ambuja Cement, Shree Cement.
[2] Industry Associations: Cement Manufactures Association (CMA).
[3] Government Source: Ministry of Commerce and Industry, NITI Aayog.
[4] The Major Researchers: Dr. Arshdeep Singh, Robert j. Vokurka, S. K. Sharma, Dr. Markus Lindemann, Alice Smith, etc.