OPERATIONS AND SUPPLY CHAIN MANAGEMENT
Vol. 13, No. 2, 2020, pp. 210 - 221
ISSN 1979-3561 | EISSN 2759-9363

Relevance of Adopting Emerging Technologies in Outbound Supply Chain: New Paradigm for Cement Industry

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ABSTRACT

In the past few decades, supply chain management operations have increased manifold and much attention has been devoted to the evolution of supply chain management in the scientific literature. This has led to accommodating newer strategies and developments in technology. Channel partners are exploring newer methods that deliver accurate information in real time to have efficient flow within the supply chain. Existing processes and operations handled by channel partners in cement industry are constrained by time, location and lack of any technology for accessing and coordinating any information. The focus of this paper is the outbound supply chain in cement industry where complexity and cost of inventory management, compliance requirements, and managing warehouse are the biggest challenge. The success of the supply chain depends on coordination, communication, and collaboration among the channel partners. Visibility in supply chain will certainly enhance tracking, timely delivery, improved decision making leading to improved customer satisfaction. Literature explores the digital trends in supply chain management affect the overall business model. From sensors to big data, a number of technologies drive the business trend across globe. The research paper looks at how the channel partners can use the technology and smart devices closely within their day to day activities associated with their processes which could connect all channel partners continuously, and have improved visibility in the supply chain. The research has done an extensive literature review as well as primary research to explore the role of existing technology in the outbound supply chain of cement industry. The study further explores that how technology can act as an enabler and can be benefited in many ways for channel partners.

Keywords: *outbound supply chain, integration, technology, channel partners, smart devices*

1. INTRODUCTION

Harvard's Michael Porter noticed that to succeed, organizations need to create a distinctive competitive advantage. If organizations somehow managed to unite their managers to conceptualize chances to create a value chain, numerous thoughts could be crystallized. These thoughts could then be classified as one of the five fundamental areas of customer value: quality, cost, adaptability, delivery, and innovation (Fawcett *et al.,* 2008). The report, "Indian Cement Industry Outlook 2020", portrays the current scenario and the forecasts for production, consumption, capacity utilization, and installed capacity for 2020. Cement industry supply chain network is especially engaged having four sorts of designs in the supply chain– Configure to Order, Built to Stock, Engineer to Order and Built to Order as expressed by (Reev & Srinivasan, 2005). Build to Order and Engineer to Order may not be of use for cement businesses straightforwardly according to (Agudelo, 2009). The manpower required in cement modern plant is usually less than 150 Employees (Agudelo, 2009). IT-enablement of supply chains, buyer-supplier relationships, and inventory management are at the core of the supply chain research (Jharkharia & Shankar, 2004).

This paper aims to study and understand the relevance of adopting technology in the outbound supply chain, which is useful for future growth of the cement industry in the global scenario. The flow of the paper is as follows: the paper began with the in-depth review of the literature including articles from journals, conference proceedings, websites and books related to technology and management aspects in the cement industry. This addresses the scope and the processes of the existing outbound supply chain and the challenges faced by channel partners in this journey. After understanding the research gap, section 3 describe the detail research objectives along with the research methodology of the present study. Mixed method approach was designed to understand the perceptions of the channel partners. The paper discusses analysis in detail for each of the objectives (in section 4) and then wrapping and concluding in section 5 . The study connects and discusses the adoption of technologies and smart devices in the outbound supply chain for the cement industry. Based on the review, research questions have been framed and listed in the next section.

The supply chain is a network which deals with the availability of products and services to the customers at the right time (Harland, 1996). Supply Chain Management (SCM) includes procurement and storage of raw materials, work-in-process and finished inventory and distribution of inventory to its point of consumption. According to Stock

and Lambert (2001), "Supply Chain integrates the key nodes of an organization from end user to suppliers that provides products and services which add value for customers and achieve a competitive advantage". Supply Chain Management may be defined as the management of upstream and downstream associations with vendors and customers to provide better customer value at least cost to the supply chain. (Dubey and Ali, 2013)

SCM is a process for designing, optimizing, which include the internal and external components of the supply chain which has to be consistent with the overall objectives of the firm. Christopher (2000) explains that an effective SCM is a powerful tool to achieve competitive advantage which can benefit all channel partners in the supply chain. Tan (1998) stated that the goal of SCM is to integrate various channel partners of the supply chain to achieve better customer satisfaction.

An outbound supply chain is the arrangement of distribution points which performs the task of procurement of inventory and also the distribution of these finished products to customers. This includes managing demand, sourcing inventory, distribution of inventory to all channel partners in the chain and then lastly delivery of product or service to the customer (Alexandria, VA: APICS). It is a process and includes the flow of information, inventory, and also funds both within and between supply chain members (Jain *et al*., 2009). Competitive advantage can be attained in the supply chain by creating a framework of supply chains which is integrated (Sukati *et al.,* 2012).

This paper attempts to explore the perceptions of adopting emerging technology in an outbound supply chain in the cement industry in India. The paper presents initially a study that examines challenges faced by channel partners in managing the outbound supply chain. Next, using a mixed method approach (qualitative as well as quantitative) perception studies were carried out to understand the trends in technological adoptions that offers benefits to the channel partners. Finally, the last section focuses on results and discussion with the implications on channel partners as well as on researchers highlighting the road map in enhancing the adoption of emerging technology in outbound supply chain of cement industry in the near future. The study includes the following research objectives (ROs) –

RO #1: To list the challenges faced by channel partners in the outbound supply chain of cement industry.

RO#2: To identify the role of technology and devices that are already in use by channel partners in the outbound supply chain of cement industry.

RO#3: To understand the trends in technological development that offer benefits to the channel partners in the outbound supply chain of cement industry.

RO#4: To propose a framework for adopting the technological solution using SCOR Model in the outbound supply chain of cement Industry.

2. LITERATURE REVIEW

The literature review was done including many journals, websites and conference proceedings related to supply chain and technology. The Literature Review encompassed various articles which were academic peer-reviewed journals published in between 1995 - 2018. A systematic review of the literature was conducted in detail.

Beesley (1997) discussed how there can be a reduction in cycle time through IT initiatives in supply chains. Ragatz *et al*. (1997) found that the success of channel partners is contributed significantly by supplier membership. By reducing the lead time SCM can improve a firm's performance (Towill, 1996). Galt and Dale (1991) found that organizations are working to reduce their supplier base, and better communication with the suppliers. IT use in SCM was researched by (Kwan, 1999), and explained that the best SCM strategies are 1) One of the core competencies for supply chain is logistics and 2) rather than working on a forecast to produce as per demand. Anon (1994) have found that manufacturers were slow movers in applying new concepts.

Supply chains have progressed toward improving performance for better business execution in both manufacturing and service systems. Lee & Billington (1995) characterized supply chain management as an *arrangement* of tasks in a manner that encourages better use of raw materials, change them into semi-finished inventory, finished items, and distribute it to end customers through a distribution framework. The supply chain traverses acquisition, producing, assembling and delivery of products and services. Research explains that improved supply chain visibility with the use of IT leads to better execution of inventory management which leads to better sales and good forecasting of demand (Kaipia & Hartiala, 2006; Kulp, 2002; Lee & Whang, 2000). Fawcett *et al*, (2007) talked about that customers' needs should be fulfilled as they are an integral part of the framework, giving information with respect to their requirements. Nowadays, customers are requesting enough because of the level of awareness they have with them. The customers expect at shorter lead times, lower costs, reliability and better quality as indicated by Verwaal and Hesselmans (2004). According to scholars (Guide & Van, 2002; Wassenhove, 2002) information is required for optimum utilization of the product this can help to reduce the gap in the cycle time of product returns and give details about the returned product.

Researchers have strongly advocated that information is of the utmost importance for the success of SCM (Chopra & Meindl, 2013). The literature on supply chain information management is abundantly available (Pereira, 2009). The existing literature focusses on an important aspect of the supply chain which is demand information management (Kumar & Pugazhendhi, 2012). In an environment of uncertainty information sharing is very important (Mithas *et al.*, 2011). Visibility of demand information can improve responsiveness, reduce lead times and enhance decision making (Handfield & Nichols, 2002). To support decision making information can be considered as "meaningful data" (Detlor, 2010). Delayed and less and information can lead to a lot of problems in supply chains (Chow *et al.*, 2008). The current SCM literature is focused on the coordination of material and demand information (Pedroso & Nakano, 2009).

Sharing the information properly with other channel partners in the supply chain can improve coordination for an efficient flow of material and information (Damiani *et al.*, 2011). The significance and impact of information sharing on the performance depend on how the information is shared (Holmberg, 2000). Information sharing and information quality are positively influenced because of trust built in the

supply chain (Wang *et al.*, 2013). Lack of trust is one of the major obstacles for information sharing (Eurich *et al.*, 2010). Sharing a lot of information is also not a good practice for supply chain (Liker & Choi, 2004). Due to the complexity in information flows, IT-enabled sharing of information in supply chains is required (Evans & Annunziata, 2012). Moreover, beyond IT, SCM also requires channel partners to align IT with business strategy and restructure supply chain (Armstrong & Sambamurthy, 1999). SCM requires optimum utilization of external resources by channel partners in the supply chain (Bensaou, 1997). Several research papers had examined its contribution to supply chain performance (Ray *et al.*, 2004). 'Supply Chain Management in Cement industry' is the initiation article and since then a lot of work has been done in this direction (Agudelo, 2009).

3. RESEARCH METHODOLOGY

This conceptual framework is developed with peer-reviewed journals going back 24 years from 1995 to 2018. The scope of the study includes research objectives (ROs) which are mentioned in the section 1. To meet these objectives, firstly the gap analysis was done by gathering the secondary data from the diverse sources like case studies, research papers, white papers, web sites, blogs, journals, etc. related to technology adoption in outbound supply chain of cement industry. The research plan includes understanding the present trend of using technology and devices in the existing process of the outbound supply chain in the cement industry. The different stages of the study have the following steps:

Step 1: To meet the above-mentioned sub-objectives, a systematic review of the literature was conducted in detail. For this the authors sought for published papers retrieved from a variety of databases like Proquest, JSTOR, IEEE, Science Direct along with press releases, websites, and blogs related to the keywords – outbound supply chain; integration; technology; channel partners; smart devices; and cement industry. The inclusion criteria for the papers decided by the researchers were: papers published in English only; scholarly and peer-reviewed; and full text. The reports and research papers were analyzed to understand how the outbound process in the cement industry is being handled.

Step 2: The plan was to conduct a mixed method – qualitative as well as quantitative approach (having open-ended as well as closed-ended questions). The questionnaire was designed to gather the primary data and, in this context,, an empirical study was done. The research plan is to have both type of data collection: primary as well as secondary data. Primary data is collected with distributing questionnaire and having personal interviews of channel partners to understand their operations of the company. The secondary data involves existing literature from multiple sources such as published books and electronic sources like published scholarly articles, thesis, blogs and web portals.

Primary data was collected from the channel partners in the cement industry. The convenience sampling method was used to collect data from participants. A self-administered questionnaire-based survey was used to obtain the participants' views. After obtaining consent from participants, 102 questionnaires were distributed to participants. The questionnaire focus was to capture the details of how day to day activities were handled by the channel partners. It comprises of three sections – the first section contains the demographics of the respondent, the second one includes their extent of using devices and technologies, if present, in handling basic functions of inventory management (like receiving, stock verification, order execution priority, order placement and shipping). And the final section of the questionnaire comprises the detail of capturing the perceptions of channel partners regarding benefits received by integrating technologies for managing outbound.

The usable 52 forms were administered for data analysis. These 52 respondents located in Rajasthan and Uttar Pradesh. It had taken us nearly two months to complete the interviews. Though the sample size was small because of its complexity, the scope of the study assumes that it is self-sufficient to provide the as-is scenario, Hence it is useful further to provide the inference made for future references. Interviews with Cement Company executives involved in supply chain outbound operations were done. The interviews took place personally or over the telephone. Qualitative as well as quantitative data were gathered with this aspect. The questionnaire focus was to capture the details of how day to day activities were handled by the channel partners.

Step 3: Based on the existing practices and from the above study, recommendations are presented in the analysis section. These suggestions are specific to the business area of the outbound supply chain of cement industry which can adopt the specific set of technological solution. This could be further used to create value by offering not only the benefits but also the opportunities to the channel partners. Findings were combined (from qualitative as well as quantitative method) along with the analysis of interviews and synthesized the findings which have been incorporated in the next section.

4. ANALYSIS AND FINDINGS

Each of the research objectives (ROs) along with analysis is discussed in the following section:

4.1 Challenges faced by channel partners in the outbound supply chain of cement industry

Businesses depend on their channel partners and therefore should consider channel partner's requirements and strive to achieve customer satisfaction. A firm's channel practices can generate organizational success by supply chain management practices and improve its performance. The channel partners are not able to address the need of the customer because of the lack of integration of various processes across different business domain with technology. In order to enhance customer satisfaction the research needs to identify all possible challenges faced by channel partners in the outbound supply chain. The major challenge inherent in outbound supply chain is responsiveness for managing uncertain lead times, traceability, geographic dispersion and sources of disruption which create hurdles in execution.

Table 1 displays the major concerns faced in the outbound supply chain of cement industry. Good customer service depends not only on information but also depends on the visibility of information. As seen from the literature as well as from the existing practices there is a flow of materials or product, information and money going through the whole network and none of these resources exists in isolation as

they are tightly bound together (Plenert, 2006). To cope up with challenges it's necessary that channel partners are able to provide as much data as possible, in order to make decisions and communicate changes in the outbound supply.

Table 1 Challenges faced in outbound supply chain of cement industry

Concern Area	Challenges faced in Outbound of Supply Chain of Cement Industry
Strategic Challenges (Manuj, Dittmann & Gaudenzi, 2007).	• Challenge is because of cultural differences, physical distances, infrastructural constraints, difference in time zones across the globe
Co-ordination Concerns (Chopra & Meindl, 2010)	• Lack of the common vision and goal, there exist conflicts which lead to increased replenishment lead time, increase manufacturing, labor, inventory and transportation costs.
Inventory Control (Marion, 2016)	• Challenge is to achieve 100% inventory accuracy
HR Resources Concerns (Boxal & Purcell, 2003)	• Lack of talent availability as the plants and warehouse are in remote locations. • Lack of effective human resources management means a lack of competitive advantage.
Supply Chain Collaboration (Kannan & Tan, 2010)	• Poor coordination of effort because of less technological support • Poor coordinated production planning and operations, procurement, order processing
Technology Integration (Michael, 2017; Farooqui 2010)	• Lack of existing compatible technology because of the varied nature of nodes in the outbound supply chain
Risk Management (Manners-Bell, 2014)	• Usually, supply chains are vulnerable and without risk management, they can easily collapse.
Cost Control (Press Release, 2017)	• Lack of control on rising energy/fuel and freight costs • Increasing labor rates
Economic Risks (Ross, 2015)	• An unexpected event (like a natural disaster, increase in the price of fuel, etc.) may result in a material shift in the supply chain.
Communion Issues (Csapo & Featheringham, 2005)	• Lack of effective communication which is an essential factor of organizational success whether it is at an interpersonal, intergroup, intragroup, organizational or external level.
Environment Issues (Buchholtz & Caroll, 2009)	• Becoming sustainable and greener is good for the environment, and also for business firms.
Theft (Manners-Bell, 2014)	• Theft from vehicles, warehouse and on the shelf is increasing around the world because of lack of real-time monitoring mechanism.
The Bullwhip Effect (Farooqui, 2010)	• Challenge is to control the excess inventory, inefficient production, poor customer service and stock out.

It was observed that through collaboration companies can proactively react and hence the response to their customer demand (Botta-Genoulaz *et al.*, 2010). With better communication between channel partners of a supply chain, there is a decrease in conflicts (Oxford College of Procurement & Supply, 2017). Optimization of resources allows companies to have better functioning in a supply chain (Plenert, 2006).

These above challenges, however, also generate opportunities for companies with advanced logistical systems and skilled employees, efficient and effective management to grow their market (Okeudo, 2012). Studies suggested that integrating technological solutions in the supply chain will help in coping few of these challenges and hence would lead to improved supply chain agility, reduced cycle time, higher efficiency and would ensure delivery to customers in a timely manner. According to one of the surveys done by MHI's 2017, about 80% of respondents assume that the digital supply chain will be the dominant model in the next five years, while 16% of them think it is happening today itself. Next objective is hence to understand the existing status of technology in the outbound supply chain of cement industry.

4.2 Identifying the role of existing devices and technology used by channel partners

Business imperatives are changing for every industry across the globe which was seen from the literature study. The focus here is to see the existing usage of technology in the outbound supply chain of cement industry. The outbound supply chain includes delivery and return as the two major domains. Delivery handles the processes that provide finished goods as per the demand or advance planning. The

product i.e. cement is distributed in bags. Return covers usually disposing defective or excess bags. Usually, cement returns are uncommon. Mostly the damaged product like during rains or wet bag could be replaced by the normal one as per the requirements.

An empirical study was conducted in this space where the questionnaire focused on the aspect of "usage of existing set of devices and technologies which are used by channel partners to manage operations in outbound supply chain. The details of the background of the questionnaire were mentioned in the research methodology section. Demographic details of the empirical survey indicate that 96% (of total) respondent have a small number of the employees working with them which is less than five. It is stated that 77% (of total) have a single warehouse while remaining have multiple. 58% (of total) are keeping multiple brands of cement stocks. It is found that for stock calculations manual methods are used. People are reluctant to use any modes of smart devices and technologies on daily basis to handle operational activities. It is observed that all the respondents are using the telephone as the most common media to find the availability of the stock at company's warehouse. Very few of them (27% of total)) are making use of all devices like web camera, Internet, mobiles and computers for managing inventory at their warehouses. It is visible from the above observation that there is a huge missing link between the receiver of material and the company. It is observed that the information is taken through telephone largely. In case of material sourced directly from plant/manufacturing unit, many companies send the information through SMS to the consignee which is based on the data already uploaded in the customer master. The message is sent immediately after the invoicing is finalized. This way the consignee gets the message of his material being loaded and the billing is done however he doesn't know about the timing of arrival of his material. The similar method is also used in case of material being shipped from warehouses however the real time billing is not done at many warehouses and so the purpose of SMS remains limited for the confirmation of billing. At many occasions, if the warehouse is located locally, material reaches before the SMS is delivered as material moves on delivery challan. Noche & Elhasia (2013) focused that vertical integration is challenging with logistics providers in the cement industry. Also, the study reveals that technology integration is at a very nascent stage in outbound supply chain of cement industry.

It is observed (**Figure 1**) that people would like to adopt some sort of technology in overall monitoring process; real time location tracking and detecting the individual products (which is cement bag).

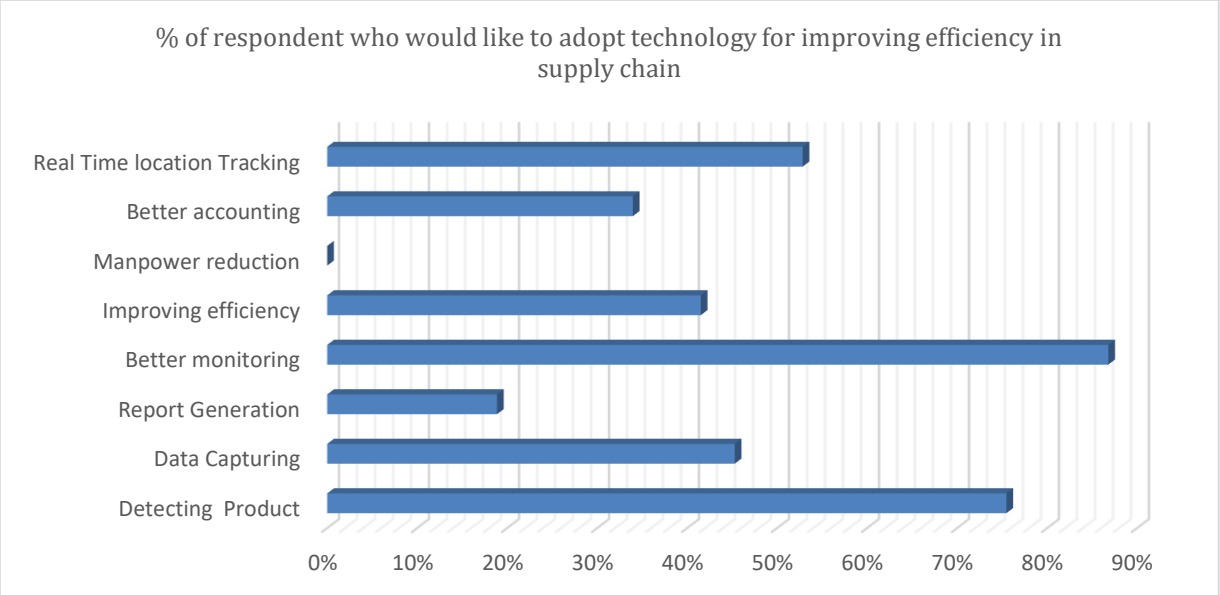

Figure 1 Areas that channel partners would like to adopt technologies in cement industry

Since this industry is heavily labor intensive (non-technical staff), the very first and immediate objective is to handling inventory and logistics by dealing with physical damage and theft of the bags, improper accounting of the bags, overall units counting and monitoring at the warehouse side.

It is observed that people have resistance in adopting technologies as it directly implies changes in the workforce of the company / and warehouse. New expertise is required and there are few people with the necessary competencies especially at the logistics and inventory management in the cement industry. Additionally, one of the key points which has come up is the adoption of innovative technologies may result in frustration to the employees that have to change the way they normally used to do their routine job.

As the industry is changing very fast globally there is a need to shift the focus from product oriented to customer oriented. Hence huge opportunities exist for the channel partners for collaboration and information sharing to gain a competitive edge over others. The next objective would, therefore, look into the benefits which different technological solutions can offer to supply chain functions in the outbound systems in line with this.

4.3 Understanding recent technological development and its benefits to the channel partners

Literature (Johnson, 2008) discusses the role of technology in managing the flow of inventory in supply

chain. By integrating with technology supply chain participants could gain many advantages like information sharing become easier (Gavirneni *et al.*, 1999); reduction in supply chain risks (Christopher & Lee, 2004); communicating and collaborating effectively (Subramani, 2004); and supply chain structures to be more efficiently designed (Dedrick *et al.*, 2008). This will lead to a reduction of transaction costs and will have positive financial and operational performance (Cachon & Fisher, 2000).

As understood by literature technology and smart devices has a significant impact on the functioning of supply chain. Tracking technologies including satellite-based systems, wireless networks, RFID, GPS, etc. are the recent trends which are promises to fundamentally change the perspective of supply chain. The above study has indicated that although the channel partners are aware of the benefits in adopting IT but more awareness have to be created to channel partners on the benefits of using technology which can reduce cycle time and improve visibility in supply chain. As clear from the challenges of the outbound supply chain in cement industry transportation and inventory handling is the one of the biggest challenges.

To address this need, a number of technological solutions (listed in **Table 2**) could be preferred to coordinate effectively across the business function areas of outbound supply chain by the channel partners.

Table 2 Challenges faced in outbound supply chain of cement industry

Technological Solutions	Benefits Offered by Adopting Technological solutions
Mobile Apps (Gebauer, 2002; Kalakota, 2003)	• The communication velocity can be improved by use of Mobile Apps.
RFID (Chamberlain, 1997; Bushnell, 2000; Milner, 1999; Ashton, 2000)	• To effectively monitor every product both at the production line and in the supply line. • Automating the check-out process and attaining savings in cost
GPS (Global Positioning System) (Devlin *et al.,* 2007)	• More information like humidity, temperature, location, product quality, equipment status, packaging quality etc. could be traced. • Tracking the vehicle with status is possible and also to track shipments and storage of products
Wi Fi	• Wi-Fi inside the buildings is a good alternative for managing inventory
Artificial Intelligence and Robotics (Lauseng, 2017)	• Pic pack load automation is possible • Perform routine, repetitive tasks with far greater speed and accuracy than human beings.
Internet of Things (IoT) (Lauseng, 2017; Pettey, 2018)	• To track activity across the whole manufacturing workflow • Could be used in sourcing, logistics, manufacturing, and demand management
Robotic process automation (RPA) (Pettey; 2018)	• It allows supply chain to eliminate errors and speed up processes.
Wearable's Technologies (Bossche, *et al.,* 2016)	• Opportunity to further improve operational efficiencies. • Fitness wearables can also monitor health and stress levels of employees and GPS can easily locate the location of the entity in the supply chain.
Social Media (Hill, 2017)	• Useful for increasing the visibility in the market (to gain a competitive edge over competitors) • Product reviews and Quality feedback Checks
Cloud Computing (Accenture Report, 2014)	• Remote access is possible • Data availability is possible to different channel partners based on the ownership
Advance Analytics (Pettey; 2018)	• Prescriptive analytics can be used to improve decision making and can be deployed to improve performance in supply chain.
APS & DRP (Planet Together, 2018)	• What-If Scenarios provide flexibility to compare sourcing options to meet changing demands
Automated Inventory tracking system (AITS) (Golan *et al*, 2004)	• Real-time status of the inventory levels of all the products are possible.
Automated Guided Vehicle System (AGVS) (Attaran, 2007)	• Material handling operation without any human intervention is possible. • Robot coupled with AGVS is used to pick up exact material requirement for a customer order when required.

Cement industry is a mature industry and it was seen that there are lot of challenges in the outbound cement supply chain. In the context of using technology, integration is defined by (Zhu et. al, 2006) as "the degree of inter connectivity among back office information systems and databases inside the firm and those externally integrated with suppliers' enterprise systems and databases". Collaboration with the partners in the supply chain improves the ability to bring innovation (Kaufman *et.al*, 2000). These two contexts – collaboration and integration in the outbound supply chain can happen only by adopting emerging technologies with different business areas.

Innovations which are enabled by technological solutions are developing improved ways for supply chain management effectively (Sambamurthy *et al*, 2003).

The next objective elaborately tends to propose a framework using SCOR model as a specific prescription to individual channel partners in the cement industry. This would encompass all relevant information and helping channel partners to figure out appropriate technology for the business functions executed at their level and also how the business area will be benefited by adoption of technology at their level.

4.4 Proposing a framework for adopting the technological solution using SCOR model in outbound supply chain of cement industry

In today's global business environment, the channel partners expect faster delivery and quality products at a competitive price. To ensure sustained growth, a design of supply chain having technology and smart devices is essential. Within the outbound supply chain network, collaboration and integration strongly adopted by using technology. For this the pre-requisite is that the information sources have to be linked and fully accessed otherwise benefits can't be leveraged in the company's value chain (Mata *et al*., 1995).

In today's intensified competition having access to information is a challenge in supply chain. The adoption of technology e.g. RFID (Ramudhin *et al*., 2008; Balocco *et al.*, 2011); Balocco *et al*., 2010; Perego & Salgaro, 2010) the visibility can be increased in supply chain, this has led to an inclination for these solutions (Choi & Sethi, 2010). Technological interventions are necessary to increase the efficiency of the transport domain in outbound supply chain. Channel partners need to think various aspects of handling products (cement bags), inventory, transport mode, distribution and also to cater to environmental concerns and reduction in fuel costs.

In the cement industry, adoption could be plan as per standard framework. The supply chain reference operations model (SCC, 2010) is considered by many scholars (Huan *et al.*, 2004; Hwang *et al*, 2010) as the most promising for strategic decision-making model. The business process SCOR model facilitates communication and integration across the supply chain. The processes used by SCOR model are: PLAN, SOURCE, MAKE, DELIVER and RETURN.

The model spans across all business processes end to end in the supply chain having major activities involved. **Table 3** discusses about some of these business areas by suggesting the technological solutions in outbound supply chain in cement industry which has been mapped as per SCOR model.

Table 3 Mapping of business areas and SCOR in outbound supply chain in cement Industry

SCOR	Business Areas	Integration
PLAN	Demand Forecasting and Planning	• Plan gives an action plan for source, make, deliver and return (Fawcett *et al*, 2007; Marion, 2016). • SC integration optimization can lower the cost of cement supply chain (Isabel, 2009). • Integration on end to end SC includes raw materials, transport and information. Cement producers can also use IT solutions (Carmichael *et al*, 2011).
SOURCE	Inventory Planning and Management, Warehouse Management	• Source includes contracts and better supplier relationship management (Cachon *et al*, 2000). • Cement industries is driven by environmental regulations and relate to optimum utilization of raw materials (Galt *et al*, 1991).
MAKE	Inventory Planning and Management, Interface with Channel Partners	• Cement manufacturing process is highly automated continuous production which is capital and energy intensive (Banker *et al*, 2006; Noche *et al*, 2013). • Companies have to minimize logistics costs as cement is a low value density product. The production process is make-to-stock where products can be kept in warehouses and delivered when there is demand (*Choe et al*, 2008).
DELIVERY	Transport Management	• Delivery includes managing the demand, logistics and distribution management (Basolea *et al*, 2016; Stock, 2001).
RETURN	Tracking and Event Management, Logistic Procurement, Network and Routing Optimization	• Return requires a good extent of IT interface to optimize on time and cost (Christy, 2018; Kelvin, 2017). • Although in cement returns are uncommon but returns can be generated by problems with the quality of the product and hence has to be replaced (Guide *et al*, 2002).

New technologies can drive integration of supply chain elements. This can help companies have immense savings by integrating with the channel partners. Two major domains where they are useful are – collaboration and real time information sharing.

- Collaboration in the supply chain environment is essential and consists of a supplier and a customer working together to achieve mutual performance improvement. Visibility is the key to understand what is happening in the supply chain irrespective of location, day, time, product, people, process, etc.
- Effective collaboration with supply chain partners requires sharing valuable information in a real time. For example, BOMs, Orders, Prices and promotions, inventory, transportations related information that help to make the best decisions are available and shared real time by channel partners leads to improved supply chain.

5. CONCLUSION

This paper has addressed the relevance of information technology in strengthening systems of outbound supply chain in cement industry. The industry has grown in last few years and the per capita consumption is much lower than world average, the growth potential is still high in spite of India being the second largest producer of cement in the world. Cement supply chains need to make themselves relevant by inducing technology to enable them to stand competition from cement businesses. Relevance of Technology for the supply chain and logistics in outbound is need of digital business operations by which devices enable organizations to plan better and lead to more intelligent decision making. On one side will be cement companies that have embraced technology, and on the other side will be those that have not. Companies that embrace technology will move forward, leaving those who do not behind. The future of supply chain strategy is shifting cement industry from traditionally manually driven processes to IT integrated supply chain to be more effective and better customer response. "Complex global supply chains are increasingly relying on automation, robots and A.I. to reduce waste, lower cost, and, most importantly, boost innovation". Robotics and Artificial Intelligence techniques are used to reduce waste and lower cost in outbound supply chain (www.theconsumergoodsforum.com, 2018). Also, some recent advancement in technological solution like IoT, Nano technologies and 3D printing can greatly reduce the complexity in manufacturing and has many more advantages over the conventional techniques. By using advanced technology such as Artificial Intelligence and IoT can improve supply chain transparency. However, to be connected and associated with the channel partners in the real time scenarios companies need to adapt these technologies. It must be pointed out in this context that channel partners must be able to adapt and evolve if they want to survive. The ability to change and adapt is essential for survival. There is a strong belief that use of IT by channel partners will certainly make supply chains to "sense and respond" faster to changes (Kapoor *et al*., 2007). This adoption can create more opportunities, but evidence suggests that channel partners in cement industry do not utilize much of these technologies as stated above.

The future scope of this study could be understanding the cost implication because of IT integration. This study can also be taken further with a larger sample size by collecting data of more channel partners from more cement companies nationally and internationally. The study can also be extended to IT adoption in inbound supply chain of cement industry. Finally, benefit of IT integration can also be studied across various industries.

This paper provides a critical element for the adoption of emerging technologies in the outbound of supply chain by identifying the links existing between the current barriers faced by the channel partners. The researcher' anticipate that finding of this paper will be practical and will be beneficial for researchers, academicians as well as practitioners. These findings have an important implication for the channel partners of cement industry to comprehend the significant role of adopting technologies that can benefit the day to day operations in outbound supply chain. The study highlighted that channel partners could improve their operational effectiveness, by adopting new set of technologies. There is a lot of potential cost savings that could be realized having the best technology in place even though the initial investment is bound to be higher. Logistics and inventory personnel especially are to be well informed and updated with the real data by adopting the smart devices and technologies. Lastly, this research focused on using smart devices which create significant opportunities to gain alignment for cement companies.

EXHIBIT 1: QUESTIONNAIRE

a) How many warehouse / warehouses you have?
b) How do you keep the stock calculation?
c) How do you select the order lot size?
d) How do you find the availability of the stock at company's warehouse?
e) How do you find the stock requirement of customer?
f) How do you trace location of ordered material?
g) What technological devices you normally use.
h) How do you track the warehouse / warehouse operations in each of the following function?

	Existing Method		Benefit of using Technology in these functions are (please choose anyone out of High, Medium and Low)		
Functions	Manual	Using Technology	High	Medium	Low
Receiving					

	Existing Method		Benefit of using Technology in these functions are (please choose anyone out of High, Medium and Low)		
Stock verification					
Order Execution Priority					
Order Placement					
Shipping					

Rank the options given below on the scale of 1 to 5; where 1 is the highest priority and 5 is the lowest priority

a) What is your expectation from cement companies regarding outbound supply chain?

Ranking (from 1 to 5, where *1 is the highest priority and 5 is the lowest priority*)	
Flexibility	
Usability	
Productivity	

b) If there is technology intervention, which function you will prefer immediately to adopt for boosting the efficiency in outbound supply chain?

Ranking (from 1 to 5, where *1 is the highest priority and 5 is the lowest priority*)	
Detecting product	
Data Capturing	
Report Generation	
Better monitoring	
Improving efficiency	
Manpower reduction	
Better accounting	
Real Time location Tracking	

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