Theory of Constraints for Managing Downstream Supply Chain in Indian FMCG Sector: A Literature Review

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Abstract

Many firms have benefited from Theory of constraints implementation helping them in achieving ambitious goals. Theory of constraints uses inherent potential in supply to turnaround businesses. This paper uses case study approach to explore the existing implementation model of Theory of constraints especially in downstream supply chain and uncovers the associated challenges involved in the implementation. As a novel contribution to the already existing body of knowledge of Theory of constraints, a robust new model of implementation of Theory of constraints is presented, which can be of great help for supply chains of consumer products companies in performing sustainably.

Keywords: Sustainable Supply Chain Model, Theory of Constraints, Downstream Supply Chain Management, Uncertainty

Introduction

Fast Moving Consumer Goods (FMCG) is the article of daily use having a high consumption frequency Huber, Gossmann, and Stuckenschmidt, 2017). FMCG supply chain managerial decisions focus on finding out when to order and how much to order. Keeping up the optimum flow of goods is usually a priority of FMCG supply chain. The main objective of a consumer goods supply chain is to satisfy market by developing decisive competitive ability to add service orientation to the core product concept and thereby, managing the constraints for on time delivery performance (Mohan and Deshmukh, 2013).

On the basis of product flow, FMCG supply chain can be carved up into two parts: upstream supply chain and downstream supply chain. The upstream supply chain is the portion of a supply chain with product flow from raw material suppliers to producers and downstream supply chain as the portion involving product flow of finished goods from producers to retailers or customers (Yao and Minner, 2017). The divisions of supply chain in the upstream supply chain and downstream supply chain is important from strategic and tactical perspectives. FMCG downstream supply chain experiencing slight demand fluctuation causes huge variation in the level of inventory held in upstream supply chain and increase in stock outs negatively impacts customer service level (Ivanov, Tsipoulanidis and Schönberger, 2017). A fluctuation in the downstream supply chain has its effects throughout the supply chain. As the firm expands, in the pursuit of velocity and efficiency, the probability of fluctuation propagating throughout a chain grows (Scheibe and Blackhurst, 2017).

Upstream supply is forecast-driven and downstream supply chain is customer order-driven (Sindi and Roe, 2017). Forecasts can rarely be entirely accurate and uncertainty of future demand is always difficult to be fully eliminated (Choi, 2016). Hence, the FMCG companies relying heavily on demand forecasts are unable to respond rapidly to changes in real demand.

An increase in demand fluctuations along the upstream supply chain causes situations of stock-outs and excess inventory along the downstream supply chain Huber, Gossmann, and Stuckenschmidt, 2017). Forecast-driven supply chains can be at high risks of losing sales as a result of multiple undesirable effects such as instances of stock outs, degradation of customer service, the high cost of production, and relatively longer lead-times (Mital,

Del Guidice and Papa, 2017). Stock-outs prevalent in a downstream supply chain can have cascading undesirable effects on service levels of downstream supply chain members, who tend to increase the ordering quantity (order size) to safeguard against stock out scenario (Sharma, 2017).

Information technology can play an important part in managing the downstream supply chain. Information Technology, specifically communication technology, can help in optimizing supply chain network for competitiveness, higher service level, lowering levels of inventory, and reducing supply chain costs (Varma and Khan, 2014). Human intervention in the determination of optimum reorder size and order quantity can be significantly reduced by Information Technology, which can aid in controlling stock-outs (Sankaran and Ahmed, 2017). Nonetheless, the reality is that end users of FMCG companies, as large scale as Unilever, face frequent stock-outs in the downstream supply chain. A study on demand forecasting system revealed that forecast accuracy varies with a skill level of individuals, and modifications by functional managers (Alvarado-Valencia, Barrero, Önkal and Dennerlein, 2017). Forecast accuracy is also hooked on personal factors of product development teams, such as their wishful thinking, optimism bias, cognitive biases, and emotions (Belvedere, and Goodwin, 2017). Moreover, the role of inventory specialists in logistics keeps changing and there are variations in their competencies, job requirements, training needs, and personality traits (Dave, Lemay, Periatt, and Opengart, 2013). The study by (name) (Tatham, Wu, Kovács and Butcher, 2017) focused on accuracy of demand forecasting in relation to skills of managers and it was found that skills of supply chain managers (such as problem-solving skills and customer/ supplier relationship management) affect the accuracy of demand forecasting. As a remedy, certain FMCG companies have implemented the Theory of Constraints solution in the downstream supply chain and results has been encouraging as reported in increase in throughput, improvement in lead time, and reduction in system inventory.

A Review of Literature

The range of application of TOC includes diverse areas, such as Project Management (through Critical Chain Project Management), Distribution & Supply Chain (through Buffer Management), Production (through Drum-Buffer-Rope), Sales & Buy-In (through Layers of resistance), Strategy & Tactics, Education sector (Thinking process tools), and Finance and Measurements (through throughput accounting). TOC has been applied in integration with ABC, Linear programming, TQM, Enterprise Resource Planning, and Lean. TOC application covers the functional fields of marketing, people management, and product management, services management (e.g. Management of restaurants, Healthcare facilities, sustainable development, E-commerce, Innovations Management, Entrepreneurship, Aviation, and Banking). In fact, the scope of application of TOC is growing rapidly at present.

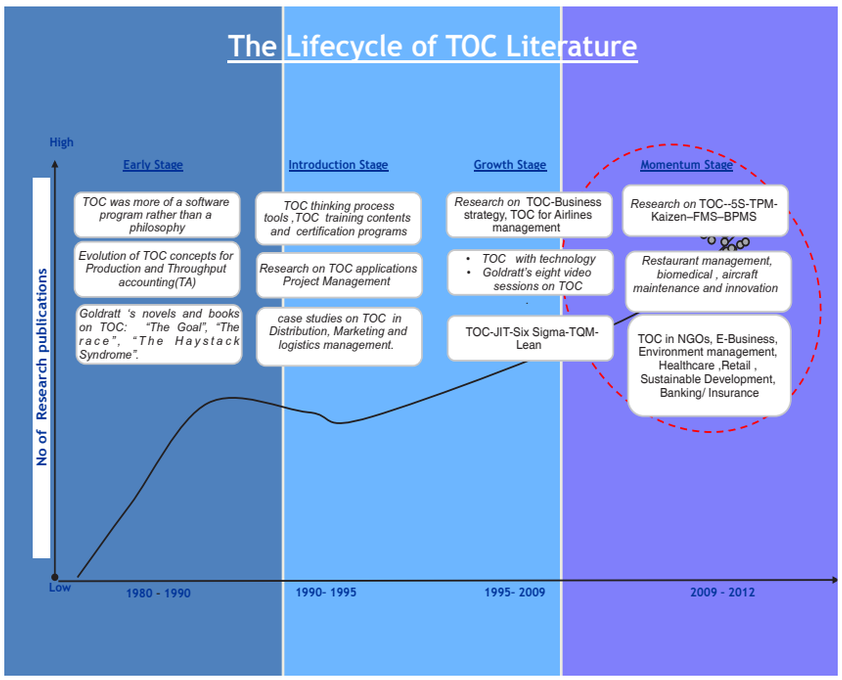

Fig. 1: A Lifecycle View of Literature of Theory of Constraints

Optimized Production Technology is a scheduling software developed by Goldratt, which brought a paradigm shift in production management at the beginning of Theory of Constraints evolution in the early 1980s, is regarded as the beginning of the Theory of Constraints. The scheduling software contained nine rules, which were applicable at the shop floor in repetitive manufacturing and process industries. The scheduling software was the premier constraint-based advanced planning and scheduling system to help manufacturing firms to have a decisive competitive edge by helping to achieve their goal of money now and in the future. Goldratt demonstrated that theoretically, it was possible to revamp performance of a sick plant through the application of TOC.

A revised edition of "The Goal", subtitled as "A Process Of Ongoing Improvement (POOGI)" was published, which encouraged firms to establish a clear strategic choice for moving on the red curve (for financial growth) from the green curve (for stability) to attain a Decisive Competitive Edge (DCE). In this context, Goldratt redefined the goal of a firm from "making money now & in future" to "becoming an ever- flourishing company." The body of TOC knowledge includes the Strategy and Tactic Tree, a step-by-step implementation guide structured logically with a clear focus on taking strategic & tactical steps to reach the goal.

The popularity of the business novel, "The Goal" encouraged several manufacturing firms adopt TOC. Theory of constraints literature involves mention of the quantitative and qualitative benefits obtained in terms of reduction in inventory level, increase in throughput and reduction in lead times, and qualitative benefits obtained, in the form of a paradigm shift of firms from cost-world thinking (reducing operating expenses) to throughput-world thinking (generating throughput). The Drum-Buffer-Rope is used to manage production geared to increase sales and cut down inventory. The function of the drum is played by the identified constraint, which directs the pace of production, the buffer is as a shield created for decoupling the Drum from the fluctuations, the Buffers is as a time buffer guarding the constraint to avoid starvation & overproduction, thereby allowing constant production and a buffer of finished goods to ensure due date performance. The Rope is a signaling mechanism for releasing materials on the shop floor (Blackstone, 2001). The Drum-Buffer-Rope sets the orientation of management towards an understanding that system efficiency is better than subsystem efficiencies, following which helps the system in making more money than earlier. An opposite approach would increase subsystem efficiencies, but might lead to a decrease in profits.

Several studies involved comparison of TOC, linear programming and other methods in a manufacturing environment and studies focused on the ideal product mix by goal programming and highlighting of the weaknesses of TOC in multiple bottleneck problems. The ABC resource usage analysis should be converted into a resource supply. Managerial attention should be on bottlenecks accommodation by using TOC to identify the optimal short-term mix of products that can be manufactured.

A study by (Ferencíková, 2012) was focused on the role of information technology in improving the decision-making in TOC projects in a manufacturing environment. An analytical product cost approach has been advocated by scholars for deciding to delete a product line, to have improvement in setup time, to create the market for differentiated products and to leverage knowledge base, communication process, resources management for POOGI in a TOC environment.

Though ABC subscribes to the 'cost world' paradigm can still provide TOC with the information on the range, cost, and consumption of activities throughout. It was argued by (Holmen, 1995) that the economic concept makes ABC suit long-run goals, while TOC suiting the short-run horizon.

The integration of TOC and ABC works well in a manufacturing environment (Kershaw, 2000; Kee, 1995). TOC approach is comparatively easier, takes less data and managerial efforts than ABC. However, integration of TOC, TQM, and continuous improvement principles is not recommended for these approaches for not complementing each other (Holmes, 2005). It was proposed by (Kee, 1995). that a simple mixed integer-programming model ideally suited for typical small-scale firms lacking expertise in applying complex mathematical programming models. (Tatham, Wu, Kovács and Butcher, 2017) Argued that ABC is suitable for people-intensive departments while TOC is for machine-intensive departments. The "Full Kit" in operations management demands to ensure full availability of the operations kit: components, tools, drawings, and information before commencing a job, failing which leads to wastage in terms, reduced efficiency of labor, lead time and higher WIP, and increases in manufacturing defects.

The qualitative benefits of applications of TOC in manufacturing environment were mentioned and concluded that ABC is a poor means of assessing cycle time reduction, while TOC's focused-mechanism, powered by employees' co-operation to TOC application

reduces the setup time on the constraining resource which benefits a firm in increasing throughput (Campbell, Brewer and Mills, 1997). However, limitations of TOC in manufacturing environment were mentioned by (Kee, 1995). for TOC having short-term orientation and for being oriented too much on throughput maximization leading to sub-optimal decisions.

Perception of management about the organization being a system with constraints motivates firms to prefer TOC to ABC. It was argued by (Tollington and Wachter, 2001) that the choice of the ABC and TOC is determined by the company's orientation of throughput or cost. TOC becomes a preferred choice when a constraint is within the organization, but when the constraint is in the market; TOC can't provide complete information to take tactical marketing decisions. However, TOC and ABC integrated information system is enough to help to take informed strategic decisions, New Product Development (NPD) and promotion of new products. The impact of environmental changes in cost management is being studied along with its weakness and the reasoning to introduce a TOC-based cost management approach suitable for modern firms. An integrated model of TOC and linear programming is suitable (Grondskis and Sapkauskiene, 2011).

An integrated model of TOC and ABC was presented through an analytical model for logistics costing, processes, and cost structure. An integrated approach of Lean Accounting and throughput accounting revealed that the integrated approach provided better data on costs and results obtained in comparison to the data provided by individual methods.

Through a Mixed Integer Linear Goal Programming Model for product-mix decisions, it was argued that ABC partly solves issues of cost accounting and TOC is good at throughput orientation, but weak in ensuring the reliability of information in case of vast range and high factory burden (Rajesh, 2014). The Balanced Score Card (BSC) has been criticized for its limitations, and TOC provides short-term maximization of profits while ABC maximizes long-term profitability with optimized resource supply, product mix, pricing, and CRM.

Vector Consulting had undertaken projects of Theory of Constraints in the Engineered to Order Segment including Tata Robinson Fraser Ltd- Bulk Material Handling Systems Division, Ports and Yards Equipment Division and the Bulk Material Equipment Division, Tata BlueScope Ltd, Building Solutions Ltd, Godrej and Boyce-Storage Solutions Division, Consumer Security products Division, Offices Solutions Division, Tooling Division and the Process Equipment Division, Bajaj Electricals- Engineering and Projects, Kirloskar Oil Engines Ltd- New Product Development Division and the Engineered to order business, Jyoti Ltd, Raymond Zambaiti Ltd, Pari Robotics Ltd and Crompton Greaves Ltd, Instrumentation Transformer Business Unit.

Integrated approach of ABC and TOC in a service environment is useful in the service sector. Further, an application of Theory of Constraints in e-commerce (service environment) also revealed that the integration of ABC and TOC works well, e-commerce is best suited for application of an integrated ABC and TOC due to having the right blend of throughput orientation (maximization of retail inventory "throughput") and cost orientation (minimization of fixed overhead costs) [61]. Service sector case studies of the application of Theory of Constraints brought into the limelight an alternative approach to costing method called Global Decision-making Methodology (GDM), wherein "light ABC" system supported GDM.

Study of the effect of costing technique on the cost performance of new product development initiatives in industrial companies revealed a relation of ABC with TOC, but a stronger effect on ABC on the new product development cost performance. It was (Todd, 2009), who presented an integrated approach of Lean and Six Sigma through 6 TOC. Sheela Foams had a successful integration of TOC and ERP. Integrated approach of TOC and Lean is helpful in achieving continuous improvement. Integrated approach of TOC and Lean is useful in creating the right sequence of production on equipment.

Throughput accounting is the brainchild of Goldratt from Goldratt's business novel "The Goal", after which throughput was taken quite seriously at par with individual machine utilization. However, the idea of throughput accounting might have its roots from the lessons learnt in the implementation of non-TOC techniques in many firms in the UK. Throughput accounting was not a new knowledge of accounting literature, but a tool to make paradigm shifts in management accounting practices, and several accountants had re-modeled/customized throughput accounting to suit many firms.

Throughput accounting in a factory setting solves production flow problems and focuses remain on throughput gain and inventory control with control on operating expenses. Goldratt stressed on rolling out the three standard operating measures right from shop floor to the system level so that every attempt is made to achieve the goal (to make more goal units, now and in the future).

Cost accounting was criticized by Goldratt for its flawed assumptions and suggested that the plant managers should adopt three standard operating measures (throughput, inventory, and operating expense) under Throughput accounting paradigms, as a substitute for cost accounting measures in managing manufacturing units.

A throughput accounting based mathematical model was developed by (Ortiz-T. et al., 2014) to get optimal output from small-scale shoe manufacturing units. There is a possibility of loss of throughput for not following the concept of the Full Kit. Lean accounting and throughput accounting were compared by (Myrelid, 2015) in a firm using Advanced Manufacturing Technology (AMT), which provided cost data of the bottlenecks and value streams.

Applications of Theory of Constraints in the make or buy decisions gained momentum in the 1990s. Standard accounting, TOC, and linear programming were compared and found that the outsourcing models need situational analysis of internal and external constraints perspectives (Mohanty, 2009). Applications of TOC in services management for quality of services in banks and health care institutions were discussed (Motwani, Bramorski and Madan, 1998). Vector Consulting had implemented Theory of Constraints supply chain solutions in automobile segment firms including Fleetguard Filters (Cummins), Tata Toyo Radiators, Kirloskar Oil Engines Ltd - Auto segment, Lucas Indian Service, Tata Auto Components South Africa, TOPINDO - Indonesia, Filtrum Polymers and Filtrum Tools.

TOC applications can help in treatment of health care problems (Kershaw, 2000). Application of TOC covers hospital measurement system. Applications of TOC also covers health care sector. The study suggested that all physician executives to use the TOC systematic thinking process. It was concluded that an application of TOC in mental health domain improves clinical efficiency and reduces waiting times in the mental health care industry. Application of TOC in managing innovation was presented and it was concluded that TOC helps in accelerating innovation by managing the constraint through the five focusing steps, which improves innovation throughput (Dalton, 2009). Vector Consulting had implemented Theory of Constraints in the infrastructure projects companies including Rallis India, Trident Group- Yarn Division and Tata Metallics.

Private sector restaurants have benefited from Theory of Constraints application in the form of higher throughput, higher resource efficiency, reduced operating expenses and elevated customer satisfaction. Public sector restaurants have benefited from Theory of Constraints application in the form of reduced customer waiting time, higher customer footfalls and better stock market performance of the restaurants.

In the last fifty years, the Indian Fast Moving Consumer Goods (FMCG) industry has evolved to become the fourth largest contributor to India's GDP. Historically, the Indian FMCG industry has been dependent on forecasts to manage a supply chain. Notwithstanding, the forecasts have always been inaccurate, resulting in stock-outs in the downstream supply chain, which means that customers are not able to find products available at the point of sale. In addition, the forecasts failures have also resulted in excess stock in the downstream supply chain, which means distributors, wholesalers, and retailers earn a lower Return On Investment (ROI). FMCG firms have proven to reduce dependency on forecasts by applying Theory of Constraints. Still, there are a limited number of cases published in the public domain. A study focused on accuracy of statistical forecasting techniques confirmed that forecast driven supply chains produce retail outlets level frequent out-of/ excess stock (Anusha, Alok and Ashiff, 2014). Literature review reveals that the companies applying Theory of Constraints in the downstream supply chain have, within the first twelve months of the implementation, gained throughput of over two-thirds, due date performance of over one-ninths, decreased inventory levels by half, and lead time reduction of over three-fourth. Consumer goods industry reaches stagnation when its constraint, located in the market, is not exploited properly in the long run, which conduces to the company's throughput becoming stagnant as well. It calls for building up and implementing breakthrough injections to get maximum performance out of the constraint.

Supply chain management is customer oriented, integrates business planning and balances supply and demand in a supply chain. An actual sale is considered only when the end customer buys merchandise in the supply chain. Supply chain reliability is assessed by the reliability of retailers on their vendors. A typical supply chain network includes entities consisting of retailers and a manufacturer. In such a supply chain, on one end there are retailers offering superior customer service and satisfying the market demand, while on the other end, there is a producer looking for responding rapidly to the market demand. The manufacturer is liable to manage inventory availability at retailers. Theory of Constraints has a yardstick called "Throughput Dollar Days" which

empowers retailers to appraise the delivery performance of their manufacturers/suppliers. "Throughput Dollar Days" can be used a tool for improving supply chain performance and accountability of the supplier, which encourages supply chain members to accelerate their responses to satisfy the final customer.

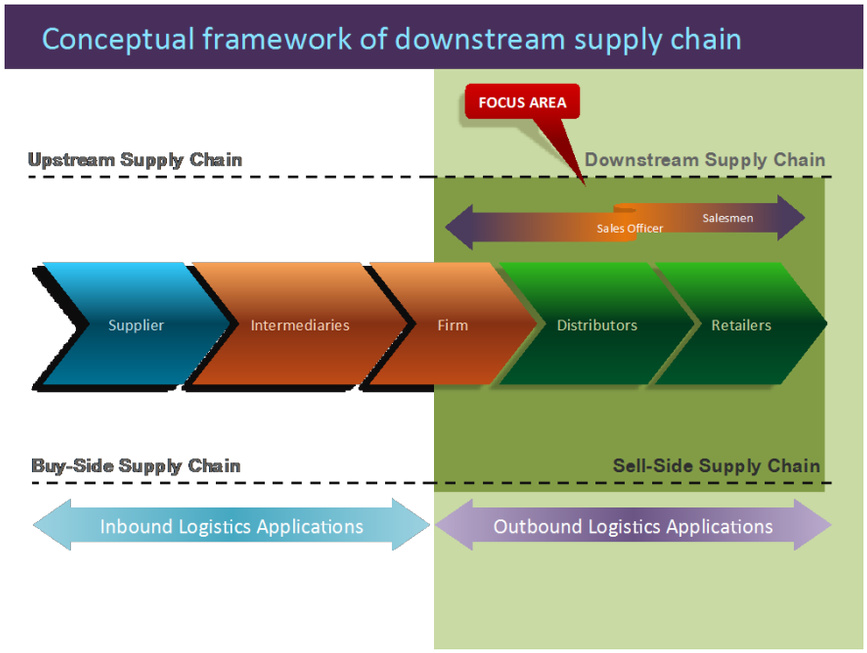

Fig. 2: Conceptual Framework of Upstream Supply Chain and Downstream Supply Chain in an FMCG Firm

Manufacturers, as well as retailers, can suffer important losses as a result of stock-outs; the damages depend on specific consumer reactions, which are variable with product, consumer, and situation factors (Campo, Gijsbrechts and Nisol, 2000). Goldratt estimated that the most downstream supply chain links for most of the distribution companies usually exhibit stock out of over one–fifths. The fluctuation in supply chains, the bullwhip effect, is a well-documented phenomenon. Supply chain strategy should minimize the bullwhip effect (Gonapa, Samuel, and Sharma, 2012). It implies that supply chain strategy, which plays a critical role in supply chain performance, should get proper attention (Dalal and Athavale, 2012). On account of reliance on demand forecasting, demand forecasts accuracy can be considered as a precondition for making sound supply chain decisions (Anusha, Alok and Ashiff, 2014). The ability to detect disturbances quickly, as they arise in a supply chain, helps to manage them efficiently and effectively (Shukla and Naim, 2017).

Application of Theory of Constraints approach can bring down overall inventory in the supply chain by over half, increase sales by one-fifth, increase stock turns by double, decrease stock transference other than customer dispatches, decrease obsolescence by half, and all this was achieved without increasing operational expenses.

A literature review of supply chain management was conducted by (Kumar, Saxena, and Agrawal, 2012) involving over two hundred published research papers. An exploratory framework of the role of handling inventory and its management was presented by (Chalotra, 2013) covering over one hundred wholesalers. It was found that personal factors such different educational qualifications of wholesalers have an impact on handling inventory. A similar study was conducted by (Singh and Pandey, 2013) to identify the variables affecting the performance of a supply chain and prevalent techniques of supply chain performance measurement. A study by (Parkhi, Jagadeesh, and Arun Kumar, 2014). focused on retail logistics costs in the business to customer channel. A study by (Deshmukh and Mohan, 2016) Arun Kumar involved factors influencing implementation of demand chain management practices. It was concluded that top management commitment and support in the implementation of new supply chain policy is the most significant enabler.

A critical review of the literature of sustainable supply chain management was presented by (Dubey, Gunasekaran, Childe, Papadopoulos and Wamba, 2017), wherein it was argued for "WCSSCM", as the literature review revealed a significant difference between definitions and methodologies in the literature. Supply chain practices

and organizational performance were studied by (Gorane and Kant, 2017), wherein it was found that a successful supply chain model implementation not only improves the operational performance but also improves customer satisfaction and financial performance.

It was mentioned by (Rahman, 2002) that the literature mentioned more quantitative studies involving rigorous statistical analyses and there was a lack of papers on case studies on implementation of the Theory of Constraints in supply chain management.

The case study approach, which is based on learning from past problems for finding a revised model of a supply chain, was advocated as there are limited cases studies in the literature of Theory of Constraints in supply chain management (Dalal and Athavale, 2012).

A leading FMCG firms, Godrej Consumer Products Limited, had an ideal mindset for adopting a paradigm shift required for implementing the Theory of Constraints. Godrej Consumer Products Limited (GCPL) adopted Buffer management system in 2005 for arresting lost sales due to non-availability of items in its downstream supply chain.

A case study of an application of throughput accounting in FMCG sector was undertaken (Schragenheim, 2013). However, the study did not cover application of TOC solutions in a downstream supply chain. The study was based on throughput accounting software developed by (Schragenheim, 2013) and its deployment in FMCG Company, JK Files & Tools- a subsidiary of Raymond. The cases of application of TOC in the downstream supply in FMCG sector in India are limited to few of the studies (Schragenheim, 2013; Sangameshwaran, 2013; Menon, 2013 and Kulraj, 2014).

Vector Consulting provided consulting services for application of Theory of Constraints in downstream supply chain in FMCG sector in India in Godrej and Boyce-home furniture division, Fleetguard Filters Ltd (Cummins Group), Raymond Textiles, Bajaj Electric- Fans Business Unit, Bajaj Electric - Appliances Business Unit, Bajaj Electric - Morphy Richards Appliances Business Unit, JK Files and Tools Ltd (Raymond Group engaged in Home Care Tools Business), Tata Steel long Products Division, Godrej Consumer Products Ltd, Godrej Sara Lee Ltd, Godrej and Boyce - Security Products Division - Retail business, Godrej and Boyce - Storage Division - Retail business, Godrej Hershey, TOPINDO- 2nd largest lube oil company in Indonesia, Kirloskar Oil Engines Ltd - Power generators Business Unit, Kirloskar Oil Engines Ltd - Agriculture Business Unit, Kirloskar Oil Engines Ltd - Spares business, Liberty Shoes Ltd, Bajaj Electric - Luminaries Business Unit, Lucas Indian Service, Apollo Paints Private Limited, Trident group - Paper division, Trident Group - Towel division, Tata Auto Components South Africa, Tata BlueScope Ltd - Coated steel division, Tata Steel Tubes Division and Pidilite Ltd.

Thinking Process tools of TOC were applied in the FMCG supply chain of Godrej Agrovet and the company and found that "unsuitable policy' as the constraint and the constraints management approach helped the firm to get a reduction in inventory levels and increase throughput. TOC was implemented in the downstream supply chain of Godrej Sara Lee, a consumer goods firm engaged in the business of household insecticides and personal care products. The implementation resulted in improvement in availability, increase in financial performance of the distributors and the retailers and improvement in the sales force performance (measured through sales force efficiency & effectiveness).

It was suggested that a successful implementation should exclude push distribution style, focus on TOC training (such as "Train the Trainers" programs), and sufficient handholding for participants in the implementation process. Godrej Consumer Products Limited (GCPL), a leading FMCG firm, undertook a full-scale implementation of TOC in the downstream supply chain (Mitra, 2012). Godrej Consumer Products Limited acquired Godrej Sara Lee. However, both the firm had implemented TOC in their downstream supply chain.

A case study was presented on application of Theory of Constraints in a division of Bajaj Electricals Limited, a large FMCG firm, engaged in sales & distribution of household and industrial electrical appliances, and other electrical items (Sangameshwaran, 2013). The study covered implementation of TOC in the upstream and the downstream supply chain of Morphy Richards, a business unit of Bajaj Electricals Limited. The distribution system of Morphy Richards had Undesirable Effects: the sales turnover was low and highly skewed at month-ends, and dealers maintained a high level of inventory to avoid stock outs. Despite that, they experienced stock outs leading to a reduction in their Return On Investment, and the measurement system of inventory had promoted push mode of distribution as the inventory was measured in its value terms rather than measuring it in the days of sales. The process of application of Theory of Constraints in the upstream supply chain and downstream supply chain (in Morphy Richards): TOC implementation in the upstream supply chain involved ensuring that the suppliers operated on dynamic buffers for benefiting them

the highest return on inventory achieved with improved availability at a lower level of inventory at an item level. TOC implementation in the downstream supply chain of Morphy Richards involved maintaining dynamic buffers at warehouses in alignment with the buffers at the suppliers. Distributors and retailers also operated on dynamic buffers in alignment with the buffers at the warehouses. Consequently, the warehouses benefitted with improved availability at a lower level of inventory at an item level. The company offered to pay penalty to distributors for not meeting the desire fill-rates. The sales of distributors improved as a result of a reduction in stock-outs from a previous level of one-fourths to a level of over one-tenths. The Return On Investment of the distributors increased to a level of two-fifths from its previous level of one-thirds. The real-time visibility of inventory was maintained by deploying the Dynamic Buffer Management system, sharing of sales & inventory data through daily reports based on the distributor-scorecard and physical stock auditing every month. A reward system was designed based on the distributor scorecard performance to change the behavior of the distributors for accurately maintaining and reporting item level inventory data. TOC implementation resulted in an equal focus on fast movers as a well as slow movers because of interest taken by the salespeople to gain product knowledge of all items. Consequently, the sales pitch was more successful and as reported in improvement in sales productivity and line selling.

VIP Industries, India's number one luggage FMCG Company implemented TOC in the year 2013 for improving its operational efficiency (Kulraj, 2014). The aim was to reduce inventory while improving availability at point of sale. This would enable an increase in reach and range of the company.

A case study was presented on application of Theory of Constraints in FMCG sector firm, Godrej & Boyce, in its Locks division in 2008 (Menon, 2013). Sales forecasting in Godrej Locks often failed, resulting in overproduction. To get rid of the excess inventory, salespeople were incentivized to push inventory downstream resulting in blocking capital of distributors, which could have been used in dealing with a wider range of company's products. The Dynamic Buffer Management system was implemented at the upstream supply chain to replace sales forecasting. The same was extended to downstream supply chain to include six hundred distributors and thousands of retailers.

FMCG firms use demand forecasting as a tool for effective production planning and inventory management. However, instances of demand forecasts often failing are quite common, which forces firms to face a conflict between reducing logistics cost and controlling stock-outs. Such unresolved conflict or a bad compromise leads to either excess inventory buildup or out of stock situations in upstream supply chain links. Upstream supply chain link tends to get rid of excess inventory by pushing inventory at downstream supply chain links, such as distributors. At the core lies a wrong assumption that pushing in from one upstream supply chain link to the next (downstream) link is a shortcut to increase sales. Firms are assumed that a distributor can, in turn, further find some way outs to get rid of excess inventory, for instance by offering discounts or by creating new demand in the market.

The undesirable effect of the use demand forecasting is forecast failure, by the time it is realized; it is too late to react. The two options for firms (and the downstream links) are to maintain high inventory levels (to avoid stock outs) and to maintain low inventory levels to control cost. This conflict leads to stock outs and excess stock outs. As inventory accounts for the major investment of a firm and its distributors, therefore the high inventory level reduces Return On Investment (ROI). On the contrary, as stock-outs lead to loss of sale, therefore it also decreases ROI.

There are further negative consequences of the push behavior. Maintaining a high level of inventory implies high investments. In distribution environments where cash flow (and space) is a constraint, so maintaining a high level of inventory of a wide range of items implies cutting down the availability of certain items. Product variety available at a certain supply chain link thus gets constrained, which implies sales opportunity loss. In fact, the items subject to experience shortage are often the fast movers; therefore the possibility of loss of sale is significant at the point of sale.

It is empirically evident that proper implementation of TOC improves the performance of a company, as seen in many Fortune 500 firms that implemented TOC. Over hundred implementations of Theory of constraints have resulted in an average inventory reduction by half, lead-times and due date performance and financial performance jump by 2/3rd. TOC enhances the performance of the sales force of a distribution firm. At a higher level, the TOC predicts that organizations can achieve the prime goal by implementing its philosophy (Korn, 2009).

The website of Vector Consulting mentions the application of Theory of Constraints in downstream FMCG, retail supply chain in India, especially in Landmark Ltd, Westside, Vivek Ltd, Liberty Retail Revolutions Ltd,

Godrej and Boyce Ltd-Home Furniture Company Stores chain and Raymond textiles - Company Stores chain. The website of Goldratt Consulting mentions the application of Theory of Constraints in downstream FMCG, retail supply chain of Titan Industries.

TOC implementation resolves supply chain conflict by challenging flawed assumptions. It enables reactions to the real market demand by adjusting the stock buffers as per the demand fluctuations, helping to control excess stocks and stock-outs. Therefore, sales lost due to stock-outs of high-sale items are minimal with TOC methodology. Because lower stocks of all items are kept and the quantities are further decreased when consumption is low, low sale items are much less of a problem since their quantities remain minimal. Therefore, using TOC pull distribution is very effective in eliminating lost sales.

The performance measurement metrics of TOC in the supply chain include measuring throughput; inventory, operating expenses and the related local performance measures at the downstream supply chain are Throughput-Dollar-Days and Inventory-Dollar-Days. The Throughput Dollar Days (TDD) evaluates the opportunity cost of throughput due to stock shortages. The Inventory Dollar Days (IDD) evaluates the negative impact of excess stocks. The two measures ensure superior customer service in a win-win manner for achieving the goal.

Supply chain is consisted of upstream supply chain and downstream supply chain (Schragenheim, 2010). The direction of the flow of goods, in the upstream supply chain, is from supplier towards the plants, whereas in the downstream supply chain, the direction of the flow of goods is from the plants towards the customer. Downstream supply chain management involves supply chain activities that help in making supplies of finished goods (including the flow of information and finances) downstream from company warehouses towards the end users.

A successful implementation of TOC, in the upstream supply of consumer goods firm, leads to significant improvements in the output of the manufacturing units. Consequently, inventory rotations and overall availability increase significantly in the upstream supply chain. However, lack of a focused approach in managing the downstream supply chain of a consumer goods firm leads to the emergence of the following Undesirable Effects (UDEs):

- Company follows push distribution style at the distributors.
- Distributors follow push distribution style at the retailers.
- Highly Skewed demand at the month ends at the distributors.
- Fill rate to the distributors is poor at monthly horizons.
- Inventory level remains high at the distributors.
- Inventory turns remain poor at distributors.
- Return On Investment (ROI) of distributors and the retailers remain low.
- Products availability remains poor at distributors and the retailers.
- Sales contribution from the retail segment remains poor.
- Products are often highly discounted.

As a remedial action, application of TOC in the downstream supply chain (coupled with the TOC interventions applied at the upstream supply chain have led to the firms enjoying higher ROI of the channel partners, maintaining correct levels of inventory for the majority of the range of product, across the supply chain links leading to increase in sales. Some of the results (within the first six months) of application of Theory of Constraints in the supply chain are as below:

- Production lead-time reduction by half;
- Sales growth by one fifth;
- Supply chain inventory reduction by half;
- Inventory rotation increase by two folds;
- Reduction of obsolescence and increase in freshness of inventory;
- Improved relationships between upstream and downstream supply chain partners.

TOC solutions applied at upstream supply chain increases throughput with the application of Drum Buffer Rope; and Buffer Management implemented at the raw material suppliers, and then at manufacturing units, which releases the latent capacity of the plants resulting in a reduction of lead-time in plants, which increases the output of plants. The constraint shifts from production to market, which opens the gates for a company to increase sales and build a decisive competitive edge. It is possible for a firm to become content with the gains in the upstream supply chain.

The gains of increased output at upstream supply chain can go waste if the downstream supply chain does not benefit in terms of increased sales gained through improved

availability (at a lower level of inventory). This is achieved by implementing TOC solutions for downstream supply chain, which involves the implementation of the Dynamic Buffer Management System and TOC measurements for sales people, who normally have product knowledge but ignorance of effective presentation of decisive competitive edge to channel partners and their customers. In order to capitalize on the decisive edge, TOC application in the downstream supply chain provides an "Unrefusable offer", which is presented by salesforce to the channel partners with an explanation of cause & effect analysis of the elements of the offer aimed at win-win resolutions of previous unresolved conflicts in the supply chain. However, as sales increases sharply, the constraint can enter back in within the firm, i.e. in production, which if ignored would lead to loss of the competitive edge.

TOC application at the downstream supply chain level starts with the deployment of the Buffer Management system (by setting inventory norms) at the Central Warehouse (CWH), Branch warehouses (BWH), distributors and the retailers/dealers. The conventional assumption in the downstream supply chain is: In order to be an excellent customer service provider, a downstream supply chain link must hold excess inventory to counter fluctuations in demand.

TOC has invalidated this assumption through the Dynamic Buffer Management system. The stock norm (called buffers), set at the item level, protects against overstocking and stock-outs, which implies maintaining of very high level of availability in the downstream supply chain, most of the times, at a much lower level of inventory. The capital, which otherwise was to be blocked in excess stocks, remains free to be invested in the downstream supply chain in dealing with a wider range of items of the company. The wide range is then used to reach out to more retailers/dealers. The contributor to the throughput gain of a consumer goods firm implementing TOC in the downstream supply chain is a combination of maintaining confirmed availability (at a lower level of inventory), a wider range of items being dealt by the downstream supply chain members, and increased reach.

Analysis of Literature Review

Criteria Used in Literature Review

The present review of literature is aimed at finding key studies on the Theory of Constraint applications in the downstream supply chain in FMCG sector in India, to analyze the most compelling arguments made and the standards set by the writers so as to arrive at the fitment of the present study into its academic discourse. The primary sources of data for literature review are articles from peered-reviewed scholarly journals, articles from trade journals, articles from other journals, implementation plan documents of the companies, Email records, Interviews, Audit presentations, and conference presentations. The secondary sources of data for literature review included Wire Feeds articles, articles from book sections, online, multimedia items, press release notes, newspaper articles, business, business magazines articles and podcast transcription.

Approaches in the Review of Literature

Table 1: Approaches in Review of Literature

Area of investigation	Approach	Focal point
What is TOC?	Introduction of TOC through review of literature	Definitions of TOC
What is at the core of TOC?	Review of literature to explain principles of TOC	The four principles of TOC
What is the approach of TOC?	Review of literature to explain The five focusing steps of TOC	Details of constraint management approach
What is the general scope of TOC?	Review of literature to identify applications of TOC in various fields and the trends in the literature.	The key studies published globally on applications of TOC in broad areas.
What is the scope of application of TOC in the downstream supply chain, particularly in FMCG sector within India?	Review of literature to identify the relevant published cases and the trends in the literature.	The key studies published on applications of TOC specifically on the downstream supply chain pertaining to the FMCG sector in India
What is the need for conducting a literature review and the present research?	Analysis of the gaps in the literature	Justification of reasons for conducting the present research

Area of investigation	Approach	Focal point
How is the review of literature relevant to the proposed study?	Evaluation of the published literature	The criteria used for conducting the review of literature
What is the rationale for organizing the literature?	Summarization of sources of literature review	The similarities, differences between sources and the identified research gaps and conclusions
What is the contribution development the literature?	Developing the initial research question to fill the gap in the existing literature	The key arguments and the gaps in the literature forming a base for the proposed research

Word Cloud of Literature Review

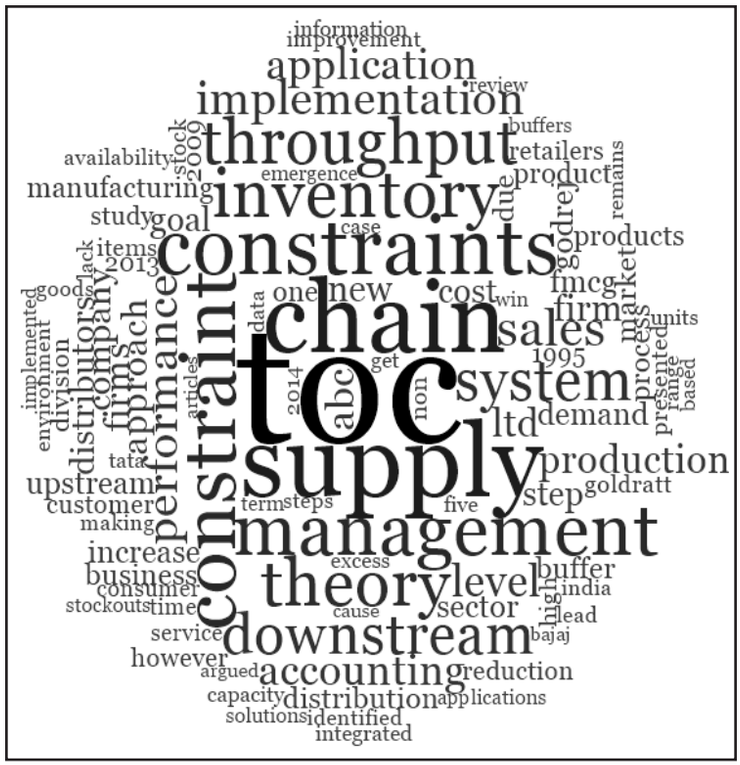

Chart 1: Word Cloud of Literature Review

The Most Frequent Words in the Word Cloud

Table 2: Comparison of the Most Frequent Words in the Word Clouds

The Most Frequent Words in the Word Cloud of Literature Review	The Words in objective of Literature Review
TOC (Theory of Constraints)	TOC (Theory of Constraints)
Supply chain	Supply chain
Application, Implementation	Application, Implementation
Downstream	Downstream
Management	Management
Case Study	Case study
FMCG sector	FMCG sector
System	India

The Most Frequent Words in the Word Cloud of Literature Review	The Words in objective of Literature Review
Throughput	
Distributor	
Process	
Inventory	
Goldratt	

- **Matching of words:** The words in objective of Literature Review match with the most frequent words in the Word Cloud.
- **Word size:** The largest words are TOC, Supply, Chain, theory, constraints, management, downstream, which indicates that these themes are the most widely discussed themes in the review of the literature.
- **Centring:** The words centred in the middle of the word cloud are TOC, Supply, Chain, which indicate that these words take centre-stage throughout the review of the literature.
- **Position:** The bunch of words on the left of the word cloud (distributors, company, firm, approach, implementation, availability, and performance) indicates the themes occurring most widely towards the beginning the review of the literature. The bunch of words on the right of the word cloud (range, India, buffer, products, market, Goldratt, firms, FMCG, products, sales, and system) indicates the themes occurring most widely towards the end of the review of the literature.

Word Hierarchy Chart of Literature Review

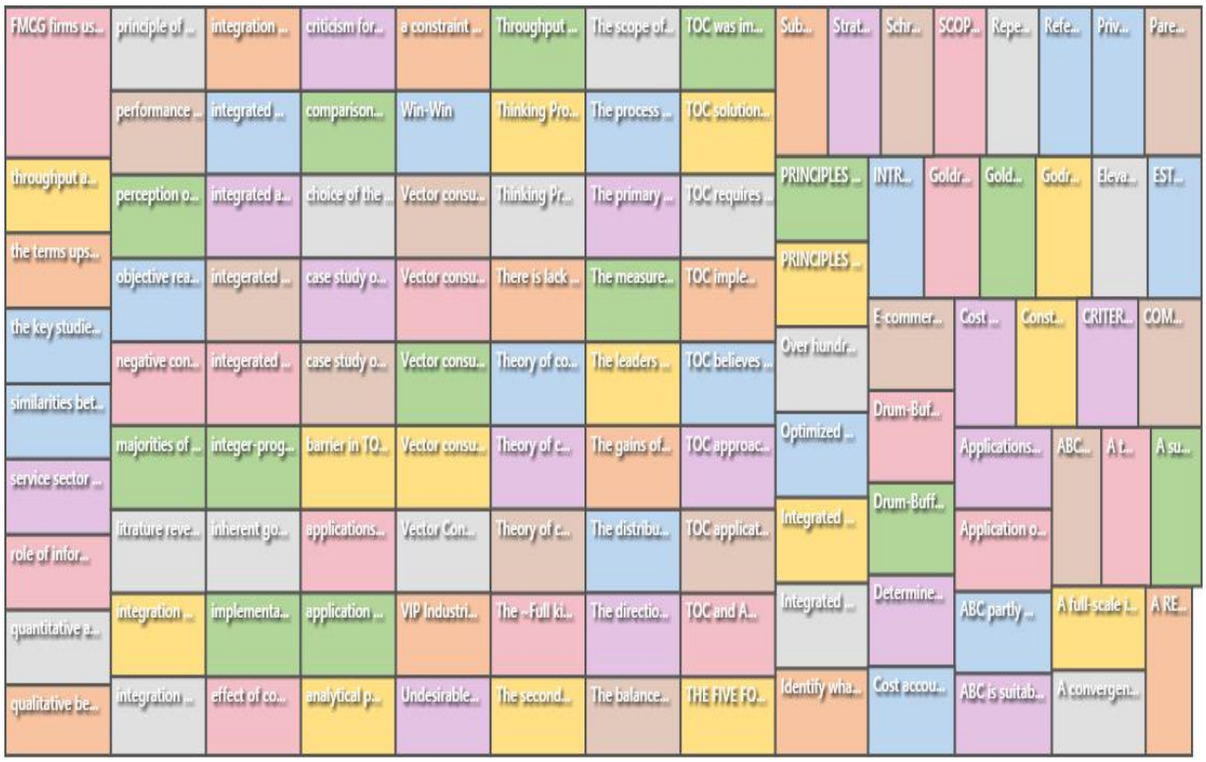

Chart 2: Word Hierarchy Chart of Literature Review

The title of the study has the following words: case, study, application, theory, constraints, downstream, supply, chain, FMCG, sector, India. The words appearing on the top of the word hierarchy chart match with the words in the title of the study.

Number of Coding References in the Literature Reviewed

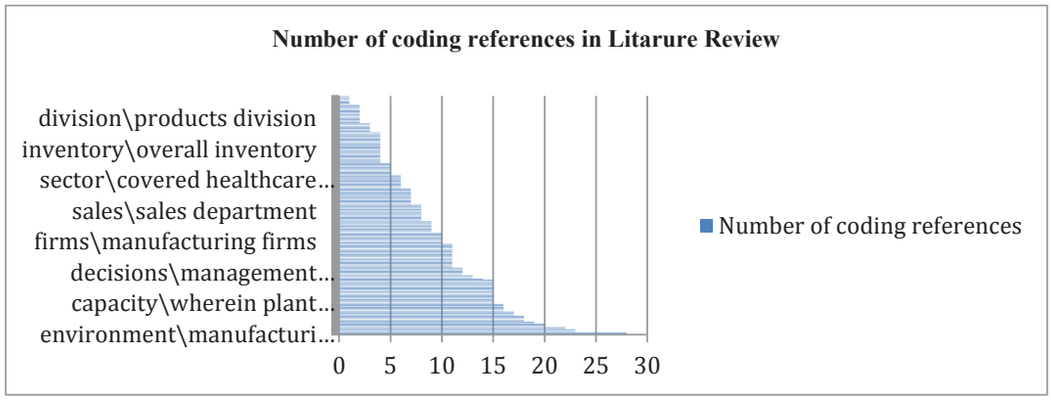

Chart 3: Number of Coding References in Literature Review

Codes Compared by Number of Coding References

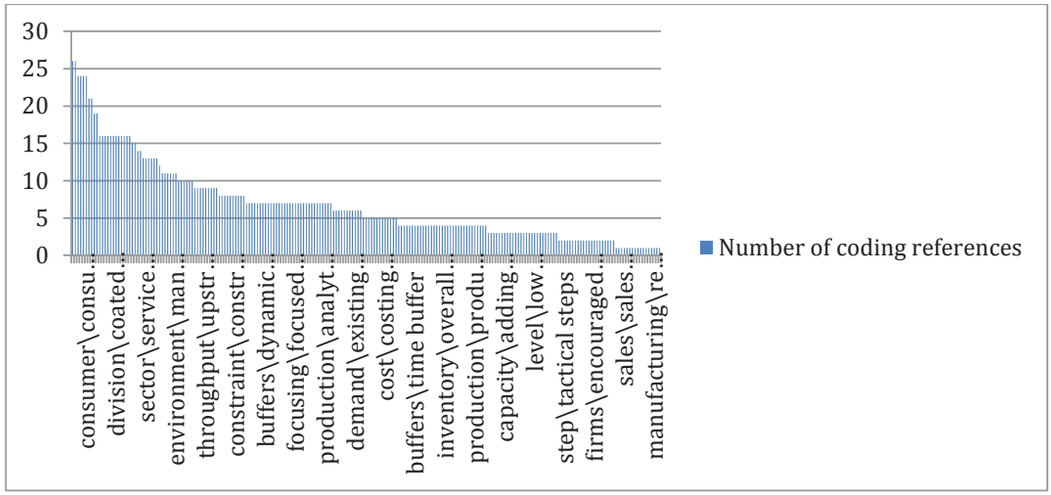

Chart 4: Codes Compared by Number of Coding References

Top 50 Words Frequently Occurring in the Literature Reviewed

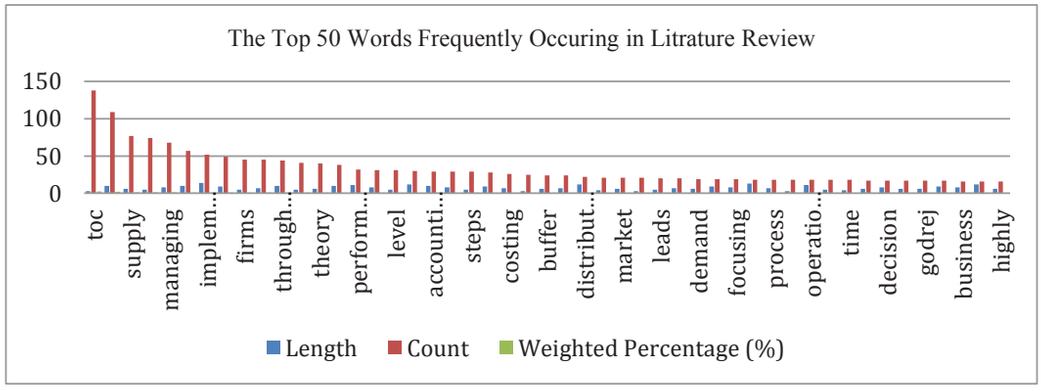

Chart 5: Top 50 Words Frequently Occurring in the Literature Reviewed

Number of Coding References in the Literature Reviewed

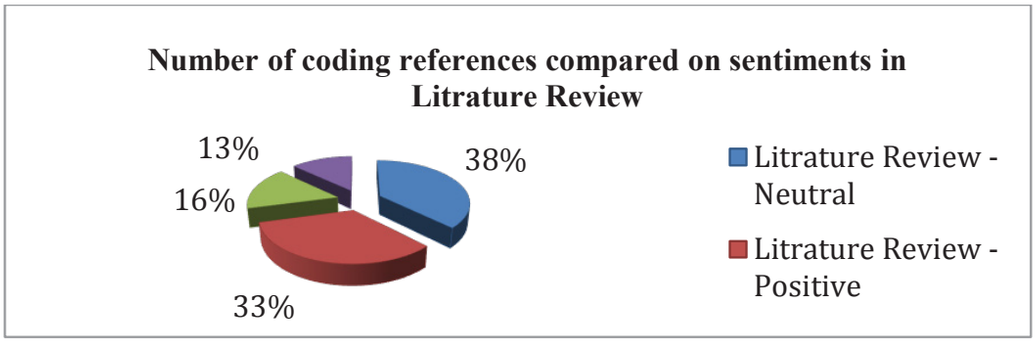

Chart 6: Number of Coding References in Literature Review

Table 3: Nodes and Number of Coding References: Summery

Nodes	Number of coding references
Literature Review	192
Literature Review - Neutral	72
Literature Review - Positive	64
Literature Review - Mixed	31
Literature Review - Negative	25

Table 4: Node Compared on Sentiment Basis: Summery

Nodes comparison on sentiment basis	Number of coding references
Literature Review - Neutral	72
Literature Review - Positive	64
Literature Review - Mixed	31
Literature Review - Negative	25

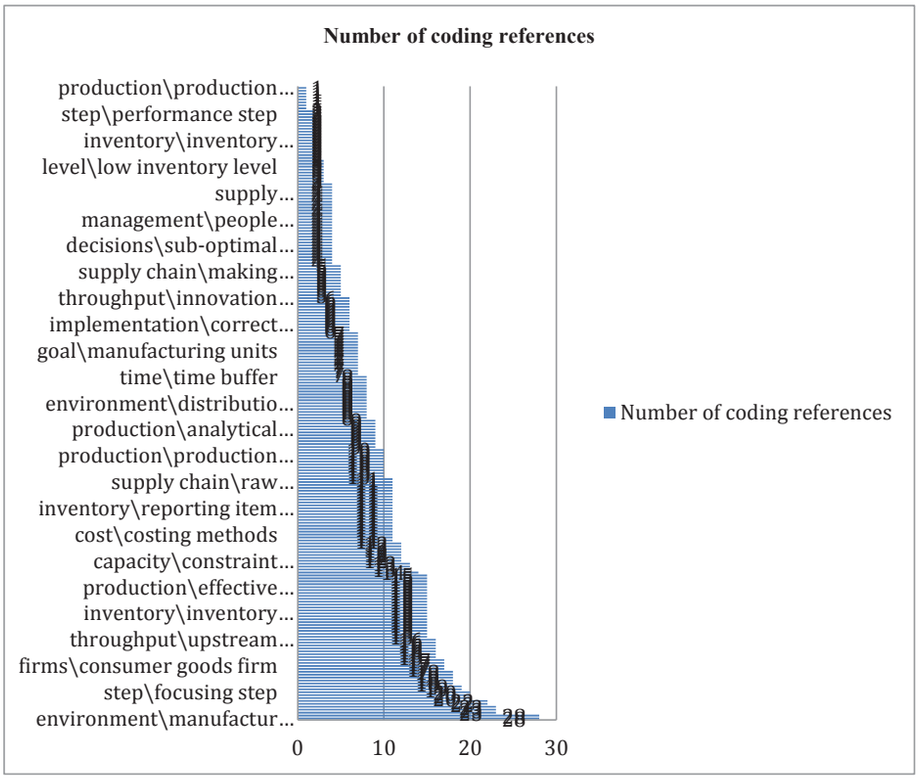

Chart 7: Number of Coding References in Literature Review

Conclusion

There are claims that the implementation of the Theory of Constraints has a positive impact on organizational performance. On the contrary, there are criticism for Theory of Constraints implementation for being complex due to difficulties in interpretation of the contents, difficult to embrace due to its jargons, costs due to its implementation needing paid services of highly trained experts and for Theory of Constraints implementation being ignoring the participation of operational level employees due to its top-down approach involving strategic level employees. There is criticism for Theory of Constraints implementation for its weakness in answering questions related to opportunity cost and decision on the choice of technology. There is criticism for Theory of Constraints implementation not delivering consistent results, which doesn't support the cause of Theory of Constraints for qualifying as a scientific management approach. There are cases of failures of implementation of the Theory of Constraints as firms have failed to get the desired result of TOC implementation, which doesn't mean that TOC is not effective. TOC implementation has not led to a sustainable increase in throughput for years for many firms that are the reason why it is considered as a kind of one-off, non-sustainable solution. The assigned causes for the same are the lack of support by leaders of TOC client organization, lack of appropriate cultural change from existing culture to TOC culture and inappropriate solution design for increasing throughput sustainable.

An empirical research on TOC in systems highlights two main barriers in TOC implementation: lack of management support and lack of interest of all stakeholders in TOC and there is a limitation in terms of the high opportunity cost and difficulties in technology adoption. The TOC Literature review has often highlighted that application of TOC usually improves operational efficiency and customer satisfaction. However, the success depends on systematic implementation, change management techniques, the total system approach and benchmarking. Certain firms have not got the desired result after TOC implementation. Though they are not successful, yet it cannot be concluded that TOC is not effective. The stagnation starts, as a trend, when customers stop buying and the firms need to develop solutions for increasing throughput. TOC has to prove that it is not an one-off but sustained. For that to happen, throughput must keep on increasing consistently for years to come. When the throughput doesn't increase, the reason could be lack of TOC supportive leadership, lack of cultural change and poor solution design for increasing throughput.

TOC-Goldratt.com (2014) revealed that majorities of implementations of TOC have occurred in the US and the European countries with Indian cases being very few. Initially, a solution for the manufacturing sector, later TOC solutions for supply chain and distribution were designed, implemented and reviewed by academicians and industry professionals in distribution firms. TOC requires changes in policies and procedures and there could be instances of TOC failing to achieve its objectives, partially or in totality.

There is a lack of research highlighting such cases depicting several challenges involved in implementing. TOC implementation, in the FMCG supply chain, especially downstream, is, however, very different than applications in the upstream supply chain in several aspects. A successful adoption of TOC in downstream supply chain management in FMCG sector requires these structural differences and associated challenges to be identified, and the TOC methodology modified accordingly.

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