Supply Chain Insider

Supply Chain Insider

Volume 01, Issue 02, 2018. 30-11
Article Received: 16-09-2018
Accepted: 05-10-2018
Available Online: 10-10--2018
ISSN: 2617-7420 (Print), 2617-7420 (Online)
supplychaininsider.org

Supply Chain Engineering management and its application in modern business challenges

Sharfuddin Lisan
Bangladesh Institute of Human Resource Management (BIHRM), Supply Chain Department, Coordinator BISCM, Dhaka, Bangladesh

Abstract

Modern business is becoming more challenging as increasing complicated factors are influencing in our business decisions. Traditional experience based daily business decisions are not enough. A holistic approach of intra-disciplinary and practical analysis needed that will enable to combat the complex logistics challenges. So forth, Supply chain planning need to integrate business and engineering approaches, which will enable to use mathematical models and methods to determine the optimal strategies for managing the supply chain. Just as modern tech companies are using to customer behavior and offer advertising solution. Also, Supply Chain need to design a relatively complex system of interconnections and flows that move both goods and information across the globe. In order to accomplish that in a systematic way, we must turn to some reasonably precise and verifiable tools of analysis. Supply chain Engineering Management thus comes into light with a combination of best management and engineering tools to design and operate whole supply chain network

The worldwide exchange of goods, the mobility of the people and constant flow of information and ideas requires expertise about transport chains and how exchange process work, what design options are available and the ability to develop new methods to meet future challenges. The primary goal of supply chain management (SCM) is to achieve constant gains in competitive advantage and to organize the entire chain from strategy to implementation in the best possible way

SCEM for Current and Future Business challenges: Future business world is challenging. It is becoming more complex. To understand, tackle, combat and convert the challenges to opportunities both management and engineering tools are needed. Therefore to satisfy the industry demand, a holistic approach through interdisciplinary and practical knowledge needed that will enable for the complex logistics challenges. So forth, Supply chain planning need to integrate business and engineering approaches, focus on a company's internal organization and the alignment of SCM according to the company's operational strategy. Also it takes into account external company structures and explores supplier relationships as well as the management of relevant company networks. (Monczka & Handfield, 2005), (Mulani,2005)

What is Supply Chain Management?

Most of these activities involved in supply chain engineering also come under the rubric of *supply chain management* (SCM). Chopra and Meindl (2001) define supply chain management (SCM) as "the management of flows between and among supply chain stages to maximize supply chain prof- itability." A more complete definition of SCM by Simchi-Levi et al. (2003) states, "SCM is a set of approaches utilized to efficiently integrate suppliers, manufacturers, warehouses and stores, so that merchandise is produced and distributed at the right quantities to the right locations, and at the right time in order to minimize system-wide costs while satisfying service level requirements." Their definition brings out all the key aspects of SCM including the two conflicting objectives in SCM—minimizing supply chain costs while simultaneously maximizing customer service (Ravindran, & Warsing, 2017).

Meaning of Supply Chain Engineering:

Supply chain engineering encompasses the following key activities for the effective management of a supply chain (Ravindran, & Warsing, 2017):

1. Design of the supply chain network, namely the location of plants, DCs, warehouses, etc.
2. Procurement of raw materials and parts from suppliers to the manufacturing plants
3. Management of the production and inventory of finished goods to meet customer demands
4. Management of the transportation and logistics network to deliver the final products to the warehouses and retailers
5. Management of the integrity of the supply chain network by mitigating supply chain disruptions at all levels

Supply Chain Engineering management is a structured system of designing the supply chain network and the use of mathematical models and methods to determine the optimal strategies for managing the supply chain.

An important distinction, however, between Supply Chain Engineering (SCE) and Supply Chain Management (SCM) is the emphasis in SCE on the design of the supply chain network and the use of mathematical models and methods to determine the optimal strategies for managing the supply chain (Ravindran, & Warsing, 2017).

Now question may come why the use of word 'engineering' comes with supply chain? Design is the province of much of engineering. While some engineers design physical products (e.g., computers, automobiles, bridges), others design systems. Expert supply chain people design the whole system of their business using management and engineering tools. As they 'Design system' we call them 'Supply chain Engineer'. Let's discuss more about designing system

While the prevailing notion of a system is that it is "more than the sum of its parts," we can perhaps be a little clearer than that. One of the most concise and useful definitions of a system, in our minds, was offered some years ago by the Nobel-prize- winning economist Herb Simon, who stated that a system is comprised of a "number of parts that interact in a non-simple way." The "non-simple-ness" (i.e., complexity) of the interaction of the parts is the hallmark of a system, and what leads to the "more than the sum of its parts" notion of how a sys- tem operates (Simon, 1962).

Indeed, the design focus of some engineers goes beyond individual, discrete products to deal with systems, which are, collections of discrete entities that interact—often in "non-simple" ways—to produce a desired outcome. In some cases, those systems are comprised of entities that are physical and tangible, like the heating and air conditioning system designed by a mechanical engineer. In some cases, some aspects of the systems being designed are more conceptual in nature. Industrial engineers (IEs) design such systems. IE-related systems are typically comprised of a mix of tangible and intangible components. For example, production systems take physical inputs (e.g., materials and labor) and conceptual inputs (e.g., projected consumer demand, short-term and long-term business plans) to achieve an output of physical products that ultimately are sold to satisfy customers (Ravindran, 2008). Same as that in SCEM, distribution systems take as their input the products generated by the production system and, along with labor and other plans related to business goals and customer demand, coordinate the movement, storage, and trans- port of those products to ultimately satisfy that demand, hopefully on-time and in the right quantity (Goetschalckx, M. 2014). SCEM focus on the design of the *supply chain system*, which involves connecting many such production and distribution systems, often across wide geographic distances, in such a way that the businesses involved can ultimately satisfy consumer demand as efficiently as possible, resulting in maximum financial returns to those businesses connected to that supply chain system (Ravindran, & Warsing, 2017).

Having established that this SCEM is about design, let us be clear about another important issue, specifically that design always involves *tradeoffs*.

Indeed, in designing any product, or any system, you cannot get everything* (e.g., the highest customer service at the lowest cost). Therefore, another important aspect of SCEM is that, in presenting and developing the mathematical models that form the toolkit for supply chain design, we will continually refer back to the nature of the tradeoff(s) involved in the decision at hand. In some cases, we will formalize this decision tradeoff through the use of *multi-criteria decision making* (MCDM). This is a unique aspect of SCEM, something that distinguishes it and makes it a valuable resource in building and extending the understanding of this topic that touches so many individuals in so many ways around the globe. Where appropriate, we return to the MCDM framework, utilize the tools of MCDM to build decision models that explicitly account for the tradeoffs between competing objectives(Ravindran, & Warsing, 2017).

This emphasis on **mathematical models makes sense as in supply chain we need to design a relatively complex system of interconnections and flows that move both goods and information across the globe**. **In order to accomplish that** in a systematic way, **we must turn to some reasonably precise and verifiable tools of analysis.** Hence, our emphasis on supply chain design—ultimately what we hope to characterize as *optimal* design—**requires a hand-in-hand emphasis on mathematical models** (Ravindran, & Warsing, 2017) (Chan, Lettice & Durowoju, 2012).

Without doubt, commerce has become increasingly global in scope over the past several decades. This trend toward *globalization* has resulted in sup- ply chains whose footprint is often huge, spanning multiple countries and continents. Since products and funds now regularly flow across international boundaries, **engineering a global supply chain becomes impractical—or at least ill-advised—without the use of sophisticated mathematical models**
(Ravindran, & Warsing, 2017). The use of the methods of operations research and applied mathematics for supply chain engineering decisions is must for these many reasons (Goetschalckx, 2014).

<u>SCEM in Practice:</u>

So far we have tried to set logic for need of Supply chain engineering management. But how does it work. Well for that we can use an example. In this example we want to find a one of the ancient yet modern business question, what price will maximize my profit, considering the production supply side) cost and size of the potential customer.

Suppose we are manufacturing some product, let's call them I-Door.

Supply side: Our fixed cost is 50,0000. 75 BD Taka variable cost. Now if we want to calculate the cost of production, we simply can multiply with number of items to be produced. we can call it ‘ x’ In this case we can form a linier function:

<u>Cost = f(# made) =500,000 +75x</u>

At this cost, the more we produce, the cost will increase.

Demand side: Now, to set the expected price, we need to determine how many units to sell. To know the number of selling units, we need know the Market size/number of customers. We take we have 20,000 potential customers. Now, let’s assume, from our experience we see, for each BD taka price increases, we will lose 80 customers. In this situation, we formulate an equation.

<u>Unit sales= f(price)= 20,000-80p</u>

Where p is price, as the price increases, we will lose customers 80 customers for each taka increase. Another word we can say, Total demand in the market is 20000. This is the quantity the market can absorb if the price is zero. For every dollar increase in price the demand drops by 80 units. Combing the above two, you can see that demand at any price p can be expressed as 20000−80p (Rothkopf, 2018).

We want to find the profitability then. So we need to find the revenue and the cost and then subtract them. So what is the revenue? Well, that's simply going to be the number that we sell, which we just figured out from the demand function. 20,000 minus 80 times p, the price. And how much will I make. We'll multiply that by p. That's what I'm charging for each one. So that turns out to be 20000p minus 80 times p squared (Rothkopf, 2018).

Now the costs here are simply going to be this cost function. But instead of x, how many will we make. We'll make the amount that I expect to sell. So I'm just plugging that in for x. So it's 500,000 plus 75 times 20,000 minus 80p. That equals, if you carry it out, 2 million minus 6,000p. I want to find the profitability though, so I'm just going to subtract revenue minus the costs (Rothkopf, 2018).

So then,

Revenue= (20,000-80p)p =20,000p-$80p^2$

Costs=500,000 +75(20,000-80p)=2,00,000-6000p

And if we plug this out, we end up with this equation of minus 80 times p squared plus 26,000 times p minus 2 million. Looks like a quadratic.

Profit = Revenue-costs

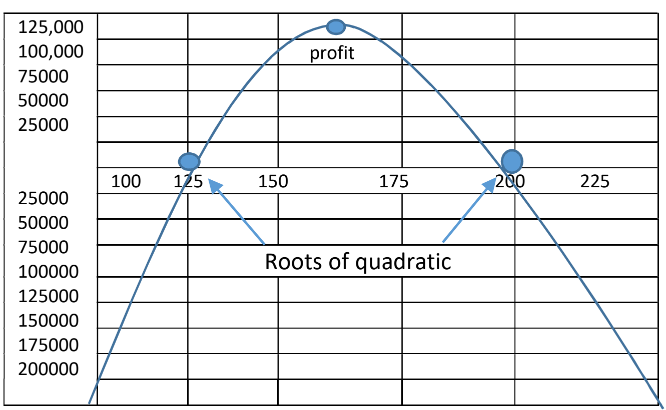
=20,000p-$80p^2$-(2,000,000-6000p)

= -$80p^2$+26,000p -2,000,000

And this is what's describing the profit function as a function of the p, the price. So this is a quadratic. So we can find the roots. If we want to find the roots of this, we are just going to use my quadratic equation, which we all know and love, where my a value is minus 80, my b value is 26,000, and my c value is minus 2 million. After plugging these, we can find the roots (Rothkopf, 2018).

$$r1, r2 = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

r 1= 125, r2=200, Average of those =162.5



R1 equals 125 and R2 equals 200. Now, what we've done is we've described this profit function. And it's a function of p, the price. So this chart is showing, on the horizontal axis, the price that I'm charging per Door, and on the vertical axis, the total profit. And we found these two routes. Now what we want to find really, is not the routes necessarily- those are important-- but I really want to find this point. Where do I maximize our profit. This R1 and R2 value are representation of a quadratic function, a upward curve. Whre does it the curve maximize? The average of R1 and R2, in other words, we can find profit starting from 125 and ending on 200, more than that we will lose the potential sell. The average of those at 162.5, we can maximize our profit.

To sum up:

Future business world is challenging. It is becoming more complex. To understand, tackle, combat and convert the challenges to opportunities both management and engineering tools are needed. Therefore the program will satisfy the industry demand through a holistic education approach through interdisciplinary and practical knowledge that prepares students for the complex logistics challenges (Cohen & Huchzermeier, 1999), (Fawcett, Ellram & Ogden, 2007).

So forth, there is need to integrate business and engineering approaches as combination of these approaches can help to us for ultimate planning and operation. It can focuses on a company's internal organization and the alignment of SCM according to the company's operational strategy. Also it takes into account external company structures and explores supplier relationships as well as the management of relevant company networks. Taking into account all these business needs, 'Supply chain engineering management' (SCEM) is a time befitted arena.

BIHRM Supply Chain- BISCM brings 'Supply chain engineering management (SCEM)'. It aims to provide an in depth understanding of the essential aspects in designing, maintaining and analyzing supply chains as well as teach the skills necessary to apply methods and tools to successfully and responsibly work in supply chain networks. Understand the strategic importance of supply chain engineering management in a global market.

References:

- Chan, H. K., Lettice, F., & Durowoju, O. A. (2012). Decision-making for supply chain integration: Supply chain integration. London: Springer.
- Chopra, S. and P. Meindl. (2010) Supply Chain Management, 4th edn. Upper Saddle River, NJ: Prentice, Hall.
- Chopra, S. and P. Meindl. 2010. Supply Chain Management, 4th edn. Upper Saddle
- Cohen, M. A. and A. Huchzermeier. (1999) Global supply chain management: A survey of research and applications. In Quantitative Models of Supply Chain Management, eds. S. Tayur, R. Ganeshan, and M. Magazine, pp. 671–702. Norwell, MA: Kluwer Academic Publishers.
- Cohen, M. A. and S. Mallik. (1997). Global supply chains: Research and applications. Production and Operations Management. 6(2): 193–210.
- Fawcett, S. E., L. M. Ellram, and J. A. Ogden. (2007). Supply Chain Management. Upper Saddle River, NJ: Pearson Prentice Hall.
- Ferre, J., J. Karlberg, and J. Hintlian. (2007) (March). Integration: The key to global success. Supply Chain Management Review. 11(2): 24–30.
- Friedman, T. L. (2005) The World Is Flat: A Brief History of the Twenty-First Century. New York: Farrar, Strauss and Giroux.
- Goetschalckx, M. (2014). Supply chain engineering. New York: Springer.
- Monczka, R. M., R. Trent, and R. Handfield. (2005). Purchasing and Supply Chain Management. Cincinnati, OH: ITP.
- Mulani, N. (2005) (May). High performance supply chain. In Production and Operations Research Conference. Chicago, IL.
- Ravindran, A. (2008). Operations research and management science handbook. Boca Raton: CRC Press.
- Ravindran, A. R., & Warsing, D. P. (2017). Supply chain engineering: Models and applications. Boca Raton, FL: CRC Press.
- River, NJ: Prentice, Hall.
- Rothkopf, Alexander (2018) ,Supply chain key concepts, Key Concepts Document, MIT Center for Transportation & Logistics, Cambridge
- Simchi-Levi, D., P. Kaminisky, and E. Simchi-Levi. 2003. Designing and Managing the
- Simon, Herbert A. (1962) Proceedings of the American Philosophical Society, Vol. 106, No. 6. (Dec. 12, 1962), pp. 467-482.
- Supply Chain, 2nd edn. New York: McGraw Hill.