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EVOLUTION OF SUPPLY CHAINS

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MASTER OF SCIENCE IN INTEGRATED SUPPLY CHAIN MANAGEMENT

By

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Abstract

This paper tracks the evolution and globalization of supply chain management and how it has evolved over the last hundred years. The evolution of supply chains, had made business transactions much more complex, although they are proving to be much more efficient than ever. The expansion of infrastructure and implementation of new processes in our supply chains are allowing supply chains across the globe to minimize costs while optimizing efficiencies. This seminar paper will explore not only how companies and organizations have implemented new functions within their respective supply chain, but also look into the future of further globalizing supply chain as a whole.
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Introduction

Starting in the 1980’s the term supply chain management became more and more relevant in business operations. Though supply chain hasn’t always been around, individuals had never used the phrase “Supply Chain Management” until 1983. The world has experienced vast change over the last few hundreds of years in the way we have used our supply chains and today they are becoming more complex than ever. What was once started as a simple term, “supply chain” now refers to many different cross functional terms that correlates to numerous business processes around the world. How has supply chain chained around the world in the last hundred years? Supply chain was once considered to only be relevant in local and regional areas and was never expected to expand past restrictive territories. With global expansion all around the world, improvements to infrastructures, and more communication avenues than needed, nations are experiencing true globalization.

Although supply chains are changing over time, we still follow many of the core processes in which were held in 1800/1900’s. Supply chains are however beginning to become much more complex than companies had ever imagined. In the 2000s, businesses began using multiple different functions within their supply chains to better utilize their resources and become more efficient than ever. Consumers around the world are becoming more and more involved with our supply chains and companies are finding ways to adapt by adding a multitude of functions in their supply chains to be more efficient than their competition. Companies now have an abundance of access to data networking that propels them to succeed if utilized correctly. Businesses are now focusing on avenues such as integration, operations, warehousing, distribution, and of course logistics and transportation along with other pivotal areas to alleviate an issue in their supply chain because of the complex nature of expansion. Covering and
understanding all functions within a supply chain allows managers around the world to better understand the complex nature of their operation and allows them to adjust to change, which is inevitable in today’s world. How many supply chain functions have been added since supply chain became relevant? Adapting and overcoming any barriers in a supply chain is what allows organizations to thrive and overcome any obstacles they face.

**Purpose of Study**

It goes without saying that supply chains around the world are inevitably changing and adapting as our world grows busier. Finding solutions to barriers in our supply chains will forever be an everlasting challenge, but companies are finding ways to mediate those barriers quite efficiently. The purpose of this paper is to exploit past scenarios that have undoubtably helped improved supply chain functions over the last hundred years or so. “The evolution of supply chain management has been characterized by an increasing degree of integration of separate tasks; a trend underlined in the 1960s as a key area for future productivity improvements since the system was highly fragmented. Although the logistics tasks have remained relatively similar, they initially consolidated into two distinct functions related to materials management and physical distribution during the 1970s and 1980s” (*The Evolution of Supply Chain Management*. (2021)). Corporations around the world are continuously finding even more ways to improve supply chains and globalization is just starting to take off. This paper will identify some of the key historical events in the evolution of supply chain and discuss the importance of those breakthroughs in regard to supply chain.
"Over the course of history supply chains have emerged to meet the diverse needs of human societies, to exploit natural resources and to enable humans to engage profitably in commerce and trade" (MacCarthy et al., 2016). How much change have supply chains over the course of the last few hundred years endured and how much more complex are supply chains now? It is without doubt that organizations differentiate their supply chain needs based on their current markets. For instance, furniture, clothing, or automobile markets that have been around for over a hundred years are finding ways to adapt, however they are still building of their core foundations and finding ways to alter their supply chains. Other markets that are fairly new and rely heavily on internet/social media platforms that are substantially different and operate on different grounds. Supply chains are evolving and more than ever, companies are finding ways to cut costs in manufacturing, production, warehousing, and of course shipping.

If somebody were to ask exactly how supply chains have evolved over the years, they would find there are too many answers to solely give credit to one answer. “From the introduction of new handling procedures to relying on ocean-going vessels, and from containerization to computerization, global supply chains are both more complex and more efficient than they’ve ever been” (Blume Global, n.d). In the early supply chain years, researchers saw the vast majority of businesses stay centralized in one small region. Fast forward to the industrial years when railroads were beginning to be laid and supply chains were almost immediately improved. The foundation and improvements of infrastructures allowed organizations to ship supplies further, faster, easier, and even cheaper.

 Corporations begin seeing even more improvements to supply chains in the early 1920s when the first semi-trucks were introduced in the United States. With that, warehouses also
began using wooden pallets, which laid a foundation in which we still use today. Warehousing and transportation instantly became far more efficient, and companies were able to utilize both of these improvements to improve the qualities of shipments they sent. Around the 1930s is when supply chain operations really began utilizing logistics and transportation methods to improve operations. Improvements in transportation were largely due to World War II. “At home, supply chains were necessary to manufacture military hardware and supplies, while abroad, it was essential to get supplies and support to troops as quickly as possible” (Blume Global, n.d). Companies found ways to consolidate their products and began shipping them quicker than they ever had.

One of the most important revolutions in global supply chain came in the 1950s when shipping containers were introduced to overseas shipments. The introduction of the shipment containers meant that they could be transported via sea, rail, or even truck and this ended up being a direct correlation to the vast increase in global/international business. Because businesses began using these containers in all three of the above shipping methods, they began saving money immediately. More improvements came in the 1960s when the above “containerization” era starting to come around full circle. Companies were now beginning to use these containers primarily on the road via freight (semi) because they found it was one of the fast methods of transportation in our nation.

The 1960s was also the era of “computerization” when IBM produced its first inventory management system and forecasting system. “Before the 1960s, logistics records and data were captured, sent and reported through paper. Data computerization started to streamline logistics and created opportunities in many areas including more accurate forecasting, better warehouse storage, truck routing and better inventory management (Blume Global, n.d). IBM still utilizes
different systems for inventory management today; one that I actually use (AS400) on a regular basis. The introduction of computerization and inventory management improved supply chains immensely and companies began utilizing their data subsets to improvise and improve where they could.

More improvements were made in the 1980’s and 90’s that supported the computerization era, however there weren’t any major breakthroughs in the supply chain world. During this era, however, companies began looking towards turning to full globalization. In present time, companies are manufacturing goods in numerous different countries and finding ways to outsource materials to cut costs where they can. Companies are truly finding ways to minimize costs in almost every facet of supply chain, however, these companies are learning that it comes with some risks. Because of the nature of globalization in present time, companies are finding issues with customs/tariffs, natural disasters (sea carriers), along with others. Companies are finding that the utilization of big data within our modern supply chains is great, though there are still ways to improve and become even more efficient.

**Analysis**

**Infrastructure Implementation and Improvement**

Supply chains, similar to any other business, relies heavily on continuous improvement. As we further move into a world full of technology, ongoing improvement becomes more vital within any organization. The immense increase in demand correlates to businesses relying frequently on logistics and transportation companies. Though companies do not have a direct correlation with infrastructure implementation, they do heavily rely on it. “The economy needs reliable infrastructure to connect supply chains and efficiently move goods and services across
borders. Infrastructure connects households across metropolitan areas to higher quality opportunities for employment, healthcare, and education” (Puentes, 2016). A quick drive on the freeway brings insight to the vast amounts of materials and finished goods that are being moved across the nation at a time. The utilization of infrastructure is now more relevant than ever and could prove to be even more important in the future.

Infrastructure is not only limited to highways and freeways, however. Over 83 percent of world economic growth in the next five years is expected to occur outside of the United States, and because of rapid globalization it will be concentrated in cities. This offers an unprecedented opportunity for American businesses to export more goods and services and to create high quality jobs at home. It also amplifies the importance of our seaports, air hubs, freight rail, border crossings, and truck routes, which move $51 billion worth of goods quickly and efficiently each day in the complex supply chains of the modern economy (Puentes, 2016). It should be heavily noted that infrastructure improvements are just as important for seaports and airports as they are in regard to highways/freeways. Without the introduction of cargo freight and airliners, globalization would not have evolved near as quick as it had.

Moving forward, countries must continue building upon their roads and other transit systems. Companies are seeing an overwhelming amount on demand increase which has a direct correlation to transit needs. “Disruption of these systems could impose potentially significant economic consequences in the form of delays and increased costs. To minimize such economic losses, it is important that critical infrastructure systems be resilient—that is, able to maintain and regain operational capacity in the aftermath of a major disruption, and to recover relatively quickly and at low cost following the disruption” (Narayanan, A. 2016). Numerous studies are now showing that countries that lack proper infrastructure are often times countries that have bad economies.
Globalization of Supply Chain

Globalization is better known as the movement of goods and services and the way a business operates at an international level. Businesses around the world, primarily in the United states, utilize globalization because it allows them to gather high quality products at lower costs. Many companies are finding that outsourcing products and services to provide their finished goods items are often cheaper from foreign countries. This includes labor costs of course, but none of this would be possible without the implementation of globalization and infrastructures.

With globalization, comes both positive and negative aspects. Companies of course can reach new customers around the world, expand sourcing opportunities, offer larger selections of goods and services, grow and expand the scope of their business, and of course save/cut money and improve profits. With that, globalization also has few downfalls. Organizations face many more complex situations that come with globalization, they face increased risk to their respective supply chains, have more competitors, face more legal issues, and even see more challenges in regard to data consumption because of the vast amounts of data analysis readily available to consumers/organizations.

Technology

As mentioned above, the 1960s were super important for companies and their respective supply chains. This was the era in which computerization and technology came to fruition and provided companies with an abundance of factual information that they could incorporate into there everyday processes to begin making their supply chains more efficient and accurate. The primary focus of computerization in respect to supply chain came in the format of inventory management, where companies could more accurately keep tabs on their inventory and monitor
specific products that were running low. Inventory management permeates decision-making in countless firms and has been extensively studied in the academic and corporate spheres (Rosa et al., 2010). The key questions - usually influenced by a variety of circumstances which inventory management seeks to answer are: when to order, how much to order and how much stock to keep as safety stock based on current lead times. Keeping ahead on inventory is crucial now and in the past, companies simply had to keep count of their inventory with pen and paper (though accurate, it was much more time consuming). Allowing an automated system allows the user to simply monitor inventory levels and utilize reorder points to order more product. Most systems also allow users to input current lead times in production and transportation so they are aware of when a product will be available for a consumer. “An analysis of the literature dealing with inventory management model selection shows that it originally focused on production and distribution environments in which demand and lead time tend to be more predictable or, in other words, in which it is easier to answer the questions of "what" and "how much" to order” (Wanke, 2014).

Though IBM was the first system to utilize and implement inventory management in the 1960’s, others are following suite. Though inventory management was arguably one of the most important breakthroughs in respect to supply chain and its correlation to technology, other systems are rapidly being implemented as well. “Fast and flexible low-cost data processing and information systems have transformed business operations. Reductions in production setup times, lot sizes and inventory levels have yielded substantial improvements in productivity and profitability. The continuing changes sweeping American business impose significant impacts on the distribution (or logistics) function within manufacturing and merchandising firms” (Gustin, et
al., 1994). All these improvements within respective organizations store valuable data and utilize it to make any improvements where necessary.

**Utilization of big data**

With the implementation of infrastructure, globalization, and of course technology, also came the introduction of “big data”. “Big data analytics is the use of advanced analytic techniques against very large, diverse big data sets that include structured, semi-structured and unstructured data, from different sources, and in different sizes from terabytes to zettabytes” ([Big data analytics](https://www.ibm.com/analytics/topics/analytics-big-data-analytics)). The use of this data for knowledgeable candidates can prove beneficial and give a competitive advantage over competition, but it is extremely important to note that the utilization of big data can also be misleading. Different organizations rely on different sub sets of valuable data, therefore the same data subsets might not be applicable to another organization. Gathering and implementing the data with knowledge on the subject is important. Supply chains often utilize this data in order to improve their systems in regard to demand planning, logistics and transportation methods, and of course inventory management. Big data analytics can help improve decision making, help predict future outcomes, and enhance business intelligence/operations.

For some companies, data is not the biggest obstacle to overcome. “The adoption barriers that organizations face most are managerial and cultural rather than related to data and technology. The leading obstacle to widespread analytics adoption is lack of understanding of how to use analytics to improve the business, according to almost four of 10 respondents” ([LaValle et al.](https://www.ambar.com)). Having valuable experience reading and understanding data is extremely valuable for companies that utilize big data because of this. With proper implementation on the
subject, organizations can really make themselves stand out above their competition because the data allows them to improve on all functions within their respective supply chains.

While using big data analytics, companies should focus on value added improvements. Focusing on the biggest and highest value added opportunities is something that often times proves beneficial for companies. Always having a strategic plan of attack while implementing processes gathered from big data is critical. “Don’t start doing analytics without strategic business direction, as those efforts are likely to stall. Not only does that waste resources, it risks creating widespread skepticism about the real value of analytics” (LaValle, et al 2011).

**Evolution of Supply Chains**

As this seminar paper has demonstrated, the evolution of supply chain over the last hundred years have shown immense improvements in the processes in which organizations follow. Having a thorough understanding of how the worlds supply chains have evolved over these past 100 years are immensely important. From the implementation of railroads and containers/barges all they way to the implementation of analytics and data, organizations are continuously looking for improvements in their processes that they use for their respective supply chains. Because most of our infrastructure and transportation issues are now becoming less relevant, organizations are not focusing on more value-added activities that relate to better utilization of those aspects.

Growth is inevitable and adapting to new markets will further demonstrate an organization’s ability to adjust to adversity in the future as well. The changes in supply chain today is taking place at a very fast pace, given the rapid advances in the application of SCM technologies, such as ERP, RFID, Robotics, Artificial Intelligence, IOT, big data and data
analytics. It is predicted that, in the future, SCM will run smoothly and effectively without any need for human interventions and result in huge job losses as we progress through what is termed as the fourth industrial revolution (Schwab, 2017).

Because the future of supply chain will continue to change as new processes are being added, we must maintain as much knowledge as we can and continue to look for any improvements we can, but not veer too far from reality. Globalization will slow down for no one, and companies will learn quickly that they cannot fall behind in terms of technology. “During our current age of globalization, and Industry 4.0 where changes in the means of production is happening in leaps and bounds due to constant innovation in information and other technology, along with unstable demand and supply, intense global competition, and other variables, the work environment is altering once again.”

**Discussion and Conclusion**

The evolution of supply chain might now more than ever be a little more predictable than in the past, however supply chain professionals must always be looking for ways to adapt. Though our railroads, highways, sea ports, and even airlines are more refined than ever, companies are always seeking ways to improve on value added activities and finding ways to minimize costs as much as possible. Days of looking for modes of transportation are slowly coming to an end as we have more ways than ever from logistics and transportation companies to ship products and services and low costs. Since 1960, companies are now more focused on value added processes like inventory control, proper demand planning, operations, and transportation.

In the coming years, we are more likely to see an increase in the utilization of self-propelled vehicles (without drivers) and the use of robots within warehouses. “The warehousing
industry urgently needs automation to do the tedious, laborious, and unsafe tasks that make it difficult to recruit and retain staff. While supply chains continue to expand at a rapid pace driven by growth in e-commerce, interest in jobs that are repetitive and even dangerous continues to decline. This trend has been further complicated by COVID-19 -- increased volume, an exacerbated labor shortage due to health concerns, and the inability to guarantee safety for workers without heavily disrupting operations have amplified the need for automation” (2020, August 9). With the immense increase in technology from the ’60s, future restrictions are virtually limitless. Companies are likely going to begin spending much more money in the future for “value added” opportunities with the hope it benefits their company long term. While we might still be uncertain of what our future holds in regard to supply chain, one thing is certain; supply chain will continue to evolve and the individuals who are in charge, must evolve with them.
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