

# 2

## Inside Supply Chains Large and Small

So, what is the best way to simply describe the supply chain and how it functions? To me, the supply chain is like music. It can be relatively simple or exceedingly complex, but in order for the supply chain to succeed, the steps must be precisely arranged and perfectly executed in exactly the right sequence. One grandson who is learning to play the piano began by mastering a few one-handed notes, then added the second hand, and two months later was playing a simple arrangement of “Jingle Bells.” At the opposite end of the musical spectrum is the Pittsburgh Symphony Orchestra performing Mahler’s haunting Ninth Symphony under the direction of its renowned Austrian conductor Manfred Honeck. When my grandson misses a note in a basic piano piece, it is obvious. If the more than one hundred musicians, horns, woodwinds, strings, and percussion of the Pittsburgh Symphony Orchestra do not mesh at the exact moment and maintain the same tempo, it is likewise obvious. The same is true for supply chains. Supply chains in some industries are relatively simple, and others complex, but like the notes in a musical composition, the steps must follow in the appropriate order and work seamlessly together to produce a successful end result. This chapter looks at how a supply chain works in theory, and then it describes several more recent innovations on the classic supply chain model. The critical role that transportation and logistics plays in the supply chain, with

particular emphasis on air cargo and maritime shipping, will appear in the next two chapters.

### **The Classic Supply Chain**

No two supply chains are the same. They differ from industry to industry, country to country, and contain variants which emphasize one or more ways to satisfy the ultimate customer. From my experience, there are six basic stages in most traditional supply chains:

- Stage One is devoted to design. Whether a design is dictated by the requirements of the final customer or springs from a new product idea that a company wishes to promote, the design stage engages the talents of many individuals and the creation of prototypes leading to a workable model.
- Stage Two takes place after a prototype and workable model are approved and one company or several companies are selected to manufacture and assemble the necessary components. Before proceeding, the manufacturer(s) must identify reliable and skilled suppliers and formalize the relationships with those suppliers and their sub-suppliers with legal contracts. Then they go to work.
- Stage Three involves the work of the suppliers and sub-suppliers in producing all the components that will eventually be assembled by the manufacturers into an item for general sale or for a specific customer.
- Stage Four is warehousing and distribution. During this stage, the products which have been manufactured are stored until needed to be made available to the ultimate customer. (Warehouses of today are nothing like the past. Chapter 8 examines how robotics is revolutionizing this stage.)

- Stage Five is transportation and logistics. Logistics involves the physical movement of products from the sub-suppliers and suppliers to the manufacturer to the warehouses and ultimately to the customer. The most common forms of transportation in a domestic setting are trucks, trains, and vans or smaller delivery vehicles. In global supply chains, it becomes more complicated, because products are normally moved via sea or air (as further explained in Chapters 3 and 4).
- Stage Six can encompass a wide a variety of post-consumer activities. Installation, ongoing customer service and repairs, and even the methods for returning defective products are just some of the activities at this stage. The goal, obviously, is to ultimately make the customer happy.

### ***Stage One: Invention and Design***

The initial stage of the supply chain takes place when (1) a company decides to innovate a new or improved product or service, or (2) a customer requests that a product be created to meet its requirements. From my experience, Stage One is the most important yet least understood of the six stages. Later, in Chapter 7, I tell the story of Henry Ford and how he revolutionized the classic supply chain a century ago. In Ford's day, the supply chain dictated the customer's choices. If you wanted a Ford automobile a hundred years ago, it came in one version (Model T) and one color (black). Today's customer is much more in charge of dictating what kinds of products and services they will buy. This new reality forces companies to constantly re-imagine and redesign their products in order to meet customer demands.

A key element in Stage One is deciding on the best materials. For example, there are a number of rare and exotic metals which are difficult to source globally but are critical components

in products such as electronics (described in greater detail in Chapter 20). The design stage includes thoroughly researching the availability of components and materials. Another aspect of design is creating products which have fewer, rather than more, components. Simplicity is always preferable. Why produce something comprising of twenty components if, with a better design, it can be done with eight components? This of course emphasizes the importance of incorporating the most up-to-date technologies in product design. Sadly, far too many companies continue to sell products which utilize outdated technologies. It is a mistake because it gives your competitors a chance to enter the picture and offer a redesigned product, thus potentially wreaking havoc on your existing market.

Finally, the design stage must not ignore costs. All of this innovation requires the development of prototypes. Prototypes by their nature are expensive to create because they are often composed of components which are not readily available. This is why in Chapter 7 I explain in detail the emergence of 3-D printing and why it is a revolutionary technology driving fundamental changes at this stage of the supply chain. Once a working prototype is developed, the final step is costing out the product, and then it is time to move on.

### ***Stage Two: Manufacturing***

After a product is designed and prototyped during Stage One, it is ready for a manufacturer to become involved and bid for the work. Chapter 19 provides specific examples of how the manufacturing process and supply chain can vary from industry to industry. In some industries, certain processes and injection molding are central; in others, they are nonexistent. During Stage Two, manufacturers must identify which suppliers of components they intend to work with. Manufacturers are not always free to select their own suppliers. There are times when their suppliers

are selected by the ultimate customer. Amazon reportedly maintains strict requirements as to which companies it will work with for the products it offers. For more sophisticated types of products, manufacturers act more as aggregators. By that I mean they source parts from many different suppliers, and then instead of manufacturing, they assemble either a major component or the entire machine itself for resale. Manufacturers selling to larger entities such as the “big-box” stores are regularly forced to compete on the basis of lowest per unit price as well as delivery capabilities in order to get the business.

### ***Stage Three: Suppliers and Sub-Suppliers***

Most manufacturers cannot exist without access to reliable suppliers and sub-suppliers which are essential to provide the components, parts, and raw materials necessary for production. Manufacturers with a long history in the industry and deep financial resources have an advantage over others because they are able to vet the capabilities of suppliers they have worked with over a long period of time.

One of the repercussions felt in China due to the COVID-19 crisis was that many small to medium-sized privately owned Chinese factories went bankrupt overnight. Chapter 5 gives insights into how this happened, but essentially, many Chinese suppliers who worked on very narrow profit margins were shocked when China’s supply chain stopped for a period of three months. Without capital, many were unable to continue operating and went out of business. Thus, suppliers and sub-suppliers now, more than in the past, are forced to convince the manufacturers they work with not just about their capabilities to produce a product but also of their underlying financial stability. Can a company withstand sudden interruptions to the supply chain caused by unexpected events like COVID-19? This reality means that sub-suppliers need to be more flexible, because for years,

merely producing a single part required very little imagination and flexibility. That time is gone. As big-box stores and companies like Amazon are increasingly catering to specific customer desires, greater flexibility is required from suppliers and sub-suppliers. While business was tough in the past, it is infinitely more demanding today.

### ***Stage Four: Warehousing and Distribution***

Warehouses today are no longer cavernous dusty buildings with shelves holding products until they are picked from the shelves by humans pushing carts. The best warehouses now resemble a futuristic city where robots are actively working alongside humans on a 24-hour basis through sophisticated algorithms and are responsible for organizing products in the warehouse so that they are immediately available and accessed. Companies like Amazon have been forced to do this because they have conditioned the ultimate customer to expect immediate fulfillment when a product is ordered. No longer is the average customer willing to wait weeks or even days for their order to be delivered; in some cases, they expect delivery the same day. This is why warehouses, now more commonly called “fulfillment centers,” make up a critical point in the supply chain for both commercial and individual customers.

### ***Stage Five: Transportation and Logistics***

International supply chains differ from domestic supply chains. In a domestic supply chain, products are generally moved from place to place by commercial trucks, vans, railroads, and, in some limited cases, by drones. This is possible because of the greatest public works project in American history—President Dwight D. Eisenhower’s decision to fund and construct a massive interstate highway system crisscrossing America. When Eisenhower first introduced the idea of a highway network enabling someone to

drive from coast to coast without stopping at a single traffic light, he was ridiculed. Sixty years ago, the only way to move products was to load them onto a train and then have trucks do the rest. But Ike had the last laugh. Under the United States-Mexico-Canada Agreement (USMCA), trains, trucks, and railroads are the methods by which products are transported within all of North America. International transport is different because when there is an ocean or very long distances between countries, there are really only two options for shipment: sea or air. Chapter 3 focuses on maritime as the dominant way to ship internationally. Chapter 4 explains how air cargo for a limited range of items is the other option.

### ***Stage Six: Customer Service/Installation/Repairs/Customer Fulfillment***

Stage Six is a key factor in why the supply chain has begun to transform itself in recent years, long before the COVID-19 crisis. The customer has suddenly emerged as the primary driving force in transforming retail, be it through e-commerce or brick-and-mortar locations. The supply chain is now under pressure to satisfy the customer by facilitating the prompt delivery of products; there is no choice. Stage Six includes changes demanded by more frequent product returns. If the customer is not happy, they demand satisfaction, and retailers must comply if they expect future business.

## **Designer Supply Chains**

So far, I have described the six basic stages in the functioning of any supply chain. These stages make up the traditional model, but because of e-commerce and the rapidly changing face of retail, there are other more specialized models (I like to refer to them as “designer supply chains”), such as e-commerce

supply chain platforms, sole company supply chains, and big-box retailer supply chains. Each can differ from the others in where they place more emphasis along the supply chain. By focusing on one aspect, those companies have achieved success.

### ***E-Commerce Supply Chain Platforms***

Fifty years from now, it will be fascinating to look back to what Amazon is—or was. Building this massive company from a garage in the state of Washington in 1995 is an amazing story. In its first twenty-five years, Amazon grew from the simple idea of selling books online into a vast multinational enterprise which is both a retailer and a technology leader. Beyond selling literally millions of items (twelve million according to a recent count), Amazon is more recently betting on the cloud, computing, and artificial intelligence (AI) platforms. The impact of Amazon on the basic supply chain model cannot be underestimated. Basically, its focus was always on an e-commerce supply chain platform. Unlike the big-box stores and other brick-and-mortar retailers, Amazon did not begin with a physical presence. It sold pretty much everything online. In a sense, Amazon seeks to market its own branded products as well as products made by just about any company looking for an e-market presence. Amazon, in my view, has become the ultimate disrupter of traditional mass scale retailing. At the time of this book being written, Amazon is the largest online global retailer by reported revenue and is one of the top three private employers in the United States. Amazon no longer rejects the value of physical presence, as evidenced by its purchase of Whole Foods Market in 2017. This step reversed its earlier focus on only being an online e-commerce retailer. Part of the success of Amazon is based upon its focus on Stages Four, Five, and Six of the supply chain described in this chapter. Amazon continues to construct vast warehouses or “fulfillment centers” throughout the United



States and around the world, plus aggressively embraces AI and the use of robots. Amazon was laughed at just a few years ago when it announced its intention to deliver products to customers via drones. Those who laughed were surprised to see how quickly that drone capability became a reality through the use of AI. For example, some shipments of vaccines during the COVID-19 crisis were delivered to largely inaccessible locations by drones. In short, Amazon recognized early on that if it could offer an essentially unlimited list of branded and unbranded products in an e-commerce setting, consumers in America (and around the world) would be tempted to abandon retail establishments in exchange for the promise of having furniture, food, toys, and electronics personally delivered to their homes within days, if not hours. The Amazon model of the supply chain promises to continue evolving in response to consumer trends.

### ***Sole Company Supply Chains***

Another variation on the traditional supply chain is the “sole company supply chain.” It reminds me of the classic line, “Everything old is new again,” which has been variously attributed: to ancient Chinese proverbs, Jonathan Swift, and Mark Twain, among others. I am not sure of the true origin of the phrase, but the concept reflects the sole company supply chain. In Chapter 7, the contributions made by Henry Ford in which he attempted to centralize his production into a vertical supply chain are used as an example. It was Ford’s dream to create the all-encompassing Rouge Plant, in which raw materials arrived on ships and were converted into components for the assembled automobiles which came out the other end of the plant. A hundred years after Henry Ford, Tesla seems to embrace the same idea. Tesla uses electric-powered rather than combustion engines and focuses the design and manufacture of

both the Tesla automobiles and their essential batteries in one massive complex. Elon Musk, Tesla's founder and CEO, has announced that the Tesla headquarters will move away from Palo Alto, California, and into new headquarters near Austin, Texas. Apparently, the company wants to focus on having the corporate headquarters and design operations located close to its manufacturing facilities as a way to gain economic scale and a laser-like focus on production. In addition, Tesla owns and operates its own retailers to sell its automobiles. It is a model that would make Henry Ford proud but promises to be highly disruptive to the traditional American automobile industry.

### ***Big-Box Retailer Supply Chains***

Unlike the e-commerce supply chain platform promoted by Amazon or the sole company chain of Tesla, the big-box retailers have moved the supply chain in a whole different direction. Retailers such as Walmart, Target, Staples, Home Depot, Dick's Sporting Goods, and dozens of others hope to dominate the retail arena by allowing customers to find everything they need in a particular market niche under one roof. Because of their immense size, these retailers have the ability to exert strong economic pressures on their suppliers to sell all types of goods at very low margins because they can guarantee high volumes of sales. Some big-box retailers like Sam's Club prefer to sell generic or store-brand products because they are cheaper to buy than national name-brand products. By owning their own warehouses, big-box retailers make it difficult for smaller retailers without such a broad network to compete. Big-box essentially means big stores, big warehouses, and an enormous selection of products, often from competing manufacturers. That is why a big-box store can offer not just products for sale, but often also include a grocery store, pharmacy, café, and a place to get your car's tires rotated, all under one roof. Due to the enormous

economic power exerted by online retailers like Amazon and others over the past decade, the big-box stores have embraced an online presence as a way to promote themselves and their customer services outside of their brick-and-mortar locations. By doing this, the big-box retailers are able to guarantee that their large stores will remain reliable profit centers.

What's next? Supply chains involved in the consumer marketplace will continue to evolve and change. At this point, three driving factors stand out. First, online shopping and e-commerce are here to stay. All retail stores, regardless of their size, must make their products more widely available other than in a physical setting if they hope to survive. This means that retailers need to develop an online presence to reach more customers. The next trend is that "the customer is king." No longer can retailers force customers to accept the goods that they think are in their customers' best interests. The ability to shop not just in person but also by browsing online has educated customers to realize that if they cannot get what they want in one location, it is easy enough to find it at another location. Finally, how products are made and where they are sourced will be changed by 3-D printing and the increased use of robots. These technological innovations, along with others described throughout this book, will accelerate massive changes in the retail marketplace as never before.