The Supply Chain of the Future

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Table of Content

Introduction.................................................................................................................. 5

PAST

Supply Chain Disasters................................................................................................. 8

FOXMEYER DRUG 1996............................................................................................... 8

Boeing 2007/2008......................................................................................................... 9

Mattel 2007.................................................................................................................. 10

Ford, GM, Chrysler 2000-2004.................................................................................. 11

Wal-Mart 2003-2009.................................................................................................. 12

PRESENT

Changing Trends in Supply Chain................................................................................. 16

Customer Service to Customer Relationship Management................................. 17

Adversarial to Collaborative Relationships............................................................... 18

Functional Focus to Process Integration................................................................. 18

Incremental Change to a Transformational Agile Strategy........................................ 19

Metrics......................................................................................................................... 21

Demand Management................................................................................................. 24
The Supply Chain of the Future

Talent Management ......................................................................................... 25

Vertical Integration to Virtual Integration ..................................................... 26

Information Hoarding to Information Sharing and Visibility .............. 27

FUTURE

Main challenges that the future shows ......................................................... 30

Cost .................................................................................................................. 30

Visibility ............................................................................................................ 31

Supply Chain Integration ............................................................................ 32

The Benefits of Supply Chain Integration ................................................. 33

The Obstacles to Supply Chain Integration .................................................. 34

Risk ..................................................................................................................... 41

Customer Intimacy ......................................................................................... 42

Globalization .................................................................................................... 42

Best Practices ................................................................................................... 44

Cost ..................................................................................................................... 44

Visibility ............................................................................................................ 45

Risk ..................................................................................................................... 47

Customer Intimacy ......................................................................................... 48

Globalization .................................................................................................... 49
Introduction

To be honest, I didn’t know much about Supply Chain Management before starting my studies at the Illinois Institute of Technology. From the very beginning I could feel a natural attraction for this topic, in part for its dynamic and always changing environment, in part for its global and cross border nature. As a young and motivated Industrial Engineer that just came from Barcelona, it is the perfect field to satisfy the insatiable thirst for knowledge that I felt.

The courses that it took helped me to achieve this goal: Supply Chain Management, Purchasing, Manufacturing and Logistics Systems, Export/Import, Applied Strategies for Competitive Enterprise, Strategic International Business, and Industrial Leadership.

I also joined associations related to the field such as APICS and CSCMP for the opportunities that their plant visits and meetings offered for a young man like me in terms of learning and knowledge, and also for the huge amount of folios, articles, magazines and discussions that constantly were published by them.

With all this background, when the time for choosing the Special Project came, I didn’t have to think that much. It was clear to me that I would do it about a topic directly related to Supply Chain Management. The unknown was the topic itself.

After extensive reflection I realized that I still didn’t know much about Supply Chain Management and, after reading some articles, the idea of its constant evolution strongly caught my attention. I wanted to know how future successful supply chains would be in some years, which problems would future supply chain executives have to face and how would they overcome these challenges. I wanted to know how this world would be right after I become a professional and start working in a supply chain management environment in a day-to-day basis.

Because of that, I decided to do my Special Project about the Supply Chain of the Future.
In this project, the research was separated in three big groups: Past, Present and Future.

The first part (Past) is based on past supply chain disasters that big organizations had to face, so that the reader can understand some of the catalyst for failure and its consequences.

The second part (Present) talks about the current practices that are already changing in the world of supply chain management and that are crucial to be met by executives in order to have a competitive position in the near future.

The third part (Future) tries to cover the main challenges that future supply chain managers –and probably me myself– will have to deal with. It also gives some insight on which ways will be the best ones to overcome these challenges.

This project tries to help people willing to know, in a fast way, how the future supply chain will look like, and to do that, very brilliant and helpful sources have been consulted, being the basis on which this research has been built.
PAST
Supply Chain Disasters

Before talking about the future, it is first necessary to understand the past. In this section it can be found some examples of how leaders of the industry are also able to make mistakes and, in some cases, bigger mistakes than one could ever imagine. There is an analysis of the reasons that drove companies to supply chain disasters and of the results and implications that these companies had to face at the end of their ambitious processes.

FOXMEYER DRUG 1996

This is perhaps the biggest supply chain disaster of the last 20 year. Back in 1996, Foxmeyer was the second largest wholesale drug distributor in the U.S., with sales over $5 billion dollars.

The end of the company came with the decision of starting an ambitious project that planned to renew both the IT systems and its distribution facilities. This project would require a new ERP system and also a highly automated Distribution Center in Ohio that would rely on a huge number of carousels for order picking and conveyors for moving the product.

Many negligent decisions were made before and during the project, starting with the bid of future contracts based on the over-estimations of cost reductions that would have had to come from the huge efficiency gains that the new systems were supposed to provide.

Moreover, it was SAP’s first big scale project into the world of high volume distribution and, as they were not as sophisticated as they are now, the system was not able to sustain the massive amount of orders.

Mysteriously, Foxmeyer ignored multiple warning signs. Many were the things that didn’t work before the launch of the system, but Foxmeyer’s managers ignored them, as none of the issues could by itself break the deal. The problem is that they didn’t see that the combination of many small problems created a impassable wall.
In addition, the order processing system wasn’t the only issue: the Distribution Center automation was also a mess. Nothing worked as it was supposed to. Foxmeyer had to deploy hundreds of workers to fix the huge amount of individual little issues, with frequent stops to set up the machines in the middle of intense demand and picking hours.

The combination of both the order processing system and distribution centers became a lethal poison that was already flowing through Foxmeyer’s veins. The customer would receive a partial order, and call to complain. Unable to see that the rest of the order had shipped on a later truck, the customer service department would authorize a replacement shipment for product already on its way to the customer. Tens of millions of dollars in unrecoverable shipping errors ensued.

After its bankruptcy, the main operating division of the once $5 billion company was acquired by its larger competitor, McKesson, for only $80 million.

**Boeing 2007/2008**

Following the trends that Supply Chain Management seemed to be evolving to, the aircraft leader decided to shift the production of their new model (Boeing 747, or Dreamliner) into a heavily integrated process, empowering its suppliers more than ever before and, by that, sharing risks with them and reducing Boeing’s costs. In return, suppliers would acquire and share Boeing’s intellectual property. First-tier suppliers were responsible not only for the production of a significant part of the aircraft, but also for its design and engineering. Lateral communication among suppliers was desired, and Boeing would just to act as a referee is any dispute appeared.

Boeing was seeking the reduction of cycle time for design and first shipment and they also wanted to reduce the number of parts and components, so the final assembly in Boeing’s facilities would take significantly less time than
before¹. With all these changes and improvements, Boeing expected to achieve billionaire savings.

However, the reality was far from the forecasts. It all started at the beginning of 2007, when delays in the supply of specific bolts caused a reconfiguration of the initial schedule program. Moreover, as first tier suppliers were given the responsibility of producing and assembling themselves big parts of the aircraft themselves, they outsourced part of the process, destabilizing the network of suppliers and also obstructing Boeing’s visibility over the whole process. Suppliers had to invest in new facilities and technologies. They had to face a completely new scenario, which helped increase the delays. On top of that, Boeing also had to face other issues such as machinists’ strikes. Finally, the first customer deliveries were done in 2010, about 2 years later than what was planned.

Billions in sales dollars were delayed, billions of dollars were invested to help suppliers and, no doubt Boeing lost potential revenue due to the collapse in the world economy.

**Mattel 2007**

In 2007, the world’s largest toy manufacturer suffered the consequences of globalization and non-traceable supply chain network and made US consumers mistrust “made in China” products.

At this time, Mattel had contracts in China with about 37² principal vendors who, at the same time, had their own contracts with their own suppliers. In total, estimations say that Mattel products were made by about 3,000 Chinese companies. The level of ramifications of the supply chain was so high that, if any issue occurred, it was almost impossible to find the point where it started. And bad things happen.

¹ Supply Chain Digest; Top Supply Chain Disasters 2009
² Mattel case study
It was found that some toys of the company exceeded the levels of lead in its paints set by law in US. Then, a massive recall of products started, and the tracking process of the bad suppliers too. Millions of toys were retaken by Mattel, whose stock price went from about $27 to $17 in the end of 2007.

It is worth saying that the entire recall process was accomplished in a very transparent and supportive way. After this recall, it was clear that knowing and having visibility over one company’s supply chain was a must; it also showed the hazards that companies were taking by moving their production overseas. Since this moment, Mattel felt the need of knowing and measuring its suppliers and its suppliers’ suppliers.

**Ford, GM, Chrysler 2000-2004**

At the beginning of the 2000s Ford, GM and Chrysler announced the launch of Covisint, an IT company that would be used by these three giants that would be used to execute most of their procurement spend, which was of about $300 billion at the time.

The announcement was followed with great expectations and the three automobile giants were confident that Covisint would have a huge positive impact in their companies and because of that they made an initial investment of about $250 million. Other companies such as Renault and Nissan followed this trend and created another company analog to Covisint. The three Detroit located companies claimed that just after 2 years Covisint would be able to go public. They were following a rather aggressive strategy.

The problems started right after it went public. Its stock market fell down just after two months of the initial announcement. Moreover, to make the platform work cost more than what one would expect, that is to say about $30 million every month on consultants alone by 2002, when annual revenues were in the $40 million range.

“It was a speed-to-market thing. Forget expenses, just go,” then VP of operations Rick Stephenson later said.
In addition, suppliers started to show reluctances, feeling marginalized and commoditized. Also, the three big car manufacturers realized that each of them needed personal modules at the platform. All these combined rocketed the costs of this project and a bunch of CEOs started to come and go, spending few weeks each of them at the top of the company. With this scenario, Covisint started to put its eyes on suppliers such as Delphi rather than buyers. In the end, Covisint was sold to Compuware and is now a successful provider of electronic messaging services in the health care and the automotive industries, as well as the public sector.

Ultimately, Covisint was sold to Compuware, and seems to be successful as a provider of electronic messaging services for a variety of industries – far from its original mission. The OEMs lost basically all of their investment, and reverted to previous or new proprietary procurement solutions.

At the same time, Ford which was considered the initial driver of Covisint, created a new e-procurement platform which was a complete disaster and the project was abandoned in 2004 after more than $200 million in spend.

**Wal-Mart 2003-2009**

This example is a controversial one. It is included in the section of “supply chain disasters”, but for the record, in this case Wal-Mart just paid the price of being pioneer and the company was able to continue with its project and, moreover, it introduced the advantages of RFID to the rest of the companies in the World. The question is: would Wal-Mart repeat the operation if they were in the same situation than 2003?

Wal-Mart first announced its intentions to have suppliers tag cases and pallets being shipped to its stores in June, 2003. Technology vendors spent big amounts of money on marketing and technology development to try to catch Wal-Mart’s attention. The goal: Thousands of suppliers needing to invest on tagging. On the other hand, consumer goods companies were divided. Some of them were supportive but concerned, meanwhile others just wanted the situation to go away.
The plan was to have Wal-Mart’s 100 top suppliers using RFID chips at the beginning of the project and, by the end of 2006, have it implemented to the rest of its suppliers. It didn’t work like this at all.

It is true that a few waves of several hundred suppliers did some tagging of products going to a few distribution centers in Texas, however, this amount of products were never significant. Wal-Mart’s story of how its suppliers would benefit changed several times in the first few years. A strong feel to the whole program never developed and partner companies were very reluctant to buy in the methodology. Consumer goods executives were saying that they didn’t mind piloting the technology, but they were not willing to cover the substantial costs linked to the operation.

Wal-Mart itself seemed to lose focus in 2006 as it moved on to other initiatives, when the company started seeing dramatically slower sales growth.

Wal-Mart decided to shift its RFID strategy in October 2007, taking the focus away from tagging cases going to Wal-Mart stores. According to SCDigest, major consumer goods companies stand that Wal-Mart no longer cares if they tag product or not. As a result, technology vendors have almost totally abandoned Wal-Mart focused strategies.

The many people who took manager or director positions with “RFID” titles at consumer goods manufacturers, which once looked like a great role to have, now try to find a spot back in IT or operations where they used to be, their services no longer needed for RFID at present. In the end, this rates as a top supply chain disaster because:

- Many years later, it is difficult to believe that Wal-Mart could have achieved any return from its investment in time and equipment for RFID to this point.
- Hundreds of suppliers also spent much time and cost in tagging cases and planning for the future, a future that turned out to be much later than they were expecting early in the program.
- It is very likely that technology companies invested hundreds of millions of dollars in technology and marketing for the Wal-Mart initiative and
the large wave of other retailers generally expected to come along for the ride once Wal-Mart proved a success.

However, as suggested at the beginning, this case can be seen as a needed sacrifice, worked out by these companies for the rest of the world, so that we can now make use of a widely evolved RFID technology.
PRESENT
Changing Trends in Supply Chain

It is accepted by almost everybody that Supply Chain Management is experiencing a fast reorganization. However, it is worth it to investigate which variables of the equation are currently showing the most significant transformations.\(^3\)

**Customer Service to Customer Relationship Management**

It may be the most discussed topic in supply chain and despite almost everybody has given their point of view it still shows great difficulties to SCM professionals. Changing the approach of how to interact with the people that pay and value one company’s products is not an easy thing to do, often involving high level management, beyond supply chain.

This new approach requires prioritizing among customers so that the limited resources and capacities of the company can be optimized and focused over strategic clients. As a consequence, companies must abandon the traditional method that consists on standardizing service for all customers. This method may seem the most cost effective one, but it is not the best one in terms of profit. Following the traditional approach has an intrinsic problem: it is easy to miss or be unable to meet the customer’s specific expectations by giving them all the same treat, so that the added-value perceived by a client is almost zero. Nowadays, customer service should try to give a unique response to each client, according to their specific requirements. The supplier has to be able to understand and meet its customer’s needs, achieving a collaborative partnership between both companies and, as a consequence, building long term relationships. With such a scenario, the supplier will be able to foresee its customers’ needs, being able to act fast and increasing customer’s satisfaction.

Suppliers will have to create different supply chains for every customer or group of similar customers. Moreover, an investment on inventory control software should be made, together with a scorecard for each customer that enables the supplier to stratify clients in levels of importance. And here comes the problem: money. This investment is the biggest wall preventing companies

\(^3\) CSCMP’s “Game-Changing Trends in Supply Chain”
from achieving the proper customer relationships. Nevertheless, companies that get stocked in the traditional customer service without any outstanding competitive advantage are doomed to gradually run out of suppliers.

**Adversarial to Collaborative Relationships**

This is another over-discussed topic that can drastically improve the operations results of a company in many different ways but still is seen with mistrust by many supply chain professionals. The objective of these collaborative relationships is to shift the traditional win-lose system into a win-win. Companies have to be aware that successful suppliers or successful customers are more likely to bring success to their own companies than poor customers or suppliers. So companies work together with their partners for their partners’ interests may experience improvements in lead times, supply and demand forecasting and level of stock, among others.

In this case, the biggest hitches are the lack of trust between parties and the need to adapt the each company to the other’s organization and culture. Companies have to abandon the pursuit of short-term objectives at expense of their partners.

To achieve long term successful collaborations both companies have to be deeply committed, understand the goals of the venture, set metrics that help and motivates each party, and create dispute solving mechanisms before starting working together so that any prospective issue or clash of interests can be handled in a standardized way, preventing any party from breaking the partnership. The win-win space has to be thoroughly defined, common goals have to be clear and based on this win-win zone and both parties have to paddle to the same direction. It is also important to share risks and rewards between the two organizations, as well as encourage mutual trust, setting long-term goals and sharing information so that a proper integration can be achieved and both companies win in terms of supply chain visibility. The information-sharing is the most technical part of the venture. Companies have to integrate their information systems so that they can share real time information and automatically adapt their demand and production planning.
avoiding redundancies, reducing waiting periods and cutting inventory costs, among others.

**Functional Focus to Process Integration**

It has been mentioned before the importance of integration with suppliers and customers. However, before reaching this step, it is necessary to achieve a strong and robust cross-functional integration within the same company. All functions in the company must be interconnected, so that supply chain, sales/marketing, finance, accounting, legal, human resources, customer service and all the different functions of the company work together to meet a shared goal.

Decision-making has to be a cross functional activity, the company has to enable the fast and real-time data availability from one department to another one, and cost reductions and increase of benefits have to be pursued in an overall way instead of just seeking the individual success for each department. The sum of the combined work has to be greater that the individual sums of each department. Unfortunately, there are some issues that companies have to face to reach the desired level of cross-functional integration:

- Every department has its own metrics and, in many cases, one department’s metrics collide with another department’s objectives. The typical example is the purchasing department buying a lot of raw materials to have better price while people from warehousing see how their shelves are filled more than what they desire and thus, the cost of stock rockets.

- Lack of current and modern tools is a big obstacle in terms of cross-functional integration. Companies must invest on information systems and software that enables the automatic share of information between departments and also reduces the inefficient manual work, human mistakes, redundancies and wasted time.

- Traditional approach in which companies try to create value through individual functional designs.
• Lack of supply chain strategy alignment with the firm’s strategy. Once again, purchasing people may think that their duty is to buy material at the possible lower price, while the overall strategy of the company is to deliver high quality product, being willing to accept a higher price in raw materials that can improve the final quality of the product.
• Companies may not have a developed culture of internal business collaboration and integration.

**Incremental Change to a Transformational Agile Strategy**

Top-performing firms are realizing that when they face a problem similar to a past issue they dealt with, a similar response can’t be applied, as it won’t work effectively in the current business environment. The constantly changing constrains and scenarios are proving that supply chains have to become more agile, with mechanisms that allow companies to act in front of completely new and unexpected issues, without necessarily depending on past scenarios. As Dr. John Bell and Dr. David Gilgor said in the CSCMP Game-Changing Trends in Supply Chain, agility can be defined as “*the firm’s ability to adjust tactics and operations within its supply chain to respond or adapt to changes, opportunities, or threats in its environment.*”

To achieve this level of agility and flexibility, companies have to invest on advanced analytics and modeling, based on a wide range of variables, whose combination reveals to the company the optimal operational parameters.

As said before, to reach the desired level of agility, it is crucial to coordinate one company’s operations with its suppliers and customers’ operations, creating a strongly integrated supply chain that allows them to quickly adjust their operations to sudden changes in demand or supply.

University of Tennessee defined five aspects that affect agility, which are alertness, accessibility, decisiveness, swiftness, and flexibility.

• Alertness is defined as “*the firm’s ability to quickly detect changes, opportunities and threats.*” It is the ability that companies have to
detect environmental, competitors, customers, suppliers, governmental changes at their early stages so that a fast response can be given.

- Accessibility is “the ability to access to relevant data.” According to the University of Tennessee, once a change is detected, the company has to be able to evaluate the important and significant data that they have, avoiding the data that will not add value, so that the response given by the company is based on empirical evidences. Companies must try to have access to wide information and data sources. This information has to be managed in a virtual way and shared by the supply chain members involved in the business.

- Decisiveness is defined as “using the available information to make decisions resolutely.” That is, the ability of one company to make good decisions, based on the information gathered previously, that will help the company to outcompete its rivals.

- Swiftness represents “the ability to implement decisions quickly.” Once the company has decided which is the strategy that they will follow, or the operational change that they will apply, companies have to be able to make it work as fast as possible, to take advantage of potential opportunities and start making profit before their competitors.

- Flexibility is “the ability to modify the range of tactics and operations to the extent needed.” Companies’ operations are constrained by some variables that determine the ranges in which the company will work. As an example, production is commonly constrained by the capacity of the machinery. The wider this range is, the bigger flexibility the company has. Companies have to increase the length of these ranges, so that their supply chains will be able to quickly absorb unpredicted changes on demand and supply, or sudden changes on the company’s strategy direction.

Intensive analytical and modeling research is more than important in this case. Artificial intelligence can give managers very complex real-time information. As an example, in a manufacturing company with a properly integrated supply chain, a good model can detect the variation of the price of a specific raw material that can mean a shortage of some commodities and an increment of
price of some products in some months; knowing that at the very early stage (alertness), with a fully integrated supply chain that provides the company of a total visibility (accessibility), the manufacturing company will be able to set an action plan to fight this prospect shortage (decisiveness), the model should also give some clues on how to produce or how to store the extra-amount of products, making the implementation of the final decision easier (swiftness). On top of that, if the model is well designed and it has the proper parameters, the output of the model may suggest that the manufacturing company’s capacity is not enough and they should outsource production to accumulate a safe amount of stock before the prices go up because of the shortage, at the same time, the model may proposes to choose another supplier for purchasing larger amounts of a commodity involved in the production process (flexibility).

However, the model is not the only important thing that will provide agility to a company: the employees are the key. Alertness, accessibility, decisiveness, swiftness and flexibility can be well used to define a human being’s agility, so by hiring and maintaining talented and agile workforce, the company is improving its agility in a natural way.

**Metrics**

The World is changing, markets are changing, companies are changing, supply chain management is changing... are metrics changing? They should definitely be changing too. With the fast evolution of the world in the past few years and with the overwhelming data availability, companies that use the same metrics than 5 or 10 years before are obsolete. With every change of strategy conducted by a company there should appear a new set of metrics different than the ones used just one month ago. Thanks to internet and software technologies, companies currently have access to endless amounts of data and information, and they have to be able to see the actual and potential value of each significant group of data, so that innovative and representative ways of measuring performance can be found. Finding the correct metrics is one of the top nightmares of executives, given that a bad choice in metrics can prevent
the company of performing at its highest level, losing ground in front of their competitors.

Dr. Paul Dittmann explains how a firm that worked with The Global Supply Chain Institute managed to avoid using non-representative or weak metrics. In this company, they made sure that these metrics satisfied some criteria:

- Stable and accurate data with few, large, random, or unexplainable swings.
- Understandable to everyone, along with a “line of sight” so that key personnel can see how their actions influence the metric.
- Designed so that they cannot be easily manipulated or gamed.
- Capable of drill-down analysis so that the root causes of changes are apparent.
- Clear cause and effect drivers.
- Easily accessible for relevant parties and available in clear reports that were developed and published with clear explanations.

The result of going through these steps was that in the end they only had to deal with a reduced number of high impact of Key Performance Indicators (KPIs). To be completely effective once the metrics are set, companies have to be very strict when documenting and monitoring their metrics and the rest of the data they produce.

Dr. Paul Dittmann stands that top performing firms use four principles to create a metrics framework:

1. Create the right cross-functional accountability.

   Responsibility has to be shared between all the functions that with their actions may directly affect the value of a metric. An example of incongruity is that in many firms, the sales department doesn’t share accountability for inventory metrics, even though sales play a significant role in the levels of inventory.
2. Establish a driver-based metrics framework.

Companies have to clearly know their main goals and select the specific metrics in a logical way and order, so that their combination drives to the fulfillment of these main goals and every individual in the firm has the ability to easily check if the objectives are being met. According to research made by Ernst & Young, a good way to find the best metrics for a desired outcome is to use statistical correlational analysis between the driver and the desired outcome. For this analysis companies not only have to use the intrinsic data of their company, but also the data that their customers and suppliers share with them.

3. Set appropriate goals

This is completely different to setting metrics. Most of companies usually compare their numbers with their own numbers the year before. This isn’t definitely the best practice because this way companies are just competing against themselves, and they are at risk of not paying attention and losing track of their competitors. To avoid that, firms have to compare their relative outcome variations to the ones of their competitors, as well as comparing it with the market fluctuations.

4. Ensure that metrics cannot be easily gamed.

Metrics have to be sacred, and the reporting managers have to be consistent and aware that, in order to be statistically consistent, they have to take into account all the SKUs, even though they have had unexpected or external problems with one of them and they feel the temptation of hiding it. This kind of actions can only hurt the company as they only distort the real performance of the firm. There has to be a sense of responsibility and a shared vision in which the firm’s interests are over individual interest because, in the end, a successful firm will make their employees successful too.
**Demand Management**

Effective forecasting comes attached with many benefits for the company: cost reduction, increase of sales, higher cash flow...

New technologies have allowed forecasting to evolve very fast in the last years. Nowadays, forecasts are made by scenario-based simulations that, apart from the classic parameters like sales or shipment history, include all kind of variables such as macroeconomic factors, and also special events that represent anomalies such as Halloween, Thanksgiving Day, etc. These models give reliable forecast for the short term, and quite a good idea of how the demand will be in the medium (3-6 months) and even long term (2-5 years).

As Dr. Mark Moon says, demand planning is now really going from the ability of high end forecasting processes to “sense and respond” to dynamic and evolving customer or customer behaviors. According to Ernst & Young, an extra-effort to find data is required, searching sources such as social media, public blogs, and relevant subscription based services, which provide this data (IRI, Neilsen, D&B, weather data, labor statistics...). Then, these data are then processed, forecasting the sales to customers at a given time and location (demand point). This demand signal will go through the planning and decision support, like S&OP and finally to the actual execution from sales order processing to manufacturing execution.

*Sales & Operations Planning (S&OP)*

This term is worth its own lines. When working properly, these cross-functional teams are fruit of effective function integration within a company, which is the biggest obstacle found for their creation and efficiency. They are created to drive internal collaboration between supply, demand, production and finance functions in order to business plans that achieve a balanced set of goals matching demand forecasts with supply forecasts.
**Talent Management**

Strategies may be good, but only the right people will bring it to the next level.

Dr. Paul Dittmann explains that the book *The New Supply Chain Agenda* contains the main competences that a good supply chain leader must have. These competencies are the following:

- Global orientation
- Cross-functional, cross-company understanding
- Leadership skills
- Technical and analytics savvy
- Superior business skills

To hire, develop and put in the correct place the right people is not an easy thing to do. However, until now, it was seen just as an extra cost instead of as a future opportunity. Companies that saw the importance of this aspect are now delighting and enjoying an excellent supply chain, filled with motivated people that have strongly absorbed the knowledge and the specifications that their job requires. This human asset is now giving them a competitive advantage almost impossible to copy by their rivals.

Firms have to hire the right people and, to detect them, the employer has to clearly know which are his company’s goals and objectives and also which are the skills and competences desired for the person that will have to fill a certain supply chain position in the future. The leading companies don’t limit their talent search within the borders of their country, so their talent basket is filled with people from all around the globe (Europe, China, India, Brazil, etc.).

As far as education and developing, outperforming firms are no longer training their people only about specific functional skills, but also about how to contribute to the overall outcomes of the company and how to help the rest of the employees with one’s expertise and knowledge. Firms have to create a professional development plan for every manager in the supply chain organization. Leading companies are focusing on post training programs to make sure their people apply the skills learned. Some of these firms line up
projects right after the education session so that the skills learned can be employed.

**Vertical Integration to Virtual Integration**

It looks like 3PLs are at the peak of their glory days. The increase of rough competition and demanding and sophisticated customers forced companies to progressively focus their activities and resources only in what they do really good, while outsourcing the activities that don’t give them a competitive advantage or just don’t add value to their customers. The question is: will the 3PLs continue increasing their market share, or the trend will just reverse on the next years?

The next chart\(^4\) shows the U.S. 3PL market from 1996 to 2013 (estimated).


So, while it is true that many firms preferred to stay vertically integrated to reduce reliance on others, to retain intellectual property, and to have a better controls of costs, quality and delivery, it is worth highlighting the fact that from 2003 to 2013, despite the global recession, the revenues generated by 3PLs in US have almost doubled. This is a clear indicator that companies are outsourcing significant parts of their operations.

Outsourcing operations can help to overcome the entry barrier created by a hypothetical initial capital investment. It also can mean the reduction of price and labor cost and can bring access to a larger customer base. However, virtual integration involves more risk, possible supply chain disruptions, fluctuating costs, variable quality and possibly an investment in supply chain relationships.

**Information Hoarding to Information Sharing and Visibility**

Dr. Randy Bradley stands that “firms are changing the game by linking together masses of information from multiple sources.” Companies have to ensure that they have access to real-time and cross-network information. It is no longer useful to work with the data generated within the four walls of the company. Because of that, integrated enterprise solutions will be required. This goes beyond a traditional ERP which function is to link the departments of the company. Nowadays, software has to be designed for cross-enterprise planning and execution. But make no mistake, ERP systems are just tools. Supply chain professionals will have to strengthen and develop their data network as this is the best way to keep current partners and to know new ones.

According to Dr. Randy Bradley, there are three other issues that must be taken into account to reach the desired level of visibility and data sharing:

**Big Data and Key Insights**

Avoid getting caught in the trap of focusing on and being inundated with Big Data. Remember that value resides in the insights (transformational information derived from the data) that can be leveraged for improved competitive advantage. Focus on those insights.

**Data Quality**

Determine what constitutes high-quality data by developing specific metrics for measuring quality of the information. Data is only good if it yields good, actionable insights. As such, the tools you use to store, aggregate, and analyze
the data play a vital role in determining the quality of your data. Remember, all analytics tools are not equally adept at handling certain types of data and their inherent anomalies.

**The Breadth of Your Anticipated Supply Chain Network**

Choose solutions that enable or enhance your ability to improve collaboration among members of your anticipated supply chain network. Consider what the breadth of your supply chain network (e.g., multi-echelon, domestic, global, multi-party) will look like and recognize that it, in essence, should be a starting point for determining your “new enterprise” (i.e., your new boundaries).
Main challenges that the future shows

After talking about the past and the present, it is time to take a glance to the future. More precisely, to the main challenges that successful supply chain managers will have to overcome to keep their companies afloat. In one of its surveys, IBM detected\(^5\) that there are 5 major challenges that will very likely occupy an important part of future supply chain professionals’ agenda. These challenges are: cost containment, visibility, risk, customer intimacy, and globalization.

**Cost**

Cost volatility can make supply chain management a random process. According to IBM, cost containment is supply chain executives’ number one responsibility. This obsession on controlling costs is translated on massive resources assigned to cost reduction initiatives. However, the volatility of the world has transformed this once methodical and continuous improvement process into a frenetic one. The massive amount of cost-related variables with unpredictable behavior such as exchange rates fluctuations, fast wage inflation in low-cost labor markets, brusque increases and decreases of commodity prices, bank and credit issues, shifts from insourcing to outsourcing to insourcing again some operations make the cost control a titanic, almost impossible mission if the company’s supply chain works as it used to do few years ago.

Supply chain managers can do nothing but constantly react and readjust the short term cost issues that they find. Such a simple thing as the fluctuation of the oil price make executives constantly think if they should subcontract a 3PL or even share loads with other companies.

These changes are happening in such a fast way that traditional supply chains cannot absorb them as fast as they should and they are becoming obsolete. Leading supply chains focus on agility and flexibility.

\(^5\) IBM The Smarter Supply Chain of the Future
Visibility

In the future, the amount of data flow will be exorbitant. The bright side is that companies will be able to track the product from end-to-end of the supply chain and to use the data to produce more accurate models, forecasts and decisions. The other side of the coin is that managing such a massive amount of data will be very challenging, and even more challenging will be the process of dismissing the useless data and choosing the insignificant portion that can be transformed in effective information to be used and to give competitive advantage to the firm.

Even though its proved benefits, supply chain managers don’t perceive the actual importance and potential of this topic. The collaboration required for getting the information in a continuous way and make decisions based on it prevent managers of facing this challenge. They are more concerned in strategy alignment, continuous process improvement and cost reduction. The first needed thing to have clear visibility is to achieve integration. Functional integration –the one within the walls of the company – ranks fourth on supply chain managers priority list, according to IBM. When talking about company-to-company integration, the situation is even worse, as it ranks on the 7th position of the priority list. Executives describe their efforts to improve external integration as ineffective and unprofitable compared with the rest of initiatives that they are undertaking.

Supply chain executives blame lack of visibility mostly on functional silos and on their lack of time to share information. They also claim that it is not worth the effort due to the absence of short term benefits and their mistrust on customers and suppliers to share information with them.

Truth be told, many supply chain managers are implementing some practices to improve visibility. Nonetheless, just a minority of supply chains are deeply committed on achieving it extensively. These supply chains hold successful companies that will outcompete their rivals in the future.

Such is the importance of this challenge and the lack of attention that it is receiving that the next section will be dedicated to give a little bit more of insight on supply chain integration:
Supply Chain Integration

Companies are working to integrate their internal functions and begin to understand the workings of the global systems in which they belong. Companies seem to start having a better understanding of the scope of supply chain integration.

Lawrence and Lorsch defined integration, in the year 2000, as “the quality of the state of collaboration that exists among departments that are required to achieve unity of effort by the demands of the environment”.

This definition refers to internal integration in a company, however, the current idea of integration also includes external entities that are also players of a given supply chain.

Bowersox, Closs and Stank (2001) have classified integration in a supply chain context in six different types. These are customer integration, internal integration, material and service supplier integration, technology and planning integration, measurement integration and relationship integration.

Stevens (2003) identified four stages of supply chain integration: stage I represented the fragmented operations within the individual company. Stage II focused on limited integration between adjacent functions, e.g. purchasing and materials control. Stage III required the internal integration of the end-to-end planning in the individual company and stage IV represented the true supply chain integration including upstream to suppliers and downstream to customers.

Lee (2000) outlines three dimensions of supply chain integration: information integration, coordination and resource sharing, and organizational relationship
linkage. Information integration refers to the sharing of information and knowledge among the members in the supply chain, including sales forecasts, production plans, inventory status and promotion plans. Coordination and resource sharing refers to the realignment of decisions and responsibility in the supply chain. Organizational relationship linkages include communication channels between the members in the supply chain, performance measurement and sharing of common visions and objectives.

The final structure and integration strategy will vary based on the internal structure of the firm, the market and the existing relationships within the supply chain. For example, in some cases it may be better to integrate only one key process with a given partner, while with another partner, the company may want to integrate more than one process.

The integration must be concentrated on sharing sales and forecast information, along with information on new products development, expansion plans, new processes, marketing, etc. in order to increase the profits for the entire supply chain participants, not just for the company itself: i.e. if you share demand forecast with your supplier, it will be able to adapt to your needs, reduce their inventory, which will lead to a cost reduction that, finally, will allow them to lower their prices.

The Benefits of Supply Chain Integration

Successful supply chain integration occurs when companies realize that supply chain management must become a part of the strategic planning process, in which final customer’s needs and the idea of the supply chain as a whole must determinate the objectives and policies.
When a company is able to overcome the barriers of integrating their supply chain, they will feel improvements from customer’s satisfaction to decrease of costs. These are some of the benefits that a good integrated supply chain will bring to the company:

- Increased market share and sales growth
- Reduced inventory levels
- Reduced SCM costs
- Decreased order cycle/fulfillment time
- Increased asset and capital utilization
- Improved delivery performance
- Flexibility in meeting/responding to customer requirements
- Improved return on assets and sales
- Increased forecast accuracy
- Reduced cash-to-cash cycle time

Combining these factors, a revenue growth would be motivated by an increase of responsiveness and flexibility occurring at a lower cost. As the demands of customers increase, and global competition grows, a good supply chain management enables companies to experience improvements in multiple measures of performance.

**The Obstacles to Supply Chain Integration**

Now that we have seen all the beneficial outcomes that an integrated supply chain can bring to a company, it would be interesting to analyze the obstacles that impede the process integration along the supply chain and even more interesting to talk about some remedial measures that can be implemented to overcome the mentioned obstacles.
A number of factors can impede external process integration along the supply chain, causing information distortion, longer cycle times, stock-outs, and bullwhip effect, resulting in higher overall cost and reduced customer service capabilities. Some of the biggest obstacles are the following:

**Silo Mentality**

There are companies that haven’t paid attention to the impact of their actions on the supply chain and on their long-term competitiveness. The mentality of those companies have led them to use the cheaper suppliers they could find, to pay no attention to the needs of the customers, and to sideline research and development. These decisions will be translated on a bad performance in terms of quality, cost, delivery and customer service that will hurt the whole supply chain.

When the silo effect appears between departments, the overall performance of the company will go down: the transportation manager will create an increase of safety stocks by trying to minimize the total annual cost of transportation, ordering less shipment with more product. Shortages can occur, damaging customer service’s levels.

To overcome the silo mentality, the company has to be able to set global supply chain goals and rewards for good overall performance. Decisions must be made considering the final impact on the entire firm, instead of focusing only on each department’s numbers. Managers must be able to integrate their processes internally and to create cross-functional teams with people from every department so that the overall outcome is beneficial for the company.
Lack of supply chain visibility

Lack of information visibility along the supply chain is a common supply chain process integration problem. Companies have to be able to synchronize their operations to the ones of their key partners and to ensure easy and fast flow of data and information among them.

Without supply chain visibility, each participant has to find data by themselves, with the increase of time spent that can mean lost of end customers and higher costs across the supply chain.

Lack of trust

Process integration between partners requires: companies will be opening their data bases to their partners. Companies with silo mentality or lack of information are more susceptible to experiment a lack of trust on their partners. Developing trust is not a thing that can be created in one day. It occurs over time and each participant earns trust offering commitment and building its reputation among the other businesses. Relationships based on trust end up being win-win for the participants.

Unfortunately, human nature doesn’t help to this cause. Until parties understand that it is in their own best interest to trust each other and share information, supply chain management success will be an uphill battle. For example, in the group project that I made in this course, I could see that Boeing has broken the walls between its suppliers and itself. For the development of the Dreamliner (Boeing 787) they made a complete integrated approach, in which they only held between the 33 and 35% of the work share. They empowered their suppliers by giving them all the information they
needed and letting their suppliers discuss between them, acting as a referee. This level of empowerment and Intellectual Property sharing made them win the support of the airline Japanese industry, while its competitor Airbus, that still worked in a more traditional way, was having serious problems to sell their new A380 to the Japanese market.

**Lack of knowledge**

While the idea of collaboration and process integration is somewhat old, technology has appeared on the stage more recently, allowing the process integration across the whole supply chain. Companies must realize that a successful integrated supply chain requires a high level of training and education of both partners and company’s employers. When education and training are promoted, innovation occurs.

**Activities causing the bullwhip effect**

The variability increases in moving up the supply chain from consumer to grocery store to distribution center to central warehouse to factory is known the *bullwhip effect*. The costs of this variability are high inefficient use of production and warehouse resources, high transportation costs, and high inventory costs, to name a few. In this section there are listed four major causes of bull whip effect and some methods to fight against this threat.

1) **Demand updating**

Whenever a buying firm places an order, the selling firm uses that information as a predictor of future demand. Based on this information, sellers update their demand forecasts and the corresponding orders placed with their suppliers. As lead time grows between orders placed and deliveries, then the
safety stock also grow and are included in any order as they pass up the supply chain. Thus, fluctuations are magnified as orders vary from period to period and as the review period change, causing frequent demand forecasting updating.

One solution to this problem is to make actual demand data available to the firm’s suppliers. Better yet, if all point-of-sale data are made available to the upstream tiers of suppliers, all supply chain members can then update their demand forecast less frequently, using the same data.

2) Order Batching

Typically, demand goes consuming inventory until a reorder point is reached when one customer places an order. Inventory levels, safety stocks, and the desire to order full truckloads may cause orders to be placed monthly or ever less often, or at a varying time intervals. This type of order batching amplifies demand variability and adds to a bullwhip effect. Another type of order batching can occur when sales people need to fill end-of-quarter or end-of-year sales quotas, or when buyers desire to finish year-end budget allotments.

As with forecast updating, information visibility and use of more frequent and smaller order sizes will tend to reduce the order batching problem.

3) Price Fluctuations

When suppliers have special promotions, quantity discounts, or other special price discounts, these price fluctuations results in significant forward buying activities on the part of buyers, who are stock up to take advantage of low price offers. Forward buying occurs between retailers and consumers, between distributors and retailers, and between manufacturers and
distributors due to pricing promotions at each stage of the supply chain, all contributing to erratic buying patterns and, consequently, the bullwhip effect. If these price discounts become common place, firms will stop buying when prices are undiscounted and buy only when discounted prices are offered, even further contributing to bullwhip effect. This may cause manufacturers to vary capacity by scheduling overtime, while they will have to find places to store stockpiles of inventory, paying more for transportation, and dealing with higher levels of inventory damage as inventory are held for longer periods.

The obvious measure to reduce the problem caused by fluctuating prices is to eliminate price discounting among the supply chain’s members. Manufacturers can reduce the forward buying by offering uniform wholesale prices to its customers. Instead of offering promotions, suppliers may offer everyday low prices, which must appear at the contract and must depend on the demand agreed on at the negotiation process. Another possibility could be to apply the discounts at the same period of the season so the demand and the forecasts wouldn’t be so erratic.

4) Rationing and Shortage Gaming

Rationing occurs when demand exceeds a supplier’s finished goods available; and, in this case, the supplier may allocate product in proportion to what buyers ordered. Thus, is the supply of goods is 75 percent of the total demand; buyers would be allocated 75 percent of what they ordered. When buyers figure out the relationship between their orders and what is supplied, they tend to inflate their orders to satisfy their real needs. This strategy is termed as shortage gaming. This implies a big issue in the supply chain, as the supplier struggles to keep up with these higher demand levels. When, on the
other hand, production capacity eventually equals demand and orders are filled completely, demand suddenly drops to less-than-realistic levels, as the buying firms try to unload their excess inventories. A good example is on the gasoline supplies; as soon as consumers think a shortage is looming, demand suddenly increases as people top off their tanks and otherwise try to stockpile gasoline, which itself creates a real shortage. When these types of shortages occur due to gaming, suppliers can no longer discern the true demand; and this result in unnecessary additions to production capacity, warehouse space and transportation investments.

One way to eliminate shortage gaming is for sellers to allocate short supplies based on the demand histories of customers. In that way, customers are essentially not allowed to exaggerate orders. And, of course, the sharing of capacity and inventory information between a manufacturer and its customers can also help to eliminate customers’ fears regarding shortages and eliminating gaming. A number of rational decisions on the part of buyers and suppliers tend to cause the bullwhip effect. When trading partners use the preceding strategies to reduce the bullwhip effect, the growth of information sharing, collaboration, and process integration occurs along the supply chain. Firms that strive to share data, forecasts, plans, and other information can significantly reduce the bullwhip effect.
Risk

Going back to the future challenges of Supply Chain Management, after visibility, risk management is another hot topic that is having an increasing impact on the way business is done and that leading companies will have to thoroughly try to hedge to avoid having to unexpectedly close their facilities overnight.

In general, all executives agree that this is an important issue. Nobody wants to see how a tropical storm at the opposite part of the world sends a ship –whose destination was Singapore– to the bottom of the ocean carrying some steel parts with it that happen to be a crucial element for a Singapore located manufacturing company that happens to be one of your tier suppliers in USA. At the same time, another form of risk called currency risk can make to despair purchasing people, when they see that the prices of the commodities needed are constantly fluctuating.

It looks like that it is not going to change in the future. Otherwise, it will probably increase. Globalization just added a very varied list of risk to the supply chain world, and I am sure that there are still many more to discover. Also, as companies outsource non-value-added operations and again they do it worldwide, supply chains are becoming more and more branched, with the exponential increase of risks that this fact carries, and the difficulty to manage this implacable growing risk.

Executives stand that the lack of standardized processes, the lack of data and the need for more sophisticated technologies are what is really preventing them from effective risk management. Despite a large number of companies already have programs to monitor some standards, leading firms will have to incorporate cutting-edge IT software and sophisticated models to avoid disruptive events and leverage cost fluctuations.
Customer Intimacy

By nature, companies tend to interact with suppliers more than customers. Let’s say that giving orders is more attractive than receiving commands.

According to IBM, rising customer demands ranks as the third highest supply chain challenge, and two out of every three companies struggle to accurately identify customer needs. However, despite the obvious need for customer interaction, companies tend to focus more on their suppliers than their customers. Eighty percent design products jointly with their suppliers, but only 68 percent do so with customers. Even in supply-chain planning, with all the demand-driven hype, only 53 percent of companies include customer input, while 63 percent invite supplier participation.

Despite the help that new technologies and information systems are bringing, working with customers is still a subject that needs more improvement. Companies have to include their customers in their demand planning, as customers are the ones that will provide the best and more accurate information in this aspect. Nevertheless, many companies see customer interaction just as a cost and time-consuming activity, making them to entirely ignore their customer’s opinion. These firms will have to change their minds or just perish under the weight of other customer-oriented competitors, as high stock levels will become unaffordable and customers will require specific value-added requirements on their orders that only customer-oriented companies will be able to fulfill, taking away sales from suppliers that turn their backs to their customers.

Globalization

Globalization is a vast source of opportunities for companies of any size and many industries. Connections are made in such a way that a supply chain may start in a country, circle the entire globe and finish in the very same country. Expansion to new markets with its intrinsic growth, cost reduction driven by lower labor wages, higher quality imported from high specialized countries,
movement of human resources from country to country... The benefits provided by globalization seem to be endless.

Given the growing interdependence among economies worldwide, it’s no surprise that globalization ranks as a top supply chain challenge. However, it has its own problems: according to IBM, many companies are encountering issues with global sourcing, including unreliable delivery (65 percent), longer lead times (61 percent) and poor quality (61 percent), with an additional 14 percent of respondents anticipating such problems within the next three years.

From the company perspective, the advantages of globalization are greater than the obstacle that it brings. Companies’ profits are, in general, bigger. This increase in benefits is rather linked to the growth of sales than to a reduction of costs which in general lines have increased. This gives a new opportunity to supply chain people, as this sales growth came with a lot of room for improvement in terms of efficiency.
Best Practices

As we have just seen, the challenges that future presents in terms of supply chain management don’t have an obvious solution. Every organization is unique and it has its own strengths and weaknesses. However, there is a set of best practices and some scenarios and tools with which companies maximize their probabilities of success and increase their ability to achieve competitive advantages. In general terms, future organizations will have to excel and try to:

– Make optimal use of **New Technologies** and Gadgets.
– **Be connected**, not only to your direct suppliers/customers, but from the very first raw material to the final consumer
– Use **Advanced Analytics and Modeling** that Help your Company to Deal with the Fast Changing Environment, Risks and Constraints

IBM⁶ gives a lot of light to these issues, in which the study will be focused again on the challenges mentioned before, which are: cost, visibility, risk, customer intimacy, and globalization.

**Cost**

The best way to react against cost volatility will be through achieving a high degree of flexibility in your supply chain. Future supply chains will rely on a high interconnected network of partner companies that will work together to absorb sudden changes on demand and supply. To make proper use of resources, the supply chain of the future will have to invest on smart modeling and simulations that allow supply chain executives to see the cost, service level, time and quality according to the different possible scenarios.

Future software and information systems should be able to, having processed some parameters set by customers such as volume of demand, country or delivery time, calculate the optimal supplier that meets the specifications linked to each customer. If any problem occurs during the transportation step, thanks to tracking systems the system should be able to immediately notice

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⁶ IBM The Smarter Supply Chain of the Future
the issue, or even foresee possible disruptions and act quickly, asking for new orders and notifying customers and suppliers immediately.

According to IBM, there are some specific solutions that will help to achieve the desired degree of cost flexibility.

In terms of new technologies usage:
- Sensor-based solutions to reduce inventory costs with increased visibility.
- Production and distribution process detectors to monitor and control energy usage and waste.

In terms of internal and external connection:
- Agile, on demand network of suppliers, contract manufacturers, service providers and other (financial and regulatory) constituents.
- Outsourcing non-differentiating functions to share risks across the global network.

In terms of advanced analytics and modeling:
- Scenario-based operational analysis.
- Simulation models and analyzers to evaluate flexibility factors — service levels, costs, time, quality — with inventory synchronization.

**Visibility**

Again, it is vital for a healthy supply chain running to know every single action that occurs in the process. This requires time and commitment at each level of the organizations, and also at each level of the supply chain. It has to be seen as a win-win partnership that, if implemented properly, can have a huge positive impact across all the companies involved. Every partner has to contribute, and all of them have to show the same amount of effort and sacrifice.
Once the commitment is evident, the information of a visible supply chain has to come from the objects such as trucks, pallets, store shelves and even single products moving through the supply chain.

Visibility will not stop only at the level of product and shipment tracking. It will also involve environment visibility, gathering and using information of market trends, climate phenomenon and patterns, political unrest, economic indicators, new laws and regulations, etc.

Future visible supply chains will deal with too much information, and organizations will have to make the best of it through modeling and analytics.

According to IBM, there are some specific solutions that will help to increase visibility through the supply chain.

In terms of new technologies usage:
- Event-driven monitors and alert detection based upon thresholds and tolerances
- Smart devices and sensors (RFID) to capture real time visibility: forecasts/orders, schedules/commitments, pipeline inventory, shipment lifecycle status

In terms of internal and external connection:
- ERP to ERP to ERP integration.
- Integrated forecasting, orders and point-of-sale.

In terms of advanced analytics and modeling:
- Service-level analysis with inventory optimization.
- Pipeline inventory forecasting and analytics.
**Risk**

As we have seen before, risk has many faces and it is intrinsic to most of the operations in which companies are involved. From unlikely terrorist attacks to higher level of certain restricted material in the final product, passing through political unrest, economic and currency risk, climate risk...

Also, risk is something that single companies cannot control by themselves, and unexpected events at the other part of the world, like an earthquake in Japan, can destroy entire industries’ production plans and demand fulfillment levels.

Because of this randomness, future supply chains have to see risk as part of the business and, instead of trying to control it, leading organizations will have to develop advanced modeling and analytical methodologies that help them to track and anticipate disasters, have plan B, C, D,..., Z,...,ZY, ZZ, and be able to detect anomalies with time enough to react properly and avoid disruptions.

A proper connectivity between firms will also be crucial in terms of risk management so that a quick response can be given and companies get to share small amounts of risk, instead of seeing the crack at one step of the supply chain that will drag with it many other companies involved.

According to IBM, there are some specific solutions of Risk Management that will help to minimize supply chain disasters.

In terms of new technologies usage:

- Sensor solutions for monitoring product condition through the supply chain to help ensure product quality.
- Weather intelligence and sensors for predictive analysis for supply planning, shipment routing and allocations.

In terms of internal and external connection:

- Resilient supply chain network design at strategic level.
- Compliance strategies and policies with suppliers, service providers, contract manufacturers.
In terms of advanced analytics and modeling:

- Probability-based risk assessment and predictive analysis: likelihood, severity, ease of detection for key risk factors with mitigation policies and procedures.
- Disaster response simulation models.

**Customer Intimacy**

Future top supply chain managers will be able to succeed on knowing and understanding customer’s needs and expectations.

It will be not enough to interact with the customer to provide good delivery conditions. The best supply chains of the future will be customer oriented ones. Customer will have to be involved throughout the whole product lifecycle, from the first steps of research and development, to product end-of-life.

Companies will have to be able to analyze market signals and trends through customer collaboration. They will also have to use analytics to discover new and current appealing customers.

According to IBM, there are some best practices that will help companies to stay in constant constructive interaction with their customers.

In terms of new technologies usage:
- Sensor solutions to signal retail shelf requirements.

In terms of internal and external connection:
- Customer collaboration throughout all supply chain processes.
- Networked S&OP with optimized forecast, buy/sell decision support.

In terms of advanced analytics and modeling:
- Customer segmentation of product/service portfolio: profitability; geography/market; product/service mix.
- Simulation models of customer behavior, buying patterns and market penetration applied to planning and operations volumes.
Globalization

As discussed before, in general terms, globalization means an opportunity to grow for many companies, increasing profit throughout revenue. However, this expansion usually implies a step back in terms of efficiencies and redundancies. There is a lot of room for supply chain optimization in global activities. The clue lies in internal and external integration.

Visibility will help companies to detect and fight global bottlenecks, quality problems, at the same time that flexible supply chains will not be tied to a specific region or country.

According to IBM, there are some best practices that will help companies to optimize and improve global supply chains.

In terms of new technologies usage:
  - Sense-and-respond event management for end-to-end supply chain activities.
  - Real-time interconnection with sensors to detect product and shipment locations worldwide.

In terms of internal and external connection:
  - End-to-end supply chain collaboration tools and methods.

In terms of advanced analytics and modeling:
  - Integrated dashboards for KPIs and event alerts, driven by business rules.
  - Demand, supply and distribution network planning and execution.
Sustainability

In a project like this, it is vital to talk about sustainability, and to give it its own title in the table of contents because it cannot only be seen as a future challenge. It is a lot of more than this. Our activities will determine the state of the world that we leave for next generations. Growing and profitability are always welcome, but not at expenses of the planet’s health.

Supply chain sustainability’s mission is to standardize practices, methods and decision making in terms of environmental, risk and waste. Governments all around the world had long before set specific regulations with the intention of restricting and constraining companies’ activities increase in terms of environmental care. Today, developed countries are even hardening these laws and specifications. However, the real opportunity to change lies in developing countries.

During the last decade thousands of organizations shifted their production to developing countries such as China, India, Thailand, Brazil, etc. This movement was generally triggered by the significant reduction of labor costs, but in many other cases it was encouraged by very permissive laws or, in some cases, inexistent regulations in terms of emission and pollution. This represents quite an unethical behavior given that, a large number of these organizations wouldn’t be allowed to produce following the processes that they use in the developing countries, or they wouldn’t be able to produce at such a high volume of outcome than they would in their home country due to quality requirements and inspections.

Organizations have to stop seeing sustainable procedures as a cost driver. On the contrary, companies with strict sustainable supply chain policies will see how their investments on this matter will be the catalyst of revenue and profit growth in the future. The consumer pressure over eco-friendly products is increasing constantly as we are witnesses of how the environment is rapidly changing under the action of human being. With this trend, and with the constant public pressure on them, big companies will pursue eco-friendly programs in their production and, in addition, they will prefer to make
business with suppliers that show a high level of maturity in terms of supply chain sustainability.

Collaboration between all involved parties will be necessary. That is to say, supply chain integration is a requirement in order to achieve a good level of supply chain sustainability. It is also very important the visibility through all the supply chain so that companies can identify the origin of the products and the conditions under which it was produced. Distribution will also be a key factor, so that organizations will have to reduce the gasoline consumption and CO₂ emission by sharing trucks so that they are loaded to their full capacity. Sometimes it can involve creating partnerships even with direct competitors so that both companies can mutually obtain benefice from a common situation.

There is still a lot to do in terms of sustainability. Nevertheless, the first companies that take this train will be the first ones to start noticing the benefits of a responsible and mature supply chain management.
Summary

Supply Chain Management is constantly evolving. This is the first finding that should be mentioned.

Great past Supply Chain disasters were a consequence of negligent managerial control and decisions, lack of visibility over the supply chain, lack of trust and exchange of information between partners...

Many of these factors are still damaging supply chain, but there is a shared opinion that some old practices have to change, and most of them are already changing.

- To start with, companies are realizing that they can no longer give the same treat to all customers, what they really need to do is to focus their resources and capacity to serve strategic clients in a unique way.
- Organizations also see that they can no longer see their partners as their enemies. Collaborative partnerships are desired in which both parties look for a win-win situation. This has to be based on mutual trust, and this trust will lead to the information sharing and to a wider visibility, understanding and flexibility of the supply chain.
- Still talking about integration, external integration cannot be achieved without having previously built a solid internal integration. This old bad practice still remains in organizations. Silos have to disappear, information has to naturally flow through the company in a real time frame. Departmental success is no longer the best option, as the really desired outcome is the company’s overall profit.
- Another changing aspect is that supply chains have to become more agile so that they can be ready to foresee and respond quickly in front of unexpected issues and potential disruptions.
- Metrics have to change too. They have to be consistent and aligned with the company’s strategy, changing with every switch of direction of the organization. Metrics have to be clear, easy to understand, looking for the overall benefit of the company and difficult to be gamed or cheated.
- Demand Management is also evolving. It has to take advantage of all the possibilities that new technologies offer. New parameters have to be
added in the equation including macroeconomic factors, creating scenario-based simulations. Sales & Operations Planning has a big role to play in this field.

- As far as talent management, future supply chain managers have to have some the following skills: global orientation, cross-functional, cross-company understanding, leadership skills, technical and analytics savvy, superior business skills.
- 3PLs have a very important role to play in the future, so that companies will spend their resources and capacity in value added operations and will outsource activities in which they don’t have a competitive advantage.
- To make all these listed changes real, it is crucial that firms start sharing information and helping each other, understanding that a successful trusted partner is very likely to bring success to your own company.

Looking at the future, there are 5 challenges that stand out as the most decisive. They are: cost, visibility, risk, customer intimacy, and globalization.

- **Cost**: because of the volatility of the environment, supply chain management is becoming a random process in many industries. Executives are losing the initiative and they start to readjust and react in front of sudden changes of parameters such as currency exchange rates, fast wage inflation in low-cost labor markets, brusque fluctuations on commodity prices, etc.
- **Visibility**: this is a challenge that can clearly make the difference between competitors. However, supply chain executives are not able to give it the time and commitment that it requires. Future complex networks will be full of data and information, and new technologies will allow companies to select the data they need in order to go one step over their rivals. Visibility can be divided in two: internal (between the company’s departments) and external (between partners) visibility. The process to achieve a good degree of visibility is called *supply chain integration*. It requires a high degree of cooperation, coordination, trust and managerial commitment from all the parties involved, and this is why it is so difficult and challenging. Firms able to do it properly will surely hold a strong position in the market.
- **Risk**: Current facts such as globalization or the proliferation of complex supply chain networks are parameters that have increased the amount of risk involved along the supply chain. Moreover, this risk is very likely to keep growing in the future. The lack of standardized processes and the still underdeveloped data processing systems and technologies make very difficult to prevent risky events and to react against them when bad things happen.

- **Customer intimacy**: organizations tend to interact with suppliers more than with customers. Successful organizations will have to be able to get the customer involved not only in terms of demand planning, but also in the whole process, from product development to the final consumer. Their opinion is crucial. Companies will have to be *customer-oriented*, knowing the needs and the value added activities for each client. With that, they will increase demand and reduce costs in terms of inventory.

- **Globalization**: this is the last of the future massive challenges that companies will have to face in the future. It doesn’t matter if the company is just focused on the local market and all their suppliers are local. The availability of similar products made in different parts of the world forces any company of any country at least to keep informed of raw materials cost fluctuations, political events or natural disasters. Globalization offers the opportunity to grow and increase benefits by settling in new markets. This growth is often driven by more sales, usually implies losing efficiency and also room for improvement.

So, after identifying all these big challenges, the question is: how do we fight them? There is not an easy answer for each of them and, as we are talking about future events, we don’t know with a 100% of certainty how supply chain management will evolve. In general organizations will have to excel in the three following categories:

- Make optimal use of **New Technologies** and Gadgets.
- **Be connected**, not only to your direct suppliers/customers, but from the very first raw material to the final consumer
- Use **Advanced Analytics and Modeling** that Help your Company to Deal with the Fast Changing Environment, Risks and Constraints.
There are also some specific tips and best practices to overcome each one of the future challenges mentioned before:

- **Cost**: the best way to fight cost volatility will be achieving a high level of supply chain agility and flexibility. Cost fluctuations will have to be absorbed by the whole supply chain instead of being concentrated in one or small group of companies. This will become on a healthy supply chain with good synergies between parties. Future technologies will have to be able to calculate the optimal product path based on a wide range of parameters affecting decision making.

- **Visibility**: it will require a lot of commitment from all parties involved. With a high level of commitment, firms will have to invest on tracking devices to immediately locate any product moving through the supply chain. Environment visibility will be also very important in terms of preventing disruptive events. Finally, to properly process the endless amount of data, modeling and analytics will be very important to not get lost in the middle of the information.

- **Risk**: there is a high level of randomness intrinsic in this challenge. Companies will have to accept risk as part of the business and, instead of trying to control it, develop advanced modeling and analytical methodologies that help them to anticipate disasters and to act properly when they occur, creating scenario based situations. Connectivity and communication between companies will be crucial.

- **Customer intimacy**: best supply chains of the future will be the customer oriented ones. Customer will have to be involved throughout the whole product lifecycle, from the first steps of research and development, to product end-of-life. Deep analysis of market trend will be decisive.

- **Globalization**: as said before, globalization came fast and full of inefficiencies. Visibility will help companies to detect and fight global bottlenecks, quality problems, at the same time that flexible supply chains will not be tied to a specific region or country. End-to-end product tracking, collaboration and scenario based models will be the way to handle this challenge.

Finally, sustainability deserved its own section. Growth is desired but not at any cost. Supply chain practices have to be standardized and there have to be
common regulations in terms of environmental care. Ethical practices have to be encouraged and rewarded. Developing countries will eventually harden their environmental regulations and companies have to be ready for that. Sustainable procedures have to be seen as a profit driver rather than a cost driver. In the future, environmental-care companies will see how their revenue increases as there is a rising pressure for eco-friendly products. Under this public pressure, big companies will choose suppliers with developed supply chain sustainability programs and practices.

Of course collaboration between parties will be necessary, but the first companies to apply strict and serious sustainable procedures will be the first to collect their fruits.
Conclusion

What I have personally learned is that there are an infinite number of factors and parameters playing at the same time, and the successful supply chain managers will have to be people with a very wide and creative point of view of the world. It is crucial that these executives have a cross-functional formation as supply chain may not be seen just as another department inside the company anymore. Supply chain has to be the spine of the organization, the meeting point in which specialists from all branches of the organization discuss looking for the overall profit. Future successful companies will have to be operations based and customer focused.

Moreover, Supply chain has to be the glue and the ties between companies. It has to be the banner of collaborative partnerships, building win-win situations and contributing on a more optimized and efficient flow of products through the world.

Supply Chain has to be the catalyst of company and industry evolution. It can no longer be seen just as a cost driver. Instead of that, it has to be seen as an opportunity to achieve long term competitive advantage.

Personally, this project helped me to understand in a deeper way the present of such an interesting topic and, as the name of the project claims, it gave me a detailed idea of how SCM is likely to be in some years. The interesting thing about it: no one knows the future, so after finishing the project, I feel both the responsibility and curiosity to constantly check and monitor the evolution of supply chain management, and I am sure that my research on this field of study has just started and it will be ongoing during many, many, many years.
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