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Managing supply chain risk through collaboration

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Managing supply chain risk through collaboration

Abstract

In an increasingly uncertain, complex, and global supply chain environment, supply chains face a greater multitude of risks. Information sharing and collaboration between supply chain players can reduce risk within the supply chain. This project discusses emerging supply chain risk management (SCRM) strategies pertaining to the distribution of products and how purchasing and logistics departments can work to build a resilient and agile supply chain.

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MANAGING SUPPLY CHAIN RISK THROUGH COLLABORATION

By

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Abstract

In an increasingly uncertain, complex, and global supply chain environment, supply chains face a greater multitude of risks. Information sharing and collaboration between supply chain players can reduce risk within the supply chain. This project discusses emerging supply chain risk management (SCRM) strategies pertaining to the distribution of products and how purchasing and logistics departments can work to build a resilient and agile supply chain.

Keywords: supply chain, collaboration, risk management, purchasing, logistics

MANAGING SUPPLY CHAIN RISK THROUGH COLLABORATION

Introduction

“The Only Thing That Is Constant Is Change” — Heraclitus. Supply chains are becoming increasingly uncertain, complex, and global. Technology is driving an innovation that many companies cannot keep up with and the connected world has left us with information at our fingertips. The only thing we know for certain is change. This uncertainty translates in to supply chains facing a greater multitude of risks. Supply chain professionals have evolving responsibilities. Historically, being a supply chain professional meant being involved in the functions of procurement, manufacturing, and logistics and in process and resources. A supply chain professional’s role now includes responsibilities such as risk, security, and sustainability (Bowersox, Closs, Cooper, & Bowersox, 2010). Business Continuity Institute’s 2016 Supply Chain Resilience Report with 526 respondents from 64 countries found 70% of global companies have experienced at least one supply chain disruption in the last 12 months and 40% do not analyze the source of the disruption (Alcantara & Riglietti). Most companies have experienced a supply chain disruption recently but do not analyze the source to prevent it from happening in the future. This paper will discuss ways to prevent and mitigate the effects of supply chain disruptions.

Companies experience different types of risk. Risk in the supply chain can be classified as operational, financial, and reputational and to manage risk, companies must identify and classify risks, perform an impact assessment, and have a risk strategy (Johnson & Flynn, 2015, pp. 29-31). In an increasingly uncertain, complex, and global supply chain environment, how can supply chain partners, and more specifically, logistics and purchasing departments reduce risk? Cooperative behavior is proven to reduce risk and improve overall logistical process efficiency (Bowersox, Closs, Cooper, & Bowersox, 2010). To achieve high cooperation, it is

necessary for supply chain participants to share strategic information and plans, not just transactional data (Bowersox, Closs, Cooper, & Bowersox, 2010). There is an opportunity to eliminate waste and repeated effort in the supply chain with the help of technology, acknowledgement of mutual dependence, and trust (Bowersox et al., 2010). To reap the benefits of collaboration, companies must maintain relationships through mutual strategic operational goals, two-way performance measurements, and formal and informal feedback mechanisms (Bowersox et al., 2010). Through these methods, supply chain disruptions can be prevented and supply chain disruption effects can be mitigated.

Supply Chain Risk

Supply chain risk is defined as “Unforeseen events that might interrupt the smooth flow of materials” (Waters, 2011). The goal is to get products to customers, if there is an interruption this can affect customer satisfaction and cost the company unnecessary dollars. This definition is broad and encompasses the various types of supply chain risk.

In today’s supply chains, there is an increased level of risk with the current trend in supply chain management to operate lean and remove slack that could absorb minor variations (Waters, 2011). Dan Howe, Senior Manager of Strategic Risk Management at General Motors (GM), recalled a memory from thirty years ago walking in to a GM plant and seeing 80% of inventory physically in the plant and 20% of inventory in transit. Mr. Howe states this is the exact opposite today. Today, there is about 20% of inventory in the plant and 80% in transit. In comparison to thirty years ago, Mr. Howe now uses data to make informed decisions rather than looking at what inventory is physically in the plant. However, if the smooth flow of goods is interrupted in transit, this poses as greater risk than if the goods were already in the plant. Mr. Howe also states that the global environment in which we live today is much more complex than

it used to be. Factors he would have never considered before, such as the political environment of Poland and Ukraine, are very relevant in the work he does today.

“We are in the midst of seeing more change in the next five years than we've seen in the last 50 years,” Mary Barra, GM’s CEO (Thompson, 2016). Dan Howe spoke about how the technology age has added a new sense of complexity to the automotive industry. He has found that software and electronics suppliers are not used to automotive production. Technology supplier products are available in cars for many years at a time, a concept that is new to these types of suppliers. Technology suppliers are used to coming out with new products every couple months, whereas cars come out yearly and must be planned years in advance. Dan points out that consumers are keeping cars for longer and GM is in a situation where they must keep car parts longer to service customers in after sales. These trends in the automotive industry create more complexity in the supply chain.

Dan Howe describes the supply chain today as longer with an increased number of opportunities for failure. Mr. Howe points out that companies must be insightful and selective in deciding which risks require detailed planning. Companies cannot anticipate everything and cannot afford to mitigate all risks (Banker, 2016). Being selective in the risks that companies choose to allocate resources and plan for is an important step in supply chain risk management.

Consequences of Supply Chain Disruption

“The chain is only as strong as its weakest link” (Waters, 2011). Disruption anywhere in the supply chain can cause problems for the whole supply chain. The consequences of a supply chain disruption can be detrimental and affect many areas of the business. Supply chain disruptions have a significant impact on a company’s overall performance and financial performance (Tang, 2006). The most commonly reported consequences of supply chain

disruptions are 68% loss of productivity, 53% increased cost of working, 38% damage to brand reputation or image, 40% increase of customer complaints received, 40% in service outcome impaired, and 37% loss of revenue (Alcantara & Riglietti, 2016). Other consequences include: stakeholder/shareholder concern, delayed cash flows, product release delay, loss of regular customers, expected increase in regulatory scrutiny, share price fall, payment of service credits, product recall/withdrawal, and fine by regulator for non-compliance (Alcantara & Riglietti, 2016). As you can see the list could go on, supply chain risks are not something to be taken lightly and should be thought out no matter the size of the organization.

In a world where news is instant and accessible at the touch of our fingertips, it is important to protect your brand. Hannah Kain's article "Protector of the Brand (2016)," gives the example of Chipotle, a Mexican food chain known for its local, farm fresh ingredients that was loved by many. There was an outbreak of food borne illness at Chipotle locations in at least 12 states forcing the company to shut down temporarily in 2016. This resulted in a 47% drop in Chipotle stock, a \$10 billion loss in market capitalization, and its reputation as a healthy restaurant choice to its customers was severely damaged (Kain, 2016). Chipotle identified the issue due to a "Supply chain issue." The issue was difficult to determine as Chipotle and The Center for Disease Control had to investigate many suppliers globally. It is now more important than ever to manage purchasing supply chain risk because supply chain visibility is easily seen by customers online. "Damage to a company's reputation leads to a decrease in sales when customers are lost, and it can lead to a large amount of unexpected work to rectify the problem and the public perception of a potentially damaging incident" (Khan & Zsidisin, 2012). This unfortunate event will have lasting effects, Chipotle will have challenges to overcome to reestablish its brand as a healthy food chain.

Japan's earthquake and tsunami that struck in 2011 affected 30 GM suppliers and 390 GM parts (Sheffi, 2015). Although 390 out of a total of 30,000 parts for an average car seems minor, a single part missing could prevent completion and shipment of a car (Sheffi, 2015). GM would eventually find out this number would grow to 5,830 parts affected by Japan's earthquake and tsunami. The initial estimate was that by the end of the month, all of GM's factories would be down and production might be disrupted for at least seven months (Sheffi, 2015). Now known as "Project J," GM's first step was to create a crisis room, consisting of three rooms: one for central coordination of Project J, one for supply chain solutions, and one for engineering solutions for affected parts (Sheffi, 2015). The crisis was identified as a supply chain disruption, and a global supply chain director led the effort with a strong collaboration between the supply chain organization and the engineering organization (Sheffi, 2015).

GM's response tasks included detecting the potential disruptions, creating a visual dashboard (white-space charts), delaying shutdown, reducing time-to-recovery, and allocating scarce supplies when needed (Sheffi, 2015). In the end, GM handled the crisis well, but learned some valuable lessons. The first lesson was for team members to stick to their roles and expertise to avoid impeding progress and minimize extra work when dealing with complex manufacturing operations (Sheffi, 2015). The next was strong support from top management to not get involved in the details and finding cross-functional experts who have breadth and depth knowledge of their role as members of the team (Sheffi, 2015). These aspects of the crisis management team helped GM handle the Project J crisis well.

Types of Supply Chain Risk

The types of supply chain risk according to Johnson and Flynn are operational, financial, and reputational. Johnson and Flynn define operational (disruption) risk as the risk of

interruption of flow of goods or services (2015). Operational risk encompasses all factors beyond the purchaser or supplier's control, this could mean catastrophic events such as earthquakes and other natural disasters and strikes and accidents. Another type of risk is financial, the risk that the price of the goods or services acquired will change significantly (Johnson & Flynn, 2015). The fluctuating price of oil is an example of financial risk. The last type of risk is reputational, risk in which legal and ethical supply issues may affect the company's reputation, internal, and external communication decisions, and behavior of supply personnel (Johnson & Flynn, 2015). Political scandals where bribery and kickbacks take place are an example of reputational risk. This paper focuses on operational (unknown) and reputational (known) risk. Risk can further be classified as purchasing and logistics risk.

Purchasing Risk

The release of Samsung's Galaxy Note 7 in September 2016 led to Samsung initiating a global recall due to the devices smoldering, smoking, and catching fire. The replacement batteries were having the same issue which led to the Galaxy Note 7's discontinuation in October of that year. Samsung claims in a Wall Street Journal article that manufacturing and battery design problems with suppliers led to the recall of 2.5 million devices (Martin & Jeong, 2017). Samsung experienced purchasing risk with battery suppliers. The effects can be damaging, Samsung disclosed \$5 billion in losses and lost sales from the phone recall (Martin & Jeong, 2017). The root cause of the battery malfunction is still to be determined (as of February 2017) but two of Samsung's battery suppliers were having the issue of overheating batteries (Martin & Jeong, 2017). Outside investigators are still coming to conclusions but some statements have been made that the battery casing was not big enough, causing deformations (Martin & Jeong,

2017). To prevent something like this from happening again, Samsung implemented safety measures during the design stage, an eight-step safety check after production begins, and created an external panel of battery experts (Martin & Jeong, 2017). Samsung also has delayed the launch of the Galaxy S8 due to the incident. This has been a costly lesson for Samsung, something that could have been prevented.

To reduce purchasing risk, Dr. Yossi Sheffi discusses ways to mitigate risks. “The major risks for the purchasing function are those of clerical errors and poor judgement in supplier selection” (Smeltzer & Siferd, 1998). Dr. Yossi Sheffi further states that key sources of supply risk come from critical, low-spend, low-volume items because “They can lack a high priority for suppliers more focused on larger-volume products” (Syed, 2016). To mitigate risk on low-volume items, Dr. Sheffi suggests procurement managers hold more inventory because carrying costs are low for low-spend items (Syed, 2016). Another suggestion is to ensure low volume items do not have unique engineering specifications for the buying company, therefore, these items can be purchased from another supplier if necessary (Syed, 2016). Lastly, Dr. Sheffi states another approach to mitigate risk, to consolidate procurement operations with one supplier or to sign a long-term contract with suppliers of low volume product (Syed, 2016).

There are two theories to help mitigate purchasing risk. The “Transaction cost theory views negotiating, monitoring and enforcing contracts as transactions, all of which have associated costs” (Smeltzer & Siferd, 1998). “By reducing the number of transactions, management can reduce the associated costs” and opportunism, the self-interest seeking with deceit (Smeltzer & Siferd, 1998). There is less opportunity for error with less transactions. The resource dependency theory states that “Dependency creates risks, making goals more difficult to

achieve, and increasing the potential for extreme consequences” (Smeltzer & Siferd, 1998).

Minimizing costs and dependency can help mitigate risk in purchasing.

Risk-sharing contracts are also often offered to buyers from suppliers to coordinate channel partners when facing uncertain price and demand (Wakolbinger & Cruz, 2010). Risk-sharing contracts can be applied in the context of supply chain disruption risk in production and transaction processes (Wakolbinger & Cruz, 2010). Wakolbinger and Cruz found that information sharing can further increase the benefits of risk-sharing contracts or in other cases, information sharing and risk-sharing contracts can be substitutes (2010). When choosing suppliers, it is important to consider all options in deciding what type of relationship is desired. Wakolbinger and Cruz’s “Models indicate that the beneficiary of reduced information-sharing costs is in some cases dependent on the negotiation power of participants and that it is also dependent on the type of risk-sharing contract used” (2010).

Reactive v. Proactive Supply Management

The traditional approach to purchasing was to be reactive to internal customers (Smeltzer & Siferd, 1998). A reactive purchasing department receives an order from another department and places the order with a supplier, filling a need when told to do so (Smeltzer & Siferd, 1998). A reactive purchasing department is transaction-oriented and services other functions. More time is spent expediting than planning in a reactive purchasing department (Smeltzer & Siferd, 1998). The reactive purchasing department is evaluated on administrative costs and savings on material expenditures (Smeltzer & Siferd, 1998).

Smeltzer and Siferd (1998) examine proactive supply management, which is concerned with a different issue: risk management. Smeltzer and Siferd (1998) discuss proactive purchasing examples such as “Back-ward vertical integration, outsourcing, establishing supplier quality assurance programs, supplier development, supplier-purchaser data sharing, and risk-sharing

with the supplier.” This is the type of responsibilities we see in a lot of purchasing departments today. Proactive purchasing can also be summarized through a transition from a transaction perspective to a supply management orientation (Smeltzer & Siferd, 1998). As this transition occurs, two shifts in focus are happening: “1. From internal processes to value-adding benefits 2. From tactical management to strategic management” (Smeltzer & Siferd, 1998). “Proactive purchasing management is the management of risk — it actually mitigates risk and, at the same time, provides a higher return” (Smeltzer & Siferd, 1998). Proactive purchasing management includes activities that are beyond traditional administrative tasks and include “Reducing the supplier base, developing long-term alliances, achieving early supplier involvement, and outsourcing are activities” (Smeltzer & Siferd, 1998).

With a proactive purchasing department, highly competent purchasing professionals can manage risk through “Pursuing such activities as supplier certification programs, development of target costing with partners, outsourcing, and implementation of quality management programs” (Smeltzer & Siferd, 1998). In addition, these professionals “Work to reduce routine administrative activities with such tactics as procurement cards and decentralization of routine tasks” (Smeltzer & Siferd, 1998). Mitigating supply chain risk can happen at the purchasing level, where interactions between organizations occur. Having a knowledgeable purchasing team can make more informed, smarter decisions to effectively reduce risk.

The importance of some suppliers over others is a concern raised through the Pareto rule, where 80% of spend will be with 20% of suppliers. Managing relationships with these 20% of suppliers must be done appropriately or else this allots for higher risk. There is a trend to reduce the number of suppliers to foster good relationships, cut costs, and reduce complexity, by doing this you are increasing value, but also increasing risk (Mangan & Lalwani, 2016). This tradeoff is

balanced with the idea that collaboration must be carefully selected with a few suppliers and ensuring the resources necessary for successful collaboration are developed.

Global Sourcing Risk Management

In an increasingly global environment, it is important to note how risk management can be applied to global sourcing. There is a trend of increased global sourcing to attain benefits of low cost labor, cheaper raw materials, and access to technology (Khan & Zsidisin, 2012). However, with these benefits of global sourcing comes many challenges such as currency fluctuations, political changes, economic changes, long and variable lead times, increases in inventory, quality considerations, inventory ownership, and availability of legal recourse (Khan & Zsidisin, 2012).

Khan and Zsidisin (2012) created a framework for incorporating risks that includes a two-step process: audit the global procurement process and identify and implement appropriate strategies. The purpose of auditing the global procurement process is to find out if the cost savings indeed match the expected savings (Khan & Zsidisin, 2012). Once the audit is complete, several strategies can be utilized to overcome barriers found in the audit. Strategies include: global organizational and total cost focus through performance measurement, long-term relationships, internal and external integration, standardization across products, staggered new product introductions, and training (Khan & Zsidisin, 2012).

Khan and Zsidisin (2012) further define the types of risk for global sourcing as cost, quality, lead time, and security. Cost risk can become pertinent when vital components of sourcing are excluded. Sources of cost risk include: additional costs of inventory (in-transit, stock-outs, obsolescence, and damages), currency fluctuations, rising wage rates, cost of ensuring security, expedited airfreight, and cost of intellectual property loss (Khan & Zsidisin, 2012). Quality risks were found to be a routine occurrence in Khan and Zsidisin's studies such as

the global supplier's lack of capacity to replace defective parts and materials. Lead time risks can result from delays at customs, port congestion, capacity constraints, and geopolitical issues (Khan & Zsidisin, 2012). The cost of lead time risk and product cost needs to be balanced carefully because increased lead time increases inventory and impacts the service level provided to customers (Khan & Zsidisin, 2012). Lastly, security risks include information systems security, infrastructure security, and freight breaches from terrorism, vandalism, crime, sabotage, and piracy (Khan & Zsidisin, 2012). These pose as potential risks to the loss or adulteration of goods and the potential exploitation for criminal purpose (Khan & Zsidisin, 2012). Purchasing risks should be identified and examined to determine root cause.

Khan and Zsidisin attribute reasons why companies are subject to these types of risks to regional parochialism, or narrow-mindedness, focusing on cost as the main driver of global sourcing decisions, lack of visibility, lack of information sharing, increased rate of new product introductions, rigidity to change single or dual sourcing patterns, and lack of training (Khan & Zsidisin, 2012). Regional parochialism refers to the prevalence of local metrics that are regionally aligned and focused on lowering regional purchase costs rather than being optimized at a global level (Khan & Zsidisin, 2012). To make financials look good, companies focused on per piece cost, although Khan and Zsidisin found that some companies factor in transportation and buffer costs, their practices were not advanced. Lack of visibility and access of relevant information is a barrier to conducting accurate analysis and making informed decisions (Khan & Zsidisin, 2012). This is from a lack of information sharing which is caused by a lack of technology integration and silo-oriented mentality and lack of trust (Khan & Zsidisin, 2012).

Customers demanding newer, more customized products with aggressive lead times has caused more frequent and higher new product introductions. This in turn increases complexity

for suppliers and increases lead time risks (Khan & Zsidisin, 2012). Product complexity results in more inventory and fewer economies of scale, which requires more management attention (Bowersox et al., 2010). This becomes a business need to balance marketing and supply chain perspectives to maximize profit. Offering the latest and greatest product in a timely manner proves to be more challenging and complex.

Khan and Zsidisin have found that companies get stuck in the traditional way of doing things and are reluctant to changing sourcing patterns even if having too many suppliers was a problem. “Lack of training can lead to poor supplier quality management, supplier management with an emphasis only on price negotiation, inadequate competitive bidding processes, and incomplete total landed cost analyses” (Khan & Zsidisin, 2012). Investing in the training of an organization’s purchasing department can help reduce the costs of poor supplier selection, quality, and price negotiation.

Logistics Risk

It is difficult to monetize supply chain losses when they first occur, there can be lasting unforeseen consequences. An example of a logistics supply chain loss is with Korea’s largest shipping company, Hanjin Shipping. Hanjin Shipping went bankrupt on August 31, 2016, causing the world’s seventh-largest emergency bankruptcy filing (Wiener & Walters, 2017). Mariners and their cargo were stuck at sea during the shipping industry’s peak season, the year-end shopping season (Wiener & Walters, 2017). The bankruptcy court of Korea was receptive of granting relief to facilitate Hanjin Shipping’s rehabilitation procedure, but the outcome of Hanjin Shipping’s rehabilitation remains to be determined (as of February 2017) (Wiener & Walters, 2017). Hanjin Shipping’s bankruptcy can be attributed to overcapacity and declining freight rates as well as the political and institutional structure of South Korea (Wiener & Walters, 2017). It is

important to note that although the shipping company had notable supply chain issues, other factors such as political and institutional structure affected the supply chain.

A study conducted by Linköping University surveyed 177 logistics managers from Swedish manufacturing companies and found the least common area to collaborate with supply chain partners was strategic planning (Sandberg, 2007). Another study found that higher levels of flexibility by retailers resulted in higher levels of retailer-supplier collaboration, which in turn resulted in higher levels of time-based logistics service quality (Richey, Adams, Dalela, 2012). In addition, the study also found retailers investing in technologies that are compatible with suppliers are better equipped to leverage the technology for collaborative advantage (Richey, Adams, Dalela, 2012). A study published in the Journal of Business and Behavioral Sciences found larger sized organizations practiced some global supply chain risk management but try to avoid it while smaller sized organizations lack needed strategies to mitigate or avoid global supply chain risks and just accept these risks (Varzandeh, Farahbod, & Zhu, 2016). Companies of all size should be actively engaging in risk management.

Types of Logistics Risk

Traditionally, insurance specialists were the ones responsible for risk, concentrating on facilities, employees, and export/import shipping losses (Cavinato, 2004). Now, risk is factored in to all business processes and functions and all sizes of organizations.

Risk in logistics has broadened to encompass more than goods being lost or damaged in transport. Joseph L. Cavinato has categorized logistics risk in to five “sub-chains:” physical, financial, informational, relational, and innovational (2004, p. 384). The physical risk is the traditional view of risk in logistics, it can be transportation disruption, damage of goods, inability to access inventories, and manufacturing discontinuity (Cavinato, 2004, p. 385). Financial risks can include settlement process disruption (in accounts payable and accounts receivable),

improper investments, and the lack of cost transparency in the supply chain (Cavinato, 2004, p. 385). Informational “sub-chains” foster efficiency, security, and access of information (Cavinato, 2004, p. 385). Informational risk can involve the investment in an information system that is not capable or efficient in its intended purpose and future business needs (Cavinato, 2004, p. 385). Next, relational risk is the linkages between buyers, sellers, and logistics parties. These relationships can vary with the traditional arm’s length approach and collaborative and joint venture approach—each having different value and risk (Cavinato, 2004, p. 385). Lastly, innovational “sub-chains” map the discovery, flow, creation, and market processes within a firm and its suppliers (Cavinato, 2004, p. 385). Stagnant supply chains are more prone to risks and costs because they are not innovating with new market demands. Optimizing these five categories can help build an agile supply chain, one that allows for flexibility.

Global Logistics Risk Management

Competition in the third-party logistics market is intense and requires more attention on sustainability with the rapid increase of online shopping and global supply chain environment (Wang, Jie, & Abareshi, 2015). To allow companies to focus on their core competencies, logistics is one of the many functions organizations are outsourcing. In a study with 98 Australian third-party logistic providers, empirical evidence provides logistics capability in innovation, flexibility, and information technology mitigates supply chain uncertainty and risk (Wang, Jie, & Abareshi, 2015). Although courier firms had a high logistics capability, implementing new technology had the lowest average mean out of the capabilities, below optimizing business processes and operation flexibility. The authors (Wang, Jie, & Abareshi, 2004) suggest third-party logistic providers hone in on continuously implementing new technology and ideas in to daily business operations to further develop their logistics capability.

Companies choosing to outsource logistics could have an advantage if the courier firm is implementing new technology, optimizing business processes, and operation flexibility.

A publication in the *International Journal of Logistics Management* discussed logistics outsourcing in terms of supply chain vulnerability and supply chain risk management. Logistics outsourcing is increasingly used for its benefits, but can increase the vulnerability of the supply chain, which is especially dangerous with increasing disruptions expected (König & Spinler, 2016). Making the decision to outsource logistics should be a carefully thought-out process to determine benefit.

Internal Integration

For collaboration to work successfully outside the organization, organizations have a better chance if they already collaborate successfully internally (Fontanella & Sabeth, 2002). Two key internal supply chain functions, purchasing and logistics, can integrate to prevent supply chain disruption and mitigate supply chain risk. Logistics and purchasing information sharing can be integrated to enhance the overall value of supply chain collaboration.

A study published in the *Journal of Operations Management* explored the factors that enable and inhibit the internal integration of operations, purchasing, and logistics. The level of integration was determined by how much manufacturing, logistics, and purchasing interacted, collaborated, and worked to arrive at mutually acceptable outcomes. Mark Pagell defines integration in his publication as “A process of interaction and collaboration in which manufacturing, purchasing and logistics work together in a cooperative manner to arrive at mutually acceptable outcomes for their organization” (2004).

The enablers of internal integration across these three functions were goal setting and rewards, cross-functional activities at lower levels (Kaizen), and plant level data shared in formal

meetings (Pagell, 2004). The inhibitors of internal integration are a disconnect on cost, layout of facility, limited understanding of other functions (lack of rotation), and no informal mechanisms to create interaction (Pagell, 2004).

There is evidence that integration is partially a result of open communication of problems and opportunities in the supply chain (Pagell, 2004). Organizational structure and culture play a role in keeping communication open. There is evidence that real-time and informal communication is preferable to formal and scheduled communication. Issues brought up in real-time are addressed quicker and informal communication increases the chances of impacted managers to talk about it (Pagell, 2004). For informal communication to take place an antecedent could be the layout of the facility, or how easily it is to get to other departments (Pagell, 2004). Informal communication was much more likely to take place if employees from different functions were near one another (Pagell, 2004). Another enabler is creating cross-functional teams to overcome isolation in the facility and create linkages between functions. Job rotations also aid in creating a greater organizational understanding (Pagell, 2004). In addition, people tend to perform the activities for which they are rewarded, therefore, measurement and reward systems positively influenced the level of integration (Pagell, 2004). Aligning a department's strategic goals with business strategy and knowing how other department managers make and prioritize decisions are important parts of integration (Pagell, 2004).

Dan Howe, Senior Manager of Strategic Risk Management at General Motors (GM), gave insight on how purchasing and logistics work together. In Mr. Howe's role, he identifies strategic long term risk, emerging risks, and cross-functional risk. Risk in GM spans across many departments and can include purchasing, logistics, engineering, and customer care and after sales service. The GM supply chain relies on quick, automated information such as electronic data

interchange (EDI) to make informed decisions and collaborate. The supply chain works on an exception basis, looking for things that were supposed to happen but did not. If there are problems, these are communicated through email, text, or phone call to solve.

Dan's role is mainly focused on securing material availability. Looking at supplier risk profiles is especially important when selecting suppliers. Many factors such as environment, location, political, and if the location is natural disaster prone go in to making these decisions. Original equipment manufacturers (OEMs) are now expected to know their whole supply chain as more regulations surface such as conflict minerals. Not only looking at Tier 1 but multiple tiers of the supplier base is becoming more important, but more complex. The shorter the supply chain, the less risk. Dan sees a trend of suppliers moving closer and offering more locations closer to production facilities due to the costs of transportation.

At GM, purchasing and logistics now work together to calculate total landed cost, sometimes referred to as enterprise cost or total logistics cost. Total landed cost is the sum of costs related to performance and administration of order processing, inventory, transportation, warehousing and materials handling, and facility network (Bowersox et al., 2010). There must be a balance between purchasing, which is concerned with the cost of the product and logistics, which is concerned with the cost of transportation. Total landed cost gives an expansive view of a product rather than just cost per unit.

Supply Chain Risk Management (SCRM)

“Prevention is better than cure” (Waters, 2011). It is always better to avoid harm rather than look for restitution after it has occurred (Waters, 2011). Supply chain risk management (SCRM) is defined as “The management of supply chain risks through coordination or collaboration among the supply chain partners so as to ensure profitability and continuity” (Tang,

2006). The three areas of investment in risk management and resilience are detection, prevention, and response, which help reduce the duration, likelihood, and magnitude of supply chain disruptions (Sheffi, 2015). Supply chain risk management is continual and should happen at every stage to ensure risks are mitigated. SCRM also needs the support of senior management to ensure managers consider risk in decisions made.

To mitigate the impact of supply chain risks, there are four basic approaches: supply management, demand management, product management, and information management (Tang, 2006). These approaches are intended to improve supply chain operations via coordination or collaboration (Tang, 2006). Supply management focuses on five inter-related issues: supply network design, supplier relationship, supplier selection process, supplier order allocation, and supply contract (Tang, 2006). Demand management considers shifting demand across time, shifting demand across markets, and shifting demand across products (Tang, 2006). To compete with market share, many manufacturers expand their product lines within product management. “While product variety may help a firm to increase market share and revenue, product variety can increase manufacturing cost due to an increase in manufacturing complexity” (Tang, 2006). Product variety also increases inventory cost due to demand uncertainty (Tang 2006). Product management strategies include: postponement, process sequencing, and product substitution (Tang 2006). Lastly, information management can be classified under durable and non-durable goods and can be managed through information sharing, vendor managed inventory, and collaborative forecasting (Tang 2006). These risk management strategies help companies prepare for supply chain disruptions. When disruptions occur, the supply chain can react quickly and minimize costs with the optimization of supply management, demand management, product management, and information management.

The enterprise risk management (ERM) model was taught by Gregory L. Schlegel in the APICS Supply Chain Risk Management Seminar on March 16, 2017. The basic ERM model steps involve defining internal risk environment, inserting risk in to business strategy, identifying disruptive events, risk assessment, risk response, information and communication, and risk event monitoring. The primary value of ERM is to increase risk awareness, avoid or mitigate risk, increase certainty in meeting strategic and operational objectives, and eliminate silos (Advisen, Zurich, RIMS, 2013). The ERM model can be utilized by small, medium, and large organizations. However, organizations can approach risk differently.

How will your firm view risk? Hajmohammad and Vachon further discuss four risk mitigation strategies: risk avoidance, monitoring-based risk mitigation, collaboration-based risk mitigation, and risk acceptance. The supply chain risk management strategies are options for analyzing internal risk environments, the first step of the ERM model. Risk avoidance is a strategy aimed to eliminate risk by removing the risk source (Hajmohammad & Vachon, 2015). Monitoring-based risk mitigation focuses on assessing supplier's processes against performance criteria to verify compliance (Hajmohammad & Vachon, 2015). The collaboration-based risk mitigation strategy aims to improve partnership with suppliers through jointly developed environmental and social solutions (Hajmohammad & Vachon, 2015). These three risk mitigation strategies are considered proactive strategies while the last strategy, risk acceptance, is a reactive strategy. Risk acceptance retains risk by taking no further actions and budgeting for damage control (Hajmohammad & Vachon, 2015). In this case, companies simply do not care to root cause the issue or do not see it as significant and just budget for the implication.

Applying SCRM in Purchasing and Logistics

Risk can be very emotional for people. When people think about risk, negative thoughts and emotions often start to form. Risk stems from uncertainty or lack of full and timely information, this can cause people to panic and think the worst. It is many people's instinct to resist change and fear the uncertain. However, with the right change management initiative people can learn to embrace change and proactively manage risk. We cannot predict the future but what we can control how we react to it and respond to supply chain disruptions. If we have options in a disruption crisis, this is likely to be calming. People can think about the situation rationally and take steps toward a solution. Preparing for supply chain disruptions can better equip us to prepare for the unknown and reduce the negative effects of a supply chain disruption.

In the APICS Supply Chain Risk Management Seminar instructed by Gregory L. Schlegel, it was stated that generally, earning a greater reward requires enduring greater risk. Whether it is a reward from people, assets, capabilities, or resources, the greater the stakes, the greater the reward. This is true in any size of an organization. This idea solidifies the fact that organizations must plan for supply chain disruptions and be prepared. If organizations are better equipped for supply chain disruptions, what might be a crisis for one company may be an opportunity for another.

The 2011 Thailand floods left many hard drive suppliers unable to get product to their customers. As told by Gregory L. Schlegel, some hard drive suppliers were proud to have recognized they were to be situated on a flood plain ahead of time. These suppliers proactively elevated their plants to avoid water damage and purchased insurance to protect against potential floods. When the floods hit, the machines in the plants were not damaged, but getting product in and out of the plant was the challenge. Workers were rowing on boat in raw material and rowing

out finished product. Many companies were affected especially in the camera industry. This example demonstrates the importance in considering purchasing risk and logistics risk when choosing suppliers. Although the hard drive suppliers thought about potential flood damage, they were not thinking about the logistics of getting product in and out of the facility. The customer, when choosing hard drive suppliers also did not consider this aspect, the purchasing side. Purchasing and logistics risk are essential in evaluating suppliers. However, one customer had an advantage because they supplied some hard drives outside of Thailand and seized this opportunity to get ahead of their competition. This company could mitigate the effects of the supply chain disruption and create an opportunity to sell more product that their competitors could not supply.

Purchasing and logistics risk are considered two distinct classifications of risk. Although they are integrated and together make up supply chain risk, it is important to note their differences. To combat purchasing risk, suppliers focus on purchasing approach, purchasing view, supplier quality/order management, commodity/cost management, supplier integration, and supplier performance while logistics is focused on warehouse replenishment, distribution management, transportation/delivery management, and delivery commitments (APICS SCRM Seminar). These elements in purchasing and logistics risk are important for the smooth flow in the distribution of products. Through purchasing and logistics risk classification and distinction companies can pinpoint specific vulnerabilities in the supply chain. By separating the elements of a supply chain, it is easier to identify potential problem areas and risk. In the hard drive supplier example, it would have been better to distinguish purchasing and logistics risk early on. The customers of the hard drive suppliers in Thailand looked at purchasing risk and saw they were of low cost, insured, and situated above the flood plain. If customers had looked in to the

logistic risk of the Thailand location, they may have thought twice about single sourcing the hard drive supplier.

Modeling Supply Chain Risk

Visibility in the supply chain stimulates recognition of risks. LLamasoft, headquartered in Ann Arbor, MI, is a software and services company that develops and markets technology to model and optimize supply chain networks. LLamasoft states that modeling technology can be used to create living models of a company's end-to-end supply chain with the ability to redesign and re-optimize when forecasted changes or unplanned events occur. It is important for companies to identify their individual risks because what might be a risk for one company might not be for another, the same idea goes with products even within the same company. According to LLamasoft, the biggest risk a company can have is not natural disaster related, but not being competitive daily with other companies on the market. LLamasoft's white paper identifies three elements of an effective supply chain risk management strategy:

- 1) Visibility: What is the current structure and flow of goods through my supply chain?
- 2) Scenario analysis: What if we try this? How would my costs or service be affected by this?
- 3) Rapid response: How should I react to an unplanned event?

LLamasoft models risk to better understand inventory placement, service and performance metrics, product demand forecast, production footprint, network structure, and transportation. Through assessing, prioritizing, analyzing, and planning, software modeling companies can better equip a customer to respond to a supply chain disruption. For a company to be able to prevent supply chain risks, they must be able to detect them first. Modeling the supply chain end-to-end will provide better visibility and detection of risks.

Supply Chain Collaboration

Mark Williams, Demand Management Specialist at QAD, Inc. stated in an interview at Supply Chain Brain that customers today expect on time, rapid, and complete delivery, but at the same time supply chains have become lengthened and global. Williams states that relying on a forecast no longer makes the cut. Collaborating with customers then collaborating with suppliers is imperative to fulfil customer demand. The book, *Supply Chain Collaboration* by Mei Cao and Qingyu Zhang defines supply chain collaboration as “A long-term partnership process where supply chain partners work closely together to achieve common goals and mutual benefits” (p. 58, 2013). Supply chain collaboration is an emerging discipline and is not feasible with all supply chain players. Much research has been conducted on the benefits of supply chain collaboration and how collaboration can be used to mitigate risk.

Supply Chain Collaboration Categories

Generally, a long, narrow supply chain is riskier than a short, wide one (Waters, 2011). A supply chain that works together and has visibility and free information flows is less susceptible to risks than one that is in isolation. Supply chain collaboration can be put in to two categories: process focus and relationship focus. The business process focus of supply chain collaboration is where “Two or more supply chain partners work together toward common goals and achieve more mutual benefits than can be achieved by acting alone” (Cao & Zhang, p. 55, 2013). Supply chain collaboration can also be viewed with a relationship focus, “The formation of close, long term partnerships where supply chain members work jointly and share information, resources, and certain degrees of risk in order to accomplish mutual objectives” (Cao & Zhang, p. 55, 2013). In the relationship focused supply chain collaboration, partners share risk. By sharing the risk, each supply chain partner’s risk is mitigated.

Supply chain collaboration is not a “one size fit all” concept, it must be customized and tailored to each supply chain and its members. Cao and Zhang state seven components for defining collaboration: information sharing, goal congruence, decision synchronization, incentive alignment, resource sharing, collaborative communication, joint knowledge creation (2013). Firms that have learned to collaborate successfully internally are most successful in building collaborative relationships outside of the organization than those that do not collaborate internally (Fontanella & Sabeth, 2002). Internal collaboration is a prerequisite to external supply chain collaboration.

Recipe for Supply Chain Collaboration

There are conditions that can lead to or affect supply chain collaboration such as IT capability, inter-organizational systems, organizational culture, and trust (Cao & Zhang, 2013). These factors combined can create an environment where successful supply chain collaboration can take place. Each of these conditions are examined below.

Information Technology (IT) Resources

Information technology is an *enabler* of supply chain collaboration. It facilitates communication across the globe with supply chain players. The results from a Linköping University study indicate that the use of electronic data interchange (EDI) and internet-based alternatives for information sharing facilitate transferring information, but not the content of the information, or the extent the information is adjusted for the receiver (Sandberg, 2007). Although a company may have the means to transfer information, this does not mean the receiver will interpret and utilize the information to its full potential. Sharing data tailored to the receiver’s needs will allow it to become more valuable and have a greater impact on planning efficiency and performance in the supply chain (Sandberg, 2007). IT resources include IT

infrastructure flexibility, how systems can be reconfigured to support different business applications and IT expertise, the knowledge of staff provides for technical and business solutions (Cao & Zhang, 2013). Laying the groundwork for successful information sharing, IT resources are essential in today's world.

Inter-organizational Systems (IOS) Appropriation

Inter-organizational systems (IOS) is the information technology spanning firm boundaries between two or more companies (Cao & Zhang, 2013). IOS can be used for integration, communication, and intelligence between supply chain partners (Cao & Zhang, 2013). It is these IT elements together that foster supply chain partners to work together and facilitate the transfer of information in an effective, efficient way.

Collaborative Culture

The IT tangible resources help lay the groundwork for collaboration but intangible elements further develop supply chain collaboration with the premise of relationship building. Collaborative culture is defined as "The norms, beliefs and underlying values with relationship orientation shared in a firm regarding appropriate business practices in the supply chain" (Cao & Zhang, 2013, p. 41). It is an organizational trait, not an individual trait and is a shared meaning among people (Cao & Zhang, 2013). Collaborative culture encompasses collectivism - the "we" rather than "I" consciousness, long term orientation relationship building with supply chain partners, power symmetry - the belief that supply chain partners have equal say, and uncertainty avoidance – the extent to which a firm feels threatened (Cao & Zhang, 2013). Fabricating this culture as an organization and transpiring it with supply chain partnership building will create an environment of mutual benefit.

Trust

To further enhance collaborative culture, trust is the belief in the reliability that supply chain partners will perform work based on expectations, regardless of the ability to check and monitor the work (Cao & Zhang, 2013). To validate trust, creditability creates confidence in a supply chain partner's predictability, reliability, honesty, and competence (Cao & Zhang, 2013). Good intentions can best be explained through benevolence, how a firm expects a supply chain partner to act, that is, fairly and not take unfair advantage of the firm if given the chance (Cao & Zhang, 2013). In a study testing the influence of trust on collaborative relationships in supply chains, it was found that trust is a critical factor in achieving supply chain collaboration (Kac, Gorenak, & Potocan, 2016). Shared values and communication have a positive influence on trust and opportunistic behavior has a negative influence on trust in supply chain collaboration (Kac, Gorenak, & Potocan, 2016). Trusting supply chain partners is the difference in a great collaborative relationship and a bad one.

Process Focused Integration

Information Sharing

The book, *Supply Chain Collaboration* by Mei Cao and Qingyu Zhang defines information sharing as "The extent to which a firm shares a variety of relevant, accurate, complete and confidential information in a timely manner with its supply chain partners" (p. 58, 2013). Information sharing is essential to supply chain collaboration, some describing it as the "heart" of supply chain collaboration (Cao & Zhang, 2013). When organizations foster strategic relationships and collaboration, the faster information will be disclosed (Varzandeh, Farahbod, & Zhu, 2016). "Information sharing promotes the opportunity for joint problem solving across

supply chain partners to implement best practices in the extended supply chain for identifying and managing disruption risks” (Wakolbinger & Cruz, 2010).

The benefits of information sharing span throughout the organization and help the organization become more efficient. “Comprehensive information sharing would lead to a wide exposure to new ideas, technologies, or opportunities, which will in-turn reduce the risk of being unprepared for changes taking place in the firm's surroundings” (Skippari, Laukkanen, & Salo, 2016). Information sharing can help reduce risks in the supply chain. Information sharing has also led to reducing the bullwhip effect to enhance coordination in supply chain (Cao & Zhang, 2013). The ability for supply chain partners to see one another’s information allows one another to monitor progress of products, thus supply chain partners can use this shared information to better fill demand more quickly (agile) with shorter order cycle times (Simatupang & Sridharan, 2008). Through information sharing, supply chain members can see key performance metrics and process data, which allows members to understand the bigger picture and make better decisions (Simatupang & Sridharan, 2008). Formal arrangements of information sharing include vendor-managed inventory (VMI), collaborative planning, and synchronized material movement.

It was also found that the degree of process orientation, intensity of information sharing, and degree of joint planning are positively related to the experienced effects of collaboration (Sandberg, 2007). Wakolbinger and Cruz’s models found that some members of a supply chain sometimes do not obtain benefits from information sharing. The more intense process orientation, information sharing, and degree of joint planning are shared, the more information sharing positively affects collaboration.

A study conducted by Linköping University surveyed 177 Swedish manufacturing companies and found the type of information that was shared most frequently and easily by

respondents were forecasts (Sandberg, 2007). In a Supply Chain Brain executive briefing, Mark Williams speaks of collaborative planning, forecasting and replenishment (CPFR) to aid in customers and suppliers sharing forecasts and fulfilling demand. CPFR creates a means of constant integration between supply chain players which can lead to problem solving (Sandberg, 2007). Williams mentions it is important that this information is passed through the organization internally to the people who can get things done. Sales and operations planning is mentioned as the people who get things done, they promote the passing of information internally in the organization and look at commitments made in the past. Forecasting helps smooth out demand and sharing forecasts increases the affects collaboration has on the supply chain.

Goal Congruence, Decision Synchronization, Incentive Alignment, And Resource Sharing

The other process-focused components of supply chain collaboration are stated and defined as followed:

- Goal congruence – how supply chain partners perceive their own objectives against the accomplishment of the supply chain objectives
- Decision synchronization –supply chain partners coordinate activities in supply chain planning and operations to optimize supply chain benefits
- Incentive alignment – the sharing of costs, risks, and benefits amongst supply chain partners
- Resource sharing – leveraging assets and making mutual asset investments among supply chain partners (Cao & Zhang, p. 58, 2013).

These elements ensure alignment of goals, decisions, incentives, and resources. Ensuring supply chain partners are aligned and transparent will create an environment where collaboration can thrive.

Relationship Focused Integration

Collaborative Communication

Collaborative communication is “The contact and message transmission process among supply chain partners in terms of frequency, direction, mode, and influence strategy (Cao & Zhang, p. 58, 2013). Open, frequent, two-way, multi-level communication is thought to be an indication of a strong partnership (Cao & Zhang, p. 65, 2013). Communication drives the process focused components of supply chain collaboration. Without the foundation of open communication, the information being shared may not be beneficial.

Joint Knowledge Creation

Joint knowledge creation is “The extent to which supply chain partners develop a better understanding of and response to the market and competitive environment by working together” (Cao & Zhang, p. 58, 2013). The two types of knowledge creation initiatives are knowledge exploration and knowledge exploitation (Cao & Zhang, 2013). Knowledge exploration is to “Search and acquire new and relevant knowledge” (Cao & Zhang, p. 67, 2013) and knowledge exploitation is to “Assimilate and apply relevant knowledge” (Cao & Zhang, p. 67, 2013). Communication of the right and relevant knowledge and applying it will further create an efficient supply chain. The wrong knowledge wastes time and energy.

Benefits of Supply Chain Collaboration

Supply chain collaboration is getting more attention in academia and firms for its potential benefits. Collaboration can be used as a competitive advantage because it is not easily imitated. Supply chain collaboration takes time and resources to execute and does not happen overnight. The results from a Linköping University study indicate that respondents reported

more positive effects on service related issues than cost related issues in supply chain collaboration (Sandberg, 2007). Service is something that is carefully crafted and is not as cut and dry as cost issues. Understanding service is understanding relationships and many collaboration efforts focus on relationship building.

Firms strive to create value for their customers, this innovation and value is best done through collaboration with other supply chain members. A study with 203 manufacturing companies in Australia conducted by Jie Chen, Amrik S. Sohal, and Daniel I. Prajogo in 2013 found that supply chain risk can be mitigated through supply chain collaboration. In addition to mitigating risk other benefits of collaboration can include: “Increased knowledge creation capabilities, revenue enhancements, cost reductions, and increased operational flexibility to cope with high demand uncertainties” (Skippari, Laukkanen, & Salo, 2016, p. 25). Furthermore, supply chain collaboration provides “Upstream and downstream visibility; reduces costs of inventory, premium services, and production scheduling; expands gross revenues; raises customer satisfaction through focused response; uses readily available information; and supports flexibility, outsourcing, and rebalancing of resources” (Fontanella & Sabath, 2002, p. 25).

As demonstrated, supply chain collaboration is not a science but rather a mix of process and relationship focused factors. Before firms reap the benefits of collaboration, they will likely experience challenges.

Challenges of Supply Chain Collaboration

Although collaboration is regarded by academicians and practitioners as important and can positively impact firm performance, adopting and implementing the frameworks of collaboration are not easy (Richey, Adams, Dalela, 2012). John Fontanella and Robert E. Sabath

describe supply chain collaboration as “The most used, the most frequently misunderstood, the most popular--and the most disappointing--strategy that has come along to date” (p. 24, 2002).

John Fontanella and Robert E. Sabath attribute the difficulty of implementing supply chain collaboration to “An overreliance on technology, a failure to differentiate the most profitable customers from the rest, and a lack of trust” (2002, p. 24). Other reasons can include: “Connectivity and inability to share information...unwillingness to share information, unwillingness to share risks and rewards, inflexibility of organizational processes, safeguarding by managers and firms, resistance to change, lack of a shared vision, and short-term financial thinking” (Richey, Adams, Dalela, 2012, p. 35). Supply chain collaboration finessed poorly can also lead to “Internal squabbles, external blame, offloading of annoying responsibilities, increased costs, customer disappointment, and dropped responsibility” (Fontanella & Sabath, p. 25, 2002). With these negative effects of collaboration, it is no wonder why collaboration with organizations is selective and not done with every supply chain player.

Skippari, Laukkanen, and Salo (2016) stated “One of the key challenges in the generation of collaborative innovation is to engage all actors into the innovation process, nurture inter-organizational relationships, and consolidate the various, possibly conflicting interests and perceptions of actors towards a common goal.” Supply chain collaboration must be customized for every partner and “Incremental benefits must be gained from the tailoring effort, which consumes managerial time and talent” (Cao & Zhang, p. 57, 2013). Supply chain partnerships for a whole supplier base is not feasible (Cao & Zhang, 2013). Organizations would lose money if they attempted to foster these relationships with every organization in the supply chain.

Erik Sandberg sums up the challenges of supply chain collaboration to two barriers: technology and humans. In a Linköping University study, respondents who reported more

intensive information sharing experienced more technology related problems (Sandberg, 2007). Technology problems can result in more time and resources dedicated to fixing the technology. In addition, the involvement of top management in ongoing collaboration is positively related to the intensity of collaboration through more frequent information sharing and joint operational planning (Sandberg, 2007). Effective supply chain collaboration is to be more successful when it is driven by top management.

The Linköping University study also found that most of the respondents' collaborations are concerned with operational issues, not strategic issues (Sandberg, 2007). Erik Sandberg goes on to state that only when strategic issues are involved in collaboration can a shift happen toward a completely integrated supply chain (2007).

There are a lot of elements that need to orchestrate together smoothly for supply chain collaboration to take effect, however, when done correctly the results and benefits can prove endless. Therefore, many companies are practicing this concept and perfecting it. Although there are frameworks, there is not a comprehensive take on supply chain collaboration.

Implementing Supply Chain Collaboration

While there are clear challenges to supply chain collaboration, many seek for the benefits of collaboration. Firms first need to decide if collaboration is right for them in certain business scenarios, most relationships do not require cross-enterprise collaboration and can involve main-line business arrangements such as basic contracting and sourcing (Bowersox, Closs, & Stank, 2003). Once the decision is made to pursue a collaborative relationship, how is collaboration implemented?

The framework displayed in Figure 1 outlines cross-enterprise competencies and capabilities in to three processes: leadership, planning and control, and operational. Process

change using this framework is initiated first by “Identifying and reaching managerial consensus on existing collaborative competency” and secondly, “Comparing consensus results to a benchmark average of high-achieving firms in comparable industries” (Bowersox, Closs, Stank, 2003). To begin, both organizations must exchange product-service value and market accommodation. Next, leadership must provide a mental framework for collaboration by identifying roles, guidelines, information sharing, and risk sharing (Bowersox, Closs, Stank, 2003). The planning and control process must then create technology, planning, and measurement (Bowersox, Closs, Stank, 2003). Integrated operations require customer, integration, and material/service supplier integration (Bowersox, Closs, Stank, 2003). Lastly, information and cash flow will materialize between the organizations.

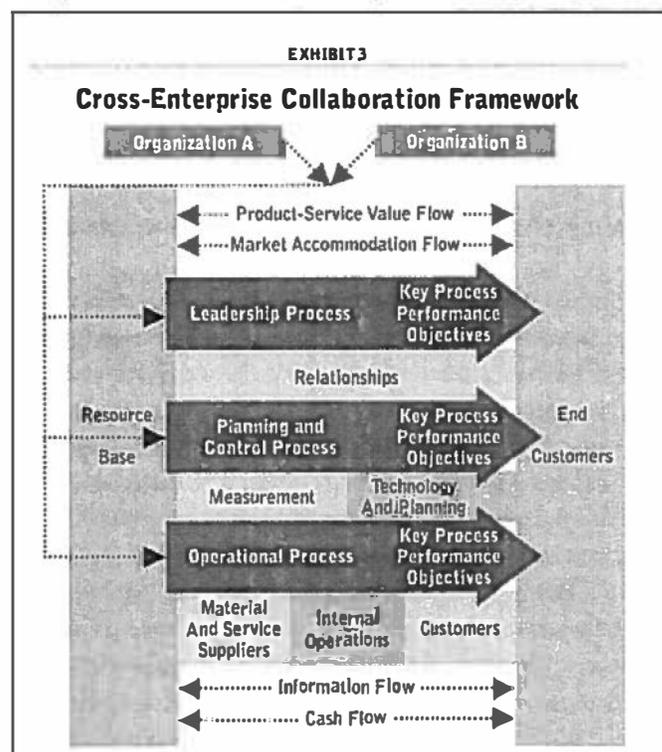


Figure 1. A cross-enterprise collaboration framework to implement supply chain collaboration. Adapted from “How to Master Cross-Enterprise Collaboration,” by D. J. Bowersox, D. J. Closs, and T.P. Stank, 2003, *Supply Chain Management Review*, p. 26. Copyright 2003 by Framington: Peerless Media, LLC.

This framework from Figure 1 should be used as a roadmap to detail specific jobs and functions and provide a guide to management in the quest for supply chain collaboration.

Resilient and Agile Supply Chains

Dan Howe sees resiliency as not so much about what happens, but how fast you can recover. As supply chain disruptions become more common in a global and interconnected business environment, building a resilient and agile supply chain has become more important now than ever. The trend of operating a lean supply chain removes slack that could have absorbed minor variations (Waters, 2011). Balancing the lean principles of efficiency and resilience will allow a supply chain to run efficiently but also be ready for supply chain disruptions when they arise.

Supply Chain Management Review defines supply chain resilience as “The ability to adapt, change, and respond quickly to threats as they arise” (2016). Resilient supply chains are able remain agile when threats arise. Risk is based on uncertainty, which always exists. Therefore, there must be flexibility built in to the supply chain to deal with unforeseeable events. Building a resilient and agile supply chain could mean radically changing, or reengineering, the existing supply chain. Table 1 describes features of a resilient supply chain. The physical features and relationships attributes listed in the table are what create stronger and risk adverse supply chains.

Physical Features	Relationships
<ul style="list-style-type: none"> • Design is matched to demand • Parallel paths • Shorter supply chains • Shape of the supply chain • Higher stocks • Spare capacity • Agility • Downstream decoupling point 	<ul style="list-style-type: none"> • Collaboration • Confidence in partners • Visibility • Process convergence • High velocity

Table 1. Features of a resilient supply chain. Adapted from *Supply Chain Risk Management: Vulnerability and Resilience in Logistics, Second Edition* by Donald Waters, 2011, Kogan Page Copyright Donald Waters © 2011, Publisher: Kogan Page.

The features of a resilient supply chain are what most companies strive for. Getting there can be more difficult. Supply chain risk management and supply chain collaboration are a means to build resilient and agile supply chains.

Contingency Planning

While risk management is important, without a recovery plan, the probability that an organization can operate in the aftermath of a severe supply chain disruption decreases significantly (Supply Chain Management Review, 2016). Flexible operations can avoid the worst effects of disruptions and the supply chain can continue to work normally, but sometimes, the effects are too severe for even the most flexible supply chains (Waters, 2011). Disasters have two essential features: “1) Events are very rare, with such a low probability of occurrence that they do not even register as anticipated risks; and 2) there are very severe consequences when an event occurs” (Waters, 2011). Although some disasters are rare, some attention should still be directed toward them. “Ignoring risks may compromise business continuity and impact stock performance” (Khan & Zsidisin, 2012). Contingency plans are used in the case of emergencies and as a last resort. It is a “Plan B” in case of an unforeseeable event.

In the interview with Dan Howe, it was noted that he is more concerned with supplier's business continuity planning rather than GM's. Working with suppliers to create plans to ensure materials are readily available is a top priority to ensure there is little to no downtime at plants, which can be extremely costly. Contingency plans are only as good as its members. In the examples of Samsung and Chipotle, it was difficult to pinpoint the root cause of the issue because investigations had to be made within multiple tiers of suppliers globally. Looking at the financial health of suppliers is important to determine if suppliers are likely or unlikely to be able to bounce back from a major supply chain disruption. Knowing suppliers can withstand major mishaps can help create a more resilient and agile supply chain.

Business Continuity

Business continuity management are the "Methods that ensure the essential business functions continue to work through an emergency" (Waters, 2011). This differs from crisis management, the "Designs procedures to deal with severe, unexpected disruption to a supply chain, however the disruptions were caused, and return the chain to working as quickly as possible" (Waters, 2011). Donald Waters (2011) puts it simply, "Risk management deals with identified risk, crisis management deals with unidentified risk, and business continuity management ensures that core operations work normally."

To initiate business continuity management (BCM), Donald Waters (2011) provides six steps: initiate the process of BCM, define the requirements of BCM and develop a strategy to achieve them, assess the risks, prepare the business continuity plan, implement the business continuity plan, and continually monitor and adjust plans for changing conditions. Assessing the risks means identifying vulnerable operations with the supply chain, analyzing the impact if a key operation is no longer available, and design options for handling an emergency (Waters,

2011). The business continuity plan should be detailed in procedures, communication, descriptions of roles of all support functions, and arrangements for backup (Waters, 2011). Implementing the business continuity plan can include training and drills of employees and supply chain participants. The business continuity plan can be the difference in a supply chain loss or supply chain opportunity.

Future Research

This paper discusses how collaboration can be used to manage supply chain risk. Although theories and studies were mentioned, differentiating theory and practice is important for this topic. Exploring companies that wish to implement or improve their supply chain through collaboration is an interesting topic in putting collaboration theory in to practice. Little has been done to implement supply chain risk strategies and collaboration framework for specific cost savings and benefits. Using the cross-enterprise framework from Figure 1 to determine if this guide and others could be successfully implemented would be interesting.

Conclusion

Supply chain risk management and collaboration are a journey. These principles are emerging and currently there is not a comprehensive set of tools for SCRM or supply chain collaboration. In an increasingly uncertain, complex, and global supply chain environment, companies, no matter the size, must continually incorporate supply chain risks in to business strategy. Distinguishing purchasing and logistics risk helps to pinpoint potential risks. The increase in supply chain disruptions and evolving responsibilities of supply chain professionals further demonstrate the need for innovation. Emerging supply chain risk management strategies and supply chain collaboration frameworks pertaining to the distribution of products can work to help build a resilient and agile supply chain.

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