

Teaching Supply Chain Management

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Abstract: *The COVID-19 pandemic has undoubtedly affected every corner of the world in 2020. It has also emphasized the importance of managing supply chain risk and developing an agile supply chain. Supply chain management instructors will likely want to introduce risk management concepts and strategies into their courses to raise their students' sensitivity to the impact of supply chain disruptions. Unfortunately there is currently a dearth of coverage of supply chain disruptions and risk management in the major supply chain management text books as well as in the broader library of supply chain management pedagogical research publications. To help to close this gap in the literature for instructors, we have developed a reading and set of related discussion questions and exercises that detail the causes of the shortage in toilet paper during the pandemic and short- and long-term strategies to make the supply chain more resilient in the future. By focusing on a disruption students likely experienced first-hand, they can develop a more nuanced understanding of the complexity and interconnectedness of supply chain functions in providing products and services to customers.*

KEYWORDS: *Content areas, experiential learning, pedagogical approaches, and supply chain management.*

1. INTRODUCTION

Risk management has always been an important concept within the supply chain. As firms began to collaborate and work more closely with their suppliers and customers in the 1990s, they realized significant cost reductions through strategies such as single-sourcing, low-cost offshoring, and centralized inventory management. While these cost reductions are hard to ignore, the strategies that enabled them increased the vulnerability of the supply chain to various sources of disruption (Chopra & Sodhi, 2014). More specifically, traditional supply chain planning processes seek to align functions within an organization and those of its major suppliers and customers to reduce costs and working capital requirements through the decrease of inventory and capacity buffers. These buffers are seemingly redundant after the reduction of demand and supply uncertainty realized through collaboration and integrated planning. This planning strategy works well in “business-as-usual” environments but not necessarily as well in scenarios that do not materialize according to plan (Trepte et al., 2020). The spread of the COVID-19 pandemic throughout the world starting in late 2019 and continuing through 2020 has brought the issue of supply chain risk and resilience into the forefront of the minds of practitioners, academics, and the general public in a way that it never has been before. At first glance, it might seem to be inexcusable that so many supply chain experts were caught unprepared to deal with the pandemic since researchers (e.g., Jüttner, 2005; Tang, 2006) have long emphasized the negative impacts of supply chain

disruptions. Firms around the world have dealt with significant supply chain disruptions due to causes such as factory fires costing hundreds of millions of dollars in damages and lost production (Mangan&Lalwani, 2016), product recalls of 21 million products due to a foreign supplier using leadpaint (Mangan&Lalwani, 2016), cybersecurity breaches costing an average of \$6 or \$7 million per incident (McCrea, 2019), and natural disasters such as earthquakes, hurricanes, tornadoes, and tsunamis resulting in approximately 35% of the affected companies going out of business within 3 years (McCrea, 2019). Many companies even have experience within the past 20 years responding to the outbreak of diseases such as SARS in Canada and many Asian countries and foot-and-mouth disease in the United Kingdom (Jüttner, 2005). What about the COVID-19 pandemic instead has disrupted supply chains so extensively compared to past events?

The COVID-19 pandemic also presents an opportunity for supply chain educators to motivate new students to recognize the importance of the supply chain in their lives and hopefully to convince more students to enter the field upon graduation. Professionals and academics have been lamenting the talent gap within the supply chain management field for at least 20 years and have tried to address it in numerous ways, but a significant gap still exists between professional job opportunities within the supply chain and available candidates with the requisite skills to fill those positions (Walden, 2020). The importance of a properly functioning supply chain (and even more significant, the frustration with an ineffective supply chain) has never been appreciated more by the general public than it has during the COVID-19 pandemic when nightly newscasts and countless social media posts depicted seemingly endless empty aisles at grocery stores. Linking supply chain concepts and strategies to students' recent experiences will likely entice some of them to think more seriously about choosing the field as a major or minor program of study.

This article is designed to review the existing literature on teaching supply chain risk management and then provide some classroom materials and suggestions that faculty members can use to introduce their students to supply chain risk management concepts through the prism of the COVID-19 pandemic and relate the issues to other, more familiar supply chain topics within the course or the curriculum as a whole.

2. LITERATURE REVIEW

Given the emphasis on supply chain risk management and resilience in the academic and practitioner literature published in the past 30 years, it is surprising to note the dearth of research that has addressed the concepts and tools within a pedagogical context. Very few published articles have focused primarily on the teaching of supply chain risk management. Samaddar and Nargundkar (2010) developed an approach to teaching supply chain risk management using a decision analysis framework (i.e., payoff tables and decision trees). Faced with a real supply chain disruption scenario, students must propose, evaluate, and recommend risk mitigation alternatives using various risk profiles and managerial objectives. Neidigh and Langella (2020) discussed the use of a mixed-integer programming model to design an optimal supply chain network consisting of supply locations, distribution centers, and demand locations. After solving the model to determine the optimal network structure and conducting a sensitivity analysis on that network by changing various model parameters, students then modify the model to consider the scenario where one of the facilities in the network is disrupted by going offline for a period of time. DuHadway and Dreyfus (2017) detailed a Sales and Operations Planning simulation that includes the random occurrence of significant positive or negative events in each period whose probability of occurrence is

based on the students' decisions within the simulation with respect to supplier and equipment selection. These activities and approaches do cover the issue of supply chain risk management, but that coverage is from a relatively narrow context or perspective such as within a very specific decision environment.

In addition to these three articles, other published supply chain games, simulations, and in-class activities address the issue of supply chain disruptions and risk to some degree. Snider and Southin (2016) presented an introductory operations and supply chain management exercise to introduce students to many topics that would be covered in the rest of the course, including risk management. In the activity debrief, students are asked to identify potential sources of legal, financial, organizational, and technical risks that the company in the activity might face. This helps to raise students' sensitivity to potential sources of risk, but (as is appropriate for an introductory activity) it does not go further to discuss the implications of the risks or ways to mitigate the risks.

Drake and Mawhinney (2007) developed a multiechelon supply chain simulation exercise that includes the possibility of students' production and ordering decisions being subject to such disruptions as transportation delays and quality uncertainty. Webb et al. (2014) also discussed a multiechelon supply chain exercise that incorporates production quality uncertainty and short disruptions of product and material flow. While these exercises do incorporate (largely short-term) supply chain disruptions to some degree, they mainly succeed in raising students' awareness of possible disruptions and the impacts of those disruptions rather than teaching them how to prevent disruptions from occurring or how to build resilience into the supply chain to handle such situations should they occur.

3. METHODOLOGY

In this section, we provide some potential discussion questions (along with sample answers) that instructors can use to facilitate a live classroom discussion or design an assignment based on the reading in the supplemental file. We have organized these questions to correspond to the section of the reading in which they are applicable.

Question 1: Did you experience stockouts during the COVID-19 pandemic? If so, what products were affected, and why do you believe those products were out-of-stock?

This question is meant to introduce the topic and set the scene of buying items during the COVID-19 pandemic. Moreover, it exposes to some of the supply chain topics discussed in this article. For example, if a student experienced stockouts of hand sanitizer and soap, hopefully he or she could identify that this was due to the store's lack of inventory to meet all of the demand and the manufacturer's inability to get inventory to the store on time. The instructor could draw the connection between the supply chain concepts of safety stock and lead time that have been (or will be) discussed in other parts of the course.

Question 2: Can you define a lean supply chain? What are some key characteristics of a lean supply chain?

The reading discusses some of the limitations of a lean supply chain. If students are struggling to define a lean supply chain, the instructor can start by asking for key characteristics of a lean supply chain such as waste reduction (particularly in the form of inventory and lead time reduction) and utilizing pull-based (or Kanban) replenishment. Using the characteristics that students mentioned, the instructor can create an encompassing definition such as "a supply chain that reduces or removes nonvalue-added activities by reducing wastes (e.g., motion, inventory, waiting, defects, overproduction, transportation, and overprocessing."

The toilet paper supply chain Case:

Question 3: After learning a little bit about the toilet paper supply chain, do you see any limitations that could have led to the shortages or inhibited recovery from the shortages?

This question allows students to brainstorm topics that were further explored later in the reading. If students are struggling to come up with ideas, instructors could try incorporating the key characteristics discussed in Question 2. For example, if inventory reduction was a key characteristic mentioned, instructors could lead students to draw the connection that if the toilet paper supply chain has minimal inventory, it can be hard to recover from a large spike in demand like the one seen during the pandemic. The following list includes other possible issues that students could raise when answering this question:

- Manufacturers produce other products in same the plant and have a large variety of products and packaging sizes, which creates additional set-up time and lowers utilization.
- Expensive paper-making machines make it difficult for manufacturers to add extra capacity when more product needs to be produced.

4. FINDINGS AND CONCLUSION

The COVID-19 pandemic has undoubtedly impacted the entire world and has thrust the importance of an effective yet resilient supply chain into the perspective of the general public. Supply chain risk management has now become an essential topic for supply chain management courses if for no other reason than to ensure that students are aware of the potential consequences of a significant supply chain disruption. Based on the current state of the literature on supply chain management pedagogy and the coverage in mainstream textbooks, however, instructors may have difficulty incorporating risk management concepts into their courses. We have developed the classroom materials and approaches discussed in this article to aid their efforts in connecting these risk management concepts to traditional operations and supply chain topics. These classroom materials can also help supply chain management courses and academic programs to use the experience of the pandemic to motivate students' appreciation for and interest in the field.

We hope that instructors find the materials that we have developed useful in introducing these supply chain risk management concepts to their students; however, the gap in the pedagogical literature and lack of textbook coverage we found when preparing this manuscript was particularly enlightening as well. Given the importance of emphasizing risk management concepts and tools in supply chain courses, we hope that this article will also galvanize pedagogical researchers to develop innovative methods to teach supply chain risk management and textbook authors to include more coverage of these topics in their revised editions. Preparing the next generation of supply chain management professionals to adequately manage risks and to build resilient supply chains will help to reduce the impact of future supply chain disruptions on the people who rely on those products and services.

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