

# Paper and packaging industry dynamics during COVID-19 and their strategies for the future

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## Abstract

**Background:** The paper examines the “mysterious case of the disappearing toilet paper” during the COVID-19 pandemic.

**Purpose:** This paper describes the strategic impacts on paper and packaging supply chains due to the pandemic.

**Study design/methodology/approach:** Structured interviews and qualitative discussions with organizational and supply chain management leaders.

**Findings/conclusions:** Several “behind the scenes” and less well-documented supply chain impacts in the paper and packaging, and logistics industries were discovered. The critical effects observed are: (1) Impact on the manufacturing side was mitigated mainly by implementing CDC guidelines and by the willingness of industry leaders to go above and beyond to shield their employees from economic hardships. (2) The transportation sector has experienced a more severe workforce shortage, amplified by government actions before and during the pandemic. (3) Product specialization, a pre-pandemic strategy for industry participants, turned into a weakness during the pandemic due to unprecedented shifts in demand across sectors. (4) Traditional “lean” supply chain thinking is increasingly making way for a more interconnected “risk avoidance” strategic model.

**Limitations/future research:** The research is limited to organizations in Midwest U.S.A. and one organization in Europe.

## Keywords

COVID-19; pandemic; toilet paper; bath tissue; facial tissue; paper towel

## Introduction

The COVID-19 pandemic impacted global supply chains, posing severe challenges to the pulp and paper industry. On the other hand, it has created opportunities for manufacturers in the business-to-consumer (B2C) segment (Liu et al., 2020). The

United States, like the rest of the world, has been affected by the COVID-19 crisis impacting food safety, healthcare products, and cleanliness in packaging. Efforts are going on to reduce the risk for future outbreaks, and hence, packaging plays a pivotal role in the pandemic crisis. The packaging is designed to protect the product from

contamination and provide impediments against moisture and oxygen transmission to enhance and preserve the quality of the packaged product. COVID-19 has spawned significant changes throughout the various aspects of supply chain management. Supply chains are networks of resource integrators to create value for organizations (Ketchen et al., 2014; Stolze et al., 2016). Further investigation of the pandemic and its effects on supply chains will develop a more comprehensive understanding of the wide range of interconnections.

The pandemic has affected all domains of global supply chains, including distribution, packaging, and sourcing of raw materials (Aldaco et al., 2020; Choudhury, 2020). It has reshaped industry megatrends to have significant short and long-term implications for packaging design (Feber et al., 2020). Lockdowns caused disruptions in the transportation of packaged foods (Choudhury, 2020), while few companies closed their plants for cleaning purposes. Weersink et al. (2020) recognized capacity restrictions due to the pandemic, leading to operational challenges. COVID-19 has impacted many sectors, and business establishments were forced to shut down their operations due to lockdowns which caused supply chain disruptions affecting the packaging industry worth \$900 billion (GEP, 2020). Supply chain risk management faces challenges due to economic policies and globalization, which have added more uncertainty and challenges to supply chain networks (Gurtu & Johny, 2021) and globalization (Figus, 2021; Hámori, 2021). Global tissue consumption is rapidly increasing due to the pandemic, which has added more stress to the capacity of the paper and packaging industry. Table 1 describes the tissue consumption worldwide in 2018 by region.

**Table 1** Tissue Consumption Worldwide 2018

Region/Country Name	Share %
North America	24.50
China	22.40
Western Europe	17.50
Latin America	11.10
Asia Far East	6.20
Eastern Europe	5.60
Japan	5.10
North & Middle East	4.10
Africa	2.30
Oceania	1.20

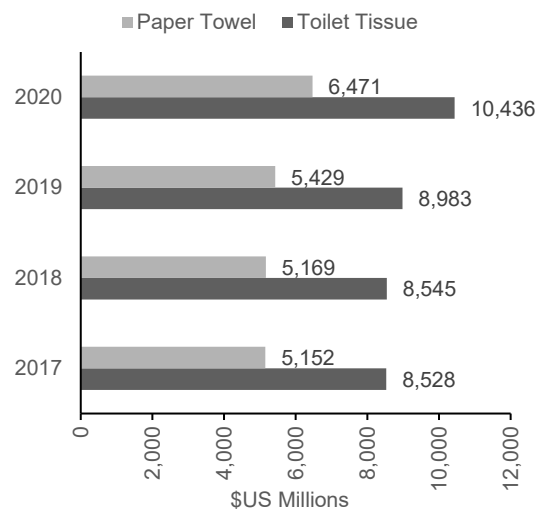
Source: the authors according to TAPPI North American Tissue market outlook

The COVID-19 pandemic stress-tested paper and packaging supply chain networks on 3Rs:

responsiveness, reliability, and relationship to meet the expectations of customers and stakeholders. The disruptions caused due to COVID-19 forced manufacturers to reassess and realign their supply chain management strategy. Manufacturers encountered several challenges globally due to this crisis, and the paper and packaging industry was no exception.

The demand for packaging in the business-to-business (B2B) sector is associated with GDP and industrial activity. While GDP shrunk, causing a decline in industrial and commercial activities, B2C activities skyrocketed, increasing demand for different products and from various segments. Due to this crisis, the demand for packaging in food distribution, healthcare products and e-commerce sharply increased, while industrial and commercial sectors declined.

The United States constitutes the largest toilet tissue and paper towel market. The consumption for the B2C market has increased, which has impacted the forecast for the top manufacturing companies in this segment. Figure 1 shows that toilet tissue and paper towel sales in the United States have increased over the last four years.



**Figure 1** Toilet Tissue and Paper Towel Sales in the USA

Source: Statista, 2021

The remainder of the paper is organized as follows: Section 1 discusses the literature on the paper and packaging industry as well as the timeline of COVID-19. Section 2 explains the methodology deployed in developing this paper. Section 3 presents a discussion and analysis. The last section presents the long-term implications of this pandemic, some limitations of this research, and proposes future research directions.

## 1. Literature review

This first section of the literature review provides an overview of the paper and packaging industry. All the papers were developed during the COVID-19 pandemic because the world had never experienced it in the past. Toilet paper drew considerable attention from the public and researchers. Many researchers worked on this from different perspectives (Abe et al., 2020; David, Visvalingam, & Norberg, 2021; Décobert, 2020; Dinić & Bodroža, 2020; Engstrom et al., 2021; Garbe, Rau, & Toppe, 2020; Im, Kim, & Lee, 2021; Kirk & Rifkin, 2020; Leung et al., 2021; Miri, Roozbeh, Rad, & Alavian, 2020; Sun & Han, 2021). The disciplines involved were from a wide range, from business and economics to public health.

The global production of paper and cardboard in 2018 was 419.72 million metric tons, and more than half of that was for graphic paper. China, the United States, and Japan are the top three countries in paper production, accounting for more than 50% of the global paper production. Imports and exports from the United States are the highest, followed by Germany (Tiseo, 2021).

Agriculture, biology, chemicals, distribution, forestry, and transportation are parts of the pulp and paper industry, and play a vital role in the world economy (Huang et al., 2019). According to the American Forest and Paper Association, approximately 4% of the total U.S. manufacturing GDP comes from forest products. This industry manufactures products worth approximately \$300 billion per year, employs about 950,000 men and women, and is among the top 10 manufacturing sector employers in 45 states of the United States. The major elements of the paper industry are sourcing, making, and converting. Sourcing of raw materials (fiber) can be through virgin growth or recycling of previously used paper/cardboard. The “paper making” process happens in paper mills resulting in a wide range of paper and board types and formats. Finally, the original paper and board are converted into applications, including office products, hygiene products, packaging materials, and specialty papers. The transportation of these products through all stages of the process is a material consideration for the overall economic footprint. Ultimately, the products are being delivered to differentiated markets in customized formats. Supply chains of toilet paper were explored as an example.

The toilet paper industry caters to two major market segments: consumers requiring toilet paper

to be used at home and commercial clients stocking restrooms in offices, malls, restaurants, and other public places. Each segment has different product expectations, which has repercussions all the way to the sourcing process. Commercial paper providers may rely primarily on recycled fiber to achieve Eco-Certifications. Their machines are set up accordingly, and the resulting product is rougher toilet paper that would not be well suited for the more demanding consumer segment. Toilet paper demand for the consumer segment increased exponentially during COVID-19, while commercial toilet paper demand decreased due to the shutdowns of business establishments (Moore, 2020). The global revenue in the toilet paper market for the year 2020 is shown in Table 2.

**Table 2** Revenue from Toilet Paper Markets

Country name	\$U.S. Millions
China	16411
United States	13402
India	7750
Japan	2835
Brazil	2775
Indonesia	2415
Germany	1981
Russia	1945
United Kingdom	1863
Mexico	1711
Philippines	1418
France	1402
Nigeria	1287
Italy	1220
Canada	1130
Turkey	1103
Pakistan	930
South Korea	928
Spain	878
Poland	814
Australia	810
Bangladesh	789
Vietnam	788
Saudi Arabia	785
Argentina	733

Source: Statista, 2021

The tissue & hygiene paper market is worth US\$35,535 million in 2021, and the market is anticipated to increase at the rate of 2.29% (CAGR) every year between 2021 and 2025. The paper industry’s largest segment is toilet paper, with the market size of US\$13,515 million in the U.S.A., followed by China, with the market size of

US\$17,602 million in 2021 (Statista, 2021). China was the world leader in toilet paper in terms of revenue in 2020 at 16.4 billion U.S. dollars, followed by the United States at 13.4 billion U.S. dollars in the same year (Statista, 2021).

This second segment of the literature review recaps the known facts and critical timelines related to COVID-19. The Wuhan Municipal Health Commission (China) first reported mysterious cases of pneumonia in Wuhan, which were ultimately attributed to a new form of coronavirus, and the resulting disease was named COVID-19. The pandemic probably started at a wholesale seafood and meat market in Wuhan. These are known as 'Wet Markets' and could be a breeding ground for spreading animal-borne diseases and viruses. As a precautionary measure, the Chinese government is reportedly considering changing meat handling and distribution practices and tighter regulations in the near future (Parker, 2020).

The WHO officially declared the viral disease outbreak to the world on January 5, 2020. The first warnings about the Corona Virus reached the United States on January 3, 2020, and the CDC issued the first public alert on January 8, 2020. The first recorded case outside China was reported in Thailand on January 13, 2020. The first case in the U.S.A. was reported on January 20, 2020, and the Chinese city of Wuhan went into a lockdown on January 23, 2020. WHO announced COVID-19 as a pandemic due to the alarming speed of the spread of the virus, its catastrophic effects, the vulnerability in handling the situation, and the global chaos (WHO, 2021). The first COVID-19 death in the U.S.A. occurred on February 6, which was not identified until April 2020. Previously the first death due to COVID-19 was believed to have occurred on February 29, 2020.

As cases started to rise in early March, individual States declared a state of emergency. By March 11, 2020, the number of cases in the U.S.A. reached over 1,000, with 37 deaths. The NBA announced the cancellation of its season on March 12, 2020, after a player was infected with the Coronavirus (Aschburner, 2020). MLS, NHL, NCAA, and other sports organizations followed suit. President Trump declared the National State of Emergency on March 13, 2020. The various States implemented closures of schools and other restrictions on public life starting March 15, 2020. On March 27, 2020, the first Corona Virus Relief Bill was signed into law. The pandemic is uncertain, and its existence will depend on various

scenarios leading to a few months or more than a year (Smit et al., 2020). The impacts along the timeline within the individual case studies will be discussed.

This third section will focus on consumer-driven demand-side changes. Consumers' shopping behavior changed to online purchase/delivery, surpassing the supply chain's agility to cope with the demand (Dunkley, 2020; Smith, 2020). Home delivery logistics services have grown in the past decade (Jara, Vyt, Mevel, Morvan, & Morvan, 2018). This pandemic has given food supply chain companies and startups a sudden jump. Online ordering of food and its home delivery was in development for many years (Cairns, 1996; Heim & Sinha, 2001). However, this pandemic has suddenly increased the demand beyond the capacity of online food retailers (Bhattarai, 2020). Scholars have been documenting the customer's expectations of last-mile logistics services since the early days of e-commerce (Esper, Jensen, Turnipseed, & Burton, 2003; Mentzer, Flint, & Hult, 2001) as well as operational service challenges that increasingly include managing crowdsourced delivery services (Castillo, Bell, Rose, & Rodrigues, 2018).

The price sensitivity among consumers is increasing cost pressures on the packaging industry, forcing packaging converters to get sufficient orders to attain the high operational efficiency of their plants. E-commerce activities and home deliveries are likely to continue to rise worldwide because consumers are increasingly inclined to buy their products through different channels than they used to buy from before the pandemic.

There has been a shift in the demand for the type of packaging, i.e., demand for some packaging declined, and some increased. As an example, e-commerce packaging increased. Many manufacturing and logistics organizations stopped operations during the pandemic to maintain the health and safety of their employees. This has affected the demand for packaging material and operations within the packaging industry. The manufacturing and logistics packaging demand from the B2C segment spiked, leading to stockpiling of bulk containers and drums for the B2B segment in mature markets like the United States and Europe. Moreover, demand for plastic packaging for the B2B segment reduced dramatically in Europe due to halted operations in other industries, leading to a 16% decline in revenues.

The closure of public spaces and lockdowns created a panic demand for packaging for food. Packaging for non-food items and premium goods got negatively affected due to the closures of stores and malls. The market for primary packaging materials like LDPE films from China fell to about \$770 per metric ton, which is a 12-year low and translating to an 8% reduction since April 2020 in spot prices. Due to the COVID-19 pandemic, Europe underwent an extensive assessment to replace non-flexible packaging with flexible packaging in the FMCG sector. This change in packaging is likely to reduce up to 21 million tons of waste per year, which is a 70% reduction in the total amount of non-flexible FMCG primary packaging. Thirdly, demand for biodegradable, recyclable, reusable, and non-toxic packaging materials increased. The demand for single-use plastics is high compared to multi-use plastics. However, these are non-biodegradable and pave the way for the globally pressing issue of environmental safety (GEP, 2020; Gurtu & Arendt, 2019).

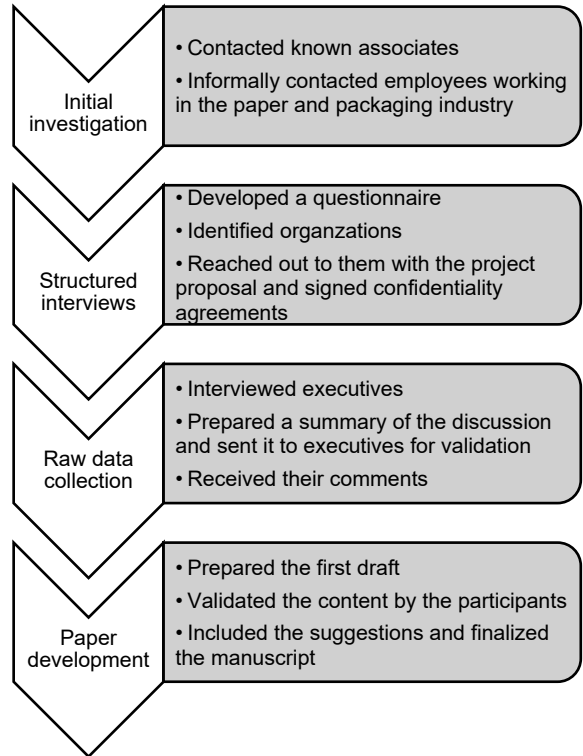
## 2. Research methodology

This research started with building a common thread experienced in the markets and summarizing the broader impacts of COVID-19 on the paper and packaging industry. Almost everyone experienced a shortage of bath tissues and paper towels across America. Investigating the reasons behind such a shortage was the starting point.

The initial investigation with known associates confirms the shortage across the nation. Next, various organizations in the paper and packaging industry were approached to dive deeper to understand the reasons for this shortage. Multiple organizations, big and small, virgin and recycled paper producers, and paper products/tissue producers for domestic and commercial applications were contacted. The snapshot of the process steps is illustrated in Figure 2.

A questionnaire was developed for structured interviews of executives. Willing organizations were identified because we reached out to several organizations in the paper and pulp industry. However, every organization was not willing to spend time on this academic research project as they had more pressing issues at hand. At least two researchers interviewed the executive jointly and compared the notes after the interview. An initial draft of findings from each organization was prepared and sent to the executives concerned for

validation, endorsement, and corrections, if any. The final consolidated manuscript contained their suggestions and changes while hiding the individual or organizational identifying information.



**Figure 2** Process steps followed in the research  
Source: the authors

Ten senior executives/COOs/CEOs were consulted from five organizations, namely (in alphabetical order) Essity, Green Bay Packaging, Precision Paper Converters, Paper Transport Inc., and Services Plus. Some common themes were expressed by executives, categorized as consumer/market behavior and industry dynamics. The comments about the individual organizations are combined to camouflage the organizations. However, summary profiles of participating organizations are given below.

Essity AB is headquartered in Stockholm, Sweden. It is a global hygiene and health company. The product portfolio contains single-use products such as tissue paper, baby diapers, feminine hygiene care, incontinence products, compression therapy, orthopedics, and wound care. Until 2017, Essity was a part of the hygiene and forest products company SCA. Essity spun off the hygiene operations in 2017 and was listed as a separate company on Nasdaq Stockholm. Essity employs about 46,000 employees. Its net sales in 2019 were

EUR 12.2 billion. The word Essity means “Essentials” and “Necessity” (Essity, 2021).

Services Plus is a privately held company located in Green Bay, Wisconsin, U.S.A. It has 150 employees, and this organization operates 24 hours a day, five days a week, and on weekends when needed. Services Plus focuses on custom manufacturing of consumer tissue and papers for residential and commercial markets. The company also supplies specialty packaging services for branded and private label Consumer Product Goods. Its customers value flexibility and the speed to market the most and rely on them as a partner to increase their brand equity (Services Plus, 2021).

Precision Paper Converters (PPC) was established in 1991 by three individuals working in the packaging industry who had the vision to begin a business in the paper industry. PPC purchased the equipment from a paper manufacturer that had shut down its operations. With five employees in total, PPC began as a small paper converting company renting space in the back of a cheese factory in St. John, Wisconsin, U.S.A. The vision became a reality as the company experienced growth over the years, ultimately leading to land purchase and construction of a new facility in Kaukauna, Wisconsin. PPC has been under the current ownership group since 2002 with over 25 years of paper converting experience. PPC has the expertise and desire to lead facial tissue conversion, including interfolded products such as lens wipes and delicate task wipes. They are the only company in North America that focuses on facial tissue production out of the main tissue product categories. PPC produces facial tissue for other paper companies under their brands. These companies choose not to make their facial tissue or make all the sizes/styles they offer to their consumers. PPC has a significant presence in healthcare, where they produce tissue sizes specific to the needs of the healthcare industry (Precision Paper Converters, 2021).

Green Bay Packaging was founded in 1933 by George F. Kress to offer corrugated shipping containers as an alternative to wooden boxes. The folding carton division was added in 1942. The company continues to grow through innovation and acquisitions and focuses on environmental impact. In 2018 the company broke ground on a state-of-the-art paper mill in Green Bay, Wisconsin, U.S.A. This was the first new paper mill to be built in the U.S.A. in decades. Green Bay Packaging is a full-service packaging company

offering corrugated cardboard, folding cartons, and coated label stock. The organization has 35 divisions, 4200 employees, and sales of \$1.3bn (Green Bay Packaging, 2021).

Paper Transport Inc. provides freight transportation services. It offers truck-load and intermodal transportation services. The company specializes in regional deliveries and runs lanes from the Midwest to the Southeast. The company was founded in 1990 and is based in Green Bay, Wisconsin, U.S.A. It has service locations in Muskogee, Oklahoma; Dallas, Texas; and Jacksonville, Florida (PTI, 2021).

### 3. Discussion and analysis

Due to various reasons, the paper and packaging industry and its supply chains were significantly affected during the COVID-19 pandemic at multiple levels. The discussion is divided into three levels, i.e., consumer and market behavior, industry behavior, and organization behavior.

#### 3.1. Consumer and market behavior

General dynamics in March 2020: Many states announced emergency and the closure of education institutes (schools, colleges, universities) and the hospitality industry (restaurants, clubs, pubs); work from home culture increased dramatically due to travel restrictions leading to a massive shift from “out of home” to “in-home,” impacting many industries. Consumers started to stockpile (Labad, Gonzalez-Rodriguez, Cobo, Puntí, & Farre, 2021; Leung et al., 2021; Prentice, Quach, & Thaichon, 2022), leading to shortages, most notably kitchen towels and toilet paper, sanitizing products, and several other essential categories. Retailers began to implement purchase limits. Business travel was largely replaced with virtual meetings and in-person education with virtual education. Online platforms like Zoom and Microsoft Teams boomed, as did the technology products related to work or learning from home.

Access to talent – a complex dynamic: Initial layoffs in March and April 2020 across industries resulted in unemployment not seen since the Great Depression of the 1930s. Even as workers began to return to work, many companies struggled to attract workers. Some chose to remain at home due to safety concerns. Attractive unemployment subsidies allowed some to have income levels comparable to returning to work, contributing to a “wait and see” strategy. Despite continued elevated unemployment levels, many companies struggle to

attract the workers they need to meet demand, especially in a rebounding market and economy.

### 3.2. Industry dynamics

Many interconnected supply chains were impacted in the paper and paper converting industries. The following is a list of observations shared by our interview partners about what happened at various stages.

**General dynamics in March:** Companies were rushing to gather information and implement CDC guidelines on cleaning, social distancing, and reducing human contacts in their facilities. The initial response varied widely, with some companies having to shut down operations for some time while others maintained continuous operations. Fierce competition for resources started, including cleaning/sanitizing supplies, work from home technologies, personal protective equipment (PPE), and items like non-contact screening thermometers. Where possible, companies asked workers to work from home. Others were furloughed. As cases rose, many business areas came to an initial freeze. In light of the growing uncertainty, many companies pared back recruiting and capital investments.

**Sourcing raw materials for paper production:** one of the key sources of pulp is recycled scrap paper. With the closure of offices and schools, the availability of scrap paper plummeted, forcing many paper companies to switch to a more expensive virgin pulp, which was not as constrained in its availability because lumber operations were able to continue.

This posed a challenge to companies specializing in serving the professional rather than the consumer market. Equipment was not configured to handle most virgin pulp, and a switch could have led to a loss of eco-certification tied to the use of recycled materials. This resulted in fierce competition for the remaining recycled pulp. Specialty product manufacturers have built their entire supply chains to fit the expectations of target markets, from raw materials sourcing, eco certifications, and machine configuration, to product offerings in specialized market segments. Unprecedented shifts across categories – commercial to consumer due to lockdowns, a knock-on effect of the commercial shutdown on recycled raw materials, a surge in domestic rolled paper demand, and a decline in folded commercial paper impacted manufacturing operations. This sudden shift in customer segments or product demand will lead to designing more flexible

manufacturing systems and targeting a mix of customer segments in the future.

**Significant product shifts within the paper industry:** demand for cut paper typically used in offices and schools sharply declined while demand for the rolled products (kitchen towels, toilet paper) in the consumer market skyrocketed. Within the commercial and hospitality markets, demand for all types of products (folded, rolled, napkins, bathroom supplied, among others) dropped significantly. Demand for folded products such as facial tissue reduced in the consumer segment due to reduced social contacts and masks. It eliminated the 2020 regular flu season. Carton demand increased in shipping due to increased B2C activities (the Amazon effect) and take-home/delivery in food sectors. Some companies made substantial capital investments to refocus their paper production capabilities and capacities on high-demand products (e.g., paper boards).

**Changes in SKU complexity:** Consumer demand routinely emptied shelves in several paper product categories (especially rolled). Historically, a wider range of SKUs provided varying purchase incentives. Manufacturers and retailers were now willing to compromise on fewer options to get the product onto the shelves quicker. This change impacted parts of the supply chain specialized in multi-packing and wrapping.

**Transportation industry early dynamics:** Many carriers, especially those with a more specialized customer base, had to park their trucks and furlough their drivers because many of their customers were not able to maintain operations. Others were able to shift volumes as certain markets began to boom. Drivers were considered essential workers, so their work did not really change, but they faced substantial obstacles. Rest stops limited food sales, access to bathrooms at loading facilities, and contact avoidance became a prominent theme. Market pressure forced spot rates down initially, which the industry was able to offset due to lower fuel prices. Lower traffic on the roads led to a substantial decline in incidents, bringing run rate safety costs down as much as one-third and providing additional financial lift.

**Highlight on driver availability:** Driven shortage due to the aging population and less income is a known issue (Gurtu, 2021). The pandemic made it even worse. New rules around drug and alcohol screening (FMCSA Drug and Alcohol Clearinghouse) had already reduced the number of available drivers. Graduation of Commercial Driver's License (CDL) declined by

about 40%, and many drivers exited the profession due to the perceived risk, alternative opportunities, or boost in unemployment programs. The estimated range of truck drivers who retired from the profession is 200K-300K. Recruiting drivers remains one of the biggest industry challenges. Referral programs and sign-up bonuses up to \$10K are here to stay for the foreseeable future.

Transportation industry later dynamics: As transportation volumes rebounded and began to boom while truck and driver supply was limited, spot rates started to recover. Since fuel prices remained low deep into 2020, the industry experienced strong profitability with a record Q4/2020. Increasing fuel prices and wages were eating into that profitability in 2021. Talent shortages remain a critical constraint.

### 3.3. Organizational challenges

Every organization has an emergency plan for incidents like evacuation in case of a fire, chemical leak, or shutting down the plant. Organizations conduct drills routinely to check the efficacy of procedures, train employees, test employees' compliance, and test equipment. However, none of the organizations contacted had a strategy or a plan prepared for a pandemic. All organizations started reacting to the developing situation almost simultaneously towards the end of February-early March. One of the executives said, "We were not at all prepared. I did not think this would be a big deal for us; nobody believed we would have a 48-day shutdown." Another executive said, "In February 2020, we did some disaster testing as part of a longer-term preparedness plan. In March, we had to send 100% of our people home, so reality came much harder. We had not planned for anything of the magnitude of COVID-19."

As the rest of the world was learning about COVID-19 and CDC was updating the guidelines, all organizations followed CDC guidelines for social distancing, masks, and sensitization. Europe (Italy in particular) experienced the harsh effects of COVID-19 before it spread to North America. Europe introduced guidelines for social distancing, temperature checking and sanitizing, among others. Essity being a European organization, started adopting these recommendations a few days before CDC recommended them for American organizations. Sanitization of the entire plant at the end of every shift became a routine. One person wiped every surface and control panel with sanitizer every shift for eight hours. Organizations communicated new guidelines and safety

precautions to employees regularly. "We (an organization executive) probably made 40 videos, communicated every week, sometimes twice, when we had a case, or something happened. We believe in informing our people. We put it on a TV in our lunchroom." There were shortages of sanitizing products and preventive items like non-contact thermometers in the beginning. Temperatures measurement for every employee at the start and in some organizations became a new routine during the shift.

A sudden increase in the demand and the closing of some vendors led to sourcing some raw materials from new vendors without the luxury of developing a relationship and trying out the products. Supplier reliance due to capacity limits, the inability of suppliers to source talent or raw materials, and prioritization decisions by suppliers were not favorably identified as the weaknesses by industry players. This situation stabilized after the third quarter, and organizations considered developing a backup plan. The lesson is to move away from the strategy of a single most cost-effective overseas source to develop a network of suppliers from different geographies, some inland and some overseas, to avoid future disruptions. Short-term scramble to mitigate them has to be differentiated from long-term lessons learned that would shape supply chains in the future, including down streaming of key capabilities into supplier base, sustained diversification, greater interconnection between product groups, etc. As a strategy, effective models of crisis management (war rooms, alternative forecasting methods) may be sustained into the future.

Every organization had the capability to remote log in and work while away from their desk. However, it was designed to help employees work remotely while traveling. A sudden need for all office employees to work from home put the system to near 100% capacity, and it became a challenge to ensure security over the internet connection. The internet bandwidth was managed successfully at the organization's end, but internet connectivity was challenging for employees living in the countryside. There were no changes in the use of technology to overcome the challenges during this pandemic. "No new technologies deployed related to COVID. Just moving along the technology curve as we ordinarily would, using AI and 3D technology in the new paper mill," said an executive. However, expansion in IT infrastructure is anticipated to make it more robust and meet the expansion in the future. "We are double purchasing



our IT infrastructure. We will set up office-like situations for our employees at home, so we double up on monitors, towers, etc. Our employees will be able to choose freely between home and office without dragging equipment back and forth,” said another executive.

No executive believes that they will ever return 100% to the pre-pandemic state. Mask and sensitization have circumvented the flu season, and masks may become mandatory in parts of operations. More employees will be working from home. The system and procedures to work remotely have been stress tested due to the sudden onset of this situation and modified wherever required. “As long as are people are productive, there is no benefit to micromanaging them.” Business travel will reduce because people are now used to video conferencing. “Business travel expenses will come down, and drivers do not have to come to the office any longer.” Digital or touch-free technology is now an acceptable norm. If a physical paper is received, its picture is taken and transmitted into the system.

This disruption has caused business leaders to take a hard look at their supply chains’ backward and forward integration. This is one area where changes will take place in the post-pandemic world. However, these are strategic issues, and such decisions require information gathering, analysis, and time.

## Conclusion

COVID-19 caused challenges in almost every area of business and social life. It affected many companies adversely and caused a large number of human tragedies. The scope of this paper is limited to identifying the effects of COVID-19 on supply chains in the paper and packaging industry. Every product needs some packaging, and every person has experienced its usefulness. When the packaging industry is affected, consumers do not get the finished products even though the products may be available.

Paper is an essential component that goes into packaging besides being used for various other purposes in daily life. Almost everyone experienced a shortage of bath tissues and paper towels during the pandemic. Almost all big-box retailers had empty shelves for these products. Many stores put a sign at the entrance that they do not have these products. Many stores limited selling products in short supply (bath tissues and paper towels) in large quantities and prohibited returning/exchanging to discourage consumers

from hoarding. In order to serve more consumers, packaging organizations changed the size of packaging (SKU), and some retailers started selling individual rolls instead of multi-roll packs. The consumer behavior created a shortage of domestic paper products in the market.

Nonetheless, commercial paper products were in excess because there were no buyers in this section. Commercial sectors include offices, the hospitality industry (hotels, bars, restaurants, stadiums), educational institutions (schools, colleges, universities), and public transport. Nevertheless, the quality, product sizes, and packaging sizes are not interchangeable between these two segments of the same products. For example, toilet roll sizes used at homes and offices are different. The manufacturers of products in these two segments are different due to input materials and the final quality. This created another challenge for organizations serving commercial sectors. Since all the offices and educational institutions were closed, there was a shortage of paper for recycling, which is the primary input material for commercial products. Another challenge was finding retailers for such products because organizations dealing with institutions did not have a sales team to interact with retailers.

The research discussions and findings in this paper have given some interesting insights into the challenges faced by the paper and packaging industry. First, there is a lack of people with specific skill sets required for operations. The tightening of rules and protocols in the manufacturing sector reduced productivity and increased unemployment due to the unwillingness of people to work due to the possibility of exposure to COVID-19. Governments gave various relief packages to people to help them manage the crisis. This added to the non-availability of people in the workforce because people were getting as much money without working. Second, the unprecedented shift in the supply chain from commercial to consumer product categories further added to the challenges of the paper and packaging industry. The raw material, processes, machine set-up, product size, packaging, distribution networks for these two segments are entirely different, and most of the manufacturers serve only one of the segments. Switching from one segment to another without considerable investments and time is not practical besides a strategic decision that cannot be taken during a crisis. However, many manufacturers will consider this now, and many may diversify their product portfolio in the future.

Finally, the industry needs to work on effective business models for sustainability, sustained diversification, and interconnection between product groups for risk minimization in the supply chain network.

This pandemic has added many new dimensions to the planning process of every organization. Most of the paper and packing industry will try to have better vertical integration and diversify its product and customer portfolio. They will also include pandemics in their risk assessment and develop plans to manage such crises in the future. The shortage of paper for recycling may develop new programs for collecting papers from home. The silver lining in all this is that operating expenses for travel and office space may reduce in the future.

This research has some limitations too. The study was limited to organizations in Midwest U.S.A. There was a lack of understanding of issues faced by the paper and packaging industry, which limited this initial research to structured but qualitative interviews rather than a survey for statistical validation. This leads to the possibility of extending this research to survey-based empirical research. Another possible extension is to include organizations from other parts of the world in this study to make it more comprehensive. Also, this study can be extended to the changes in the paper and packaging industry in the USA due to the pandemic and compare the process before the pandemic and after stabilizing in a post-pandemic state.

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