BUSINESS INSIGHTS

A COLLEGE OF BUSINESS RESEARCH JOURNAL

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In This Issue

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Sincerely,

Charles R. Roberts
Editor-in-Chief

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- Papers must conform to APA format.
- Each paper must include an abstract (150-250 words).
- All pages must be numbered and have a running head (shortened form of title).
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- Names of the author(s) and faculty advisor should appear ONLY on the title page.

Corporate Social Responsibility: How Is Starbucks Making an Impact?

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ABSTRACT

Companies employ various strategies and approaches to manage a successful organization in today's business world. The public is increasingly demanding that businesses take their Corporate Social Responsibilities (CSR) seriously. CSR is a business model that enables an enterprise to be socially accountable to its customers, stakeholders, and the public. By embracing CSR, businesses can become aware of their impact on all sides of society, including economic, social, and environmental. Businesses are implementing CSR into their operations to reap the benefits of the advantage it gives them over their competitors. Thanks to CSR, companies thrive through increased sales volume and brand awareness. This paper aims to evaluate the CSR efforts of Starbucks Coffee Company and their impact. It explores how Starbucks' financial performance success relates to its CSR, how the organization integrates CSR, and what factors have contributed to the company's performance over time. Apart from offering high-quality coffee, Starbucks adds value to its customers' lives by providing them with an unforgettable experience through trustworthy and courteous service.

Introduction

Since 1971, Starbucks' external resources have enabled the procurement process to drive innovation within developing products. Most businesses fall short of linking their culture with how they execute their business strategy, but Starbucks positions itself as not just a coffee seller, but as an experienced provider. Customers can walk into any Starbucks worldwide and experience the same warm, friendly, welcoming environment. The environment extends beyond the décor; it exists because the employees behind the counter understand how their work fits into a larger picture and work collaboratively to conduct remarkable things (Ji-Eun & Park, 2021).

Corporate social responsibility (CSR) has grown in popularity in recent years. Many enterprises are beginning to participate in CSR to manage businesses that may benefit from its use. Customers are increasingly demanding that companies embrace their social responsibilities in the modern day. Companies currently conduct their operations following the CSR method. They try to get involved in activities that will help keep the business and social environments in good shape. CSR may also make a significant difference in product quality and customer service. Currently, competitors of specific organizations are already implementing CSR initiatives and embracing this new business philosophy.

This paper will discuss how Starbucks Coffee Company has achieved success in business by incorporating CSR. Starbucks Company now supplies annual CSR reports, which are publicly available on the company's website. Starbucks proves how it is actively involved in actions linked to the socio-economic, environmental, and economic perspectives through these reports. Furthermore, Starbucks promotes CSR initiatives that improve people's lives, the environment, the quality of its coffee, and its farmers.

Starbucks Heritage and Mission Statement

On March 30, 1971, co-founders Gordon Bowker, Jerry Baldwin, and Zev Siegl opened the doors to the first Starbucks location on the cobblestone streets of Seattle, Washington's Pike Place Market. They sold freshly roasted coffee beans, tea, and spices for their customers to take home. The following year, when they considered the possibility of building another store, Alfred Peet, veteran roaster and founder of Peet's Coffee and Teas in Berkeley, California, told them that they were becoming "too big." Then came the late 1980s. Suddenly, gourmet coffee shops selling expensive coffee concoctions were springing up all over. In 1988, there were 33 Starbucks locations. Except for Chicago, Illinois, and Vancouver, Canada, they were all in Seattle, the corporate hub (Haight, 2017). As of 2019, Starbucks had added 32,210 locations in approximately 80 countries. As a result, its revenues have continued to grow steadily. Starbucks' fiscal year (FY) 2019 revenue was USD 26.5 billion (Ji-Eun & Park, 2021).

The company's name comes from the famous book *Moby-Dick,* by Herman Melville, which portrays the early shipping traditions that would have included coffee traders. Starbuck was the name of the first mate aboard the story's ship *Pequod.* Co-founders got the idea for their logo while poring over antique marine literature where they discovered a nautical figure known as a twin-tailed siren. Starbucks has two ties to the maritime world: Seattle is a port city, and coffee often travels great distances across oceans. The company has given the Siren makeovers through the years, but she still is as seductive as ever (Krishna, 2018).

Howard Schultz visited Starbucks in 1982 and expressed an interest in becoming a company member. Starbucks agreed to hire him. Schultz worked hard for Starbucks and focused on the enormous potential of extending the Starbucks operation outside of Seattle to introduce Starbucks coffee to people throughout America. The proprietors were opposed to Schultz's ideas of expansion and preferred to concentrate exclusively on its traditional core business of selling coffee beans and equipment. Though dejected, Schultz continued to press his views until the owners eventually reconsidered. Schultz traveled to Italy in 1983 and fell in love with Italian coffee cafes and the romance of the coffee experience. Schultz produced the concept to redesign the stores in the style of the Italian coffee, but altered it for the American market (Ji-Eun & Park, 2021).

Howard Schultz left Starbucks in late 1985 to found his own brand called II Giornale Coffee Company. He intended to open espresso cafes in high-traffic areas of the city. In

March 1987, the founders of Starbucks in Seattle decided to sell their company. When Schultz learned this, he bought Starbucks in August 1987, becoming the company's president and Chief Executive Officer ("Global Environmental," 2021).

Shortly after, Starbucks expanded to Chicago; Vancouver, Canada; California; Washington, D.C.; and New York. In 1996, the company built its first store in Japan, followed by a European location in 1998, and a Chinese location later that year. Over the next two decades, the company would grow to serve millions of consumers each week and would become a permanent fixture in the communities it served. Starbucks remains committed to its mission with every action, decision, and cup of coffee: to inspire and nurture the human spirit—one person, one cup, and one neighborhood at a time ("Global Environmental," 2021).

People

Starbucks Coffee Company strives to be a force for good in the world. Humanity and the well-being of everyone they contact are essential to the company, from its partners to coffee farmers to the customers who come into its stores and beyond.

Pay Equity

In December 2020, Starbucks increased the pay rates for its employees in the United States, marking one of the most significant expenditures on compensation in the company's history. At Starbucks, baristas, shift supervisors, and café attendants hired on or before September 14, 2020, received a 10% wage increase. The company increased the wages for tenured partners who had been in their positions for three years by 11%. To recognize this critical leadership role and attract the best talent, Starbucks continues to invest in shift supervisor pay and a 5% increase in all starting page rates to aid store managers in attracting and keeping new employee talent ("Global Environmental," 2021). With these investments, more than 30% of U.S. retail partners are currently earning hourly wages at or above $15 per hour, and they continue their path to ensure all U.S. partners will be making at or above $15 per hour within three years ("Global Environmental," 2021).

College Education Benefit

The Starbucks College Achievement Plan aids qualified U.S. partners to finish their bachelor's degrees online at Arizona State University (ASU). Since the program began in 2014, approximately 4,500 partners have graduated, with the May 2020 class being the largest ever at 700. In FY2020, ASU online degree programs enrolled over 14,000 partners, with over 20% of first-generation college students. Starbucks is an intelligent business when it comes to gender equality and minorities. In 2017, just 40% of their employees were U.S. citizens, while women made up 65%. Members of minority groups account for 16% of the company's top leadership team, including senior vice presidents and higher executives, and women account for 29%. Starbucks Coffee Company expects 25,000 college graduates from ASU by 2025 ("Global Environmental," 2021).

Mental Health Expansion

Starbucks Coffee Company is happy to have been a leader in developing unique benefits for full-time and part-time partners globally. In the United States, qualifying employees who work 20 hours per week receive a benefits package that includes comprehensive and affordable health insurance, stock ownership, paid family leaves, and child and adult backup care.

As reported by *Business Wire,* Starbucks Coffee Company unveiled on March 16, 2020, a revamped mental health care coverage for its U.S. employees. Included in the new coverage, Starbucks will provide all U.S. employees and qualified family members with 20 free sessions per year with a mental health therapist or coach through Lyra Health, an innovative mental health benefits provider. Lyra Health will provide access to high-quality care for Starbucks employees. Employees will be able to seek evidence-based mental health treatment, locate available health providers that fit their specific needs, and book appointments on the spot, securely and anonymously. Starbucks revamped its mental health benefit based on employee feedback and is the latest update to its overall mental health effort, unveiled last September (2020).

Hunter Relief

Starbucks Coffee Company FoodShare is a program in the United States created in 2016 in collaboration with Feeding America to supply qualifying, unsold food to food banks and mobile pantries. In FY20, the program redirected food from 74% of company-operated stores in the United States. The investments in mobile pantries allow families to overcome transportation and access challenges by bringing food to them. Due to these initiatives in FY20, Starbucks gave more than 8.9 million meals and over $1 million to mobile pantry programs. The company is expanding this program to meet the growing needs of food banks. Similar food donation initiatives exist internationally, including FoodShare in Canada and food waste diversion schemes in fourteen European, Middle Eastern, and African countries ("Global Environmental," 2021).

Community Economic Development Funding in Chicago

In FY20, Starbucks Coffee Company pledged $8 million to Chicago Community Development Financial Institutions (CDFIs) for small company and community development loans. The CDFIs received $225,000 in grants to help with capacity-building. This investment has requested funds to develop a sustainable college in Chicago's Auburn Gresham region. The land will include a two-acre clean energy generation facility, an urban farm, greenhouses, an outdoor fresh produce market, a visitor center with community activity classrooms, and a STEM teaching center. Among other things, Green Era will create 247 construction jobs and 25 permanent positions.

When employees' trust and devotion to organizational principles and goals are critical to their performance and market success, it becomes a competitive advantage. Trust increases employee loyalty and motivation to stay with the company; employees who have trust in their organization report less stress and antagonism at work. Trust efficiently defeats corporate silos and isolation. Because employees can focus better when they have trust, an organization can more easily implement its rules (Duc Tai, 2022).

Employees who are committed to the organization are its long-term assets. Employees loyal to the company are productive and the most dependable and timely of their counterparts. Resolute personnel work well as a team, following leaders and striving for success. Committed employees believe in their organization and are practical and good ambassadors. They fervently support their employer's products, services, and policies. Thus, employee trust and company commitment are linked. Companies invest in people development and in sustaining an enthusiastic, competent staff committed to the organization's long-term sustainability and responding flexibly to

societal changes. Strategic Corporate Social Responsibility (CSR) and a sustainable strategy are becoming increasingly vital to an enterprise's competitiveness. They help create company values and earn the trust and respect of employees, consumers, users, partners, and the broader social community (Duc Tai, 2022).

Planet

Starbucks Coffee Company sees a future in which it is a net contributor to resource conservation. The corporation gives back more to the environment than it takes from it. Furthermore, Starbucks recognizes that it cannot do it alone. It will require all of us to conduct this. Kevin Johnson, CEO of Starbucks Coffee Company, declared an ambition to be a resource -positive company in January 2020. The release featured preliminary science-based targets for carbon, water, and waste reductions by 2030. To achieve these goals, Starbucks has developed strategies based on science, founded on the company's mission and values, and guided by extensive market research ("Global Environmental," 2021).

Expand Plant-Based Menu Options

Expanding Starbucks' plant-based menu is one way they can reduce carbon. They strive to give customers options. In FY20, Starbucks introduced new plant-based menu items globally. The United States introduced the Impossible Breakfast Sandwich, and Canada and China introduced breakfast sandwiches using Beyond Meat products ("Global Environmental," 2021).

Single-Use to Reusable Packaging

Starbucks Coffee Company is trying to limit single-use plastics and promote recycled content in packaging. The hot cups include 10% post-consumer fiber. In FY20, they announced their participation in the Ellen MacArthur Foundation's New Plastics Economic Global Commitment. Starbucks aims to remove unnecessary plastic packaging, make all plastic packaging reusable, recyclable, or compostable, and employ 5-10% recycled content by 2025 ("Global Environmental," 2021).

Invest in Regenerative Agriculture, Reforestation, Forest Conservation, and Water Replenishment

Starbucks set up pilot projects in Guatemala, Mexico, Peru, Rwanda, and Kenya in FY20 to reduce its green coffee production and environmental delivery footprint. The projects included innovative wet mill technologies that save up to 80% of water and precision agronomy procedures like soil and leaf analyses and to help reduce their carbon footprint ("Global Environmental," 2021).

Invest in Better Ways to Manage Waste

Starbucks will remove one billion plastic straws annually by 2021. In FY20, they completed the rollout of straw-less lids across the United States and Canada, which use 9% less plastic than the traditional flat lid with a straw. Unlike standard plastic straws, these lids are recyclable in American and Canadian markets. They also signed the U.S. Plastics Pact to improve waste infrastructure ("Global Environmental," 2021). With the ban, Starbucks joins a growing list of companies that have banned single-use plastic straws and utensils in response to growing concerns about the environmental impact of plastic waste. These companies include Dunkin Donuts, Ikea, Hyatt Hotels, American Airlines, cruise line operator Royal Caribbean, and the Chicago White Sox baseball team (2018).

Develop More Sustainable Stores, Operations, Manufacturing, and Delivery

Starbucks Coffee Company bought enough renewable energy to power all its stores in the United States, Canada, Europe, and 72% worldwide. However, market restrictions in China and Japan are putting the company at risk of not meeting its goal of purchasing 100% renewable energy by 2020. Because renewable energy access is expanding in Asian Regions, Starbucks, as a member of the RE100, is committed to achieving 100% renewable energy global total ("Global Environmental," 2021).

Starbucks Coffee Company reports an 11% reduction in carbon emissions compared to its 2030 carbon goal, a 4% reduction in water consumption compared to its 2030 water goal, and a 12% reduction in waste compared to its 2030 waste goal from the fiscal year 2019 to 2020. This annual decline was not expected and is primarily attributable to reduced business activity in FY20 due to COVID-19 ("Global Environmental," 2021).

Expanding the Starbucks network of renewable energy projects in the United States helps bring green energy closer to consumers. It used its size to drive energy sector innovation and support its stores and the community around them. Starbucks committed over $97 million to twenty-three new solar community projects in New York state, which would supply solar energy to more than 24,000 households, small companies, organizations, churches, universities, and Starbucks stores. In Virginia, they completed an arrangement with a solar farm that will offset 50% of the electricity consumed by the company-operated roasting and beverage production facilities in the United States by 2022. In California, they opened the company's first next-generation, on-site solar store and engaged in a Virtual Power Purchase and Virtual Storage Agreement to offer renewable energy to over 550 of its stores via solar energy and utility-scale batteries. In Washington, a new wind farm supplies renewable energy to around 140 stores, its Kent Roasting Plant, and neighboring communities (*Global Environmental,* 2021).

Due to greater environmental awareness, the green supply chain has gained popularity among businesses and academics. Two factors contribute to the importance of the supply chain in the greening of enterprises. First, the supply chain is inextricably linked to the natural environment, as it deals with the raw materials required for manufacturing output. Second, the supply chain's purchasing methods might affect the manufacturing suppliers' environmental view and capability. Large manufacturers may utilize their purchasing power to help small and medium-sized firms adopt environmental responsibility and green practices (2021).

In six days, Starbucks Coffee Company built a drive-thru store in Abbotsford, British Columbia, Canada, using an energy-efficient modular design with near-zero building waste. The insulated panels of the building cover both sides with a substance composed of sand and other materials, resulting in a waterproof and fire-resistant construction system ("Starbucks Builds," 2021).

Coffee

Coffee is at the heart of what they do. Starbucks Coffee Company is responsibly committed to sourcing coffee for the benefit of people and the environment to ensure a long-term future for the coffee. The company is concerned with the quality of coffee beans and the improvement of the lives of farmers who grow coffee beans.

Global Farmer Fund

The Starbucks Global Farmer Fund addresses farmers' unmet financial needs and improves supply chain resilience. The Fund, in partnership with Root Capital and responsibility, provides low-interest loans to coffee firms and farmers in areas where traditional banks are not available due to high-interest rates. Loans help farmers grow trees and upgrade infrastructure. Historically, the international coffee market has been susceptible to price flexibility connected to global demand and supply conditions. It has a negative impact on coffee growers, so Starbucks assists them by purchasing their coffee and by implementing a more integrated and sustainable approach. Starbucks has agreed to pay farmers more money to help them support their families ("Global Environmental," 2021).

Emergency Relief Funds

Starbucks also extended its Emergency Farmer Relief Fund for a second year to help more farmers affected by poor global coffee prices. These supplementary payments directly benefit smallholder farmers in Central America, helping them overcome low prices relative to production costs. Despite slightly better market conditions, they distributed over $2.8 million to farmers in Guatemala and Nicaragua in FY20 (Vadakkepatt et al., 2021).

Ethically Sourced Coffee

From 2015 to 2019, 99% of Starbucks stores implemented a policy known as Coffee and Farmer Equity (C.A.F.E.) to demonstrate its commitment to the coffee-processing and sales process' ethical, environmental, and quality aspects. The C.A.F.E. Practices program aims to promote transparent and sustainable coffee-producing practices while also protecting the livelihoods of coffee farmers and workers, their families, and communities (Vadakkepatt et al., 2021).

Aside from that, Starbucks contributes funding to help farmers gain access to financial services, acquire conservation and certified coffee, including organic and Fair-Trade certified coffee, and engage in community development programs in coffee-producing nations. Finally, Starbucks has partnered with coffee producers in Costa Rica, through which it educates farmers on how to produce high-quality coffee and provides technical assistance. Starbucks places a greater emphasis on these stakeholders since they are more long-term for the company. Due to COVID-19 constraints, auditing teams could not perform all required on-farm audits in FY20, resulting in farm expiration. In FY20, 98.6% of coffee came from C.A.F.E. Practice-verified farmers ("Global Environmental," 2021).

Farm Community Support

In FY20, Starbucks trained almost 40,000 farmers, bringing them closer to the objective of training 200,000 farmers by 2030. Starbucks operates nine Farmer Support Centers worldwide. Agronomists and quality experts collaborate with coffee farmers who sell to Starbucks to share tools and information that will help them increase coffee productivity, quality, and profitability on their farms while also improving their livelihoods. Due to COVID-19 limits in FY20, Starbucks implemented online training tools and resources to support these efforts while promoting their partners, suppliers, farmers, and communities ("Global Environmental," 2021).

Starbucks Coffee Company has always prioritized delivering the highest possible quality in all parts of its operations. The company purchases high-quality coffee beans directly from the best producers, roasts and prepares the beans to the highest standards of perfection, and provides a consistent service experience to all customers through well-educated workers (Madar, 2020).

Product diversification is one of Starbucks' strategies, providing a wide variety of coffee, coffee preparations, soft drinks, pastries, coffee beans, cups, and thermoses. Their continuous improvement strategy involves improving product and service quality, productivity, and competitiveness. For example, Starbucks focuses on the product, supplying high-quality Arabica coffee, and directly supporting farmers and staff through direct support and training. Starbucks offers a selection of 100% Arabica coffees from Latin America, Africa, and the Asia-Pacific regions. The company also maintains a 240-hectare coffee farm in Costa Rica. Additionally, 99% of the coffee acquired by Starbucks worldwide follows the Coffee and Farmer Equity policies, which have assisted farmers in improving their environmental performance over the last 15 years while considering the impact of climate change (Madar, 2020).

Conclusion

This research investigated how Starbucks Company performs in business through Corporate Social Responsibility (CSR). It is fascinating to observe Starbucks' corporate principles in action, especially the mission statement, which details how Starbucks manages its business with suppliers, employees, consumers, communities, and stakeholders while caring for the environment. The other fascinating aspect of Starbucks is its code of conduct, which demonstrates how the company has partnered with farmers to obtain high-quality coffee beans while also advancing farmers' livelihoods and supporting the environment.

Starbucks has used CSR as a strategy to run its business in all areas. Starbucks cares about the environment. They save money while preserving the environment by applying cutting-edge technologies to improve their procedures. Starbucks has lofty plans to collaborate with partners and stakeholders on social issues. Starbucks has launched various events to build long-term partnerships with communities. In terms of economics, Starbucks considers the interests of all parties involved in its operation while adhering to local laws. Starbucks has established a fair-trade culture with suppliers, customers, and competitors, making Starbucks an enormous economic success.

A company's commitment to CSR can also give them an advantage over competitors. Starbucks Coffee prioritizes its suppliers (coffee farmers) and staff. They have built an enterprise that is both sustainable and profitable. The company has corrected its business model by completely embracing CSR while maintaining its market position. CSR practices affect several elements of a company's activities. Many corporations claim that CSR may enhance sales and market share, cut expenses, increase investor interest, and improve employee engagement, brand recognition, and image. Customers enjoy CSR initiatives. Hence the research shows that its CSR efforts will benefit its success. For this reason, the organization has achieved success in the business sector through CSR.

REFERENCES

Duc Tai, T. (2022). Impact of corporate social responsibility on social and economic sustainability. *Economic Research-Ekonomska Istraživanja,* 1-20. **https://doi-org.athens.idm.oclc.org/10.1080/1331677X.2022.2046480**

Global Environmental & Social Impact Report 2020. (2021). Starbucks Corporation. **https://stories.starbucks.com/uploads/2021/04/Starbucks-2020-Global-Environmental-and-Social-Impact-Report.pdf**

Haight, C.E. (2017). Of coffee, cartels and communism. *The Journal of Social, Political, and Economic Studies, 42* (3), 368-389. **https://athens.idm.oclc.org/login?url=https://www.proquest-com.athens.idm.oclc.org/scholarly-journals/coffee-cartels-communism/docview/2052796538/se-2?accountid=8411**

How corporate social responsibility and external stakeholder concerns affect green supply chain cooperation among manufacturers: An interpretive structural modeling analysis. (2021). *Sustainability, 13*(5), 2518. **doi:http://dx.doi.org.athens.idm.oclc.org/10.3390/su13052518**

Kim, J.E. & Park, E.S. (2021). The spatial design marketing strategy of global franchises that consider the characteristics of modern consumers—A study involving the global coffee companies of Starbucks and blue bottle. *Land, 10*(7), 716. **doi:http://dx.doi.org.athens.idm.oclc.org/10.3390/land10070716**

Krishna, C.G. (2018). Starbucks communication strategies—More than just a cup of coffee. *IUP Journal of Soft Skills, 12*(3), 23-53. **https://athens.idm.oclc.org/login?url=https://www.proquest.com/scholarly-journals/starbucks-communication-strategies-more-than-just/docview/2158145244/se2?accountid=8411**

Madar, A. (2020). The importance of quality and quality strategies for growing competitiveness in the market. *Bulletin of the Transilvania University of Brasov.Economics Sciences.Series V, 13*(1), 41-48. **doi:https://dx.doi.org.athens.idm.oclc.org/10.31926/but.es.2020.13.62.1.5.**

Starbucks announces plans to phase out plastic straws. (2018). *Risk Management, 65*(7), 20. **https://athens.idm.oclc.org/login?url=https://www.proquest.com/scholarly-journals/starbucks-announces-plans-phase-out-plasticdocview/2100785360/se2?accountid=8411**

Starbucks builds modular store in 6 days. (2021). *ASHRAE Journal, 63*(3), 6. **https://link.gale.com/apps/doc/A689978648/AONE?u=naal_athens&sid= bookmark-AONE&xid=dc9f74bd**

Starbucks transforms mental health benefits for employees. (2020). *Mental Health Weekly, 30*(12), 7-7. **https://doi-org.athens.idm.oclc.org/10.1002/mhw.32286**

Vadakkepatt, G.G., Karen, P.W., Mittal, V., Zinn, W., Beitelspacher, L., Aloysius, J.,...Reilman, J. (2021). Sustainable retailing. *Journal of Retailing, 97*(1), 62-80. **doi:http://dx.doi.org.athens.idm.oclc.org/10.1016/j.jretai.2020.20.008**

The Generation of Automation: The Warehouse Response to COVID-19

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ABSTRACT

There is no question that the COVID-19 pandemic immensely affected the world in many ways—personally, environmentally, health-wise, and business-wise—just to name a few. One major area that was significantly affected is supply chain and logistics. The supply chain sector was forced to make many changes in order to combat and recover from the negative and lasting effects of COVID-19. One area of supply chain that has had many changes is warehouse operations. Artificial intelligence (AI) and other technologies had already begun to be implemented in warehouses before COVID-19, but the pandemic caused these innovations to rise in popularity as a means for warehouses to remain efficient. The use of technology, such as robots, drones, and new software, have allowed warehouses to recover and overall improve their operations, while creating competitive advantage for companies and revamping the standard of how warehouses will be run from here on out.

Effects of COVID-19 on Supply Chain Systems

Supply chain was affected both inside and outside the warehouse. As people's lives were changed with new quarantine restrictions, demand of different products and services was drastically changed as well. Items such as household goods, cleaning supplies, and food items had their demands increase significantly. This drastic change of demand caused many disruptions within different supply chains, as many companies did not have the capacity to keep up with the new demand and were not able to forecast correctly. According to the article, "The Future of Global Supply Chains in a Post-Covid-19 World," 94% of Fortune 1000 companies reported experiencing disruptions in their supply chains because of COVID-19 (Panwar et al., 2021). Forecasts were no longer accurate, and businesses had to scramble to adapt to the supply and demand chaos that was created by the pandemic. These surges in demand meant that warehouses had to work faster and faster to keep up, while also ensuring accuracy and efficiency.

The way customers were purchasing changed a lot as well. E-commerce's popularity surged due to people increasingly shopping online and requesting delivery orders for their groceries and other products that they could no longer go to the store and pick up as easily for themselves. The U.S. Census Bureau reported that U.S. e-commerce sales increased 32.4% between 2019 and 2020 (Haber, 2021). This was more than double the 14.9% increase between 2018 and 2019 (Haber, 2021).

Along with the changes due to capacity and customer habits, companies also faced problems with the health and safety issues and new regulations, particularly in their warehouses where many people worked in close proximity to each other. As social distancing became a health priority, there were strains in warehouses to work both safely and effectively. Many warehouse workers became sick and had to quarantine, leading to labor shortages in daily operations. Amazon reported that between March 1, and September 19, 2020, 19,816 (1.44% of its total front-line workers) had COVID-19 at some point ("Smart Warehouses Boost Their IQ," 2020). Keeping production going while facing supply and demand shortages, health and safety concerns, and the shift to increased e-commerce, all in a short period of time, are some of the reasons that supply chain systems had to quickly reevaluate their operations. A survey taken by supply chain executives that was conducted in the summer of 2020 determined that "93% plan to increase supply chain resilience and 54% expect changes to supply chain planning" (Panwar et al., 2021). These plans, for many companies, called for automation and artificial intelligence (AI) in their warehouses.

Automation in Warehouses

Because of increasing demand requiring faster and extremely accurate and productive operations, many companies have focused on transforming their warehouses to become more automated. According to the article, "Smart Business and the Social Value of AI," artificial intelligence "has been named the number one technology to help businesses recover and improve after the COVID-19 crisis" (Leszkiewicz et al., 2022). Although robots are what are generally thought about when the words "artificial intelligence" come to mind, there have been many other types of automation implemented in warehouses that have tremendously increased productivity. One example is the use of drones. There have been RFID-reading drones being developed that can be used for quick cycle counting, and some companies are working to increase the use of drones by developing ones that can count cases on pallets and be able to recognize what is on each pallet ("Smart Warehouses Boost Their IQ," 2020) and autonomous guided vehicles (AGVs) that handle material and can travel without a human operator around warehouses. These and other innovations are not expected to slow down anytime soon. It was reported that AGV and AMR (autonomous mobile robots) markets are expected to "grow by about 35% annually and reach $13.2 billion by 2026" ("Warehouse Automation: The Rise of the Robots," 2022). As these innovations show increasingly improving results, more companies can be expected to adopt them in order to obtain competitive advantage.

The Use of Robotics

One of the biggest innovations in the automation of warehouse operations has been the inclusion of robots. Even before COVID-19 came to be, many warehouses were implementing robots into their operations in order to allow daily tasks to be completed quicker and without human

error. Robots can do much of what human workers can do, but without the detriments and basic needs of people, such as sleep and human error. With the pandemic bringing about the need for social distancing and quarantining, robots became even more important for successful warehouses to resume operations while adhering to health mandates and keeping human employees safe without having to hinder business. Besides their convenience, robots have shown to increase productivity and accuracy in warehouses. Gordon Brown, Director of Engineering for NLS, claimed they were told that implementing robots could allow the productivity in their picking process to increase by 50-75% and that they did "[see] those numbers" ("Warehouse Automation: The Rise of the Robots," 2022). With their speed and ability to work long hours, it is no surprise that these types of increases in productivity can occur with well-programmed robots.

With these robots has come the need for efficient software and communication to run these machines. According to the study "A Self-Adaptive Network for Multi-Robot Warehouse Communication," one of the most important responsibilities of having a multi-robotics system is focusing on end-to-end communication so the robots can successfully work with each other (Varma et al., 2021). This study says that robots are organized in an "ad-hoc fashion," where "each entity of the network can move around and connect in any arbitrary fashion" in order to keep track of each other's routes to work around and with each other effectively (Varma et al., 2021). The robots must be able to coincide with each other and be able to do their jobs without running the risk of running into each other or interfering with each other's job tasks. They also must be able to communicate with other systems and human workers. As with other areas of automation, since robots appear to be becoming part of the new type of warehouse, more advanced software can be expected to be developed to increase the efficiency and productivity.

Changes in Shipping

Distribution and shipping are other areas that are becoming more automated due to the increase of e-commerce, and therefore shipping, from COVID-19. It was reported that e-commerce deliveries increased by 25% in 2020 (Panwar et al., 2021). With the increase of shipping has come higher expectations from consumers on the quality of shipping. People want their deliveries as soon as they can get them. That expectation, mixed with a higher volume of deliveries that need to be made, has brought about the need to improve the distribution and shipping processes. There have been innovations in shipping, with one example being autonomous delivery vehicles (ADVs), which are vehicles that are able to make deliveries without human operators (Panwar et al., 2021). These types of delivery vehicles can increase efficiency as they, potentially, can move faster than traditional modes of delivery, such as trucks. They also do not require drivers, which means they have more space for what they are delivering. Another benefit is that there is less room for human error; for example, the chance of deliveries being dropped off at the wrong destination decrease compared to delivery drivers who can accidentally read a package's label wrong and deliver it to the wrong address. Though the idea of self-driving cars is still developing and growing, it can be expected to become part of many warehouses and distribution centers in the future.

The Future of Human Employees with Artificial Intelligence

The newly emerging tradition of automation and artificial intelligence (AI) becoming large parts warehouse operations has certainly been successful and has brought on many improvements, particularly in the recovery from the damage done by COVID. However, it is important to look at how these innovations can affect those closest to them—the human employees of the warehouse. There is the question of whether increased AI and automation will eventually dispose of the need of human workers altogether. This is a real possibility in some areas. In 2018 (before COVID-19), a Chinese company called JD.com developed a warehouse that processed 200,000 orders a day with only four employees and most of the work done by robots (Panwar et al., 2021). Examples like this can spike fear that traditional warehouse workers will soon have to face their jobs becoming obsolete. Another concern is that the new technology will mean there are new skill requirements that workers will have to be trained on in order to be able to do their jobs effectively. These concerns can cause human workers to not be receptive or even reject new innovations in their warehouses. On the other hand, there is benefit for human workers in having these automated co-workers. If robots are given the autonomous, tedious roles, it leaves room for human employees to be moved to other areas where they can have more creative roles and responsibilities. Also having to learn new skills to operate robots has its benefits. As AI is continuously rising, developing these types of skills can make an employee more competitive in their field of work.

There have also been many developments in technology that have been designed to require human employees to operate; so humans are still needed. One example of a new technology some companies have begun using is a head-mounted display system, which delivers instructions from a warehouse management system to an employee while they are working ("Smart Warehouses Boost Their IQ," 2020). One specific example is a wearable device developed by the company Zebra called HD4000, a headset device that works with a software to help employees learn their jobs quickly which can reduce onboarding time up to 90% ("Smart Warehouses Boost Their IQ," 2020). So, though it is understandable to fear that robots and AI will erase the need for human roles, there are many strides in creating a warehouse system that still requires people in its daily operations—just with some automated help.

Conclusion

Overall, the new technology that is quickly becoming more and more the norm of warehouse operations has shown itself to have great results, so far, and much potential to become even better and more complex. Having AI has led to increased productivity, a decrease of human error, and the ability to use data to better forecast supply and demand. The increase of automation also helped the health risk issues as robots became able to do the jobs that human employees were doing, without having to worry about social distancing or becoming sick. Though there are challenges that come with the automations, such as the fear of human jobs becoming obsolete and the need for increasingly sophisticated software to link all the robots and systems together, these warehouse innovations do not appear to be slowing down soon. It can be expected that a new idea of the traditional warehouse with these technologies at the forefront will possibly emerge sooner than later and more and more companies will adapt in order to compete and grow.

REFERENCES

Haber, J. (2021, May). *The future of warehouse workers.* Inbound Logistics. **https://**

www.inboundlogistics.com/articles/the-future-of-warehouse-workers/

Leszkiewicz, A., Hormann, T., & Krafft, M. (2022). Smart business and the social value of ai. *Advanced Series in Management,* 19-34. **https://doi.org/10.1108/s1877-636120220000028004**

Panwar, R., Pinkse, J., & De Marchi, V. (2022). The future of global supply chains in a post-covid-19 world. *California Management Review, 64*(2), 5-23.

Smart warehouses boost their IQ. (2020, June). Inbound Logistics. **https://www.inboundlogistics.com/articles/smart-warehouses-boost-their-iq/**

Varma, A.K., Karjee, J., Mitra, D., Rath, H.K., & Pal, A. (2021). A self-adaptive network for multi-robot warehouse communication. *Computing,* 103, 333-356. **https://doi.org/10.1007/s00607-020-00852-3**

Warehouse automation: The rise of the robots. (2022, March). Inbound Logistics. **https://www.inboundlogistics.com/articles/warehouse-automation-the-rise-of-the-robots/**

COVID-19 Pandemic: Risk Realized

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ABSTRACT

An unprecedented global health emergency, an actual Black Swan event, laid bare the weaknesses of global supply chains. As supply chain managers (SCM) navigated the uncharted waters of the pandemic, an opportunity to identify weaknesses and build resilience in supply chains unfolded. Numerous risks were exposed, while lessons learned created countless opportunities for case studies in real time. This paper will identify those risks and lessons learned by businesses and governments, which will reshape supply chains and global trade for decades to come.

Introduction

Dawn of the Pandemic

The coronavirus first appeared in Wuhan, China, in late 2019, appearing to have emerged from a wet market within the city. Chinese officials were slow to share the news with the world, but the word was out by New Year's Eve. Breaking news headlines around the world warned of the circulation of another SARS-type virus, with the potential to become a pandemic. By mid-January, the World Health Organization (WHO) issued a global health emergency, with deaths reported in numerous countries. As the infections and deaths began to make the virus a reality for many nations, travel restrictions began to materialize. The United States restricted travel from China into the United States as a preventative measure immediately after the WHO emergency declaration. By mid-March, travel restrictions, business-directed shutdowns, and government-mandated shutdowns around the world had led to the unemployment of millions and the idling of many factories worldwide. Through numerous waves of the virus, supply chains contended with the third-order effects of the efforts to slow the spread and impact of the virus on human lives around the world.

Supply Chain Disorder

Many of the world's companies were not prepared to handle the onset of the pandemic, let alone the ensuing disruptions of supply and demand (Ivanov, 2020). The pandemic highlighted the weaknesses in the current global supply chains. Before the pandemic, the supply system had become increasingly stressed, with a narrow margin for absorbing disruption (Sajjad, 2021). The lockdowns and travel restrictions affected the upstream supply while consumers drove inconsistencies in demand downstream (Nikolopoulos et al., 2021). The long-term pandemic exacerbated the problems and the cascading effects of halting large swathes of production (Seuring et al., 2022). Multiple disruptions pushed and pulled supply chain managers (SCM) as they attempted to overcome each obstacle while competing for shipping opportunities while remaining profitable. In many cases, companies halted production until the resources were available to buy, produce and deliver to the market. In the worst cases, companies without much flexibility, in terms of logistical or financial resources, failed.

Industry Impacts

Technology

One area that was hard hit during the pandemic and still attempting to recover fully is technology. This point is especially true of the automotive industry, where supply chains are extensive and complex. From the very beginning of the pandemic, original equipment manufacturers (OEM) were forced to shutter operations in China, dealing an early blow to automotive manufacturers. Specifically, many OEMs could not build their products due to a shortage of semiconductors (Eldem et al., 2022). This shortage of semiconductors drove a shortage of computerized components which, in turn, drove a shortage of end-item products which relied upon those components. Since there are thousands of parts in an automobile, the lack of one part can bring an assembly line to a halt. This problem experienced by the automotive industry played out, generally, across much of the technological sector.

Food

One of the first large-scale infections in the United States occurred in the country's meatpacking plants, with infection rates higher than in any other work sector (Dempsey et al., 2022). The plant infection rates were nearly 500% higher than the local community transmission rates (Dempsey et al., 2022). As these rates skyrocketed, plants were forced to shutter, reducing the supply of meat products to varying degrees. More concerning was the panic buying that ensued, driving people to clear shelves as soon as meat products were displayed. The shuttering of factories and panic buying caused livestock price volatility, further destabilizing the market. The U.S. Government was quick to act, declaring these facilities critical, enabling meat supplies to continue (Polansek, 2020). Disruptions in food supplies occurred across the industry, forcing companies and workers to alter their work environment and processes to keep food on people's tables while keeping themselves safe on the job.

Economic Risks

Demand Shocks: Oil

One significant economic risk was the one experienced by the oil industry. As lockdowns and shutdowns progressed and transportation decreased sharply and significantly, the global oil demand plummeted. Many oil-exporting countries entirely depend upon the income generated from oil exports (Anderson & Engebretsen, 2020). During the pandemic, oil prices dropped so fast and low that the cost of United States crude oil went into the negatives (Anderson & Engebretsen, 2020). The collapse of prices meant that many oil-exporting countries had lost their only source of revenue at the worst possible time. Being unable to fund COVID-19 mitigation measures created a

difficult situation from which to recover.

Supply Shocks: Finished Lumber

One of the most notable supply shocks that affected the market throughout the pandemic was that of lumber. Initially, as the pandemic hit, the demand for finished lumber plummeted. In response, lumber companies stopped harvesting trees, and mills stopped producing lumber. Once the lockdowns eased and construction resumed, the finished lumber products were unavailable, and many projects competed for the scarce commodity. The industry was forced to adjust operations, which slowed production and reduced supply (Moore, 2021). The initial demand shock resulted in the underproduction of products, ultimately leading to a supply shock when the average demand returned.

Societal Risks

Logistics Labor Risks

Logistics laborers are the unsung heroes of the pandemic. Nurses and doctors deservingly received much public praise but could not perform their work without the logistics workers ensuring they got their supplies. Additionally, every home in America that did not already know what Amazon was, quickly learned as its workers and the last mile delivery personnel worked hard to bring us products safely to our front doors. The impact on these workers was significant, and there was the risk of exposure to the virus. Despite the risks, many logistics companies initially appeared to fall short of delivering Personal Protective Equipment (PPE) to their workers. These conditions led many workers to stage protests, demanding improved working conditions (Lerman et al., 2020). The initial response to the pandemic created many risk areas, and labor was no exception. The potential for further supply disruptions remained high throughout the pandemic due to the frustrations and fears of the logistics labor force.

Supply Chain Front Lines

Despite the initial setbacks of the immediate response to the pandemic, many companies quickly established policies to protect their workers and ensure business operations continued. Some measures included social distancing requirements, disinfecting workspaces between shifts, and providing suitable PPE for all workers (Twinn et al., 2020). These efforts were critical in calming workers' fears and ensuring operations continuity. Due to the bravery of the workers and the efforts to protect them, supplies continued to flow.

Political Risks

Covid-19 displayed the vulnerabilities and fragility of the system created by the previous strategy of relocation, optimization, and globalization (Hong & Kochar, 2020; Sajjad, 2021). The pandemic also highlighted and exacerbated some of the existing international tensions. The dependence upon other nations, even geopolitical foes, was laid bare for all to see. As governments respond to the demands of markets and citizens, the risk of de-globalization is real. According to Derviş & Strauss (2020), a reduction in "travel, trade, and financial, digital, and data flows between nations is likely over the coming years." This reduction in trade could have far-reaching implications. If a significant amount of trade is moved out of China, for example, what further restraint would that country have in attempting to re-take Taiwan? In the current environment, the Chinese economy is significantly dependent upon exports to the United States and Europe. Without that guarantee, their leaders would have less incentive toward restraint.

Conclusion

Lessons Learned

The pandemic has forced organizations to look deeper at their supply networks, considering multiple factors when sourcing decisions. Although the previous model of efficiency successfully increased profits for shareholders, the lack of resiliency is a core feature of supply chains that managers must address. The pandemic is a historical moment dividing accepted best practices by pre-pandemic and post-pandemic thought patterns (Schleper et al., 2021).

Globalization and lean supply chains have brought significant value to companies and, by extension, customers. To abandon these concepts would be short-sighted and result in numerous unintended consequences. However, the lessons learned and the weaknesses exposed must be applied to current supply chains to increase resiliency in critical supply chains such as food, medicine, and energy. Some production should be re-shored or near-shored to ensure the continuity of supply chains. Governments must agree upon an international trade standard that codifies unified responses to future disruptive events.

Final Thoughts

Covid-19 was a rare but significantly impactful event, impossible to predict when it may strike. Businesses and governments must keep global supply chain flexibility as the top priority as they work to restructure supply chains in the aftermath of the pandemic. Without flexibility, global supply will continue to carry significant risks for companies, nations, and consumers.

REFERENCES

Anderson, C., & Engebretsen, R. (2020, September 30). *The impact of coronavirus (COVID-19) and the global oil price shock on the fiscal position of oil-exporting developing countries.* OECD. **https://www.oecd.org/coronavirus/policy-responses/the-impact-of-coronavirus-covid-19-and-the-global-oil-price-shock-on-the-fiscal-position-of-oil-exporting-developing-countries-8bafbd95/#biblio-dlel1331**

Dempsey, S., Zollar, H.M., & Hunt, K.P. (2022). *The meatpacking industry's corporate exceptionalism: Racialized logics of food chain worker disposability during the COVID-19 crisis.* Food, Culture & Society. **DOI: 10.1080/15528014.2021.2022916**

Derviş, K., & Strauss, S. (2022, March 9). *What COVID-19 means for international cooperation.* Brookings. **https://www.brookings.edu/opinions/what-covid-19-means-for-international-cooperation/**

Eldem, B., Kluczek, A., & Bagiński, J. (2022). The covid-19 impact on supply chain operations of automotive industry: A case study of sustainability 4.0 based on sense-adapt-transform framework. *Sustainability, 14* (10), 5855-5855. **https://doi.org/10.3390/su14105855**

Hong, P.K., & Kochar, A. (2020). Building resilient supply chains post-covid-19. *Supply Chain Management Review, 24*(4), 60-62.

Ivanov, D. (2020, April). Predicting the impacts of epidemic outbreaks on global supply chains: A simulation-based analysis on the coronavirus outbreak (COVID-19/SARS-CoV-2) case. *Transportation Research. Part E, Logistics and Transportation Review, 136,* 101922. **https://doi.org/10.1016/j.tre.2020.101922**

Lerman, R., & Tiku, N. (2020, May 02). *Amazon workers launch may day strike to protest treatment during COVID-19.* Telegraph-Journal. **https://athens.idm.oclc.org/login?url=https://www.proquest.com/newspapers/amazon-workers-launch-may-day-strike-protest/docview/2397187639/se-2**

Moore, A. (2021, May 19). *Ask an expert: Why is there a lumber shortage?* College of Natural Resources News. **https://cnr.ncsu.edu/news/2021/05/lumber-shortage/**

Nikolopoulos, K., Punia, S., Sch€afers, A., Tsinopoulos, C., & Vasilakis, C. (2021). Forecasting and planning during a pandemic: COVID-19 growth rates, supply chain disruptions, and governmental decisions. *European Journal of Operational Research, 290*(1), 99-115.

Polansek, T. (2020, March 16). *U.S. under pressure to keep slaughterhouses open during virus outbreak.* Reuters. **https://www.reuters.com/article/us-health-coronavirus-meatpacking-idUSKBN2133TY**

Sajjad, A. (2021). The covid-19 pandemic, social sustainability and global supply chain resilience: A review. *Corporate Governance, 21*(6), 1142-1154. **https://doi-org.athens.idm.oclc.org/10.1108/CG-12-2020-0554**

Schleper, M.C., Gold, S., Trautrims, A., & Baldock, D. (2021). Pandemic-induced knowledge gaps in operations and supply chain management: Covid-19's impacts on retailing. *International Journal of Operations & Production Management, 41*(3), 193-205. **https://doi-org.athens.idm.ocld.org/10.1108.IJOPM-12-2020-0837**

Seuring, S., Brandenburg, M., Sauer, P.C., Schünemann, D.S., Warasthe, R., Aman, S., Quian, C., Petljak, K., Neutzling, D.M., Land, A., & Khalid, R.U. (2022). Comparing regions globally: Impacts of covid-19 on supply chains—A Delphi study. *International Journal of Operations & Production Management, 42*(8), 1077-1108. **https://doi.org/10.1108/IJOPM-10-2021-0675**

Twinn, I., Qureshi, N., Conde, M.L., Guinea, C.G., Rojas, D.P., Luo, J., & Gupta, H. (2020, June). *The impact of covid-19 on logistics-ifc.org.* International Finance Corporation. **https://www.ifc.org/wps/wcm/connect/2d6ec419-41df-46c9-8b7b-96384cd36ab3/IFC-Covid19-Logistics-final_web.pdf?MOD=AJPERES&CVID-naqOED5%C2%A0**

Cultural Considerations in Global Sourcing

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ABSTRACT

Global expansion allows a business to market its product or service while allowing significant business growth, but these business relationships must be well-managed and maintained. Promoting good relationships with international partners begins with studying cultural practices and differences. The culture of international partners must be treated in a very respectful manner, or the company's credibility can be at stake if the country's cultural traditions and values are not recognized. Developing these international relationships is critical for the organization's global success.

Introduction

The first step in choosing to do business globally is researching the country's cultural differences, which include values, traditions, customs, and beliefs. Conducting international business requires companies to research the foreign country's business culture thoroughly. Through cultural education, companies commit to learning those cultural differences that make countries diverse. In global sourcing, successful international business transactions begin with understanding cultural differences and building positive working relationships, which can drive company profitability.

Before delving into cultural awareness, it is essential to define strategic sourcing and global strategic sourcing. Hulsen (2021) defines strategic sourcing as "an approach to procurement that weighs the overall value delivered through a vendor relationship rather than the simple cost of the product or service provided by a vendor" (para. 6). So how does strategic sourcing relate to supply chain management? Strategic sourcing can be considered an approach to supply chain management that includes the following: purchasing strategy alignment for business goals and an organization's consolidated purchasing power through information gathering and use for finding the best possible marketplace values (Fogarty, 2019, para. 2). The bottom line is supplier selection is of the utmost importance to achieve lower costs.

Companies choose global strategic sourcing when they wish to expand their business globally. Global sourcing is defined as the "sourcing strategy of substituting your domestic market for a global one to procure goods and services at a cost-effective rate" (Chakraborty, 2023). In global sourcing, cultural differences can be a major issue. Cultural issues include time differences and language barriers that can directly affect strategic, operational, and financial areas of the business, as well as learning more about the country's culture and societal values (Chakraborty, 2023).

1.1 Cultural Differences

Companies looking to do business in the global market need to understand cultural differences and their effects on organizational efforts. Step one of the process is knowing that cultural differences exist (Mitchell, 2009, p. 66). According to Monczka, Handfield, Guinipero, and Patterson (2016), values and behavior are two important cultural differences that can affect the supply manager. Values are internalized shared beliefs or group norms which have an effect on the way people think. Behavior affects how people act and is based on values and attitudes. When conducting business internationally, the comprehension of cultural differences improves companies' effectiveness (Monczka et al., 2016, p. 381).

When cultural differences are not accepted, miscommunication, money loss, and contracts loss can occur ("Cultural Affects on the Global Supply Chain," 2005, para. 1). For example, making money in the United States is the goal of most decisions resulting in companies employing the least amount of people to complete the job; however, when companies set up operations in China, production capacity and worker qualifications must be verified for a skilled labor force ("Cultural Affects on the Global Supply Chain," 2005, para. 1). Flexibility must be built in Brazil's agreements as a condition for success due to changing tariffs, customs, and labor conditions ("Cultural Affects on the Global Supply Chain," 2005, para. 1). Since personal relationships are essential in Japan, a deal may fall through if a company does not accept an invitation to go on a *hasigo,* better known as the Japanese version of a pub crawl.

1.2 Language Barriers

Effective communication between businesses and their global partners is important in building a successful relationship and expanding business overseas. Language differences can become a barrier to communication requirements and pose a significant challenge, and Americans are not likely to understand the native language of the country where they are doing business (Monczka et al., 2016, p. 382). "Even experienced companies can encounter difficulties with suppliers or partners when language differences create miscommunications that threaten their business plans abroad" (Soni, 2022). Communication is critical to both personal and professional relationships, and these barriers can negatively impact partnerships.

There are some companies that make the decision not to do business in other countries due to language barriers. According to Soni (2022), companies are afraid that language barriers are harmful, so they avoid them. Companies miss out on beneficial business opportunities when avoiding language differences. For example, a company may be looking for some local workers to complete a project, but cannot attract the best workers because they cannot communicate effectively with them (Soni, 2022). Another potential drawback is the initial setup of a project. Customers may be hesitant to work with companies that do not speak their language, opting instead to work with one with more excellent communication (Soni, 2022).;

It is a best practice for a company to make sure they know how to say a few phrases in another country's language before approaching the company in their location (Soni, 2022). If you can only say "hello" or "goodbye," this shows your potential

customers that you are willing to make an effort and that you are invested in the business relationship (Soni, 2022). Companies planning on working with multiple customers with a particular language should invest in quality tile learning that includes more than the basic phrases or hire a professional that is familiar with the country and their language (Soni, 2022).

According to Smit (2022), "Knowing the languages spoken in your market allows you to learn the words peculiar to the system and makes you begin effective marketing campaigns in your customer's language." Companies need to know how to persuade customers in their market, based on their traditions, what catches their attention, and the languages they speak (Smit, 2022). Two other options for overcoming the language barrier are to partner with a translation company and hire an interpreter who can prevent miscommunication between companies and their international partners while building trust (Smit, 2022).

1.3 Communication

Mitchell (2009) indicated that "doing business internationally means you will come into contact with individuals who speak different languages and live in different cultures" (p. 66). With more than 6,200 languages today, knowing the language is still insufficient for effective communication. To be an effective communicator, companies must have some understanding of thought patterns and values and of how potential customers process this information. When companies learn to deal with cultural differences, there is a likelihood that a business deal will be successful or unsuccessful (Mitchell, 2009, p. 66).

According to Mitchell (2009), when it comes to listening and processing information, culture falls into two categories: high context and low context. In low-context cultures, such as the United States and Germany, communication is more precise with a low level of shared information (Mitchell, 2009, p. 66). Communication in high-context cultures tends to be imprecise. Table 1 details the comparison between low-context and high-text cultures.

Mitchell (2009) specified that when attempting to communicate cross-culturally, there are two important rules to remember (p. 66):

1. Do not be overconfident.
   - There are differences in the receipt and processing of information.
   - If someone speaks the same language as yourself, do not take the thought processes for granted.
   - Assuming that someone thinks the same way or has the same values is dangerous.

2. Explain your position by using uncomplicated descriptive language.
   - Be clear and concise in written materials.
   - Use visual aids.

1.3.1 Non-Verbal Communication

In cross-cultural communication, making non-verbal communication work for companies is advantageous in the business environment (Mitchell, 2009, p. 76). It is wise not to underestimate the cultural differences in non-verbal communication. An individual's culture can determine the following: eye contact, standing close to each other when talking, and non-verbal sign use to express different emotions, such as anger or trust (Mitchell, 2009, p. 76). For example, a thumbs -up gesture in Britain has a positive meaning, while in Persian culture, it has the opposite meaning (Mitchell, 2009, p. 77).

The interpretation of body language requires careful attention. Facial expressions such as a smile or a frown do not always have meaning but can be revealing in some cultures (Mitchell, 2009, p. 77). Mitchell (2009) indicated, "The key to understanding the meaning behind facial expressions and body movements is not in the individual expressions or

Table 1: High-context Cultures versus Low-context Cultures

High-Context Culture versus Low-Context Culture		
Type	**Description**	**Cultures**
High-Context	•Communication is imprecise •Personal encounters are essential before a business can begin •Need ancillary information •Pay attention more to physical surroundings and business dress •Body language, facial gestures, and voice inflection are important	Latin America Asia Middle East Africa
Low-Context	• More precise in communication • Provides mountains of details • Groping for the correct words to summarize an event • Assume a low level of shared knowledge • Body language, hand and facial gestures are secondary • Business successfully conducted by letter, telephone, or email • Rarely rely on personal interaction as the driving force behind a business deal	United States Britain Germany Scandinavian countries

Note: Adapted from Mitchell, C. (2009). *A Short Course in International Business Culture : Building International Business Through Cultural Awareness*: Vol. 3rd ed., p. 20, 66, World Trade Press.

Table 2: Countries Using Formal and Informal Approaches

Countries Using Formal and Informal Approaches	
Formal Approaches Needed	**Less Formal Approaches Used**
Japan	United States
China	Australia
Russia	Canada
Germany	Nigeria
Argentina	Israel

Note: Adapted from Mitchell, C. (2009). *A Short Course in International Business Culture : Building International Business Through Cultural Awareness*: Vol. 3rd ed., p. 133, World Trade Press.

movements themselves, but rather in the transition from one body movement to another" (p. 77). Reading body language effectively is done in two steps: 1) Observing mannerisms in the initial conversation and 2) paying attention to any sudden changes in posture or behavior (Mitchell, 2009, p. 78). This method of reading body language is not foolproof in judging an individual's sincerity (Mitchell, 2009, p. 78).

Non-verbal communication comes in may forms, such as dress and appearance, eye contact, facial expressions, personal space, posture, silence, and gestures (Mitchell, 2009, p. 78). In France, direct eye contact is demanded in business meetings; while in Japan, a sign of respect is to divert your eyes away from a business colleague (Mitchell, 2009, p. 78). In Japan, a smile can be interpreted as a lack of seriousness, while Americans consider a smile as a warm relationship (Mitchell, 2009, p. 79). American, German, and Arabic business executives consider silence as unfavorable, while Asian cultures equate silence with taking time to contextualize information (Mitchell, 2009, p. 80).

1.3.2 Written Communication

Cross-cultural written language requires using plain and familiar words in clear sentences (Mitchell, 2009, p. 100). When preparing written documentation, it is essential to determine the composition of the audience and adjust the methods accordingly (Mitchell, 2009, p. 101). Visual aids such as graphics or charts may provide a lesser chance of misunderstanding when dealing with other cultures, including those whose primary language may differ from yours (Mitchell, 2009, p. 101). Every culture reads and writes in different ways. For example, Japanese can be written horizontally and vertically, while English and Hebrew are written horizontally.

A few tips to consider in cross-culture business writing include the following:

- Avoid rambling. Written communications should be focused and on target.
- Communicate an idea—try not to impress a colleague with a story.
- Keep it brief. Know what to leave out.
- Using active voice cuts down on wordiness.
- Write first, edit later. Complete the first draft before editing. Write the thoughts on paper first.
- Avoid clichés when possible.
- Use a formal tone in business communications.
- Seek out a translation service to ensure writing is appropriate.
- Be formal in emails and follow the proper email etiquette.
- When using the internal postal services, be sure the person's name is correct; some countries require addresses in their native language for delivery.

1.4 Cross-Cultural Meetings

Effective communication in meetings is critical because misunderstandings can have damaging consequences (See Appendix, p. 24). Successfully arranging international business meetings can be challenging and requires attention to detail. Some best practices for conducting successful business meetings include:

- **Do cultural research.** Gather as much information as you can before the meeting.
- **Keep an open mind.** Remind yourself that different values and beliefs make you behave differently.
- **Establish relationships.** Cultural tensions can be minimized by establishing relationships well in advance before meetings.
- **Master etiquette.** In addition to being culturally aware, practice etiquette at all times.

("Successful cross-culture meetings," n.d.).

In addition to implementing these best practices, it is vital to determine the level of formality when conducting successful business meetings. According to Mitchell (2009), some general rules to consider in formal and informal communications include the following (p. 134):

- Asian culture demands higher levels of formality than most European cultures.
- Age can play a role in the level of formality demanded, and, in general, older generations are more formal than younger generations.
- Older established firms such as IBM are, typically, more formal than smaller, more newly established firms.

Therefore, a formal or informal approach depends on the country. The company is responsible for ensuring which approach to use for the country with whom they are doing business. Table 2 provides a list of countries and their preferred approaches.

The preparation for the meeting is the most important part of the process. Do your research and know that country's history. A poorly planned meeting can ruin your company's credibility and damage the business relationship. As indicated by Mitchell (2009), consider some of the following best practices for meeting preparation (p. 136):

- Agenda—maintain control of the main topic; let hosts know the name and titles of all attendees
- Venue—if you are the host, choose a venue that can accommodate such services as fax, internet, telephone
- Arrival—account for physical and mental effects of traveling through several time zones
- Punctuality—build in extra time for arriving to meetings on time
- Introduction and Greetings—every country has a different approach to greetings; learn what is appropriate
- Business Card Rituals—exchange cards at the beginning of the meeting; have cards in the language of the country where you are conducting business
- Concluding the Meeting—leave it to the hosts of the meeting to decide when the meeting concludes

1.5 Cross-Cultural Teams

The basic building blocks of cross-border businesses is the ability to build and effectively run cross-cultural teams (Mitchell, 2009, p. 160). Professional international managers should take a global view of business challenges, which means the following:

- Do not be content with one explanation for an event. No one situation is the same.
- Accept life as a balance of contradictory forces—appreciated, contemplated, and managed.
- Focus on conflict management, not conflict resolution. Each culture has a different approach.
- Trust the process rather than the structure to deal with the unexpected.
- Value diversity and multicultural teamwork.
- See change as an opportunity. Be comfortable with ambiguity.
- Emphasize inclusion rather than exclusion in management style.

Global teams often encounter global challenges. Some of those challenges include the following:

- Working across different time zones.
- Being deprived of the benefit of interpreting non-verbal forms of communication.
- Having no direct social contact with other team members can make it difficult to develop personal relationships.
- Coordinating or minimizing cultural differences such as attitudes toward time, goals, and decision-making (Mitchell, 2009, pp. 160, 161).

Cross-cultural teams working together can create their subcultures based on the assignment nature, team member nationalities, team organizational context, and the skills and attitudes of the team leader (Mitchell, 2009, p. 161). Moreover, the teams work together in the development of their own personality.

1.6 Cultural Competence

Peek (2023) describes cultural competence as the "ability to understand and empathize with individuals from a variety of backgrounds and experiences" (para 3). The three main factors of cultural competence are: understanding your culture, learning about other cultures, and accepting cultural differences (Peek, 2023). While crucial in business development, cultural competency encourages the development of genuine connections and minimizes misunderstandings (Peek, 2023).

According to Peek (2023), there are six predictable outcomes and benefits for business leaders that focus on cultural competence skills.

- **Cultural competence creates rapport.** Being open to learning a few words of another language show people you care about their cultural identity.
- **Cultural competence improves efficiency.** When team members understand each other, they can work better together.
- **Cultural competence opens new markets and networks.** Culturally competent people accept other cultures. Respecting cultures and beliefs unlocks the potential for new markets.
- **Cultural competence makes people feel valued and builds loyalty.** Understood and appreciated customers are likely to continue doing business with your company.
- **Cultural competence creates innovation.** Higher profits for products and services through innovation for the culturally competent company.
- **Cultural competence helps you avoid mistakes, miscommunication, and dissatisfaction.** Embracing your customer's language for clear and effective communication.

Leaders have the opportunity to foster cultural competence and aid in the development of their team members. By eliminating workplace biases, team members can work together openly. When empathetic responsiveness is practiced, there is an understanding of others' unique perspectives and experiences. Value judgment reservations affirm culture and foster loyalty. Valuing clarification is asking the customer what is important to them. Finally, practicing cross-cultural competencies leads to higher profits, innovative teams, and leader positivity (Peek, 2023).

Conclusion

Businesses can thrive globally when cultural differences, values, customs, and traditions are recognized with an open mind. Language barriers can be reduced when efforts are made to learn a few phrases of the native language. Effective communication, including verbal, nonverbal, and written, requires much time to develop the correct approach for business interactions. Cross-culture meetings and cross-cultural teams shape and add value to the organization. A culturally competent company is a company that is emphatic toward international partners. Therefore, cultural awareness matters in doing business globally.

REFERENCES

Chakraborty, A. (2023, March 27). *What is global sourcing? A comprehensive guide.* Select Hub. **https://www.selecthub.com/eprocurement/global-sourcing/**

Cultural affects on the global supply chain. (2005, April 25). Supply Chain Resource Cooperative. **https://scm.ncsu.edu/scm-articles/article/cultural-affects-on-the-global-supply-chain**

Fogarty, S. (2019, October 15). *Strategic sourcing.* ERP. **https://www.techtarget.com/searcherp/definition/strategic-sourcing**

Hulsen, D. (2021). *Strategic sourcing: A big-picture approach to procurement.* Learn.g2.com. **https://learn.g2.com/strategic-sourcing**

Lucy. (2022, August 30). *Business culture around the world.* LEaF Translations. **https://leaftranslations.com/business-culture-around-the-world/**

Mitchell, C. (2009). *A short course in international business culture: Building international business through cultural awareness (3rd ed.*). World Trade Press.

Monczka, R.M., Handfield, R.B., Giunipero, L.C., & Patterson, J.L. (2016). *Purchasing and supply chain management.* Cengage Learning.

Peek, S. (2023, February 21). *6 ways businesses benefit from cultural competence.* Business.com. **https://www.business.com/articles/business-cultural-competence**

Smit, C. (2022). *Language barriers in international business.* Culture Matters. **https://culturematters.com/language-barriers-in-internatioinal-business/**

Soni, N. (2022, September 9). *How are language barriers affecting your international business?* www.linkedin.com. **https://www.linkedin.com/pulse/how-language-barriers-affecting-your-international-business-soni/**

Successful cross-cultural meetings. (n.d.). Crown Relocations. **https://www.crownrelo.com/intl/en/article/successful-cross-cultural-meetings**

Appendix

Business Cultures Around the World				
Country	Work Based Entertaining	Communication	Meeting Etiquette	Top Tip
Australia	Do not need relationships to do business, do not extend entertaining invites until later in the relationship.	Like to create a relaxed atmosphere where everything appears under control.	Decision tend to be made quickly; often goes with first offer.	Rounds of drinks are called a "Shout; if invited for drinks everyone takes turns getting a shut for the group.
Brazil	Tend to leave office for lunch; do not bring up work sat lunch.	Are passionate and friendly; value small talk about football, family and culture.	Meeting can start 15 minutes late, but arriving on time yourself is best.	Expect to receive and give lots of handshakes, hugs, and back slaps.
China	Value introductions and are typically wary of strangers; business meals are a popular way to build relationships.	Be very polite and read up on Chinese social practices as they are taken seriously in China.	Business meetings start on time but have an unpredictable duration.	Business cards are essential in China. Print your card in Chinese and English and give it to your new contact with both hands the Chinese side facing them. Receive their card with both hands and treat it was care, reading it carefully before putting it in a safe place.
Finland	Finns sometimes work over lunch to fit with their personal schedule.	Are straightforward and don't require personal relationships to work with others. Be polite, avoid hugging, and never interrupt someone in conversation.	Finnish meetings are punctual and to the point. Meetings aren't strict, but the Finnish prefer to stick to a structure and usually say what they mean.	Finland boasts the top city in the world for work-life balance; Helsinki. Finns partly achieve this by being great timekeepers, so always be punctual to avoid disrupting their well-balanced schedules.
France	Lunch can take up to 2 hours, so be prepared for a long meeting if you meet near 1 pm.	Are direct and probing in their communication style: take longer to make a decision and will need time to consider an offer after the meeting.	Be punctual and dress in well-fitting clothes for French meetings. Meetings don't always stick to an agenda, and it's common for individuals to interrupt each other with questions as a sign of interest.	Avoid giving presents at your first meeting; they can come over too pushy.
Germany	Don't tend to focus on building relationships and will only begin to conduct lunch meetings further into the working relationship.	Are very direct, and while friendly in everyday life, they are formal in business meetings and avoid general humor.	Arrive 15 minutes early to meetings. Expect the meeting to be very formal with no jokes and a strict agenda and hierarchy.	If you don't have anything of value to say, don't say anything. Germans would rather embrace silence than fill it with informal small talk during business proceedings.
India	Relationships are essential for business in India, so your contact will invite you for an evening meal or business lunch.	Indians are indirect and will be non-committal rather than saying no when talking business.	Meetings in India are flexible and subject to valid interruptions. Agreements are usually flexible in India, so even if you make a final decision, your Indian partners will likely make adjustments after the meeting.	English is the language of business in India, but don't forget India has 22 official and 121 unofficial languages. Never assume where someone is from in India or their cultural norms.
Italy	Passionate about relationships. Working lunch meetings are common.	Italians are likely to ask about your personal life and be very open to building a relationship with you.	Begin meetings with social talk and expect the meeting to be very animated with lots of tangents and unrelated but valuable discussion.	Italians are all about quality. Dress cheaply or give an under-valued gift, and you'll do more damage than good.
Japan	Entertaining is an integral part of business. You'll likely go for Sake or Karaoke whether the deal was a good one or not.	Tend to be less direct and use coded speech to avoid saying no. Try to read between the lines of your contact's words and mirror their level of (or lack of) confrontation.	Very punctual and tend to sit quietly in meetings. Create opportunities for everyone to be involved, or those not immediately called on won't interact.	In Japan, people don't like to owe favors, so they will show thanks shortly after you do something for them.
Morocco	Will likely invite you to dinner at a restaurant or their home. Take your shoes off in their home and avoid eating with your left hand as this is unclean in Muslim cultures.	Value positive connections and avoid confrontation. Indulge in small talk about sports and family.	Meetings in Morocco are flexible and are open to overrunning.	Morocco is a Muslim country so try to avoid meetings during Ramadan or be very accommodating if you meet during this period.
The Netherlands	Dutch are friendly but don't need relationships to work together. Work lunches and dinners are usually more of a convenience rather than a bonding activity so focus on work rather than overzealous personal talk.	Focus on straightforward work talk and be open and collaborative in your discussion with everyone in the room, regardless of their position.	Arrive on time or slightly early for meetings in the Netherlands. Organizations are very flat in The Netherlands so expect staff in every position to express their opinions in meetings.	Are strategic and focus on the long-term. Construct your arguments around long-term goals, and you'll receive a warmer reception.
Russia	It's common for your host to invite you for dinner at a restaurant or their home. Avoid becoming drunk as this can be a sign of weakness.	Russians almost always need a direct introduction to start your relationship. Once a mutual contact has introduced you, be interested in Russian culture and talk formally yet warmly.	Russian meetings have a strict hierarchy, and the host will decide what you can and can't discuss. Russians will want to consult with others before making a decision, so don't expect a conclusion in your meeting.	Russians are very family orientated, so be prepared to show photos of your family, especially children.
South Korea	Relationship-building is vital to Koreans, so it's common to go out to eat together at lunch or dinner. The host usually pays, and splitting the bill is almost unheard of.	Tend to avoid confrontation, and their decisions follow a strict decision-making process.	Book meetings well in advance to fit in with Koreans' busy schedules and expect to reschedule once.	Giving gifts is a great sign of respect in Korea, but you should expect your contact to refuse your gift multiple times and to open it later in private.
Spain	The Spanish use meal times to bond rather than talk business. Expect a lunch invite to start after 2pm and a dinner invite to start around 9:30pm at which you'll get to know each other and celebrate your existing partnership.	The Spanish value relationships over technical skills–while the latter is still important, focus on meaningful small talk and relationship bonding.	While you should do your best to be on time, you won't need to heavily apologize for being late in Spain. The Spanish are also lenient on meeting duration.	The Spanish use touch to signal fondness. Expect hugs with backslaps and vigorous handshakes that grab each other's forearm.
Taiwan	Eating and drinking together are common to build mutual respect when working with Taiwanese businesses. If you drink alcohol, only begin to drink after the host makes a toast.	Keep your communication quiet and polite in Taiwan. Generally, individuals are very considerate and patient and expect the same from business partners.	The Taiwanese are very non-confrontational. Keep your conversations polite and avoid talking negatively. If you must give negative feedback, do so one-on-one.	The Taiwanese are very non-confrontational. Keep your conversations polite and avoid talking negatively. If you must give negative feedback, do so one-on-one.
United Arab Emirates (UAE)	Entertaining is a vital part of business in the UAE, so you'll likely be invited for lunch or dinner. The UAE is an Islamic country, so don't order or consume pork, shellfish or alcohol in front of your hosts.	Communication is formal in UAE, and your should greet your contacts from most senior to least. Relationships are valued, so it's normal to compliment and outright flatter your host.	Arrive early and dress formally in meetings, covering your arms and legs. Businesses are often family-run so expect the head of the family to complete negotiations and decisions.	Weekends are on Friday and Saturday in UAE, so don't schedule meetings on a Friday, and do expect contact on a Sunday!

Source: Lucy, 2023

Recent Warehouse Innovations and

Warehouse Innovation: COVID-19 Post-Pandemic Era

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ABSTRACT

Since the onset of the COVID-19 pandemic, the warehousing industry has faced unprecedented challenges, including labor shortages and supply chain challenges. A wave of mass layoffs, resignations, and a disoriented supply chain system characterize the COVID-19 impact on the warehousing industry. Warehouse innovation changes triggered by the events of the pandemic include the widespread adoption of digital technology and automation. Usually, a standard warehouse is spacious enough to allow sufficient physical distancing; however, the need to overstock to counter supply shortages during the pandemic saturated warehousing capacity. With the help of digital technology and automation machines, such as automated storage and retrieval systems (ASRS), warehouses have managed to save storage space by utilizing fewer rooms. Therefore, modern innovation technologies and other strategic measures, such as integrating multiple distribution channels, provide an effective solution that has helped warehouses overcome COVID-19 setbacks.

Operations

Technological Innovations

Warehouse Automation

Warehouses need to be effective and flexible to survive the uncertainties of the COVID-19 pandemic. Flexibility and efficiency require warehousing companies to make adjustments, such as adopting automated systems to enhance storage, picking, and distribution. Schwarz et al. (2017) indicate that warehousing activities require storing and distributing various items. Automated machines, for instance, machine learning systems, have promoted object identification and semantic segmentation. Additionally, machine learning systems effectively automate the working space by navigating through inventory accounts to speed up order delivery from on-site and remote locations. For example, using automated storage and retrieval systems has been shown to save physical space by 85% compared to ordinary shelving (Schwarz et al., 2017). Combined with advanced pick-to-light systems and automated inventory management software, warehousing activities are streamlined, promoting overall productivity. Automated pick-to-light systems help employees achieve more efficient order fulfillment using handheld scanners to navigate the inventory easily. As a result, companies can stock and hold more products to mitigate the reduced product supply issue during the pandemic.

Digital Technology

The COVID-19 pandemic is a significant catalyst for digital transformation to maintain the supply chain. Digital technology innovations, like digital monitoring systems and big data analytics, have enhanced inventory management and visibility. Integrating IoT (Internet of Things) sensors help warehouses communicate with centralized algorithms and databases to streamline activities throughout the supply chain. Fatima et al. (2022) determine that IoT is a major source of warehouse digitization. IoT enhances data assemblage, productivity, smooth operations, communication, and overall warehousing operations. As a result, IoT makes order picking and delivery more efficient by helping calculate the least time and routes during inventory management and distribution. In addition, digital learning programs, machines, and tools help speed up operations for the company, suppliers, workers, and consumers ordering through digital platforms. Furthermore, Andiyappilai (2020) determines that digital technology has facilitated the integration of warehouse management systems (WAS). WAS enhances warehousing transparency and visibility to meet stakeholder expectations. As a result, digital technology innovations have helped streamline warehousing activities to overcome COVID-19 limitations.

Artificial Intelligence

Integrating artificial intelligence (AI) allows warehouses to track real-time information, which helps companies take advantage of big data analytic systems. The more managers integrate real-time information to achieve accurate qualitative and quantitative data on warehousing operations, the faster the organization can understand and correct inefficiencies. Accurate data also helps reduce waste in the logistics and production processes to help warehouses achieve accurate and speedy order shipping and fulfillment. In addition, Zhang et al. (2021) indicate that AI effectively facilitates eCommerce businesses. For instance, crucial AI resources, such as AI algorithms, robots, and data, can be deployed, coordinated, and leveraged to work with related systems to promote warehousing performance in the eCommerce sector. As a result, the warehouse will have strong AI capacities to forecast, plan, learn, and create business value in terms of improved efficiency in labor and space optimization and error reduction.

Furthermore, real-time big data analytic systems help warehouses develop powerful cybersecurity systems to safeguard company data. Today, cybercriminals target to infiltrate weak systems for ransom or to steal confidential data, which poses adverse effects on the company. Zhang et al. (2021) suggest that, while any company can be targeted, it is essential to ensure powerful AI systems to reduce cyberattacks. Warehousing companies can protect data by outsourcing qualified IT technicians. Like in third-party logistics (3PL) firms, warehouse companies can outsource dependable 3PLs from high-quality tier 1 data centers. In addition, integrating 24/7 data monitoring software incorporated in machine learning systems can help identify and block cyberattacks concurrently.

Strategic Changes

Lean Distribution Centers

Adopting modern distribution lean centers can create a competitive advantage for warehouses. Abushaikha et al. (2018)

determine that a lean distribution strategy provides a decentralized solution for offsetting transportation costs. The author determines that there exists a positive relationship between warehouse distribution and operation performance and waste reduction. Lean distribution supports real-time digital communication within the supply chain, which enables companies to order and ship accurate stock amounts and manage inventory proficiently. Therefore, the lean distribution model provides logistics managers with a strategic understanding of how to reduce water when carrying out storage and distribution operations, which results in performance improvement and high productivity of downstream retailers.

Labor and Shipping

There have been massive labor and shipping challenges in the warehousing industry due to COVID-19 shutdowns. Most workers have resigned or been laid off. These professional fields have become challenging to fill due to scarcity of goods and services in the global supply chain and shifting shipping trends. As a result, products have become more expensive, leading to global inflation and reducing a company's capacity to hire more experts. Labor shortages have made warehouses depend more on automated technology to improve operational practices. Besides, businesses have resulted in e-Commerce strategies where online supply has peaked. However, strategic measures like renting larger storage containers can help warehouses overcome shipping and labor challenges. In addition, warehouse managers can adopt measures to increase labor capacity by creating work-in-progress inventories. Combined with automation, eCommerce, and large storage systems, warehouses can rise above shipping and labor issues triggered by the COVID-19 pandemic.

Omni-Channel Distribution

Omni-channel distribution involves developing multiple order delivery strategies for warehouses and consumers. A single distribution channel hinders customer reach, affecting consumer service delivery and satisfaction. Cergibozan and Tasan (2019) determine that multiple order delivery systems will help warehouse companies reduce logistics costs to ensure a competitive advantage. In addition, diverse distribution channels reduce storage saturation. Usually, integrating large storage spaces is a cost-intensive process. However, when multiple orders are needed, multiple distribution channels will help promote efficient order picking and delivery, supporting order batching and reducing order picking duration, travel distance, and costs.

Micro Distribution

Micro distribution using localized mini-distribution channels and centers to supply warehouses and retailers will help companies overcome border restrictions during the pandemic. Viljoen and Joubert (2018) indicate that modern societies are very integrated. Localized urban and rural land and air transport systems have developed as the demand for goods and services increases among populations. Viljoen and Joubert (2018) recommend that warehouse managers understand the geography and demographics of the locality and the supply chain interactions to facilitate micro-distribution during the pandemic when most cross-border freights have shut down. Using a Global Positioning System (GPS) to trace local connections and networked locations will help warehousing companies map the locality. However, the dynamics that drive supply interactions in micro-regions might not depend on the local population and geography. Therefore, warehouses should comprehensively understand the region and people to supply the right products to support supply chain value.

Shorter Contracts through 3PL and TPL Models

Economic uncertainties during the pandemic require warehouses to ensure that 3PL (or TPL) partnerships meet short-term agreements. Marchet et al. (2017) identify that 3PL provides warehouses with a value-creation model by providing a clear, concise, and comprehensive framework. 3PL can help value creation for shippers to help managers develop suitable shipping and operation strategies that suit and compete in the market. On their side, shippers can use 3PL to understand and evaluate logistics processes to allow them to select the right logistics partner who best fits their needs. In addition, Le et al. (2020) determine that third-party logistics (TPL) partnership facilitates an optimal decision-making model to support an integrated warehousing supply chain, especially when taking large stock. TPL helps managers determine warehousing supply chain management processes, including supplier selection, order quantity determination, and process evaluation. Therefore, managers can take advantage of the TPL and 3PL models and order large stock to ensure adequate supply during the pandemic at affordable prices. The models help shorter and more manageable distribution to optimize costs improving warehousing performance and realistic targets in the warehousing industry during the pandemic.

Greater Scalability

When warehousing companies define effective picking strategies, they can scale order delivery, distribution, and inventory management accurately and flexibly. Fang and An (2017) propose that a scalable wearable system will enhance manual order picking in warehouse operations. When warehouses use manual order-picking methods, an employee has to use a paper to indicate the name, location, and number of item, which takes time and exerts physical and mental pressure as pickers walk around to find and identify target order shelves in the densely packed environment. However, integrating augmented reality (AR) automation systems provides warehouse employees with an effective and efficient alternative to enhance manual order-picking strategies. AR helps pickers convey the order picking details into visual instruction and guidance. The system requires the management to integrate automated multi-markers in the warehouse floor and shelves to provide a map that can help the AR system to navigate accurately, continuously, and intuitively through the AR guidance system. As a result, the picker can move freely and faster through the warehouse floor and shelves without limitations.

Conclusion

The pandemic has exposed warehouses to common and enormous challenges due to high demand and low supply. Deeper investment in digital technology and automation will help warehouses become more resilient and recover to survive the pandemic. Besides, adopting strategic changes integrating micro distributions, shorter contracts, and greater scalability will help warehousing companies overcome global inflations, consumer complaints, and warehousing bottlenecks. While problems warehouses experience have a high likelihood of persisting long after the pandemic, the incredible expansion of digital technology and online customer demands will help warehouses develop functional recovery and resilience measures.

REFERENCES

Abushaikha, I., Salhieh, L., & Towers, N. (2018). Improving distribution and business performance through lean warehousing. *International Journal of Retail & Distribution Management, 46*(8), 780-800. **https://**

doi.org/10.1108/ijrdm-03-2018-0059

Andiyappillai, N. (2020). Digital transformation in warehouse management systems (WMS) implementations. *International Journal of Computer Applications, 177* (45), 34-37. **https://doi.org/10.5120/ijca2020919957**

Cergibozan, Ç., & Tasan, A.S. (2019). Order batching operations: An overview of classification, solution techniques, and future research. *Journal of Intelligent Manufacturing, 30*(1), 335-349. **https://doi.org/10.1007/s10845-016-1248-4**

Fang, W., & An, Z. (2020). A scalable wearable AR system for manual order picking based on warehouse floor-related navigation. *The International Journal of Advanced Manufacturing Technology, 109*(7-8), 2023-2037. **https://doi.org/10.1007/s00170-020-05771-3**

Fatima, Z., Tanveer, M.H., Waseemullah, Zardari, S., Naz, L.F., Khadim, H., Ahmed, N., & Tahir, M. (2022). Production plant and warehouse automation with IoT and industry 5.0. *Applied Sciences, 12*(4), 2053. **https://doi.org/10.3390/app12042053**

Le, P.L., Jarroudi, I., Dao, T., & Chaabane, A. (2020). Integrated construction supply chain: An optimal decision-making model with third-party logistics partnership. *Construction Management and Economics, 39* (2), 133-155. **https://doi.org/10.1080/01446193.2020.1831037**

Marchet, G., Melacini, M., Perotti, S., Sassi, C., & Tappia, E. (2017). Value creation models in the 3PL industry: What 3PL providers do to cope with shipper requirements. *International Journal of Physical Distribution & Logistics Management, 47*(6), 472-494. **https://doi.org/10.1108/ijpdlm-04-2016-0120**

Schwarz, M., Milan, A., Lenz, C., Munoz, A., Periyasamy, A.S., Schreiber, M., Schuller, S., & Behnke, S. (2017). NimbRo picking: Versatile part handling for warehouse automation. *2017 IEEE International Conference on Robotics and Automation (ICRA).* **https://doi.org/10.1109/icra.2017.7989348**

Viljoen, N.M., & Joubert, J.W. (2019). Supply chain micro-communities in urban areas. *Journal of Transport Geography, 74,* 211-222. **https://doi.org/10.1016/j.jtrangeo.2018.11.011**

Zhang, D., Pee, L., & Cui, L. (2021). Artificial intelligence in e -commerce fulfillment: A case study of resource orchestration at Alibaba's smart warehouse. *International Journal of Information Management, 57,* 102304. **https://doi.org/10.1016/j.ijinfomgt.2020.102304**

Automated Materials Handling Systems: Mitigating Modern Warehousing Concerns

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ABSTRACT

This paper examines modern innovations in warehousing, particularly in relation to the current state of the global supply chain. It presents several types of automated materials handling systems and how they can be used to mitigate challenges for the modern warehouse. Additionally, how these systems can help meet operational goals for warehousing is analyzed. Finally, counterpoints to the widespread adoption of warehouse automation are discussed. This is accomplished by a literature review of recent academic and professional works in the field. As technology advances amid uncertainty, this topic should be revisited with regularity and deserves intensive study.

Introduction

Automation is widely considered to be an essential facet of the modern supply chain. A number of studies have been done on right-sizing automation and on the impacts of automation on productivity and sustainability. However, recent global uncertainty in all aspects of life has led to an unprecedented need for rapid and effective supply chain innovation. While a variety of automation is available, and many types of automation can be applied to the supply chain at large, automated materials handling systems in warehouses are one of the most imminently developing categories of supply chain technology. Automated materials handling systems can help mitigate many of the concerns brought about by global change, in addition to helping warehouses stay not only functional, but also competitive in modern markets.

Warehousing Challenges and Automation Impact

With the arrival of COVID-19 in early 2020, and ongoing economic disruptions across the globe, supply chains are facing challenges never before seen to this extent. Labor shortages are prevalent due to an unusually high number of deaths, illnesses, social distancing measures, strict border regulations, workers' rights movements, and a massive increase in the number of e-commerce orders. Worker awareness of their rights, with regards to safety and compensation, is at an all-time high. And the greater public insight into both companies' business practices and environmental disasters brought about by modern media and the internet have created a need for businesses to function in a more sustainable and transparent manner. These concerns are particularly applicable to warehousing environments, where automation can be used to improve sustainability, worker safety, and speed of operations while replacing gaps left by human workers.

Sustainability

Though many people consider sustainability only along the environmental axis, sustainability's social and economic axes are equally important. The three axes are intrinsically linked from a warehousing perspective—efficiency and effectiveness of operations improve economic conditions for a business, reduce environmental impacts, and can increase both employee and customer satisfaction (Ali & Phan, 2022). Automated materials handling systems within a warehouse contribute to the "triple bottom line" of sustainability by (a) reducing damages to product and reducing waste; (b) operating more quickly and efficiently than humans, thus increasing a business's capacity and earnings; (c) removing repetitive work for employees, leaving them to do less physically strenuous and more intellectually stimulating jobs (Lui et al., 2022); and (d) reducing the energy consumption of a warehouse.

One of the greatest potential areas for sustainability improvements in warehousing that has been less studied in terms of automated materials handling is in environmental impact. As Lewczuk et al. (2021) note, heating and cooling are by far the greatest energy consumers in a typical low-automation warehouse, followed by lighting. A warehouse with a high amount of automation uses nearly five times less energy for building maintenance than a warehouse that operates with human labor and minimal automated equipment, mostly through reducing the need to heat, cool, or light a system without people. The impact of this reduction alone is enough to justify automating a warehouse, if environmental sustainability is the goal.

Worker Safety

Workers in a warehouse are often at much greater safety risk than those in an office. They are prone to injury due to repetitive labor, slips, falling objects, and interactions with machinery, such as a forklift or pallet jack. The easiest way to improve worker safety is to simply remove the hazard, which opens the door for many types of automated materials handling. Automated storage and retrieval systems are generally enclosed and remove the risk of falling objects or forklift accidents. Automated guided vehicles, which are equipped with sensors that help them avoid collisions, can replace traditional forklifts (Schwartz, 2021). Both automated storage and automated vehicles remove the need for a human worker to move objects manually, reducing the risk of repetitive labor injury. Matthews (2019) states that 38.5% of musculoskeletal injuries in a warehouse are back injuries. When a robot designed to lift and/or transport heavy goods through a warehouse is used, there are substantially fewer opportunities for back injury; and worker fatigue is also reduced.

Labor Shortages

Warehouses, especially in e-commerce and retail, tend to be heavily seasonal. It is not uncommon for warehouses to require temporary staff to keep up with demand during peak seasons; but with the arrival of COVID-19 in early 2020, global labor shortages became even more pressing. Between illnesses and deaths among the workforce, workplace capacity

measures and distancing requirements, skyrocketing numbers of e-commerce orders, and increasing inflation and unemployment rates, seasonal labor shortages have been exacerbated and have become, in some cases, year-round shortages. Many different types of automated materials handling systems can be used to reduce the impact of such shortages. For instance, automated forklifts and transporter robots can be used to move items, leaving humans to do work they are better suited to (such as picking items), thus removing the need for forklift operators or unnecessary travel around the warehouse (Lee & Murray, 2019; Michel, 2019).

Warehousing Goals and Automation Impact

Cost Reductions

Many of the warehousing challenges tie directly into a warehouse's operational goals. Consider that warehouses facing labor shortages are, in part, facing them due to rising inflation and wages. People are no longer willing to work for minimum wage and few benefits; the expectation now is that they will be compensated in a manner that allows them to have a decent standard of living. For those workplaces that have managed to acquire and retain staff by paying them fairly, these rising costs lead to the necessity of employing cost-cutting measures elsewhere in the warehouse. As discussed previously, a warehouse that operates largely manually uses nearly five times more energy than a highly automated warehouse (Lewczuk et al., 2021). Even a moderately automated warehouse, while requiring the up-front cost of the equipment, can save money by automating over just a few years. In fact, the return on investment for equipment such as automated lift trucks can be as short as two years or less (Michel, 2020); with returns on investment that short, there is little financial argument to be made against the purchase for any company with the ability to pay up front and reap the benefits over the next eighteen months.

Process Improvement

Process improvement is a need in all warehouses and a continuous driving force in those using Lean or Six Sigma methodologies, in particular. Improvements in efficiency, reduction in wasteful activity, and more accurate performance are all goals that can be furthered by the considered application of one or more automated materials handling systems to a warehouse. Transportation robots that move picked goods to a packing station or move an entire rack to a picking station can eliminate the need for a worker to travel through the warehouse, an activity that, in itself, does not generate value (Lee & Murray, 2019). Product damage rates can be reduced by switching to automated forklifts that can avoid collisions with both objects and staff (Schwartz, 2021). Automated storage and retrieval systems, such as carousels or grid storage, can be used to minimize inventory variance, improving performance (Alnahhal et al., 2022). These systems can also help humans continue to perform their normal tasks, but with greater efficiency; according to Michel (2019), one vendor's deployments saw improvement in productivity of 200% to 300%.

Competitiveness

Process improvements and cost reductions tie heavily into the need for a warehouse to stay competitive. A warehouse with fast, accurate, cheap, and reliable service will undoubtedly be more competitive than a warehouse with none of those qualities. Increased consumer awareness of sustainability plays a part, as well; and warehouse automation is essential to improving sustainability and performance long-term (Alnahhal et al., 2022).

Future-Proofing Operations

COVID-19 and the economic uncertainties of the last few years have proven to be drivers for change. The supply chain in particular has faced difficulties due to the unanticipated challenges of continuing functions through a global pandemic, border closures, and factory shutdowns. It has become obvious that the supply chain must be more resilient and adaptable than ever before, and must consider scenarios not previously considered. Automation within warehouses can provide excellent tools to help with these endeavors. For example, Alnahhal et al. (2022) state that automating warehouse storage can reduce the amount of land used, if automation is considered in the warehouse design prior to construction. This reduced footprint can be of great use in urban and suburban areas as the global population continues to grow.

As Long COVID becomes a greater concern, transportation robots can be tasked to handle movements through a warehouse that an entire generation of disabled workers may not be able to accomplish with the same speeds as before (Aprillia et al., 2019). Robots cannot become ill and can be used to keep workplaces functioning, even with social distancing measures if needed (Newberry et al., 2021). And robots can continue working tirelessly and consistently even as the aging population of workers retires and is potentially not replaced (Mayer, 2021).

Warehouse Trends

For warehousing, automation is vital for continued future operation and to mitigate modern challenges. Fortunately, automated materials handling technologies are not stagnating. These systems are becoming more affordable, inspiring more companies than ever to realize their usefulness and deploy automated picking, packing, and shipping solutions (Mayer, 2021). Warehouse automation first developed in the 1960s, according to Azadeh et al. (2019), but has only expanded since the turn of the millennium. The development of self-driving vehicle technology by companies such as Tesla has created a push for similar technology in autonomous vehicles within warehouses (Viktor & Szeghegyi, 2021). New forms of automated storage and retrieval using a grid-and-shuttle system have been developed within the last decade (Azadeh et al., 2019), and Amazon's adoption of a robotic transporter that moves entire racks has further reduced the need for dedicated pickers (Lee & Murray, 2019). The adoption of these technologies has only increased since early 2020, especially as they become cheaper to produce.

Automation Shortcomings

Despite the usefulness of automation in the supply chain, and automated materials handling in warehouses in particular, these systems have a number of potential shortcomings that are rarely addressed in literature. While they can be used to help a warehouse achieve sustainable operations, improve worker safety, and cover labor shortages, they can also perform entirely counter to these points.

Energy Usage

As established earlier, a study by Lewczuk et al. (2021) showed that highly automated warehouses use less energy than a warehouse that is performing largely manual operations. However, they note that this result is only calculated for operational emissions for the warehouse, is dependent upon conditions like climate and the volume of the warehouse, and is based on the low-automation warehouse being an unusually

inefficient building. This does not take into account the environmental impact of manufacturing the robotic systems themselves or of mining the raw materials necessary for manufacture. The energy usage of these systems when considered as an overall number, rather than operation-only number, is likely much higher. This is an aspect of automated warehouse systems' sustainability that requires further study.

Safety

Another area in which automated systems in a warehouse may fail to live up to expectations is in worker safety. Consider that all automated systems are driven by software, and that software can be hacked (Viktor & Szeghegyi, 2021). For example, if the software controlling an automated forklift were hacked, the forklift could easily fail to recognize a human worker in its path or cause the dropping of a heavy object. Even absent malicious activity, software bugs could render a system useless, requiring humans to work around it in ways they are neither equipped for or prepared to deal with, thus risking injury to those workers (Lui et al., 2022). It is also possible that a situation could arise where there was no choice but to place life at risk, reminiscent of the Trolley Problem where one person may be harmed in order to prevent a greater number of people being harmed. As Viktor & Szeghegyi (2021) point out, there are extreme ethical concerns as to whether a computer system should be allowed or trusted to decide the fate of human lives.

Job Availability

In the presence of high unemployment and battles for workers' rights, many workers understandably mistrust automated systems in some ways. A common refrain in interviews done by Lui et al. (2022) is that of workers concerned that robots are taking or will take their jobs. Almost half of the respondents who had negative impressions toward warehouse automation feared losing their jobs or having robots eliminate entire categories of jobs for future generations. These workers expressed worries that, despite automated systems taking the more strenuous and repetitive tasks, the new roles they would be forced to occupy may not be ones they were trained for or prepared to do. Given the current global financial state and unemployment rates, there may be some truth to these fears—if a robot were not being tasked to transport products through a warehouse, a currently jobless person might be.

Ultimately, automated materials handling systems provide a number of clear, interrelated benefits to a warehouse. They help warehouses achieve their operational goals while providing a buffer for uncertain times and mitigating many of the challenges faced in the modern supply chain. They are only becoming more useful and justifiable, particularly from the perspectives of financial and sustainability concerns. However, as the technology continues to rapidly develop, it should be examined with a critical eye to ensure it is not causing some of the same problems it seeks to resolve.

REFERENCES

Ali, I. & Phan, H.M. (2022). Industry 4.0 technologies and sustainable warehousing: A systematic literature review and future research agenda. *The International Journal of Logistics Management, 33*(2), 644-662. **https://doi-org.athens.idm.oclc.org/10.1108/IJLM-05-2021-0277**

Alnahhal, M., Salah, B., & Ruzayqat, M. (2022). An efficient approach to investigate the tradeoff between double handling and needed capacity in automated distribution centers. *Sustainability, 14*(13), 7678. **https://doi.org/10.3390/su14137678**

Aprillia, B.S., Kurniawan, E., Ramdhani, M., & Rizal, A. (2019). Design and implementation A* algorithm on movement system robot in the warehouse. *Journal of Physics: Conference Series 1367*(1). **https://doi.org/10.1088/1742-6596/1367/1/012066**

Azadeh, K., DeKoster, R., & Roy, D. (2019). Robotized and automated warehouse systems: Review and recent developments. *Transportation Science, 53*(4), 917. **https://doi.org/10.1287/trsc.2018.0873**

Lee, H., & Murray, C.C. (2019). Robotics in order picking: Evaluating warehouse layouts for pick, place, and transport vehicle routing systems. *International Journal of Production Research, 57*(18), 5821-5841. **https://doi.org/10.1080/00207543.2018.1552031**

Lewczuk, K., Klodawski, M., & Gepner, P. (2021). Energy consumption in a distributional warehouse: A practical case study for different warehouse technologies. *Energies, 14*(9), 2709. **https://doi-org.athens.idm.oclc.org/10.3390/en14092709**

Lui, J., Narsalay, R., Afzal, R., Nair Sharma, I., & Light, D. (2022, February 11). *Research: How do warehouse workers feel about automation?* Harvard Business Review. **https://hbr.org/2022/02/research-how-do-warehouse-workers-feel-about-automation#:~:text=The%20number%20one%20fear%20expressed,jobs%20safer%20and%20more%20meaningful**

Matthews, K. (2019, August 5). *How warehouse robotics reduce worker injuries.* EHS Today. **https://www.ehstoday.com/safety-technology/article/21920298/how-warehouse-robotics-reduce-worker-injuries**

Mayer, M. (2021). Warehouse automation is key to maintaining consistency in unpredictable environment. *Food Logistics, 223,* 16-22.

Michel, R. (2019). Mobile robotics descend on warehouse operations. *Logistics Management, 58*(7), 52-54.

Michel, R. (2020). Is now the time for robotic lift trucks? *Modern Materials Handling, 75*(12), 32-37.

Newberry, M., Rainwater, D., Crane, A., & Rauch, K. (2021). What's next: Implementing "touchless" DCs through advanced warehouse systems. *Logistics Management, 60*(1), 38-43.

Schwartz, S.J. (2021). Minimizing severe injury & fatality risk in warehouse operations. *Professional Safety, 66*(7), 15-17.

Viktor, P. & Szeghegyi, A. (2022). Safety of the introduction of self-driving vehicles in a logistics environment. *Periodica Polytechnica Transportation Engineering, 50*(4), 387-399. **https://doi-org.athens.idm.oclc.org/10.3311/PPtr.20006**

Supplier Diversity and Sustainability: The Future of Government Contracting

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ABSTRACT

Supplier diversity and sustainability are becoming increasingly important in federal contracting. There are programs to encourage supplier diversity, such as the SBA's 8(a) business development program, and certifications to encourage greater sustainability efforts, such as ISO 14001 certification. There are many benefits, both morally and commercially, to implementing supplier diversity, such as broadening competition and ultimately creating better value. There are also companies already excelling in these regards, including Northrop Grumman in supplier diversity, and Lockheed Martin in sustainability. Ultimately, it is unquestionable that supplier diversity and sustainability are the future of government contracting.

Introduction

Government contractors have much to consider when creating programs and protocols that will lead to longevity in the federal contracting sector. Two of these considerations are supplier diversity and sustainability. These two subjects have not always been deemed a necessity in order to contract with the government; however, they have become increasingly important. These two issues have the potential to work hand in hand to move federal contractors into the future.

Supplier Diversity

Supplier diversity is defined as "a business strategy that guarantees a diverse supplier base in the procurement of goods and services for any company or organization. It highlights the formation of a diverse supply chain that works to secure the inclusion of diverse groups within procurement plans for government, not-for-profits, and private industry. In other words, supplier diversity refers to a supply chain that encompasses businesses possessed by diverse entities or parties" (Simfoni, 2023). Bateman et al. (2020) with *The Harvard Business Review* define a diverse supplier as "a business that is at least 51% owned and operated by an individual or group that is part of a traditionally underrepresented or underserved group." Supplier diversity is important because it allows traditionally under-represented groups to enter the contracting pool and partake in the contracting opportunities that the federal government offers.

The federal government provides many opportunities for these under-represented groups. The Small Business Administration (SBA) is a large part of providing these opportunities. According to the SBA website, the federal government aims for small businesses to receive at least 23% of federal contracting dollars, with at least 5% of those going to women-owned businesses, 12% going to small disadvantaged businesses, 3% going to service-disabled veteran-owned businesses, and 3% going to small businesses in HUBZones (U.S. Small Business Administration, 2023). One of the programs provided by the SBA for small businesses (specifically socially and economically under-represented small businesses) is the 8(a) Business Development Program. This program is designed to help socially and economically disadvantaged small businesses become more competitive in federal contracting through training and technical assistance. Once certified as an 8(a) business, a contractor can:

- Efficiently compete and receive set-aside and sole-source contracts
- Receive one-on-one business development assistance for their nine-year term from dedicated Business Opportunity Specialists focused on helping firms grow and accomplish their business objectives
- Pursue opportunity for mentorship from experienced and technically capable firms through the SBA Mentor Protégé program
- Connect with procurement and compliance experts who understand regulations in the context of business growth, finance, and government contracting
- Pursue joint ventures with established businesses to increase capacity
- Qualify to receive federal surplus property on a priority basis
- Receive free training from SBA's 7(j) Management and Technical Assistance program

(U.S. Small Business Administration, 2023)

With these available resources, 8(a) certified companies have a much better chance at being competitive in the federal contracting sector. It is also worth noting that 8(a) certified companies have the ability to compete for sole source and set-aside contracts for the government specifically available for 8(a) companies. Additionally, the U.S. General Services Administration (GSA) announced on April 18, 2022, "steps to advance equity and supplier diversity in federal procurement, in line with recent changes to the category management program, and other actions to reduce obstacles for small disadvantaged businesses (SDBs). These steps will help GSA reach the Biden-Harris Administration's goal of increasing the share of contracts awarded to small disadvantaged businesses by 50% by 2025" (GSA, 2022). So, there will likely be many more opportunities in the future for small, disadvantaged businesses. See Appendix on page 36 for a list of practices and commitments GSA has set forth to aid in these efforts.

There are many benefits to utilizing supplier diversity in a company. Firstly, there are moral and ethical benefits in being fair to all suppliers. It is simply the right thing to do to give everyone an opportunity to compete. However, the benefits do not end at knowing you have done the right thing. Implementing supplier diversity programs within a company also benefits business. According to *The Harvard Business Review,* "An inclusive procurement strategy widens the pool of potential suppliers and promotes competition in the supply base, which can improve product quality and drive down costs. And by providing more sourcing options, inclusiveness can make supply chains more resilient and agile—an increasingly important advantage in these uncertain times" (Bateman, et al., 2020).

An increase in competition inevitably creates better value for the government. Additionally, supplier diversity lessens the chance of a supply chain breakdown.

An example of a government contractor who has successfully implemented a supplier diversity program for their subcontractors is Northrop Grumman. The program is called the Global Supplier Diversity Program (GSDP). Per the Northrop Grumman website, "The GSDP office is designed to expand subcontracting opportunities for all small business concerns, including small disadvantaged, minority, women-owned, historically underutilized business zones, veteran, service-disabled veteran-owned, lesbian, gay, bisexual, transgender and questioning, disability owned, historically black colleges and universities, minority institutions, Alaska Native Corporations and Indian Tribes" (Northrop Grumman, 2023). Northrop Grumman's GSDP office includes representatives spanning several different areas of expertise, mostly consisting of women and people of color, further indicating their commitment to including traditionally under-represented groups. The Mission Statement of the GSDP office states, "Our Corporate mission is to provide policy guidelines and strategic direction for the implementation and interpretation of the Federal government initiatives and public law mandates. In addition, we ensure consistent application of the prescribed Northrop Grumman initiatives, policies, and procedures across the enterprise" (Northrop Grumman, 2023). Northrop Grumman has won many awards for their efforts in diversity as well. Some of these awards in 2022 included: The Champion of Veterans Enterprise Award, #10 on the 2022 HBCU Top Supporters List, 2022 Best of the Best Top Supplier Diversity Programs, among many more (Northrop Grumman, 2023).

Sustainability

Sustainability is defined as "meeting the needs of the present without compromising the ability of future generations to meet their own needs" (United Nations, n.d.). This paper's focus is on environmental sustainability. This means making sure the Earth is in good shape and is still able to produce natural resources for future generations. Many companies have already implemented some level of sustainability or "green" initiative, but there is still more progress to be made in this area. *FAR 23* already addresses sustainability initiatives that the government is trying to implement. FAR 23.103 states as follows:

(a) Federal agencies shall advance sustainable acquisition by ensuring that 95 percent of new contract actions for the supply of products and for the acquisition of services (including construction) require that the products are
    (1) Energy-efficient (ENERGY STAR® or Federal Energy Management Program (FEMP)-designated);
    (2) Water-efficient;
    (3) Biobased;
    (4) Environmentally preferable (e.g., EPEAT®-registered, or non-toxic or less toxic alternatives);
    (5) Non-ozone depleting; or
    (6) Made with recovered materials.
(b) The required products in the contract actions for services include products that are
    (1) Delivered to the Government during performance;
    (2) Acquired by the contractor for use in performing services at a Federally-controlled facility; or
    (3) Furnished by the contractor for use by the Government.
(c) The required products in the contract actions must meet agency performance requirements.
(d) For purposes of meeting the 95 percent sustainable acquisition requirement, the term "contract actions" includes new contracts (and task and delivery orders placed against them) and new task and delivery orders on existing contracts (FAR § 23.103, 2023).

Additionally, Executive Order 14057 entered by President Biden "outlines an ambitious path to achieve net-zero emissions from Federal procurement by 2050 while increasing the sustainability of Federal supply chains" (Office of the Federal Chief Sustainability Officer, n.d.). This proves that the federal government is devoted to the move toward sustainability, and further initiatives and requirements in this regard will likely come in the future.

Some steps that have already been taken to encourage sustainability are ISO certifications. Specifically, ISO 14001:2008 relates to environmental management. This certification "focuses on Pollution Prevention, Conservation of Energy and Natural Resources; promotes Continual Improvement and Environmental Sustainability" (Kotte, 2011). Contractors who have been ISO 14001-certified have an advantage in the sustainability game. If a contractor is certified, they will already have the processes in place to work toward becoming more sustainable. ISO certification is not necessarily a requirement for all contractors, but it certainly enhances a contractor's chances with receiving government contracts.

An example of a contracting company that has implemented sustainability practices is Lockheed Martin. According to their website, Lockheed Martin's sustainability mission is "to foster innovation, integrity and security to protect the environment, strengthen communities and propel responsible growth" (Lockheed Martin, n.d.). Lockheed uses a Sustainability Management Plan to implement sustainability changes. Their environmental initiatives are expansive and include energy management, hazardous chemical/materials, and resource and supply vulnerability. Impressively, Lockheed Martin has a "Go Green Program," through which they aim to reduce carbon emissions and increase use of renewable energy. This is achieved with an "ISO 14001-certified Environment, Safety and Health Management System" which "drives continuous improvement and commits all business areas to operating in a manner that protects the environment, conserves natural resources, prevents pollution and reduces and actively manages associated risks" (Lockheed Martin, n.d.). Also of note, Lockheed Martin has been recognized in the DOW Jones Sustainability Indices World Index and North American Index Ranking, and was awarded the Energy Star 2021 Partner of the Year Sustained Excellence Award (Lockheed Martin, n.d.).

Conclusion

At first glance, supplier diversity and sustainability may not appear to be linked in any way. However, it can be argued that when supplier diversity is utilized, greater sustainability can be achieved. When traditionally under-represented contractors are included, new technology, new ideas, and new protocols for sustainability can be brought to the table. Both are necessary for growth in the federal contracting sector. New regulations and legislation have already been enacted regarding both supplier diversity and sustainability. This proves that the federal government is moving toward stricter requirements in this regard. Thus, supplier diversity and sustainability programs really are the future of government contractors.

REFERENCES

8(a) business development program. (n.d.). U.S. Small Business Administration. **https://www.sba.gov/federal-contracting/contracting-assistance-programs/8a-business-development-program**

Bateman, A., Barrington, A., & Date, K. (2020, August 17). *Why you need a supplier-diversity program.* Harvard Business Review. **https://hbr.org/2020/08/why-you-need-a-supplier-diversity-program**

Federal Acquisition Regulation, 48 C.F.R. § 23.103 (2023).

Global Supplier Diversity Program (GSDP). (2023, January 3). Northrop Grumman. **https://www.northropgrumman.com/suppliers/global-supplier-diversity-program-gsdp/?utm_source=google&utm_campaign=fy23framework&utm_medium=kw&utm_audience=list_g&utm_content=null_null&utm_format=copy&utm_code=OTH-13321&source=OTH13321&gclid=Cj0KCQjwi46iBhDyARIsAE3nVraTPo0qUm3NRDBhaOzYhM30V6K4O5Meh9ZBLfH514tG17MVuwQmIAAvSIEALw_wcB**

GSA announces actions to advance equity and supplier diversity in Federal Procurement. (2022, April 18). GSA. **https://www.gsa.gov/about-us/newsroom/news-releases/gsa-announces-actions-to-advance-equity-and-supplier-diversity-in-federal-procurement-04182022**

Kotte, B. (2011, November 29). *Sustainability & ISO certification.* Quality Systems Enhancement. **https://enhancequality.com/connecting-sustainability-to-iso-certification/**

Net-zero emissions procurement by 2050: Federal sustainability plan: Office of the federal chief sustainability officer. (n.d.). Office of the Federal Chief Sustainability Officer. **https://www.sustainability.gov/federalsustainabilityplan/procurement.html**

Supplier diversity—why & how to implement diversity in procurement & supply chain. (2023, January 4). Simfoni. **https://simfoni.com/supplier-diversity/#:~:text=It%20highlights%20the%20formation%20of.by%20diverse%20entities%20or%20parties**

Sustainability at Lockheed Martin. (n.d.). Lockheed Martin. **https://sustainability.lockheedmartin.com/sustainability/index.htm.**

Appendix

GSA Practices and Commitments to Supplier Diversity

The GSA has committed to advancing supplier diversity with the following more fair and equitable practices;

- Giving agencies automatic credit towards all awards made to socioeconomic small businesses, beginning in FY 2022.
- Encouraging implementation of category management plans consistent with statutory socioeconomic responsibilities and ensuring that these plans do not prioritize spending on “Best-In-Class” solutions at the expense of meeting socioeconomic small business goals.
- Ensuring that the use of “Best-In-Class” solutions is balanced with decentralized contracts and other necessary strategies to increase diversity within agency supplier bases (GSA, 2022).

The GSA has also committed to the following list in order to reduce obstacles for small disadvantaged businesses:

- Establish a new IT governmentwide acquisition contract (GWAC), Polaris, to increase SDB representation. GSA has released the small business and women-owned small business solicitations.
- Simplify the process for firms to obtain a multiple award schedule (MAS) contract and improve vendor education using human centered design principles to create a pathway to federal procurement through the MAS contract vehicle.
- Create a post-award engagement strategy to help contractors who are new to government to succeed.
- Establish a supplier diversity plan promoting successful outcomes for vendors. This will include a strategy and criteria for regular on-ramping relative GWACs and multi-agency contracts.
- Enhance e-tools so SDB contractors can evaluate federal marketplace opportunities (GSA, 2022).

Space Junk: Preventing Kessler Syndrome

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ABSTRACT

Since the launch of Sputnik 1 in 1957, humankind has contributed to the "space junk" that is currently orbiting the Earth. Space junk is the result of spacecraft launches, unfunctional satellites, and any man-made debris resulting from space exploration. The accumulation of space junk has worsened considerably since 1957, as man continues to pursue space exploration ventures. Space junk poses hazards to potential and ongoing missions. Collisions with existing debris cause additional debris to be created, further adding to the problem. Donald J. Kessler coined the term "Kessler Syndrome" to theorize the phenomenon of the continued accumulation of debris that will eventually cause mass collisions with orbiting spacecraft in a chain reaction. With launches occurring more and more every year, and the destruction of decommissioned satellites, the issue of space junk needs to be addressed sooner than later.

Defining "Space Junk"

Between approximately 200 and 40,000 kilometers above the Earth's surface, there are over 23,000 pieces of man-made debris larger than 4 inches and over 100 million smaller fragments currently orbiting the Earth (Gorman, 2019). The total weight of this debris is estimated to weigh 6,000 tons. Only six percent of this man-made debris is composed of spacecraft that are still operating. Every year, the amount of space junk continues to grow as new satellites and other spacecraft are launched.

Space Junk Impacts Missions

Space junk can be extremely hazardous to space missions. High-velocity impacts from the debris can cause irreparable damage to the exterior of the spacecraft and, in the worst cases, severe enough damage to threaten the lives of any crew on board. Donald J. Kessler thought of this during the days of early space exploration, 1978 to be exact. He theorized that space debris would impact other space debris, creating multiple fragments that split into more fragments, and so on. Some speculate that a chain reaction of this magnitude could be devastating to all objects orbiting Earth. Samson et al. (2022) cite a startling fact from the European Space Agency, "A collision of just a one centimetre wide particle travelling at 10 km/second will release the same amount of energy on impact as a small car crashing on Earth at 40 km/hour." If an external force is great enough, it could potentially cause some damage to any spacecraft in its wake.

Space Junk Could Prevent Future Missions

At the current rate of accumulation, space debris will eventually be so significant that any future missions will be endangered. Future deployment of satellites for weather, communications, research, etc. will be at such significant risk that it will be impossible. As vast as the Earth and its orbit are, there is only so much space available for spacecraft to orbit. If humans were to need one day to leave Earth for some cata-

Figure 1—Impact from Space Debris

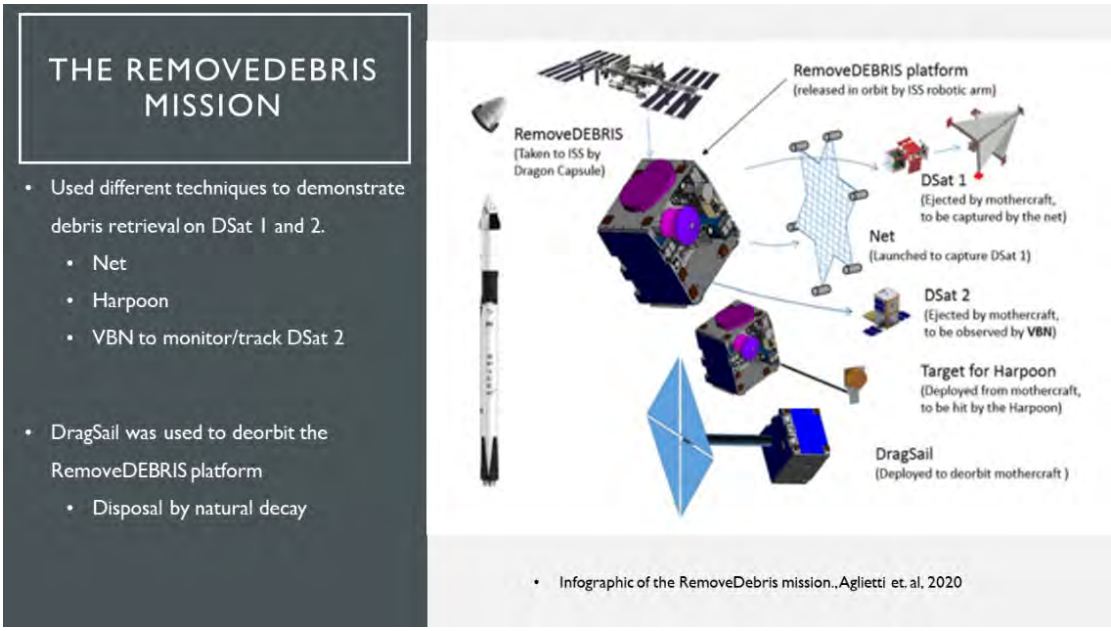

Figure 2—The RemoveDEBRIS Mission

strophic reason, it may not be possible due to the debris that currently envelops the planet. It's a disturbing thought and realization that needs to be addressed in all space-faring organizations and nations.

Space Junk Effects on Earth's Surface

Space junk can have hazardous effects on Earth's surface as well. Neflia and Rohmah (2022) conducted a study of the potential hazards of space debris measuring over ten centimeters to the Earth's surface, specifically in Indonesia. Due to Indonesia's span of roughly 5,000 kilometers (1/8 of Earth's circumference), it is more susceptible to experiencing the re-entry of objects in orbit. Neflia and Rohmah (2022) also state that:

> Of all space debris, only those with an altitude below 200 km potentially fall to the Earth, which is around 1,517 pieces. In addition, the most dangerous debris in the Indonesia region commonly has a low inclination with the passage around 12 to 16 times a day. However, there are only 15 objects which satisfy this category with a small number. Hence, the need of space debris surveillance should be done for mitigation purposes.

Their call for space debris surveillance leads to the next concern of the overwhelming amount of space junk.

Space Junk Is Costly

The steady accumulation of space junk creates a need to track the debris to avoid collisions with orbiting spacecraft and to prepare for the re-entry of larger fragments. Significant amounts of time and money are needed to track these fragments (Samson et al., 2022). There is also a staggering cumulative cost for the fuel needed to move spacecraft out of the path of potential collisions. Time and opportunities to collect data are lost whenever sensors and instruments are turned off during maneuvers to avoid a collision. Additionally, spacecraft design will have to be reevaluated continuously. Research and design take long amounts of time and much money to properly conduct. Spacecraft will have to be built with stronger, more impact-resistant materials to avoid damage and destruction; both would cause more space debris to accumulate. Stronger, thicker materials are more costly and add to the weight of a spacecraft, which requires more fuel, which overall increases the cost of a mission. In short, the economic impact of space debris is also to be considered a major problem for nations and organizations that make use of space for research and monitoring purposes.

The RemoveDEBRIS Mission

The removal and prevention of space debris are of the utmost importance to ongoing and future missions. There have been many suggestions and studies of the best way to remove space junk from orbit. Aglietti et al. (2020), in the abstract, describe the RemoveDEBRIS mission which successfully demonstrated different techniques and technologies that can be used to retrieve space debris:

> Technologies for the capture of large space debris, like a net and a harpoon, have been successfully tested together with hardware and software to retrieve data on non-cooperative target debris kinematics from observations carried out with onboard cameras. The final demonstration consisted of the deployment of a drag-sail to increase the drag of the satellite to accelerate its demise.

The RemoveDEBRIS platform had structural features like a CubeSat, with tools equipped for capturing space debris attached. RemoveDEBRIS was transported to the International Space Station by the Dragon Capsule, where it was deployed in orbit by an ISS robotic arm. The DSat 1 was onboard the RemoveDEBRIS and was deployed to be captured by a net in a successful demonstration. The DSat 2 was also on board the RemoveDEBRIS to be deployed and observed by a VBN camera to demonstrate "navigation algorithms based on real flight data;" most space debris is difficult to capture due to un-

certainty of size, distance, and velocity. The use of a harpoon to pierce and reel in a target mock-up of satellite debris was successfully demonstrated as well as the use of a drag sail to successfully de-orbit the RemoveDEBRIS.

Using Visual Guidance and Navigation to Retrieve Space Debris

The use of a visual guidance navigation system is being studied and developed for space debris retrieval as well. A study reviewed by Kimura et al. (2021, p. 1277) describes the system used:

> A highly intelligent camera system combining autonomous control software technologies and commercial off-the-shelf (COTS) devices is developed in this study. Using a high-resolution COTS imager and a field-programmable gate array (FPGA) system, we achieved high-resolution images and high-speed image processing at an extremely low cost, which was approximately one-tenth of that of space computers.

The need for this type of system is due to the uncontrollable state of space debris. The position, speed, and direction of space debris can be evaluated by the system to calculate the precise maneuver needed for successful retrieval. Astrocale's ELSA-d mission is a plan to launch the ELSA-d satellite equipped with this visual guidance and navigation system to test a capture using different maneuvers. It was successfully launched in 2021 aboard a Soyuz-2 (NASA, 2023).

Using Space Tugs to De-orbit Space Debris

Another technique for actively removing space debris is the use of "space tugs." Trushlyakov and Yudintsev (2019) describe a space tug as "an active spacecraft that can capture and de-orbit selected space debris object." In normal practices, the space tug can either pull the debris with a tether or push the debris after docking with it. Trushlyakov and Yudintsev propose a new way of de-orbiting debris in basic terms:

> In the proposed technique the rotation of the tethered tug-debris system is used to "rigidize" the tether due to the action of the centrifugal forces on the debris and space tug. It allows to apply the tug's thrust along the tether to push the debris object. To de-orbit the system, the tug's thrust should be turned on when the projection of the space tug's force on the orbital velocity vector is negative.

All techniques described here can be effectively used to de-orbit space debris.

Use of Plasma Thrusters on Space Debris

A relatively new technology to de-orbit and remove debris is the use of a plasma thruster ("Plasma Thruster: New Space Debris Removal Technology," 2018). Satellites are equipped with propulsion systems that "eject bi-directional plasma beams" to decelerate debris so that they fall to a lower altitude, ultimately burning up naturally upon entering Earth's atmosphere. However, there are downsides to this technology. Additional weight is required to add the propulsion systems to the satellite, and ejecting a plasma beam will accelerate the satellite in the opposite direction of the beam shot toward the debris. An upside to this is that satellites equipped with these propulsion systems can use plasma beams to maneuver themselves in different directions, which can be useful in changing altitude and positioning.

A Call for Action

While there are many mitigation techniques to attempt to control existing space debris, a collaboration between the space-venturing nations needs to occur. The United States, specifically NASA, took the first step by leading the creation of the Inter-Agency Space Debris Coordination Committee (IADC) in 1993 which is described as an "international forum of govern-

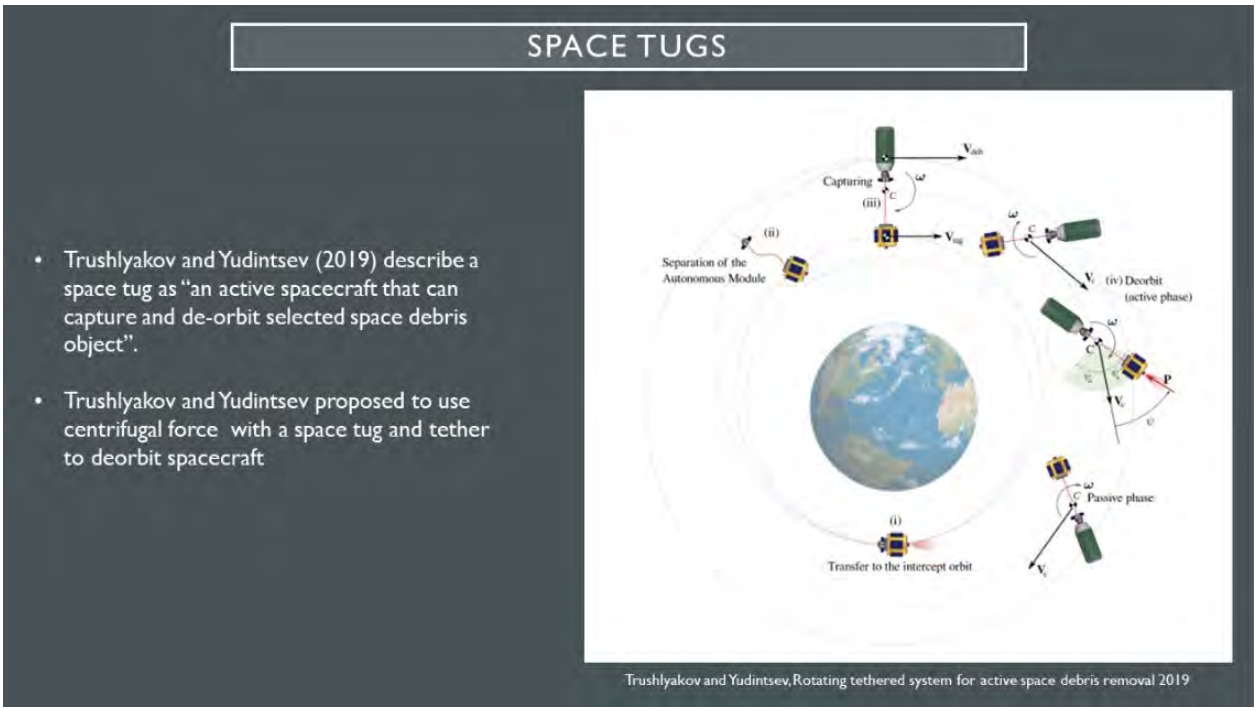

Figure 3—Using Space Tugs to De-orbit Space Debris

mental bodies for the coordination of activities related to the issues of man-made and natural debris in space" (Mudge, 2022, p. 107). The primary purpose of the IADC is to band together the space-venturing nations to share information on debris research activities as well as strategic mitigation techniques. NASA also took the initiative by adding space debris to the agenda of the Scientific and Technical Subcommittee (STSC) of the United Nations Committee on the Peaceful Uses of Outer Space (COPUOS) in 1992. Unfortunately, these actions have not gotten significant traction toward the goal of controlling and removing space debris "due to significant structural limitations within resulting mitigation guidelines and poor global compliance."

IADC's Guidelines on Space Debris

Still, IADC persevered by developing the IADC Space Debris Mitigation Guidelines in 2002. The guidelines were updated in 2007, and despite being only voluntary, have become successful in the fight against space debris. Most intergovernmental space organizations maintain standards that are compliant with the IADC guidelines (Mudge, 2022, p. 107). Mudge describes the purpose of these guidelines:

> They particularly focus on (1) limiting debris released during normal operations, (2) minimizing the potential for on-orbit breakups, (3) post-mission disposal, and (4) preventing on-orbit collisions. They are designed to apply to mission planning and the design and operation, including the launch, mission, and disposal, of all spacecraft and stages intended to be operated in Earth orbit (2022, p. 107).

The IADC Guidelines establish LEO and GEO, roughly 200 kilometers and fifteen degrees inclination, as "protected regions" of space and the primary focus of debris reduction.

Limiting Debris During Active Missions

Considering the root of the problem, limiting debris during active missions, the guidelines recommend changing the design of spacecraft to ensure that no debris is released in orbit and limited where possible. "In order to minimize on-orbit breakups, the IADC Guidelines recommend depleting any stored, on-board energy sources, such as batteries, propellants, or flywheels" (Mudge, 2022, p. 108). Additionally, spacecraft should be designed to withstand collisions with smaller debris, such as shielding and maneuvering techniques. Coordinating launch windows can also prevent unnecessary collisions with space debris, where possible. Another huge problem that adds to space debris is the intentional destruction of decommissioned spacecraft, which the IADC guidelines state "should not be planned or conducted." Disposal of GEO spacecraft should occur at an altitude of 235 additional kilometers above the "protected region." The orbital lifetime of any spacecraft that is bound to pass through LEO post-mission should be under 25 years, and at the end of life be lowered to an altitude that allows natural decay to occur.

Attempts of the United Nations to Control Space Debris

The United Nations (U.N.) has also studied the problem of space debris, focusing on standardizing efforts to mitigate strategies globally (Mudge, 2022). A set of guidelines like the IADC's was established by the COPUOS. Unfortunately, the guidelines presented by the COPUOS are not as detailed as those presented by the IADC. An example presented by Mudge (2022, p. 109) states that "the IADC Guidelines discuss a specific altitude and formula for GEO end-of-life 'graveyard' movements, while the COPUOS Guidelines merely recommend non-interference with GEO after the termination of operations." The COPUOS guidelines also do not offer any suggested maximum orbital lifetime, whereas the IADC Guidelines do.

Limitations of Space Debris Mitigation Guidelines

Despite the best efforts of the IADC and COPUOS, the guidelines they have presented are significantly limited considering how out-of-control the space debris problem is. Both guidelines are overall for the prospective prevention of additional debris but offer no retrospective solutions to the space debris that has already accumulated. In 2006, Jer Chyi Liou, NASA's current Chief Scientist for Orbital Debris argued that "using statistical modelling that LEO's debris population was unstable and that growth would continue even with widespread implementation of mitigation measures" (Mudge, 2022, p. 115). There is a significant need to deal with the existing problem more than to prevent future debris. Additionally, these presented guidelines are voluntary and are not enforceable. There is a challenge associated with enforcing laws across all nations that conduct activities in LEO and beyond.

Challenges of Enforcing Legal Obligations

Currently, space law has no way to enforce legal obligations to countries and organizations responsible for their space debris. "Legal development is advanced mainly through voluntary guidelines and States practice, though some States have called for a set of binding rules" (Li, 2015, p. 309). The reasoning behind the slow legal development of guidelines is that "debris mitigation can hardly be separated from other space law issues" (Li, 2015, p. 309). Convincing space organizations to come to a consensus on space debris mitigation will surely lead to the discussion of other related subjects with which they may not agree. Another reason is the vast difference in space-faring technology between advanced and developing countries. Some developing countries may not have the resources or funding available to follow restrictive guidelines and mitigation techniques as more developed countries do. More advanced space-faring nations would have to help with technical requirements, which in most cases would not be economically ideal.

Current Liabilities Considering Space Debris

There are some current liabilities considering space debris. Considering the Liability Convention, space debris can be categorized as a "space object" and "States can be held liable for damage caused by space debris. However, the Liability Convention is confined to damage in respect of loss of life, personal injury or other impairment of health; or loss of or damage to property" (Li, 2015, p. 312). However, it is difficult to place blame on damaging events from space debris. Despite this one specific rule on damages caused by space debris, there is a significant need to standardize mitigation and prevention techniques across the board. Again, the guidelines presented by the IADC and COPUOS are voluntary and cannot be enforced directly under international law. A new Space Treaty needs to be developed and agreed upon by all entities that use space and Earth's orbit for any reason.

Conclusion

In conclusion, the issue of space junk is one that needs to be fully addressed sooner rather than later. Space is humankind's last place left to explore. Satellites are depended on by billions of people for weather and communications, as well as for research purposes for NASA and other space-faring organizations. Man-made space debris poses a threat to currently operating satellites as well as any future space missions. Kessler Syndrome seems to be entirely possible, considering the current state of orbiting space debris. A new Space Treaty or enforceable agreement is desperately needed to prevent debris; but more than that, the removal of existing debris would be the most effective in solving the problem.

REFERENCES

Aglietti, G.S., Taylor, B., Fellowes, S., Ainley, S., Tye, D., Cox, C., Zarkesh, A., Mafficini, A., Vinkoff, N., Bashford, K., Salmon, T., Retat, I., Burgess, C., Hall, A., Chabot, T., Kanani, K., Pisseloup, A., Bernal, C., Chaumette, F., ...Steyn, W.H. (2020). RemoveDEBRIS: An in-orbit demonstration of technologies for the removal of space debris. *The Aeronautical Journal, 124*(1271), 1-23.

Gorman, A. (2019). Ghosts in the machine: Space junk and the future of earth orbit. *Architectural Design, 89*(1), 106-111.

Kimura, S., Atarashi, E., Kashiwayanagi, T., Fujimoto, K., & Proffitt, R. (2021). Low-cost and high-performance visual guidance and navigation system for space debris removal. *Advanced Robotics, 35*(21-22), 1277-1285.

Li, L. (2015). Space debris mitigation as an international law obligation. *International Community Law Review, 17* (3), 297-335.

Mudge, A.G. (2022). Incentivizing 'active debris removal' following the failure of mitigation measures to solve the space debris problem: Current challenges and future strategies. *The Air Force Law Review, 82,* 88-178.

NASA-NSSDCA-Spacecraft-Details. (n.d.). Nssdc.gsfc.nasa.gov. **https://nssdc.gsfc.nasa.gov/nmc/spacecraft/display.action?id-2021-022N**

Neflia, Ahmad, N., & Rohmah, F. (2022). Potential hazards analysis of the space debris over 10 cm in size based on their orbital parameters. *Journal of Physics: Conference Series, 2214*(1).

Plasma thruster: New space debris removal technology. (2018). *R & D, N/a.*

Samson, N., Kazaz, N., Malkowsky, V., & Greenbaum, D. (2022). Space debris: It's time to look up and do something. *Intellectual Property Journal, 34*(3), 267-316. **https://athens.idm.oclc.org/login?url=https://www.proquest.com/scholarly-journals/space-debris-time-look-up-do-something/docview/2711038203/se-2**

Trushlyakov, V.I., & Yudintsev, V.V. (2019). Rotating tethered system for active space debris removal. *Journal of Physics Conference Series, 1260*(11). **DOI: 10.1088/1742-6596/1260/11/112032**

Supply Chain Innovations Prompted by the COVID-19 Pandemic

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ABSTRACT

Innovation is the key to lasting progress. Seeking to find new and creative ways to meet the needs of customers allows businesses to stay ahead of their competition. This often involves adapting to an adverse situation. One such situation is the COVID-19 pandemic. Over the last three plus years, many areas of the supply chain and logistics industry have capitalized on this opportunity to not only meet the needs of their customers, but do so in a way that better positions them for future successes.

Introduction

The COVID-19 pandemic made it painfully clear that our society, for all of its advancements and successes, simply was not prepared. This point may seem obvious in hindsight; however, it comes from a point of reflection and a desire to be properly equipped when the next great disaster is upon us. Putting aside the obvious impact the virus had on human life, the sheer disruption to the supply chain infrastructure was absolutely catastrophic. Numerous industries, such as airline, automotive, energy, manufacturing, medical, and retail saw their infrastructures turned upside-down in a matter of weeks by something that none of our senses could even perceive. Engaging in combat with an enemy you can see is difficult enough, but to do so with one that is imperceptible is virtually impossible. For perspective, the size of a COVID-19 particle is on average 0.3 µm, whereas the width of a human hair is approximately 130 µm (Ang, 2020). Our world was crippled by something 0.23% the width of a human hair!

Millions of deaths, countries shut down, food, material, and essential personnel shortages, were all caused by a virus. The COVID-19 pandemic had a significant impact on countless aspects of the world. While many of them have been negative, there are a lot of positive impacts. For example, in real-time, as the virus waged its war on our society, industries began to change their policies, practices, and basic business operations in an effort to regain control of market-share and of their respective industries. These changes allow businesses, entire industries, and our society as a whole to operate more efficiently. With this in mind, perhaps next time we will be prepared.

Collaboration

Throughout the supply chain and logistics industries there have been significant advancements. However, none may be as beneficial as the dramatic increase in collaboration between groups typically seen as competitors. Medical facilities often source materials and equipment from various suppliers. This can be done for a variety of reasons, such as price, availability, and the desire to keep prices low by dual or poly-sourcing.

One such example of this is M Health Fairview Hospital in Minneapolis, Minnesota. Using a collaborative approach, they were able to maintain a relatively steady flow of necessary materials by holding daily meetings between their two largest suppliers and their supply chain team. This allowed them to determine what materials were needed, who was best suited to provide them, and what the best methods were to obtain them (Barlow, 2020). Such open and direct communication and willingness to collaborate so closely likely saved countless lives. Additionally, it created new supply chain streams and opened suppliers up to greater exposure.

Another excellent example of collaboration comes from Florida, where an astonishing fifty-one independent hospitals created a data-sharing network to combat COVID-19 by aggregating and distributing information on their capacity and resources (Conway, 2020). This type of information-sharing has the potential for revolutionizing how and where patients in need of any type of medical attention, not just COVID-19 related, are taken. Access to this data offers the best opportunity for ensuring patients are being sent to the hospitals most equipped to treat them. This allows for not only better medical outcomes for the patients, but also a reduced overall strain on the medical facilities and their associated employees. As a result, the facilities operate more efficiently.

Technology

Technological innovation has also developed out of the COVID-19 pandemic. Some of these advancements were necessitated by shortcomings in existing supply chains. These limitations resulted in a scarcity of materials necessary to produce traditional ventilators. As a result, researchers in California designed a new ventilator that could be manufactured with considerably fewer components and more readily available materials. The result is a “high performance, low cost, functional ventilator” (Raymond et al., 2022, p. 1). The most critical success of this venture is that its reduction of components helps to reduce the strain on the supply chain and, as a result, shortens the time to market for manufacturers.

Not all manufacturers are looking to new technology to combat the impact of COVID-19. Instead, some are using existing technology for new applications. Ford, General Motors, and Tesla are attempting to use excess capacity at their vehicle manufacturing plants to produce ventilators for medical use (Brem, 2021). Although this has significant potential benefits to the medical industry, there are considerable difficulties to address, as the supply chain shortages created by the virus make it difficult to obtain some of the necessary components.

Another technological advancement is the increased use of artificial intelligence (AI) in the supply chain industry. AI has been utilized for more than seventy years, and we are still scratching the surface on its capabilities. It seems that everywhere we turn there are opportunities for its use. With the oppressive impact of COVID-19 on our supply chain and lo-

gistics infrastructure worldwide, it is evident that any opportunity for automation or optimization should be explored.

With this mindset, researchers have found, "Self-learning and self-organizing technologies like AI-based on algorithmic approaches can aid in the decision-making process" (Modgil et al., 2022, p. 140). These programs allow businesses to more effectively plan and coordinate their sourcing and distribution functions for optimal customer outcomes. Access to more advanced processes such as these enable supply chains to focus more attention in other areas such as cost-saving and poly-sourcing. Subsequently, they can advance their own agendas while still offering necessary solutions for their existing customers as well as their shareholders.

Sustainability

For businesses, surviving the pandemic is only one small piece of the puzzle. The true key is understanding and implementing sustainable infrastructure capable of minimizing or eliminating future shortcomings within the supply chain industry. Sustainability efforts lead to an overall increase in resiliency and an ability to address issues in real time. This approach, as opposed to failing in the face of adversity and working to correct systems after the fact in the hope of avoiding future failure, establishes a framework of innovation and advancement.

The University of Pittsburgh Medical Center (UPMC) Health network created and put into operation a forecasting system to track their medicines, personal protective equipment (PPE), and other associated supplies. Furthermore, their system's advanced nature allows for accurate forecasting of usage, replenishment timelines, and ordering reminders. Although this would be impressive if it was for one hospital, it is even more remarkable when you consider that the UPMC Health system consists of more than forty facilities across multiple states (Barlow, 2020). This system advances UPMC Health's ability to prepare for the future while maximizing their impact on current issues they must face.

This is far from a novel concept, as a high number of organizations research and implement ways to build "supply chain resilience" into their respective business practices (Belhadi et al., 2021). This resilience is designed to reduce the impact another pandemic or other global issue has on the supply chain and logistics industry. Most importantly, these studies are being used to help organizations devise more proactive approaches when faced with issues on the scale of COVID-19, as well as issues of far lower magnitude.

Although previous examples discussed areas of sustainability as it relates to supply chain perpetuation and prolonged business relevance, there are other areas of sustainability to consider. For example, many manufacturers have used the COVID-19 pandemic as a means for review of their current processes and raw materials to find ways to assist in combatting the pandemic. In fact, some organizations have gone as far as to completely change what they are producing for the good of the world at large.

For example, French perfume manufacturer LVMH, in response to a request by the French government that manufacturers do their part to combat the COVID-19 pandemic, was able to shift from its traditional practice of producing and bottling perfume to that of hand sanitizer production and bottling (Abboud, 2020). They were able to accomplish this because perfume and hand sanitizer production share many of the same ingredients, specifically "purified water, ethanol, and glycerin" (Abboud, 2020). However, having the necessary ingredients was only part of the challenge, as equipment and processes had to be fundamentally altered to achieve the goal. Coupled with the fact that LVMH was able to complete the task in roughly three days, the outcome is nothing less than remarkable. This level of effort is indicative of a desire to focus on the sustainability of human life, not profits, and it exemplified the human spirit at its peak, even in the face of a worldwide pandemic.

Another area of sustainability to consider is that of pharmaceutical manufacturing. Much focus has been on how quickly COVID-19-specific medicines can be brought to market. However, it is also important to remember how many other life-saving drugs must be produced to keep people healthy. As COVID-19 ravaged our world, many geographic regions were put into lockdown statuses, and manufacturing and supply chain activities were placed on hold. The pharmaceutical industry was no exception. Although most medicines are produced via batch processing, the COVID-19 pandemic brought to light the inefficiency in this. Specifically, batch processing, as opposed to continuous manufacturing "leaves the supply chain susceptible to disruptions that can cause shortages of critically important, lifesaving drugs" (Miller et al., 2020, p. 6). As a result, pharmaceutical companies have been asked to determine whether continuous manufacturing should be the preferred approach.

Conclusion

Even in the face of six million deaths and counting, the COVID-19 pandemic has had a positive impact on the world and, in particular, the global state of supply chain and logistics. Although there are still countless material shortages and excessive congestion in ports worldwide, innovation and collaboration has exploded in ways that we could never have imagined just a few short years ago. This innovation was born of the necessity to survive, both at the basic human level as well as in business. Regardless of the reason, it is important to recognize that these advancements benefit society as a whole and push supply chain planning to further heights. Our ability to collaborate, strive for technological innovation, and seek new avenues for sustainability are not new concepts. However, this may be the first time they were used on such a cohesive, global level, with such an altruistic goal in mind: prioritizing human life over profits.

REFERENCES

Abboud, L. (2020, March 19). *Inside the factory: How LVMH met France's call for hand sanitizer in 72 hours.* Financial Times. **https://www.ft.com/content/e9c2bae4-6909-11ea-800d-da70cff6e4d3**

Ang, C. (2020, October 15). *This is how coronavirus compares to the world's smallest particles.* World Economic Forum. **https://www.weforum.org/agenda/2020/10/covid-19-coronavirus-disease-size-comparison-zika-health-air-pollution/**

Barlow, R.D. (2020). Making do with much ado by award-winning supply chain teams. *Healthcare Purchasing News, 44*(2), 14-16, 18. **https://athens.idm.oclc.org/login?url=https://www.proquest.com/trade-journals/making-do-with-much-ado-award-winning-supply/docview/2442315406/se-2?accountid=8411**

Belhadi, A., Kamble, S., Jabbour, C., Gunasekaran, A., Ndubisi, N., Venkatesh, M. (2021). Manufacturing and ser-

vice supply chain resilience to the COVID-19 outbreak: Lessons learned from the automobile and airline industries. *Technological Forecasting and Social Change, 163,* 1-7. **https://doi.org/10.1016/j.techfore.2020.120451**

Conway, K. (2020). Will collaboration become a new standard operating procedure? *Healthcare Purchasing News, 44* (6), 58. **https://athens.idm.oclc.org/login?url=https://www-proquest-com.athens.idm.oclc.org/trade-journals/will-collaboration-become-new-standard-operating/docview/2422005347/se-2?accountid=8411**

Miller, S., Hodgdon, C., & Mattie, A. (2020). Generic drug shortages: A case for continuous manufacturing. *Journal of the International Academy for Case Studies, 26*(3), 1-7. **https://athens.idm.oclc.org/login?url=https://www-proquest-com.athens.idm.oclc.org/scholarly-journals/generic-drug-shortages-case-continuous/docview/2435125256/se-2?accountid=8411**

Modgil, S., Gupta, S., Stekelorum, R., & Laguir, I. (2022). AI technologies and their impact on supply chain resilience during COVID-19. *International Journal of Physical Distribution & Logistics Management, 52*(2), 130-149. **https://doi-org.athens.idm.oclc.org/10.1108/IJPDLM-12-2020-0434**

Raymond, S., Baker, S., Liu, Y., Bustamante, M., Ley, B., Horzewski, M., Camarillo, D., & Cornfield, D. (2022). A low-cost, highly functional, emergency use ventilator for the COVID-19 crisis. *PLoS One, 17*(3), 1-16. **https://dx.doi.org.athens.idm.oclc.org/10.1371/journal.pone.0266173**

Warehouse Innovations

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ABSTRACT

The introduction of brand-new technology into the marketplace has resulted in major improvements to the logistics industry, which, in turn, has facilitated the expansion of online shopping. Kahn et al. (2022) show online purchases have increased by 26.5% since 2017. This study will focus on how third-party logistics providers may adapt their operations to meet the growing demand in the market for shorter delivery lead times and lower order sizes. This includes utilizing various solutions such as technical advancements, improved inventory management systems interfaced with the customer's ERP, and dependable shipment tracking software for monitoring delivery milestones.

Introduction

The expansion of e-commerce is often regarded as one of the primary causes behind the rising need for a greater variety of options and a speedier response time. Because of this emerging pattern, warehouses and distribution centers need to keep up with customers' rising expectations to fulfill their order appropriately regarding timing, quantity, and quality. According to Srinivas and Marathe (2021), digitization entails the creation of new methods that are more efficient and effective in meeting customers' needs along the supply chain. These new methods are intended to provide customers with more value.

Innovations in Warehouse Logistics

According to Ferrari et al. (2021), Amazon's acquisition of Kiva robots sparked a robot arms race, ultimately resulting in Alibaba's purchase of Geek+ robotics. This conclusion is based on the assertion made by Asian Robotics. According to Ferrari et al. (2021), digitization has grown increasingly significant in today's economy across industries.

IT was once used as a back-end system for finance or inventory. It has now extended to cover things like enterprise resource planning (ERP) and customer relationship management (CRM) (Marathe, 2021). Because of this, the two companies have fully embraced robotics and automation to increase efficiency, delight customers, and establish a durable competitive edge in their respective markets.

Point-of-Sale (POS) Systems

In addition, electronic identification technology makes it possible for third-party logistics providers to enhance premium services. An example of a helpful piece of technology that can assist an organization in maintaining its data-using capacity and providing visibility to its warehouse operations is a point-of-sale (POS) system. Examples include images, barcodes, and beacons (Marathe, 2021). Through automated identification, businesses can rapidly determine the identity of an item and its location at any point along the supply chain.

Third-party logistics companies will discover this technology is necessary once they have integrated telematics and the Internet of Things (IoT) into their business models. Because it can be used to keep track of products and boasts features like sort, count, and location data during their whole lifecycle, it significantly impacts logistics and inventory management. This is because it can be used to manage the data. According to Bogue (2021), automating the production process and improving warehouse visibility is necessary.

Internet of Things (IoT)

The Internet of Things (IoT) will enhance corporate applications and supply chain solutions by integrating people, data, processes, and other items through mobile apps and sensors. It can influence on a global scale, and third-party logistics providers can utilize it to get full visibility and speedier problem identification, establishing a network of swift decisions (Bogue, 2021).

Radio-Frequency Identification (RFID) Chips

However, third-party logistics providers must be open to adding many new forms of technology (Ali et al., 2022). This indicates that technology needs to serve as a go-between, assisting the various business divisions in coordinating their efforts to realize their respective objectives. RFID chips, for example, can communicate information such as the current temperature, position, and identification of an object to a cloud-based system, which then makes this information accessible from any location.

Cloud technology is considered the "future of logistics" because it offers value and flexibility while simultaneously providing solutions and services via the internet. The competition level in the modern corporate world makes the quality of the delivery services one provides quite important. The logistics industry can surpass the expectations of manufacturers and shippers to provide consignees with remarkable experiences. This can include branded communications and deliveries, shorter delivery windows, purchaser feedback, tracked delivery, and easier returns (Ali et al., 2022). Consequently, using product delivery orchestration solutions such as cloud computing will make it much less difficult to satisfy these needs and the costs involved.

In addition, the timely, risk-free, and cost-effective transportation of the consignment from its point of origin to its final destination is crucial to the accomplishment of a contract for the provision of export or import services (Bogue, 2021). In addition, the distributor and the manufacturer must be able to communicate physically for the supply chain to function properly.

Electronic Data Interchange (EDI)

Electronic data interchange (EDI) has emerged as an essential component of the logistics business and the supply chain as a whole. To improve their level of engagement with their other business partners, third-party logistics companies can use this helpful service effectively (Bogue, 2021). EDI capabilities of quickening information sharing, lowering the risk of making errors, and lowering associated expenses make efficient sup-

ply chain operations possible.

In the future, information will serve as the primary motivating factor. The same thinking should be applied to storage facilities. In the same way they do for every other company in the world, all of Google's future innovations, digitalization goals, and advanced intelligence projects will revolve around data in some way (Marathe, 2021). Warehouses generate an enormous amount of data, and the end-user applications that can use this data to assist warehouses in learning from and improving their operations are continually emerging and increasing.

Nowadays, many warehouses still face a huge challenge when attempting to use the massive amounts of data they collect as a basis for decision-making. There will certainly be an increase in the number of IoT devices utilized in a warehouse, which will result in creating a new pool of potential data collectors (Marathe, 2021). Because of this, warehouse managers will have an even higher burden as the amount of data that needs to be collected and analyzed continues to expand.

Applications utilizing big data, identifying new dark data sources, and data integration are future advancements that will be implemented in warehouses over the next several years. The vast majority are aimed to improve efficiency and output while streamlining business processes.

After accumulating this data, warehouse managers will better understand the flow of goods and staff within the warehouses, the stock dynamics, the potential for improved stock planning, and more. The long-term objective is to raise operational intelligence to optimize warehouse operations. Because of this discovery, it is now possible to store products with greater turnover rates in warehouses that are physically closer to the end user (Ferrari et al., 2021). By utilizing many geographically dispersed warehouses, it is possible to lessen the severity of the collapse of logistical areas, improve the efficiency of the "last mile" process, and strengthen the supply chain.

Unmanned Aerial Vehicles (UAVs)

The use of driverless trucks and drones should also be encouraged among third-party logistics firms. Since its debut at the turn of the twentieth century, unmanned aerial vehicles (UAVs) have significantly changed the transportation sector worldwide. Using autonomous automobiles could improve the efficiency of handling material at production facilities, distribution hubs, storage facilities, and cross-docking hubs.

According to Ferrari et al. (2021), there has been a surge in the need for industrial space to locate products close to customers to attract them. This is done to maintain a competitive advantage. However, UAVs have the potential to be used to help relieve this issue by assisting in scheduling, dispatching, and routing. This would ensure that transportation requirements, such as a shorter route, an earlier departure time, and a higher route capacity, are satisfied.

Even though they have not yet won over most of the public, it is anticipated that autonomous vehicles will become widespread. Consequently, logistics businesses ought to be ready to put them into effect. Additionally, it has been forecasted that UAVs, also knows as drones, will become widespread in the operations of warehouses and supply chains within the next decade.

According to Bogue (2021), they have numerous potential applications in the logistics business. Some of these applications include package delivery, reading barcodes, navigating warehouses, and minimizing the need for additional instruments such as forklifts. One such example is Amazon's Prime Air Drone, an UAV produced by the corporation and utilized to make deliveries for the company.

3D Printing Technologies

According to Bogue (2021), it is anticipated that during the next few years, 3D printing will radically revolutionize the logistics business and help streamline the supply chain. Printing on the go in the warehouse is one example of how this technology may enhance efficiency, save costs, and enable extreme personalization. As a result of the development of 3D printing, the logistics industry is on the cusp of experiencing profound disruption. In the future, logisticians will increasingly function as manufacturers, developing components within warehouses to provide greater client service. In addition, this phenomenon will assist in lessening logistics' negative effects on the environment by enhancing the supply chain's resistance to disruptions.

Conclusion

In conclusion, new requirements have been imposed on third-party logistics providers due to the continuous emphasis placed on satisfying the market's requirements and enhancing customer satisfaction. As a result, third-party logistics companies should embrace cutting-edge technical approaches to improve the e-commerce delivery experience rather than relying on old-fashioned rules for what constitutes a suitable delivery window and the kind of services that should be provided.

In addition to all of these developments for the near future, other technologies will impact the logistics industry and help tackle some of the challenges that the industry will face in the coming years (Ali et al., 2022). These technologies include autonomous vehicles, blockchain, drones, and others. However, in ten years, we should start to see the first practical results from a number of these technological advancements. Indeed, the lists above illustrate many of the significant advances that will play a role in determine how warehouse operations develop in the coming year.

REFERENCES

Ali, S.S., Kaur, R., & Khan, S. (2022). Evaluating sustainability initiatives in warehouse for measuring sustainability performance: An emerging economy perspective. *Annals of Operations Research,* 1-40.

Bogue, R. (2022). Warehouse robot market boosted by covid pandemic and technological innovations. *The Industrial Robot, 49*(2), 181-186. **doi:https://doi.org/10.1108/IR-11-2021-0270**

Ferrari, A., Zenezini, G., Carlin, A., & Rafele, C. (2021). *An integrated simulation modelling approach for a warehouse 4.0.* Research Gate. **DOI:10.21203/rs.3.rs-317679/v1**

Kahn, M.G., Mui, J.Y., Ames, M.J., Yamsani, A.K., Pozdeyev, N., Rafaels, N., & Brooks, I.M. (2022). Migrating a research data warehouse to a public cloud: Challenges and opportunities. *Journal of the American Medical Informatics Association, 29*(4), 592-600.

Srinivas, S.S., & Marathe, R.R. (2021). Moving towards "mobile warehouse": Last-mile logistics during COVID-19 and beyond. *Transportation Research Interdisciplinary Perspectives, 10,* 100339.

Blockchain Supply Innovation

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ABSTRACT

The pandemic has changed many aspects of the supply chain perspective. When faced with a problem never before anticipated in our modern era, supply chain innovations became necessary to take back resilience and control. Blockchain is one such example of an innovation to pandemic-related supply chain issues. Blockchain was used during the "worst" of the pandemic (2020-2021), but has long-term expectations to continue due to its successes. Many sectors utilize Blockchain due to the easy access to and flow of data and ability to streamline processes.

Introduction

Supply chains are an integral part of the world economy. A great deal of analysis, planning, preparation, and cost goes into a product from initial design to landing on the retailer's shelf. As such, it is important for supply chains to operate in such a way to mitigate market and product disruptions. Unfortunately, the recent coronavirus pandemic has illustrated that even the most meticulous plans are still subject to unforeseen circumstances. A pandemic was not a scenario that was expected to occur in the modern era. This caused a great deal of problems in supply chains on a global level, but also led to innovation. While some supply chains were unable to recover, other supply chains were able to become more resilient and proactive during the difficulties faced by the onslaught and aftermath of the pandemic due to supply chain innovations like Blockchain.

Blockchain Defined

There are many ways to describe Blockchain. This technology has been referred to as "next-gen" (Banerjee, 2020), "emerging" (Hawser, 2021), "trending" (Madhani, 2021), "new age" (Bhandari, 2021), "traceable" (Major Crises and Supply Chain Disruption, 2021), and "cutting-edge" (Papadaki et al., 2021). In short, it can be summarized as the digitization of an entire supply chain. This has numerous benefits to the supply chain as a whole.

The digitization of supply chains functions to increase visibility, improve data management and quality, process efficiency, and enhance security features. This has been accomplished through technologies such as Blockchain, which has become an increasingly popular business option for companies in response to the Coronavirus pandemic, as well as in this "post-pandemic" modern time. This allows supply chains to "adapt to challenges in real-time," (Madhani, 2021), which was made all too relevant during the unprecedented supply chain and logistical disruptions of the pandemic.

A real-time ability to access accurate data can be incredibly important in different aspects of a supply chain. For instance, a supplier that has a parts shortage that resulted in hundreds of backorders can accurately and efficiently track assets as they arrive and release them quickly to the backordered requisitions. One of the biggest advantages of Blockchain is that it fosters an atmosphere of proactiveness rather than reactiveness to supply chain problems.

There is no longer a need for a go-between person in the supply chain, since the data is decentralized and accessible to applicable stakeholders. Data is updated in real-time and is accessible 24/7. Madhani (2021) further details this point by explaining that Blockchain "streamlines deficiencies of inter- and intra-organizational business processes by making them immutable, decentralized, secure, transparent, and operational-efficient," which is of great benefit to all members of the supply chain. This has positive ramifications regarding overall security, visibility, and responsiveness. More specifically, improved demand forecasting, inventory management, and product traceability are some of the very real impacts of utilizing Blockchain (Madhani, 2021). This is accomplished similarly to how postal services track step-by-step updates and digital check-ins of a package at every step of the journey, and then provide that information to the customer. Inventory management is streamlined, decentralized, and clearly visible (each asset movement is digitally tracked).

Blockchain during Coronavirus Pandemic

Every business engages in some form of cost/risk assessment, typically on at least an annual basis. Unfortunately, a global pandemic was not something that anyone anticipated occurring in the modern era. The coronavirus pandemic was the catalyst for severe market disruptions beginning in 2020 (in the U.S.). Major retailers had numerous aisles of empty shelves; sanitizer and other cleaning products first had an incredible shortage and then experienced a great surplus; the number of employees allowed or able to work dramatically changed; and some companies went out of business. Pre-covid supply chain processes and expectations were no longer applicable or accurate. Changes had to be made in order for the supply chain to survive.

Blockchain is a global supply chain innovation technology. From the apps on smartphones, to the widely-known Microsoft, to even lesser known companies such as DBS Bank, headquartered in Singapore, who used Blockchain "to solve transparency of ownership and traceability for the burgeoning digital-asset economy," (Hawser, 2021), it is evident that Blockchain can be beneficial to a myriad of supply chains spanning across the sectors.

A prime example, Microsoft won "Process of Technology Innovation of the Year" through its successful use of Blockchain in response to the pandemic. Their use of Blockchain "reduced cycle time and improved end-to-end, item-level traceability. The technology has uncovered $50 million in hidden costs and expanded margins by digitizing items in a shared data structure," (Gartner Tech Innovation Award for Blockchain Capabili-

ties in supply Chain, 2021). Not only did this technology cause Microsoft to be resilient and proactive, it also identified cost savings. The pandemic introduced many new costs and restrictions in supply chains; any opportunity for cost savings was advantageous.

Another innovation during the pandemic was the tandem usage of Blockchain with Geographic Information Systems (GIS)-equipped smartphone applications. These were formulated to track an individual's proximity to Covid-positive individuals (Papadaki et al., 2021). The idea was that people could be informed via their phone of increased Covid contamination risk close to them. On a more generalized level, other companies globally "have started to use Blockchain to develop applications that can help fight COVID-19. The goal of these apps is to resolve a critical issue, which is the lack of checked required data convergence," (Rajendran et al., 2022, p. 76).

Post-Pandemic

The success of Blockchain during the coronavirus pandemic illustrated the multifaceted advantages of this technology on both a long-term and global scale. There are numerous ideas on even more innovative uses of Blockchain, such as when used in tandem with other technology like artificial intelligence (AI), satellite imagery, and Radio Frequency Identification (RFID). Not only are there ideas for improving Blockchain capability through combined technology, there are ideas on how Blockchain can improve preexisting industries.

Papadaki et al. (2021) states that "the increased demand for COVID-19 tests as a prevention measure to avoid contamination leads to the increasing need for a new decentralized global health-care system." Blockchain does decentralize data, which would allow easier and quicker access for patients, appointments, specialists, and more. Further, it is secure (encrypted) and time-stamped. Papadaki et al. (2021) also went on to discuss the importance of this in situations such as vaccination certificates. In light of the forged paper copies of the COVID vaccination certificates, it could become a valid requirement in the future.

Beyond revolutionizing the healthcare system, there are high hopes that Blockchain can "address the third world's corruption problem in international trade due to its transparency," (Madhani, 2021). There is no room in Blockchain for counterfeiting or stealing at any level of the supply chain; everything is decentralized, encrypted, utilizes digital signatures, updates in real-time, and is time-stamped. Reducing corruption in supply chains could absolutely be advantageous to the goal of reducing corruption in international trade as a whole.

A less-discussed opportunity to utilize Blockchain is within the food industry; it could be "used to trace the origin and production process of food ingredients," (Madhani, 2021). This would be of great benefit in regards to tracking trace-contaminants of food allergens (like nuts and fish), as well as for dietary restrictions (kosher, keto, vegan, vegetarian, etc.). This would also likely have positive repercussions regarding situations where food products are recalled. Decentralized and real-time data could realistically lead to early identification and dissemination.

Sectors Utilizing Block Chain

Many supply chains are utilizing Blockchain: food (such as agri-food and companies including Chipotle Mexican Grill), pharmaceutical products, diamonds, technology, healthcare, banking/finance, etc. Blockchain is able to be universally applied to various supply chains and adaptable to their specific needs or constraints. Blockchain was initially utilized regarding "cryptocurrencies and financial-oriented applications" (Madhani, 2021), but it is evident that it has far outgrown its original intent.

With concrete and positive results, it is fast becoming the innovation of the modern era, particularly when results show that Blockchain "can significantly improve industries margin...by reducing waste almost by 50%" (Sengupta et al., 2021). It seems that there is no sector barred from enjoying the benefits that Blockchain has to offer.

Conclusion

Supply chains are absolutely an integral part of the world economy. When faced with supply chain disruptions, such as the one caused by the unforeseen pandemic, it is important that supply chains are adaptable and proactive. The utilization of Blockchain, doubtless, has been advantageous to numerous sectors during this time. Cost savings have been identified, supply chains have become decentralized, data is updated in real-time, all stakeholders have 24/7 access to data, waste has been reduced, and so much more. Supply chain uncertainty is reduced through Blockchain, as seen through the many different companies utilizing this innovative technology. It is evident that Blockchain is adaptable depending on the specific needs, and can even be used in tandem with other technologies. Overall, it is evident that Blockchain has been a positive innovation used both during and after the pandemic.

REFERENCES

Banerjee, A. (2020, November 3). *The post-covid manager.* Business World. **https://www.businessworld.in/article/The-Post-Covid-Manager/03-11-2020-338872/**

Bhandari, K. (2021, May 13). *The pharmaceutical sector bats for research and innovation.* Business World. **https://www.businessworld.in/article/The-Pharmaceutical-Sector-Bats-For-Research-And-Innovation/13-05-2021-389537/**

Gartner Tech Innovation Award for Blockchain Capabilities in Supply Chain. (2021, March 18). Dataquest. **https://www.dqindia.com/gartner-tech-innovation-award-blockchain-capabilities-supply-chain/**

Hawser, A. (2021). Digitalizing supply chains. *Global Finance, 35*(6), 26-26.

Madhani, P.M. (2021). Supply chain transformation with blockchain deployment: Enhancing efficiency and effectiveness. *IUP Journal of Supply Chain Management, 18*(4), 7-32.

Major crises and supply chain disruption. (2021). *Strategic Direction, 37*(4), 36-38. **https://doi-org.athens.idm.oclc.org/10.1108/SD-01-2021-0008**

Papadaki, M., Karamitsos, I., & Themistocleous, M. (2021). Viewpoint covid-19 digital test certificates and blockchain. *Journal of Enterprise Information Management, 34*(4), 993-1003. **https://doi-org.athens.idm.oclc.org/10.1108/JEIM-07-2021-554**

Rajendran, R., Piali, B., Chandrakala, P., Gampala, V., & Majji, S. (2022). Role of digital technologies to combat covid-19 pandemic. *World Journal of Engineering, 19*(1), 72-79. **https://doi-org.athens.idm.oclc.org/10.1108/WJE-01-2021-0043**

Sengupta, T., Narayanamurthy, G., Moser, R., Pereira, V., & Bhattacharjee, D. (2021). Disruptive technologies for achieving supply chain resilience in covid-19 era: An implementation case study of satellite imagery and blockchain technologies in fish supply chain. *Information Systems Frontiers: A Journal of Research and Innovation,* 1-17. **https://doi-org.athens.idm.oclc.org/10.1007/s10796-021-10228-3**

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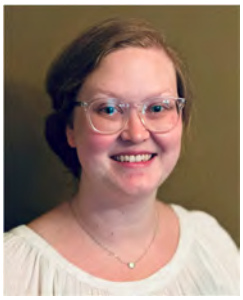

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