**Global Supply Chain Transformation: Achieving 3Rs with the "GREAT" Strategy**

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**Executive Summary**

Unexpected crises in both demand and supply have caused unprecedented transformation in global supply chain management. To combat the risk of demand volatility, changes in consumer behavior, demand and supply disruptions, and more, leaders need the 3Rs: responsiveness, before the crisis; resilience, during; and restoration, after. We have scrutinized real cases to devise strategies that will help global companies achieve the 3Rs, transform their supply chains, and survive future crises. We have placed these measures in five domains which comprise the GREAT strategy: Government policies and measures, Redesigning global supply chains, Economic and financing strategies, Adjusting operations, and Technology.

**Introductory Note**

Pandemics, hurricanes, earthquakes, fires, and other unexpected disruptions cause crises which can damage global supply chain operations. Xiaoyan Xu, Suresh P. Sethi, Sai-Ho Chung, and Tsan-Ming Choi propose the GREAT strategy to help leaders weather these crises by transforming the global supply chain to achieve the 3Rs: responsiveness, resilience, and restoration

In recent decades, globalization has promoted the rapid development of global supply chain management. However, the rapid spread of COVID-19 disrupted our sense of prosperity. Supply chain managers now face transforming a massive system in response to enormous risks on both the demand and supply sides. The demand side risks include demand disruptions, uncertainty, and alterations in consumer behavior, which shocked financial markets during and even after the pandemic. The primary concerns on supply side include supply disruptions, resource allocation, and transportation, particularly having to do with inadequate preparation and government measures, such as lockdowns. Other unexpected disasters, including the Suez Canal obstruction in 2021 and Hurricane Ian in 2022, raise similar risks.

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Responsiveness, resilience, and restoration, which we term the 3Rs, are essential for global supply chain managers facing the challenges that arise before, during, and after the crisis.[[1]](#endnote-2) Once they have identified the current stage of a given crisis, managers should focus on the corresponding R:

* **Responsiveness (R1):** Before a crisis, higher responsiveness - the ability to adjust time, effort, cost, or performance - will help the company to react to unexpected risks when the crisis strikes. One of the greatest dangers is a sudden disruption of either demand or supply. Such disruptions may have causes as varied as medical lockdowns and massive strikes. Before they occur, leaders should work to increase the flexibility and foresight of their global supply chains.
* **Resilience (R2):** During the crisis, supply chains need resilience, the ability to survive, adapt and grow in the face of risks. Companies with resilient supply chains are better able to cope with the turbulence of changes in consumer behavior, demand volatility, supply disruptions, and more. The ability to resist and recover from damage can help companies to survive the crisis and even compete.
* **Restoration (R3):** After the crisis, supply chains managers should focus on restoration, the ability to adapt and reconfigure in accordance with new conditions. Companies capable of restoring their supply chains will be able to quickly reposition themselves for long-term development. Even now that most leaders agree that the COVID-19 pandemic has ended, all the risks have not disappeared.[[2]](#endnote-3) Indeed, the impact of the crisis will be long-lasting, and in some cases permanent, especially with regard to consumer behavior. Leaders who want their companies to be economically sustainable in the long term should prioritize adapting to the new normal in the post-crisis stage.

So, how can leaders achieve the 3Rs? The details of real crises hold the answers. Our scrutiny of how big global enterprises responded to the COVID-19 crisis revealed some common strategies for success.

Let us begin with the demand side. Consumers feared getting infected while visiting physical stores. They reduced their demand on physical stores and so caused significant losses. Retailers like Apple, Louis Vuitton, Toyota, and Nike responded by temporarily or permanently closing their physical stores, reducing their operating costs to compensate. They also encouraged consumers to buy online and even moved to help society by producing much-needed medical supplies. Moreover, by making operations more efficient and improving customer service, leaders can make their supply chains more resilient (R2). For instance, McDonald's and Walmart have adopted artificial intelligence (AI) and blockchain to facilitate supply chain efficiency and transparency.

Company leaders in a range of industries also made successful decisions in response to the effects of the crisis on the supply side. When they faced supply disruptions, the leaders of Apple, Nike, and Walmart diversified their suppliers. The leaders of Coca-Cola, on the other hand, launched a local sourcing strategy to simplify its supply chain. In so doing, Coca-Cola mades the supply chain more resilient (R2) during the crisis, ensuring that supply kept pace with the demand. Some companies have endured through effective collaboration with governments or local and national health authorities. The additional support can help them restore their supply chains and prepare for long-term development after the crisis (R3). To help leaders achieve the 3Rs and survive the next crisis, we have devised a set of transformative supply chain strategies, covering five critical domains: Government policies and measures, Redesigning supply chains, Economic and financing strategies, Adjusting operations, and Technology. Together, they comprise the GREAT strategy.

**Government Policies and Measures**

In unsettled times, governments should enact policies and measures to ensure the smooth operations of the global supply chain. During the pandemic, the first of these measures was voluntary quarantine and community screening. Canada, mainland China, Hong Kong, and Japan have long used these tools which ameliorated the spread of the virus and helped the supply chain recover from capacity bottlenecks. Countries should also collaborate to fight against crises, pooling their efforts to achieve an all-win situation. Their efforts should range from global research and development to agreements about allocation of resources. The United Nations' Sustainable Development Goals state that global cooperation is an essential precondition for sustainable development.[[3]](#endnote-4) During the pandemic, this goal was especially pressing. In 2020, during the early stages of COVID-19, eleven United Nations (UN) agencies and two global non-governmental organizations (NGOs) agreed to procure personal protective equipment (PPE) jointly, ensuring their people sustainable access to necessary supplies. Scientific bodies also collaborated to develop vaccines, with the leaders of four of Europe's largest economies vowing to develop a COVID-19 vaccine on European soil. Different countries and agencies should also collaborate when they face other disasters, including floods, hurricanes, and earthquakes. NGOs, like the Red Cross, Doctors Without Borders, and Human Rights Watch can also contribute.

During the pandemic, well-designed subsidy programs were also crucial to supply chain operations. Subsidies make products more affordable for consumers and improve the productivity of manufacturers, balancing supply with demand and increasing social welfare.[[4]](#endnote-5) Subsidies help companies to maintain resilient supply chains during a crisis and to restore them afterward (R2, R3). It’s no surprise, then, that governments worldwide adopted this strategy during the outbreak of COVID-19. Japan's Ministry of Economy, Trade, and Industry, for example, provided generous support to mask manufacturers and some individual businesses. The US government’s American Rescue Plan allocated $1.9 trillion to help its citizens maintain not just their health, but their homes and livelihoods during COVID-19. And when it comes to restoring the global supply chain (R3), policies that maintain fairness and equity are essential. Although these policies do not directly improve profitability, they do ensure that companies have an equal opportunity to recover from disruptions, which also supports the welfare of their employees and customers.

**Redesigning Global Supply Chains**

Our supply chains, as they stand today, are not equipped to combat global risks. We urgently need to redesign these systems before the next crisis. In doing so, supply chain managers should focus on increasing their flexibility to make them responsive and resilient (R1, R2). The first step is to remodel production lines so that they help firms to quickly adapt to extreme market volatility, avoiding disruptions. The plant charter strategy advises firms to integrate their supply chains vertically and devise consolidation plans for each product line. Coca-Cola adopted this measure during the pandemic, with great success. In response to a spike in consumers staying at home, the company’s leaders shifted the priority of its production lines from fountain products to bottles, cans, and multipacks. They alsopostponed the planned assembly of a new modular marketing system, focusing instead on increasing supply chain flexibility. Toyota used its just-in-time (JIT) manufacturing process to keep its supply chain flexible. The JIT strategy prevented Toyotafrom being harmed by the massive demand uncertainty of the pandemic by allowing company leaders to adjust the production schedule in accordance with the conditions of the moment. Leaders throughout the manufacturing industry should strongly consider adopting this strategy, so their firms can quickly adapt to changing conditions.

By creating contingency plans in advance and devising a range of logistics options, leaders can vastly improve the resilience of their supply chains (R2). The heavy equipment manufacturer Caterpillar has used alternative sources and air freight in its global supply chain, making its shipping modes extremely flexible. Toyota’s leaders, likewise, have built a network logistics model that allows them to use small lots and frequent deliveries, significantly improving the company’s efficiency.

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Reshoring and nearshoring, the strategies through which companies bring manufacturing closer to their markest, are also well worth considering. Before COVID-19, most global enterprises prefered to put their manufacturing wherever it would be cheapest. But the uncontrollable politics and regulations of the pandemic made offshore production unprecedentedly risky, giving company leaders ample motivation to move their production closer to home. In the process, they made their supply chains more responsive and resilient (R1, R2) and thus better prepared to cope with the next crisis. In the US today, more companies than at any time in recent decades are planning to increase the local suppliers and sources of essential materials. Western European managers tend to consider Eastern European countries for nearshoring their manufacturing because they combine low costs with proximity. US companies favor Mexico for the same reasons.[[5]](#endnote-6) But not all companies can afford the high cost of reshoring or nearshoring. For them, supply diversification can be the best choice. Over the past decade, supply bases that were once centralized in China have expanded to India, Vietnam, Indonesia, and Bangladesh, countries which also have low labor costs.[[6]](#endnote-7) Manufacturers of trendy or essential products, such as semiconductors, medicines, and chemicals, do particularly well with this strategy, which protects them from disruptions arising from a single country or region.

Improving efficiency is also an essential step in redesigning a supply chain. Managers can take several steps to form strategic alliances and coordinate the supply chain. By designing long-term contracts carefully, perhaps offering option or cost-sharing contracts, they can eliminate delays in production and increase profitability, helping the supply chain to work at optimum efficiency, even during a crisis. Large retailers, including Walmart and JD.com, have benefited from such contractual collaborations. By signing long-term contacts with thousands of suppliers, their leaders have established strategic, coordinating alliances that help them to survive crises. A good coordinator is vital to supply chain efficiency. Each participant in the global supply chain strives to maximize their own benefits, so a neutral third party may be best suited to help build cooperation. During the COVID-19 pandemic, the US Federal Emergency Management Agency (FEMA) supervised the distribution of more than 8,100 ventilators, which indicates that government bodies and industrial organizations are in a strong position to support and coordinate the supply chains of different industries, especially during severe threats of disruptions.

**Economic and Financing Strategies**

Financial circumstances will always be a determining factor in the development and survival of businesses. Confronted with the global financial crises that unexpected disasters can cause, company leaders should design a financing strategy specifically to combat the risks. The most direct and effective way to relieve economic stress and increase a company's resilience (R2) is through stategic use of credit. In 2020, as COVID-19 was accellerating, Toyota tapped a ¥1.25 trillion line of credit. Yet using credit can be risky. The pandemic, for example, created a highly unstable political and regulatory environment. Leaders should estimate their long-term profitability before making credit decisions. Reducing expenditure is just as important as increasing income. Many firms responded to the drastically changing financial situation during the pandemic by reshaping their cost structure. Cost and resource flexibility allowed them to recover more rapidly from abnormal trading conditions. Nonetheless, it is possible to overdo it. During the peak of the pandemic, many companies tried to conserve cash by refusing to pay their suppliers, accepting prebuilt products, or unilaterally extending payment terms. In late October 2020, the German apparel brand Colloseum deferred its payment for completed orders. Likewise, the Amsterdam-based retailer Hema canceled all its orders from Asian suppliers in January 2021.[[7]](#endnote-8) These actions inevitably cause hardship for the suppliers and damage their workers' incomes. The 2013 collapse of the Dhaka garment factory in Bangladesh, one of the worst industrial accidents in history, is a notorious example of the hazards of blind cost-saving. Thousands died or were badly injured. And many of the workers who survived were subsequently laid off or sent home without even the pay that was owed to them, leaving families in miserable conditions. Therefore, it is essential that governments help to prevent such tragedies, both through regulation and by granting subsidies to small and medium enterprises (SMEs) and to workers during difficult times. Finally, if the company has a budget surplus, a well-planned future project can help to restore (R3) the supply chain. Toyota, for example, has invested long-term development funds in smart cities and self-driving technology. In the post-pademic age, looking to the future is the key to long-term success.

**Adjusting Operations**

During and after the pandemic, businesses, and particularly consumer retailers, face an unsettled market and radical changes in consumer behavior. In order to restore (R3) their supply chains, many leaders had to adjust their operations to adapt to the new normal. Because consumers feared infection, brick and mortar stores felt a severe shock. In Hong Kong, a quarter of physical stores had closed by the end of 2020. Fashion retailers Inditex and H&M closed hundreds of stores worldwide. To reduce the impact of such a loss, company leaders should devise channel strategies that allow them to smoothly shift their focus from offline to online sales, perhaps compensating for closed stores by encouraging online purchases and offering digital promotions. Making such transitions smoothly can reduce operation costs while finding new long-term sales opportunities. And when exceptionally high setup costs prevent companies from closing stores, as is the case with the flagship stores of luxury brands, leaders can take innovative measures to combine offline services with online shopping, for example offering WhatsApp shopping. These methods will allow them to still get the utmost out of their physical stores.

Managers should also be alert to new demand generated by the crisis itself. Realizing the enormous demand for PPE and medical supplies during the pandemic, many manufacturing firms shifted some part of their production to those products. The companies took social responsibility, a focal point of restoration (R3), while expanding into a new market. To do so, they had to innovate rapidly, repurposing their existing resources. L'Oréal manufactured hand sanitizer, while Dyson repurposed knowledge, resources, and technology to build ventilators. Coca-Cola, Louis Vuitton, and Nike also adopted this strategy. Besides, many firms formed industry clusters, sharing common markets to their mutual benefit. Leaders who adopt this measure can build competitive and responsive supply chains (R1) to weather the crisis. In 2020, the European Cluster Collaboration Platform (ECCP) launched the COVID-19 Industrial Clusters Response Portal, which helped participants to interact quickly and directly, accessing helpful information and making their firms more competitive.

Technology is essential to transforming global supply chains so they can combat crises.

**Adopting Technology**

These days, nobody is likely to deny the extraordinary contributions that information technology is making to supply chain management. It will be no surprise, then, that adopting technology is essential to transforming global supply chains so they can combat crises. Five tools are particularly helpful. Big data analytics has been widely adopted for short term forecasting and real-time analysis. Supply chain managers have long struggled with the bullwhip effect caused by demand uncertainty, a problem which is exacerbated by crises. The accurate demand forecasts offered by big data analytics can help. Walmart got through the pandemic in large part by relying on its responsive supply chain (R1), which used big data analytics to estimate the demand for products as diverse as hand sanitizers and fresh meat. This technology also performed sophisticated analyses for global healthcare operations, solving complex vaccine development and allocation problems.

Intelligent information systems (IIS), or business analytics, are another powerful tool, and one with roots that go back to the early 1950s. After decades of development, the integration of data analytics in IIS provides more precise information, supporting better, faster decisions. Its accurate recommendations for resource allocation and transit strategies allow managers to build resilience and restoration (R2, R3) into their supply chains. Executives should also consider when and how the efficiency and economy of 3D printing can help their companies through a crisis. The US Food and Drug Administration encouraged manufacturers to 3D print PPEs during the pandemic. Now, self-replicating 3D printers can increase production capacity or stimulate future demand, supporting both resilience and restoration (R2, R3).[[8]](#endnote-9)

Executives can also consider the use of blockchain systems to transform global supply chains. In 2020, the World Trade Organization reported that the international trading value of blockchain was set to exceed three trillion dollars by 2030. Blockchain provides transparent and incorruptable transaction data, which is critical to the procurement process. The United Kingdom and South Korea used blockchain to authenticate and distribute COVID-19 vaccinations, and to track vaccinated people. In retail, Walmart uses blockchain, with the support of IBM, to trace food sales and supply, addressing consumer concerns about food safety and sustainability. During the pandemic, many companies also used AI to build self-service stations, as they can streamline transactions while reducing interpersonal contact. McDonald's, for example, used AI to automate the drive-thru ordering systems of ten stores in Chicago making shopping more convenient and comfortable for customers both during and after the pandemic.



**Figure 1.** Global supply chain transformation with the GREAT strategy2.

There will always be another crisis, whether it is COVID-19 2.0 or some other disruption. But the lessons we have learned from the pandemic will never be outdated. By using the 3Rs to transform global supply chains, we can make sure we’re ready for future disruptions. And opportunity, as the saying goes, favors the prepared. The firms that survive the next crisis will be those that prepare their supply chains now!

**Author Bios[[9]](#endnote-10)**

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**Endnotes**

1. Xiaoyan Xu et al.,“Reforming Global Supply Chain Management under Pandemics: The GREAT-3Rs Framework,” *Production and Operations Management* 32 (2023): 524-546, DOI: 10.1111/poms.13885. [↑](#endnote-ref-2)
2. Bernd Debusmann Jr., “[Covid-19 Pandemic Is Over in the U.S. - Joe Biden](https://www.bbc.com/news/world-us-canada-62959089),” BBC, September 19, 2022. [↑](#endnote-ref-3)
3. Goal 17: Partnerships. [↑](#endnote-ref-4)
4. Xiaoyan Xu et al., “Government Subsidies and Policies for Mask Production under COVID-19: Is It Wise To Control Less?” *IEEE Transactions on Engineering Management* 77, (2022): 3172-3188, DOI: 10.1109/TEM.2022.3198101. [↑](#endnote-ref-5)
5. Morris A. Cohen et al., “OM Forum—Benchmarking Global Production Sourcing Decisions: Where and Why Firms Offshore and Reshore,” *Manufacturing & Service Operations Management*, 20, no. 3 (2018): 389-402. [↑](#endnote-ref-6)
6. Morris A. Cohen et al., “Designing the Right Global Supply Chain Network,” *Manufacturing & Service Operations Management*, 22, no. 1 (2020): 15-24. [↑](#endnote-ref-7)
7. [Official website of Worker Rights Consortium (WRC)](https://www.workersrights.org/updates-and-analysis/) [↑](#endnote-ref-8)
8. Bin Hu, “Managing Self-Replicating Innovative Goods,” *Management Science* 68, no. 1 (2022): 399-419. [↑](#endnote-ref-9)
9. We sincerely thank the editor and reviewer for the helpful and constructive comments. [↑](#endnote-ref-10)