Supply Chain Outlook: Counteracting the Bullwhip Effect

By G. Ravishankar

Although COVID restrictions are easing, disruptions to the global supply chain continue to hurt the economy. Between rising inflation, port congestion, supply shortages and labor issues, it will likely be several years before the supply chain corrects itself. In 2022 and beyond, distributors must carefully reexamine their policies to avoid overstocking and profit loss.

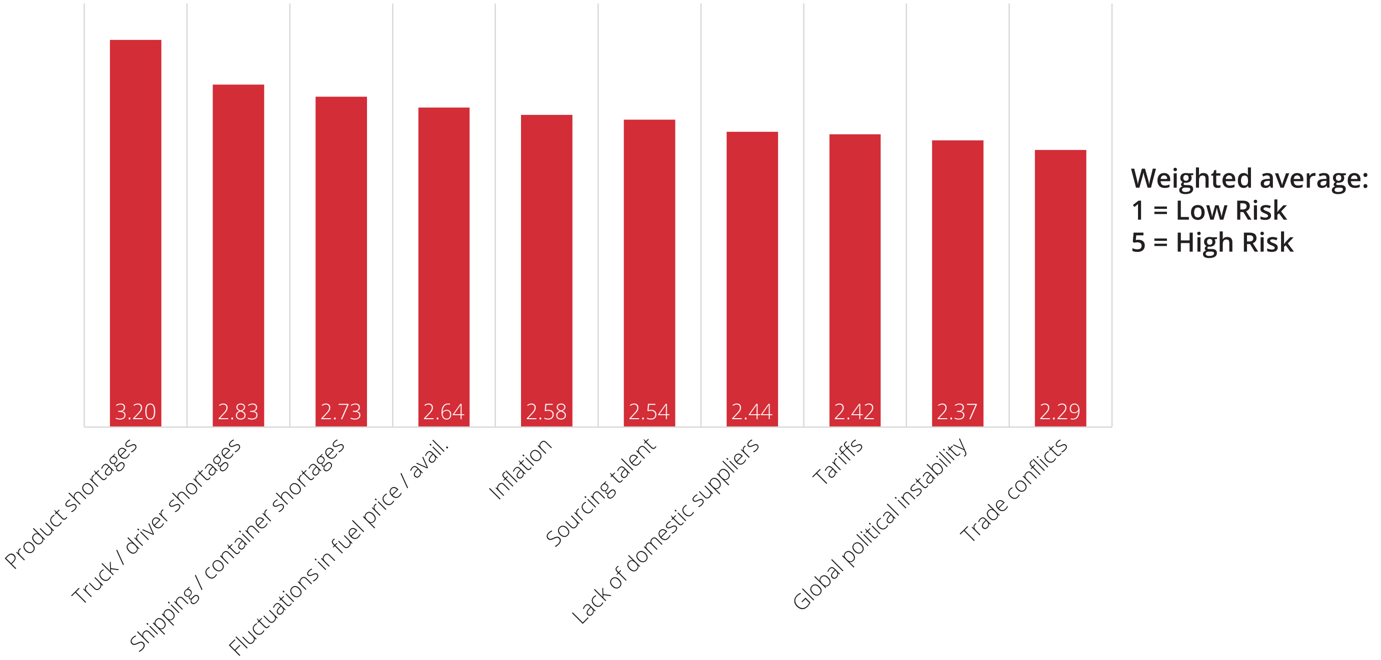
This whitepaper will examine recent Distribution Strategy Group research and provide expert analysis to identify what distributors should be paying attention to moving forward and how to counteract the "bullwhip" effect.

What is Driving Supply Chain Disruption?

Several factors continue to fuel supply chain disruption in the U.S. and abroad. Globally, the primary drivers of disruption include:

Labor Shortages: A combination of tough working conditions and low pay has resulted in labor shortages in manufacturing, transportation and distribution. Many companies, such as Amazon, have

Chart 1: Factors rated by how much risk they pose to distributors' ability to source products effectively.



raised wages and are offering more comprehensive benefits to combat this. Unfortunately, several key industry positions require specialized training, which can take months or years to complete.

Rising Costs of Materials: The costs of raw materials continue to increase. Shortages in basic materials like steel and aluminum along with rising cost of production has affected manufacturing across several sectors and has contributed to inflation.

Shipping Challenges: Shipping constraints are likely to continue into the coming year. Chinese companies dominate the market for containers, and ongoing regional conflicts are exacerbating the transportation challenges.

Chassis/Truck Shortages: The shortage in parts primarily sourced from China continues to hamper the production of chassis and trucks, further driving up the prices of both.

Port Burden: While the ports have recently made strides in reducing the backlog of containers piling up, they are still months away from returning to normal. Looming in the near future are labor contract negotiations for dock workers. Given the rising wages in every other sector of the economy, is reasonable to expect that there will be an upward revision of wages. That will affect supply chain costs.

COVID Lockdowns: Although COVID-related lockdowns are easing in the U.S., lockdowns in the manufacturing and shipping hubs of Shanghai and Guangzhou are likely to create a second ripple of supply chain issues in the coming months.

In 2021, the U.S. imported $3 trillion in foreign goods. Distribution Strategy Group survey respondents reported that roughly 40% of their products were sourced from China, a significant increase from prior-year averages. Most said their reliance on Asian imports arose from their customers caring more about price than a product's country of origin.

To future-proof your business and combat supply chain-related losses, we recommend focusing on three things:

- Resilience and Agility
- Visibility
- Risk Management

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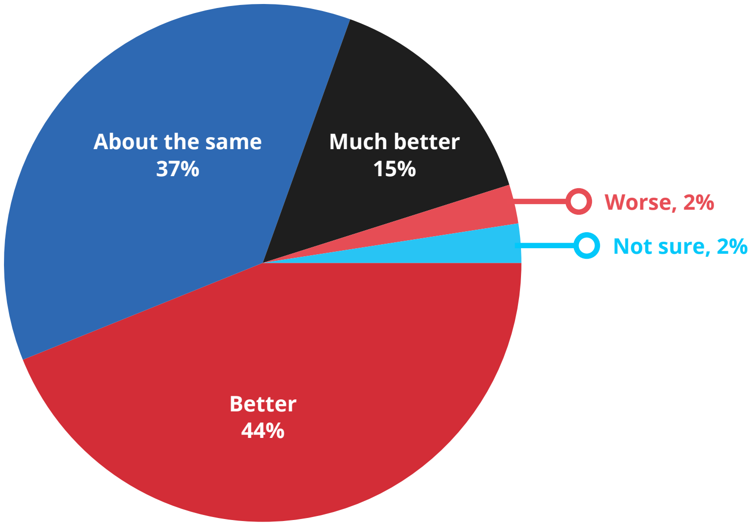
Chart 2: How well distributors believe they have managed supply chain issues compared with their competitors



Resilience and Agility

Resilience is the capacity to recover quickly from difficulties, and agility is the ability to move swiftly. Modern distributors must have both attributes to successfully navigate the supply chain's turbulent waters. Unfortunately, this is easier said than done.

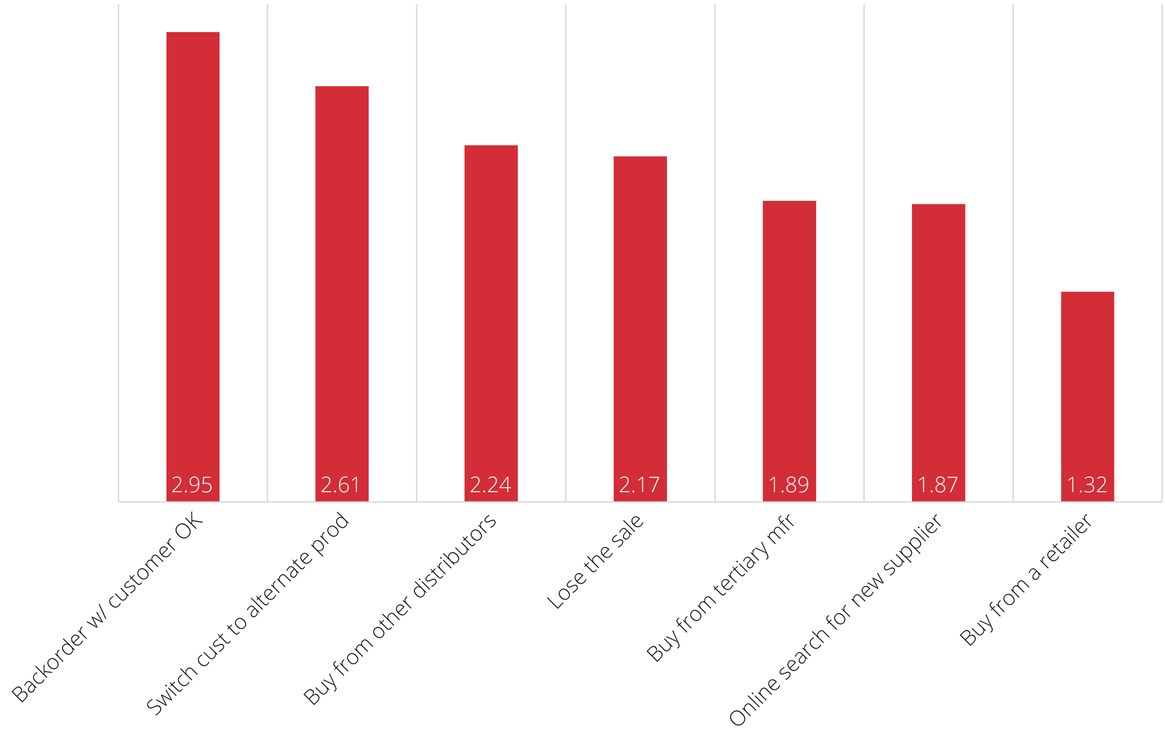
There are two aspects to being resilient and agile in distribution.

1. How many intermediaries are there between the source of the product and your end customer?
2. How easy is it to substitute out-of-stock items?

The greater the number of intermediaries in the supply chain, the farther you are from the source and hence, the more unpredictable availability and delivery dates become. A disruption that affects any of the companies within the supply chain quickly gets amplified.

Some products can be easily substituted, while others cannot. For instance, items that have specific dimensions that cannot be replicated with another product, even if it is similar. The harder it is to find an equivalent product that meets the customers' needs, the riskier the supply chain becomes. Proactively developing a substitution strategy makes a company more agile in the event of a supply disruption.

Chart 3: When customers try to order products that are not in stock, how frequently do each of these happen?



Weighted average:
1 = Low Risk
5 = High Risk

A geographic concentration of production creates greater risk because an issue affecting one supplier has a higher likelihood of affecting others. A distributed source of supply naturally creates resiliency because the probability of the same issues affecting geographically disparate locations is lower. Pandemics are clearly the exception to this. But as recovery rates vary across the world, a distributed source of supply still increases resiliency.

Distributors' fulfillment challenges fall into two categories: product substitution and the availability of product. When a product cannot be substituted, nor can it be sourced, the only option may be to put the item on backorder. Recognizing the length of their supply chain and understanding how many intermediaries they are working with allows distributors to create backup plans. Working with suppliers from multiple areas may make distributors more resilient and agile when disruption hits.

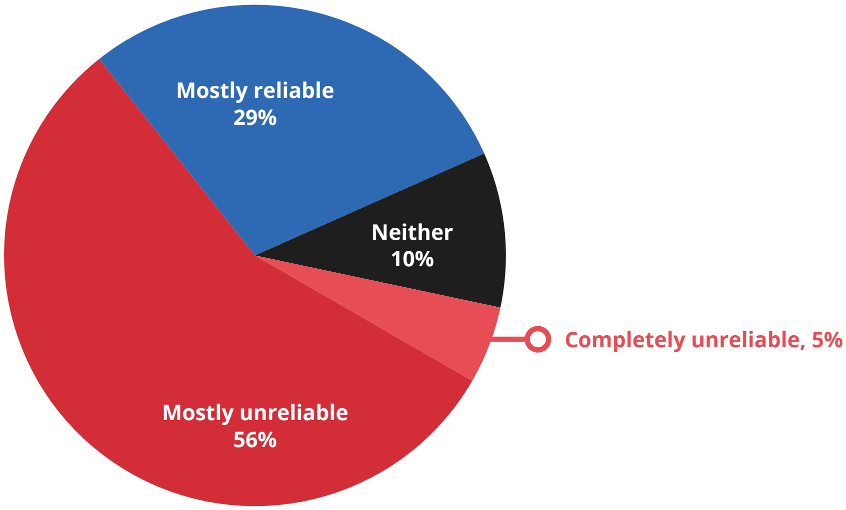
Visibility

One of the major challenges companies face is a lack of visibility. The only thing worse than having a product shortage is not knowing when you will receive your next shipment. In retail, companies have gone to extraordinary lengths to provide visibility to consumers about the physical location of their orders. However, in the industrial world, distributors rarely have this level of insight.

Our research found that while most distributors are taking steps to build resiliency and agility, they are still struggling with visibility. When we asked distributors to tell us how consistent manufacturer delivery dates were, they reported that dates were largely unreliable.

A lack of visibility and varying delivery dates often force distributors to offer substitutions to customers, place products on backorder or buy from other distributors. Unfortunately, as we mentioned above, industrial product substitution isn't easy. Because product designs often have specific dimensions or tolerance requirements, a lack of availability can cause production to halt. In a worst-case scenario, the distributor may lose the sale if a substitution is unavailable.

Chart 4: How reliable are delivery dates from manufacturers, even though orders are delayed?



Visibility can be a competitive advantage. Customers are more likely to buy from a supplier whose accuracy with delivery dates is higher. Delivery consistency is as important if not more important than fulfillment of an order quantity during periods of shortage, because production schedules can be aligned to the quantity available, if they know when it will be available.

Risk Management

It is simple enough to detect a problem, especially when it is staring you in the face. However, determining how big that problem is and understanding when another issue may arise is essential to mitigating risk.

A byproduct of product shortages and surging demand is the bullwhip effect. Shortages lead to exaggerated demand, which leads to irregular order patterns. This change can result in inaccurate demand forecasts and panic as distributors order more inventory than needed to increase their safety stock.

Unfortunately, this cycle can be detrimental to businesses. As supply catches up to the backlog in orders, cancellations increase, and prices decline, resulting in distributors having excessive inventory.

Emotion-Driven Ordering Practices Lead to Excessive Inventory

One of the first things to consider when determining whether you are at risk of the bullwhip effect is order variation. What is the actual variation in orders you are receiving versus the orders you are placing? When the variation in orders placed to suppliers is larger, the risk of experiencing the bullwhip effect increases. As supply, demand and price oscillations become more prevalent, you may start to experience financial whiplash.

For example, consider a customer who needs 10,000 pounds of pellets. Because of the shortage in the market, the customer may decide to place an order with three different distributors. The customer will pay the first one to deliver their pellets but cancel their order with the other two distributors. After all, they only need 10,000 pellets.

In a rush to provide the customer with what they need, each distributor will place an order for 10,000 pellets with the manufacturer. The net effect of this behavior is that the demand experienced at the manufacturer is higher than the actual customer demand. Unfortunately, unlike end customers, distributors typically cannot cancel orders from their suppliers. Without the ability to cancel orders, the distributors will be stuck with the order that was placed if they are unable to sell it. With this sudden influx of products, the distributors would either have to find a place to store them or cut prices to clear their inventory.

Determining Your Risk of the Bullwhip Effect
A relatively straightforward way of determining whether you run the risk of experiencing the bullwhip effect is by measuring the coefficient of supply and demand variation.

In other words, comparing the variations between customer order patterns and orders placed with your supplier will indicate your risk.

Coefficient of variation

Coeff of variation = $\frac{\text{Standard deviation of orders}}{\text{Average order size}}$

Analyzing customer orders

Average customer order size = 637

Standard deviation of customer orders = 218

Coefficient of variation of demand = 218/637 = **0.342**

Analyzing supplier orders

Distributor 1

Average order size = 209

Standard deviation of orders = 365

Coeff of variation of supply = 365/209 = **1.75**

Distributor 2

Average order size = 175

Standard deviation of orders = 311

Coeff of variation of supply = 311/175 = **1.78**

Distributor 3

Average order size = 238

Standard deviation of orders = 377

Coeff of variation of supply = 377/238 = **1.58**

An amplification factor greater than zero indicates a risk of experiencing the bullwhip effect. Conversely, a factor less than zero indicates that your risk is lower, and you are less likely to experience this phenomenon.

Amplification factor for bullwhip

$$\textbf{Amplification Factor} = \frac{\text{Coeff of variation of supply - Coeff of variation of demand}}{\text{Coefficient of variation of supply}}$$

Amplification Factor A > 0 indicates risk of bullwhip effect

Amplification Factor A < 0 dampening of demand variation

$$\text{Distributor 1} = \frac{1.75 - 0.342}{1.75} = 0.8 \qquad \text{Distributor 3} = \frac{1.58 - 0.342}{1.58} = 0.78$$

Working Capital Risk Ratio

When shortages occur, distributors often have an instinctive desire to hold more safety stock than usual to compensate for the lack of inventory. Therefore, the higher the perceived demand, the greater the safety stock. However, it is crucial to realize that your safety stock rises disproportionately with the desired service level. For example, increasing from a 97% service level to a 99% service level would result in nearly 24% higher safety stock.

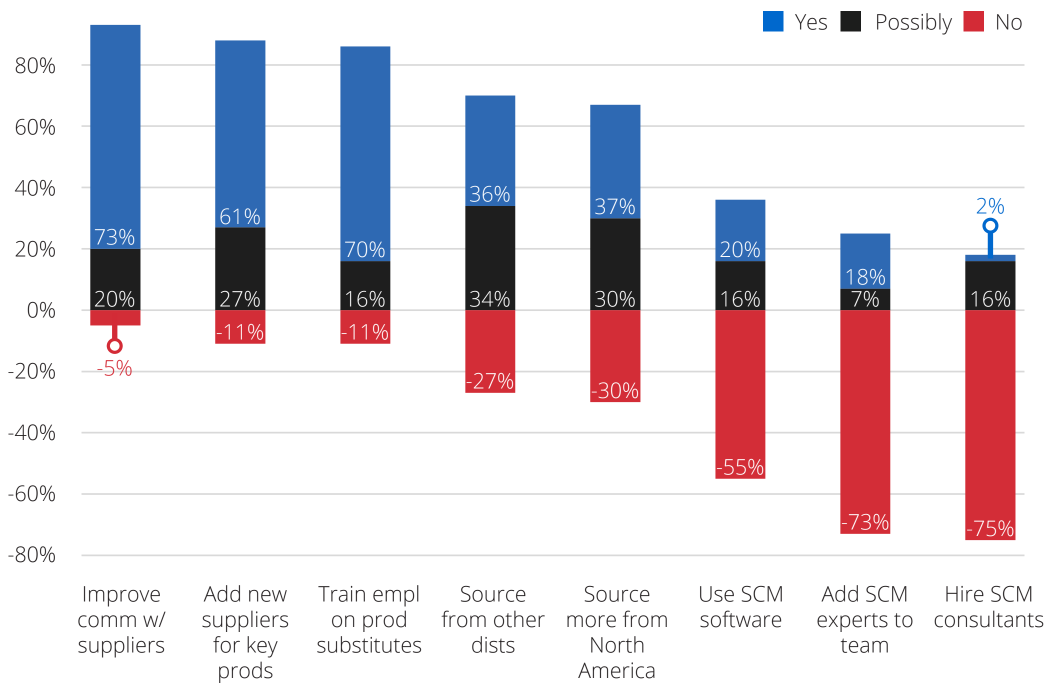
A lack of visibility into pipeline inventory, with an ever-increasing backlog, can result in becoming overextended. Your working capital risk ratio can provide insight into whether your organization is being overextended. When your working capital risk ratio falls below one, your risk rises.

Working capital risk ratio

$$\frac{\text{\$ value of outstanding backorders X probability of not being cancelled}}{\text{\$ value of outstanding purchase orders to suppliers}}$$

= **>1 = okay**
<1 = higher risk of problems

Chart 5: Steps distributors are taking to improve supply chain agility and/or resilience



What Should Distributors Do?

As constraints on the supply chain ease, there will be a flood of backordered products appearing at docks. When supply suddenly catches up with demand, prices will likely drop.

Now is the time to:

- Reexamine your ordering policies to determine whether you are ordering too much stock from your suppliers.
- Utilize the above formulas to determine your chance of experiencing the bullwhip effect. Calculate your working capital risk ratio.
- When you understand where your business falls, take steps to readjust your ordering and fulfillment practices.

Longer term:

- Investments in getting greater visibility into the supply chain
- Product classification to develop agility
- Supply base diversification to increase resilience

DISTRIBUTION STRATEGY GROUP

About Distribution Strategy Group

Distribution Strategy Group's thought leadership, research and consulting services are led by a team with decades of experience as senior operators in the distribution industry. They have since worked with more than 70 distribution companies to build a solid foundation to win in today's changing market.

Distribution Strategy Group offers strategic guidance for distributors in the face of disruption, including:

- Digital and ecommerce strategy
- Customer lifecycle management strategy
- Customer analytics
- Sales channel strategy

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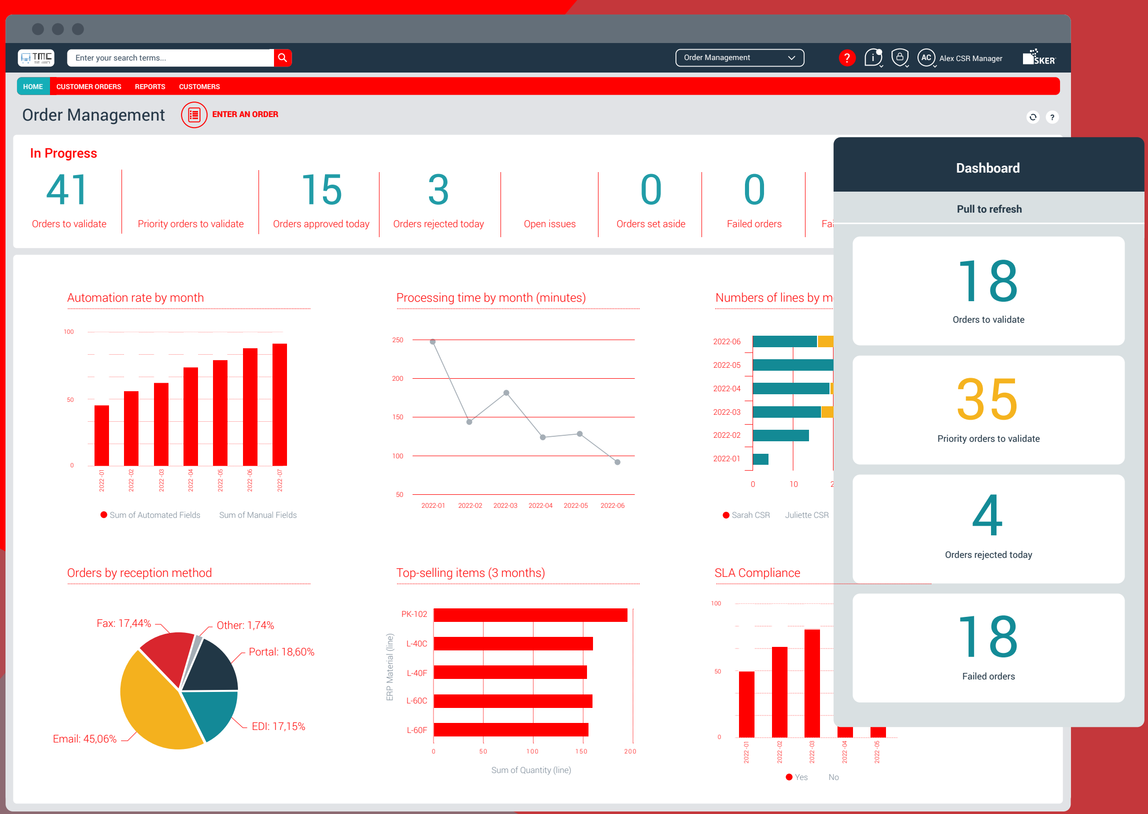

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