Lehigh Business Supply Chain Risk Management Index

Quarterly Report

1st Quarter / 2024

LEHIGH UNIVERSITY | College of Business

CENTER FOR SUPPLY CHAIN RESEARCH AT LEHIGH

CSCMP Council of Supply Chain Management Professionals

Educating and Connecting the World's Supply Chain Professionals.™

LEHIGH BUSINESS SUPPLY CHAIN RISK MANAGEMENT INDEX

Welcome to the **Lehigh Business Supply Chain Risk Management Index Report** developed by the Center for Supply Chain Research at Lehigh University and the Council of Supply Chain Management Professionals.

We launched this index in August of 2020 to better understand the different kinds of supply chain risks businesses face. **Supply chain professionals rated the likelihood that the risk in the 1st Quarter of 2024 compared to the risk in the 4th Quarter of 2023 would likely increase, remain the same or decrease for 10 different Supply Chain categories.**

The Lehigh Business Supply Chain Risk Management Index (LRMI) value is a number between 0 – 100, where greater than 50 suggests increased risk, equal to 50 suggests the same risk and less than 50 suggests decreased risk. **The average LRMI for the 1st Quarter is 64.61 which is a decrease from the 4th quarter, suggesting a lower level of risk in the 1st Quarter 2024.**

The table below reflects the 10 categories of risk from highest risk to lowest risk when evaluated independently as perceived by supply chain professionals.

If you would like to have additional information about the survey or to participate in the survey, please contact Dr. Zach G. Zacharia at zacharia@lehigh.edu.

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Executive Summary

Cybersecurity is again the highest risk overall at 78.34, with a slight increase from last quarter - suggesting cyber-attacks, data corruption, data theft, system viruses, and security platform controls are becoming more severe risks. Customer risk has jumped up to second, suggesting it is getting harder to predict customer demand and customer loyalty. Economic risk, even though 3rd highest risk overall, has gone down and is now the lowest it has been in the past 3 years, suggesting there is less worry about increasing energy costs and labor shortages. Government intervention risk is 4th overall, has also gone down, and is also the lowest it has been in the past 3 years, suggesting less worry about new regulations and government restrictions. Technological risk has become a top 5 risk for the first time, and this is the highest value for technological risk in the past 3 years, suggesting there is a concern about disruptive and replacement technology going forward. The average risk index has decreased slightly to 64.61 compared to last quarter which is still low compared to the average risk historically.

Risk Type	4th Quarter 2023 Risk Index	1st Quarter 2024 Risk Index	Trend
Cybersecurity and Data Risk	75.34	78.21	↑
Customer Risk	67.12	71.79	↑
Economic Risk	71.92	68.83	↓
Government Intervention Risk	71.92	65.58	↓
Technological or Competitive Risk	62.33	65.38	↑
Environmental Risk	61.64	64.94	↑
Supplier Risk	65.75	60.90	↓
Transportation Disruption Risk	63.51	59.62	↓
Operational Risk	54.69	58.33	↑
Quality Risk	56.76	52.56	↓
Average Risk Index	65.10	64.61	↓

The Risk Index is a number between 0 – 100.
The further the number is from 50 the greater the level of risk.
The arrow indicates whether the risk is increasing or decreasing in comparison to the previous quarter.

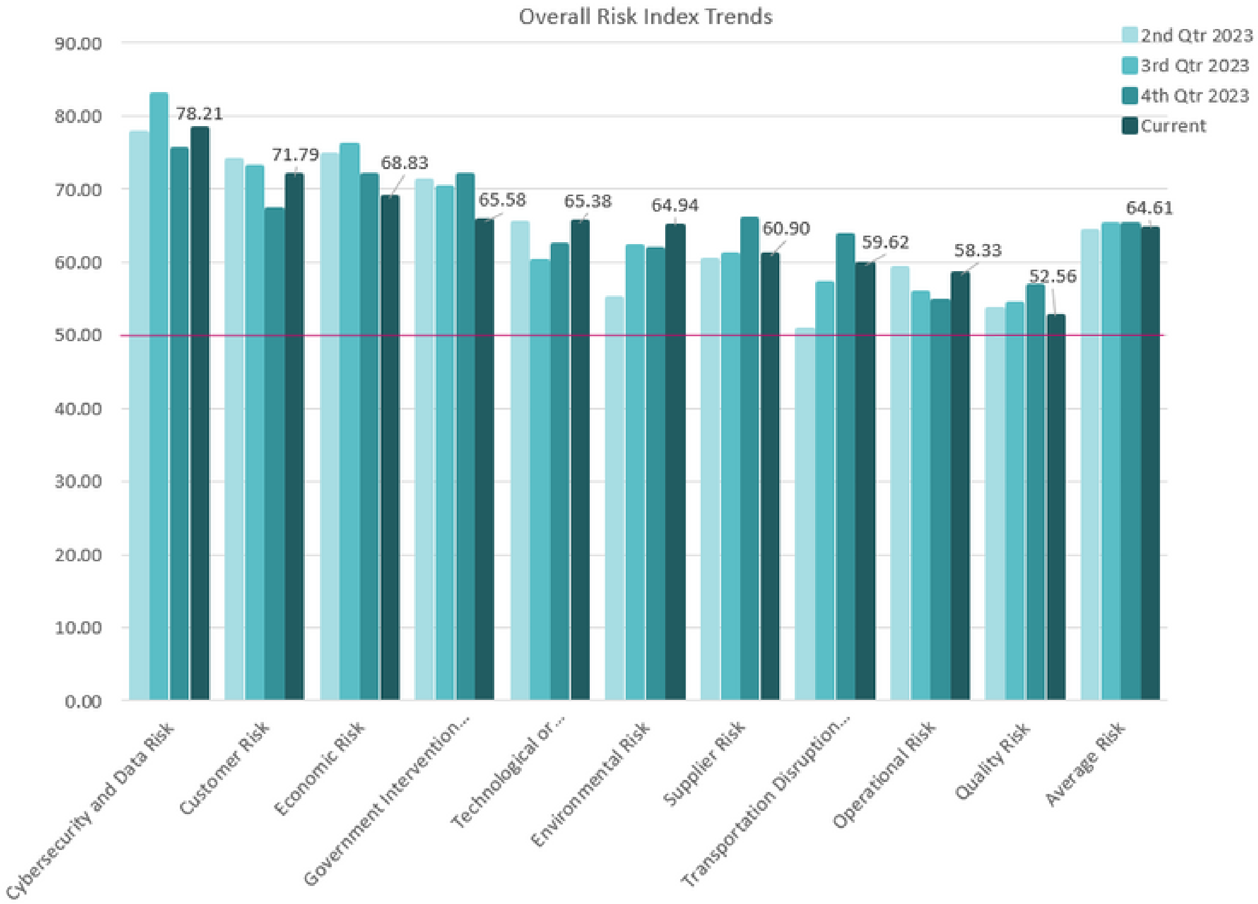
Did You Know?

The Lehigh Business Supply Chain Management Risk Index for the 1st Quarter in 2024 is

64.61

LRMI Risk Index Over the Last Year

One of the advantages of examining supply chain risk is to consider how these risks change over time. The table below shows the changing levels of risk across the 10 different areas of the supply chain this last year. It is also insightful to see that some areas of the supply chain are consistently seen as high risk and other areas of the supply chain are seen as lower risk over the same 1-year time period.



Four Biggest Risks in Head-to-Head Comparison 1st Quarter 2024

(Respondents are asked to compare across all 10 risks simultaneously, instead of rating one risk at a time.)

1. Economic Risk
2. Cybersecurity and Data Risk
3. Customer Risk
4. Government Intervention Risk

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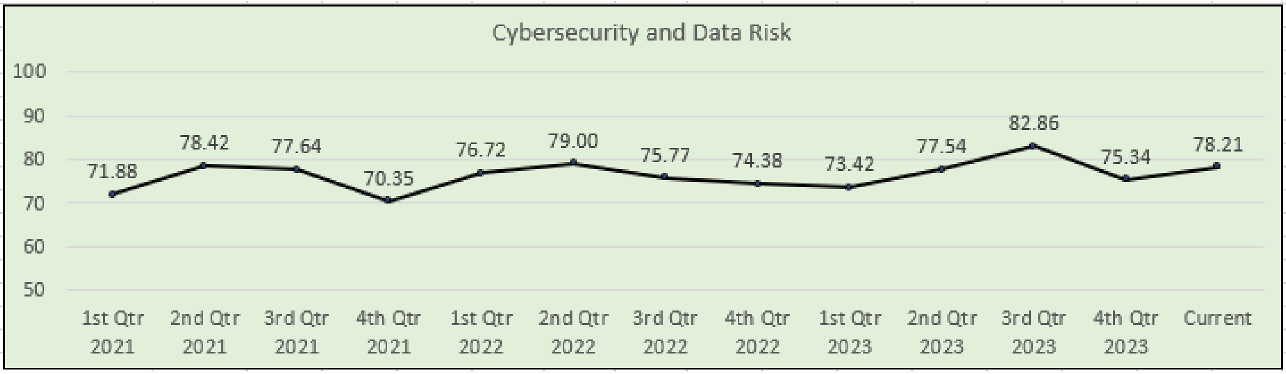
01 Cybersecurity and Data Risk

Some examples are: cyberattacks, data corruption, data theft, system viruses, hardware and software issues and security platform controls.

Selected Comments:

- "Diligence" is our watchword.
- Hackers continue to become increasingly more creative.
- New hacking and phishing methods keep challenging us.
- Too many new cyberattacks are being created.
- Global uncertainty increases this risk substantially (e.g., nearshoring away from China, Middle East unrest, war in Ukraine).
- Risk increases, especially as new software comes online.
- Cyberattacks continue to be a major risk.
- Trend line of this risk is increasing.
- While not in my wheelhouse, this is a growing concern.
- There is an increased focus on transportation companies by cybercriminals. The recent Estes Express Lines cyber incident is proof of this.
- Slight increase in risk is likely due to more cybersecurity risks and identity theft, with technology/AI advances making this easier for criminals.
- This risk has been on the rise, and we expect more risk in this area than in others. The need to address the growth and sophistication of cyberattacks, combined with data theft and corruption, is critical.

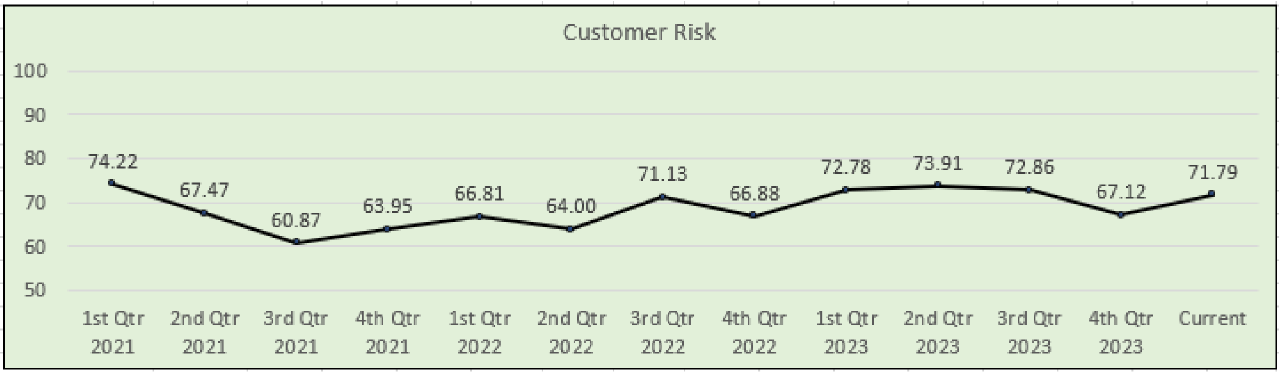


02 Customer Risk

Some examples are: fast changing customer demand, easy to lose customer loyalty, changing customer base demographics, hard to predict customer behavior and hard to service customers.

Selected Comments:

- As we gain more customers, the risk to keep them all satisfied increases.
- All of the listed risks are going to go up as the inventory imbalance post-holiday season, and markdowns, are realized.
- More trucking capacity leads to lower rates on the market.
- As pricing drops in trucking and available capacity continues to be a non-issue, it commoditizes the value and services that we provide as a freight broker.
- This risk will be greater in the near term than in recent memory for many supply chains.
- Increase in suppliers predicting relatively flat growth in 2024 driving additional and often unrealistic price sensitivity and expectations.
- Still emerging from COVID, our customer models may prove to be invalid.
- Due to an acquisition, we may not retain the customer base from that purchase, and service disruption to the existing customer base may cause issues.
- Not anticipating short-term demand fluctuations.
- Impacted by political decisions leading to uncertainty and an increase of taxes.
- The impact of both the consumer segment and ongoing industrial economic weakness leads to more risk.
- Overall macroeconomic factors and opaque demand are increasing risk.
- As inflation increases, it forces customers to seek lower cost alternatives.
- Businesses, overall, have serviced customers poorly. Although some technology, such as speech technology, has made some inroads, most automated designs are designed without the customer in mind. Therefore, there is growing customer dissatisfaction. We do not see it getting better anytime soon.

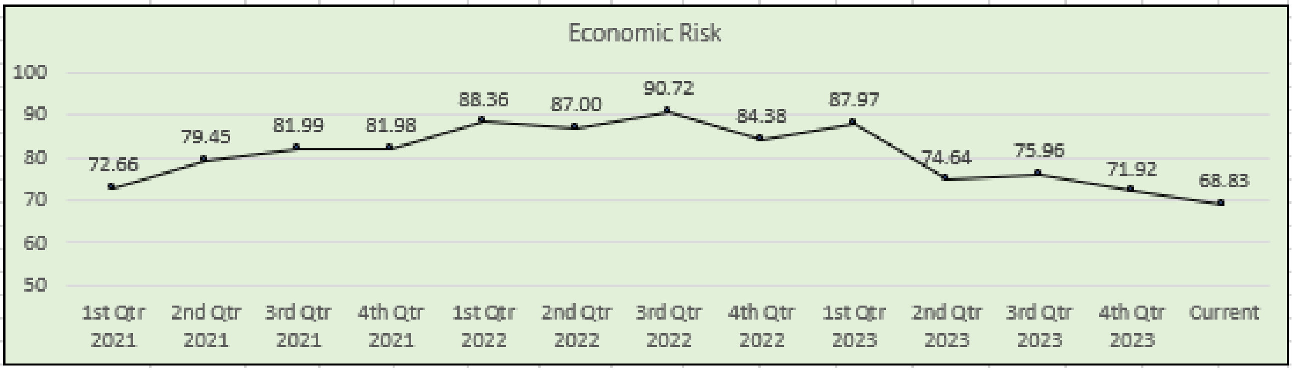


03 Economic Risk

Some examples are: increasing energy costs, commodity price volatility, labor shortages, sudden demand shocks, global energy shortages and border delays.

Selected Comments:

- Increased risk based on labor shortages, as well as higher gasoline and diesel prices.
- Interest costs are taking their toll. Looks like a soft landing.
- Mild recession and entering an election year could have an effect on buying behavior.
- Too many global volatilities in countries today.
- Prices are improving, labor remains an issue, cost of capital is driving issues.
- As a mortgage REIT, the interest rate hiking cycle and related market volatility has put substantial pressure on us as a fixed income investment firm. The market currently believes that cycle is over, which should be beneficial to our outlook.
- Inflation is being tamed and, while still a ways off, we get closer to a rate reduction.
- We are continually challenged to bring in required technical support for our floor operations. As we continue to grow, we are concerned about support staffing availability.
- Labor shortages and fuel cost have always been issues that most of the companies, especially manufacturing, face. I personally do not see any solution on the horizon, and I predict, from the political and economic data, that it could worsen in Q1 24.
- Increased union activity will lead to increased risk.
- Slight risk increase as winter approaches and energy supply tightens.
- There are yet to be viable energy substitutions for fossil fuels. More electric vehicles will stress our electrical grids beyond capacity and will end up burning more fossil fuel to provide the infrastructure and electricity required. Our energy programs require an overhaul to address the most realistic (effective/efficient) energy sources and uses that help preserve the environment and provide energy to our economy and population.

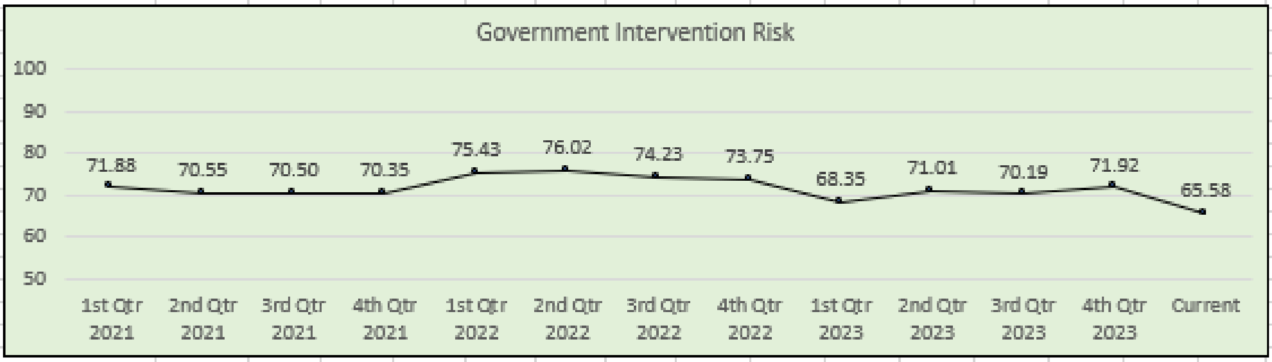


04 Government Intervention Risk

Some examples are: new regulations, tariffs/trade wars and governmental restrictions on source material, methodologies or technologies.

Selected Comments:

- We anticipate more cross-border controls, which will increase risk.
- We are seeing a more charged global landscape.
- With an election year in 2024, the government may accelerate controversial initiatives for fear there could be a change from democratic to republican control.
- FMCSA has been too lax on issuing MC/DOT #'s without proper due diligence, causing a drastic increase on illegal double brokering. FMCSA also has not enforced one single penalty for double brokering despite a law in place and over 100K known cases. Rate transparency for freight brokers is also an issue and it should not be in effect. Besides being an antiquated law that was written prior to deregulation of the trucking industry in the early 1980's, it will force brokers to share proprietary data, some of which we are contractually prohibited from sharing by shipper contracts.
- Election year will likely increase government risk.
- Sustainability is a great thing. Piecemeal, unrealistic state-level laws are not.
- We are in a global war and governments are unstable.
- Our industry, plastics, is under heightened scrutiny.
- Hard to predict...Israel-Hamas war is an example.
- This is a key risk, to be addressed and monitored.
- Russian steel sanctions are a large issue in that we must contact and affirm with suppliers that they are not sourcing from Russian mills. The addition to compliance agencies for Environment and Social Governance (ESG) and Forever Chemicals (PFAS) are slowing the supply chain while shifting our focus to these programs.
- Many governments focusing on a shift toward more national independence means more tariffs and less friendly global trade policies.

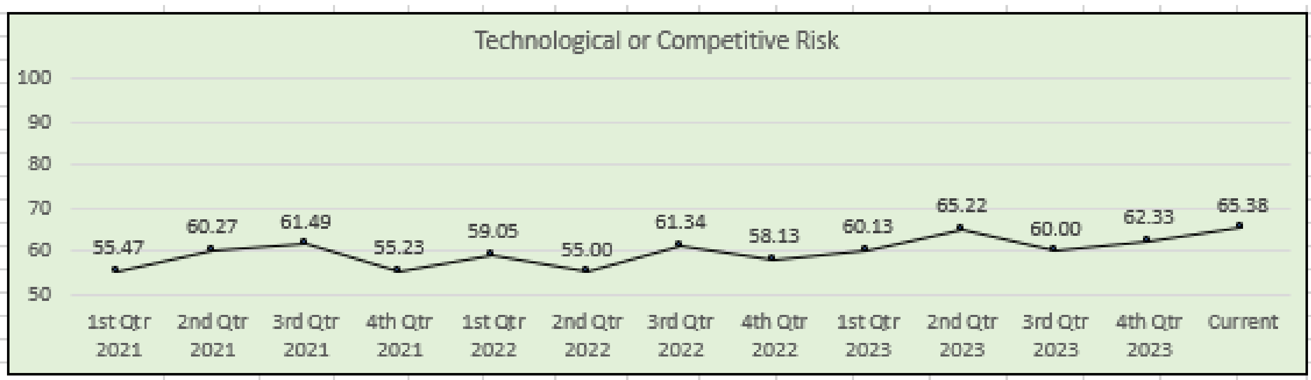


05 Technological or Competitive Risk

Some examples are: disruptive or replacement technologies, introduction of new competitor firms and ineffective or non-existent regulation for competitors.

Selected Comments:

- Buying will be driven by need.
- Technological resources, visibility and connectivity are becoming the norm in the trucking industry. Adapt or get left behind.
- Supply chain is catching up to other verticals quickly. This intent to make quick change to support AI/ML enhancements will increase the risk of disruption.
- Decrease in the cost of automation, increase in the amount of automation, and in the ease of access to new automation, will lead to increased risk.
- There is a lot of excess capacity in the marketplace. Competitors are getting desperate and offering very low prices in an attempt to increase market share.
- Limited budget and organizations' readiness limit deployment of new technology.
- Implemented several projects in 2023 to improve technology.
- Chinese alternatives to certain Wallbox products are threatening the market for big box retail (e.g., Home Depot, Lowe's, Amazon). They offer a similar, but worse performing, product for a fraction of the cost.
- AI is quickly accelerating the pace of technological advancement.
- More and more options are out there. It can be difficult to make longer-term decisions on technology, especially to believe which companies/options will be flexible/able to address future needs.

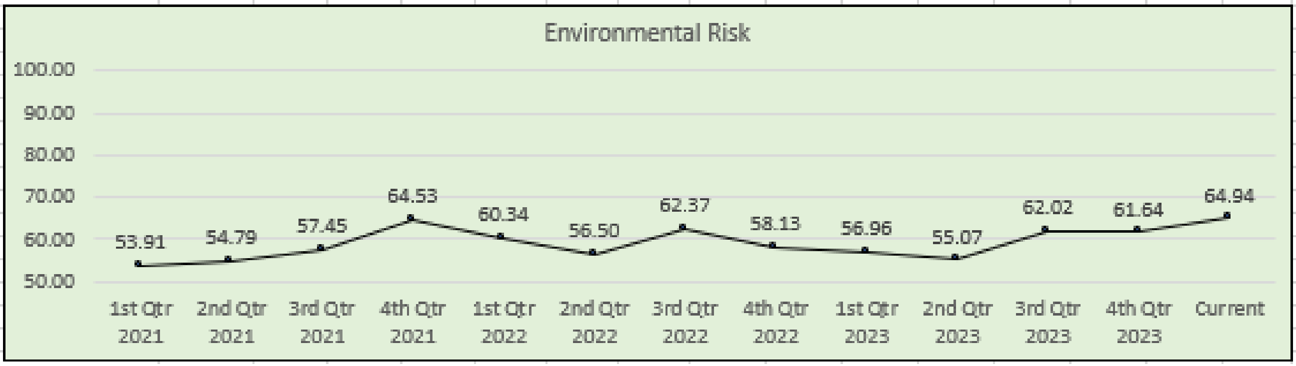


06 Environmental Risk

Some examples are: natural disasters, extreme weather, industrial accidents and pandemics.

Selected Comments:

- Severe drought and high heat conditions in 2024 will lead to shortages of crops and fresh goods.
- With an election year in 2024, the government may accelerate controversial initiatives for fear there could be a change from democratic to republican control.
- Unpredictable environmental risk.
- Natural disasters and weather disasters seem to increase every year.
- Uncertain effects of climate changes globally.
- Anyone/company who thinks global warming is an issue, or any other popular press narratives, instead of focusing on real problems, deserves to go out of business.
- We have made a sizable investment to mitigate environmental risks to key assets.
- This risk continually increases as climate change/warming and more extreme weather breaks records.
- This risk will likely increase. We forget that across the USA, and across much of the world, there are many more people, towns, cities and infrastructure that were not around 50, let alone 20 years ago. This condition alone will continue to increase damage and destruction even if natural occurrences remain at a steady state year over year! This has a big impact across the entire world economy, impacting supply chains and much more.
- Worse weather generally around the country.

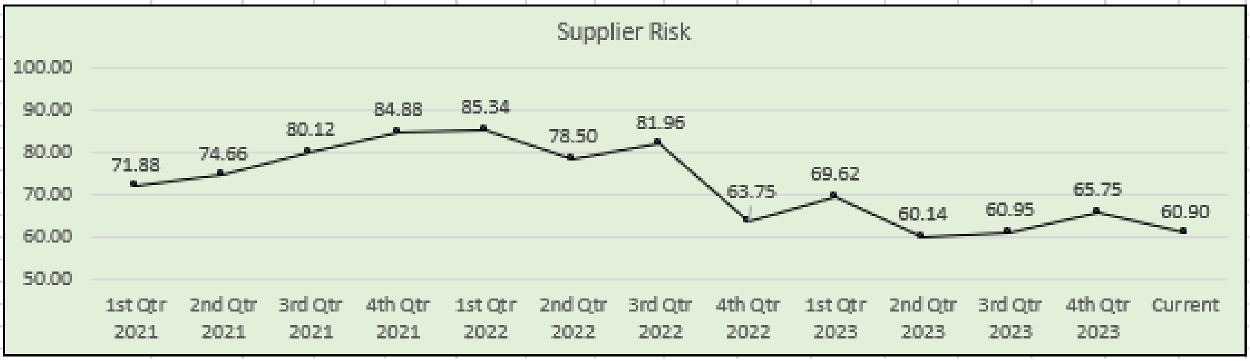


07 Supplier Risk

Some examples are: single/sole source supplier, suppliers from one geographic location, supplier quality issues, and price volatility.

Selected Comments:

- Chinese New Year production will lead to seasonal drops, but poor consumer confidence (especially in Europe) will lead to increased costs to make up from revenue shortfalls.
- Supplier risks have declined due to many companies holding excess inventory. Suppliers are much more capable in meeting demand, and adjusting to new procedures and purchasing habits, after the difficulties during the pandemic.
- Too many suppliers vying for our business.
- Nearshoring will increase risk.
- If you haven't reshored or friend-shored then you are too late. And rightfully so.
- New brands, that were part of our acquisition of a player in the motorsport market, may not want to work with us.
- Continued reduction in lead times as suppliers have recovered, for the most part, from the supply crisis.
- Increased supplier risk due to response to customer risks.
- Decoupling from China increases risk in the overall supply chain.
- Pricing continues to rise in adhesives and insulator films. Alternatives need to be sought to either control costs or continue the flow of approved parts. Metal products, such as metal stampings or fasteners, have to be verified to not contain Russian steel.
- Possible increase as geopolitical tensions are high (due to Russia/Ukraine, Hamas/Israel) and may expand, impacting supply. As an example, Israel is expected to begin bombing Hamas after the recent pause ends, and other terrorist groups may expand the current conflict in Europe.
- We see more risk with counterfeit products from outside the USA.

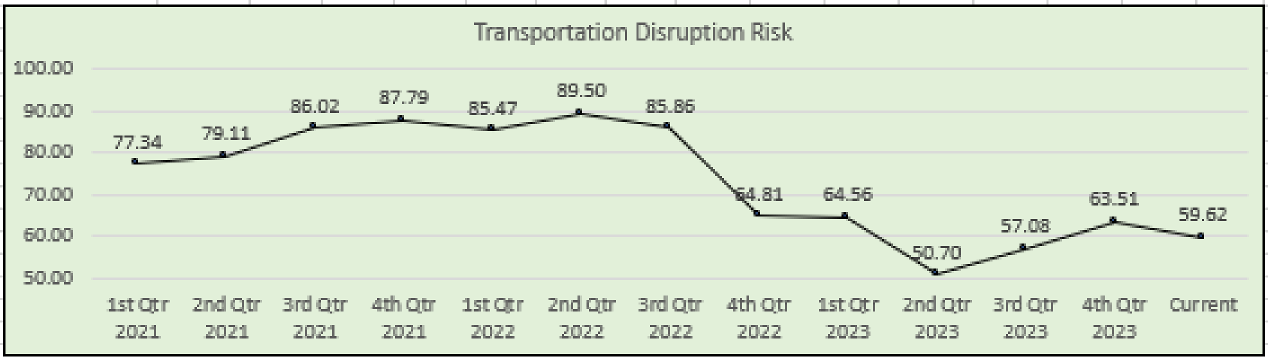


08 Transportation Disruption Risk

Some examples are: fuel prices, driver shortage, infrastructure and demand volatility.

Selected Comments:

- Low demand in the freight market, along with the rise of energy prices, has led to lower transportation risk. This will indirectly affect my company, as all of our clients use transportation to move their products.
- Blank sailings, overly high container capacity, and demand will affect ocean shipping rates and schedules. North American road transport costs are going to rise and capacity will tighten.
- There is plenty of capacity; no changes seen.
- Transportation capacity exceeds demand. Fuel prices down.
- Fuel costs are going up, increasing transportation risk.
- Fuel costs, driver shortages and demand volatility are currently very high and have been high over the last 12 months. There is no sign of decline in any of them in the near future, creating hardship on truckers. Many of the trucking companies without capital will be unable to sustain operations.
- Hard to answer. Need to see how the truck landscape rates change.
- Lot of uncertainty in a volatile economic state, especially in the transportation sector.
- Current supply of drug materials and product has been less predictable in the last 90 days. Based on lack of awareness of root cause, I would suggest the risk may increase in the near term.
- Carriers are beginning to change agreements to shorten our work day.
- LTL segment is still absorbing the impact of the Yellow freight shutdown.
- Fuel prices, labor shortage (FTL), and company consolidation are increasing risk.
- The risk of driver shortages and demand fluctuations were expect to be greater.
- Looks like fuel prices are decreasing and hearing it's a good drivers' market for now.



09 Operational Risk

Some examples are: site disasters, product counterfeiting, damage or disruption to physical assets and machine breakdown.

Selected Comments:

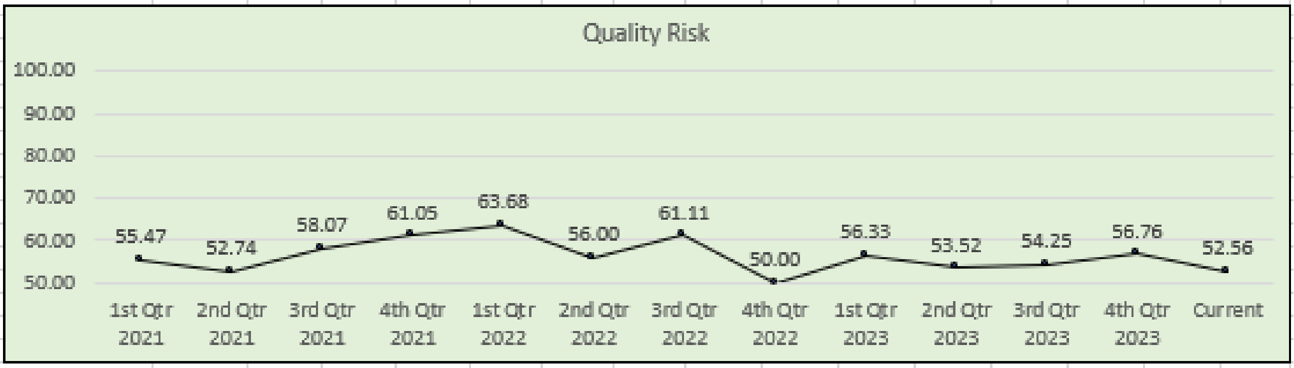
- The biggest operational risk that we will encounter in the 1st quarter will be contract renewal risks based on our performance.
- TBD - difficult to predict.
- The continued lack of components, like chips, is going to lead to equipment breakdowns.
- I feel we have SOPs in place. So any operational risk, whether positive or negative, would only happen as a result of an unexpected issue.
- I maintain a fleet of delivery vans. They will continue to age and issues and breakdowns will occur more frequently.
- We are operating within a global conflict where supply chains are a battlefield.
- High economic uncertainty combined with hesitant Q4 decision-making will make the start of the year difficult, especially for those in the consumer space.
- Implementation of the new robotic system.
- Ambiguity in customer demand and labor cost increases.

10 Quality Risk

Some examples are: lack of sufficient quality testing, changing quality standards, informal quality control documentation, customer safety issues and product recalls.

Selected Comments:

- Employee shortages continue.
- Potential quality issues related to new sourcing locations due to nearshoring.
- Labor turnover and training gaps can lead to quality issues.
- Improved stability in supply chains and fewer companies chasing explosive growth allows for more focus on quality.
- We continuously look to mitigate the quality of delivery risk and put controls and invest tools in place to support these efforts.
- Inventory accuracy issues due to the implementation of the new robotic system.
- Clearly defined quality requirements are in place and we are actively working to meet the risk.

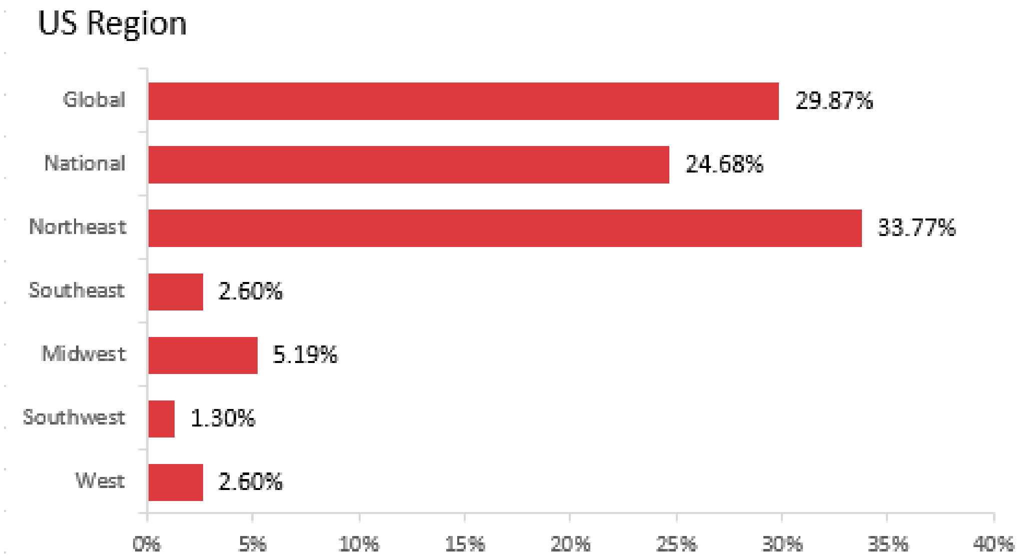


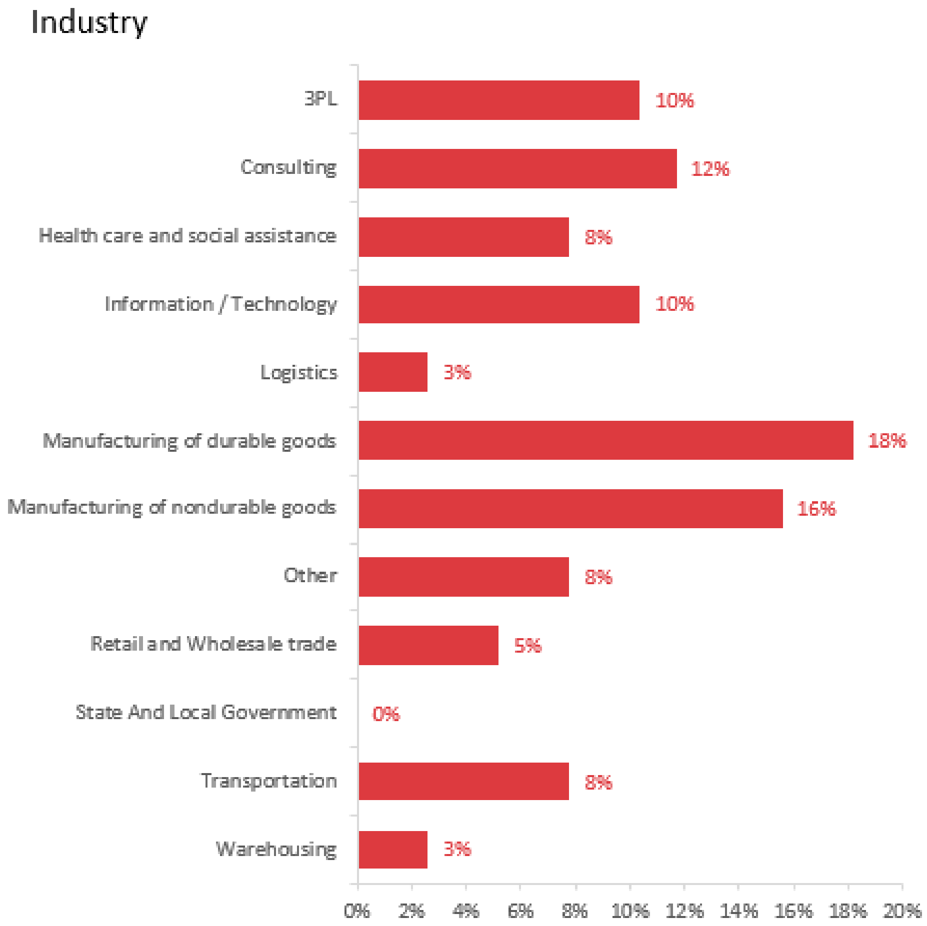
Appendix A
Risk Index Summary

The Risk Index is a number between 0 – 100.
Risk Index ≤ 49 suggests less risk
Risk Index = 50 indicates no change in risk
Risk Index ≥ 51 suggests greater risk

The further the number is from 50 greater the level of risk.
LRMI = (P1 * 1) + (P2 * 0.5) + (P3 * 0)
P1 = percentage of answers reporting an improvement
P2 = percentage of answers reporting no change
P3 = percentage of answers reporting a deterioration

Appendix B
Survey Demographics

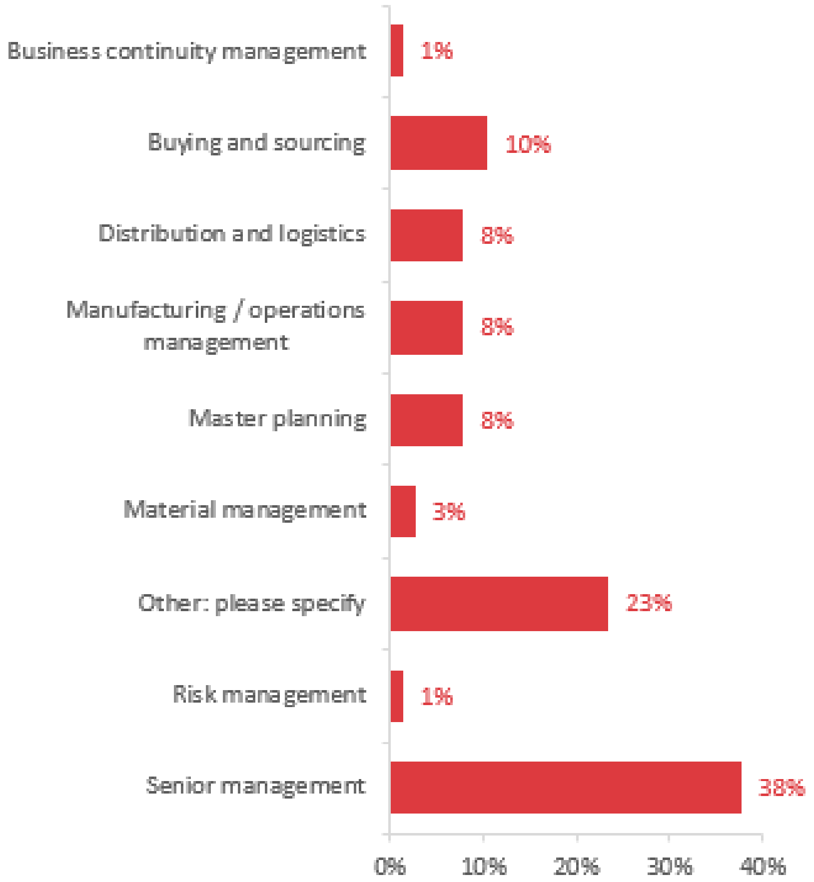




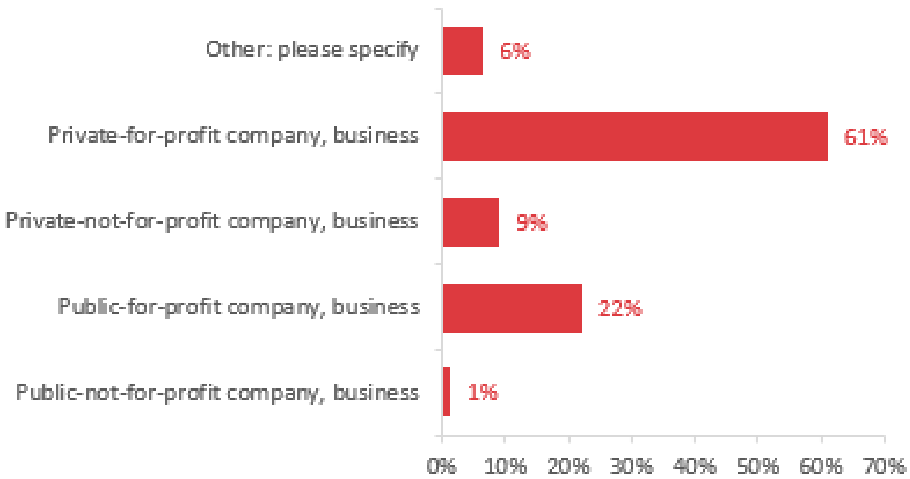
Appendix B

Demographics (continued)

Primary Role



Place of Employment



Appendix B
Demographics (continued)