Lehigh Business Supply Chain Risk Management Index

Quarterly Report

3rd Quarter / 2022

LEHIGH UNIVERSITY | College of Business

CENTER FOR SUPPLY CHAIN RESEARCH AT LEHIGH

CSCMP Council of Supply Chain Management Professionals

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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 developed this index to better understand the different kinds of supply chain risks businesses face. **Supply chain professionals rated the likelihood that the risk in the 3rd Quarter of 2022 compared to the risk in the 2nd Quarter 2022 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 3rd Quarter is 72.36 which is an increase from the 2nd quarter suggesting a higher level of risk in the 3rd Quarter 2022.**

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.

Executive Summary

Economic Risk is expected to increase substantially for the upcoming 3rd Quarter 2022 and is the number one concern for supply chain professionals. Interestingly with a score of 90.72, Economic Risk has the highest risk index across all risk categories since the creation of the LRMI in the third quarter of 2020. Economic Risk has consistently been among the top 3 risk categories, but there seems to be greater worries about increasing energy costs, commodity price volatility, labor shortages, sudden demand shocks, global energy shortages and border delays that has made Economic Risk the number one risk next quarter.

Risk Type	2nd Quarter 2022 Risk Index	3rd Quarter 2022 Risk Index	Trend
Economic Risk	87.00	90.72	↑
Transportation Disruption Risk	89.50	85.86	↓
Supplier Risk	78.50	81.96	↑
Cybersecurity and Data Risk	79.00	75.77	↓
Government Intervention Risk	76.02	74.23	↓
Customer Risk	64.00	71.13	↑
Environmental Risk	56.50	62.37	↑
Technological or Competitive Risk	55.00	61.34	↑
Quality Risk	56.00	61.11	↑
Operational Risk	58.00	59.09	↑
Average Risk Index	69.95	72.36	↑

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.

Four biggest risks in 3rd Quarter 2022

(When comparing across all 10 risks)

1. Transportation Disruption Risk
2. Economic Risk
3. Supplier Risk
4. Operational Risk

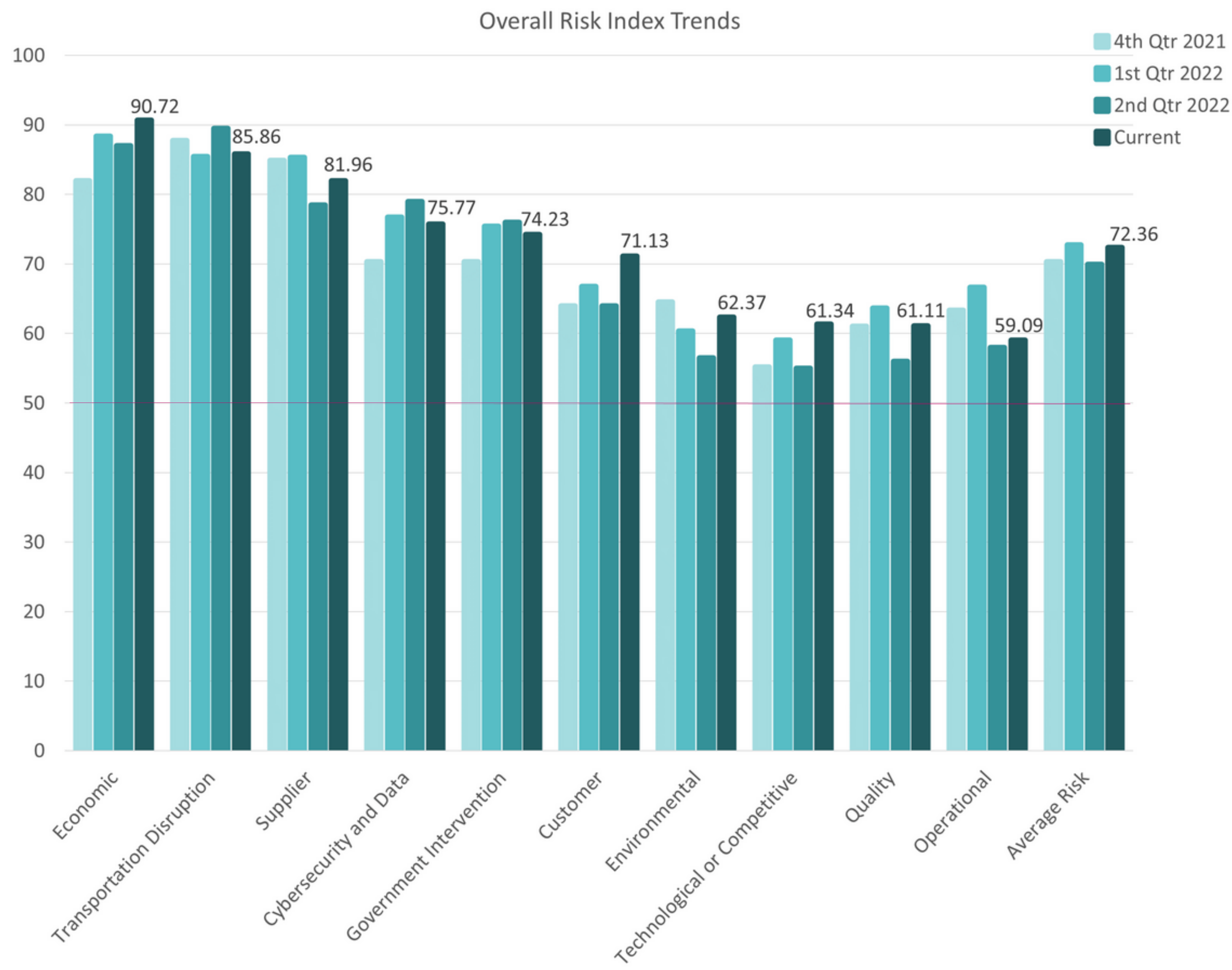
Did You Know?

The Lehigh Business Supply Chain Management Risk Index for the 3rd Quarter in 2022 is

72.36

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 the 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 as lower risk over the same 1-year time period.

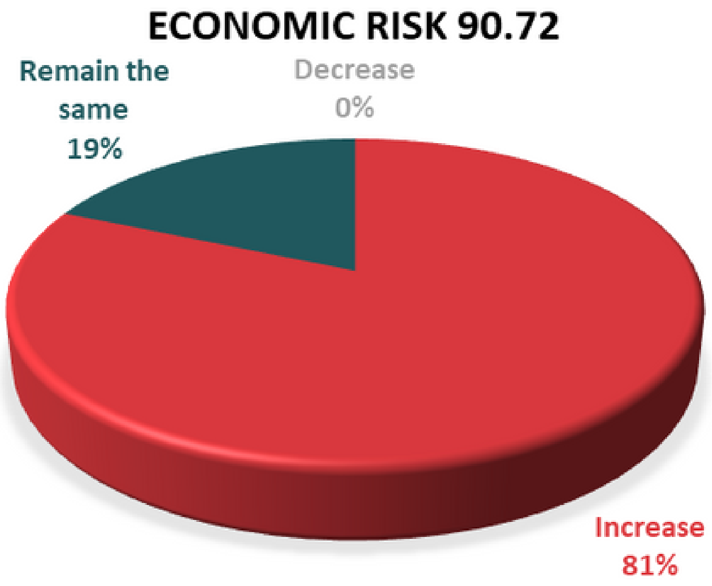


01 Economic Risk

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

Selected Comments:

- If the decrease in trucking demand is a result of a decrease in buying behavior, there could be a significant economic risk.
- Increased operational costs combined with a "cooling" economy reducing demand is a recipe for increased competition and subsequently economic risk.
- All of our prices are going up at unreasonable rates.
- Raw materials costs and lead-time and labor continue to be issues.
- War in Ukraine will continue to have an impact to fuel and material prices. Labor shortages are still plaguing a few of our plants and warehouses.
- Logistics risks and costs are increasing. Even with a potential economic slow down coming, demand continues to be high.
- Inflation very high, Ukraine conflict elongating the period of high prices.
- We will continue to feel the squeeze from past, present and future horrendous government policies.
- Global shortages mean increased risk.
- Commodity price volatility, labor shortages, border delays and increasing energy costs.
- Inflation followed by a likely recession. The government is more likely to make economic decisions which make the situation worse rather than better.
- Labor shortages and the inability to implement automation rapidly to augment capacity requirements, the increase in energy costs and current price volatility are expected to contribute to the increased economic risk and is expected to continue.
- We have an active hedge program for fuel and major commodities to reduce volatility.

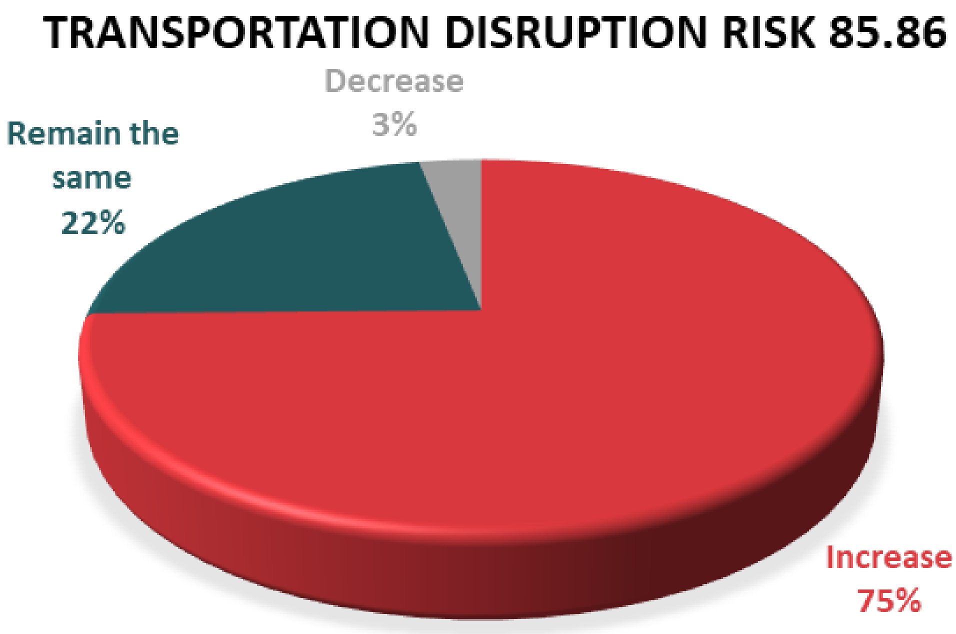


02 Transportation Disruption Risk

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

Selected Comments:

- Demand has decreased in recent weeks and is expected to continue which is decreasing freight costs for truckloads despite rising fuel costs.
- Lead times and equipment costs have increased dramatically, and parts are backordered extending equipment downtime.
- As international politics have ramped up so have transportation issues globally. Domestically the transportation issues will only increase as there are problems with availability of drivers, tractors, and trailers.
- Diesel prices are currently at record highs, truck load market is beginning to loosen which combined with owner/operators jumping back into carriers will provide relief for driver shortage. Demand is beginning to soften in less than truckload as truck load spillover goes away.
- Driver, equipment & fuel are all major issues we will continue to face for the remainder of 2022.
- Fuel prices are out of control with no clear understanding in our government on how to solve the problem by opening up exploration.
- Russia/Ukraine created additional risk especially on goods movements to Asia.



03 Supplier Risk

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

Selected Comments:

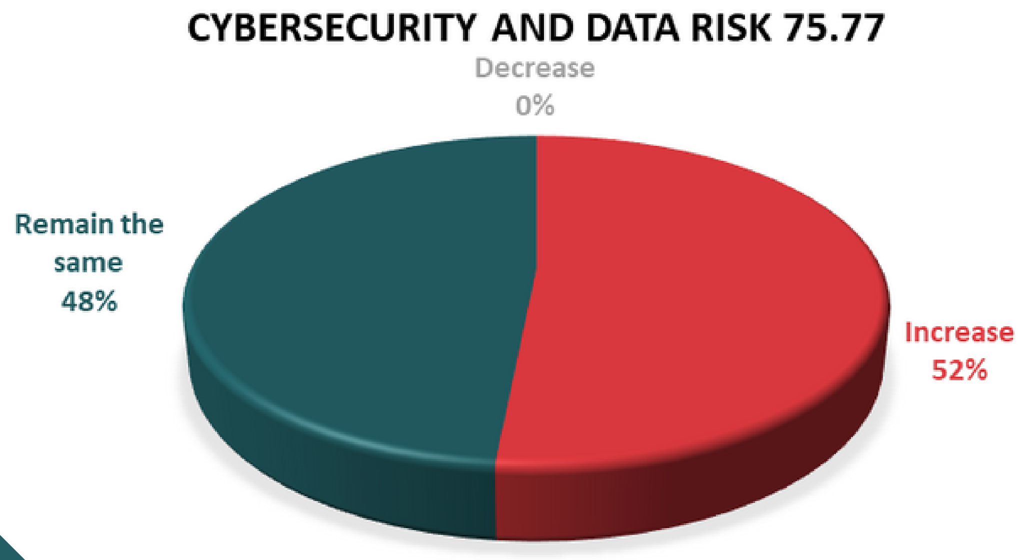
- All suppliers are at or above capacity and extending lead times and raising prices.
- It appears that suppliers are beginning to better meet commitments. Possibly due to creativity, adding suppliers...paying higher costs to source domestically?
- China's port shutdowns and subsequent backorder of parts for repairs and equipment manufacturing remain issues.
- Small to medium are in a more delicate spot and will be failing at a much higher rate.
- Continue to see supply shortages and extended lead-times throughout 2022.
- War in Ukraine, export bans, fuel prices, etc are causing issues in getting certain materials and ingredients which is impacting supply.
- We continue to see increased risk with our suppliers, as foundry capacity still remains extremely tight with many component lead times 1 to 2 years at this point.
- Drastic inflation even with the Fed precipitously increasing interest rates.
- Looking for more local/regional/national solutions. I'm not looking forward to the ensuing effects of the China lockdowns.
- Supplier quality issues leading to my quality issues.
- Price volatility and extended lead times continue to plague us.
- Already elevated, but challenging economic conditions (inflation, potential recession) will impact supplier "health" which can increase supplier risk.
- We are actively pursing initiatives to reduce single/sole suppliers, suppliers from one geographical region, delivery schedule inconsistencies.

04 Cybersecurity and Data Risk

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

Selected Comments:

- It's been bad for many years now and will continue to be. Until our government takes action to aggressively combat these cyber criminals the risk will remain elevated. Largest fear is ransomware.
- There are few actual and implemented penalties right now in the cyber world. Think about how few times you ever hear of anyone being prosecuted for any cyber issues except the smallest of them. There are going to be data battles over who owns the data. Systems companies are already holding their clients data hostage legally. This will only become a bigger problem over time.
- Continue to increase as more and more product is produced online. Plus, 1) the value of data itself will increase as folks find different ways for secondary usage; and, 2) methods for secondary usage will increase, much of which is unknown today.
- Implementing new transportation management system.
- Cyber warfare is at a magnitude we've never seen before. No one really knows what will be next. Companies trying to scale back a little bit or at least make sure that what they are currently doing and hope to do next are going to be safe and remain tenable. Lots of assumptions being questioned right now.
- Huge unknown, generally we think it's not a matter of if it will happen but when. The next big hurdle is how fast we can recover.
- I believe the risks remain the same, but there are active initiatives to help improve cybersecurity awareness and institute more controls on data.
- We are on heightened alert based on cyber activity related to the Russia/Ukraine conflict.

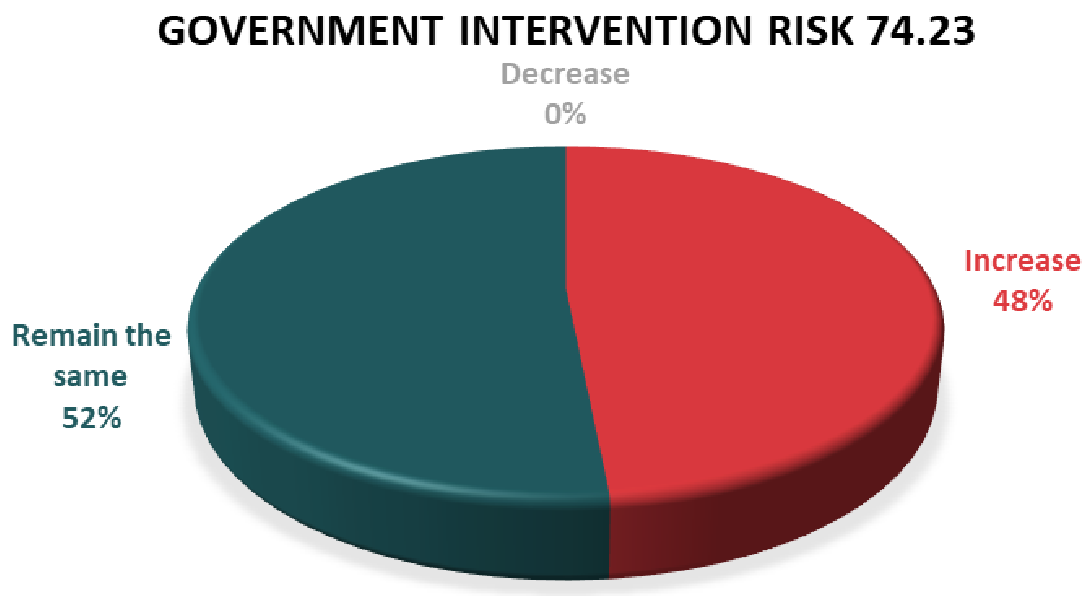


05 Government Intervention Risk

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

Selected Comments:

- There is talk of regulations being imposed requiring 3PL's to disclose internal margins, which is proprietary info and could be extremely damaging to the 3PL industry.
- In trying to help the government will just screw things up further. More often then not it is about the money for a select few under the guise of helping the masses.
- Government keeps putting additional regulations, testing and fees that are unnecessary but very costly.
- Railroad service has deteriorated to the point of Surface Transportation Board hearing recently on the topic. Current political environment favors government intervention and this is a very visible opportunity.
- Always a laggard, government intervention will be just as haphazard. However, because of the myriad of external changes and stresses to the system, time to intervention will shorten.
- Overactive US administration with no clue.
- Sanctions affecting raw material availability and our sales plans.
- The ongoing conflicts/wars are leading to interesting sanctions, alliances, etc.
- The government is more likely to make economic decisions which make the situation worse rather than better.
- New regulations in effect prior to Q3 coupled with economic and political factors may have an adverse effect on the supply chain.



06 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 customer.

Selected Comments:

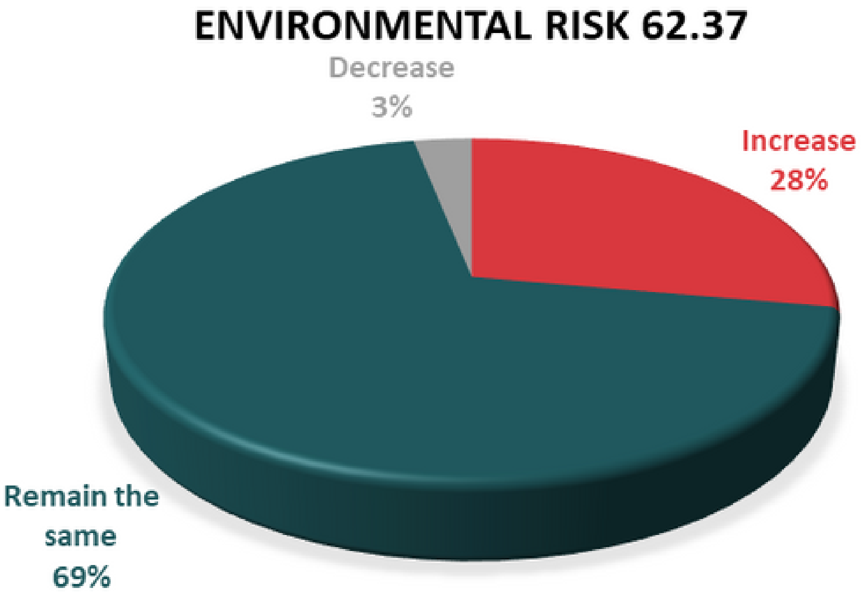
- With trucking costs decreasing, my 3PL company needs to offer price concessions to clients wherever we can. If we don't reduce where we need to, someone else will and we could damage customer relationships.
- Customers have remained stable and abundant but as other issues resolve they will turn to changing their supply chain flows, changing their expectations and who they work with. Also we are headed to a recession/slow down which will eliminate demand which is a threat to customer base.
- We are taking another price increase this summer, but demand hasn't softened as our products are still cheaper than out of home alternatives. Our poor fill rates could lead consumers to choose other brands or customers to reduce item assortment.
- Perpetual conditions, worsened by government ineptitude.
- Supply chain shortages on the front end cause short lead-times on the backend.
- Lack of valid historical data to forecast future demand due to Covid.
- As customers try to find lower cost solutions, disruption is expected in some long standing customer relationships.
- Changing market dynamics may accelerate risks as do inflationary pressures and residual effect of COVID in the past two years.
- What impact will inflation have on the revenue per bill growth and customer loyalty?
- Consumer behavior is hard to predict. Also, our demand is closely tied to disposable income levels, which are also an increased risk due to the inflationary environment.

07 Environmental Risk

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

Selected Comments:

- Wait until we have some really big storms on the coasts which shut down the ports. Or major floods hit inland waterways and destroy infrastructure.
- The unknown effects of climate change.
- Hopefully all good.
- Hurricane season.
- After the past few years, we're about as robust to these things as we can be. We are focusing on many other risks now.
- Extreme weather events.
- Climate change will continue to increase.
- The environment remains a large factor that greatly affects transportation.
- Industrial accidents and extreme weather continue to cause challenges.

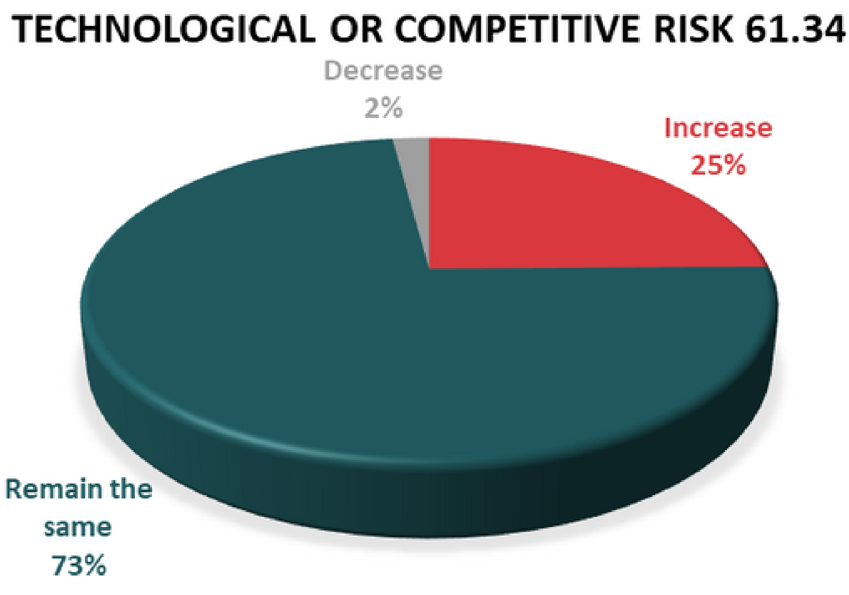


08 Technological or Competitive Risk

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

Selected Comments:

- Freight market is shifting from being 'service-centric' over the Covid years (which is typically unheard of) back to 'price-centric'. We need to stay competitive in order to maintain our market share and customer trust/relationships.
- The more technology there is the worse it becomes. It becomes a matter of what is the next best thing and who has it. Then customers will flock to those with the biggest an best even if is not really any better.
- Chinese companies selling knock-offs of our products at a lower price in the USA.
- New technologies will emerge. How they will be employed and whether or not they will make a difference is to be seen.
- Cyber risks remain high.
- Competition is always changing and improving.
- Expect competitive risk to remain the same. Competitors continue to be stretched thin, and are trying to keep up with existing demand. Technology for our sector continues to be overrated, oversold, lots of bells and whistles, but no real substance to reducing costs or improving processes.
- The emergence of disruptors and new entrants in the market, along competitor integrations and acquisitions increases the risk in our organization.
- I do not see this as the same level risk as the other questions, but I can't say that it's any better.

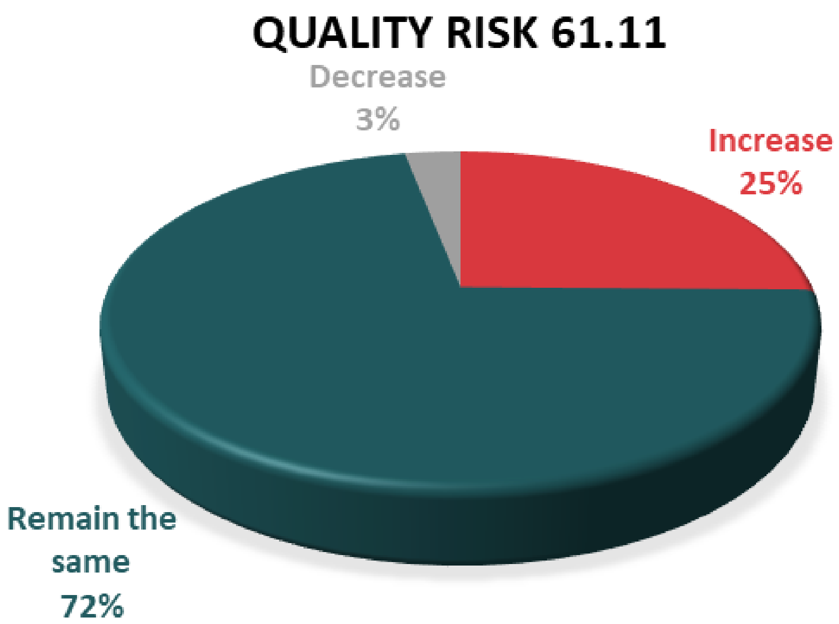


09 Quality Risk

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

Selected Comments:

- Over the past quarter quality has continued to reduce. As materials and items become more difficult to obtain the quality level will continue to diminish while the acceptance of substandard will also become more common.
- NA Class 1 Railroad service is significantly below its 5-yr average, materially degrading the quality of our product.
- For this quarter, quality risks will not emerge. It will take some time before the operational risks will result in an obvious decline in quality of manufactured product.
- Continues unknown fallout from supply chain disruptions caused by conflict in Ukraine.
- Material availabilities and fraudulent certifications related to the Russia - Ukraine situation.
- With labor hard to come by, training is minimal and we are seeing increased quality issues.
- Recalls seem to be on the upturn. Untrained labor forces hurt quality.
- My company, suppliers and customers have quality issues.
- Because demand is still very high and the labor pool is still a challenge, quality is still a concern.
- Risk is still heightened due to the amount of employee turnover with our supply base.
- Product shortages and supply chain issues are forcing buyers to source product from other sources, which brings an inherent risk in quality.

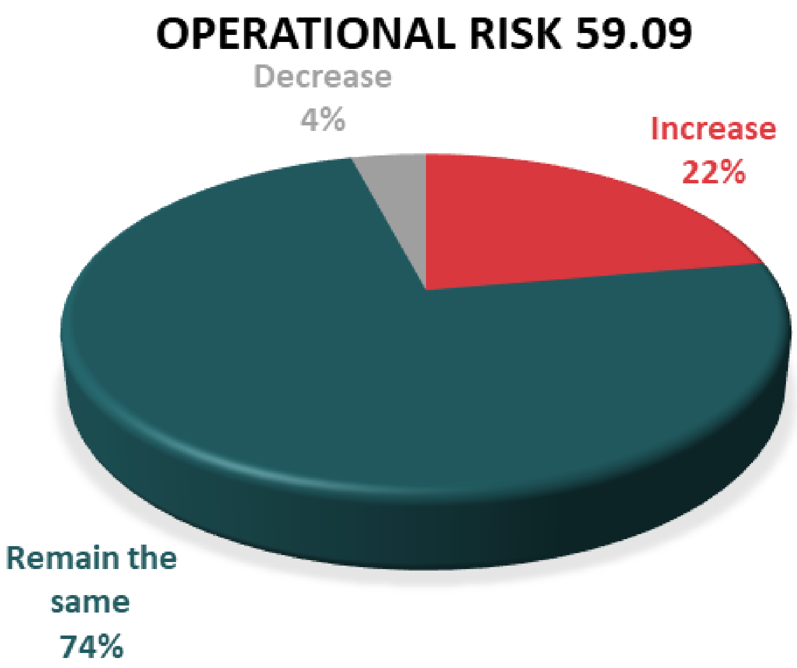


10 Operational Risk

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

Selected Comments:

- As supply shortages increase, counterfeiting of supplies will become more prevalent. Until the mechanism for making and validating supplies improves, this risk will only become more intense.
- We had a fire in a factory earlier this year which will impact one production line for Q3.
- Russia invasion of Ukraine continues to worsen impact on metal scrap/alloy prices further deepening super cycle on commodities.
- Potential ILWU strike, hurricane season, inflation.
- Business continuity plans engaged to compensate for closing 2 Ukraine locations and pausing 2 Russia locations.
- Concerns over labor and equipment availability.
- Difficulties obtaining parts for machinery and equipment as well as raw materials due to government actions (domestic and international).
- Machine breakdowns are terrible. Maintenance is understaffed right now.
- Equipment shortages is the primary issue we face at origin & final mile for delivery.
- Continued changes due to key personnel changes and stretching of current staffing. Preparing for a SAP transition in early 2023.
- Availability of physical assets remains a major problem. It may decrease by finding alternative avenues of procurement, but the need is only being controlled not improving.
- Effects of pandemic and Russia/Ukraine conflict while still present are stabilizing.
- Great power competition is wreaking havoc. Great powers include both nation-states and the global elite. Not sure what will happen.

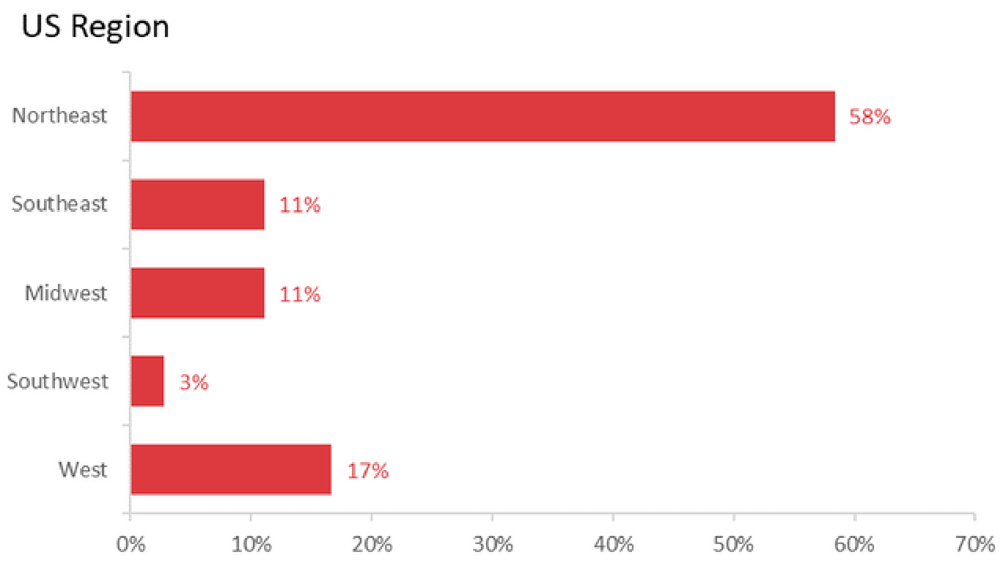


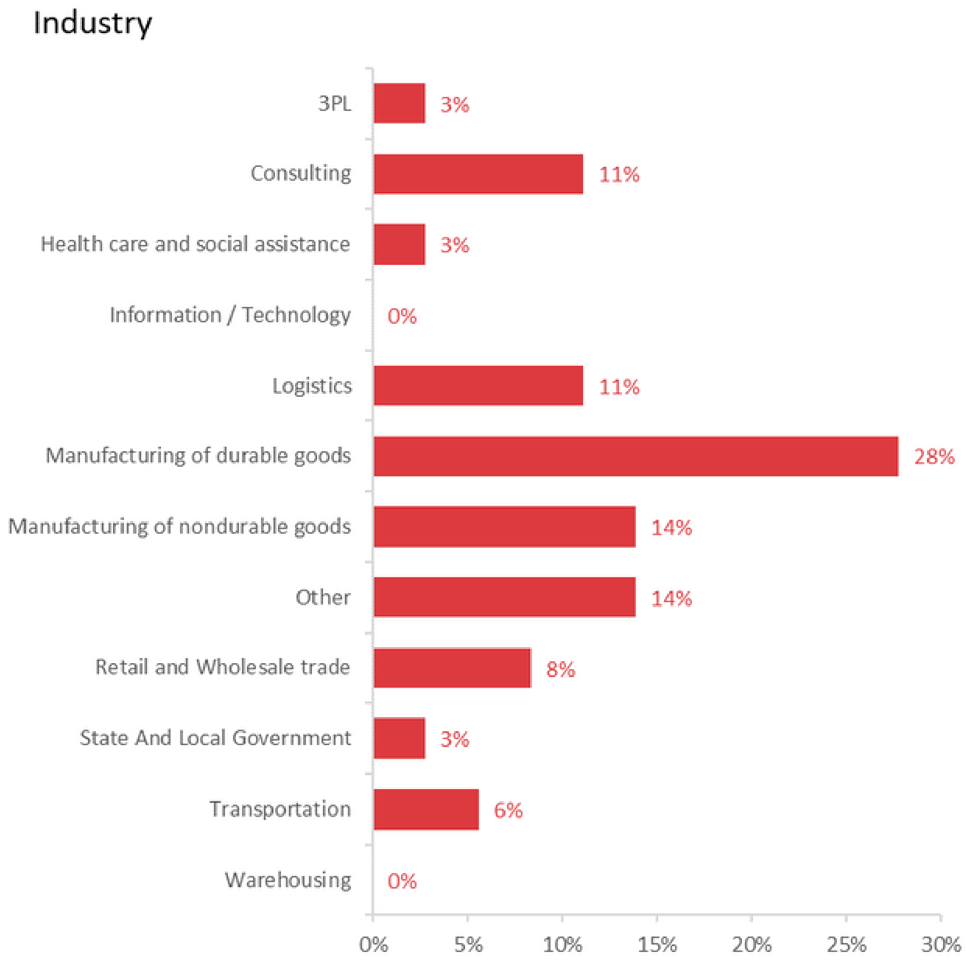
Appendix A
Risk Index Summary

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
LBRI = (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

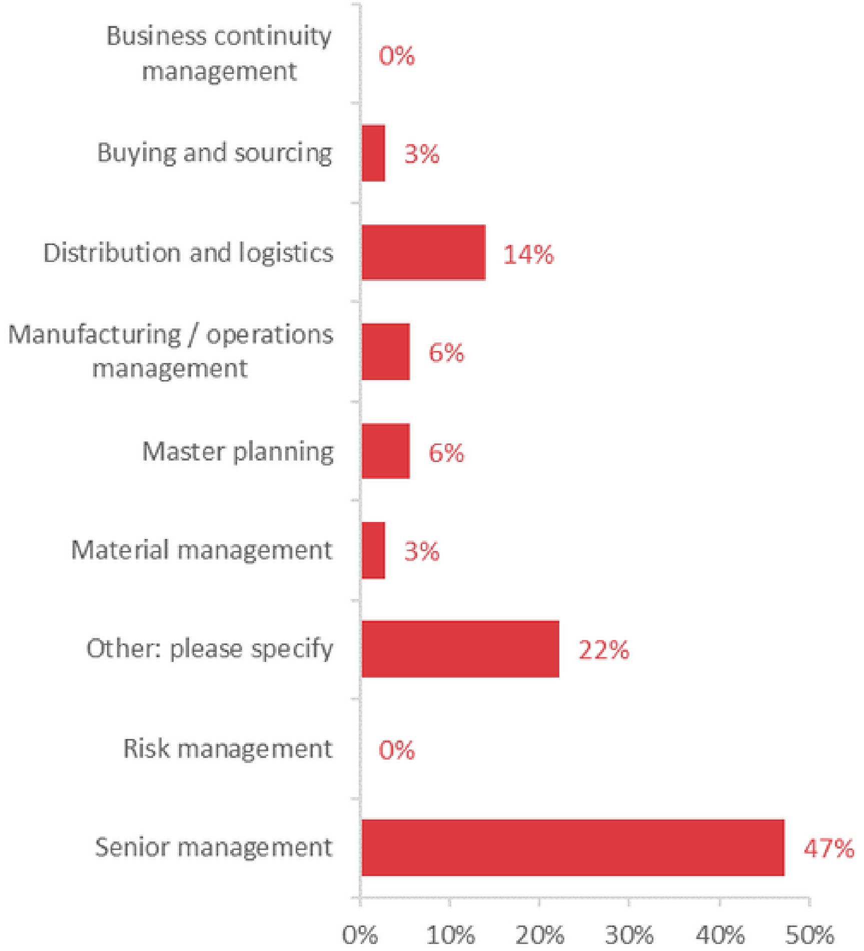
Appendix B
Survey Demographics





Appendix B
Demographics (continued)

Primary Role



Place of Employment

Appendix B
Demographics (continued)