Lehigh Business Supply Chain Risk Management Index

Quarterly Report

3rd 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 3rd quarter of 2024 compared to the risk in the 2nd quarter of 2024 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 65.95 which is an increase from the 2nd quarter, suggesting a higher level of risk in the 3rd 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.

Executive Summary

Cybersecurity remains the highest overall risk at 77.69, but this represents a notable decline from the previous quarter, indicating that cyberattacks, data corruption, data theft, system viruses, and security platform controls remain concerns. Interestingly, government intervention has surged to 74.62, its highest level in the past four years, reflecting managers' worries about tariffs, trade wars, and regulatory restrictions on source materials, methodologies or technologies. Economic risk has climbed to the third highest risk at 72.31, with concerns about rising energy costs, commodity price volatility, labor shortages, sudden demand shocks, global energy shortages and border delays. In direct comparison across all risks, economic risk remains the top concern. Customer risk, the fourth highest, reflects ongoing concerns about rapidly changing customer demands, easy loss of customer loyalty, shifting demographics, unpredictable behavior and challenging customer service. The average risk index has slightly increased from the last quarter to 65.95, which is still low compared to the historical average.

Risk Type	2nd Quarter 2024 Risk Index	3rd Quarter 2024 Risk Index	Trend
Cybersecurity and Data Risk	83.80	77.69	⬇
Government Intervention Risk	69.44	74.62	⬆
Economic Risk	66.20	72.31	⬆
Customer Risk	65.74	68.46	⬆
Transportation Disruption Risk	67.13	64.39	⬇
Supplier Risk	68.52	63.08	⬇
Technological or Competitive Risk	70.83	62.31	⬇
Environmental Risk	60.19	61.54	⬆
Operational Risk	54.63	59.09	⬆
Quality Risk	52.31	56.06	⬆
Average Risk Index	65.88	65.95	⬆

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.

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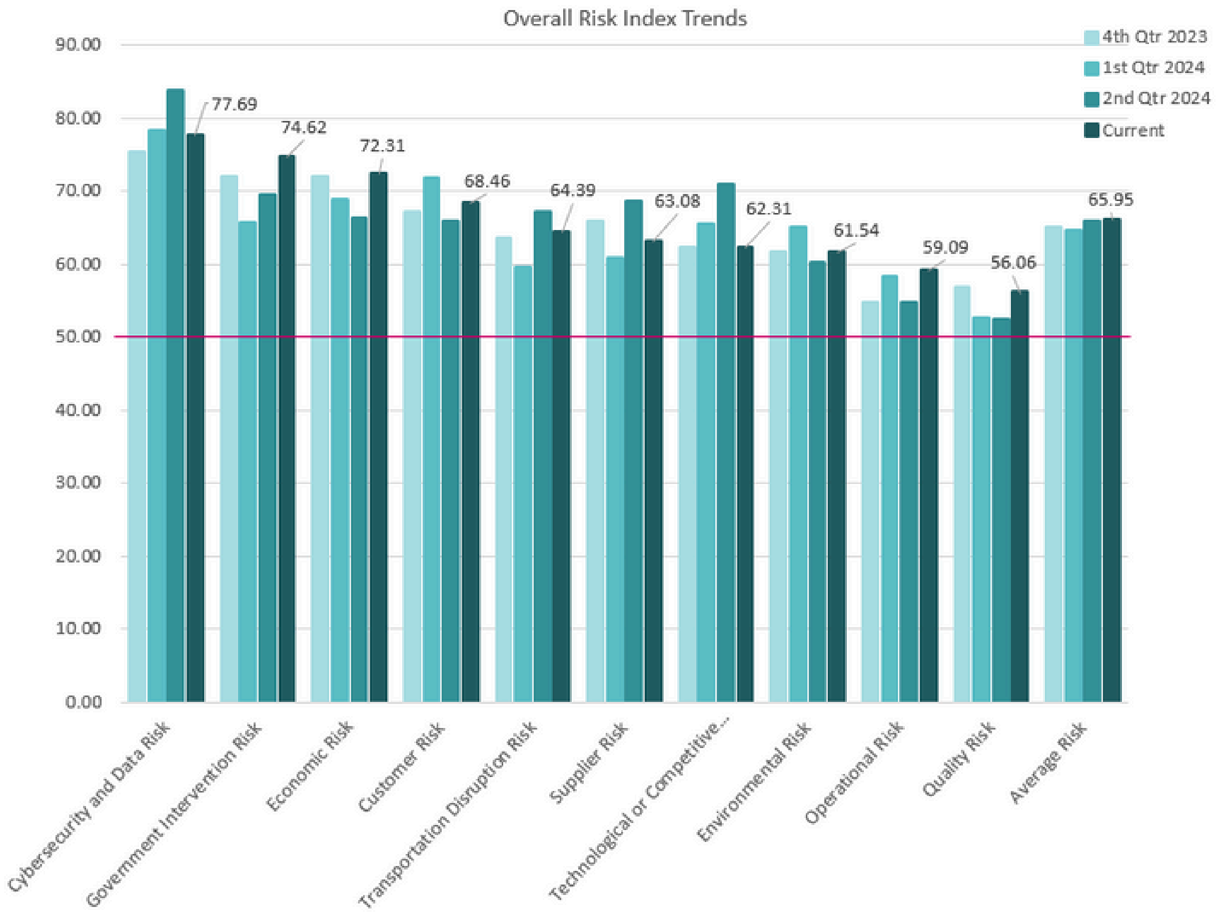
Did You Know?

The Lehigh Business Supply Chain Management Risk Index for the 3rd Quarter in 2024 is

65.95

LRMI Risk Index Over the Last Year

One of the advantages of regularly 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 3rd Quarter 2024

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

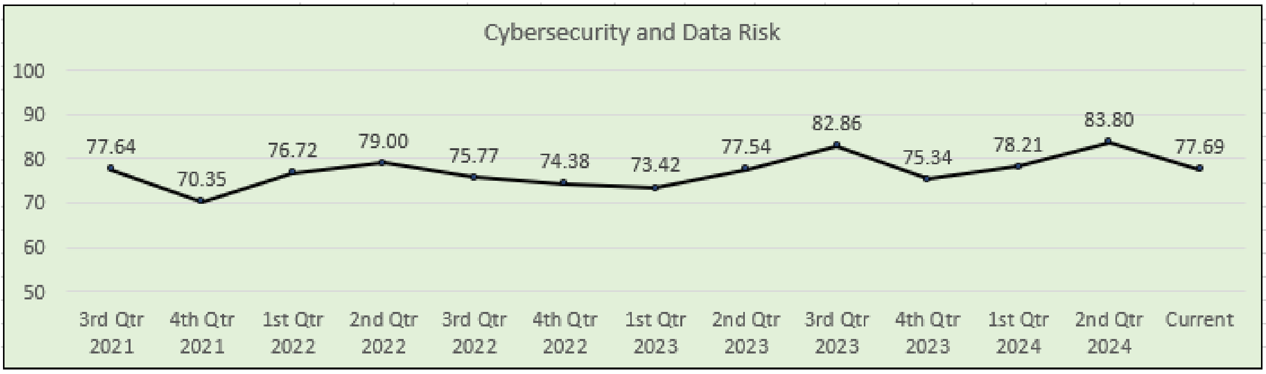
1. Economic Risk
2. Cybersecurity and Data Risk
3. Government Intervention Risk
4. Customer Risk

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:

- Additional measures have been taken to mitigate and prevent cybersecurity and data risk in the face of increasing incidents in this area.
- It seems that foreign actors are stepping up their cyberattack efforts.
- Customers report little actual change in risk; athough "fear of change" is on the rise.
- Hackers are more agile than our internal IT resources. Password management is a growing problem.
- Cybersecurity and data risk remains at a high level; it is one of our biggest risks.
- Election year turmoil will likely keep cybersecurity and data risks at bay.
- Cyberwarfare continues to rage... again, "geopolitics."
- There will be a continued increase in cyber threats as AI offers criminals more options.
- We're witnessing increased activity with regard to social engineering attacks to gain private information through personal and professional account manipulation.
- We expect this risk to increase due to the increased use of AI together with the large amount of data that is now stored in the cloud.
- Perceived vulnerability of the U.S., given the current political climate, may lead to bad players stepping up cyberattacks to weaken the U.S. at home, thereby weakening resolve overseas.
- We show weakness in international policies; China and Russia will take advantage.
- Risk will continue to rise, but our company has invested in cybersecurity as a focus.
- We have already seen some cyberattacks in the form of fraudulent charges and, with the economy tightening, these may become more of an issue.
- Russian and Chinese hacker activity is increasing.

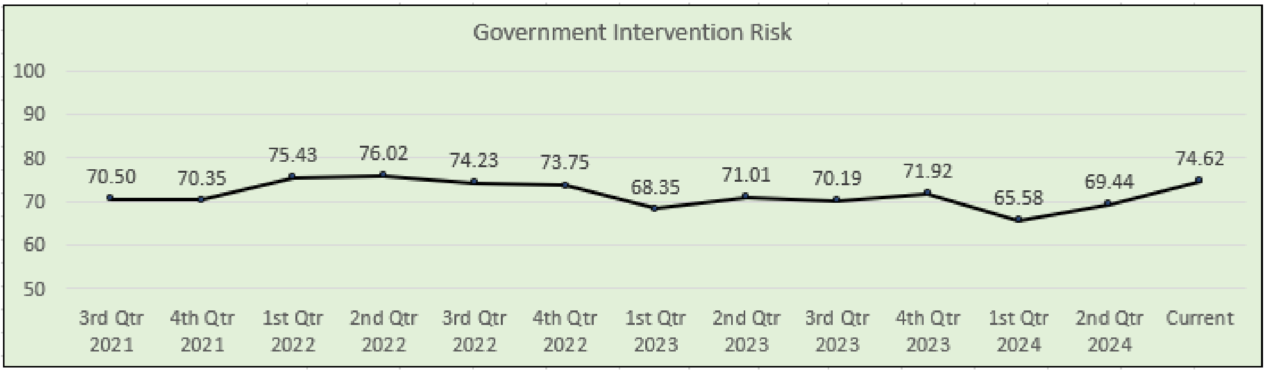


02 Government Intervention Risk

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

Selected Comments:

- Inflation, political division and increased global aggression are impacting risk.
- This risk is unpredictable, yet constant.
- This risk is predicted to increase due to the looming longshoremen strike.
- The U.S. election will add risk in Q4.
- The U.S. Government is ineffective. The nicely-termed "geopolitical risk" refers to the same world war-level conflict that we have been experiencing for a few years now, but folks are finally waking up to this.
- We expect risk to remain the same, as the China 301 tariff exclusions were extended for another year, which will help to mitigate costs.
- Until the election happens, and unless the results are accepted, both sides will just keep tinkering with the issues to make money, rather than solve problems.
- Tariffs threaten the cost of materials sourced from various countries outside the U.S.. Political unrest (Russia/Ukraine, Israel/Palestine) creates challenges as businesses refrain from trade agreements with embargoed nations.
- Government intervention could be an upside in certain projects.
- The government is increasing taxes and being more aggressive in enforcement.
- US businesses need to know what they can count on from a regulatory standpoint. Increasingly complex regulations added with no effort towards streamlining. One-off changes with no comprehensive reevaluation of all regulations leads to complexity and confusion. Government needs to look at regulations in their entirety and rewrite them to get the desired effect with a minimal amount of complexity / collateral damage.
- This risk is always increasing. Russia is especially worrisome. The geopolitics in Europe are similar to 1939.

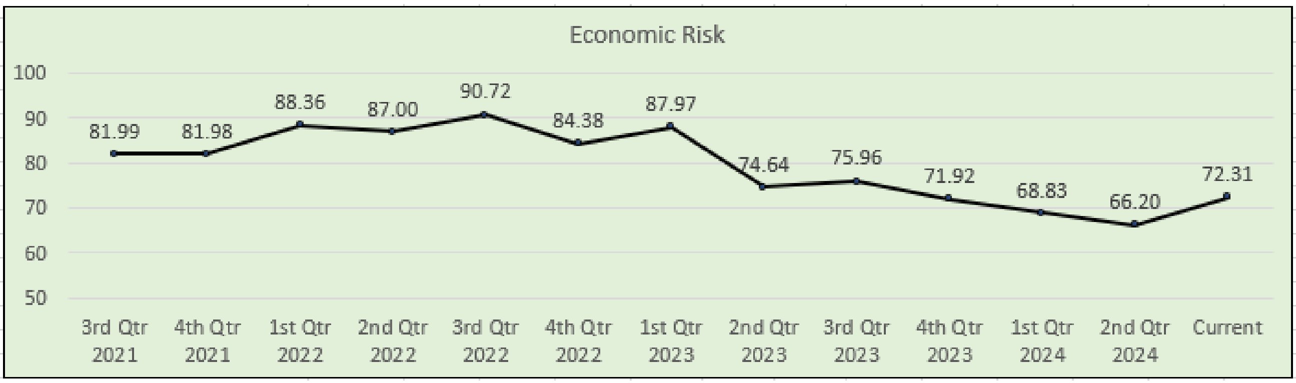


03 Economic Risk

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

Selected Comments:

- Customers view labor shortage as the number one risk to their businesses.
- Bidenomics continues to put businesses at a disadvantage with ever increasing costs, demotivated workforce, and continued uncertainty about overall macro level economic outlook.
- Companies that don't treat or pay their employees well are having a hard time finding labor, and rightfully so. Some industries with poor workforce models will have significant problems heading into the future. Let them lose to more sustainable industries and companies.
- The increase in the price of commodities, like cocoa, along with potential impact of diet related drugs will increase risk.
- We expect an increase in risk as the presidential election in November will bring ambiguity to the commodity markets.
- While inflation rates have slowed in the recent months/years since Covid, there are still inflationary pressures in housing and energy that continue to impact global pricing. China's inflation has significantly outpaced the rest of the world, which increases pricing pressures and fear of anticipated tariffs.
- Risk will increase as inflation is on the rise.
- Prices will keep going up until the U.S. government turns around the ridiculous deficit spending and balances the budget.
- The Fed and U.S. Government policies are causing issues.

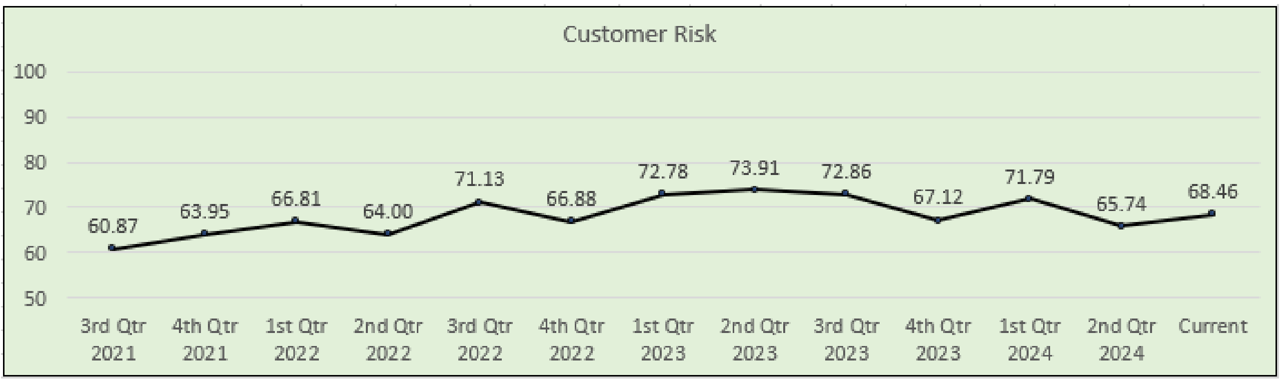


04 Customer Risk

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:

- We expect no change in risk as we build long-lasting partnerships. Our customers love us! Customer loyalty averages +10 years.
- Customer cost pressure continues to increase as does customer demand volatility.
- We expect an increase in risk. From our point-of-view, this is similar to demand volatility.
- We expect a low level of risk.
- Inflation and cost of living are hurting customer buying power.
- Customer demand remains with high volatility.
- Customer risk will increase due to price sensitivity and shrinking of categories we operate in, such as frozen food.
- Customer risk will remain the same until the spending stops!
- To remain ahead of innovative options, product development is pressured to meet demands in certain markets or risk losing sales to competitive options.
- Disposable income seems to be decreasing, and customer loyalty with it.
- We do not know the future of the economy, and this will have affects on consumers, hopefully positive.
- The intent to change providers in an effort to save costs has increased, thus increasing the customer retention risk.
- We do not know the future of the economy, and this will have affects on consumers, hopefully positive.
- Customer loyalty is decreasing as firms strive to improve bottom lines.

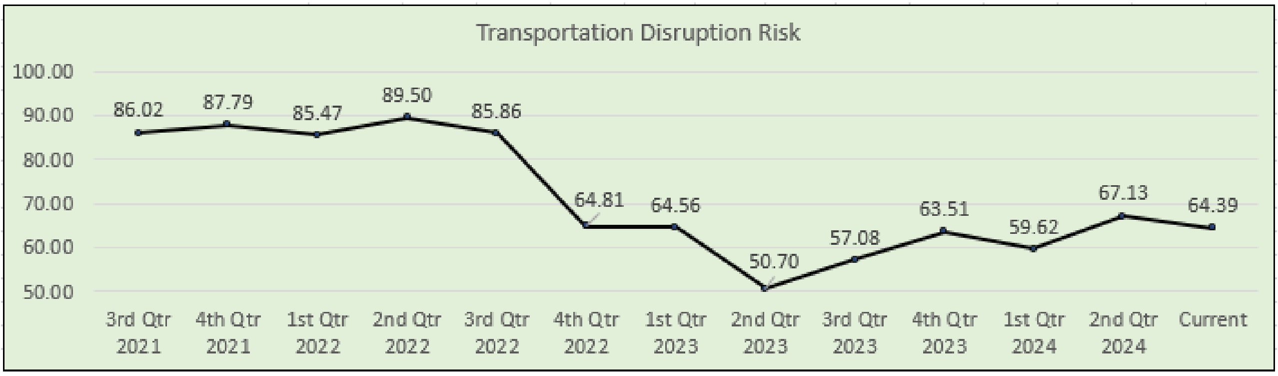


05 Transportation Disruption Risk

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

Selected Comments:

- Inflationary risks are affecting fuel costs and demand significantly.
- We're seeing a great improvement from the previous 48 months - a much more resilient and stable environment.
- There is an increase in risk as we transition into the summer months, as we see more travel and higher demand.
- Shipping costs seem to rise with inflation.
- Fuel costs for trucking, ships, trains that move the world are influenced by changes in fuel sources, supply and demand factors, etc. Certainly climate change is the elephant in the room and there appears to be no contender to tamp that down and its associate disruption in our transportation nodes due to weather, train derailments, airline challenges and supply demand volatility.
- The Port of Baltimore closed due to an "accident" and the Red Sea is still a problem due to "geopolitics."
- Ocean transportation has recovered from the last quarter's delays with canal reductions and travel around the Horn of Africa.
- Surcharges and fees seem to be the new way to recover/pass on cost increases.
- Risk has increased due to political and military activity around the Yemen and Somalia coast areas of the Indian Ocean as Houthi forces continue to threaten any Israeli-backed cargo ships/carriers.
- There are concerns regarding the stability of the electrical grid as incentives for renewables outstrip the grid's current ability to integrate these resources smoothly.
- We expect a decrease in risk as there's no increase in demand in sight, and more than enough capacity to replace carriers that perform poorly.

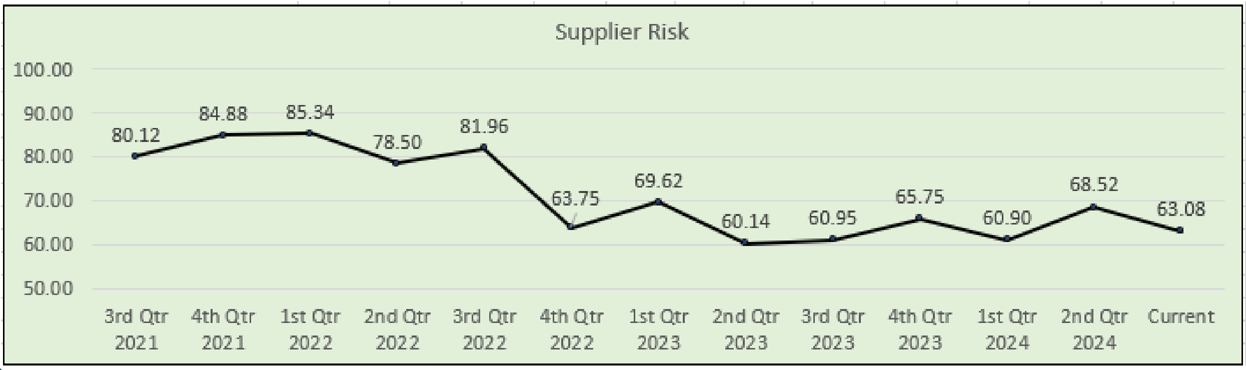


06 Supplier Risk

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

Selected Comments:

- We expect a decrease in risk as our suppliers are long reliable partners and fully vetted to conform with own ISO standards and 6S Lean principles. The pool of suppliers is periodically examined in case of capacity demand or unexpected retirement of current partnerships.
- Customers report unpredictable "geopolitical shocks." Also, the surge in counterfeiting has created significant risk to perceived quality.
- The main issues are 1) availability of natural gas (fuel source) and 2) availability of parts for the power plant if something breaks. Off-the-shelf parts are less readily available than you might think.
- Customer demand for our products continues to increase at a rate that exceeds the business and supply-base's ability to keep up with capital improvements and other capacity, quality inputs.
- Nearshoring efforts are going well, but guess who still owns the companies we are trying to do business with? - Communist China.
- We expect a slight increase in risk, especially in the auto industry as small and medium-sized suppliers see falling earnings/margins due to flat sales and volatile mix changes away from Battery Electric Vehicles and back to Hybrid Electric Vehicles and Internal Combustion Engine Vehicles.
- Prices will still be on the rise, as minimum order quantities will increase in an attempt to mitigate costs.
- Risk remains the same, but "everyone" wants "someone else" to hold the inventory.
- Threats or changes to tariffs on inbound purchases from China and other countries have generated a stronger desire to protect product sourcing alternatives to reduce or maintain cost effective options.

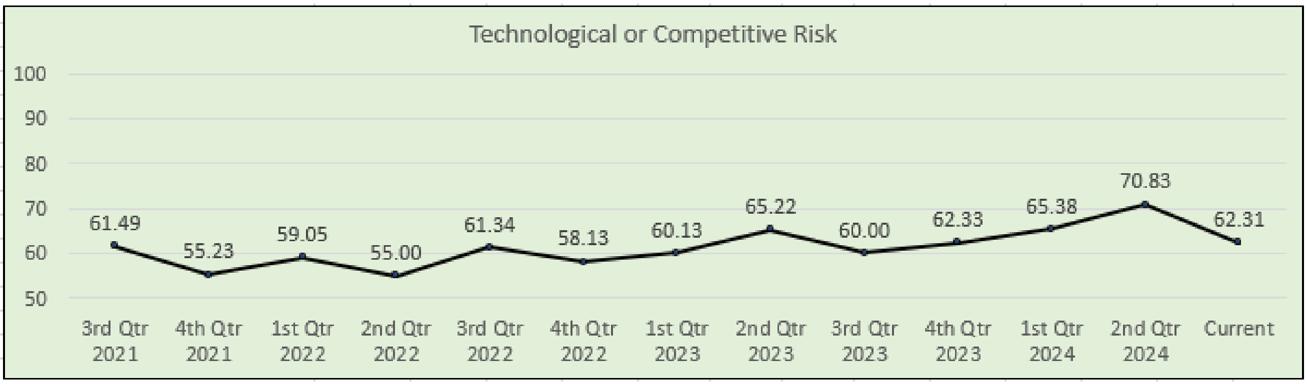


07 Technological or Competitive Risk

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

Selected Comments:

- Risk is expected to remain the same. Global Logistics is a highly competitive sector.
- This risk is expected to remain the same. New entrants are falling off.
- Green technologies and their inconsistent regulation raise the risk here.
- Risk is expected to decrease. Combined cycle natural gas plants are sort of back in vogue as the power grid searches for supply to power new AI applications.
- Customer demand for our products continues to increase at a rate that exceeds the business and supply-base's ability to keep up with technology and methods that will allow for the business to be effectively managed at scale.
- "AI" is the new rage and tools like ChatGPT are changing the nature of work.
- Continued increase fueled by AI and new technologies/disruptive innovations.
- There is an increase in competition, which leads to increased risk.
- We expect this risk to remain the same - there is no new competition in the plumbing wholesale field.
- Pressure (optics) to use AI leading to ineffective and non-profitable uses of this technology, as well as increased regulatory/government grandstanding on the related issues, leads to increased risk.

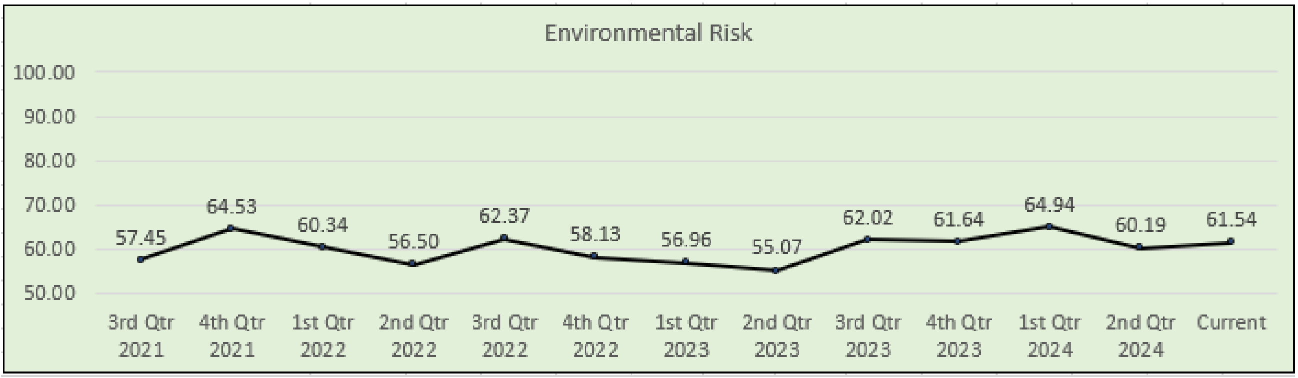


08 Environmental Risk

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

Selected Comments:

- Unchanged level of risk. This is always a background issue.
- Risk will increase as the summer months bring more weather disruptions.
- The level of Environment Risk remains the same. People are starting to wake up the fact that the "climate crisis" and associated narratives are yet another geopolitical battle ground.
- Global warming continues to drive major changes in weather and more extreme weather events - the data is overwhelming and this trend is real.
- An extremely active hurricane season is expected to disrupt the east coast of the US in Q3.
- Adverse weather conditions are becoming more common.
- Risk remains the same but contingencies need to be planned for ahead of time so there's more quick, planned response and less expensive reactions.
- We expect an increased risk due to climate change.

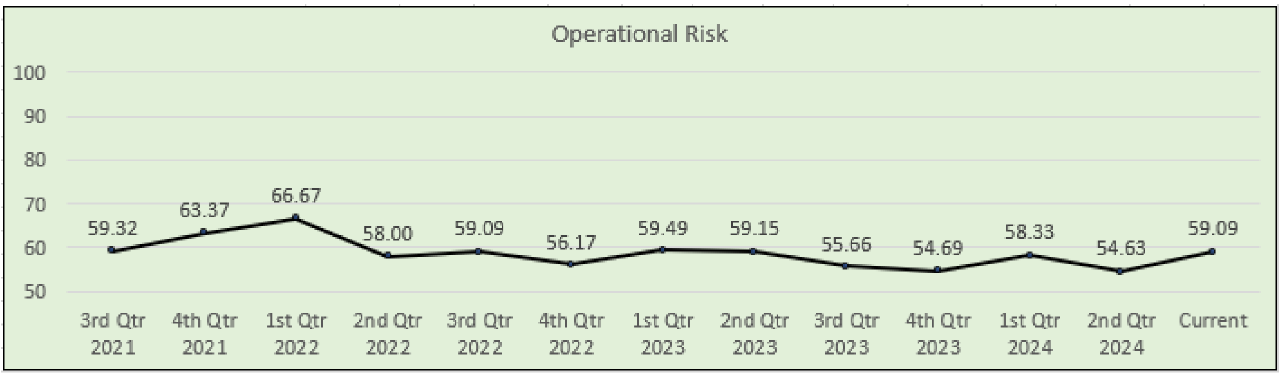


09 Operational Risk

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

Selected Comments:

- As part of our 6S Lean processes we continue to adopt new mitigation efforts to protect work force and maintain or improve assets, thereby decreasing risk.
- Risk is increased due to the change of season and warmer temperatures.
- Really no change in what customers do. Although challenges are looming, this past Quarter things remained stable.
- We don't anticipate any changes in risk. Capacity and carrier rates are what change our operational factors.
- The level of operational risk tends to be the same for combined cycle power plants (like ours). In winters the risk is due to freeze-offs, and in summers it's due to lightning strikes or some mechanical issue.
- Customer demand for our products continues to increase at a rate that exceeds the business and supply-base's ability to keep up with capital improvements and other capacity, quality inputs.
- There will be an increase in risk, induced by geopolitics.
- The level of risk increases as we are headed into Peak Season.
- We have been suffering extreme weather conditions this year with heavy rainfall, which has increased risk. It is unclear how long it will last.
- The government is unstable and getting worse.
- No issues for us here - moving forward at current projection.
- Lower/stable volumes tend to reduce operational risk. However, the focus on cost reductions can create the intent to cut corners and create shortcuts to drive efficiencies. This likely activity will increase risk, ultimately creating a neutral balance.



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:

- We expect a decrease in risk as part of our rigorous ISO 9000-2015 QP.
- There will be increased risk due to the Bird Flu epidemic spreading to livestock.
- Risk will not increase. Customers have seen little change in demand based upon products or services.
- Producers in the steel and aluminum industry (suppliers of coil) continue to show inconsistent quality resulting in delays in on-time delivery.
- Customer demand for our products continues to increase at a rate that exceeds the business and supply-base's ability to keep up with capital improvements and other capacity, quality inputs.
- There continues to be change and turnover in the workforce and the supply chain. The constant necessity to train new or inexperienced people can lead to product quality or reliability "escapes."
- This is an ongoing issue, but the level of risk is expected to stay the same with more product arriving from China.
- The focus on cost reductions can create the intent to cut corners and create shortcuts to drive efficiencies, thereby increasing the level of 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 the greater the level of risk.

LRMI = (P1 * 1) + (P2 * 0.5) + (P3 * 0)

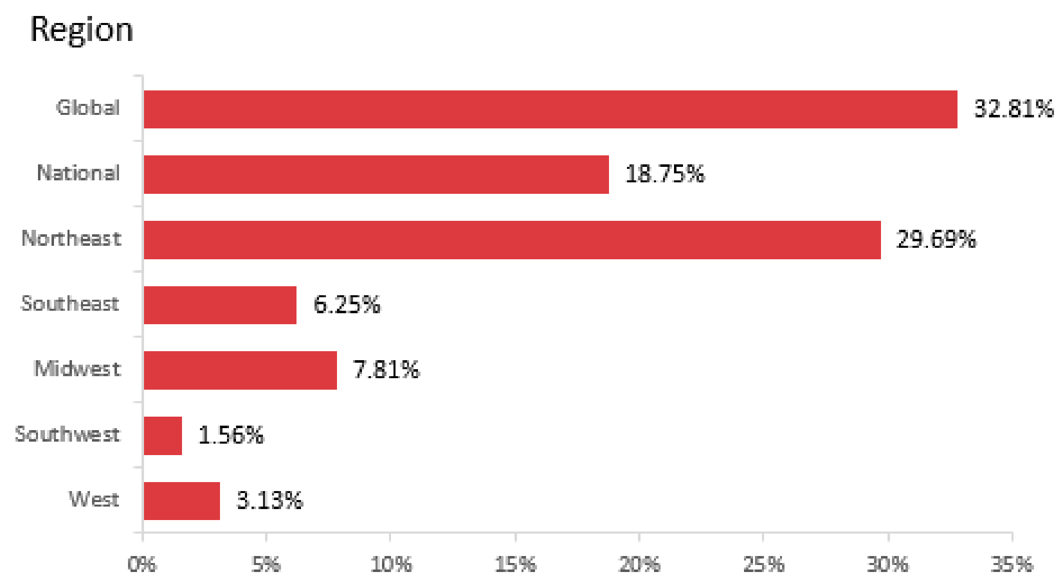
P1 = percentage of answers reporting an improvement

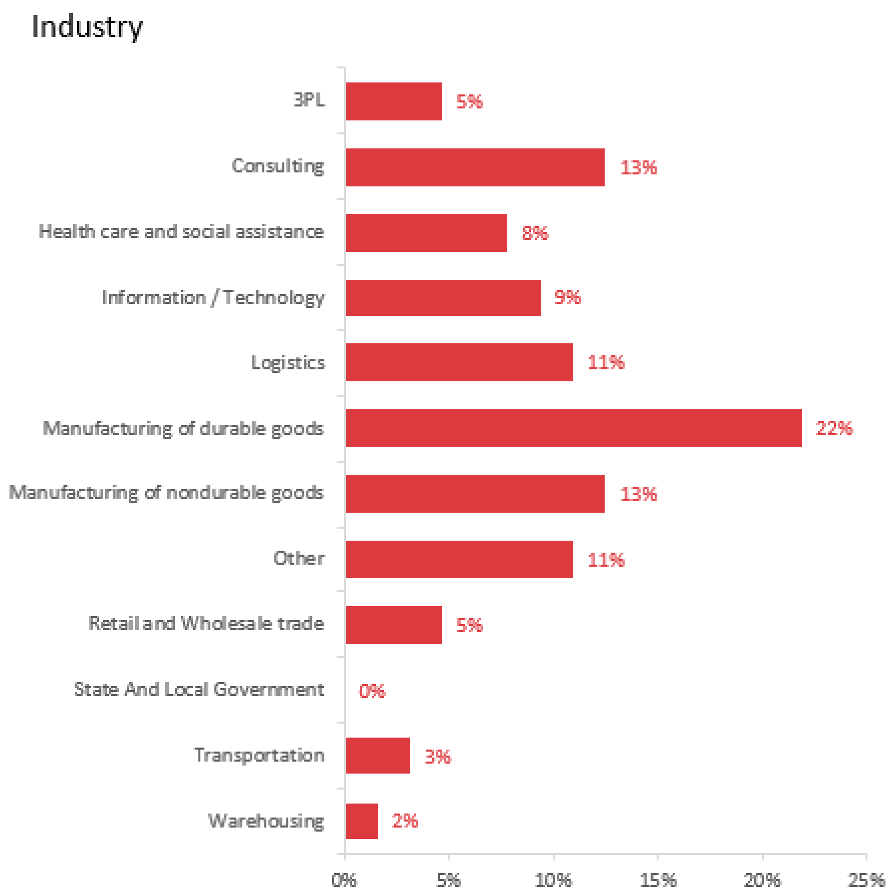
P2 = percentage of answers reporting no change

P3 = percentage of answers reporting a deterioration

Appendix B

Survey Demographics





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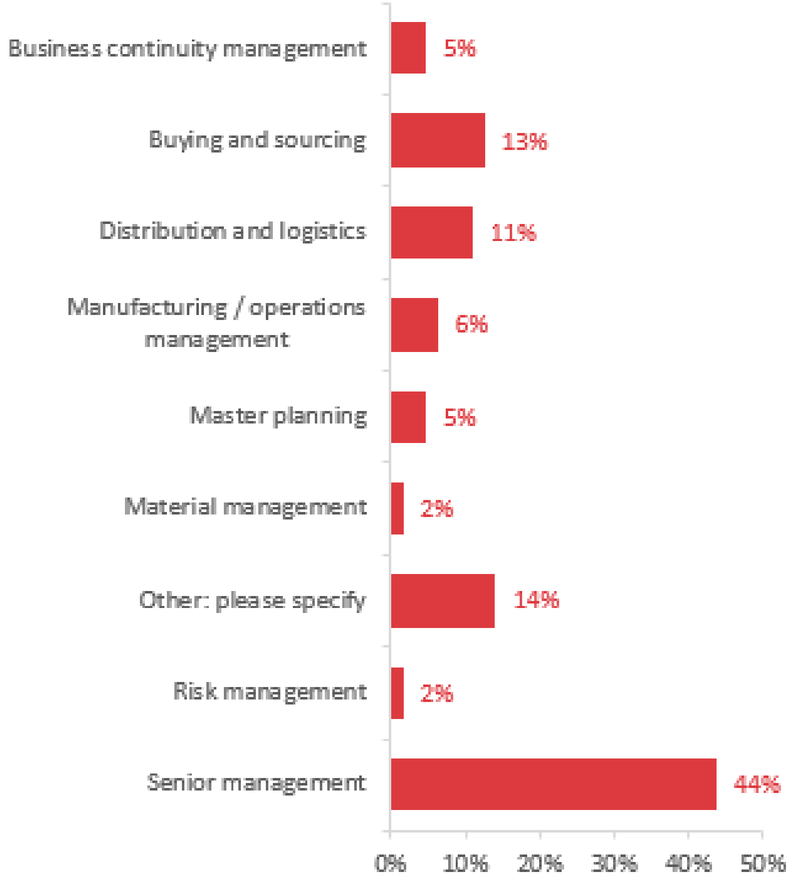
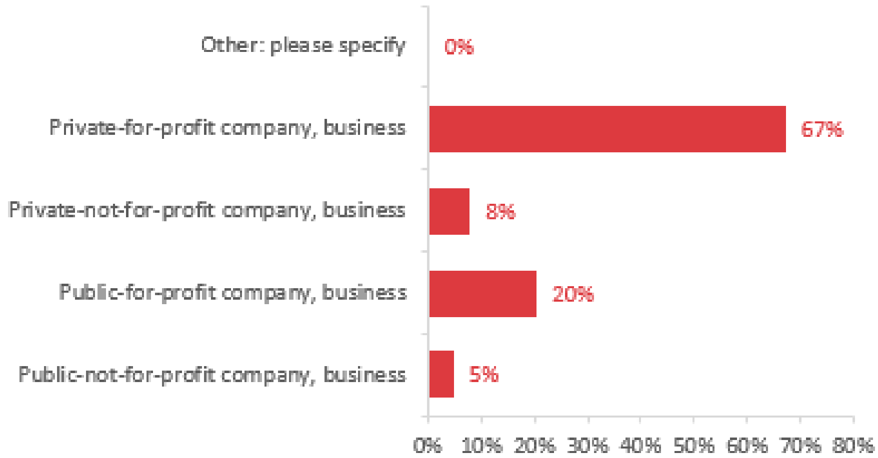
Appendix B
Demographics (continued)

Primary Role



Place of Employment



Appendix B
Demographics (continued)