SUPPLY CHAIN RISK INDEX™ LEHIGH + CSCMP

Lehigh Business Supply Chain Risk Management Index

Quarterly Report

2nd Quarter / 2022

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 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 2nd Quarter of 2022 compared to the risk in the 1st 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 2nd Quarter is 69.95 which is a slight decrease from the 1st quarter suggesting a lower level of risk in the 2nd 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

Transportation Disruption Risk is expected to increase substantially for the upcoming 2nd Quarter 2022 and is the number one concern for supply chain professionals. Interestingly with a score of 89.5, Transportation Disruption Risk has the highest risk index across all risk categories since the creation of the LRMI in the third quarter of 2020. Transportation Disruption Risk has consistently been among the top 3 risk categories but there seems to be greater worries about fuel prices, driver shortage, infrastructure and demand volatility that has made Transportation Disruption Risk the number one risk next quarter.

Risk Type	1st Quarter 2022 Risk Index	2nd Quarter 2022 Risk Index	Trend
Transportation Disruption Risk	85.47	89.50	↑
Economic Risk	88.36	87.00	↓
Cybersecurity and Data Risk	76.72	79.00	↑
Supplier Risk	85.34	78.50	↓
Government Intervention Risk	75.43	76.02	↑
Customer Risk	66.81	64.00	↓
Operational Risk	66.67	58.00	↓
Environmental Risk	60.34	56.50	↓
Quality Risk	63.68	56.00	↓
Technological or Competitive Risk	59.05	55.00	↓
Average Risk Index	72.79	69.95	↓

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.

Four biggest risks in 2nd Quarter 2022

(When comparing across all 10 risks)

1. Transportation Disruption Risk
2. Economic Risk
3. Supplier Risk
4. Cybersecurity and Data Risk

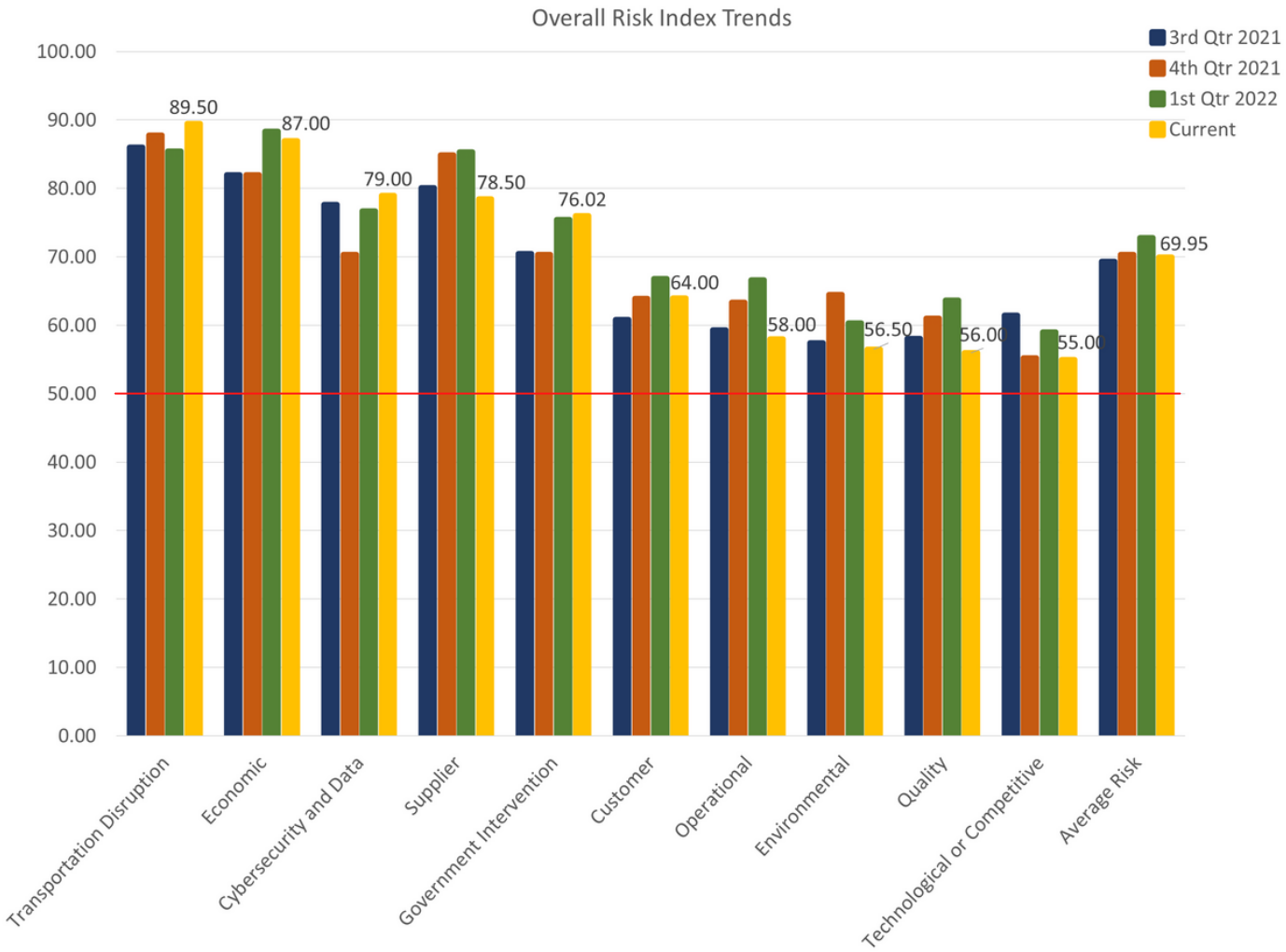
Did You Know?

The Lehigh Business Supply Chain Management Risk Index for the 2nd Quarter in 2022 is

69.95

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.

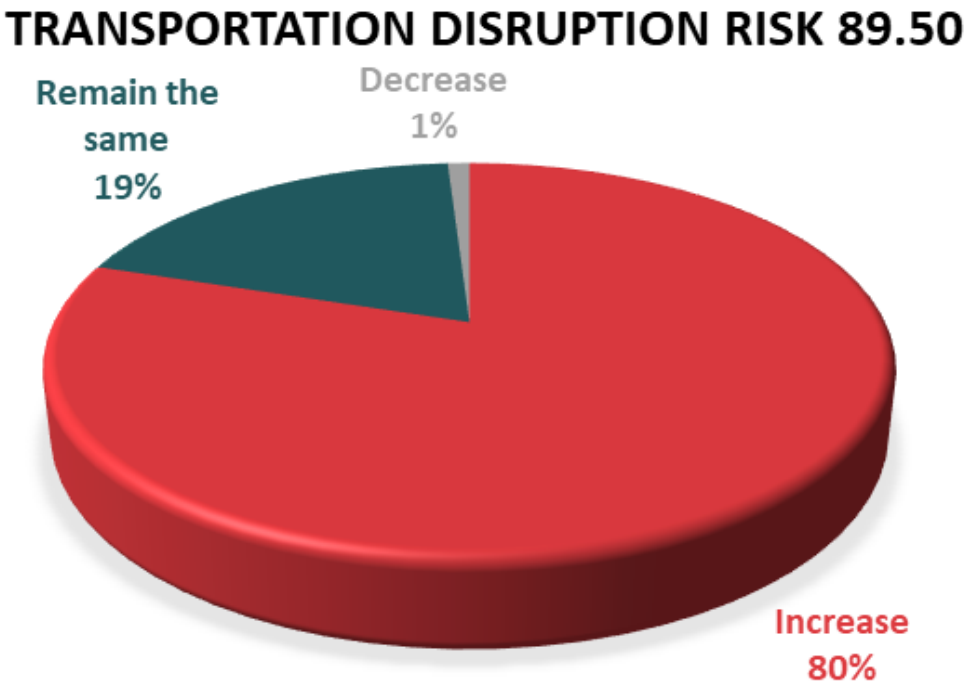


01 Transportation Disruption Risk

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

Selected Comments:

- Demand is unpredictably up; fossil fuel prices increasing; infrastructure conditions worsening; labor shortages affecting all aspects of operations.
- Fuel prices at risk of spike due to decreasing US exploration/drilling and Russian invasion of Ukraine. Driver shortage will continue.
- Costs continue to escalate by double digits.
- Labor at ports, owner operators and political issues will bring more issues and risks.
- High delivery costs just got more expensive. The government has done nothing to ease the cost, so the end customer will bear the burden of that.
- Conflict overseas, current domestic policies around production, and transportation of fuel, and diminished supply will continue to drive fuel prices higher. It is not a driver shortage, so much as an equipment shortage.
- Rise in inventory and fuel/delivery pricing increasing, loosing sales and can't do proper or quick service repairs.
- Already at historically high levels, risk may increase more due to impact of war in Ukraine, Covid, high customer demand volatility.
- Significant increase in fuel and tight transportation market. Product supply lower leading to lower payload and increased expenses.

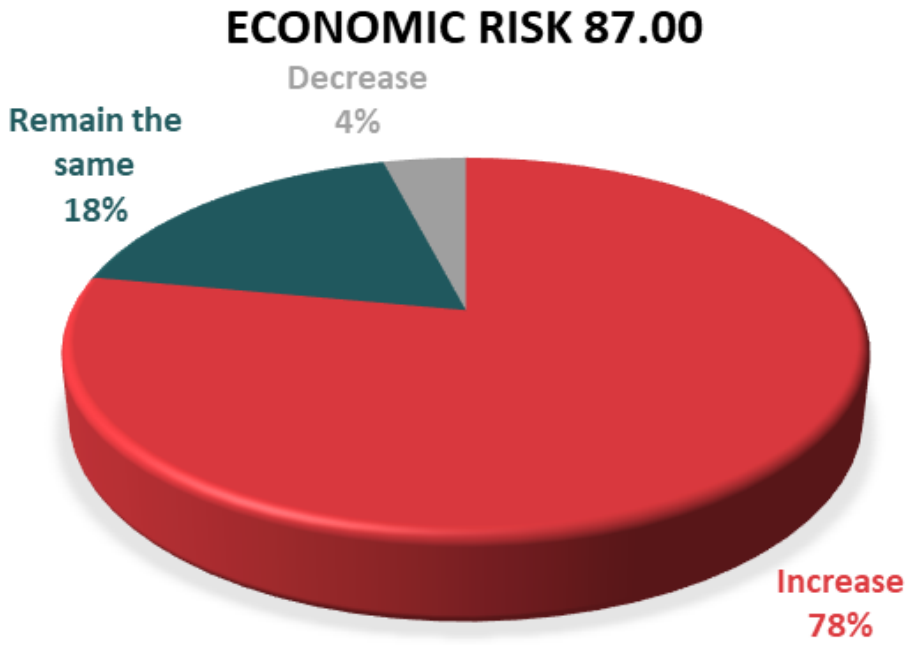


02 Economic Risk

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

Selected Comments:

- Energy and commodity prices likely to continue increasing. Labor shortages will continue.
- War-Russia, lack of domestic oil production, parts, Maintenance Handling Equipment (MHE) and long lead times.
- The stock market may be in for a major correction.
- Inflation will continue to severely impact the economy.
- Still struggle with labor and cost of doing business.
- Inflation is out of control. The price of everything is on the rise.
- Risk of high inflation and scarcity of raw materials along with this causing a recession (especially if the Fed ,overshoots).
- Volatility in energy costs, labor shortages and delivery delays continue to escalate, making projections more & more difficult.
- Increasing energy, price increases, inability to get qualified labor, global impact of Russian invasion.
- Inflation impact. We continue to react to fast increasing operating costs, reduced margins.
- Fiscal uncertainty from commodity prices, Foreign Exchange, cross border financing, cost of money with interest rates is a key risk.
- Already extremely high, but may rise more based on Russia aggression, Covid increases (China), etc.

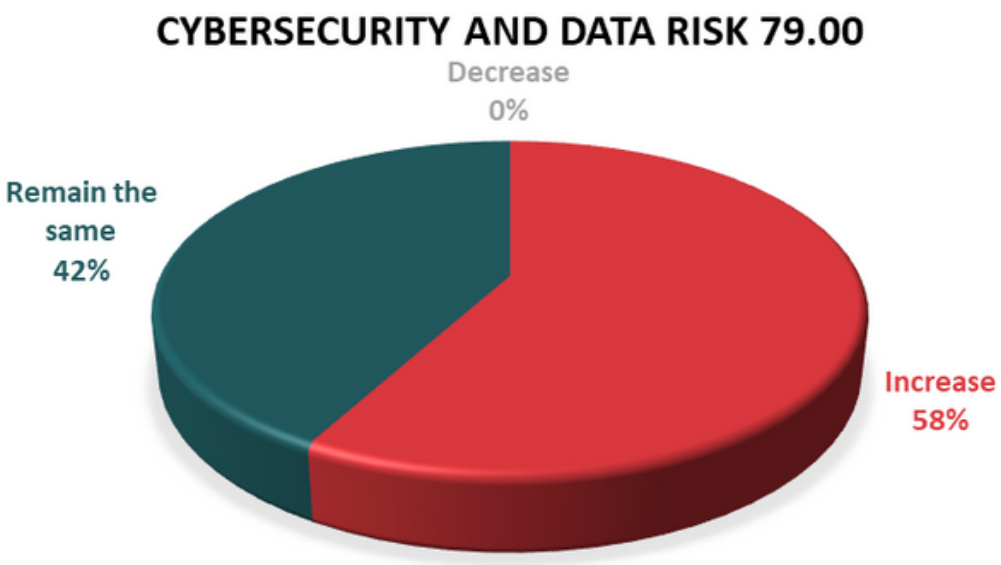


03 Cybersecurity and Data Risk

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

Selected Comments:

- The incorporation of "digital" into supply chain functions has not been met with an equal emphasis on protections.
- Due to modernization of the current application and migration of data to cloud.
- Threats and hacks are growing ever-more sophisticated and frequent.
- Situation in Russia may cause cyber attacks to increase.
- Expect the US, Russia and China to increase their attacks on corporate locations and energy production facilities.
- The situation in Ukraine is a cause for concern on increased cyber attacks.
- Pressure to perform under adverse circumstances plus the recognized value in data and information will require investment in protection and prevention.
- Conflict in Eastern Europe will increase attacks.
- The end goal of cyberattacks is not so much data corruption or data theft, as it is to undermine confidence in systems and create chaos, which results in crumbling productivity.
- I have seen a pronounced up-tick in the amount of malevolent content making it past our first-layer firewalls.
- As geopolitical tension escalate, the threat to Cyber Security elevates.
- We are concerned and protect ourselves against cyber crime. However, the risk seems always to increase.
- There is a heightened risk of cyberattacks as a result of unrest in Europe.
- If we continue sanctions, we might come under threat of cyber attacks.



04 Supplier Risk

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

Selected Comments:

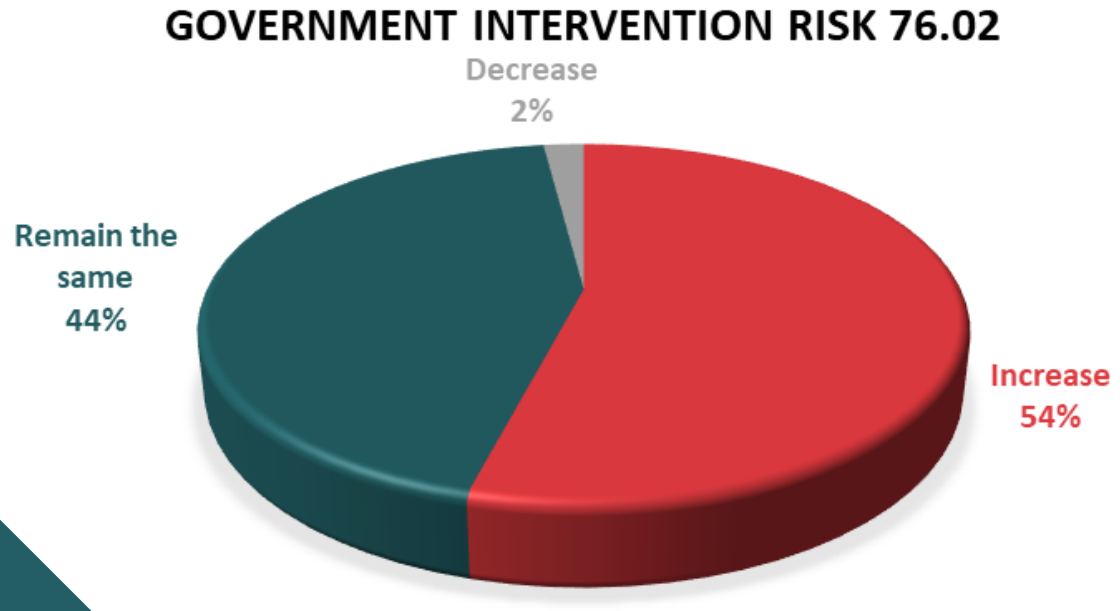
- Diversifying our supply chain partnerships in part to mitigate this very exposure.
- Lost several suppliers over the last two years, forcing us to rely on single source.
- Digital and 3D printing has improved supply whereas geopolitical differences have exacerbated distribution issues.
- China forced labor issues in Xinjiang have emerged.
- The illegal covid-related mandates led to going concerns. Bad policy has increased our risk of sole source suppliers going under.
- Back orders, inflation and quality issues all moving in wrong direction.
- Parts, labor and political intrigue will make the multi-tier supply chain vulnerable.
- Actively reducing the risk through use of Total Time To recover method. Expanding supplier base, finding substitute ingredients, increasing inventory and reducing SKU's.
- ETA's seem to be getting better but hard to find additional suppliers and alternative materials.
- London Metals Exchange canceling nickel trades - price volatility in metals commodities. Ukraine/Russia war impact on metals supply.
- As Vietnam becomes bigger part of the global supply chain there is significant risk.
- Delivery schedule inconsistency continues to prevent projects from moving forward. Furthermore, geopolitical shocks are driving prices to historic levels.
- Shortages and delivery delays should begin to ease, but significant risk continues.

05 Government Intervention Risk

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

Selected Comments:

- Administration regulators desire transformative regulation, but are unlikely to implement much of their agenda.
- The current administration seems to lack the knowledge and fortitude to deal with the economy.
- Bad policy and continuing global wars will increase risk for the foreseeable future.
- The current regime is not pro-business and is staffed with many inexperienced people. The border crisis continues.
- Sanctions in metals space remain relatively unchanged but subject to sanctions either way - US toward Russia or Russia towards US and Europe.
- The current administration has shown a proclivity to restrict that which it does not understand, and this will continue for the next several years.
- Sanctions on Russian Anthracite Coal have increased customer demand.
- Procurement realignment on related international sourcing, and risk of disruptions due to old and newly imposed Tariffs (China, Russia).
- Geopolitical positioning will drive many changes in 2022. Including foreign financial powers leveraging their capital and control.
- Increased trade restrictions related to Russia, or other countries that enable Russia (minor chance this includes China, but in their best interests not to get directly involved).



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:

- Increasing customer base always presents challenges to meet expectations.
- There are plenty of customers, just not enough product to go around.
- Lack of inventory.
- Assuming an increase in customers and changed customer expectations.
- Unpredictable customer demand and difficultly in providing service.
- Passing on pricing is a challenge. Demand destruction or brand switching will ramp up.
- Product substitution can become an issue as input costs increase.
- Hard to predict customer behavior. Determining how much stock to devote to each component is increasingly difficult.
- Prices will have to be increased. It will be harder to move to a competitor because they are raising their prices also as their costs are increasing.
- Facing a lot of frustration from customers who have ordered products with long lead times. These customers are even threatening to change to a competitor.
- This is when a long-term partnership is tested, with transparency and mutual support while sailing through rough times.
- There is always a big increase in business come Spring for me. Will the customer be willing to pay higher prices? Goods are still in short supply and I'm forced to carry more inventory to mitigate those effects.
- Some increase due to resurgence of Covid (ex China), impact of war in Ukraine and possible reduction in customer orders due to supply issues or weakened customer demand (esp in EU).

07 Operational Risk

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

Selected Comments:

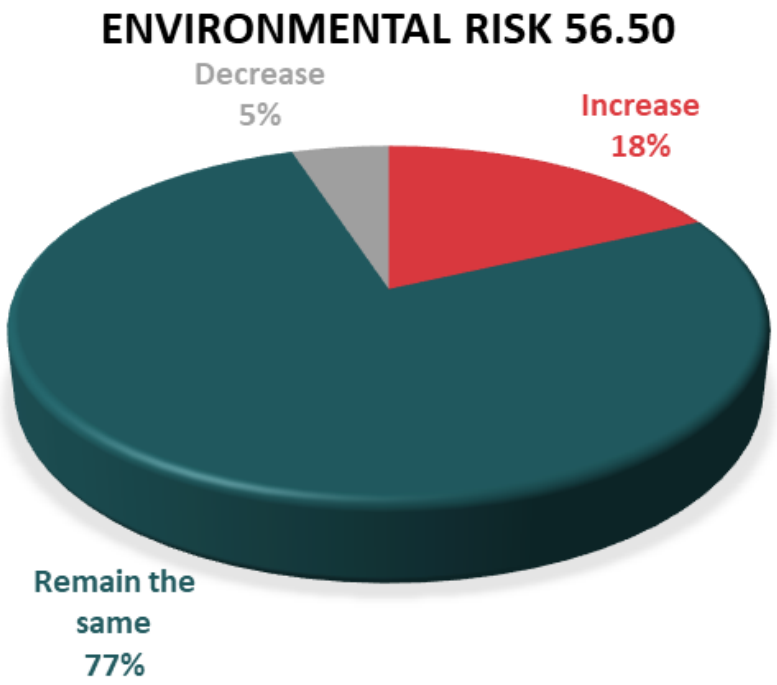
- Operational risks are increasing due to environmental stresses (unpredictable climate changes) and cultural disruptions (war; abject fears; cultural shifts) are the main factors.
- Problems getting maintenance done across production lines. Seeing more downtime due to lack of available machine maintenance techs.
- Increasing cost and labor availability driving increased risk.
- Parts availability, labor and political factors all point to more risk/volatility.
- Made additional capital investment to replace aging equipment.
- Apple has purchased large volumes of chip making capacity, this will impact the already struggling electronics industry. This will cause delivery impact for the next 8 months.
- Require coach drivers and we can't even get any to interview.
- Even though most vendors are American, many companies are foreign made and at risk.
- Small business bankruptcies will make supply chain management more challenging.
- Raw material availability and supplier capacity due to labor shortages are bigger issues right now.
- The ability to acquire and retain staff continues to be among the primary challenges.
- Companies are scrambling to source product from new locations with limited history and track record of success. Priority is to push product out the door, with less concern over quality than there was 2 years ago.
- Our facilities have a business continuity plan (BCP) in place with guidelines in case of disruptions. No unforeseen changes expected in the current business environment.

08 Environmental Risk

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

Selected Comments:

- Uncertain and unplanned.
- People seem to want to blame "climate change" for every environmental issue. As such, it seems that weather events are driving bad policy that will restrict capacity.
- Bad weather is bad for business. Warm and dry is good.
- Global warming is an issue but it is not causing these occurrences.
- There is a trend of increasing extreme weather events.
- Continual gradual improvement on sustainable practices, as part of BCP long-term strategy and business innovation.
- There is always the threat of wet weather and that keeps people from riding their bikes.
- There are always risks of blizzards or hurricanes.



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:

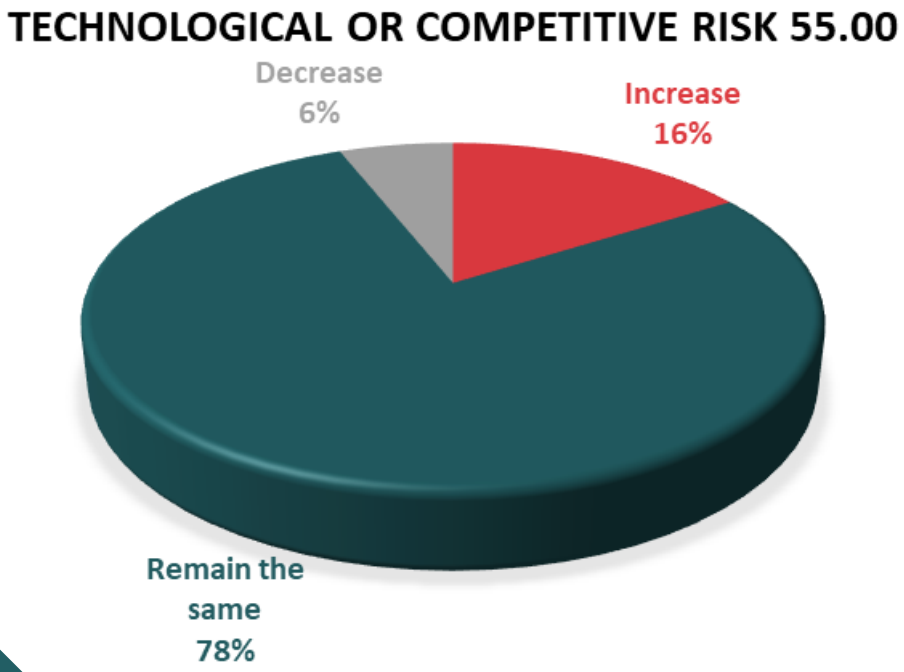
- Supply chain issues are affecting quality with some of our suppliers.
- Internal controls are improving, fewer quality disruptions. Adherence to standards is more consistent.
- Lots of quality problems due to poorer quality supplies and lack of quality control (QC).
- Staff shortages and turnover remain problematic.
- Core sourcing locations will have to be replaced by lessor known providers.
- Standards should not deteriorate and safety issues should improve. Not sure how the "new workforce transformation" is going to play out with respect to product quality.
- Supply challenges and many new employees at suppliers.
- Shortages of labor and materials forcing employees to do more with less, so quality suffers.
- Supply chain disruptions resulting in more quality issues in our industry. Sometimes have to accept inferior items on exception to keep supply chain going.
- Our facilities have a robust QMS in place, ISO 9001-2015 certified, and following 6S-Lean practices. No unforeseen changes expected in the current business environment.
- As we seek alternate suppliers to reduce, unmanageable schedule risk, need to enhance external quality control programs.
- Business increases and usually warranty issues will arise.
- Having issues getting raw ingredients and labor shortage.

10 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:

- In biotech, there is always something new around the corner.
- The three items mentioned are all present. However, it will be years until they can leverage an affect on current supply characteristics.
- We are currently lacking in terms of a modern technology tech stack compared to other players. We are in the process of modernizing our tech stack.
- Technology and the use of robotics is growing exponentially - need to keep up.
- 3D printing, AI and ML and then the Meta verse all talk to change, risk and uncertainty.
- The current economic and ecological environment will hamper new entrants coming into existing markets.
- How our product is made and the materials used is changing a lot.
- No great innovations expected.
- Self imposed regulation means that not everyone is playing by the same rules, because only some of the players abide by those rules.
- Added stress in existing WMS/TMS and overall ERP systems due to the accelerated eCommerce growth (natural, and as response to COVID-19 limitations) combined with new multi-channel EDI/SPS integrated solutions to sustain an increasingly complex supply chain flow and end-to-end visibility.
- Following the condominium collapse in Surfside, FL, our industry has seen an influx of fledgling Engineering companies surfacing in Central Florida.



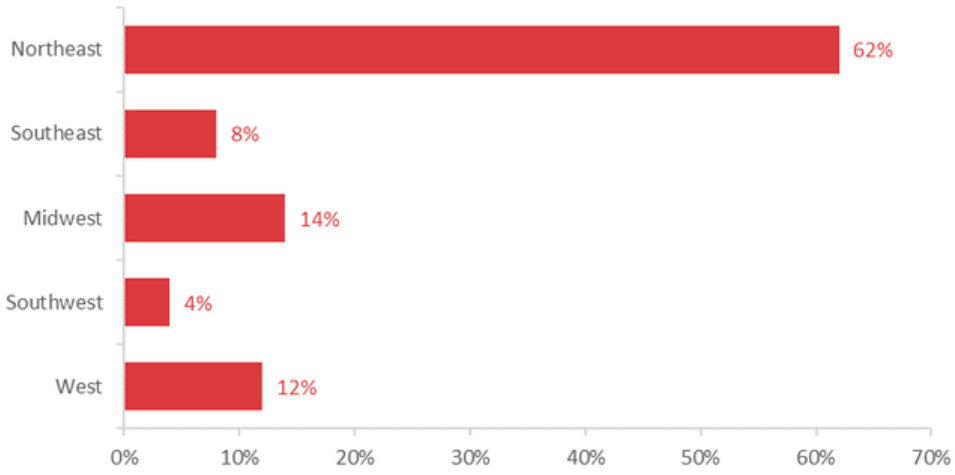
Appendix A
Risk Index Summary

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

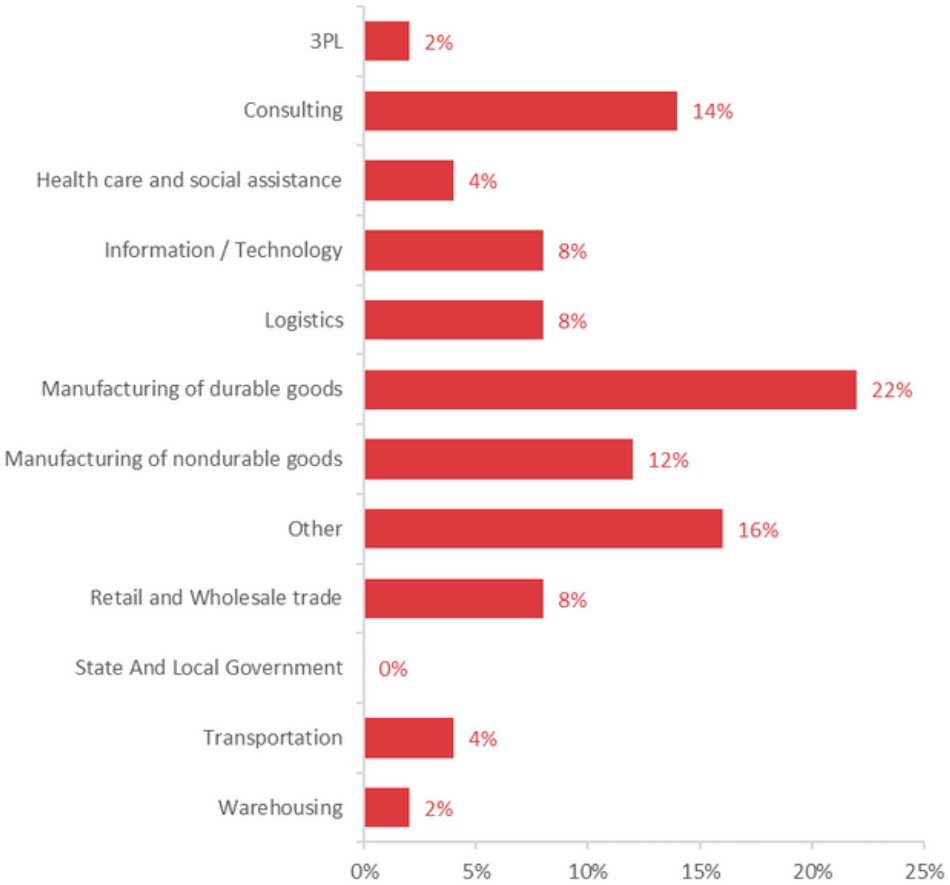
The further the number is from 50 greater the level of risk
LBRI = (P1 * 1) + (P2 * 0.5) + (P3 * 0)
P1 = percentage of answers reporting an improvement
P2 = percentage of answers reporting no change
P3 = percentage of answers reporting a deterioration

Appendix B
Survey Demographics

US Region



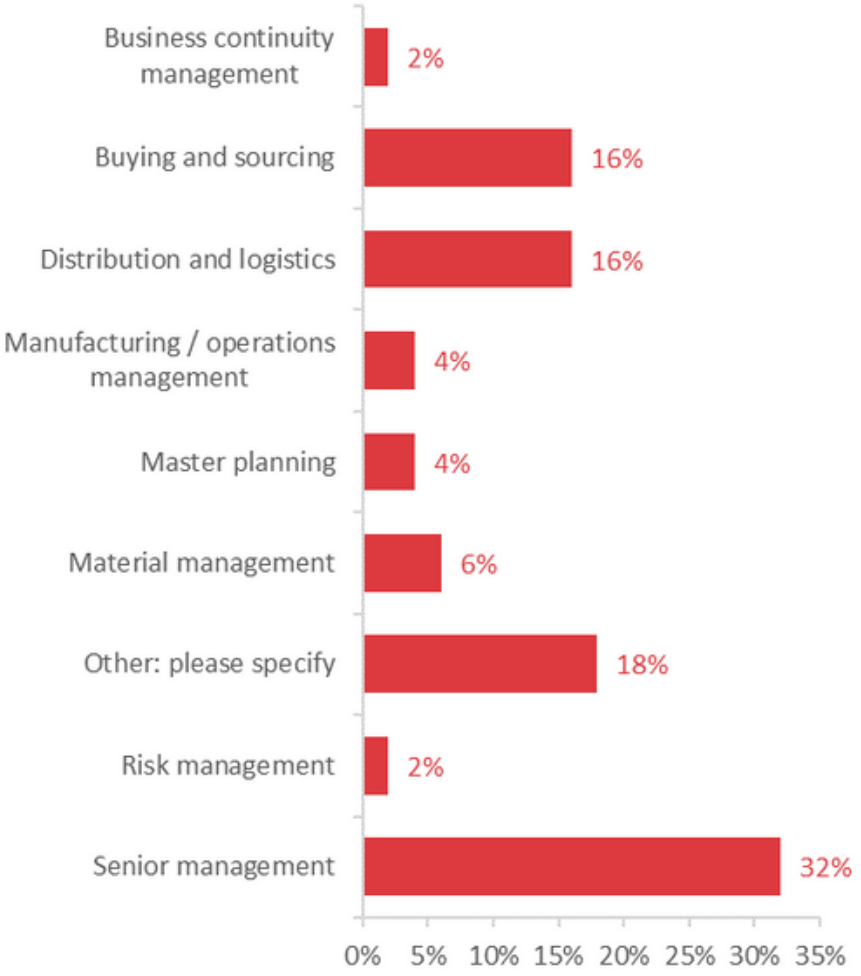
Industry



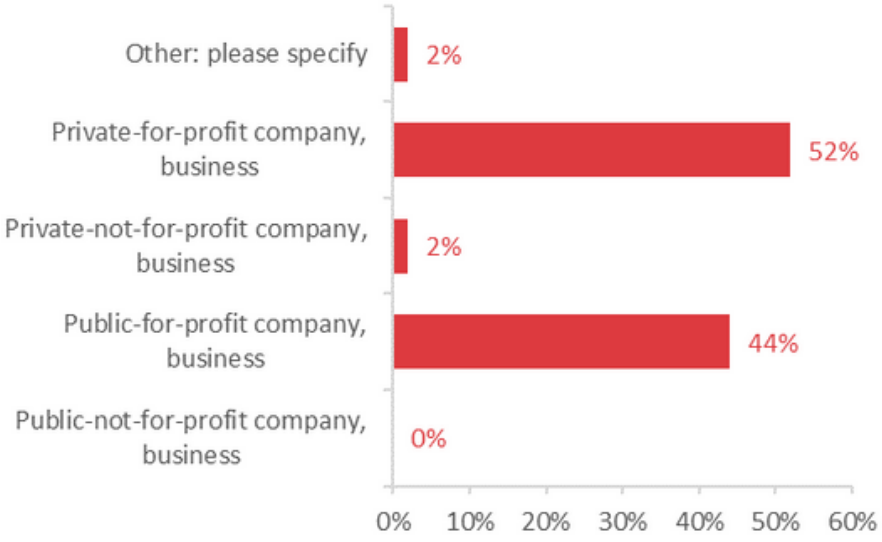
Appendix B

Demographics (continued)

Primary Role



Place of Employment



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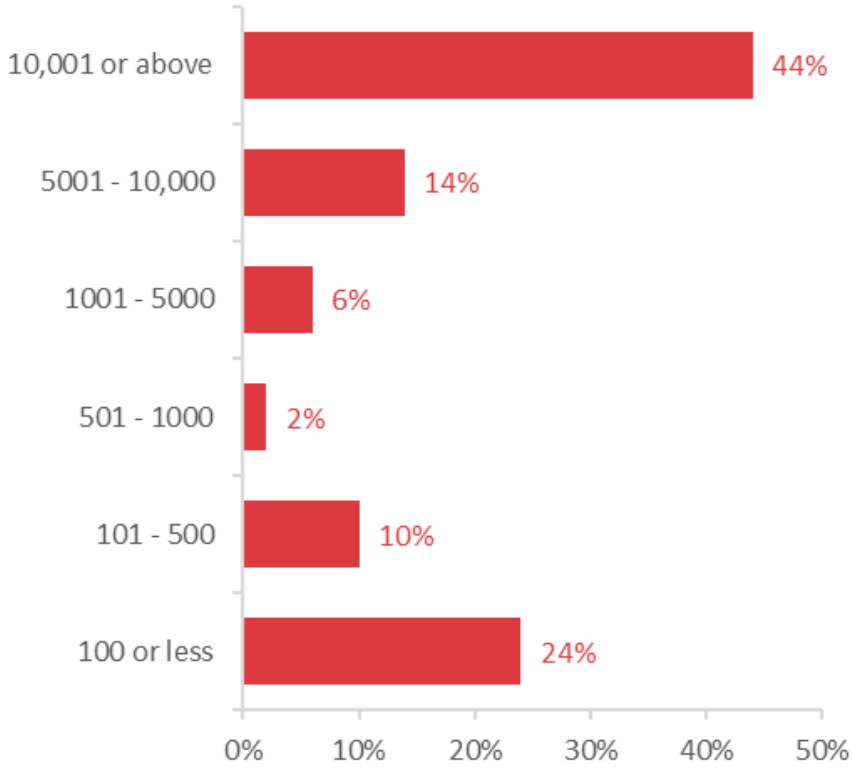
Appendix B

Demographics (continued)

Company Employee Amount



Work Experience