Lehigh Business Supply Chain Risk Management Index

Quarterly Report

4th Quarter / 2021

LEHIGH UNIVERSITY | College of Business

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 4th Quarter of 2021 compared to the risk in the 3rd Quarter 2021 would likely increase, remain the same or decrease for 10 different 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 4th Quarter is 70.35 which is an increase from the 3rd quarter suggesting an even higher level of risk in the 4th Quarter.

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 4th Quarter 2021 and is still the number one concern for supply chain professionals. Supplier Risk has increased substantially as well as it has moved from third place to second overall while economic risk has stayed the same as the 3rd quarter. When reviewing the survey data and comments from the respondents, it is clear that COVID-19 has impacted transportation and manufacturing both domestically and internationally.

Risk Type	4th Quarter Risk Index	3rd Quarter Risk Index	Trend
Transportation Disruption Risk	87.79	86.02	↑
Supplier Risk	84.88	80.12	↑
Economic Risk	81.98	81.99	↓
Cybersecurity and Data Risk	70.35	77.64	↓
Government Intervention Risk	70.35	70.50	↓
Environmental Risk	64.53	57.45	↑
Customer Risk	63.95	60.87	↑
Operational Risk	63.37	59.32	↑
Quality Risk	61.05	58.07	↑
Technological or Competitive Risk	55.23	61.49	↓
Average Risk Index	70.35	69.35	↑

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 4th Quarter 2021

(When comparing across all 10 risks)

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

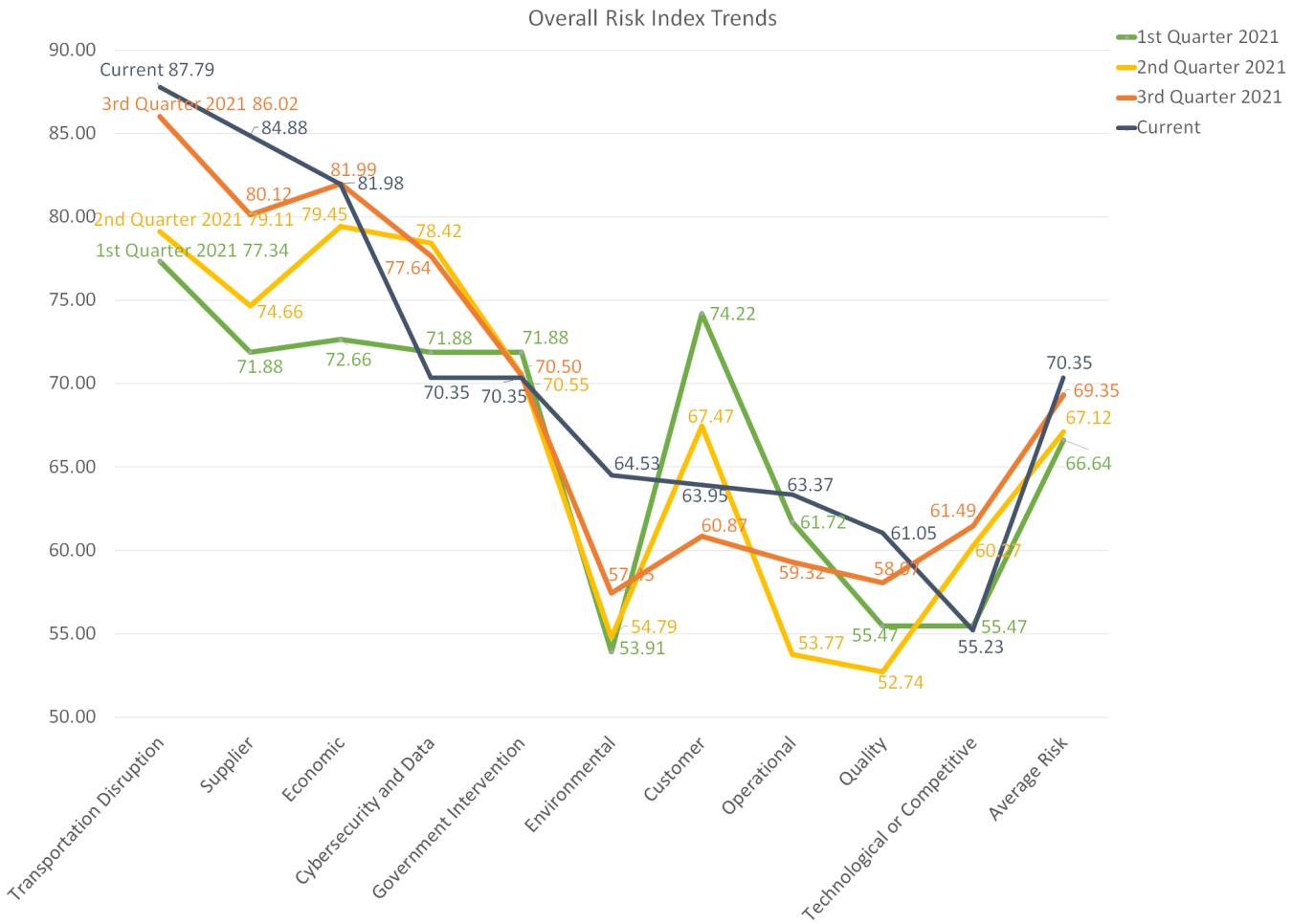
Did You Know?

The Lehigh Business Supply Chain Management Risk Index for the 4th Quarter in 2021 is

70.35

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.

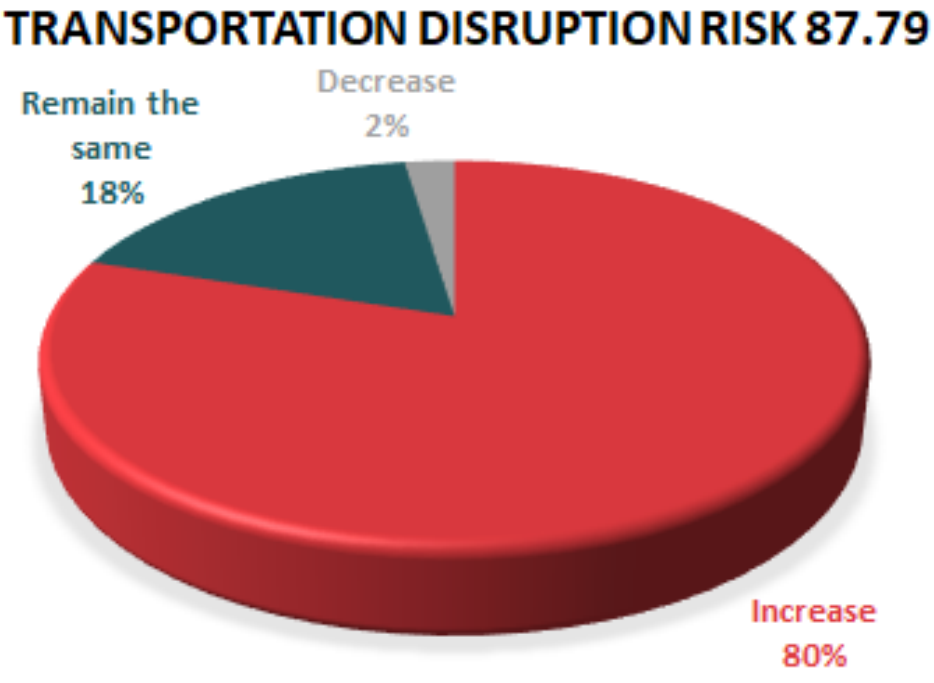


01 Transportation Disruption Risk

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

Selected Comments:

- Fuel prices and labor shortages remain the main risks.
- Pandemic driven sea container shortage, trade imbalance (Brexit), fuel cost increasing, driver shortage globally, Covid-19 driving port closings.
- Since 2018, international freight rates went up 600%. Domestic Rates hit the highest cost level beating the previous peak by almost 50%. The infrastructure bill has the potential to remove 20% of truckers from the logistics/freight activities and move them to the construction industry. 2023 and 2022 will be worse then 2021.
- Port congestion with Q4 holiday supply already above normal in August and September. Expecting the congestion to get worse in Q4.
- Dramatic increase in demand for all modes of transportation, combined with a scarcity of supply has caused a dramatic increase in the cost of securing transportation capacity.
- DOT rule changes have put the entire transportation industry in a constant state of "disruption."
- Domestic ground shipping and container freight from Asia are huge risks to our business right now.



02 Supplier Risk

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

Selected Comments:

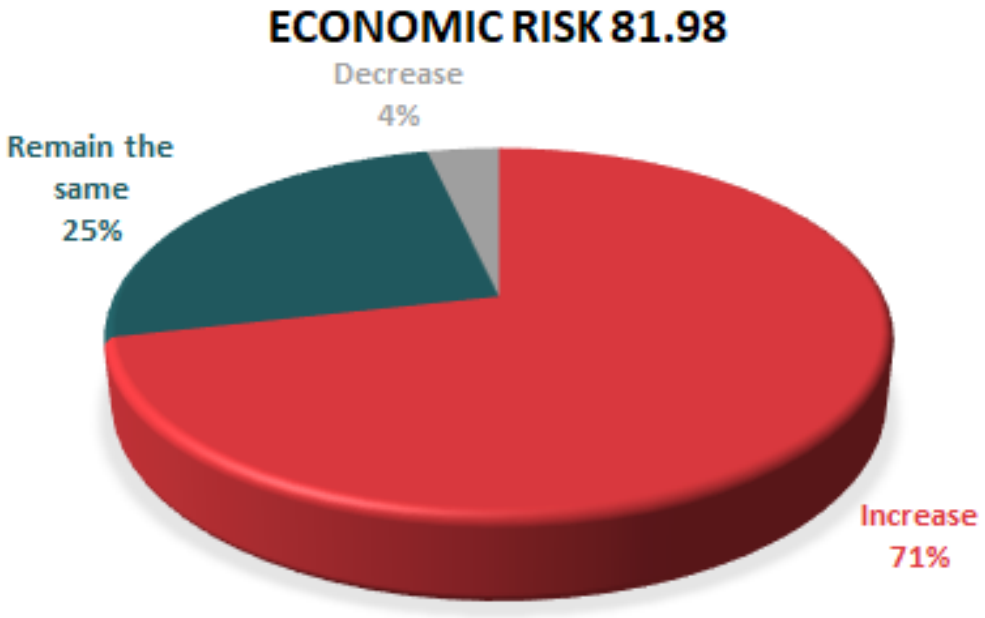
- Price uncertainty. Companies must pass on some or all of the increasing costs.
- Massive shift to on-line learning means we have had to make major technology infrastructure purchases. PPE with this new delta surge is again become scarce.
- Constraints in electronics will generate creative solutions outside approved suppliers.
- As we further diversify our supply base to address supply shortages, the risk associated with new suppliers will increase.
- As we go into post pandemic and money starts to seize up and free governmental money goes away I see many suppliers starting to close doors. Add to this the mass movement of employees across organizations will further decimate capabilities of suppliers.
- Numerous disruptions from low inventories, sudden demand increase from pandemic rebound, and labor shortages.
- Lack of supply due to ramp down from COVID, inflation risks are higher, and global supply issues.
- Vaccine mandates and travel restrictions are causing higher risk.
- The pandemic and political unrest has put the entire global supply chain at risk.
- Lead times continue to lengthen, delivery uncertainty is also increasing, the price to transport products are at an all-time high.

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:

- Labor shortages are a huge problem, shipping delays on technology, our purchases are 3 years out right now for electrical power and we haven't felt a crunch there yet.
- Labor/material shortages plus possible increased personal and business income taxes.
- Global labor shortage. Governments paying people too much to stay home for too long.
- Higher diesel prices leads to significant increase in fuel surcharges
- Inflation is going to kick our butts big time. It will be double digit and then some.
- Congress is already looking at how they can redefine it.
- Inflation, labor shortages
- Labor shortages expected to improve as more state governments stop Federal unemployment. More people will return to work even if remotely.
- Inflation and the geo-political environment has led to great instability for the near term.
- Labor shortages, rising energy costs - worldwide supply chain issues will continue to increase leading to - increasing inflations costs, dramatically reducing service throughout, limiting supplies and increasing product shortages will become the new normal - any major global shocks will just magnify. On-shore/Near-shore Supply Chain management will be seriously considered/implemented to remain competitive/in business in coming years.

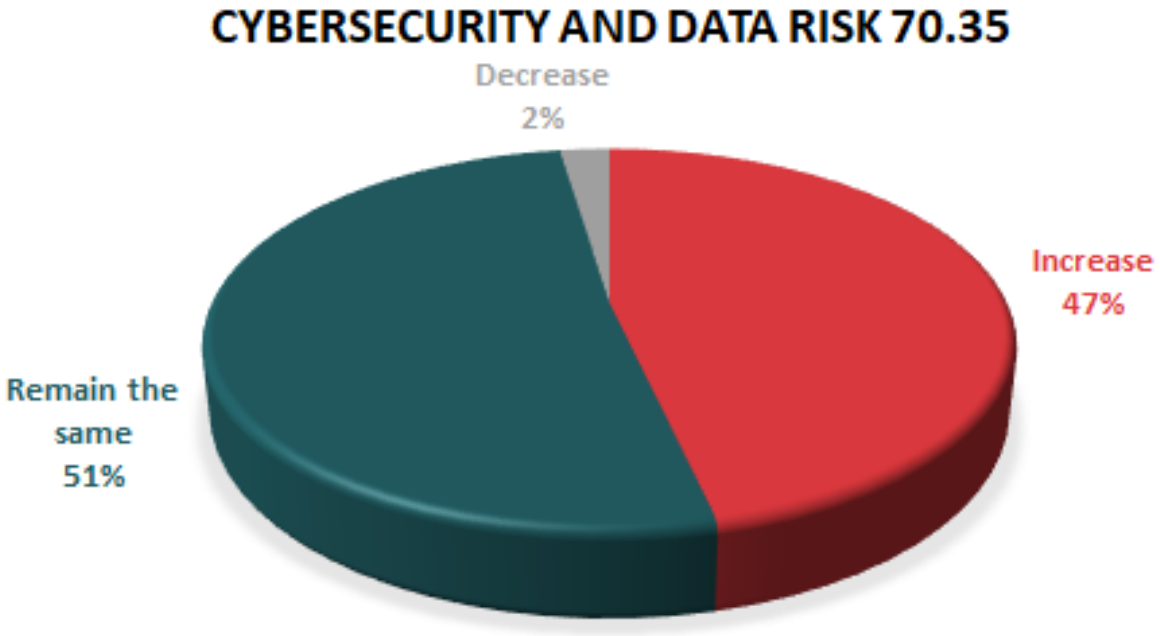


04 Cybersecurity and Data Risk

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

Selected Comments:

- Schools are at high risk for cyber-attacks due to increase tele-work of students, and lower security measures.
- Financial Services have a lot of data risks. Always cyber-threats.
- Data theft attempts typically go up around holidays.
- An increase in Ransomware attacks could be a potential threat to business operations.
- Technology companies becoming the new data risk of the future. There will be a cost to get data and cost to play that will be ever increasing. Currently have ransom ware attacks but already seeing technology companies holding data hostage for higher and higher cash values.
- As "interrupters" become more sophisticated, compromising of the data and information that we rely upon has been more of an issue.
- I'm not sure if the rate of attacks is increasing or if the bad guys are after different assets or inflicting greater damage. Money and IP continue at the top of the list to guard.
- We are getting more requests to help companies with how to protect against cybersecurity and data risk.

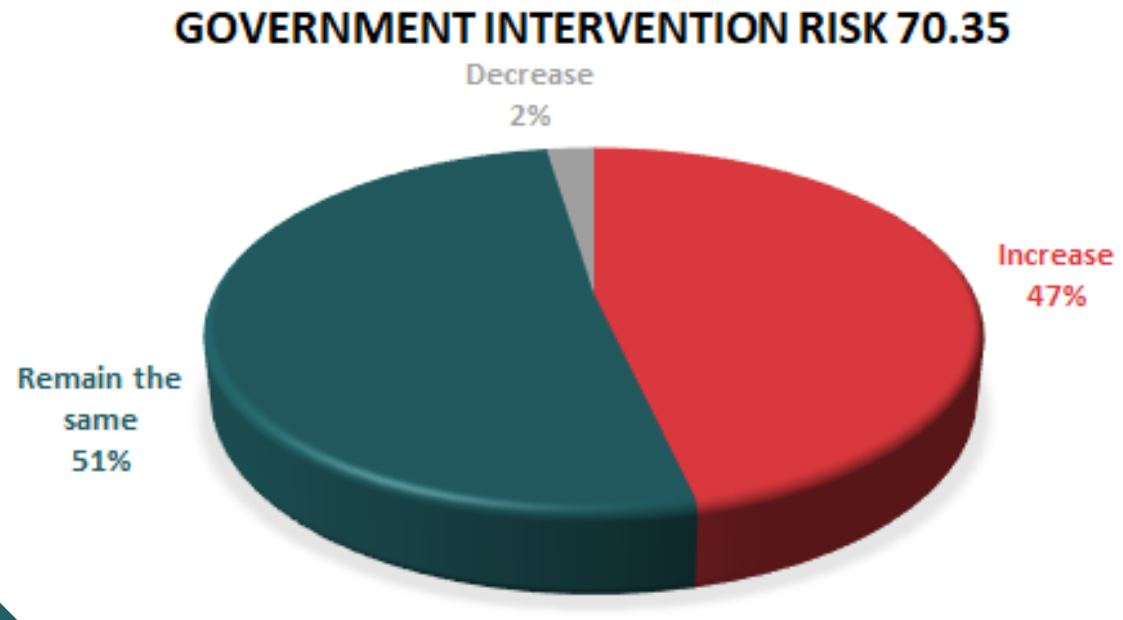


05 Government Intervention Risk

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

Selected Comments:

- Biden administration favorable bias toward labor unions is bad for businesses and the economy, possibility of increased taxes. Will depend on whether the $3.5 Trillion legislation passes.
- The more they meddle the more life get screwed. The infrastructure bill seems good on the surface but dig into it and start asking where is the money going?
- China tariffs not expected to go away in 2021.
- The US government is in a mess. It has become so divisive and focused on how do I "hurt" the other side vs what will make our country stronger and provide our citizens a healthy and fulfilling life
- Current administration policies are creating/adding increased government controls and requirements on business operations.
- Vaccination Mandate.
- Increased risk to pharma/device resulting from changes to Medicare rules for price negotiation.
- Dems in control; salivating over putting controls and taxes on everything. Companies will pass the increased costs to consumers who will slow down buying.
- Potential Federal tax code changes could adversely affect our product.

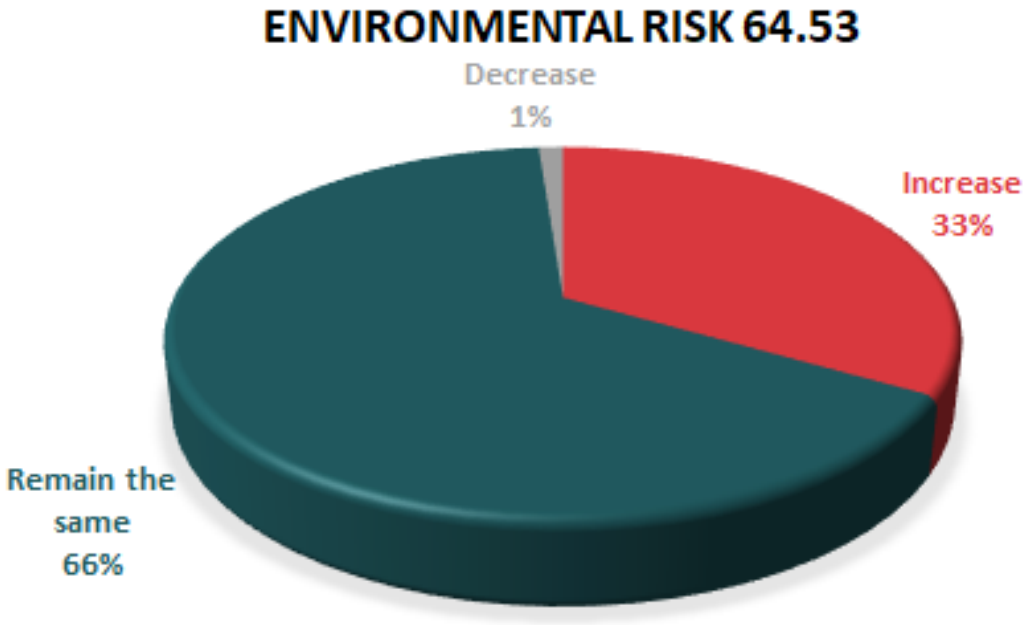


06 Environmental Risk

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

Selected Comments:

- Wildfires continue, hurricane Ida, etc.
- Hurricane season.
- Look at the recent storms!
- Only as these events disrupt our business.
- Several extreme weather events.
- Our global supply chain assumptions are being tested and shown to be fragile to emerging environmental trends.
- Since our product is a web-based software with home-based staff, we are not impacted by weather/disasters to the same extent as companies that produce a physical product or have on-site staff. However, with recent storms and flooding could cause staff members as well as customers to be without power. Oddly, though, natural disasters and extreme weather actually increase the number or orders we receive, since individuals whose homes have been damaged need to have the damage assessed and our software is used for that purpose.
- Increased risk of extreme weather (events similar to hurricane Ida).



07 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:

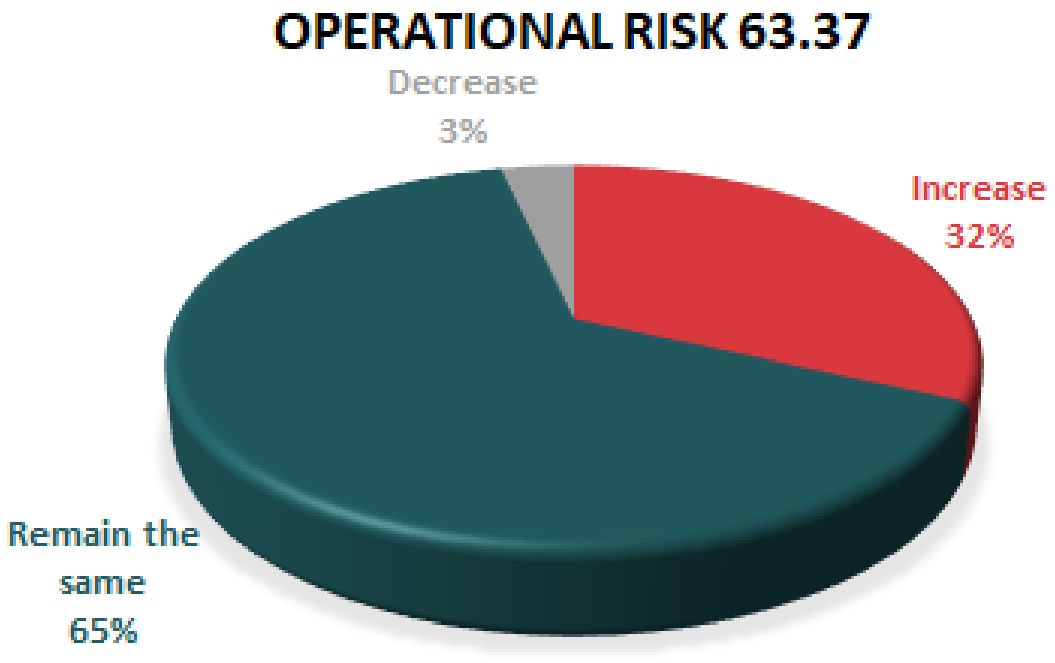
- Many companies will model Ford Motors and others by using a custom ordering process to reduce inventory and control delivery times. That was popular 50 years ago!!
- We are stretched thin if we cannot scale up our workforce we will be unable to provide important services.
- Current customers have increased forecasting and are pre-buying stock for Q4-Q2 2022.
- Material availability in market will drive forecast fluctuations.
- Supply shortages as the result of labor shortages is creating customer dissatisfaction increasing the risk that some customer will seek other suppliers.
- Customers are being crushed by costs. This is going to have huge long term impacts.
- "Prediction" has become more difficult. More folks are feeling that what we have to offer, they can perform themselves.
- E-Commerce customers expected to have increased supply expectations with faster delivery demands.
- Customers are going to switch to whatever supplier can get them materials.
- Consumer buying patterns have changed.
- Ongoing risk to changes in customer demand of product due to pandemic.
- Customer expectations have increased dramatically over the last 5 yrs.

08 Operational Risk

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

Selected Comments:

- Supply chain issues and shortages increases risks due to decreased availabilities.
- Labor shortages and COVID blip have adverse quality impacts.
- Supply Chain has been severely impacted by COVID and Chip shortage. Experiencing 2 -3 month delays, and do not expect it to get better until Q3 2022.
- Constraints on electronics market will drive high demand, counterfeit parts through broker buys will likely increase.
- Since we are a "software company", the return of business activity has reduced our risks.
- Vaccine mandates are resulting in employees across multiple supply chain industries resigning and are limiting the ability of firms to rehire.
- Weather patterns and natural disasters are becoming increasingly more common. This has an impact on our entire supply chain.
- Major operational risk is access to labor. Risk will increase if OSHA enacts a workplace rule requiring COVID vaccination and/or testing is enacted. Already operating 10 - 20% short of required number of associates.
- Additional internal capacity and additional site added to the network to reduce this risk.
- Assuming COVID does not get worse, as short staff and short cuts will likely increase.

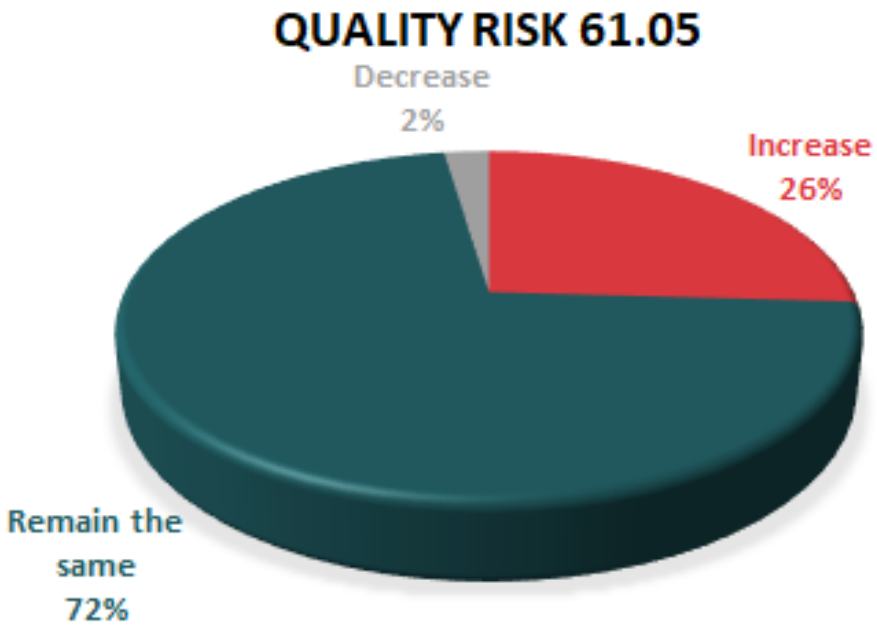


09 Quality Risk

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

Selected Comments:

- I believe quality risk will increase because of more rapid turnover/ changes in the workforce. Design and product quality especially since on boarding/ training of new personnel impacts those areas quickly.
- How does the challenge of getting labor impact quality - as shortage of staffing may drive short cuts in safety, quality testing and drive companies to reduce testing.
- Assuming COVID does not get worse, as short staff and short cuts will likely increase.
- As the supply chain in the Far East remains unpredictable at best, I see us having to shift to new manufacturing partners which always introduces risk.

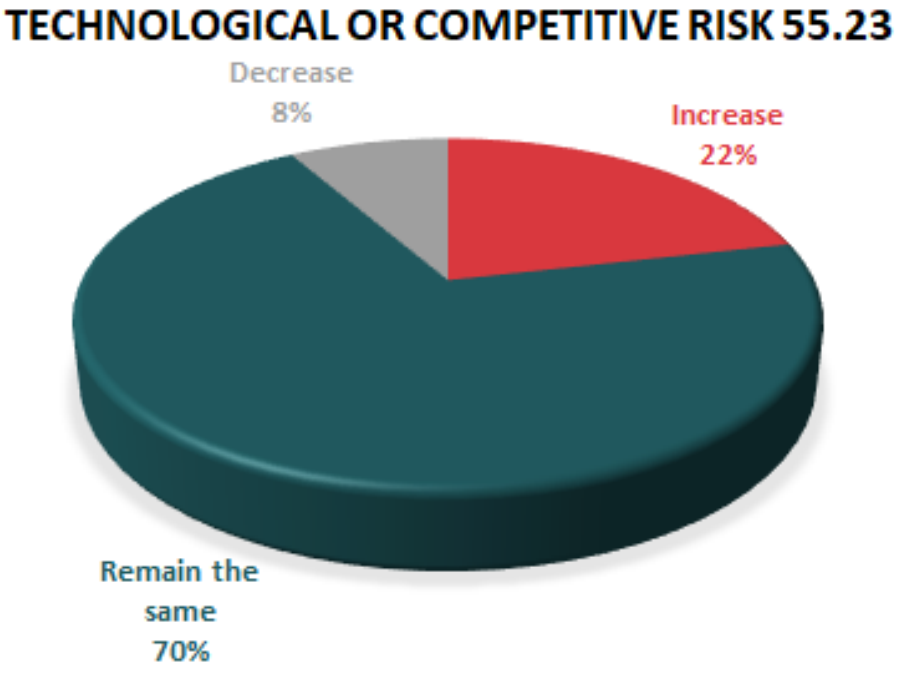


10 Technological or Competitive Risk

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

Selected Comments:

- Technology is supposed to be beneficial but also at the same time it is becoming a bigger and bigger burden. Many organizations are expending hundreds of thousands of dollars a year just for the perceived benefits of what technology might assist with. In reality it often has added more cost than it has reduced.
- We need to become both current on and expert in the new knowledge and new technology.
- One competitor has received significant VC funding, putting them at an advantage.
- We have long product life cycles... ag sector will be disrupted but nothing to worry about for the 4th qtr.
- I do believe energy related technology will be coming much faster but not for at least 3 years.
- Key supplier contract was finalized in third quarter, assuring our ability to remain price competitive into the foreseeable future.



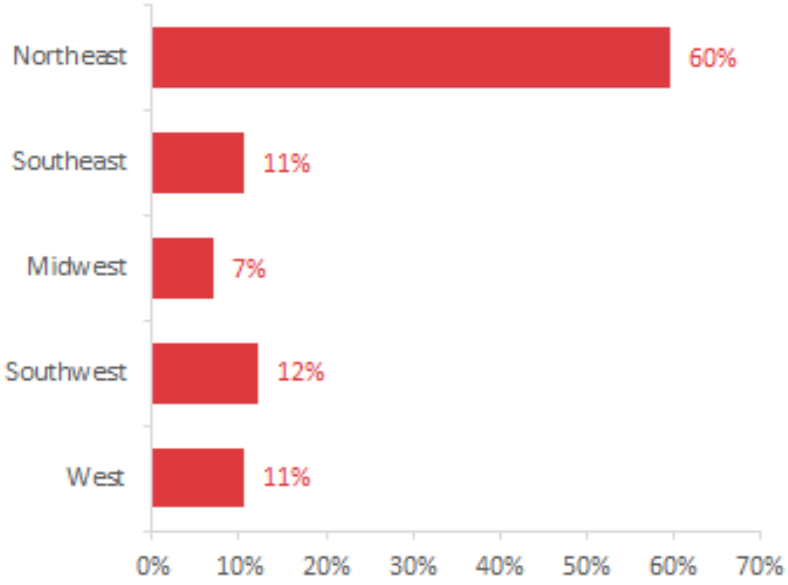
Appendix A
Risk Index Summary

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

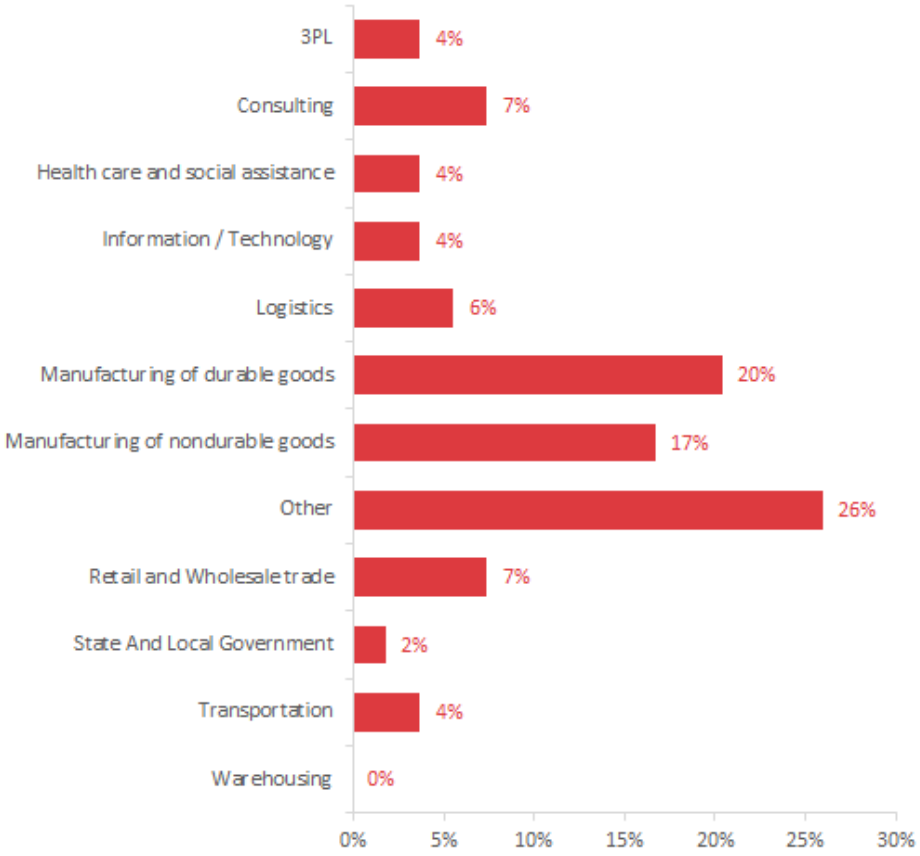
The further the number is from 50 greater the level of risk
LBRI = (P1 * 1) + (P2 * 0.5) + (P3 * 0)
P1 = percentage of answers reporting an improvement
P2 = percentage of answers reporting no change
P3 = percentage of answers reporting a deterioration

Appendix B
Survey Demographics

US Region



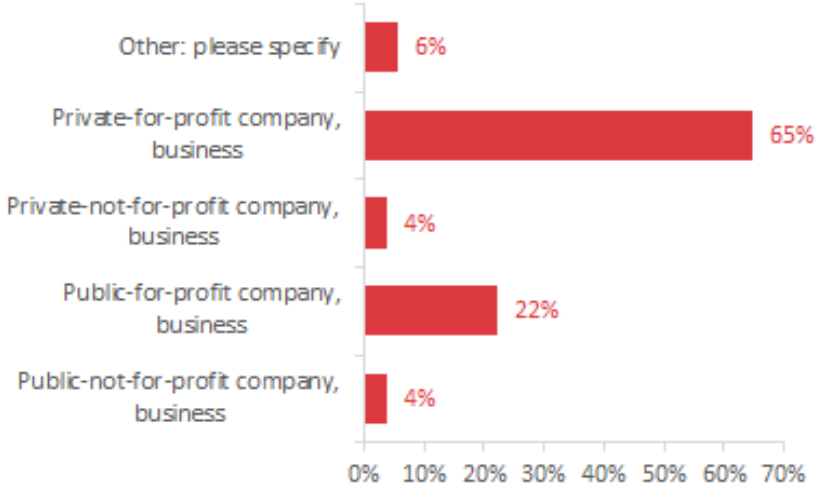
Industry



Appendix B
Demographics (continued)

Primary Role

Place of Employment



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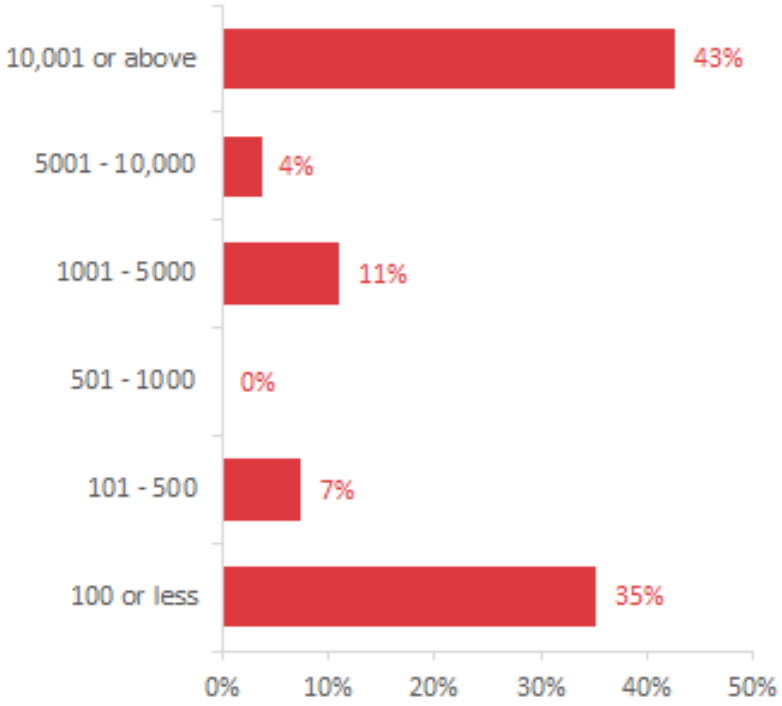
Appendix B

Demographics (continued)

Company Employee Amount



Work Experience