



Lehigh Business Supply Chain
Risk Management Index

Quarterly Report

2nd Quarter / 2021



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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' rate the likelihood that the risk in the 2nd Quarter of 2021 compared to the risk in the 1st Quarter 2021 will 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 is 67.12 suggesting an increased level of risk in the 2nd 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.



Overview

Risk Type	Current Risk Index	Last Quarter Risk Index	Trend
Economic Risk	79.45	72.66	↑
Transportation Disruption Risk	79.11	77.34	↑
Cybersecurity and Data Risk	78.42	71.88	↑
Supplier Risk	74.66	71.88	↑
Government Intervention Risk	70.55	71.88	↓
Customer Risk	67.47	74.22	↓
Technological or Competitive Risk	60.27	55.47	↑
Environmental Risk	54.79	53.91	↑
Operational Risk	53.77	61.72	↓
Quality Risk	52.74	55.47	↓
Average Risk Index	67.12	66.64	↑

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 2021

(When comparing across all 10 risks)

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

Did You Know?

The Lehigh Business Supply Chain Management Risk Index for the 2ndQuarter in 2021 is

67.12



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.

Risk Type	Current Risk Index	1st Quarter 2021	4th Quarter 2020	3rd Quarter 2020
Economic Risk	79.45	72.66	78.26	79.89
Transportation Disruption Risk	79.11	77.34	69.60	77.27
Cybersecurity and Data Risk	78.42	71.88	72.13	69.89
Supplier Risk	74.66	71.88	74.38	75.00
Government Intervention Risk	70.55	71.88	70.43	70.11
Customer Risk	67.47	74.22	70.66	81.81
Technological or Competitive Risk	60.27	55.47	58.26	54.55
Environmental Risk	54.79	53.91	59.13	64.20
Operational Risk	53.77	61.72	60.00	66.48
Quality Risk	52.74	55.47	56.80	55.68
Average Risk Index	67.12	66.64	66.97	69.49

The top 4 risks in each quarter are highlighted using the following colors scheme

- 1st Rank
- 2nd Rank
- 3rd Rank
- 4th Rank



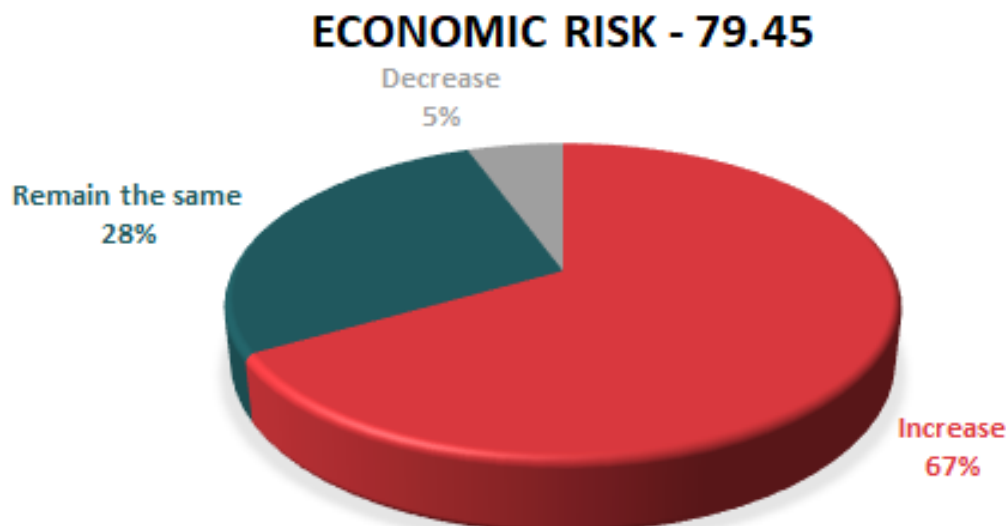
01 Economic Risk



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

Selected Comments:

- Commodities are on the rise, and COVID restrictions are lengthening transit times at borders.
- Remains at a high level, especially labor shortages, commodity prices, and border delays.
- I am seeing a labor shortage and lack of people willing to work in a warehouse environment due to Covid.
- Energy costs for sure - commodities - yes - labor shortage - probably not.
- Vaccines are showing the light at the end of the tunnel.
- Hiring will be a challenge.
- Capital costs will probably rise. Labor demands will increase. Health issues will increase
- Cost of real estate & limited supply of real estate (warehouse space) in desirable areas of the county (near key small parcel hubs).
- Commodity pricing and labor shortages are major concerns.
- Paying an extra \$300 a week in unemployment furthers the issues of not being able to get people to come back to work.
- If \$15 minimum wage goes through, labor costs and availability could be an issue.



02

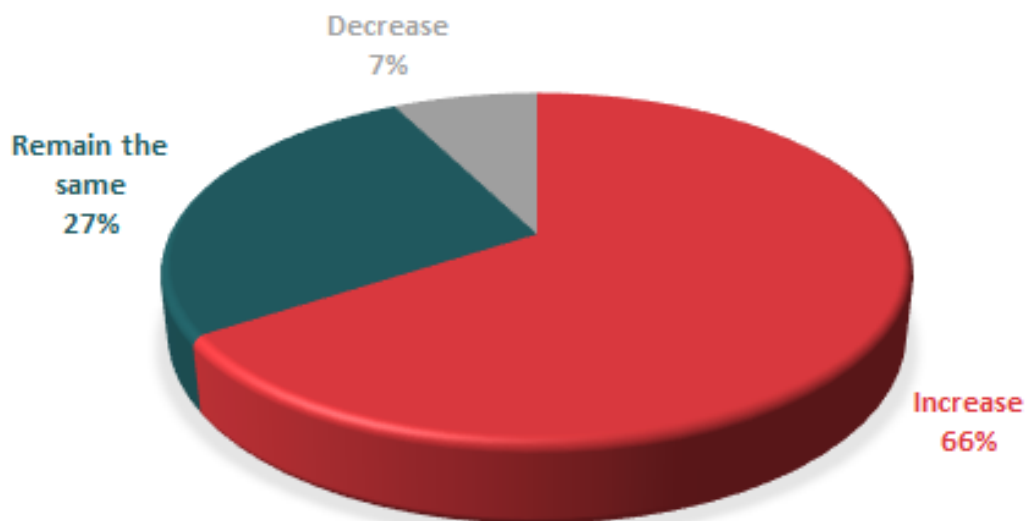
Transportation Disruption Risk

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

Selected Comments:

- Cargo on commercial flights is at risk due to decreasing routes and inconsistent commercial flight schedules.
- Local, State and Federal government leaders have no plan to provide the infrastructure needed to support transportation and warehousing growth.
- Continued port congestion on the west coast is driving up costs and making lead times unreliable.
- Fuel prices are steadily rising, the driver shortage remains acute, and infrastructure is in decline throughout the US.
- I expect labor conditions to improve, which will reduce risk.
- Fully expect fuel price increase and driver shortages.
- Shipping delays of 3 to 8 weeks on inputs.
- Every transportation mode is experiencing disruptions, leading to the Bullwhip Effect.
- With the continued driver shortage and capacity shortage in trucking, it's likely that shipping costs will continue to surge before they eventually level off.

TRANSPORTATION DISRUPTION RISK - 79.11



03

Cybersecurity and Data Risk

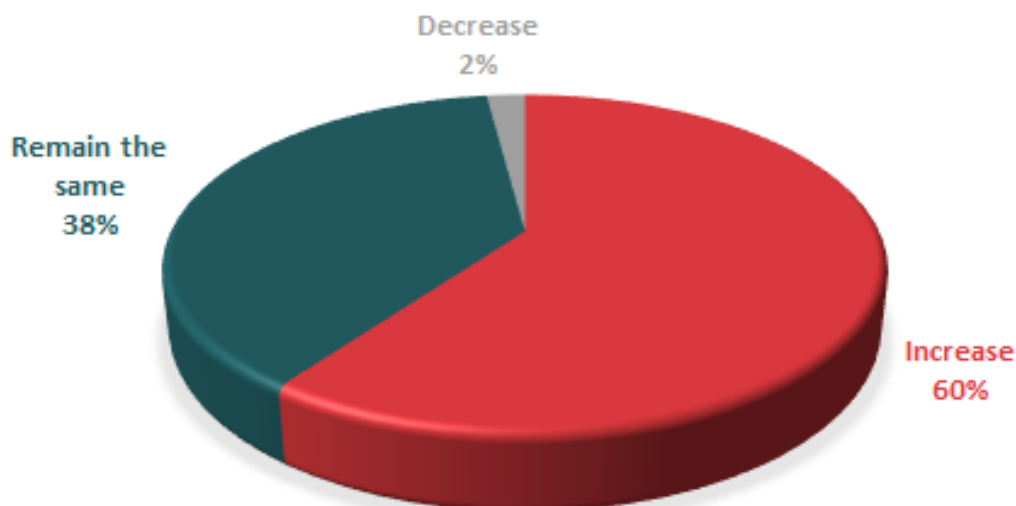


Some examples are: cyber-attacks, data corruption, data theft, system viruses, hardware and software issues and security platform controls.

Selected Comments:

- We need to stay diligent in keeping up to date on cybersecurity with employees.
- Continued work from home order for office staff means more work done in less secure locations.
- A number of transport firms in the US and Canada were targeted and hit with ransomware in Q4, and there is no reason to think it will stop.
- Any firm with data is a target but especially midsize companies that may not have the sophisticated systems to protect from these attacks.
- Not just our company being penetrated, but third-party tools we use can be vulnerable.
- We are reducing exposure to Internet-based communication and using dedicated internal networks.
- The number of attempted breaches continues to increase.
- We need to decouple as much as we can from global networks, especially the power grid.
- Software issues have been rising due to a decline in software manufacturing QA as they push releases out faster and faster.

CYBERSECURITY AND DATA RISK - 78.42



04 Supplier Risk

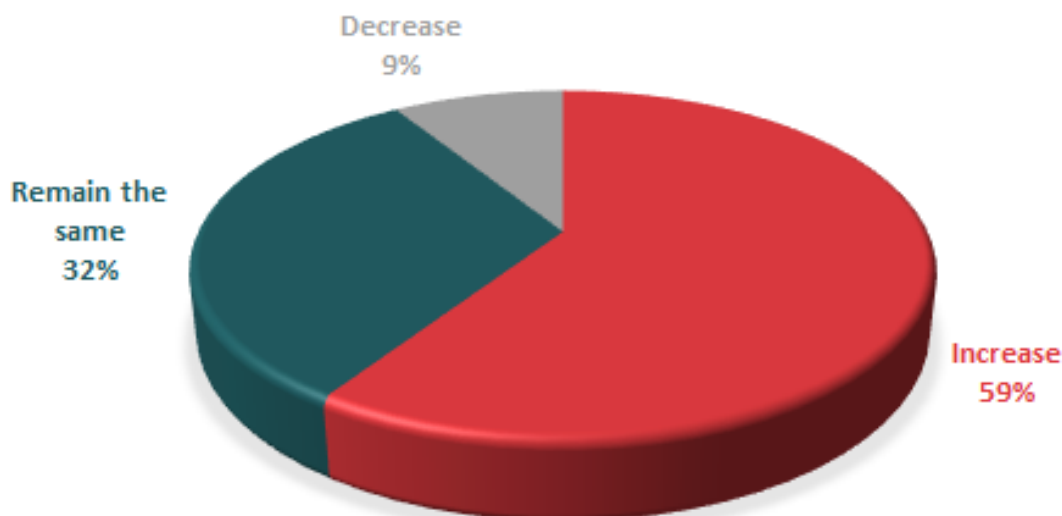


Some examples are: single/sole source supplier, suppliers from one geographic location, supplier quality issues, price volatility and counterfeit products.

Selected Comments:

- Several of our smaller suppliers may go out of business if the market doesn't rebound.
- COVID-19 infection of the workforce remains a supplier risk.
- Massive delays in raw parts and continued port congestion are causing problems.
- Hopefully, pandemic impacts begin to lessen so suppliers can get back on their feet.
- Supplier risk continues to be increasing especially around the fear of counterfeits entering our supply chain.
- We're having more difficulties obtaining supplies in a quantity and quality expected and delivered when expected.
- We have taken steps to offset supplier risk by buying supplier capacity and building some vertical integration capacity.
- The lack of computer chips has caused us to accelerate our orders leading to greater risks.
- Team building with outside vendors helps mitigation of these supplier issues.
- Capacity issues and price increases with key suppliers.
- Lead-times continue to increase by significant margins.
- Ongoing Port issues in California and wood pricing/supply are ongoing issues.

SUPPLIER RISK - 74.66



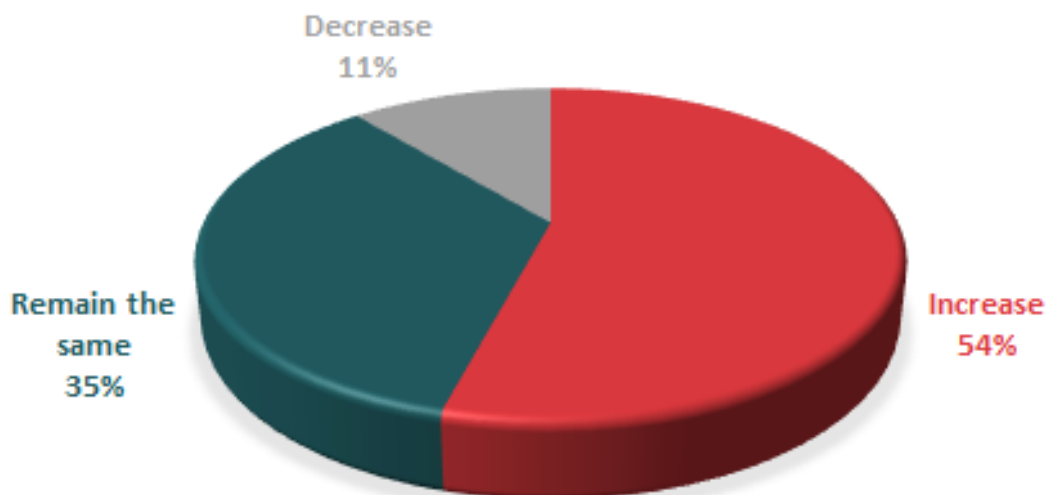
05 Government Intervention Risk

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

Selected Comments:

- New administration will resolve trade wars.
- The Biden administration has already issued executive orders to reverse progress made in trucking regulations.
- Expect a gradual decrease with the Biden Administration (more in favor of free trade, less likely to announce major tariffs without warning).
- We strongly expect the current administration at the federal level to continue to interfere with private enterprises.
- There could be more regulation and tariffs, but nothing as disruptive as last tariff disputes with China.
- It is clear that the Biden Administration isn't walking away from Trump China tariffs
- Little visibility to minimum wage increases.
- Potential risk associated with rare earth elements used in permanent magnets and exposure to Chinese tariffs.
- Tolls, Tariffs, Taxes are all on the increase.
- With the new administration, I expect more taxes and regulations.
- Labor shortages will be worse in the short term due to the "rescue" plan as people get paid not to work.

GOVERNMENT INTERVENTION RISK - 70.55



06 Customer Risk

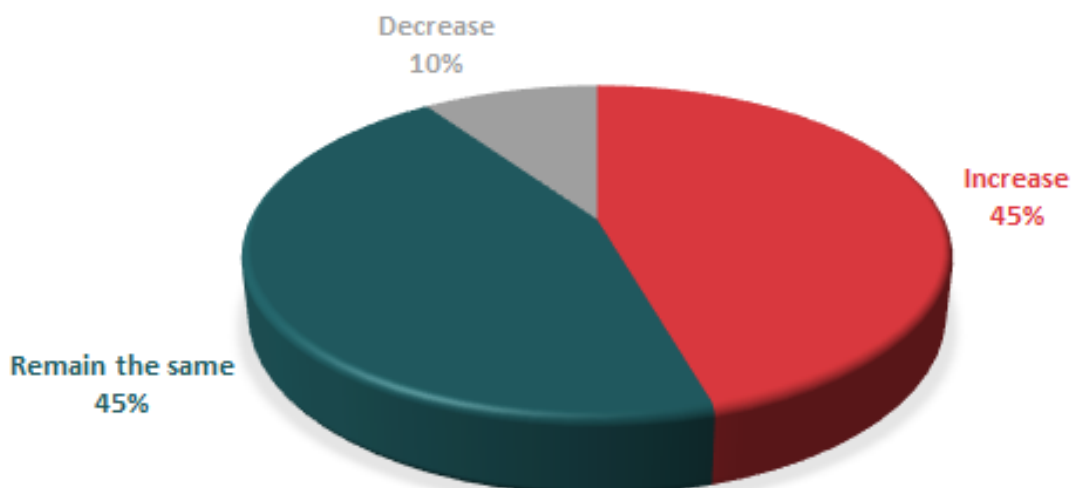


Some examples are: fast changing customer demand, easy to lose customer loyalty, changing customer base demographics, hard to predict customer behavior and hard to service customer.

Selected Comments:

- Demand variability due to Covid.
- Customer's usage patterns are failing to meet forecasts
- Expecting online sales to grow from 20% to 30% leading to more customer switching
- Vaccine distribution increases expected to bolster consumer spending and unleash consumer savings from the last year.
- Low inventory in stores creates lost sales
- Recession and recovery timing is impacting customer plans for expansion.
- Until the world returns to "normal", there is a risk consumers will conserve money/finances.
- Contrary to published data, we are seeing an across-the-board increase in pricing in almost all areas
- Customer demand will increase as we emerge from COVID.
- Customer loyalty risk has decreased.
- Customers are desperate for products, price and quality are taking a back seat.
- Most businesses are changing their business models, especially their travel plans and locations of production sites.
- Relationships are becoming less important, and cost (not service) continues to play a larger role.

CUSTOMER RISK - 67.47



07

Technological or Competitive Risk

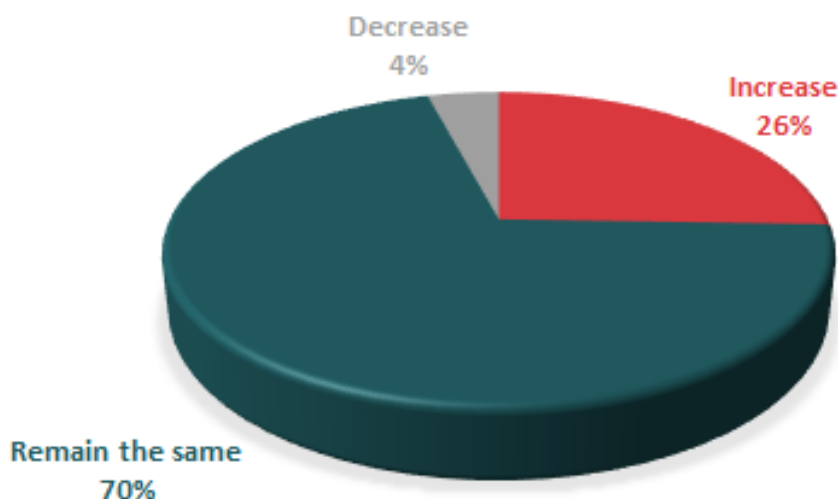


Some examples are: disruptive or replacement technologies, introduction of new competitor firms and ineffective or non-existent regulation for competitors.

Selected Comments:

- IP theft and counterfeit products are increasing.
- With the acceleration of the digital age, it is forcing companies to update their tech, which is a huge capital investment.
- More digital solutions disrupting niches of the marketplace.
- Lack of supply is dominating everything.
- Unexpected competition and alternate products enter our market unexpectedly.
- High tech, low volume contract manufacturers continue to increase in competition.
- Technology and competitor risk are high, but I do not expect these to change significantly in the next quarter.
- Regulations remain a thicket that no one, including the government, can see through or administer.
- Staffing & wage pressures require investment in technology. Lengthy ROI.
- Pandemic has accelerated implementation of digital technologies, e.g., DLT, AI, IoT
- Is technology really worth it? Maybe/Maybe not!
- We do a lot of automation.
- Bottom-line goals may drive alternative sourcing.

TECHNOLOGICAL OR COMPETITIVE RISK - 60.27



08

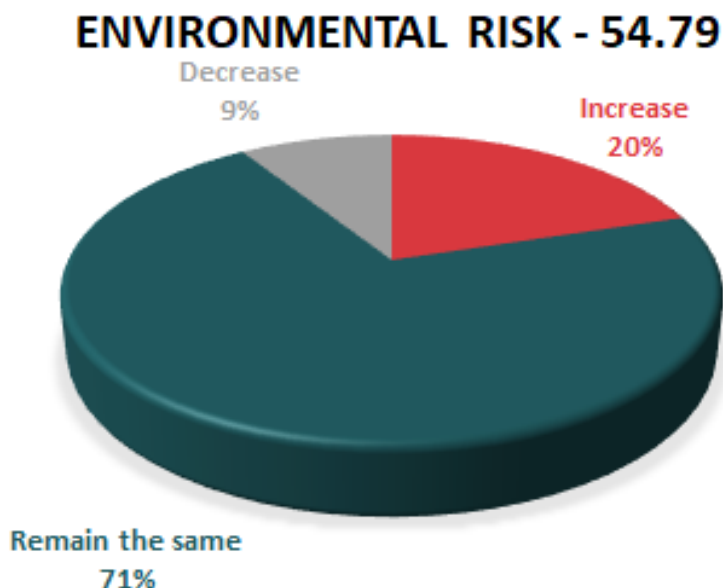
Environmental Risk



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

Selected Comments:

- The recent Texas freeze has already caused innumerable issues in this regard.
- Not only are environmental incidents becoming more frequent but also effecting larger geographic areas and are not as localized.
- Severe storms always a Winter issue.
- In general, these risks seem to increase each year.
- In general, weather damage is increasing.
- Q2 = no snow, less risk.
- Environmental risks are hard to estimate from one quarter to the next.
- Climate change.
- If you follow the trend lines, the likelihood of an environmental risk impacting your business to be growing with every passing season. And it is not just the impact in your region, but it could be anywhere across the globe which has a ripple impact on you.
- Somewhat elevated as world weather more extreme than in prior years, but similar to Q1.
- As we approach the warmer weather, the challenges created by snowstorms will disappear.



09 Operational Risk

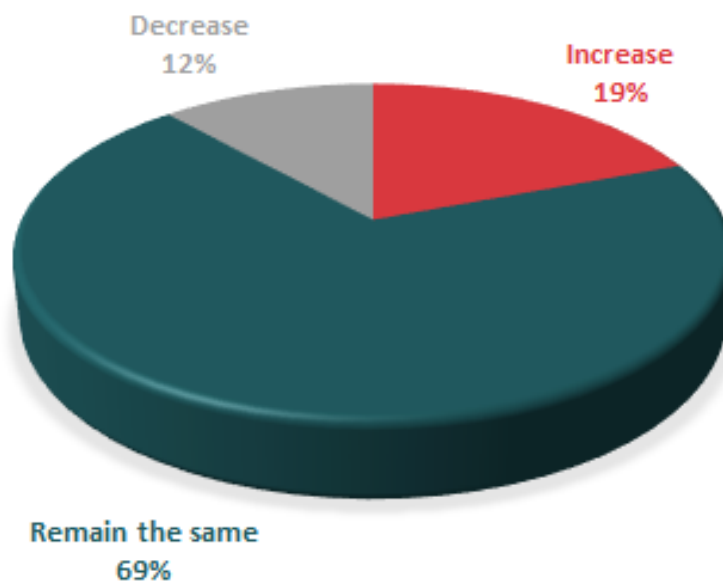


Some examples are: site disasters, product counterfeiting, damage or disruption to physical assets and machine breakdown.

Selected Comments:

- New and inexperienced personnel added, and people getting "back into the swing of things" will cause issues.
- There will continue to be sporadic disruptions in the supply chain.
- Security breaches/data protection.
- Decrease risks based on increased administration of the vaccines.
- The weather is an unknown factor and getting worse.
- Supply Chain disruptions during the global pandemic are the biggest threat.
- China has a forecasted issue with Computer chip delivery impacting electronic devices.
- Operational risk is only partially controllable due to the influence of outside factors.
- Container backlog; labor shortage.
- Increase in counterfeiting risk with the expansion of global supply chain.
- Increase in climate-related natural disasters.
- Products get very low then surges of deliveries.
- Climate extremes have caused risk to elevate in Central America and mainland USA.
- Ramp up of COVID-19 manufacturing capacity may also result in cannibalization of personnel and other resources.

OPERATIONAL RISK 53.77



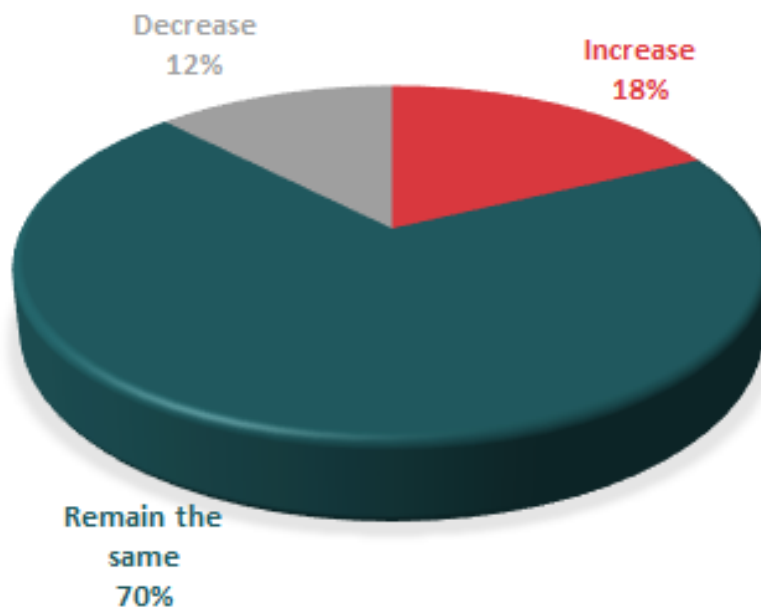
10 Quality Risk

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

Selected Comments:

- The past eight months had a large focus on quality.
- Due to Covid, I have less staff to run quality audits.
- Companies are shoving products out the doors. Quality has dropped.
- Changing quality standards are a constant risk in today's global business world.
- Quality took a hit during Covid.
- Quicker responses to demand will cause decreases in the quality of materials, parts, or finished goods.
- Inputs were lower quality across every category.
- Increased e-commerce fulfillment pressure during peak periods (Black Friday/Cyber Monday through Christmas).
- Continuing efforts to achieve bottom-line results and P/E compression by offshoring are affecting quality.
- Continuous quality improvement processes will lead to less risk.
- Without taking the right time, and this is where in-person interaction is critical, I believe there will be more quality risk.
- An increase in the economy will lead to increasing demand for a faster turn-around with poor quality implications.

QUALITY RISK - 52.74



Appendix A

Risk Index Summary

The Risk Index is a number between 0 – 100

Risk Index \leq 49 suggests less risk

Risk Index = 50 indicates no change in risk

Risk Index \geq 51 suggests greater risk

The further the number is from 50 greater the level of risk

$$\text{LBRI} = (P1 * 1) + (P2 * 0.5) + (P3 * 0)$$

P1 = percentage of answers reporting an improvement

P2 = percentage of answers reporting no change

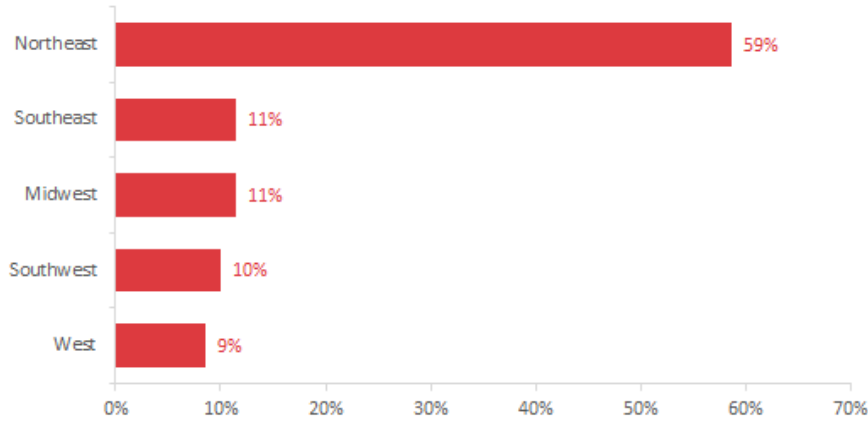
P3 = percentage of answers reporting a deterioration



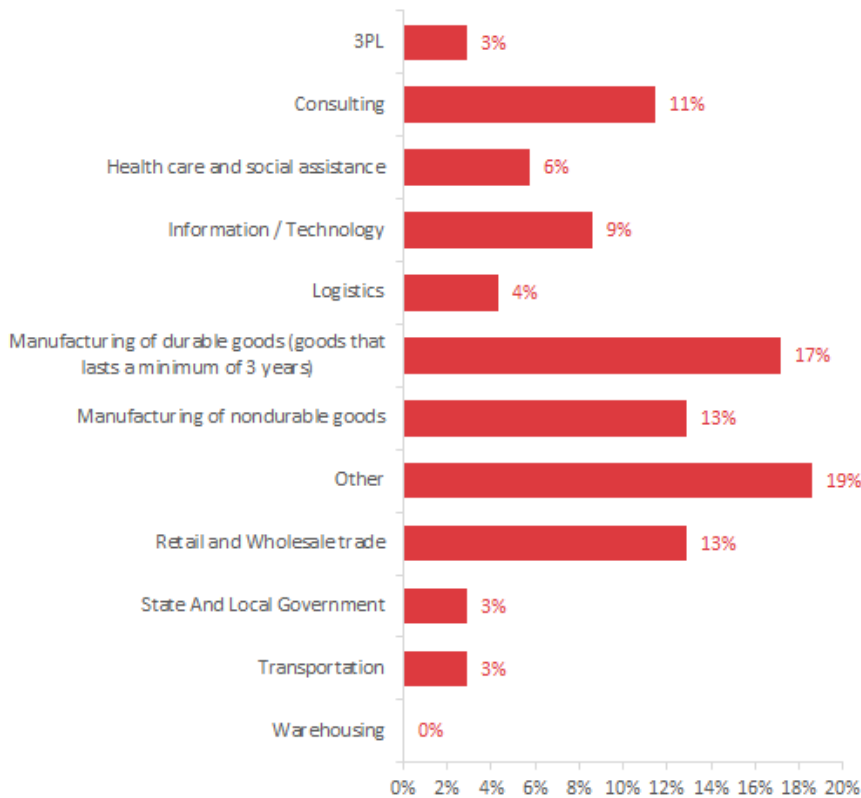
Appendix B

Survey Demographics

US Region



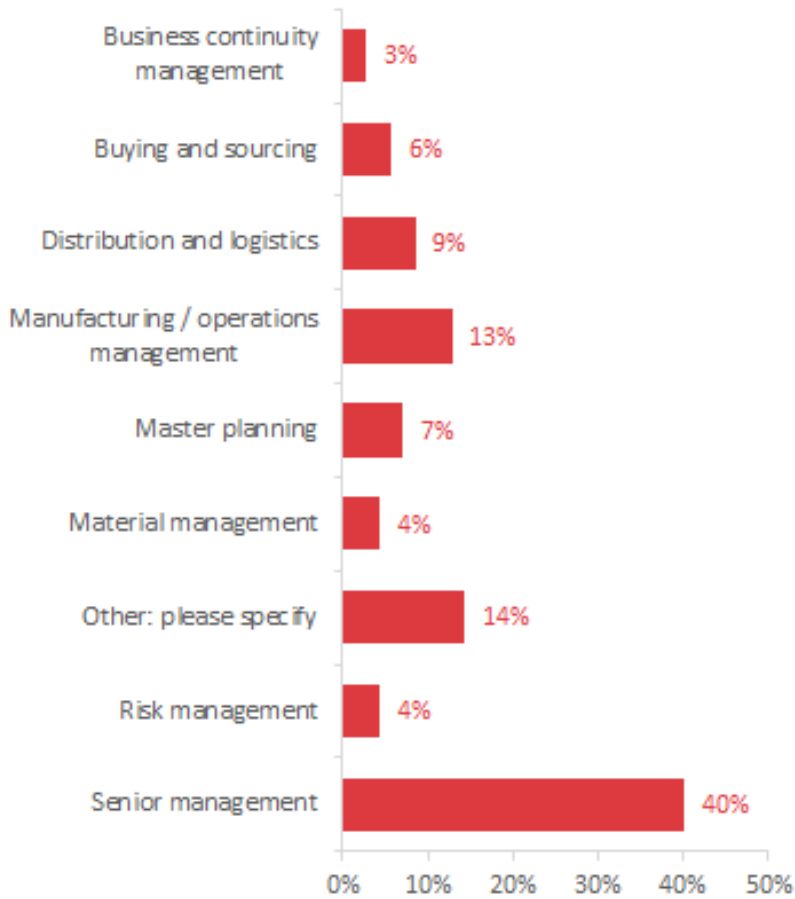
Industry



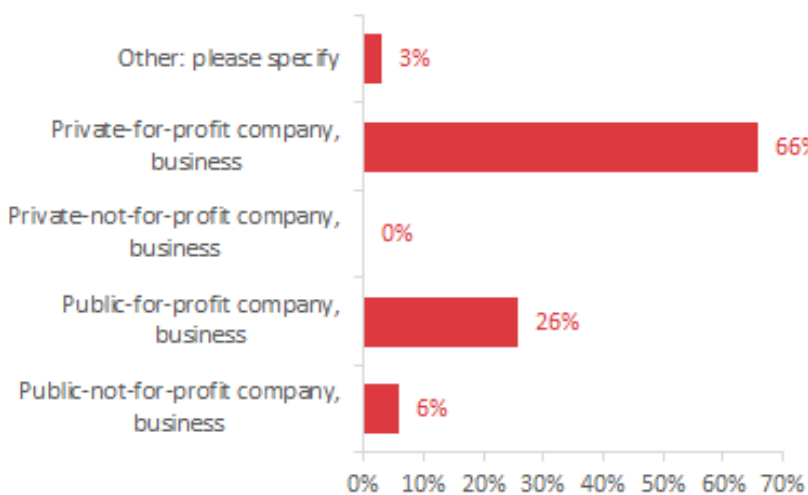
Appendix B

Demographics (continued)

Primary Role



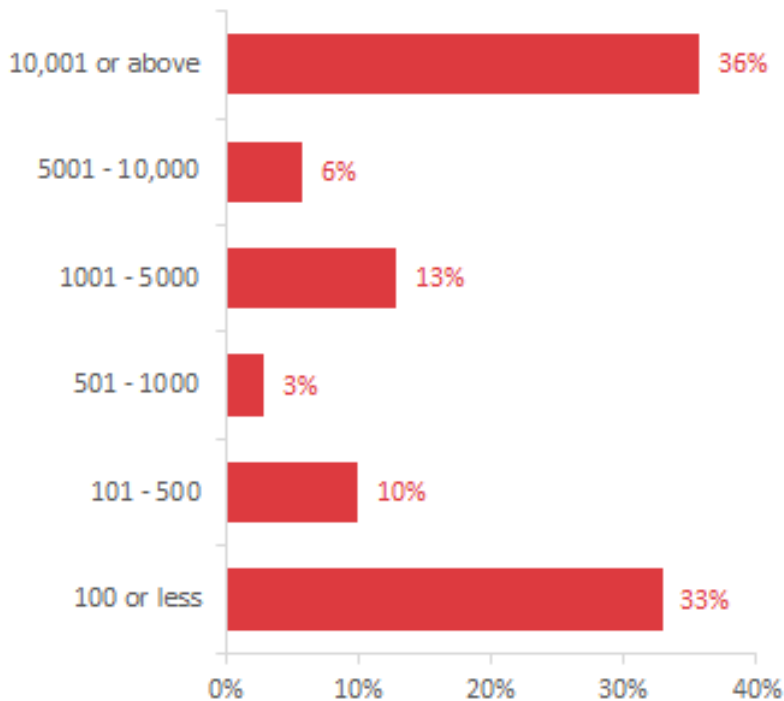
Place of Employment



Appendix B

Demographics (continued)

Company Employee Amount



Work Experience

