



Lehigh Business Supply Chain
Risk Management Index

Quarterly Report

3rd Quarter / 2021



LEHIGH
UNIVERSITY

College of
Business



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 3rd Quarter of 2021 compared to the risk in the 2nd 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 is 69.35 suggesting a increased level of risk in the 3rd 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 3rd Quarter 2021 and has become the number one concern for supply chain professionals. Economic Risk and Supplier Risk continues to increase as well, but is not as big of a focus as it was last 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	3rd Quarter Risk Index	2nd Quarter Risk Index	Trend
Transportation Disruption Ri	86.02	79.11	↑
Economic Risk	81.99	79.45	↑
Supplier Risk	80.12	74.66	↑
Cybersecurity and Data Risk	77.64	78.42	↓
Government Intervention Ris	70.50	70.55	↓
Technological or Competitive	61.49	60.27	↑
Customer Risk	60.87	67.47	↓
Operational Risk	59.32	53.77	↑
Quality Risk	58.07	52.74	↑
Environmental Risk	57.45	54.79	↑
Average Risk Index	69.35	67.12	↑

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 2021

(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 3rd Quarter in 2021 is

69.35

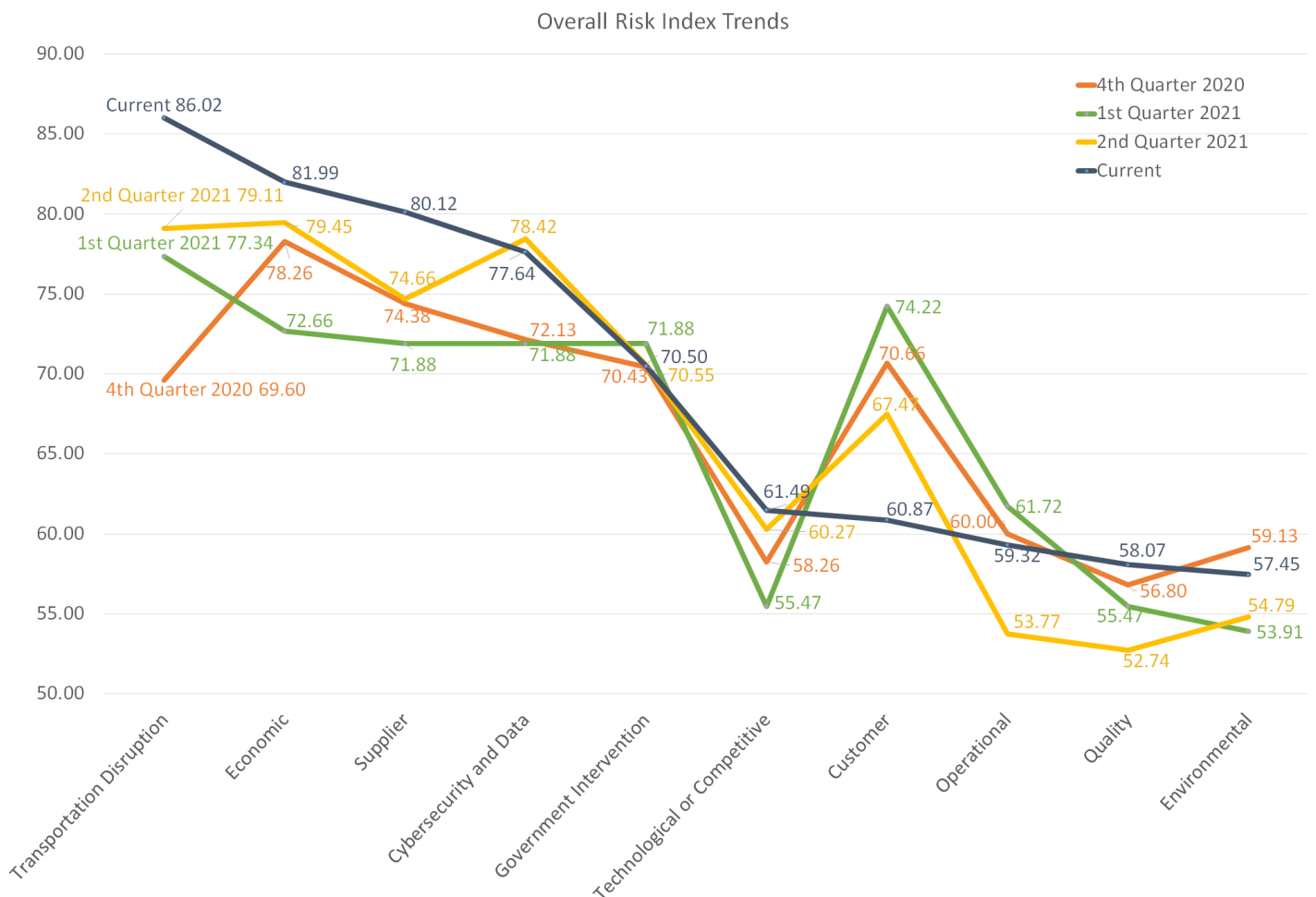


LRMI Risk Index Over the Last Year

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-yr time period.



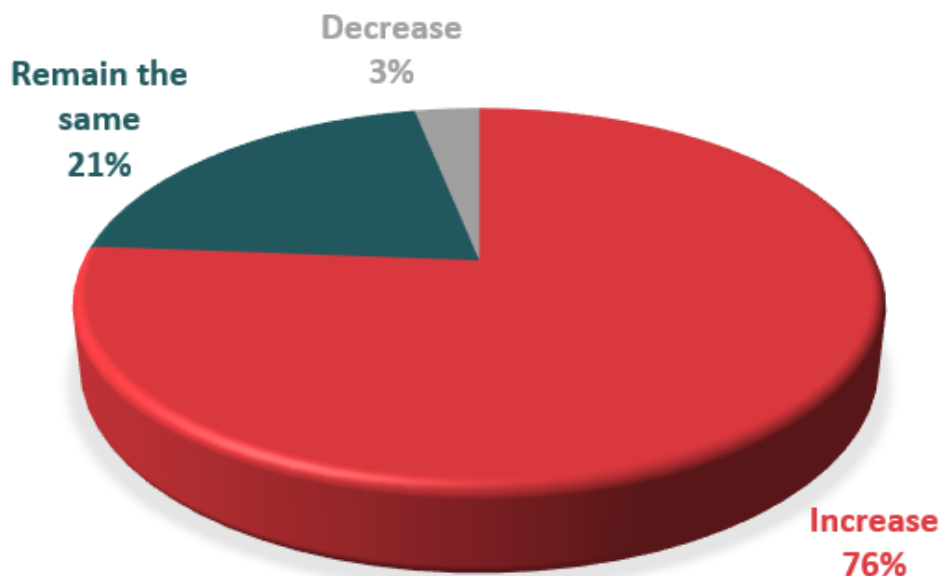
01 Transportation Disruption Risk

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

Selected Comments:

- International freight is incredibly expensive and unreliable.
- Driver and equipment shortages and terminal infrastructure are all issues.
- Leadtime increases from Asia have "settled" in to predictable albeit plus 4 week by ocean. Air freight out of China costs 6-8x normal.
- We bring in containers of glass from China and are experiencing port delays/disruptions, extremely high rates, and are now facing container allocations.
- Intermodal rail lines showing increasing delays due to equipment shortage.
- International freight continues to be a problem and it show no sign of getting better especially as we move into the start of the holiday.
- Domestically moving more volume but less tonnage and smaller shipments because of retail and consumer demand.
- Horrendous issues on the outbound side as sometimes you can only ship to certain regions at certain times. And when you can finally get something shipped it is a rush.
- Still recovering from the pipeline outage - Diesel in short supply and costs are up.

TRANSPORTATION DISRUPTION RISK 86.02

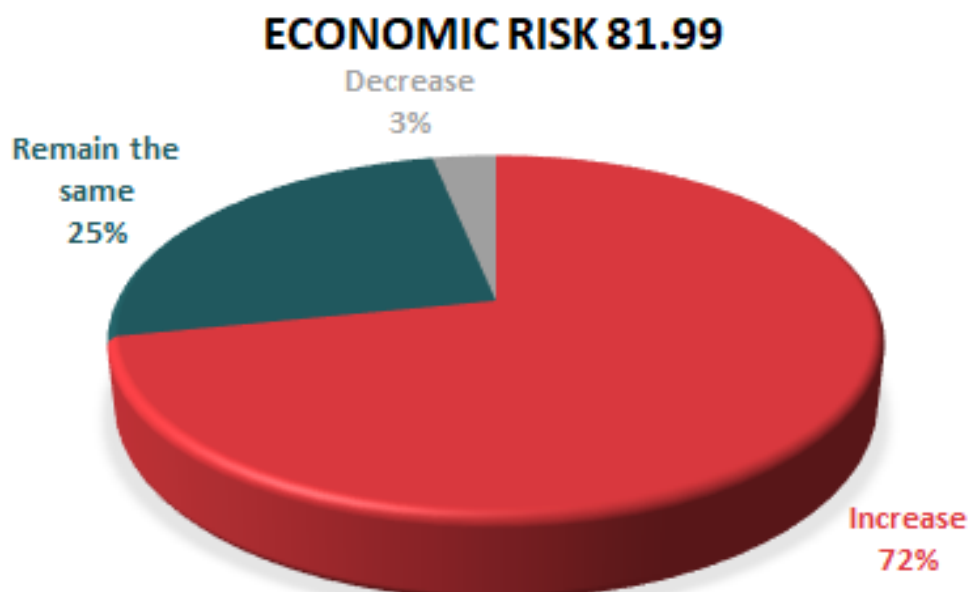


02 Economic Risk

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

Selected Comments:

- Labor shortages as employees are taking new career routes.
- Oil increasing. General inflation. Area labor shortages post Covid. Rolling electricity brown outs in southern China. Covid shutdowns of areas in Asia and Central America.
- We are not even close be being out of the Covid-19 woods on an international scale.
- Port Congestion, Increased demand coupled with tight capacity, means stock-outs.
- Commodity availability can be volatile as many commodities are sourced from Overseas.
- Labor shortages are the largest risk now and are not expected to improve.
- Shipments between borders will continue to improve but be outweighed by continuing labor issues.
- Expect huge increase in business returning after COVID.
- Pandemic still exist worldwide so supply issues will still be problematic.
- Commodity price volatility will impact materials costs - steel and copper in particular.
- Can't find labor !!! We have over 750 employees and have over 175 open positions.
- As we rebound from COVID, we have increasing costs in commodities, labor.



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:

- Electronics shortages and allocation mainly in microprocessors (MCUs or ubiquitous "chips") will put a stranglehold on the growing economy by 4Q. Certain plastic resins such as nylons and engineered resins are in very short supply and have not recovered from freeze in the Gulf Coast.
- Outbreaks of COVID in producer regions are an ongoing concern.
- Global capacity of suppliers is extremely tight right now, and most suppliers we work with are booked until 2022.
- Lumber availability/prices for pallets.
- Increasing demand with limited ability to hire new full-time equivalent (FTEs).
- Every week brings a new challenge in terms of risk, shortages, stock-outs and allocations.
- Customers are pushing for more specialized and harder to find materials with unique requirements which limit sourcing but also causes other problems.
- Lead times increasing, orders being canceled due to out of stock.
- Suppliers are regaining footing after COVID and having difficulty meeting increased demand.
- Prices are increasing as labor rates increase and supplies are tight.

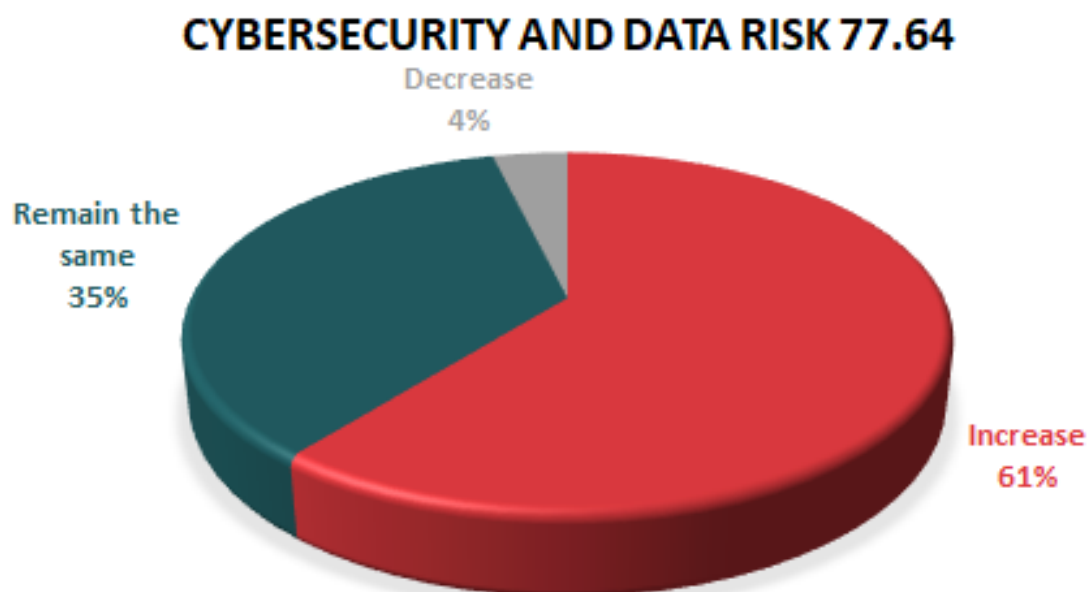


04 Cybersecurity and Data Risk

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

Selected Comments:

- Cyberattacks will continue since it has become so profitable.
- #1 concern of any company today. Ransomware will become a daily threat to many companies who have not created the proper protection.
- This is the #1 risk businesses will face regardless of their industry and the complexity or simplicity of their supply chain.
- We got our website hacked last year.
- Data risk is only increasing and we plan on spending additional resources to defend.
- We are challenged every day in cyber security. Constant vigilance is a priority.
- With so many people working remotely and so many times worrying about getting things done so quickly it opens everyone up to bigger cyber issues.
- The world is producing/creating more of everything that can be hacked!
- More people returning to work in offices will decrease the cybersecurity attack surface of people working from home, and increased face-to-face communication will reduce the risk of phishing and social engineering attacks.



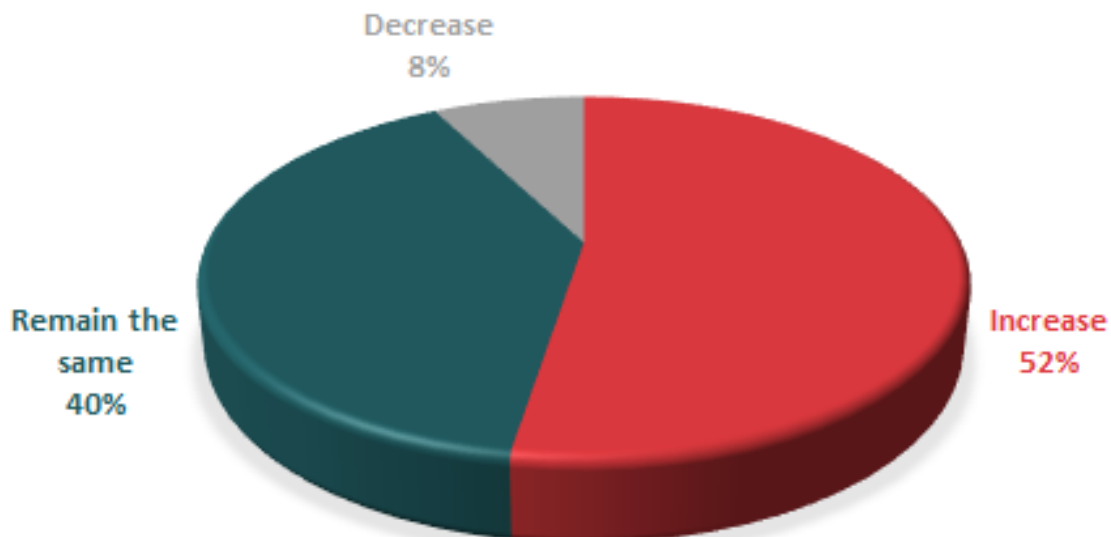
05 Government Intervention Risk

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

Selected Comments:

- Trade wars will increase. It will become more regulated.
- Like to see US Government and China back off on the 301 Tariffs (25%) but US and China still have issues.
- Our government is back to building bridges, not putting up tariffs.
- Regulations will increase on the state and national level.
- Concerned about increased regulation and taxes.
- Reduced unemployment payments at the end of May will help hiring hopefully.
- Environmental restrictions and more oversight/regulations on businesses, already underway.
- Increased taxes, regulations and pro-union policies are bad for business.
- There are lots of issues here from supplies of rare earth elements to fierce trade and political unrest. Government regulation may be tighter, but ultimately this is for the better.
- Manufacturing seems to be a target of regulatory overreach within current administration.
- New regulations coming, no confidence to plan for business costs going forward, not business friendly.
- Continue to decrease with more strategic and less tactical/unpredictable approach to global trade.

GOVERNMENT INTERVENTION RISK 70.50



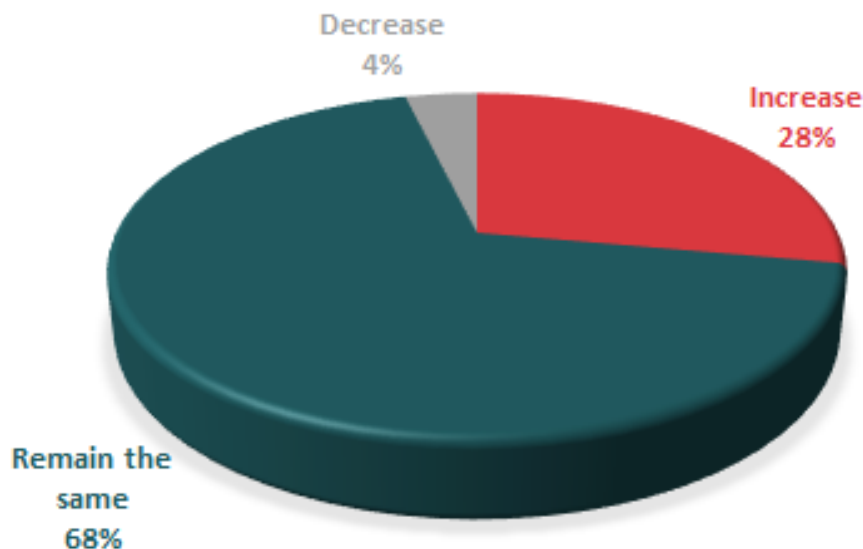
06 Technological or Competitive Risk

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

Selected Comments:

- Technologies will continue to advance.
- Barriers to entry are always challenging for new companies.
- The current Covid trends will enable our already competitive environment to become even more competitive!
- More competitive landscape in e-commerce expected as more companies have learned and are improving their reach to customers.
- Technology is at a breaking point. Many companies are not openly talking about it because they have wasted so much money on technology but they are doing many things outside the system. Companies are pulling out of block chain. People are going away from ERP/MRP processes because they cannot adjust the system to support the current state of the world and activities, they need to keep their companies functioning.
- Recognition of chip supply chain risks...dealing with same. Alternative sourcing of lithium.
- Everyone is trying to regain footing from COVID impacts, not expecting major new breakthroughs in immediate future.
- Technology deployment accelerated during the pandemic and should make most competitors stronger.

TECHNOLOGICAL OR COMPETITIVE RISK 61.49



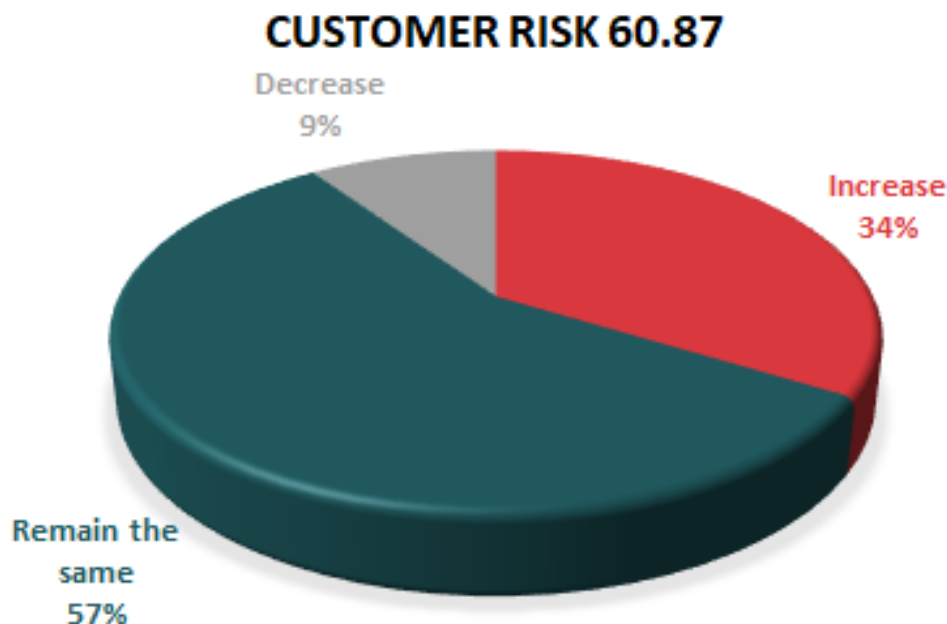
07 Customer Risk



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:

- Demand is extremely strong. Currently not able to satisfy all customer needs.
- We are proving to customers that counterfeit products are not the same quality as the OEM products.
- Customer risk will increase next year and in the following years.
- Customer behavior may have been changed due to pandemic.
- As supply issues increase, customer patience and loyalty are being tested
- Current Covid trends are helping to stabilize our customer environment.
- Customers have not reduced their expectations and they have increased them in some circumstances.
- Hard to service customer if resources, such as manpower, are not available due to unneeded unemployment comp benefits.
- Difficulty in judging/determining customer behaviors as stay at home culture lingers for extended periods.
- We are in a sales bubble that is poised to pop.
- Demand is high and supply is non existent.
- Lower margin customers may be lost while trying to maintain higher margin customers.



08 Operational Risk

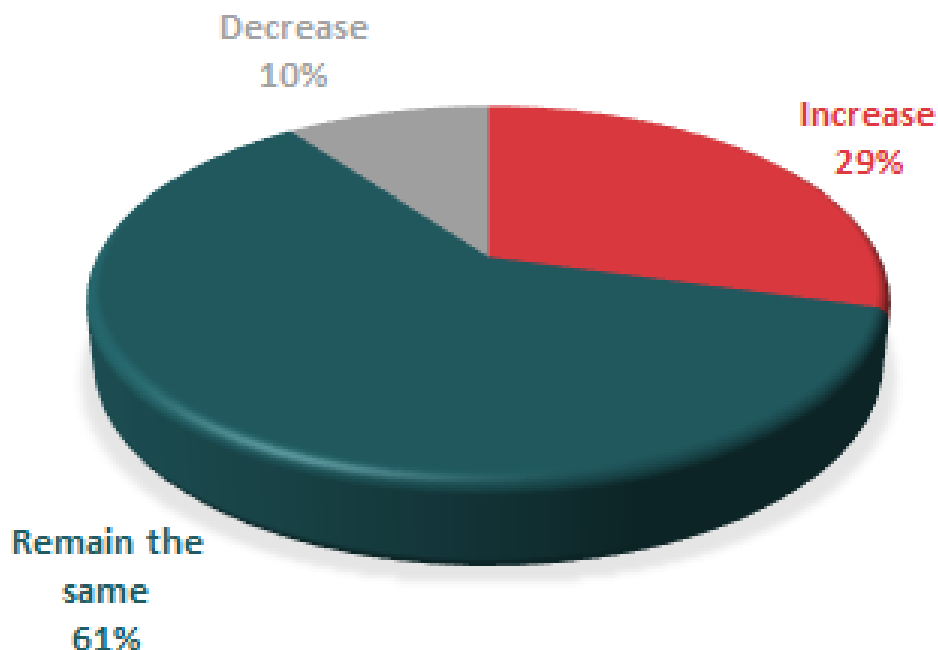


Some examples are: site disasters, product counterfeiting, damage or disruption to physical assets and machine breakdown.

Selected Comments:

- Risk will come from expedited ramping up of capacity to meet the sudden demand.
- Due to shipping concerns globally of products with chip shortages most product deliveries are delayed causing on-site disasters and delays.
- Not enough trucking capacity.
- Counterfeiting (or misrepresenting the origin of manufacture) will accelerate this year.
- Aging equipment at manufacturing plants and aging truck fleets are definitely an operational risk.
- Increase in remote working decreases overall demand for physical capital needed to operate.
- Not expecting ocean vessel timing or availability to improve for the rest of the year.
- Running machines at 80 to 90% of capacity and we're already at historically long lead-times.
- MRO items are becoming harder to get back in stock.
- Labor shortages and raw material/parts shortages will limit growth if not decrease overall output.
- Q3 will see many of our employees return to work and that could lead to problems at our office.

OPERATIONAL RISK 59.32



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:

- Risk will increase as we have to use substitute or alternate vendors to keep up with demand.
- Quality might suffer as factories continue to rush to get caught up.
- Assuming raw material quality is consistent, this will not be a meaningful risk.
- Increasing demand, may mean the existing quality staff may not be able to keep up.
- The challenge of hiring qualified employees may adversely impact quality risk.
- Harder to coordinate product movement requiring more personnel increasing risk of errors and quality control.
- We are having a difficult time finding quality engineers, to do the testing.
- Quality will remain the same in Q2.
- Suppliers are pushing out more with fewer people allowing their quality threshold to drop.
- Suppliers having adequate manpower and resources.
- Labor shortages and turnover will likely impact quality even with training.
- Spike in demand can lead to quality issues.
- Change in processes, equipment represents a quality risk.



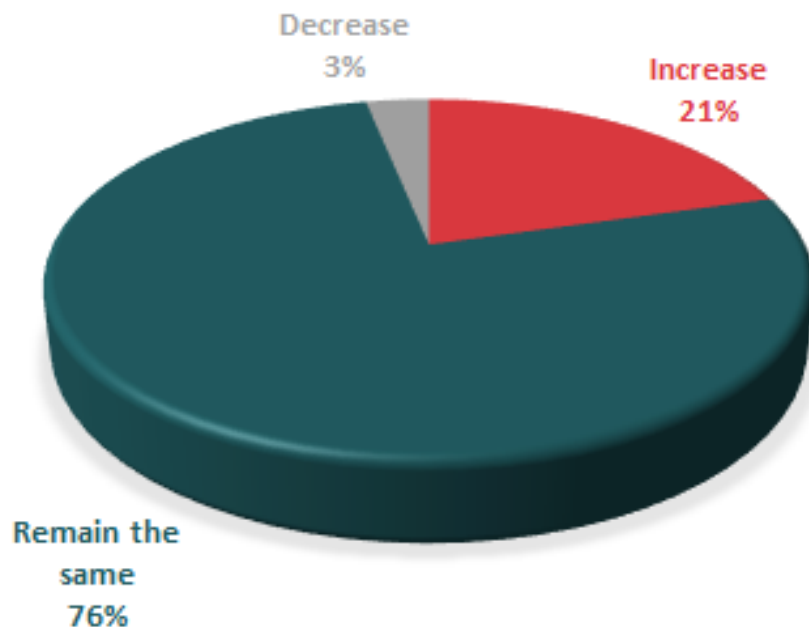
10 Environmental Risk

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

Selected Comments:

- Hurricane / monsoon season may bring extreme weather and impact material supply.
- Global warming is real and accelerating.
- Storms on the seas are tossing more containers over board with each vessel. In the last 2 month there have been over 5,000 containers lost at sea in route to the US.
- Water is a major problem in many areas/regions but is not being talked about. The West and Midwest is heading into a drought cycle which could destroy crops and foods availability for several years.
- Clearly climate change is increasing risk of extreme weather, huge loss of ice caps, etc.
- Global warming is real & we're ignoring it....again.
- Unusual to have a tropical storm offshore in May, a severe drought in May, 95 degrees for a week in May with hurricane season starting in June.
- We are about to enter summer, when we see more storms and hurricanes in a few months.

ENVIRONMENTAL RISK 57.45



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

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

P1 = percentage of answers reporting an improvement

P2 = percentage of answers reporting no change

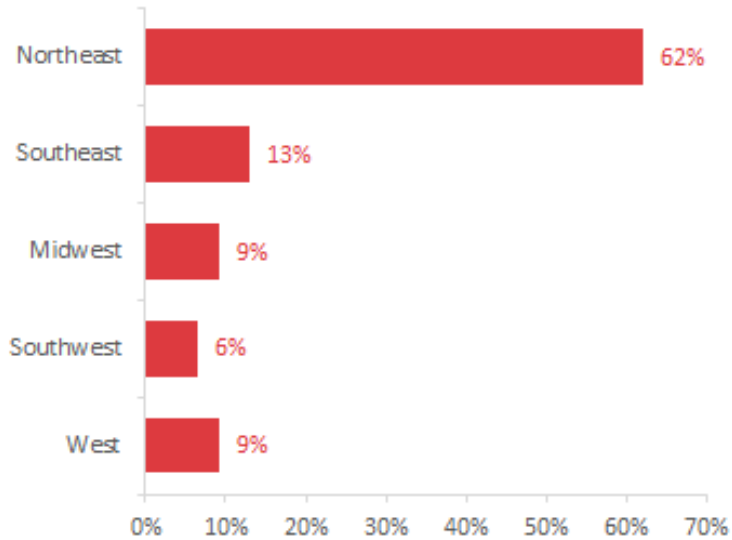
P3 = percentage of answers reporting a deterioration



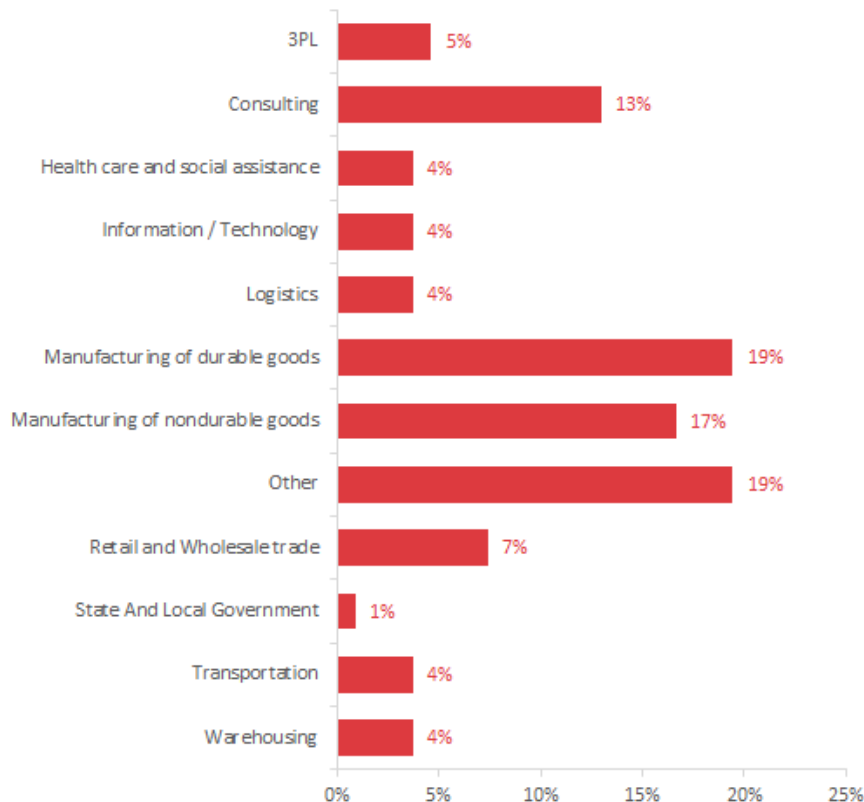
Appendix B

Survey Demographics

US Region



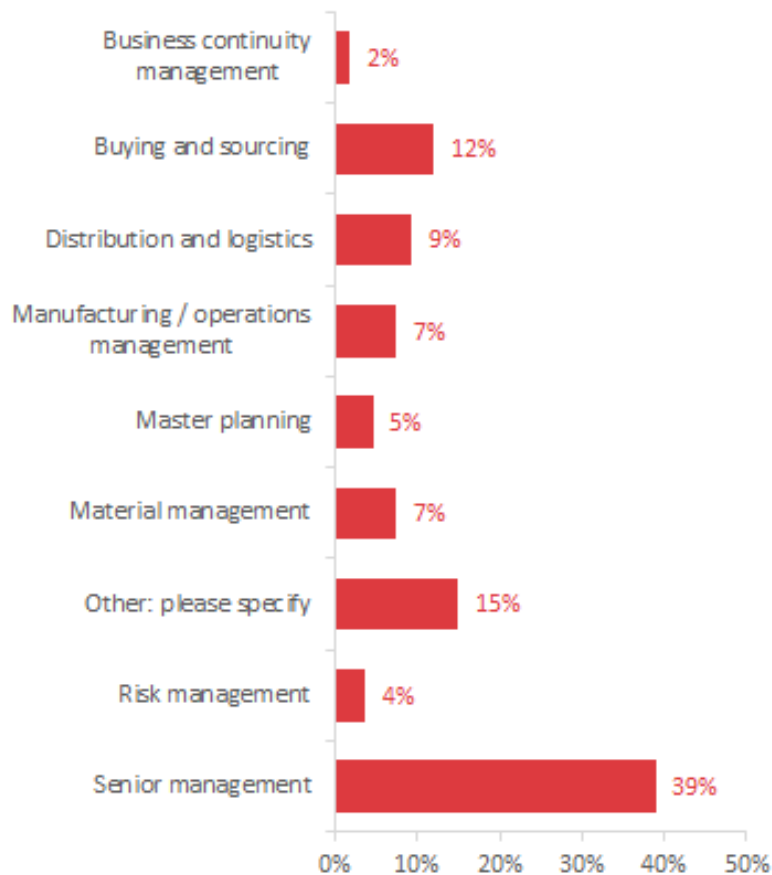
Industry



Appendix B

Demographics (continued)

Primary Role



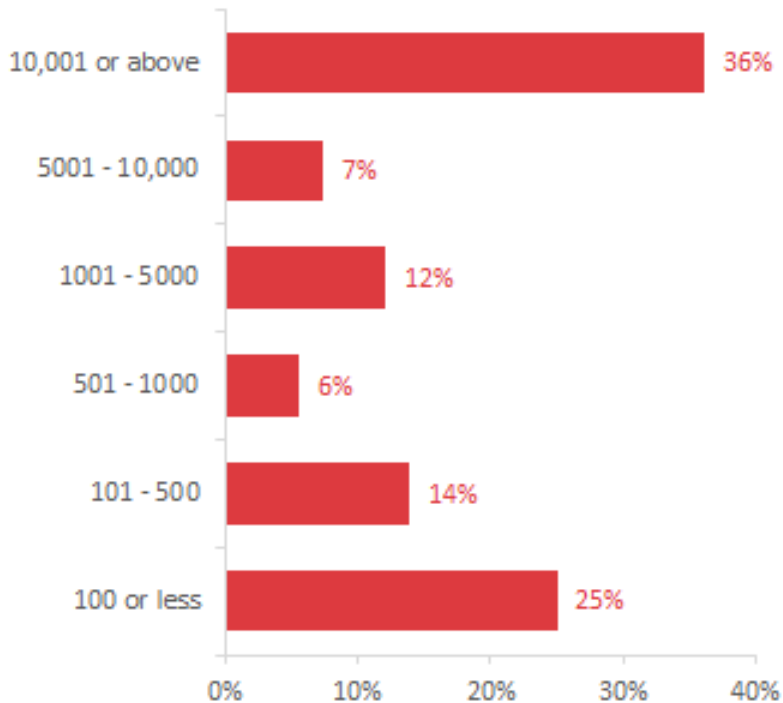
Place of Employment



Appendix B

Demographics (continued)

Company Employee Amount



Work Experience

