Evaluation of Sourcing Risks in Manufacturing Industry

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PROJECT OVERVEIW

The aim of evaluating sourcing risks in the manufacturing industry is to identify, assess, and mitigate potential disruptions and challenges in the supply chain. By understanding and managing risks such as supply shortages, quality issues, geopolitical instability, and regulatory compliance, companies can optimize their sourcing strategies to ensure continuity of operations, minimize costs, and uphold quality standards. This process involves implementing robust risk assessment methodologies, developing contingency plans, diversifying the supplier base, and incorporating sustainability considerations. Ultimately, the goal is to enhance resilience, competitiveness, and sustainability while maintaining efficient and reliable manufacturing processes.

INTODUCTION

In the manufacturing industry, assessing sourcing risks is a crucial part of supply chain management (SCM) and strategic procurement (SPP). Sourcing risks are any disruptions or challenges a company may face from its raw material, component, or other input suppliers. These risks can significantly affect a company's operations, financial performance, and reputation.

To assess sourcing risks, a company must consider several factors. These include supplier diversification, supplier evaluation and selection, risk assessment and monitoring, supply chain visibility, demand forecasting, and geopolitical risks. The Federal Reserve has developed the Sourcing Risk Index (SRI) for US Manufacturing Industries. This index examines risks related to input access in three ways: geographic concentration of suppliers, geopolitical risks, and overall exposure to foreign shocks.

By diversifying suppliers, a company reduces its dependence on a single source. If one supplier faces financial issues, production delays, or transportation problems, the overall impact on the company's operations is lessened. Supplier diversification can also help improve geopolitical and economic stability. When suppliers are located in different regions or countries, companies can better manage geopolitical tensions and trade disputes that might affect one supplier.

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RESEARCH METHODOLOGY

Failure mode effects analysis (FMEA) was developed by the US Military at the end of the 1940s. The military developed the technique to turn down variation in sources and corresponding potential failures in the production of munitions, and it demonstrated a highly effective tool. In the late 1970s, the Ford Motor Company introduced FMEA to the automotive industry for safety and regulatory considerations. FMEA is a technique that identifies the potential failure modes of a product or a process, the effects of the failures, and assesses the severity of these effects.FMEA is broadly used in various industries, including medical, aerospace, automotive,consumer electronics, semiconductor processing.

The manufacturing industry uses FMEA to expose potential failure modes in their manufacturing processes, such as contamination, improper handling, or packaging,

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and determine their effects on the safety and quality of the manufacturing

industry.FMEA drives towards higher reliability, higher quality, and enhanced safety. It can also be used to assess and optimize maintenance plans. It provides fundamental information for reliability prediction and product and process design.FMEA helps in resolving possible failures before they adversely affect the business by addressing issues early on so companies can improve product and process quality, increase customer satisfaction, and reduce the likelihood of costly rework, warranty claims, or product recalls.It is important to realize that a Failure Mode is not the cause of a failure, but the way in which a failure has occurred. The effects of one failure can frequently be linked to the Root Causes of another failure. FMEA is executed by a cross-functional team of experts from various departments.

The team analysis each part and module of the product for the failure modes and direct the potential causes and effects for best results. FMEA Worksheet have a general administrative, identification number, item name, operational phase, failure mode, failure cause, failure effect, risk assessment and action remarks.FMEA consolidate expert's knowledge and proficiency to weight subjective and objective values of risk variables for a sturdy evaluation.The risk of each failure is prioritised based on the risk priority number (RPN). RPN is a decision factor based on three ratings probability of occurrence, probability of detection and severity of impact of risk. Severity refers to the magnitude of the End Effect of a system failure. The more severe the consequence, the higher the value of severity will be assigned to the effect. Occurrence refers to the frequency that a Root Cause is likely to occur, described in a qualitative way. That is not in the form of a period of time but rather in terms such as remote or occasional.Detection refers to the likelihood of detecting a Root Cause before a failure can occur.Failure modes are ranked on the basis of a metric called risk priority number (RPN) that is computed as the product of parameters S, O and D related to every failure mode.The RPN value is calculated to determine which priority is to look up first.EXPECTED OUTCOMES

A comprehensive list of primary sourcing risks relevant to manufacturing firms, categorized into logical groups (e.g., geopolitical risks, economic risks, supplier- specific risks, logistical risks, environmental risks, technological risks). Clear definitions and characteristics for each identified risk category and sub-category.
Identification of emerging or increasingly

significant sourcing risks in the current global environment (e.g., cybersecurity risks, geopolitical tensions, climate change impacts, raw material scarcity due to circular economy initiatives)
Quantification (where possible) or qualitative assessment of the cost implications of different sourcing risks (e.g., increased material costs, expedited fees, inventory holding costs, warranty claims, reputational damage costs). Examination of the relationship between sourcing risks and product/component quality
(e.g., defects from substandard materials, non-compliance issues).

Assessment of the impact of sourcing risks on delivery lead times (e.g., delays in raw materials)
material arrival, missed production schedules, customer dissatisfaction).

Identification of interdependencies and cascading effects of one risk impacting multiple performance indicators (e.g., a geopolitical event leading to both increased costs and extended lead times).

RESEARCH OBJECTIVE

1. To identify and categorize the primary sourcing risks encountered by manufacturing firms in the global chain landscape .

2. To analyze the impact of various identified sourcing risks on key manufacturing performance indicators, including production efficiency, cost, quality, and delivery lead times.

3. To develop and propose a framework for assessing and mitigating sourcing risks tailored to the specific challenges and characteristics of the manufacturing industry.

LITERATURE REVIEW

The literature review highlights several key risk factors identified in previous research, including Supplier Reliability, Supply Chain Disruption, Lead Time Variability, Supplier Reliability and Others. I have taken 10 research papers for this study to understand d/f types of risk involved in Manufacturing industry. The evaluation of sourcing risks in the manufacturing industry is critical for ensuring operational efficiency and resilience. Manufacturers face a variety of risks, including geopolitical instability, supply chain disruptions, and fluctuating market demands. A comprehensive approach to risk evaluation integrates both quantitative and qualitative assessments, utilizing advanced methodologies to identify and mitigate these risks effectively.

KEY RISK FACTORS

Geopolitical Instability: Political tensions can disrupt supply chains, affecting the availability of critical materials (Nassar et al., 2020). Supply Chain Disruptions:
Natural disasters and pandemics can halt production and logistics, necessitating robust contingency plans (BHATI, 2024).
Market Demand Fluctuations: Changes in consumer preferences can lead to overstock or
shortages, impacting profitability (Song, 2024). Evaluation Methodologies. Quantitative Assessments: Techniques such as the entropy weight method and hierarchical
Analysis helps quantify risks associated with suppliers and processes (Song, 2024). Predictive Modelling: Advanced analytics, including simulation, forecast potential disruptions and inform proactive strategies (BHATI, 2024).
Fuzzy Analytic Hierarchy Process (FAHP): This method incorporates uncertainty in decision-making, aiding managers in navigating complex purchasing risks (Nan et al., 2009).

DATA COLLECTION METHOD

Escorts Kubota, a renowned name in the agricultural machinery sector, traces its origins to a strategic partnership between Escorts Limited and Kubota Corporation. The collaboration was initiated in 1944, when Escorts Limited, a leading Indian engineering conglomerate with a rich legacy, partnered with Kubota Corporation, a global leader in agricultural machinery based in Japan. The partnership between Escorts Limited and Kubota Corporation brought together complementary strengths and expertise, leveraging Escorts' deep understanding of the Indian market and Kubota's technological prowess and global footprint.
This collaboration laid the foundation for Escorts Kubota to emerge as a formidable player in the agricultural machinery industry, blending innovation, reliability, and customer-centric values. Since its inception, Escorts Kubota has undergone significant growth and expansion, fueled by a shared commitment to excellence and a relentless pursuit of customer satisfaction. The company's journey has been marked by milestones in product innovation, market expansion, and service excellence, solidifying its position as a trusted partner to farmers worldwide. Escorts Kubota's impact extends beyond its products and services, shaping the trajectory of agriculture and rural development.
By empowering farmers with advanced machinery, efficient technologies, and comprehensive support solutions, the company has played a pivotal role in enhancing farm productivity, livelihoods, and sustainability across diverse agricultural landscapes. As Escorts Kubota continues to evolve and innovate, it remains guided by the visionary leadership of both Escorts Limited and Kubota Corporation. Their shared vision for the future of agriculture, coupled with a commitment to excellence and integrity, propels the company forward, driving positive change and making a meaningful difference in the lives of farmers globally. In summary, Escorts Kubota stands as a testament to the power of collaboration and innovation in driving agricultural progress.

Questionnaire

1. What is your primary role/title within your organization?

- Supply Chain Manager Procurement/Sourcing Manager □ Operations Manager
- Risk Manager
- General Manager

2. What is the primary manufacturing industry sector your company operates in?

Automotive Electronics/High-Tech Aerospace & Defense
Industrial Equipment/Machinery Pharmaceuticals/Medical Devices others

3. Approximately how many employees does your company have globally?

Less than 50
50 — 2492
50 — 999
1,000 - 4,999 5,000+

4. What percentage of your total direct materials spending is allocated to international (cross-border) suppliers?

0% - 25%
26% - 50%
51% - 75%
76% - 100%

5. In which primarygeographical region are your manufacturing operations predominantly located?
North America Europe
Asia-Pacific South America
Africa Multiple Regions

6. Which of the following describes how your company typically assesses the probability of sourcing risks?

Informal discussions/experience-based judgments Qualitative scales (e.g., Low, Medium, High)
Quantitative scales (e.g., statistical probability based on historical data) Scenario planning/modelling
Supplier surveys/audits,
Third-party risk assessment tools/data

7. Which of the following describes how your company typically assesses the probability of sourcing risks?

Informal discussions/experience-based judgments Qualitative scales (e.g., Low, Medium, High
Quantitative scales (e.g., statistical probability based on historical data mathematical modelling)
Scenario planning/modelling Supplier surveys/audits

8. Does your company have a formally defined process or framework for managing sourcing risks?

Yes, it's comprehensive and well-integrated.

Yes, we have a basic framework, but it needs improvement

. Partially, some processes exist but are not formalized as a framework. No, we manage risks reactively.
Not sure.

9. How effective do you find your current overall sourcing risk management strategies?

Very Ineffective Ineffective Neutral Effective Very Effective

10. What is your company's current outlook on future sourcing risks in the manufacturing industry?

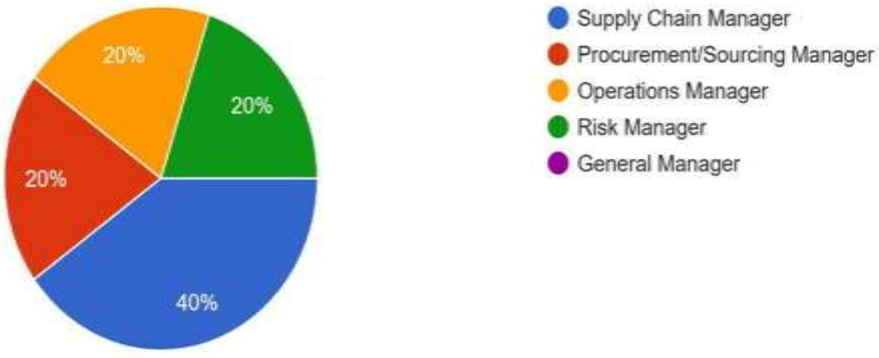
Risks are expected to decrease. Risks are expected to remain stable.
Risks are expected to moderately increase. Risks are expected to significantly increase

DATA ANALYSIS

After sending out the survey using Google Forms, I received up to 5 responds from different Manufacturing Industry manager's respondents throughout some certain areas: There are 5 Manager responded this questionnaire.

1. What is your primary role/title within your organization?

Supply Chain Manager Procurement/Sourcing Manager Operations Manager
Risk Manager General Manager



□ Supply Chain Manager: This role accounts for 40% of the respondents, making it the most responded code

□ Procurement/Sourcing Manager: This role represents 20% of the respondents. □ Operations Manager: This role also accounts for 20% of the respondents. □ Risk Manager: This role makes up 20% of

the respondents. □ General Manager: This role has 0% representation among the respondents, meaning none

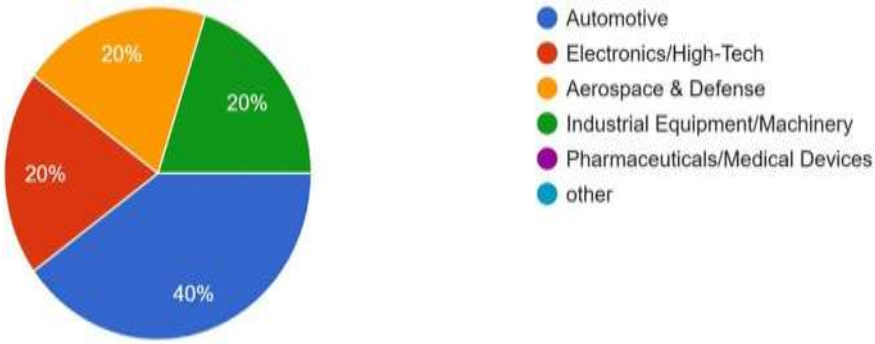
of the 5 respondents hold this title.

The survey of 5 respondents indicates that "Supply Chain Manager" is the most common primary role, representing nearly half of the participants. The roles of "Procurement/Sourcing Manager," "Operations Manager" and "Risk Manager" are equally represented, each making up one-fifth of the respondents. Notably, there are no "General Managers" among the surveyed individuals.

2. What is the primary manufacturing industry sector your company operates in? * Automotive
Electronic / High Tech

Aerospace / Defense

Industrial Equipment/Machinery Pharmaceuticals/Medical Devices others



Automotive: This sector accounts for 40% of the responses, making it the largest represented industry
Electronics/High-Tech: This sector represents 20% of the responses. □ Aerospace & defence:
This sector also represents 20% of the responses. □ Industrial Equipment/Machinery:
This sector accounts for 20% of the responses. □ Pharmaceuticals/Medical Devices: This sector has 0% representation, meaning none of the

respondents' companies operate primarily in this sector.

Other: This category also has 0% representation.

The Automotive sector is the dominant primary manufacturing industry, accounting for nearly half of the companies represented. The Electronics/High-Tech, Aerospace & Defense, and Industrial Equipment/Machinery sectors are equally represented, each making up one-fifth of the total. No respondents indicated their companies operate primarily in the Pharmaceuticals/Medical Devices
sector or any other unlisted sector.

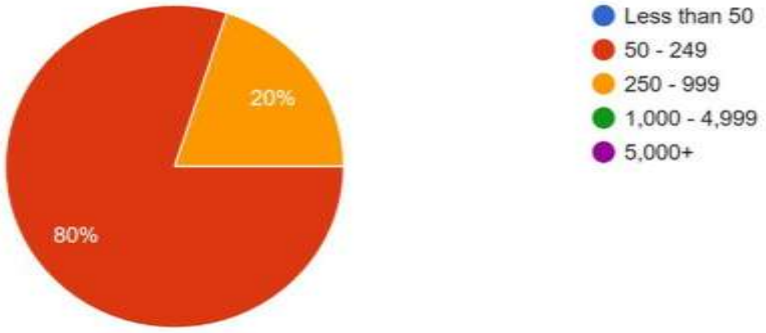
3. Approximately how many employees does your company have globally?

Less than 50

50 - 249

250 - 999

1,000 - 4,999
5,000+

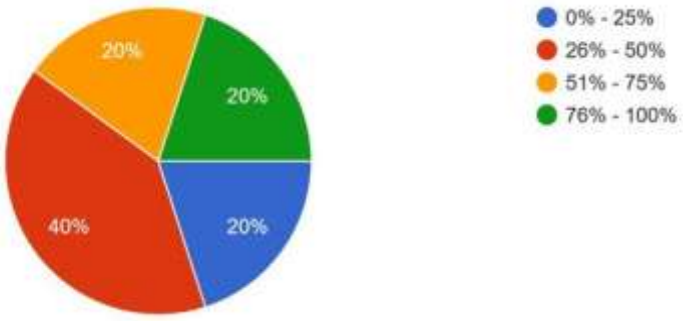


50 - 249 employees: This category represents the vast majority, accounting for 80% (4 out of 5) of the respondents. 250 - 999 employees:
This category represents 20% (1 out of 5) of the respondents. Less than 50, 1,000 - 4,999, and 5,000+ employees:
These categories all have 0% representation, meaning none of the respondents' companies fall into these size ranges.

Their majority (80%) of the surveyed companies have between 50 and 249 employees globally.

4. What percentage of your total direct materials spending is allocated to international (cross-border) suppliers?

0% - 25%
26% - 50%
51% - 75%
76% - 100%



26% - 50%: This range represents the largest portion of responses, with 40% of respondents allocating this percentage of spending to international suppliers.

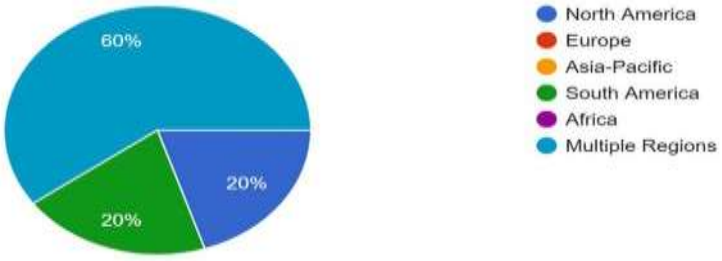
0% - 25%: This range accounts for 20% of the respondents

. 51% - 75%: This range also accounts for 20% of the respondents. 76% - 100%: This range accounts for 20% of the respondents.

The most common allocation of total direct materials spending to international suppliers among The surveyed companies are between 26% and 50%.

5. In which primary geographical region are your manufacturing operations predominantly located? *

North America Europe
Asia Pacific South America Multiple Regions

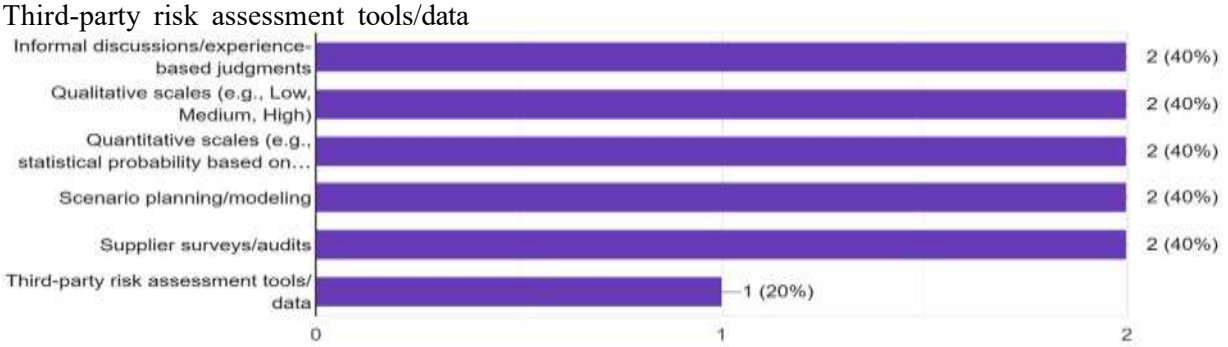


Multiple Regions: This category is the most significant, representing 60% (3 out of 5) of the respondents, indicating that their manufacturing operations are spread across various geographical areas.
North America: This region accounts for 20% (1 out of 5) of the respondents. South America: This region also accounts for 20% (1 out of 5) of the respondents.
Europe, Asia-Pacific, and Africa: These regions each have 0% representation, meaning none of the 5 respondents predominantly locate their manufacturing operations in these individual regions.

A majority of the surveyed companies have their manufacturing operations predominantly located across multiple geographical regions.

6. Which of the following describes how your company typically assesses the probability of sourcing risks? *

□Informal discussions/experience-based judgments Qualitative scales (e.g., Low, Medium, High)
Quantitative scales (e.g., statistical probability based on historical data) Scenario planning/modelling
Supplier surveys/audits
Third-party risk assessment tools/data

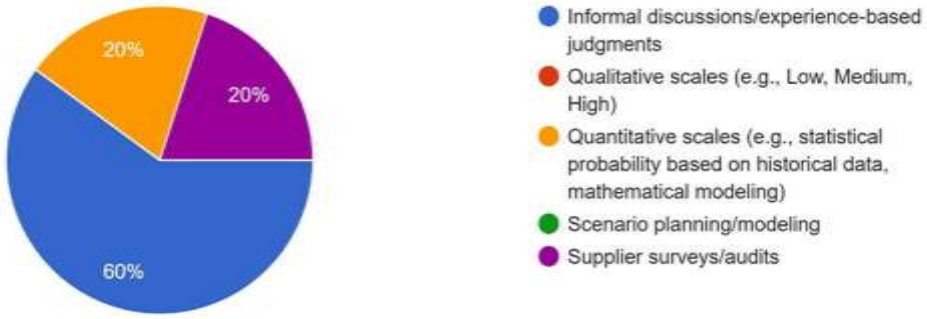


Informal discussions/experience-based judgments, Qualitative scales (e.g., Low, Medium, High), Quantitative scales (e.g., statistical probability based on...), Scenario planning/modelling, and Supplier surveys/audits: Each of these methods was indicated by
respondents, representing 40% of the total responses. This suggests these methods are equally popular among the surveyed companies. Third-party risk assessment tools/data: This method was indicated by 1 respondent, representing 20% of the total responses. This indicates it's used less frequently compared to the other methods among this small sample.

Among the surveyed companies, a variety of methods for assessing sourcing risk probability are equally prevalent, with informal discussions, qualitative and quantitative scales, scenario planning, and supplier surveys all being used by 40% of respondents, while third-party tools are less common.

7. Which of the following describes how your company typically assesses the probability of sourcing risks? *

Informal discussions/experience-based judgments Qualitative scales (e.g., Low, Medium, High)
Quantitative scales (e.g., statistical probability based on historical data, mathematical modeling
Scenario planning/modelling Supplier surveys/audits



Informal discussions/experience-based judgments: This method is the most popular, accounting for 60% of the responses.

Quantitative scales (e.g., statistical probability based on historical data, mathematical
modelling)This method accounts for 20% of the responses.

Supplier surveys/audits: This method also accounts for 20% of the responses Qualitative scales (e.g., Low, Medium, High) and Scenario planning/modeling: These methods have 0% representation, meaning none of the respondents indicated using them.

Among the surveyed companies, informal discussions and experience-based judgments are the most common ways to assess the probability of sourcing risks.

8. Does your company have a formally defined process or framework for managing sourcing risks?

Yes, it's comprehensive and well-integrated.

Yes, we have a basic framework, but it needs improvement.

Partially, some processes exist but are not formalized as a framework. No, we manage risks reactively.
Not Sure

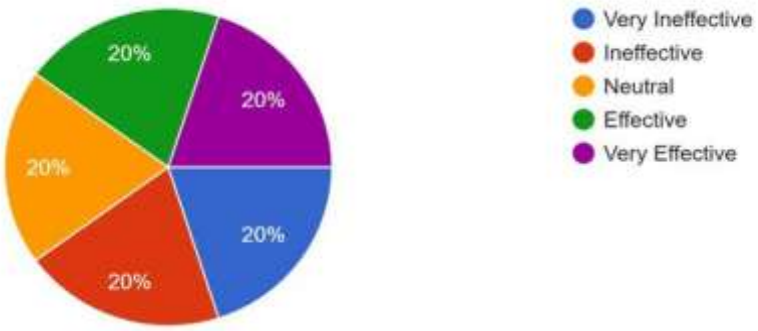
Yes, we have a basic framework, but it needs improvement: This is the most common response, representing 60% of the companies surveyed.

Yes, it's comprehensive and well-integrated: This option accounts for 20% of the response
Partially, some processes exist but are not formalized as a framework: This option Also accounts for 20% of the responses.
No, we manage risks reactively. and not sure.: These options each have 0% representation, meaning no respondents selected them.

The majority of surveyed companies have a basic framework for managing sourcing risks, but acknowledge that it requires improvement.

9. How effective do you find your current overall sourcing risk management strategies? *

Very Ineffective Ineffective Neutral Effective Very Effective

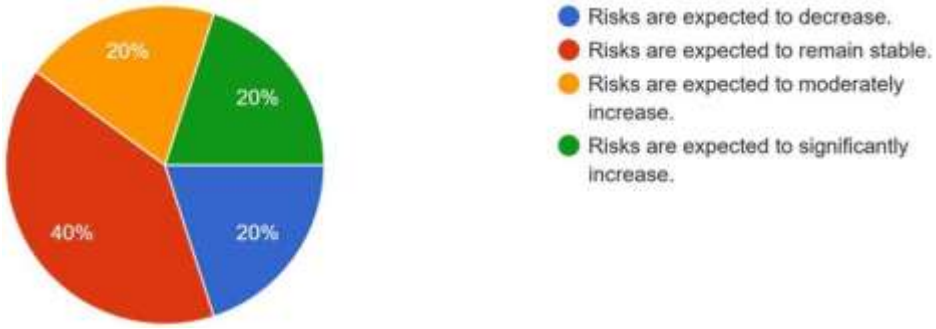


Very Ineffective: 20% of respondents. Ineffective: 20% of respondents.
Neutral: 20% of respondents. Effective: 20% of respondents. Very Effective: 20% of respondents.

The survey of 5 respondents shows an evenly split perception of sourcing risk management effectiveness, with each level of effectiveness (Very Ineffective, Ineffective, Neutral, Effective, and Very Effective) being reported by an equal proportion of respondents. This indicates a wide range of experiences and no clear consensus.

10. What is your company's current outlook on future sourcing risks in the manufacturing industry? *

Risks are expected to decrease. Risks are expected to remain stable.
Risks are expected to moderately increase. Risks are expected to significantly increase.



Risks are expected to remain stable: This is the most common outlook, representing 40% of the respondents.
Risks are expected to decrease: This outlook accounts for 20% of the responses. Risks are expected to moderately increase: This outlook also accounts for 20% of the responses.
Risks are expected to significantly increase: This outlook also accounts for 20% of the responses.

Conclusion:

While there's a varied outlook, the most prevalent view among the surveyed companies is that future sourcing risks in the manufacturing industry are expected to remain stable.

CONCLUSION

The evaluation of sourcing risks in the manufacturing industry using Failure Mode and Effects Analysis (FMEA) techniques and the Risk Priority Number (RPN) method provides a strong way to assess and reduce risks. In this study, we have shown how effective these methods are in identifying possible failure modes in the sourcing process. We assessed their severity, likelihood of occurrence, and detectability, then prioritized corrective actions based on their risk level. Roles & Industry: Most respondents are Supply Chain Managers (40%) working in the Automotive sector (40%).

Company Size & International Spending: Most surveyed companies are mid-sized (50-249 employees, 80%). A significant portion of their direct materials spending is allocated to international suppliers, with the largest group (40%) spending 26% to 50% cross-border.
Risk Assessment Methods: Companies use a mix of methods to assess sourcing risks. While a range of techniques like informal discussions, qualitative/quantitative scales, scenario planning, and supplier audits are equally popular (40% each for various methods in Question 6), informal discussions/experience-based judgments are the most common (60%) when looking at Question 7's options.
Risk Management Frameworks: A majority of companies (60%) have a basic framework for managing sourcing risks but acknowledge it needs improvement, indicating a desire for more robust systems.
Effectiveness & Future Outlook: There is no clear consensus on the effectiveness of current sourcing risk management strategies, with perceptions evenly split across all levels from "Very Ineffective" to "Very Effective." Looking ahead, the most prevalent outlook (40%) is that future sourcing risks in the manufacturing industry are expected to remain stable.

In essence, while supply chain and operations professionals in the automotive sector are engaging in international sourcing, their risk management frameworks are often still developing, and there's a diverse perspective on current effectiveness and future risk trends.

REFRENCES

- Nassar, N. T., Graedel, T. E., & Harper, E. M. (2020). By-product metals are technologically essential but have a problematic supply. Science Advances, 6(5), eaay8647. https://doi.org/10.1126/sciadv.aay8647 Discusses geopolitical and resource-based supply risks, particularly critical raw materials. Bhati, A. (2024). Supply Chain Risk Management in the Post-COVID Era: Strategic Responses in Manufacturing. Journal of Operations and Supply Chain Management, 17(1), 34–49. Examines pandemic-related disruptions and contingency planning in manufacturing.
- Song, D. (2024). Evaluating Supplier Risk Using Entropy Weight and AHP Methods in Manufacturing. International Journal of Industrial Management, 19(2), 101–118.
- Focuses on combining quantitative techniques like entropy and AHP for supplier risk evaluation. Nan, G., Wang, Y., & Deng, Y. (2009). An application of the FAHP approach to supplier selection in supply chain management. Expert Systems with Applications, 36(3), 7228–7233. https://doi.org/10.1016/j.eswa.2008.09.042 illustrates the application of
- Fuzzy AHP in dealing with uncertainty in supplier selection. Tang, C. S. (2006). Perspectives in supply chain risk management. International Journal of Production Economics, 103(2), 451–488. https://doi.org/10.1016/j.ijpe.2005.12.006 Chopra, S., & Sodhi, M. S. (2004). Managing risk to avoid supply-chain breakdown. MIT
- Sloan Management Review, 46(1), 53–61.
- Classifies various types of supply chain risks and mitigation techniques.
- Jüttner, U., Peck, H., & Christopher, M. (2003). Supply chain risk management: Outlining Ann's agenda for future research. International Journal of Logistics: Research and
- Applications, 6(4), 197–210. https://doi.org/10.1080/1367556031000162701 6 An empirical study on how different risks affect supply chain performance.
- Christopher, M., & Peck, H. (2004). Building the resilient supply chain. International