



Production's risk mitigation on the field of Automotive Industry

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Abstract

Due to its dynamic nature and complex supply chains, the automotive industry faces many production risks that can significantly affect operational efficiency and product quality. Vehicle production is highly demanding in terms of energy and raw materials. This paper examines the risks in the automotive industry, presents strategies that can be used to reduce these risks, since the goal is to increase flexibility and ensure a smooth production process. The adequacy of supply chain management, quality control, technology adoption, workforce training and regulation in its critical areas are examined, which cover the manufacturing process. The implementation of these strategies is crucial for automakers to effectively manage uncertainties, maintain high production standards, and maintain their reputation against competitors. By emphasizing the proactive measures presented, continuous improvement and collaboration with key stakeholders, automakers can strengthen their manufacturing processes against potential disruptions, ensuring sustainable growth, sustainability, and success in a highly evolving industry.

Keywords: automotive industry, financial risks, HR risks, logistics risks, OTD, production's risk, quality risks, sustainability

1. Introduction

The automotive industry, a cornerstone of global manufacturing, faces many challenges in its manufacturing processes that require strategic risk mitigation measures. As technological advances, market dynamics and external factors continue to evolve, ensuring the smooth and efficient operation of automotive manufacturing has become more complex and critical than ever. This paper discusses the various risks associated with automotive manufacturing and explores proactive strategies used by industry leaders to mitigate these challenges. Initiatives aimed at reducing carbon emissions, fostering diversity, ensuring worker safety, and engaging with local communities have demonstrated their capacity to nurture robust supplier relationships, and mitigate risks (Lin, 2023).

In the dynamic landscape of automotive manufacturing, risks can take many forms, including supply chain disruptions, technological failures, regulatory changes, and human error. Each of these factors can affect production schedules, quality standards, and overall operational efficiency. Consequently, the industry is forced to adopt innovative and adaptive approaches to navigate these challenges and maintain its market position. It is not just a matter of convenience to include both

externalities and market power mitigation together in the pricing mechanism (Varawala et al., 2023). This paper also aims to highlight the multifaceted nature of production risks in the automotive industry and the various strategies used to effectively mitigate these risks.

In our opinion, smart networks are not just technology, but a complex set of interwoven technologies that require drastic changes in both user behavior and society (Piricz, 2020). The creation of intelligent networks helps the operation of the entire supply chain, from the start of the process to the end of the process.

As we delve into the complex web of challenges and solutions in automotive manufacturing, a nuanced understanding of risk mitigation strategies will emerge (Rivera Domínguez et al., 2023). By examining real-world examples, industry trends, and emerging best practices, readers will gain valuable insight into how the automotive industry is proactively managing manufacturing risks to ensure sustained success in an ever-changing environment. The following sections address specific risk mitigation strategies, showing their impact on production resilience and the wider implications for the automotive industry.

2. Risk Mitigation Strategies

2.1 HR risk mitigation strategies

HR is a critical department that deals with the management of the organization's biggest asset, the organization's employees (Cayrat and Boxall, 2023). Compliance and legal risks can interfere with the safety of the activity when they are opposed to labor laws or with employment regulations. The consequences of these are lawsuits, fines or penalties, which affect the perception, existence and development of the company's competitiveness (Biggeri et al., 2023).

Talent management risks can be at the plant when the hiring process has inadequate recruitments, and the hiring process leads to the selection of unsuitable candidates. In the end that flow will impact overall the team's performance. Employee relations risks (Zuo et al., 2022) may appear, e.g. disputes, conflicts, and poor employee relations. All of these can affect the workplace environment and productivity. There may be a lack of effective communication, leading to misunderstandings and dissatisfaction among employees.

Risks can also appear in the areas of training and development. Inadequate training programs can result in the workforce not having the skills necessary to perform their duties effectively. Insufficient focus on employee development can lead to a lack of career growth opportunities (Liu et al., 2024), affecting morale and retention. The company must constantly pay attention to this phenomenon. Must act when any notice appears from any deterioration.

Data security and data protection risks are extremely important. Improper handling of employee data poses a privacy risk and can therefore have legal consequences. The GDPR was developed for this purpose, and HR department ensures compliance with it. Cyber security threats can also compromise HR systems. Overall, this can lead to data breaches and identity theft (Patterson et al., 2023). The risk of succession planning is a risk that we tend not to think about when starting a company. However, due to various reasons, succession must be ensured when the workforce is replaced. When we do not take care of succession, or we do not take care of it in time, we incur losses.

Compensation and benefit risks appear when an unfair compensation practice event occurs. They can lead to dissatisfaction and demotivation in employees and their effect is immediately visible in the effectiveness of their activities. Poorly designed or communicated benefits packages can also affect employee morale and retention. The occurrence of this must also be continuously checked.

Risks on the operator's side, price changes resulting from the energy crisis are seen as the greatest risk, which may even be a possibility in the future, since, at the current level of consumption, the city has an energy surplus, which may be sold at market prices in the future, so it may be advisable to examine the possibility offered by energy communities (Piricz and Révész, 2022).

Workplace health and safety risks are types of risk that apply to all employees, regardless of the work they do. Failure to provide a safe and healthy work environment can lead to accidents, injuries, and legal liability. Failure to comply with occupational health and safety regulations may result in sanctions. Its existence is so important that visitors arriving for a temporary period are also obliged to comply with the safety regulations (Biermann-Teuscher et al., 2023).

Technological risks appear in all areas of industry (Alpkan and Gemici, 2023). Relying on outdated HR systems can lead to inefficiencies and errors in HR processes, as can inadequate cyber security measures and unauthorized access to HR data. The great competition in the automotive industry highlights this risk, as it must ensure that its successes in the market are maintained in the future too.

To mitigate these risks, organizations should invest in robust HR policies, stay informed about changes in labor laws, foster a positive workplace culture, and regularly review and update HR processes to align with best practices. Regular training for HR staff and effective communication channels within the organization are also crucial for managing HR-related risks.

2.2 Risk mitigation in supply chain

Logistics department is a crucial component of many businesses, responsible for managing the movement of goods and materials throughout the supply chain. Several risks can impact the efficiency and effectiveness of logistics operations. Each of these risk factors in the automotive industry is actually a challenge that must be met successfully (Molnár and Téglá, 2023).

There can be disruptions in the supply chain (W. Zhou et al., 2023), and these affect the functioning of the entire operation. There can be countless reasons for this problem, which can be of many kinds and can have many effects on production and the production of finished goods.

Natural disasters, geopolitical events or unexpected disruptions are problems that are basically beyond the business company's control, but they can affect the flow of goods and materials, which can lead to delays and shortages and finally, it can affect productivity (Bo et al., 2023).

Inventory management risks can affect productivity (Liu et al., 2022). Overstocked or understocked inventory can lead to financial losses. Inaccurate demand forecasting and inefficient inventory management processes contribute to these risks. The procurement of raw materials is governed by rules, from forecasts to actual delivery, with the selection and mutual acceptance of appropriate incoterms.

Rising fuel costs, longer sea transportation, road transportation, or air transportation and changes in related customs clearance or other transportation regulations may also affect logistics costs (Gao et al., 2024). Delivery risks may occur, such as delivery delays, accidents or breakdowns that may disrupt the timely delivery of goods.

Technological and IT risks are the risks that represent the technology used to monitor and manage logistics operations. In logistics, their dependency is high and carries risks related to system failures, cyber security threats and data breaches (Shen et al., 2023).

There may also be supplier and vendor risks. Relying on a limited number of suppliers or a limited number of suitable suppliers can expose the organization to risks such as supply chain disruptions, quality problems or sudden cost increases (Padhi et al., 2024).

Regulatory compliance risks can arise for the following reasons. Failure to comply with customs

regulations, trade restrictions or other shipping regulations may result in delays, fines, and legal consequences. These must be considered when planning the activity. Capacity and resource constraints. Inadequate infrastructure, insufficient warehouse space or a lack of trained personnel can lead to capacity constraints and affect the efficiency of logistics operations.

Currency and financial risks can also affect efficiency. Fluctuations in currency exchange rates can affect international shipping costs and the overall financial performance of logistics operations. After all, the consideration for the services used must be paid, and any change in the exchange rate can also cause liquidity problems (Chakrabarti and Sen, 2023).

Environmental risks may arise (Raian et al., 2023). Increased awareness of environmental issues has led to increased monitoring of the environmental impacts of logistics operations. Failure to comply with environmental regulations may result in fines and damage to the organization's reputation. Overall, competitiveness may be affected by this problem, so it must be eliminated as soon as possible.

Communication and collaboration risks can arise between different stakeholders in the supply chain. Ineffective communication and cooperation between the actors, which are suppliers, manufacturers, distributors, and service providers, can lead to misunderstandings and confusion (Wang et al., 2023).

Under labor and human resources risks, we mean the following risks: lack of skilled labor strikes or other work-related problems can disrupt the operation of the logistics department (Qi et al., 2023). This can be a nuisance, but it can also be a long-term operational risk.

To mitigate these risks, organizations should implement robust risk management strategies, invest in advanced logistics technologies, diversify suppliers, and develop contingency plans for potential disruptions. Regular monitoring, collaboration with key stakeholders, and staying informed about changes in regulations and market conditions are also essential for effective risk management in the logistics department.

2.3 Risk mitigation in production

Production risks refer to the potential challenges and uncertainties that can impact the manufacturing or production processes within a business (Lai et al., 2023). These risks can affect the timely and efficient production of goods and may have consequences for the overall performance of the organization.

Supply chain disruptions affect production. Disruptions in the supply chain, such as delays in the delivery of raw materials or parts, can disrupt production schedules and lead to shortages. Dropping production or moving it to a later date effects on-time delivery, which will also affect the arrival of additional orders (W. Zhou et al., 2023).

Fluctuations in demand affect overall company production (Rajani et al., 2022). Changes in market demand can lead to overproduction or underproduction, affecting inventory levels and potentially leading to financial losses. If this is only a temporary problem, it can still lead to significant costs.

Quality control issues also involve significant risks. Defects or inconsistencies in the manufacturing process can result in substandard products, which can lead to customer dissatisfaction, returns and potential damage to the company's reputation (Babalola et al., 2023). Therefore, the examination of this risk is a permanent activity.

Equipment breakdowns can cause problems in the production of the finished product. During production, the lack of availability of an inadequate amount of production equipment can also cause the creation of an inadequate number of products. Failure of production equipment can result in downtime, delays, and increased maintenance costs (Chinta et al., 2023).

Labor shortages or strikes can block production. Lack of skilled labor or other work-related disruptions can affect production capacity and efficiency. Work force cannot be reserved, so you must prepare for this possibility. Regulatory compliance risks are present from the first minute of activity. Failure to comply with industry regulations or product standards may result in fines, recalls or legal consequences (Wei et al., 2023).

Another type of risk is technology and automation risks, which mean dependence on technology and automation (Filippi et al., 2023). It associates risks with system failures, cyber security threats, and the need for constant updates and maintenance.

The availability of energy and resource costs is also of prime importance (Palea and Santhià, 2022). Shortages in energy and raw material price fluctuations can affect production costs and profitability. Capacity restrictions may apply. Inadequate production capacity or production process bottlenecks can limit an organization's ability to meet demand (Talens Peiró et al., 2022). The Production Planning Department probably can solve the problem. Production Planning Department must work together with Production in a strong relationship.

Natural disasters and environmental risks may occur. Events such as earthquakes, floods or other natural disasters can disrupt production facilities and supply chains. Environmental concerns can also affect production processes (Shen et al., 2023). The goal is to avoid them.

There may also be risks of introducing a new product (J. Zhou et al., 2023). Introducing new products involves uncertainties regarding market acceptance, production scalability, and potential unforeseen challenges.

Intellectual property risks are also protected by law. In addition, risks related to the protection of intellectual property may arise (Chen et al., 2023). Especially in industries where patented technologies or processes are critical to production, it is justified to use greater resources.

Fluctuations in currency exchange rates are among the risks arising from currency and international trade activities (Della Corte et al., 2023). This can affect the cost of imported raw materials and services and the competitiveness of exported goods.

To mitigate production risks, organizations should implement comprehensive risk management strategies. This includes regular monitoring of supply chains, investing in quality control measures, maintaining equipment, diversifying suppliers, and staying informed about changes in market conditions and regulations. Continuous improvement initiatives, employee training, and contingency planning are also crucial components of effective production risk management.

2.4 Risk mitigation in quality assurance

Quality risks in production refer to the potential challenges and uncertainties that can compromise the quality of manufactured goods (Mishra et al., 2024). Maintaining high-quality standards is crucial for the success and reputation of a business.

Defective materials or parts can cause production difficulties (Shan et al., 2023). Poor quality or defective raw materials and components can lead to the production of substandard products. Operating with inadequate quality control processes is risky. Inadequate or ineffective quality control processes can result in defects or inconsistencies in the manufacturing process resulting in a substandard product.

Defects in production equipment, such as production machinery or equipment, can lead to failure of the final product if not detected and treated immediately (Liu et al., 2023). Production therefore checks its availability every day at the start of the shift. The risk of human error should also be mentioned. Errors made by workers during the manufacturing process, such as improper assembly or measurement errors, can compromise product quality.

The risk of inadequate training is also the risk of product compliance. Inadequate training of production personnel can lead to mistakes and errors that affect the quality, functionality, and consequent demand of products and functionality of the products and the resulting decrease in demand (De Oliveira et al., 2021). Supply chain issues can occur when quality suffers, when there are problems with suppliers, such as inconsistent quality of raw materials or delays in the supply chain.

Environmental factors can also pose a risk in this field. Manufacturing processes can be sensitive to environmental conditions, and factors such as temperature, humidity or other environmental variables can affect product quality. Regulatory compliance justified the creation of various standards in the automotive industry (Li and Nam, 2022), such as ISO TS/16949 and later the IATF standard were created. Failure to comply with industry regulations and quality standards can result in fines and damage to the company's reputation. Risks are hidden in the lack of documentation of the process. This means the mentioned ISO specifications. Incomplete or outdated process documentation can lead to deviations in the production process, which affects the quality of the product.

Testing and verification errors are a risk. If testing and inspection procedures are not rigorous or not performed properly, defects may go undetected, leading to the release of nonconforming products. Changing product design also carries risks (Li et al., 2023). Changes in its specifications may also present new risks if they are not thoroughly reviewed and validated before implementation.

If quality defects occur at the supplier, it can immediately affect the usability of the product on the customer side, since quality problems at the supplier level, including changes in production standards, can affect the quality of the final product (Azamfirei et al., 2023). The risk of a product recall may be caused by the non-compliance of a product. Recalls may be necessary if quality problems are detected after the products are released to the market, leading to financial losses and damage to the brand.

To mitigate quality risks in production, organizations should implement robust quality management systems, conduct regular audits and inspections, invest in employee training, and establish clear communication channels with suppliers. Continuous monitoring and improvement of production processes, as well as a strong focus on adherence to industry standards and regulations, are essential components of effective quality risk management in production.

2.5 Risk mitigation in financial issues

The financial department of a production plant is responsible for managing the financial aspects of the plant's operations, including budgeting, accounting, financial reporting, and compliance. Various risks can impact the financial stability and performance of the financial department within a production plant.

Countless budgetary risks arose. Therefore, inaccurate budgeting or failure to meet budget constraints can lead to financial stress and affect the overall financial health of the manufacturing plant. There is also the risk of cost overruns. Unexpected increases in production costs (Schögggl et al., 2023), whether due to fluctuations in raw material prices, unexpected maintenance costs or other factors, can strain financial resources.

During cash flow management risks, poor cash flow management can lead to liquidity problems and make it difficult to meet short-term financial obligations. Exchange rate risks were mentioned as risk factors in several areas (Alami et al., 2023). Manufacturing plants involved in international trade may face risks related to exchange rate fluctuations that affect the cost of imported materials or the competitiveness of exported goods.

Fluctuations in market demand can affect revenue generation, which in turn can affect the

financial stability of the production plant. Credit and receivables risks (Lind et al., 2012) are the risks when the delay of customer payments or the increase of bad debts can affect the cash flow and financial performance of the plant. Financial reporting errors can also occur when inaccuracies or errors in financial reports can lead to compliance issues, regulatory audits, and damage the company's reputation.

Interest rate risks may occur in countries with unstable economies (Claußen and Platte, 2023). If the manufacturing facility has taken out loans, changes in interest rates can affect the cost of debt and general financial expenses, thus financial stability. By compliance and regulatory risks, we mean when non-compliance with financial regulations and reporting obligations results in fines and legal consequences.

The volatility of the market price is also a risk. Fluctuations in the market price of finished products or raw materials can affect the profitability of the plant and other risk from suppliers (Bartos et al., 2022). Over-reliance on a small number of suppliers can expose the plant to risks such as supply chain disruptions, price fluctuations and quality problems. In the automotive industry, a customer-approved supplier is usually accepted without a substitute alternative.

Bad investment decisions or inadequate evaluation of the return on investment of capital projects can lead to financial losses (Colombari et al., 2023). Strategic risks can occur when the lack of consistency between the financial strategy and the overall business strategy can result in financial decisions that are not favorable to the long-term success of the manufacturing plant.

Failure to comply with tax regulations may result in fines and legal consequences. Although the occurrence of this is very rare, it is also a kind of risk. The risk of employee fraud and misconduct is much more common. Taxpayer satisfaction with the services provided by the government and tax authority is linked to greater compliance with tax regulations (Lutfi et al., 2023). Fraudulent activities or misconduct within the finance department can result in financial losses and reputational damage.

To mitigate these financial department risks in a production plant, organizations should implement sound financial management practices, conduct regular financial audits, stay informed about market trends, and maintain a diversified supplier base. Additionally, a strong focus on compliance, robust financial reporting systems, and contingency planning are essential components of effective risk management in the financial department of a production plant.

3. Conclusion

In summary, the automotive field faces a variety of production risks that affect efficiency, cost-effectiveness, and overall success. However, proactive risk mitigation strategies play a crucial role in minimizing challenges and ensuring the smooth operation of manufacturing processes. Figure 1 summarizes a production plant's risk mitigation, presenting the risks of the five most affected areas.

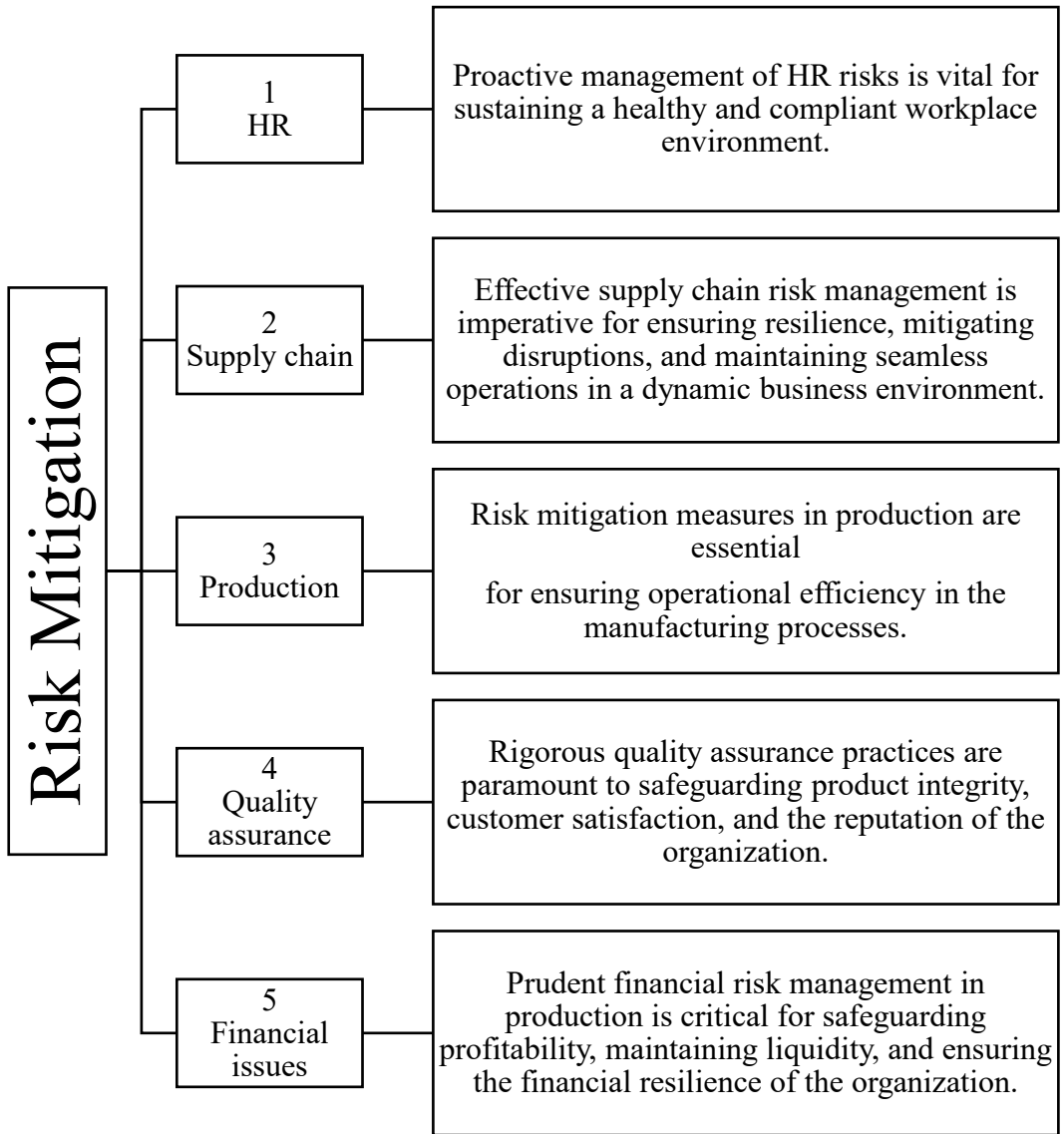


Figure 1. Production Plant's risk mitigation (developed by the authors)

Navigating the diverse landscape of HR, logistics, production, quality, and finance involves addressing a myriad of risks, from talent management challenges and supply chain disruptions to production inefficiencies, quality control issues, and financial uncertainties. Effective risk mitigation strategies across these domains are essential for organizations to thrive in the face of dynamic business environments, ensuring optimal performance, compliance, and sustained success.

The automotive industry recognizes the importance of proactive risk management in navigating the complex challenges of production. By embracing technological developments, diversifying supply chains, leveraging data-driven knowledge, fostering collaboration, ensuring regulatory compliance, and investing in talent development, manufacturers can improve the identification and assessment of production risks and reduce their capability. As the sector continues to evolve, a

commitment to robust risk mitigation strategies will be essential for sustained success and resilience in an ever-changing global environment.

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