

## RISK MANAGEMENT IN AUTOMOTIVE SUPPLY CHAINS IN POLAND

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### Abstract

The current automotive supply chain is facing more risks than ever due to the heavy dependencies of local automotive component manufacturers with foreign and established global producers. In response, this paper is designed to explore the supply chain risk management (SCRM) practice of automotive industry in Poland. The aim of the article was to assess the application of the Supply Chain Risk Management concept by automotive companies (with location in Poland). Risks identified in the external environment and internal flows (created by supply chain companies). The process SCRM and methods of detection risks are presented. Supply chain integrators (companies coordinating the flow of goods and information) and suppliers from the automotive industry were examined. Attempts were made to assess the maturity of companies in implementing the Supply Chain Risk Management concept.

**Keywords:** SCRM, Automotive industry

### 1. INTRODUCTION

The introduction should provide a clear statement of the study, the relevant literature on the study subject and the proposed approach or solution.

The developing globalization significantly influences the growth of risks occurring in supply chains. 70 % of companies declare that they co-operate with customers on the basis of long-term contracts co-creating supply chains. Other companies (approx 30 %) believe that they work in dynamic, constantly modified supply networks and the role of the integrator is taken by various receivers or logistics operator - 4LP. Both chain integrators and supply networks are looking for ways to reduce costs. To achieve that, they delegate the execution of key tasks outside the company (outsourcing and off-shoring). The number of risks in such outsourced, global increasingly dynamic supply chain grows, their type also changing. This shift of supply chain business models towards the network helps reduce costs, but also increases risks. Risk identification, assessment of risk mitigation and risk reduction requires the use of SCRM

Tang [1] defines Supply Chain Risk Management as the management of supply chain risk through coordination or collaboration among the supply chain partners so as to ensure profitability and continuity. Waters [2] defines SCRM as the process of systematically identifying, analyzing, and dealing with supply chain risks. SCRM includes activities such as identification, evaluation, selecting response measures and monitoring. The overall aim of the SCRM is to make sure that a supply chain could carry on its plans with smooth and continuous flows of materials from suppliers to customers [2]. Supply Chain integrator must consider and assess intraorganizational and interorganizational risks of all members and reduce vulnerability of chain members using efficient supply chain risk management techniques.

This paper is designed to explore the supply chain risk management (SCRM) practice of automotive industry in Poland. Overall, the automotive companies are heading towards more formal and sophisticated SCRM especially with the certification of IATF 16949:2016 although there are still plenty of rooms for improvements in the risk identification and risk assessment tools. Polish automotive industry is chosen for this study because the number of suppliers is increasing, they have internationalized their activities, they have implemented new management concepts. The data were gathered from March until September 2018, using the survey method.

The questionnaires were filled in by managers: purchasing or logistics at 33 automotive supply companies and 3 managers from car concerns located in Poland. The data was subject to a simple statistical analysis, they are shown in the chart and interpreted.

## 2. EXTERNAL AND INTERNAL SOURCES OF RISK FOR THE SUPPLY CHAINS

A simple categorization of SC risk sources is external and internal categories based on whether the risk origin is within or outside the SC. Internal risks emerge in various forms in day-to-day operations of a SC including but not limited to quality problems, late deliveries, excess inventory levels, inaccurate forecasts, human error, and faults in IT systems. Juttner, Peck, and Christopher [3] categorized supply chain risk sources into three main categories, namely environmental, organizational, and network-related risk sources. In addition, Brindley [4] categorized supply chain risk sources into three categories, namely strategic uncertainties, tactical disruptions, and operational disruptions which differ from one another based on the risk origination point and intensity. Tang [1] has proposed the following supply chain risk sources categorization: 1. Supply risks are related to the inefficiencies of suppliers when they cannot deliver the promised products on time and/or with specified quality. 2. Process risk occurs when a specific process is not capable of producing on time and high quality products. 3. Demand risk occurs when there is not enough demand for some of the SC products. 4. Control risk is due to lack of proper quality control and management systems. 5. Environmental risks originate from the interactions of the SC with its surrounding environment. The automotive industry seems to prefer the risk distribution according to Chopra & Meindl [5]. Managers name and monitor the risks listed in **Table 1**

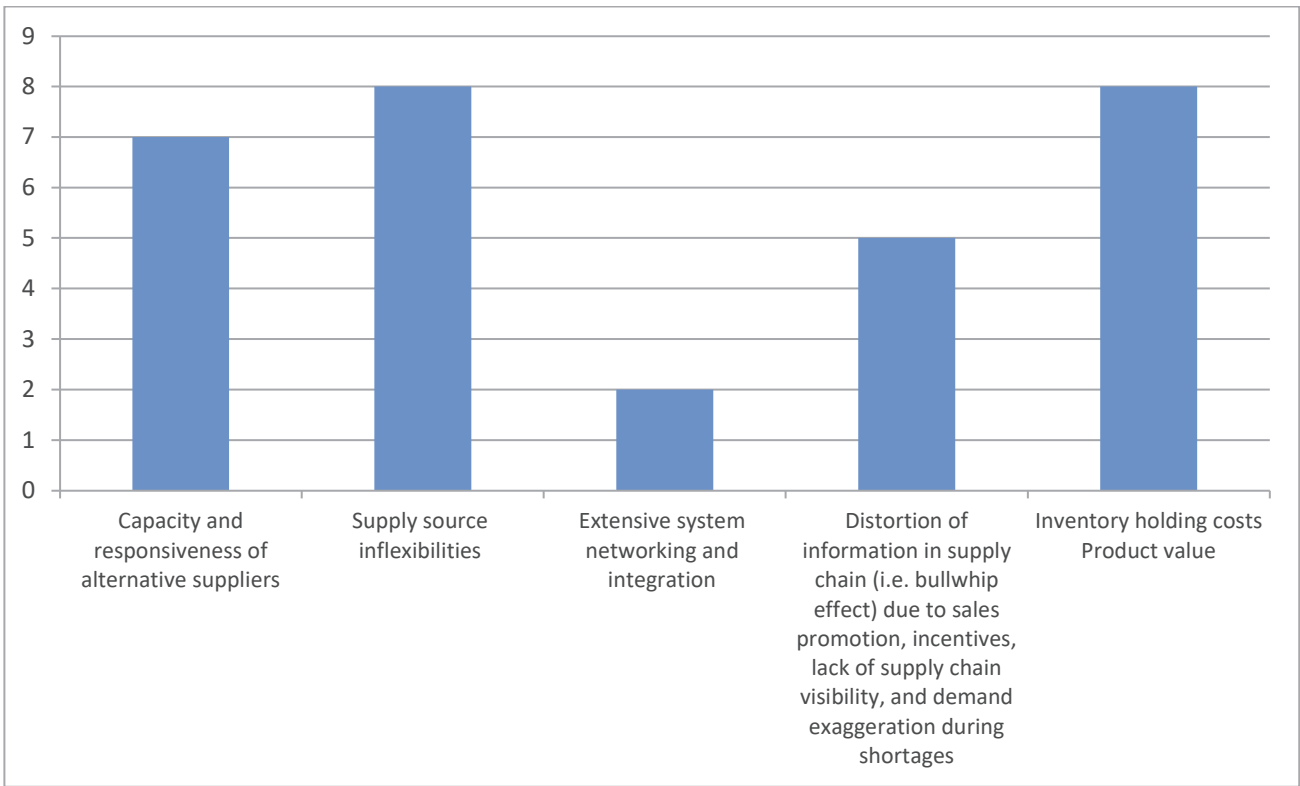
**Table 1** Automotive supply chain risks type [1]

Risk Driver	Risk Type
Disruptions	Natural labor strikes; Bankruptcy of suppliers; Disruption in suppliers such as fire; War and terrorism; Dependency on a single supplier; Capacity and responsiveness of alternative suppliers
Delays	High resource utilization at suppliers; Supply source inflexibilities; Low quality and yield at suppliers; Excessive handling due to crossing borders and changing modes of transportation
Systems	Information system failure; Extensive system networking and integration; E-commerce
Forecast	Inaccurate forecast due to long lead times, seasonality effect, variety of products, short life cycles of products, and small customer base; Distortion of information in supply chain (i.e. bullwhip effect) due to sales promotion, incentives, lack of supply chain visibility, and demand exaggeration during shortages
Intellectual Property	Supply chain vertical integration; Global outsourcing; Global markets
Procurement	Exchange rate risk; Percentage of key components/raw materials procured; Industry-wide capacity utilization; Long-term vs. short-term contracts
Receivables	Number of customer accounts; Customers' financial strengths
Inventory	Product obsolescence rate; Inventory holding costs Product value; Uncertainty of supply and demand
Capacity	Capacity costs; Capacity flexibility

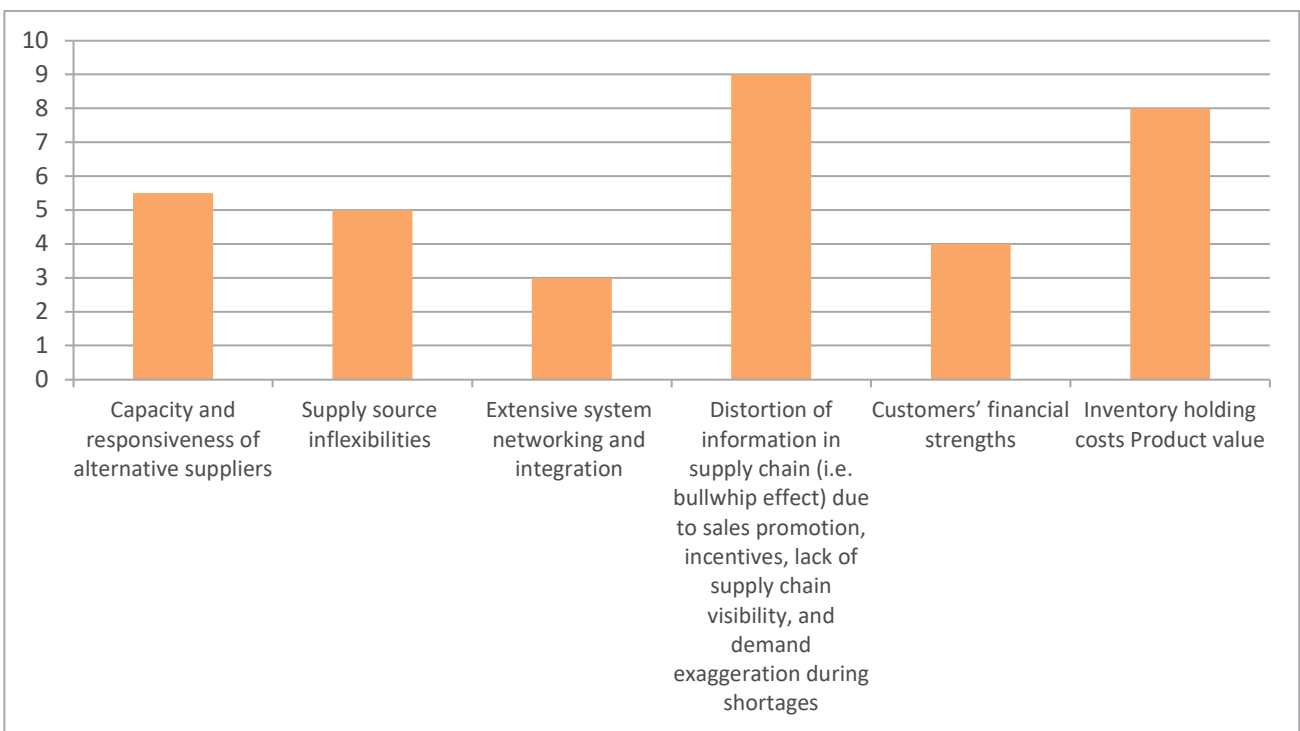
We can ask which of the links should be responsible for risk management in the supply chain. Specialized manufacturers, due to size and nature, impose procedures and use the risk mitigation measures. Logistics operators (4PL) increasingly manage risk in supply networks. Market realities, however, lead to practical conclusion, i.e. that each operator in each link of the supply chain must take responsibility for risk of its SC activities.

Automotive industry managers were asked to assess risks regarding: - occurrence probability (possible grades: 0-1 point), - the scale of threats that they create for the flows in supply chains (possible assessments: 1-10

point). **Figures 1 and 2** shows the risks that obtained the highest products of the arithmetic means of the ratings.



**Figure 1** Risks that obtained the highest products of the arithmetic means of the ratings obtained (managers of automotive concerns)



**Figure 2** Risks that obtained the highest products of the arithmetic means of the ratings obtained (suppliers evaluation) [Own study]

Suppliers implemented the SCRM based on the IATF16949: 2016 standard required by their customers. Suppliers aptly (just like customers) identify the probability and scale of risks arising in the supply chain. They are more often informed about the risks (which has arisen), less likely to identify it themselves.

### 3. RISK MANAGEMENT PROCESS IN SUPPLY CHAINS / NETWORKS

Manufacturers - supply network integrators implement the concept of SCRM (Supply Chain Risk Management) for the mitigation of risks. The application of this concept is much more difficult in dynamic supply networks than in integrated supply chains. Process can be regulated by national standards (Australian, Canadian, Japanese, British) of organization and supranational regulations - such as the AIRMIC-FERMA standard, the integrated COSO II, international ISO 31000 standard.

The automotive industry limits the risks by implementing the IATF 16949: 2016 standard. IATF 16949: 2016 (formerly ISO / TS 16949: 2009) is a Technical Specification that combines the requirements German (VDA6.1), French (EAQF), Italian (AVSQ) quality management systems, to eliminate the need for multiple certifications to meet customers requirements. SCRM implementation in automotive was based on the IATF 16949: 2016 standard. According to the standard, occurrence probability of a specific risk could be reduced via improving internal risky operational processes as well as coordination and collaboration with suppliers.

Risk management in the supply chain (in which the product is created) consists of the following stages: see: Bukowski [6]; Stawiarska [7]

- I. **Define competitive strategies** for a particular product's supply chain (the same supply chain can produce several products with different competitive strategies). The risk management process in the supply chain may be different for different products. Risk assessment standards are prepared based on the selected competitive strategy. Helpful standards they are also in determining the risk tolerance threshold. Risk tolerance also determines how much the SC partners will devote to preventive measures.
- II. **Identify SC risks:** It is necessary to examine the supply chain and define its separate activities and their relationships, and systematically study them to find areas containing risks. The output would be a list of risks threatening the supply chain. The SC members should cooperate in identifying the SC risk besides each member's specific risks. Therefore, it is very important for the success of this step to share risk data and information between the SC members.
- III. **Analyze and assess the risks:** With a list of risks threatening the supply chain, the next step is to consider their potential impacts. The impact of a risk depends on the probability of the risk and the severity of its consequences. The management role is to prioritize risks according to their impact and decide where to concentrate their SC resources. Several useful tools can help with this analysis such as failure modes and effects analysis (FMEA), fault tree analysis, event tree analysis, scenario analysis, simulation, risk mapping, and network models. The output of this step would be a prioritized list of risks and their expected consequences. Rozpoznanie zewnętrznych zagrożeń dla łańcucha dostaw. The integrator should also mark and group the threat e.g. according to supply chain level at which they arise. A sample description of the risk (A. Name of risk; B. Scope of risk; C. The nature of risk; D. Pressure group; E. Quantitative description of risk; F. Risk tolerance (level of acceptable risk); G. Actions with regard to risk and control mechanisms; H. Potential to improve the situation; I. Developing strategies and short-term plans).
- IV. **Build an information system about the possibility of risk.** Do an audit / self-assessment (audits and self-assessment remain the basic source of information on risks in SC companies). Design suitable response to the risk: Here SC managers know the significance of risks and consider different ways of dealing with them. Several different types of responses exist within this range (Waters, 2007):
  - Prevention (i.e. reducing the risk probability),
  - A. Mitigation (i.e. reducing or limiting the risk

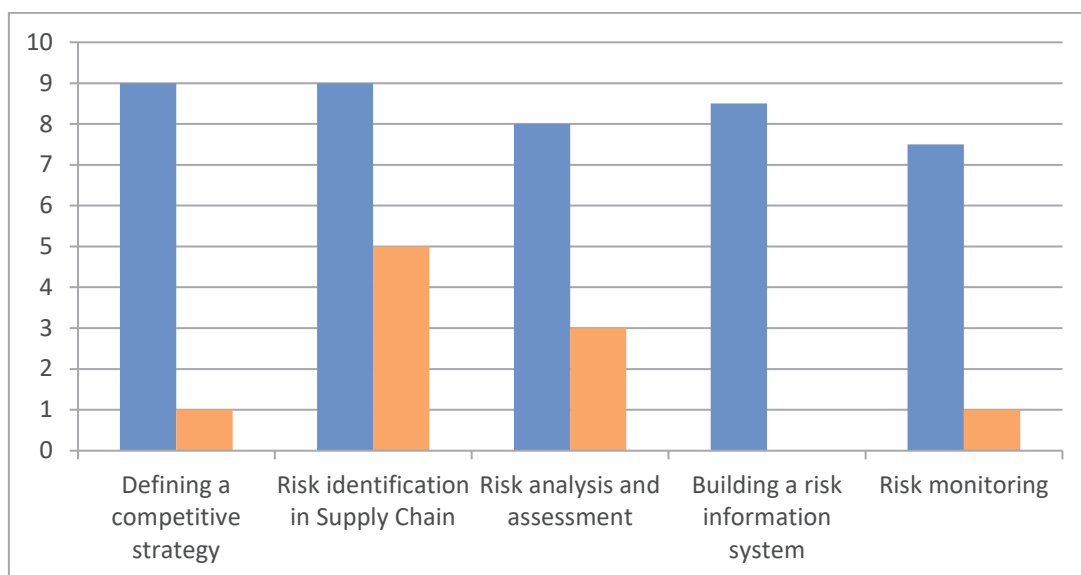
consequences); B. Waiting to evaluate actual outcomes of an event and then designing a response, ° Ignoring or accepting the risk; C. Transferring, sharing, or deflecting the risk; D. Making contingency plans; E. Adapting to risk, Opposing a change; F. Changing the SC environment. The above list shows main options for dealing with risks. Next stage would be to convert these general methods into specific plans and procedures.

- V. **Monitor the risks:** In today’s competitive world, neither SC nor their environmental conditions would remain constant. Obviously, with changing of conditions that supply chains are faced with, their risk will change as well. Hence, SC managers must constantly evaluate whether new risks are threatening their SC or not, and if such risks were identified, they have to ensure that necessary SCRM steps are taken. Information management is the only effective way to reduce risks in the supply chain. Two-way (vertical) and inter-level (horizontal) communication within the supply chain implemented both through formal reports and informal ex-change of information is the basis of SCRM. An integrated IT system, operating to reduce risk and connecting chain partners, should include modules with specified expectations with respect to co-operators (when and how to inform of the possibility of risk), modules for risk assessment and statistical measurement of adverse events, modules for compare co-operators in terms of creating threats and benchmarking modules teaching how to avert the risk.

At the end, it is important to remind that the above process is not a onetime project for a supply chain, but rather a continuous process in which the necessary feedbacks and information are being communicated between its different steps.

Managers of the automotive industry were asked to evaluate the SCRM process in terms of: - the degree of mastery of the process stage (possible grades: 0-1 point), - management efficiency at individual stages of the process (possible grades: 1-10 point). **Figures 3** and **4** show the assessments of the individual stages of the SCRM process.

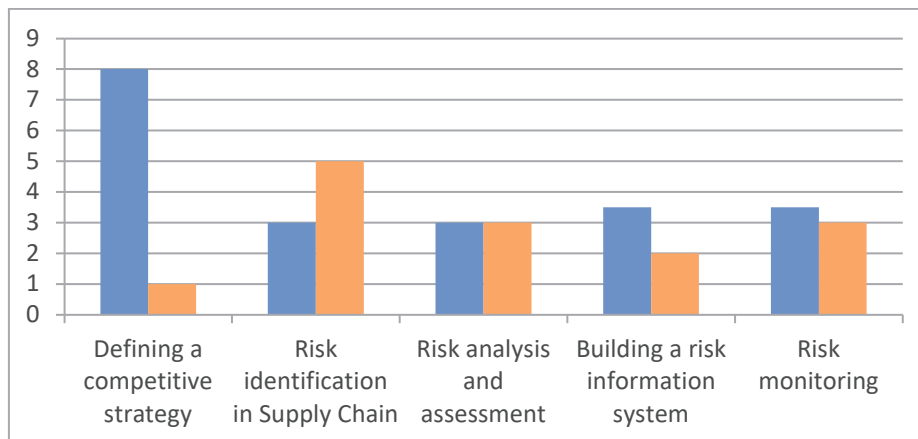
Although the application of SCRM process is frequently encouraged by international standards and enforced by automotive concerns, suppliers still implement SCRM implicitly. This is demonstrated by the assessment and self-evaluation of the SCRM process (**Figure 4**).



**Figure 3** Assessments of the individual stages of the SCRM process [Own study]

Managers of automotive concerns evaluate their activities themselves

Managers of automotive concerns evaluated the suppliers's activities



**Figure 4** Assessments of the individual stages of the SCRM process

Suppliers evaluated the integrator's activities

Suppliers evaluate their activities themselves

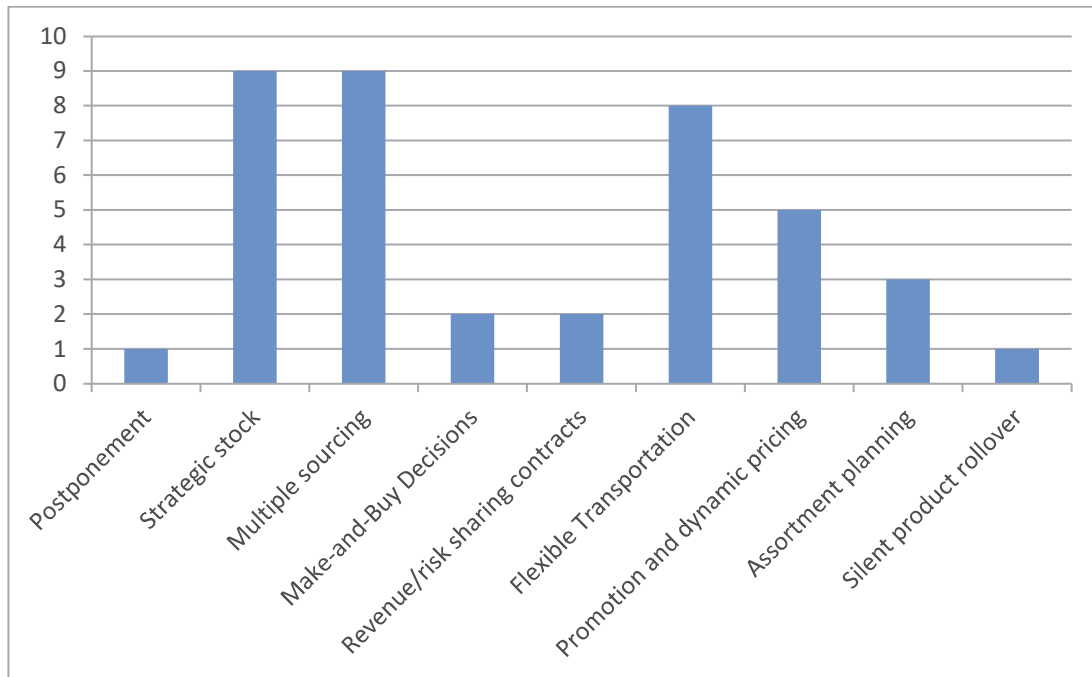
#### 4. SUPPLY CHAIN RISK MITIGATION THROUGH ROBUST STRATEGIES

Automotive companies improve flow safety throughout the own chains. They make SC maps, conduct monitoring consisting in reliable, unambiguous and undeniable identification and control of each section of the flow of materials, semi-finished and finished products as well as storage of inventories in the supply chain. They conduct flows management training, appoint risk directors (CROs), and strategic suppliers locate near their plants to maintain ongoing deliveries. Brainstorming techniques, experience and expertise were mainly used as risk identification and assessment techniques. Studies have shown that automotive companies implemented failure mode and impact analysis (FMEA). Suppliers try to cooperate with trusted subcontractors, check contractors. External audits most often concerned the quality of production, transport, storage processes, product quality parameters, and their compliance with the certificate held by the contractor. Few surveyed donors use risk assessment methods. Tang (2006) argues that supply chains should employ supply chain risk mitigation strategies that have both the efficiency and resiliency properties. An efficient risk mitigation strategy allows the SC members to deal with common SC uncertainties, while a resilient risk mitigation strategy enables the SC members to sustain their performance level to some extent during a major risk or disruption and bounce back to their original conditions after the event. Tang [1] lists the following strategies:

- I. **Postponement:** Producing a standard product and then customizing it for meeting the specific needs of target market.
- II. **Strategic stock:** Increasing the safety stock levels for critical components of a supply chain at multiple strategic locations shared and operated by different SC members.
- III. **Multiple sourcing:** Decreases demand uncertainties as well as supply uncertainties in case of a major disruption occurs for its supplier(s).
- IV. **Make-and-Buy Decisions:** Outsourcing some of products with the option of restoring them to their production.
- V. **Revenue/risk sharing contracts:** Utilizing revenue/risk sharing contracts is a way of cultivating additional suppliers.
- VI. **Flexible Transportation:** Use of multi-modal transportation systems, multicarrier transportation systems, multiple transportation routes as to add flexibility to a transportation system.
- VII. **Promotion and dynamic pricing:** Attracting customers to buy available products via promotion and dynamic pricing techniques instead of the products in short supply due to the disruption.

- VIII. **Assortment planning:** Configuring sets of products on display can manipulate customers' behavior. This technique can persuade customers to buy the products that are more available while some of the SC products are in short supply due to a SC risk or disruption.
- IX. **Silent product rollover:** This strategy is used to delay official introduction of new products until the stocks of old products are finished.

The strategies used in automotive supply chains are presented in **Figure 5**.



**Figure 5** Supply chain risk mitigation through robust strategies (average point assessment of the frequency of strategy use by the automotive concerns studied)

## 5. CONCLUSION

The occurrence of risks can be effectively reduced by implementing the SCRM concept. This article presents research on the implementation of the SCRM process in the automotive industry. A survey of automotive companies located in Poland has revealed that supply chain risk management (SCRM) practices in the automotive industry are based on the IATF 16949: 2016 standard (corporations enforce its implementation from suppliers). Car manufacturers estimate highly the maturity of SCRM implementation. Meanwhile, suppliers recognize risks, but most respondents do not have a residual rating developed. Suppliers give the integrator a low rating in SCMR process management. Suppliers try to manage the continuity of their flows using qualitative (non-analytical) methods. Research on methods and strategies for limiting risk are presented and show that Strategic stock and Multiple sourcing are most often used in automotive SC.

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