Ewa STAWIARSKA
Politechnika Śląska
Wydział Organizacji i Zarządzania
Instytut Zarządzania i Administracji

CREATING A PRODUCT INNOVATION IN THE CONTEXT OF THE RISKS INVOLVED IN THE SUPPLY SYSTEMS IN THE AUTOMOTIVE SECTOR

Summary. The aim of the article was to present risks created by suppliers of the automotive sector. Particular emphasis was placed on the risks created by Tier-1 and Tier-2 suppliers of new components. Operations of network integrators presented in the article (including operations of logistics operators coordinating the flow of goods and information) aim to eliminate threats by implementing the following concepts: Supply Chain Risk Management (SCRM), Project Management, Integrated Product Development (IPD). The article attempts to confirm the thesis that the development of product innovations is associated with the risks that can be identified, assessed and eliminated. Types, importance and probability of risks were presented on the basis of a survey conducted among representatives of the automotive industry representing companies located in Poland.

Keywords: risk, supply chain, product innovation, the automotive sector

TWORZENIE INNOWACJI PRODUKTOWYCH W KONTEKŚCIE RYZYKA WYSTĘPUJĄCEGO W SYSTEMACH ZAOPATRZENIOWYCH SEKTORA MOTORYZACYJNEGO

Streszczenie. Celem artykułu było przedstawienie ryzyka tworzonego przez dostawców sektora automotive. Szczególnie przyglądano się ryzyku, jakie tworzą dostawcy I i II rzędu nowych komponentów. Przedstawiono działania integratorów sieci (w tym operatorów logistycznych koordynujących przepływy dóbr i informacji), mające na celu eliminowanie zagrożeń przez wdrożenie koncepcji: zarządzania ryzykiem SCRM (*Supply Chain Risk Management*), GSCM (***Global Supply Chain Management***), zarządzania projektami (*Project Management*), integracji działalności rozwojowej IPD (*Integrated Product Development*). W artykule starano się

potwierdzić tezę, że: rozwój innowacji produktowych jest związany z ryzykiem, które można rozpoznawać, oceniać i eliminować. Rodzaje, znaczenie i prawdopodobieństwo ryzyka przedstawiono analizując dane z badań ankietowych przeprowadzonych wśród przedstawicieli branży motoryzacyjnej reprezentujących przedsiębiorstwa zlokalizowane w Polsce.

Słowa kluczowe: ryzyko, sieci dostaw, innowacja, sektor motoryzacyjny

1. Introduction

Increasing globalization significantly influences the growth of risks in supply chains/supply networks of the automotive sector. In this sector, 70% of the suppliers of automotive components declare that they cooperate with the recipients on the basis of long-term contracts, co-creating supply chains. Among this group of respondents, 18% of companies develop innovative products with the recipients, while the others implement turnkey solutions imposed by the recipient. 30% of companies believe that they work in a dynamic, constantly modified supply chains, where the role of integrator is taken over by another recipient or logistics operator – 4LP. Among the surveyed companies, 90% of them improve their position in the industry through R&D activities. Both automobile manufacturers and their Tier-1 suppliers are seeking ways to reduce costs. For this purpose, they transfer the implementation of key tasks beyond the company (outsourcing and off-shoring). The number of threats in such outsourced, global and increasingly dynamic supply chains is growing; the types of threats are changing, too. This change in business models in the supply chains towards the networks contributes to reducing costs, but also increases the risks in designing innovative solutions as well as the risks of losing the flow of goods liquidity. Recognizing the risks, assessment of the possibility of their occurrence and preventing incidents interrupting flows in the automotive industry is the subject of this article.

2. Supply chains and supply networks in the automotive sector

The value of the average car consists of a total of over 10 000 pieces, which emphasizes the complexity of supply chains/networks of value creation in the automotive industry. In recent years, all manufacturers have significantly reduced their own part in creating the final product, moving the production of many of its components to suppliers. Today, about 65% of the value of the car is created from suppliers and manufacturers leading to a further increase in outsourcing, which also indicates the prospects of the group of suppliers.

Currently, vehicle manufacturers intend to develop and produce, reaching 35% of their value, which means that in terms of "average car" own contribution is still about 4 000 euros. By 2015, this share drops to 2 670 euros, i.e. up to 23%. Outsourcing relates specifically to the body, sheets, paint and chassis systems, as well as production and installation of modules. From some time manufacturers also carry on suppliers (i.e. the system partners and R&D institutions), functions related to the development of new products. In the years 1995-2004 for car manufacturers gross margin (EBIT) developed an average of 4.8%, while the suppliers and the order of 6.5%.[1] Staying with the current nature of the cooperation of businesses (integrated supply chain), is further declines in margins. Innovative business models – the supply network an opportunity for savings of an average for one vehicle amounts ranging from 600 to 1000 euros, making both for customers and suppliers, the gross margin could increase by about 3%, and return on capital employed from 4% to 10%.[2] An important liberating potential savings will certainly new forms of cooperation, rubbing against concepts of hybrid products (co-operation system, cooperation production, engineering services and the effects of spin-off production on request). Pulses to such a direction of development, on the one hand, are the new technologies, the increasing complexity of vehicles and the number of input models, which significantly increases the cost of development and production. An additional incentive is the fact that the European Union has tightened environmental standards and safety standards for cars, which raises production costs. Manufacturers of vehicles – supply network integrators implement concepts of: Project Management, Supply Chain Risk Management, Green Supply Chain Management and Integrated Product Development on the need to reduce the costs and risks. The application of these concepts, however, is much more difficult in dynamic supply chains than in integrated supply chains.

3. Risk supply systems in the automotive industry

3.1. Internal threats to secure flow in supply chain and ways to combat them

Internal threats for security flows are usually posed by dishonest and non-profit market collaborators. Here, we can ask which of the links should be responsible for the security of flows in the supply chain. Specialized manufacturers, due to their size and nature of the business, impose procedures and use the measures improving the safety flows. In supply

[1] Orsato R.J., Wells P.: U-turn: the rise and demise of the automobile industry. "Journal of Cleaner Production", Vol. 15, 2007, p. 994-1006.

[2] Nunes B., Bennett D.: Green operations initiatives in the automotive industry. "Benchmarking: An International Journal", Vol. 17, No. 3, 2010.

networks, the security of flow is more and more often managed by logistics operators (4PL). Market realities, however, lead to a practical conclusion, i.e. that each operator in each link of the supply chain must take responsibility for the security of its own activities. Among the respondents, 82% of automotive companies have introduced (on its own initiative or imposed) actions improving safety. The mentioned implemented solutions include monitoring, conduct according to certain procedures, insurance of cargo, taking care of information security, staff training, checking the identity of employees, use of identifiers for employees, internal controls, devices are also used that make the seals more resistant to tampering.

Entrepreneurs are trying to work with trusted subcontractors, they check their contractor. External audits concerned mainly:

- identification of all components of the purchased product and the veracity of information given about the product,
- the quality of production processes, transportation, storage, product quality parameters, their compliance with the certificate held by the contractor (ISO/TS 16949).

Traceability technologies implemented to improve the safety of flows in the whole chain are designed to:

- exclude the possibility of falsification of the product – consisting of a reliable, unequivocal and undeniable identification and controlling of each section of the flow of materials, semi-finished and finished products, and storage of inventory in the supply chain,
- quickly locate the product on the market and in the supply chain and selection of product groups from the same manufacture batch/lot or delivery batch,
- ensuring immediate withdrawal of products threatening the security of life and health from the market and all locations in the supply chain.

Plenty of companies (mainly supply chains integrators) started to manage risk or intend to implement the concept of SCRM, as shown in figure 1.

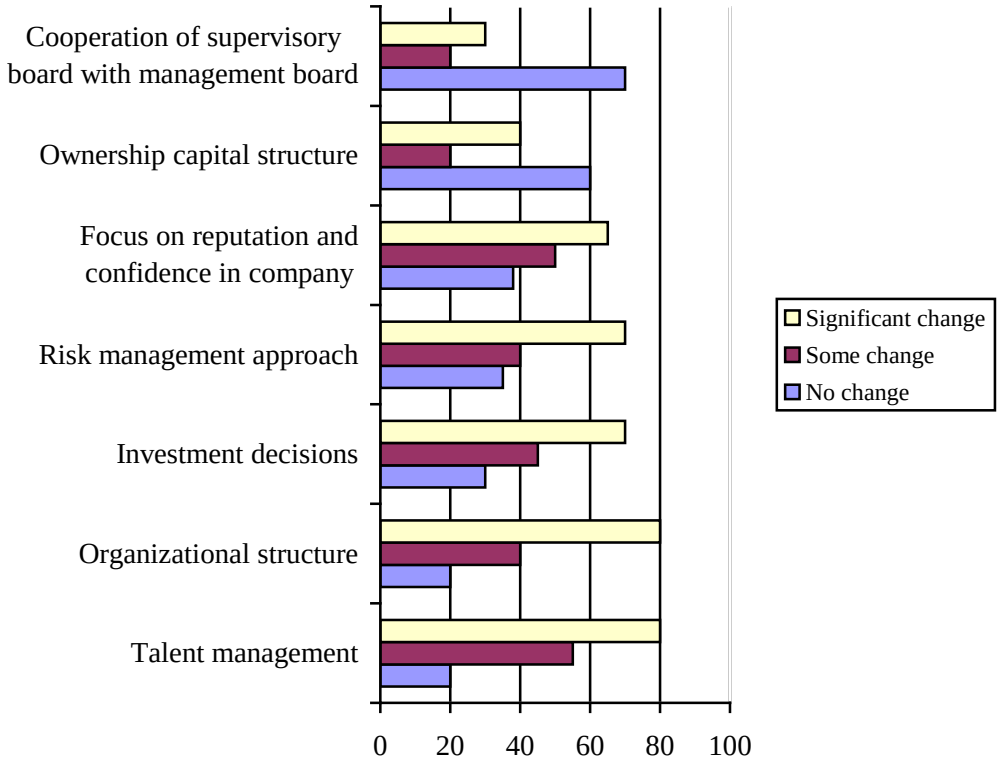

Fig. 1. Areas of change of the company operating model in the next 12 months (% of responses)
Rys. 1. Obszary zmiany modelu operacyjnego firmy w ciągu najbliższych 12 miesięcy (% odpowiedzi)
Source: Research Report Annual Global CEO Survey conducted by PricewaterhouseCoopers, www.pwc.pl/pl_PL/pl/publikacje/CEO_Survey_Polska_14-F.pdf.

3.2. Detection and monitoring of risks as an action affecting the security of flows in the supply chain

Manufacturers – supply network integrators implement concepts SCRM (Supply Chain Risk Management) for the mitigation of risks. The application of this concept is much more difficult in dynamic supply chains than in integrated supply chains. Supply Chain Risk Management is a process as shown in figure 1 and can be regulated by national standards (Australian, Canadian, Japanese, British) of organization of the risk management process and supranational regulations – such as the standard AIRMIC-FARM, the integrated structure framework COSO I, the international standard ISO 31000.

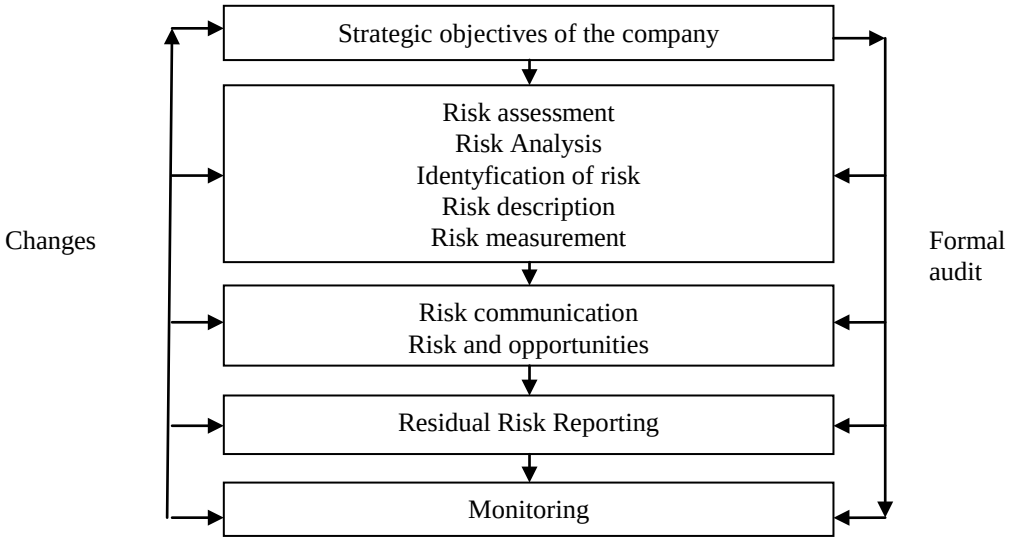

Fig. 2. Risk Management Process
Rys. 2. Proces zarządzania ryzykiem
Source: www.ferma.eu/app/uploads/2011/11/a-risk-management-standard-polish-version.pdf.

Managing risk in a supply chain/ networks (in which a product emerges) comprises the following steps:

1. Definition of competitive strategy for the supply chain of the implemented product (the same supply chain can produce several product for which different competitive strategies are implemented, therefore, the risk management process can run differently for different products in the supply chain. Based on chosen competitive strategy (differentiation, cost, concentration), standards evaluating the strategy implementation are prepared. Standards are also helpful in determining the threshold of tolerance to the presence of risk. Risk tolerance also determines how much the manufacturer and its collaborators allocate to preventive measures.
2. Recognition of external threats to the supply chain. The integrator should make and group the threats e.g. by:
   - the degree of influence on the occurrence of a crisis situation,
   - the supply chain level in which they arise,
   - activities which they may threaten.

   A sample description of the risks presented in Table 1.

Table 1

Sample description of the risks

1. Name of risk	**Description of risk**
2. Scope of risk	Qualitative description of events (scale, type and number, as well as derivative events)
3. The nature of risk	for example strategic, operational, financial, knowledge, management or regulatory compliance
4. Pressure groups	Pressure groups and their expectations
5. Quantitative description of risk	The importance and the likelihood of risk
6. Risk tolerance (level of acceptable risk)	Potential size of losses and financial consequences of the risk Distressed assets The probability and magnitude of potential harm and benefits Objectives in terms of risk control and optimum results
7. Actions with regard to risk and control mechanisms	Basic measures currently used to manage the risk Level of confidence at the current control mechanisms Existing procedures for monitoring and system analysis
8. Potential to improve the situation	Recommendations to reduce the risk
9. Developing strategies and short-term	Determination of Division responsible for developing short-term strategies and plans

Source: www.ferma.eu/app/uploads/2011/11/a-risk-management-standard-polish-version.pdf.

3. Establishment of an information system the possibility of risk of an emergency. Auditing and self-assessment remains the primary source of information about co-operators. The permanent co-operation of the staff responsible for risk management (employees: suppliers, logistics providers, and producer of the final good) is extremely important to identify and reduce the frequency of occurrence and seriousness of adverse events.
4. Planning and controlling of all activities, ranging from product design to its reverse logistics. Preparation of alternative supply maps and plans allowing quicker respond to adverse events and long-term crises. Their possible use by the decision maker is a preventive action.
5. Gathering information about emergencies, drawing conclusions – management of knowledge about the crisis.
6. Risk identification is one of the mentioned stages of risk management. Emerged risks (possible events) should be codified and the occurrence of adverse events should be analyzed in different sections:
   - frequency (number) of occurrences for the individual months of the year, years,
   - category of semi-finished products/spare parts/materials/logistics services affected by undesirable phenomenon,
   - links of supply chains/networks as the cause of adverse events,
   - links of supply chains/networks as affected elements due to adverse events,
   - financial consequences caused by the event,
   - time loss due to break in the flow,

- impact on the implementation of production/sales forecasts,
- events which in the future can be influenced and those caused by external factors beyond our control.

As indicated, one of the steps of risk management is to identify threats. Risks created by suppliers to the supply systems of vehicle manufacturers are different depending on the complexity and level of chain/supply chain. Tier-1 suppliers create threats different than Tier-2 suppliers or a Logistics Service Provider. Table 2 shows the risks that may be created by suppliers of the successive levels to their clients with regard to the division of threats: technical-technological, related to the continuity of logistics flows, socio-environmental and hence image-related[3] (i.e. worsening the product image as well as the image of vehicle manufacturer and the dealers)

Table 2

Threats to the supply system from the automotive suppliers divided into the following categories: technical & technological, logistic, socio-environmental/image-related

Risks caused by Tier-1 suppliers of new components/Risk description		The importance of risk for innovation the average of research (weighting of the criteria add up to 1)	The probability of risk the average of research 1-5 scale (the highest rating)	Weight x the probability of risk assessment
Technical & technological	1. Limited resources of R & D component suppliers, the need of the order the R & D / loss now how.	0,15	2	0,3
	2. Lower innovativeness of the applied technology and materials in comparison to the competition.	0,1	2	0,2
	3. Problems with management of innovation projects implemented in cooperation.	0,2	3	0,6
	4. Dissemination of confidential information	0,15	2	0,3
	5. Emerging technical limitations arising from the possibility of manufacturing processes.	0,25	1	0,25
	6. Difficulties in obtaining quality certificates and within business certificates, for example ISO/TS 16949: 2009 (which excludes the important supplier afterwards).	0,05	1	0,05
	7. Defectiveness of supplied modules	0,1	2	0,2
		1		**1,7**

[3] See: Stawiarska E.: Realizowanie polityki CSR i budowanie wizerunku współpracujących biznesów motoryzacyjnych a odpowiedzialność zakupowa Polaków, [w:] Karczewski L., Kretek H. (red): Odpowiedzialny biznes i konsumeryzm wyzwaniem XXI wieku. Politechnika Opolska, Opole 2015.

cont. tab. 2

Logistic	1. Difficulties logistics in integrating innovative product solutions	0,45	3	1,35
	2. Difficult testing of prototypes	0,2	2	0,4
	3. Delays in deliveries (reasons: capacity load, decrease in the level of specialization inventory, lowering inventory levels due to a desire for a radical reduction in storage costs).	0,15	4	0,6
	4. Delays in deliveries in the *Just-in-Time, Vendor Managed Inventory* systems.	0,05	4	0,2
	5. Delivery delays caused by external factors (delayed customs operations, theft, prolonged operations at transshipment terminals, strikes).	0,1	2	0,2
	6. Lowering timeliness and flexibility of deliveries (reason: the increased distance from the receiver due to the transfer of business to new areas with cheaper labour force (low cost country sourcing, off-shoring).	0,05	2	0,1
		1		**2,85**
Socio-environmental/ image-related	1. Unethical behaviour toward employees when moving a business into new regions with cheaper labour force with unregulated labour law.	0,05	2	0,1
	2. Non-compliance with / violation of environmental requirements.	0,45	2	0,9
	3. Lack of reports prepared / published according To GRI guidelines.	0,2	3	0,6
	4. Irresponsible social and environmental behaviour selected in the course of auditing or during self-assessment (according to the self-assessment questionnaire) and the disclosure of those irregularities to public opinion.	0,3	3	0,9
		1		**2,5**
Risks caused by Tier-2 suppliers of new materials/Risk description				
Technical & technological	1. Restrictions in relation to needs: production capacity, research and development, implementation of new products and technologies.	0,4	5	2
	2. Incorrect performance of the contract (technical, quantitative, qualitative).	0,25	4	1
	3. Low quality of products/defective products.	0,15	4	0,6
	4. Interruption of supplies caused by the failure of the machinery.	0,1	3	0,3
	5. The difficulties related to the withdrawal from the contract in case of emergence of a new innovative competitive product/supplier.	0,05	2	0,1
	6. No insurance contract and consequently, the bankruptcy of the supplier and its loss.	0,05	1	0,05
		1		**4,05**

cont. tab. 2

Logistic	1. Communication breaks (reasons: faulty IT systems, periodic absences of persons authorized to communicate with the recipient, the language barrier).	0,4	5	2
	2. Implementation of new technologies (ICT) which cause an avalanche of problems with the transmission, security and the information storage.	0,4	3	1,2
	3. Delayed delivery time (reasons: delayed loading of materials onto the designated means of transport).	0,2	4	0,8
		1		**4**
Socio-environmental/ image-related	1. The emerging difficulties at the start of co-operation (switching to a chain/supply chain). Globalization for this group of suppliers means that the recipients are geographically disconnected. Language and cultural barriers cause errors in the implementation of R&D projects, restrictions on the possibilities of hazard identification, analysis and evaluation. A different law of patent protection prolongs the implementation of inventions.	0,4	5	2
	2. Chaos as a result of poor coordination among the suppliers.	0,2	5	1
	3. Conflicts among other suppliers (caused, among other things, by technical errors, functioning in different, even competing supply chains and the abuse of leadership by the supplier).	0,25	3	0,75
	4. Unethical behaviour towards employees.	0,05	3	0,15
	5. Non-compliance with/violation of environmental standards.	0,05	3	0,15
	6. Irresponsible social and environmental behaviour selected in the course of auditing or during self-assessment (according to the self-assessment questionnaire and the disclosure of those irregularities to public opinion.	0,05	2	0,1
		1		**4,15**
Risks caused by a Logistics Service providing the implementation and commercialization of new product/Risk description				
Technical & technological	1. Lack of understanding and errors in the logistic support of the manufacturer in the research and development (e.g. the lack of specialized packaging for prototypes, failure to ensure a high level of security and confidentiality of innovative products, errors in transport fleet management, unprepared to carry materials of a particular size).	0,4	4	1,6
	2. Delays resulting from errors in preparing the infrastructure of transport and logistics including transfer points and the means of transport.	0,3	4	1,2
	3. Failure of information systems.	0,3	3	0,9
		1		**3,7**

cont. tab. 2

Logistic	1. Delays in delivery caused by the failure of transportation.	0,4	2	0,8
	2. Failure of delivery for the following reasons: theft, damage/destruction of the load (degree of that risk depends on the geopolitical position of the country through which the transport routes run).	0,4	1	0,4
	3. *Bullwhip effect* caused by lack of transparency and shortcomings in the flow of information among the operator and the shippers.	0,1	5	0,5
	4. Failure of delivery due to natural disasters such as hurricanes, floods, fires, earthquakes, as well as the organized crime (Mafia activity and criminal groups).	0,1	1	0,1
		1		**1,8**
Socio-environmental/ image-related	1. Unethical behaviour toward employees of the logistic operator and suppliers.	0,1	1	0,1
	2. Non-compliance with/violation of environmental standards (excessive CO2 emissions generated by road transport, the use of non-organic packaging, etc.).	0,1	1	0,1
	3. Recurring operational problems gradually deteriorating relations between the partners, reducing transparency and mutual trust, limiting the possibility of improving the quality and effectiveness of cooperation, which in turn may even lead to the disintegration of the integrated supply chain.	0,4	2	0,8
	4. Irresponsible social and environmental behaviour selected in the course of auditing or self-assessment (according to the self-assessment questionnaire) and the disclosure of those irregularities to public opinion.	0,4	2	0,8
		1		**1,8**
Risks caused by R&D institutions/Risk description				
Technical & technological	1. The narrow cross-section of technologies in the research and development of new products, e.g. the lack of R&D services for software engineering, sensor technology, automation, aid systems, battery technology, propulsion systems, microelectronics and software.	0,3	4	1,2
	2. The narrow cross-section of technologies in the research and development of innovative production methods.	0,3	4	1,2
	3. Limited skills in the project management in the field of research and development.	0,2	3	0,6
	4. Limited ability to co-organize development activities, e.g., on the basis of the Integrated Product Development.	0,1	5	0,5
	5. Limited possibility of customer involvement in the evaluation of proposals for product innovations, e.g. on the basis of Quality Function Deployment.	0,1	5	0,5
		1		**4**

cont. tab. 2

Logistic	1. Restrictions/barriers to the flow of goods and information across collaborative development projects.	1	2	2
		1	**2**	**2**
Socio-environmental/ image-related	1. Non-observance of/violating environmental standards (excessive CO2 emissions in R&D projects).	0,5	1	0,5
	2. The irresponsible social and environmental behaviour (selected in the course of auditing R&D institutions) affecting the image of the employer.	0,5	1	0,5
		1		**1**

Source: Own study based on the primary research of the companies belonging to the supply chain of Fiat Auto Poland and General Motors Manufacturing Poland, Volkswagen Group Polska.

Looking at the steps of "Risk Management Process" (figure 2), in the article attempts to risks description present in supply chains/networks automotive industry (with divided into risks: technical & technological, logistic, socio-environmental/image-related). Taken attempt to assess strength of risks (based on a calculated average: weights and assessments of risk factors – data obtained from study 100 automotive companies, companies representing various levels of the supply chain). The research results presented in Table 2 and figure 3.

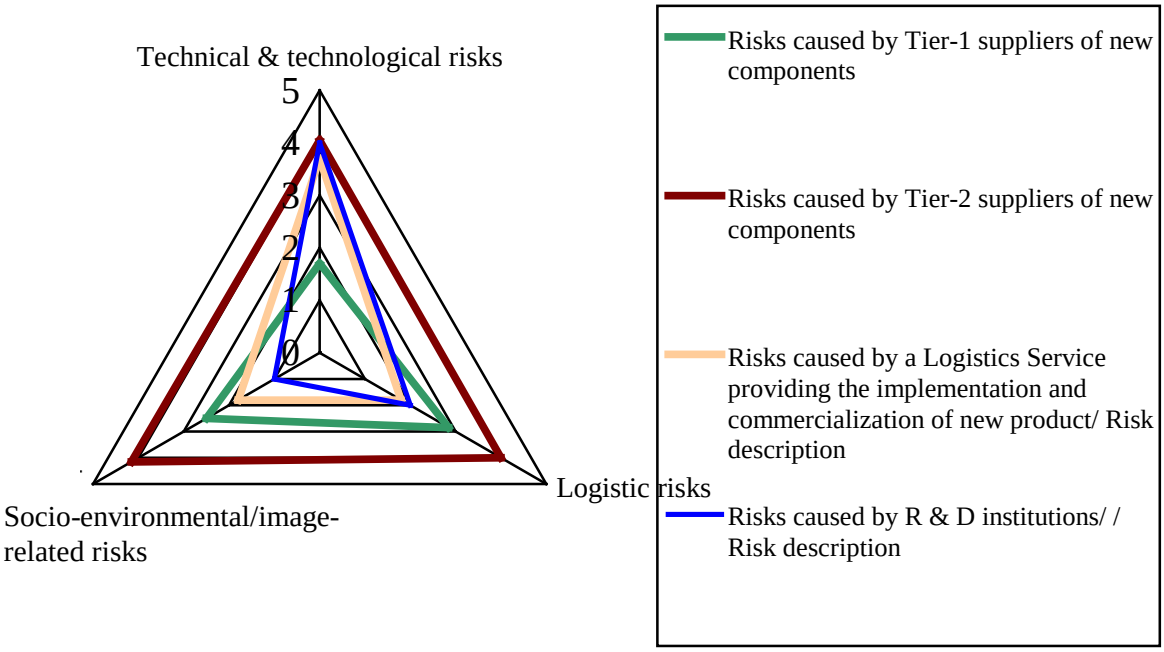

Fig. 3. Risk assessment to the supply system divided into the following categories: technical & technological, logistic, socio-environmental/image-related

Rys. 3. Ocena ryzyka w systemie zaopatrzenia w podziale na następujące kategorie: techniczna i technologiczna, logistyczna, społeczno-środowiskowa/związana z wizerunkiem

Source: Own study based on the primary research of the companies belonging to the supply chain of Fiat Auto Poland and General Motors Manufacturing Poland, Volkswagen Group Polska.

The research results can make a small contribution to the construction of an expert system. This system must evaluate. For, managers make decisions in very complex circumstances with rapidly changing conditions, uncertain goals, little information, tight deadlines, numerous constraints, diverse stakeholders, difficult relations with other organizations, political considerations, inherent uncertainty, varied opinions, limited resources and a whole range of other complications. And this means that standard methods of analysis can be too simplistic to deal with all of the complexities of real problems[4]. However, there is still a lack of a framework type approach that could be the foundation for building an expert system to support the design and evaluation of complex supply chain resilience[5]. The future focus will be on several supply chain performance areas including the following[6]:

- leveraging supplier capabilities and know-how to establish new sources of revenue: e.g., leverage jointly developed technologies with suppliers for internal use or for sale to other customers,
- identifying and mitigating supply risks of any kind to ensure business continuity: protection of intellectual properties.

The proposed in this article the concept of expert system can doing the steps:

- Companies of various levels of the supply chain doing definition the risks.
- Recipients gives risk assessments with can do suppliers.
- The risk assessments are processed statistically.
- Analysis shall be provided in the form of reports to suppliers, together with recommendations to improve selected areas (technical & technological, logistic, socio-environmental/image-related).

Analysis and reports can be prepared once a quarter or a year.

4. Conclusions

In 2013 the new action plans CARS 2020 for the EU automotive industry for the period until 2020 was published. This plan implies the involvement of the ministers of industry, representatives of industry and trade unions in the preparation of coordinated measures to address the problem of excess production capacity, to provide the necessary investment and adjustment support measures for the automotive industry. One of the objectives of the plan is

[4] Waters D.: Supply chain risk managemet: vulnerability and resilience in logistics. Kogan Page Limited, 2011, p. 18.
[5] Bukowski L.A., Feliks J.: Multi-dimensional concept of supply chain resilience. ClC, 7.- 9.11.2012, Jeseník, Czech Republic, EU, http://konsys-t.tanger.cz/files/proceedings/09/reports/1218.pdf.
[6] Monczka R.M., Handfield R.B., Giunipero L.C., Patterson J.L.: Purchasing and supply chain management. South-Western Cengage Learning, Mason 2011, p. 743.

the creation of a European council Board of Skills which specializes in the automotive field, which will focus existing national organizations carrying out research on skills and employment in the automotive sector. The Board of Skills is to promote mutual learning based on the exchange of information and good practices as well as provide a platform for dialogue to reduce the risks associated with the industry. In the automotive risk management in supply chains/networks focusing on: Commitment, Competencies and Cognizance – the "three C" and "four P": Principles, Policies, Procedures and Practices. "However it is difficult in such a way to manage risk in innovative projects.

The advantage of Europe's automotive sector is expected to remain dynamic development of eco-innovation (vehicles lighter, more efficient, less polluting and easier recycling). Key pro-development technologies include batteries and energy storage, driver assistance systems, cars, increasing fuel efficiency (connected to the network Car2Car, car2infrastructure), safety (eCall) and availability (used by disabled drivers). It is therefore necessary to eliminate the risks associated with the development of innovative projects, implementing them into production and commercialization. In many publications sectoral risk reduction is seen in the broader social and environmental responsibility in the implementation of innovations in environmentally-friendly and successful implementation depends on network resources and initiatives to share knowledge and information between suppliers and manufacturer[7]. Gardner Forecasts for 2015 say that the availability of information flowing to business partners forces them to rethink how to create value. Regulated flow of information is the domain of the automotive sector; mainly due to logistics operators are increasingly included in the 4PL. In the integrated IT system operating for the purposes of risk mitigation, and connecting partners chain/suppliers in the supply chain should include modules with specified expectations with respect to suppliers (when and how to inform of the possibility of risk), modules for risk assessment and statistical measurement of adverse events modules to compare suppliers in terms of creating danger, benchmarking modules, learning how to mitigate the risk. Systems for project management reduce the risk resulting from the creation of innovation. It should, however, lead the statistics of risks (here the automotive industry) to create even better of tools for managing risk[8].

An important group of risks are listed in table 1 threat posed supplier for innovation. The research suppliers automotive sector shows that such risks exist, interrupting the flow

[7] Stawiarska E.: Realizowanie polityki CSR i budowanie wizerunku współpracujących biznesów motoryzacyjnych a odpowiedzialność zakupowa Polaków, [w:] Karczewski L., Kretek H. (red).: Odpowiedzialny biznes i konsumeryzm wyzwaniem XXI wieku. Politechnika Opolska, Opole 2015.

[8] See: Bukowski L.A., Feliks J.: Evaluation of technical systems dependability with the use of fuzzy logic and experts' knowledge, www.iiis.org/CDs2011/CD2011SCI/RMCI_2011/PapersPdf/RA686ZW.pdf.

when creating new products. Analysis of these risks and their likelihood will contribute to faster development, implementation and commercialization of innovations. The use of the concept of SCRM, GSCM, Project Management and Integrated Product Development effectively reduces disease risk.

Bibliography

1. Bukowski L.A., Feliks J.: Evaluation of technical systems dependability with the use of fuzzy logic and experts' knowledge, www.iiis.org/CDs2011/CD2011SCI/RMCI_2011/PapersPdf/RA686ZW.pdf.
2. Bukowski L.A., Feliks J.: Multi-dimensional concept of supply chain resilience. ClC, 7.-9.11.2012, Jeseník, Czech Republic, EU, http://konsys-t.tanger.cz/files/proceedings/09/reports/1218.pdf.
3. Grant D.B., Trautrims A., Wong Ch.: Sustainable logistics and supply chain management: principles and practices for sustainable operations and management. Kogan Page, 2013.
4. Nunes B., Bennett D.: Green operations initiatives in the automotive industry. "Benchmarking: An International Journal", Vol. 17, No. 3, 2010.
5. Monczka R.M., Handfield R.B., Giunipero L.C., Patterson J.L.: Purchasing and supply chain management. South-Western Cengage Learning, Mason 2011.
6. Orsato R.J., Wells P.: U-turn: the rise and demise of the automobile industry. "Journal of Cleaner Production", Vol. 15, 2007.
7. Stawiarska E.: Realizowanie polityki CSR i budowanie wizerunku współpracujących biznesów motoryzacyjnych a odpowiedzialność zakupowa Polaków, [w:] Karczewski L., Kretek H. (red): Odpowiedzialny biznes i konsumeryzm wyzwaniem XXI wieku. Politechnika Opolska, Opole 2015.
8. Waters D.: Supply chain risk management: vulnerability and resilience in logistics. Kogan Page Limited, 2011.
9. Research Report Annual Global CEO Survey conducted by PricewaterhouseCoopers, www.pwc.pl/pl_PL/pl/publikacje/CEO_Survey_Polska_14-F.pdf.
10. www.ferma.eu/app/uploads/2011/11/a-risk-management-standard-polish-version.pdf.