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# Risk Management Instruments in the Supply Chain of the Furniture Industry

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***Abstract:***

***Purpose:*** *The aim of the article was to indicate selected risk management instruments for the identification of deviations, and threats in the flow of supply chain processes in the furniture industry. It is based on research conducted by the authors on the example of a selected company in the supply chain of a furniture industry, IKEA.*
***Dersign/methodology/approach:*** *The FMEA method was applied in this study. Relationships were determined on the basis of guesses, observations and conversations with people who worked or work at IKEA. The business areas involved in the flow of goods and services of the above industry were analysed. The potential type of defects was defined together with their consequences. The probability of defect occurrence was determined on a scale from 1 to 10. The RPN parameter was determined.*
***Findings:*** *For a given branch, the biggest area of potential defects could be problems in the sales department. The distribution department also needs significant improvement, as transport companies have significantly inflated their financial expectations and the frequency of deliveries by road transport has increased significantly due to changes in the trend of customer orders via the Internet. The computational experiment consisted of applying a newly developed random search algorithm to solve a number of cyclic delivery synchronisation problems. The results obtained by the algorithm were compared with the solutions calculated by the exact method.*
***Practical implications:*** *Based on the above data, a risk map of the analysed risk factors was created. The matrix shows the occurrence of hazardous situations and the impact of the risk on the enterprise, manifested in specific ranges of significance of the occurrence of risk factors.*
***Originality value:*** *It can be concluded that there were risk factors in the enterprise that could critically disrupt the course of processes in the sphere of procurement, production and distribution, as well as in the management of logistics processes. More critical risks occurred in the sphere of production.*

***Keywords:*** *FMEA, risk map, risk factors.*
***JEL codes:*** *G32, M10, M11, M12.*
***Paper Type:*** *Research article.*

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## 1. Introduction

Supply chain management is a new concept, where the term was used by consultants in the early 1980s. Supply chain management researchers refer to concepts from the late 1950s. J. Fostera, explains the concept of supply chain as a flow of goods between suppliers and customers points out the problems of excessive inventories related to information distortion. "A supply chain is a network of organisations involved, through links with suppliers and customers, in the various processes and activities that create value in the form of products and services delivered to end consumers." Similarly, the supply chain is defined by P.K. Bagchi, who states that: "The supply chain consists of a network of plants and contractors that supply raw materials and components, then transform them into intermediate products and sub-assemblies, then produce the final product from them, and then enable their consumption by the final consumer (Depta, 2015)."

The main objective of supply chain management can be achieved through effective management, which is an attempt to simplify and improve the supply chain. Effective supply chain management requires simultaneous improvements in customer service levels and internal operational efficiency of companies within the supply chain. Customer service, at its most basic level, means consistently high order fulfilment rates, on-time deliveries and low customer return rates for whatever reason.

## 2. Building a Supply Chain Model for the Furniture Industry

In the era of globalisation of economic activities and open market economy systems, companies compete with each other by improving logistics, which significantly affects the efficiency of operations. In today's world, an excellent logistics system acts as a decisive factor in competition in the markets, both nationally and internationally (Rosak-Szyrocka, Żywiołek, Kulińska, and Matulewski, 2021).

Companies are no longer competing with each other and the competition between multiple interlinked elements - supply chains - has started. Logistics ceased to play only an operational role, related to the flow of goods, and started to be perceived as a strategic opportunity to gain a competitive advantage.

The basic idea behind the success of IKEA, is to create a functional, well-designed item that is accessible to the consumer at an affordable price. With this in mind, IKEA offers consumers around 11,000 products in more than 300 shops worldwide. The entire production and distribution system is subordinated to this goal. After this entire process, the final product is always re-tested and inspected (Passamonti,

2020). The policy of affordable prices is also subject to "hard" rules of negotiations with suppliers. IKEA has developed a special system for selecting suppliers. Suppliers and co-workers must comply with the IKEA WAY, a philosophy that defines minimum requirements placed on suppliers. IKEA auditors not only check regularly that standards are being met, but also help to ensure they are being achieved at an appropriate level.

Depending on the outcome of the audit, a supplier is either signed up or not, a contract is renewed or on the contrary, terminated. Factors such as availability of stock, quality, absence of complaints, service level, financial situation, knowledge of IKEA's core objectives and continuous improvement policy, focus on the end-customer and aiming at supply chain integration are also important in selecting suppliers. The organisation of storage, planning and production processes is therefore also important.

IKEA today is a role model for other companies in terms of global supply networks. The IKEA supply chain encompasses the following processes, product conceptualisation and design, sourcing of raw materials and components, purchasing, production, distribution, transport and ultimately retail in individual shops. The company has developed five different supply chain structures that are used efficiently, helping to reduce costs across all stages of the business.

Since IKEA is very often a strategic customer for suppliers, ordering large volumes and therefore generating the most revenue, it is very common for suppliers and furniture manufacturers to compete with each other to acquire IKEA, often offering high discounts, which is also an advantage for the Swedish corporation.

## 3. FMEA for the Furniture Industry

The FMEA process is carried out to identify factors that may impede the fulfilment of the requirements of the design specification or disorganise the manufacturing process. These factors can be related to: processing methods, processing parameters, post-measurements, machinery and equipment. The FMEA of a process is applied before the start of serial production or in serial production in order to improve processes that are unstable or do not provide the required performance. FMEA is carried out in three essential stages:

1. Preparations.
2. Carrying out a proper analysis.
3. Monitoring preventive actions.
   (https://core.ac.uk/download/pdf/160237353.pdf)

Relationships have been determined on the basis of guesses, observations and conversations with people who have worked, or are working, at IKEA. The business areas involved in the flow of goods and services of the above industry

were analysed. The potential type of defects has been defined together with their consequences. The probability of a defect occurrence was determined on a scale from 1 to 10. The value 1 is assigned to the situation which is the least probable, while the value 10 is obtained for the most probable situation (Kulinska and Dendera-Gruszka, 2019).

***Table 1.*** *Criteria values of numbers in the FMEA method*

| **R** | Fundamental flaws (significance of the defect) | **P** | Likelihood of defect | **D** | Probability of Detection |
|---|---|---|---|---|---|
| 1 | Slight | 1 | Low probability | 1 | Certain defect detection |
| 2 | Low | 2 | Defects are rare | 2 | |
| 3 | Small | 3 | Few errors | 3 | High defect detection |
| 4 | Average | 4 | Occasional errors | 4 | |
| 5 | | 5 | | 5 | Average defect detection |
| 6 | Moderate | 6 | Average in small quantities | 6 | |
| 7 | Large | 7 | Recurring errors | 7 | Difficulty in detecting a defect |
| 8 | Important | 8 | | 8 | |
| 9 | Very important | 9 | Very high probability of error | 9 | Failure to detect a defect |
| 10 | Extremely important | 10 | | 10 | |

***Source:*** *Own elaboration based on Kulińska E., Dendera-Gruszka, M., 2019.*

The last stage of the FMEA analysis is to determine the RPN parameter. The value of the RPN parameter (risk priority number) is the product of the assigned criterion numbers R, P and D, while this value should not exceed the number 100. Otherwise, when the value exceeds the above number, steps should be taken to exclude the defect. Specific process and product faults should be identified and eliminated. (Kulinska and Dendera-Gruszka, 2019)

The resulting analysis of the surveyed company shows that, as a first step, the company should undertake actions that could eliminate existing defects. For a given branch, the biggest area of possible defects may be problems in the sales department, where employees are not fully qualified, however, this is a global problem because it is difficult to find suitable professionals on the labour market.

The customer is also a decisive factor, and the company must constantly evolve and look for new and innovative solutions to retain regular and trusted customers as well as finding ways to win potential new customers. The distribution department also needs significant improvement, as transport companies have significantly overestimated their financial expectations and the frequency of deliveries by road has increased significantly due to changes in the trend of customer orders via the Internet, which is undoubtedly due to the global situation caused by the coronavirus.

Furniture production is also very dependent on sourced raw materials, with wood playing a key role, however, in this area it is difficult for the company to have a direct influence as the issue is shaped by factors beyond the company's control.

## 4. Risk Map for the Furniture Industry

Risk assessment by means of a risk map makes it possible to present all the risks of a company on one plane and makes it easier to compare them (Ziemski, 2016). One of the basic tools for risk mapping is a matrix to be filled in with hazard factors. It is completed after identifying potential hazards and drawing up a list, then each hazard is entered, depending on the probability of occurrence and the magnitude of potential losses it may cause, into the appropriate quadrants of the matrix (Kulinska, 2010).

The first part of the table describes the probability of a hazardous situation occurring and the impact of the hazard on the company. The components identified in the upper left-hand corner denote the area of risks with high probability of occurrence and low impact. The middle of the matrix is characterised by the medium probability of the risk occurring, which in turn has a medium impact on the company. The bottom right corner of the matrix, on the other hand, is characterised by low probability of occurrence but high impact (Dendera-Gruszka, Kulinska, and Masłowski, 2017).

The compilation of risk factors at the IKEA branch in Wroclaw was based on the risk register found earlier in the work. Significant influence on the risk analysis was the observation and cooperation with the employees of the branch. A five-grade scale of probability and impact of risk factors was adopted:

- probability of risk factor: <1% very low (VL); 1-10% low (L); 10-20% average (a); 20-50% high (H); > 50% very high (VH),
- and impact as effect of occurrence of a risk factor: minimal (m); slight (s); average (a); large (l); extreme (e).

The identified risk factors were assessed in terms of probability and impact, taking into account the division into individual areas of the functioning of logistics processes:

In the SOURCING zone, the probability and impact were assessed for risk factors such as: delays in delivery, breach of contract by carriers, logistics operators, lack of close cooperation with suppliers, lack of overall assessment of all primary suppliers, material price volatility, failure of suppliers to meet technical standards, timely deliveries, changes in delivery terms, relations with contractors, inadequate supply of materials in terms of quantity, quality, time, place and cost, problems with information flow, staff qualifications and experience, shortage of staff.

In the PRODUCTION zone, the probability and impact were assessed for risk factors such as, high production stock, long material and product flow paths, lack of suitable packaging, lack of modern planning and control instruments, lack of quick access to production department data, poor production planning, lack of flexibility in the production process, failures of machinery and equipment, staff qualifications and experience, shortage of staff, shortage of raw materials, factor shortages.

In the MARKETING AND CUSTOMER SERVICE zone, the probability and impact were assessed for risk factors such as, lack of knowledge of market niches, lack of funding for marketing research, problem in identifying key customers or buyer groups, failure to anticipate customer needs, inadequate level of services provided, fashion, the impact of promotional and advertising measures.

In the DISTRIBUTION zone, the probability and impact were assessed for risk factors such as, failure to estimate customer profitability, selection error in the distribution channel management strategy, demand volatility, misunderstanding of market needs, lack of customer integration, inadequate demand forecasting, competitive market forces, market potential , inflation, variability of legislation, structure and strength of customers, staff qualifications and experience, shortage of staff, failure to meet lead times, relations with contractors, decrease in number of orders.

In the TRANSPORTATION zone, the probability and impact were assessed for risk factors such as, lack of adequate means of transport, downtime due to waiting for means of transport, vehicle failures, drivers 'working time, drivers' qualifications and experience, drivers shortage, accidents.

In the STORAGE zone, the probability and impact were assessed for risk factors such as, no division of warehouse into fast-rotating and slow-moving materials, lack of materials classification, lack of detailed data on particular stock, material shortages, quality control system for materials, hidden defects of materials, staff qualifications and experience, shortage of staff.

***Table 2.*** *Overview of risk factors at IKEA branch in Wroclaw*

| | Probability | | | | | Impact | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Risk factors | BM | M | Ś | W | BW | m | n | ś | d | e |
| LOGISTICS PROCESSES MANAGEMENT | | | | | | | | | | |
| Information flow problems | | | x | | | | | x | | |
| Too low capacity of partners to react to unexpected orders (low flexibility, too slow to adapt to requirements) | | x | | | | | | | x | |
| Lack of integration between production, distribution and transport processes | | | | x | | | | | x | |
| Excessively high service | | x | | | | | | x | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| costs | | | | | | | | | | |
| Lack of integration between customers and suppliers | x | | | | | | | | x | |
| Problems with horizontal integration in the supply chain | x | | | | | | | x | | |
| Too much time for a new product to appear | x | | | | | | | x | | |
| Underdeveloped solutions | | x | | | | | x | | | |
| Disbelief in success | | x | | | | x | | | | |
| Staff qualifications and experience | | | x | | | | | x | | |
| Shortage of staff | | x | | | | | | | x | |
| Lack of experience | | | | x | | | | x | | |
| Underestimation of expected costs | x | | | | | | x | | | |
| Imitation of solutions | x | | | | | x | | | | |
| Economic consumption of the designed solutions | | x | | | | | | x | | |
| Failure to meet specified deadlines | | x | | | | | | | | x |
| Shortage of capital | x | | | | | | | x | | |
| Delay compared to competitors | x | | | | | | | | x | |

***Source:*** *Own creation.*

The overview of risk factors in IKEA branch in Wroclaw was conducted in the following logistic processes, production, marketing and customer service, distribution, transportation, storage and management of logistics processes.

Based on the above data, a risk map of the analysed risk factors was created. The matrix shows the occurrence of hazardous situations and the impact of the risk on the company, manifested in specific ranges of significance (effect size and probability) of the risk factors. The relationships between effect and probability were counted and entered into the appropriate areas of the matrix.

***Figure 1.*** *Risk map of the analysed risk factors*

| **Probability** | **Impact** | | | | |
|---|---|---|---|---|---|
| | Extreme (e) | Duży (l) | Extreme (a) | Niewielki (s) | Extreme (m) |
| Very High (VH) | **1** | **0** | **0** | **0** | **0** |
| High (H) | **1** | **5** | **2** | **1** | **0** |
| Aerage (A) | **3** | **7** | **8** | **1** | **0** |
| Low (L) | **6** | **4** | **10** | **5** | **2** |
| Very Low (VL) | **4** | **7** | **7** | **4** | **3** |

***Source:*** *Own creation.*

The results were then divided into three significance groups (effect size and probability) of risk factors:

- Gr. A - VHe, VHl, VHa, He, Hl, Ae - events marked in red on the matrix, the most severe for the company.
- Gr. B - VHs, VHm, Ha, Hs, Hm, Al, Aa, As, Le, Ll, La, VLe, VLl - events marked in yellow on the matrix, requiring monitoring, less severe in terms of impact than the risk factors in the red boxes of the matrix
- Gr. C - Am, Ls, Lm, VLa, VLs, VLm - events marked in green on the matrix, risk factors of marginal importance for the process flow.

In the next step, a quantitative overview was made and the importance of the occurrence of risk factors in each group was determined. The quantitative analysis consists of adding up the events occurring in the groups:

SA = VHe + VHl + VHa + He + Hl + Ae = 1 + 0 + 0 + 1 + 5 + 4 = 10
SB = VHs + VHm + Ha + Hs + Hm + Al + Aa + As + Le + Ll + La + VLe + VLl = 0 + 0 + 2 + 1 + 0 + 7 + 8+ 1 + 6 + 4 + 10 + 4 + 7 = 50
SC = Am + Ls + Lm + VLa + VLs + VLm = 0 + 5 + 2 + 7 + 4 + 3 = 21
SR = SA + SB + SC = 10 + 51 + 20 = 81
SA - number of risk factors in group A
SB - number of risk factors in group B
SC - number of risk factors in group C
SR - sum of risk factors present in matrix

The determination of the importance, significance for the risk factors analysed was obtained as follows:

WA = SA / SR = 10/81 = 0.123
WB = SB / SR = 50/81 = 0,617
WC = SC / SR = 21/81 = 0,260
WA - risk factor value in group A
WB - risk factor value in group B
WC - risk factor value in group C

An overview of the quantitative and value-based risk assessment (shows the state of safety in the individual significance groups and the seriousness of the risks affecting the company.

***Table 3.*** *Overview of quantitative and qualitative risk assessment*

| Risk assessment | | |
|---|---|---|
| Group | Quantity | Importance |
| A – Greatest risk | 10 | 0,123 |
| B – Large risk | 50 | 0,617 |
| C – Insignificant risk | 21 | 0,260 |

***Source:*** *Own creation.*

## 5. Conclusions and Summary

On the basis of the obtained results of the analysis of risk factors occurring in the logistics processes of the furniture industry, it can be concluded that in the company there were risk factors that could critically disrupt the course of processes in the sphere of procurement, production and distribution and in the management of logistics processes. More critical risks occurred in the production sphere, due to the fact that furniture production is dependent on such factors as shortage of staff or failure of machinery and equipment. This is due to the lack of suitably qualified production workers or operators of production machinery and equipment.

The impact on the given factors may be caused by the fact that people are not motivated to work in production and there is a noticeable tendency among young people to go abroad to work. In this case, the solution may be to increase the salary for the production work offered or to introduce additional training to allow people to get used to the activities performed in production more quickly. The highest number and importance of risk factors occurred in the yellow boxes of the matrix. These are not the most dangerous risk factors for the industry.

However, the possibility of potential problems in the area of procurement should be singled out, as the following problems may occur: changes in supply conditions, relations with contractors, lack of close cooperation with suppliers, failure to meet contractual conditions by carriers or logistics operators. Certainly action must be taken to reduce their number, to minimise their impact so as to move them towards the green zone of the matrix.

In the green area of the matrix 21 of all recorded risk factors were included. The value and quantity indicate that the processes in this area are relatively controlled. Marketing and customer service elements were the most numerous in this area. We can therefore safely conclude that this is the best-run area of the company at the moment and is working flawlessly.

By applying the risk matrix, we can obtain information on the degree of significance of the risk factors present in the industry. Thus, it is known against which to take protective measures against their occurrence in the first place. They are also helpful to:

- develop common transparent evaluation criteria, comparability and the ability to deal with risk factors in extremely different areas of the logistics processes,
- to define simple relationships between the effectiveness of risk management and the achievement of objectives for all participants in logistics processes,
- restoration of functioning of individual elements in order to increase the efficiency of the main processes of the enterprise and the whole company
- the impact of the pandemic on business management.

## References:

Caridi, M., Pero, M., Sianesi, A. 2012. Linking product modularity and innovativeness to supply chain management in the Italian furniture industry. In: International journal of production economics, 136(1), 207-217.

Dendera-Gruszka, M., Kulinska, E., Masłowski, D. 2017. Mapa ryzyka jako narzędzie analityczne wspomagające zarządzanie ryzykiem, Studia i Materiały. Miscellanea Oeconomicae, No 4/2017, Vol. I, Opole University of Technology, Opole.

Depta, A., Wojtaszek, H. 2015. Zarządzanie łańcuchem dostaw w przedsiębiorstwie produkcyjnym UM w Łodzi Logistyka, no 6, 622-627, CD.

Passamonti, S. 2020. Giancarlo De Carlo and the Industrial Design Luigi Mandraccio, Francesco Testa Histories of Postwar Architecture, 2020-08-01, 2(5), 139-160.

Kulinska, E. 2010. Narzędzia analizy ryzyka w procesach logistycznych. Logistyka nr 6/2010, Opole University of Technology, Opole.

Kulinska, E., Dendera-Gruszka, M. 2019. Zarządzanie ryzykiem łańcuchów dostaw. Difin, Warszawa.

Likumahwa, F.M., Purwaningsih, R., Handayani, N.U. 2019. The Influence of Green Supply Chain management on Company's Performance and Competitiveness in Wood Furniture Industry: An Overview of Conceptual Model. In: IOP conference series. Materials Science and Engineering, 598(1), 12076.

Machowiak, W. 2012. Risk management - unappreciated instrument of supply chain management strategy. In: LogForum, 8(4).

Rosak-Szyrocka, J., Żywiołek, J., Kulińska, E., Matulewski, M. 2021. Analysis of Enterprises' Readiness in for Industry 4.0 Implementation: The Case of Poland. European Research Studies Journal, 24(3), 615-628. DOI:10.35808/ersj/2374.

Ziemski, J. 2016. Mapa ryzyka jako mieszana metoda oceny ryzyka w przedsiębiorstwie. Zeszyty Naukowe of the Silesian University of Technology, Gliwice.

Yu, Ying., Wang, Xin., Zhong, Ray, Y., Huang, G.Q. 2017. E-commerce logistics in supply chain management: Implementations and future perspective in furniture industry. In: Industrial Management & Data Systems, 117(10), 2263-2286.