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# CURRENT TRENDS IN SUPPLY CHAIN MANAGEMENT

**Abstract:** Modern companies must manage their supply chain to ensure efficiency, cost reduction, customer satisfaction, and overall profitability. In the past 15 years, revolutionary changes have occurred in the field of information technology that have inevitably influenced the development of supply chain management. Having that in mind the main goal of the paper is to identify perspectives and issues discussed in the area of Supply Chain Management. The authors analyzed abstracts of research papers registered in the Scopus database in the period 2010–2025. Latent Dirichlet Allocation Analysis was used in the analysis of abstracts of research papers. All calculations were conducted using programs prepared in the Python language. The paper analyzes the most significant topics identified in the published research papers.

**Keywords: S**upply chain management, Scopus, Latent Dirichlet Allocation Analysis, Topics.

## 1. INTRODUCTION

The supply process is a crucial aspect of every enterprise, as its efficiency directly affects the overall efficiency of the company. Additionally, its costs significantly impact on the final product's pricing, thereby influencing its competitiveness in the market. Supply chain disruptions within a company are almost certain to affect the production of final products, and the impact can extend further, leading to supply issues for other companies in the role of buyers.

The supply chain represents the flow of materials (raw materials, semi-finished goods, and final products), information, money, and services from raw material suppliers, through manufacturers, to warehouses and end customers. It encompasses the entire life cycle of a product or service. The material flow refers to the movement of materials from suppliers to consumers or in the reverse direction in the case of reverse logistics. The information flow involves the transfer of detailed data among supply chain members, such as order details, customer information, order fulfillment, and delivery status. The financial flow includes payment transfers and financial arrangements such as payment schedules, credit terms, and electronic fund transfers. (Turban et al., 2018)

Supply chains today are becoming increasingly complex, as companies have multiple suppliers and customers across various locations, presenting challenges for decision-makers. The digital transformation of operations and supply chain management offers a potential solution to these challenges. Companies must undergo the digitalization of their business processes to remain competitive, with real-time monitoring, visibility, and automation playing a key role in this transformation. The digitalization of operationals management and supply chain management requires advanced technology and capabilities. (Baycik & Gowda, 2024) Industry 4.0 technologies such as blockchain, IoT, Big Data analytics, and artificial intelligence are emerging as potential solutions that are being increasingly applied in these processes. (Al-Okaily et al., 2024; Culot, Podrecca, & Nassimbeni, 2024)

The main advantages of blockchain technology in SCM include enhanced traceability, more efficient product deliveries, improved coordination among companies, increased product security and safety, better quality control and management practices, and reduced illegal counterfeiting. (Agrawal et al., 2024; Al-Okaily et al., 2024; Raj et al., 2024; Sahoo et al., 2024) Artificial intelligence can significantly impact various supply chain management functions by improving operational efficiency, performance, and sustainability. By utilizing AI technologies such as big data analytics, manufacturers can enhance resource efficiency, product customization, predictive maintenance, and production process optimization. (Patalas-Maliszewska, Szmołda, & Łosyk, 2024; Shahzadi et al., 2024) The use of IoT technology in industrial applications leads to more efficient production processes, better communication between operators and machines, and improved quality control while reducing losses. IoT technology can enhance tracking and visibility in supply chains. (Al-Okaily et al., 2024)

Considering all these technologies, which have undeniably found application in supply chain management, the authors set the objective of their research to identify the most significant topics in SCM over the past 15 years.
To achieve this goal, the authors will analyze the abstracts of research papers indexed in the Scopus database from 2010 to 2025 and answer the following research questions:

- RQ1: What research topics were raised during the period analyzed, and how has interest in the identified topics evolved over time?
- RQ2: What is the connection between the identified research topics?

A Latent Dirichlet Allocation (LDA) analysis will be performed on the dataset of abstracts from the Scopus database within the defined period.

## 2. RESEARCH METHOD - LATENT DIRICHLET ALLOCATION ANALYSIS

Latent Dirichlet Allocation (LDA) is a classical method for topic identification in large sets of textual documents represented in the form of frequency matrix. It was prosed in Blei et al. (2003) LDA methods try to identify a user-defined number of topics in an unsupervised learning process, where a frequency matrix is used as the learning set. Recognized topics are described by distribution over words and are represented the $\boldsymbol{\Phi}$ matrix:

$$\boldsymbol{\Phi} = \begin{bmatrix} \phi_{1,1} & \dots & \phi_{1,LV} \\ \dots & \dots & \dots \\ \phi_{LT,1} & \dots & \phi_{LT,LV} \end{bmatrix}$$

Where:

- $\phi_{t,j}$ is a probability of occurrence of the $j$-th word in the $i$-th topic,
- $LT$ is a number of topics,
- $LV$ is a number of unique words appearing in all analysed documents.

It is assumed that the $i$-th row of the $\boldsymbol{\Phi}$ matrix is a random variable taken from the Dirichlet distribution (it means that every $\phi_{t,j} \in [0;1]$ and that $\sum_{j=1}^{LV} \phi_{t,j} = 1$).

After topic recognition, every document may be presented as a mixture of identified topics. The structure of the whole corpus of the documents is defined in the $\boldsymbol{\Theta}$ matrix:

$$\boldsymbol{\Theta} = \begin{bmatrix} \theta_{1,1} & \dots & \theta_{1,LT} \\ \dots & \dots & \dots \\ \theta_{LD,1} & \dots & \theta_{LD,LT} \end{bmatrix}$$

Where:

- $\theta_{i,j}$ is a probability of occurrence of the $j$-th topic in the $i$-th document,
- $LT$ is a number of topics,
- $LD$ is a number of documents.

Rows of $\boldsymbol{\Theta}$ matrix have Dirichlet distribution (therefore every $\theta_{i,j} \in [0;1]$ and that $\sum_{j=1}^{LT} \theta_{i,j} = 1$).

Usually, Gibbs sampling method is used for estimation $\boldsymbol{\Phi}$ and $\boldsymbol{\Theta}$ matrices (Heinrich, 2005). LDA model has generative character. It means that having $\boldsymbol{\Phi}$ and $\boldsymbol{\Theta}$ matrices new documents can be created. However, it should be considered that during generation, a frequency matrix representing new documents is created, not the documents themselves.

# 3. RESULTS - MAIN TOPICS IN THE AREA OF SUPPLY CHAIN MANAGEMENT

Below are 15 topics (figure 1, 2 and 3) in the area of supply chain management along with the words that most frequently appear within each topic. In the first topic (topic 1, figure 1), the most mentioned words are logistics, business, and management, which is not surprising since Supply Chain Management is often associated with logistics management within business. The next second topic includes research, management, and literature. The second topic (topic 2, figure 1) is likely formed based on articles that provide a literature review, many of which exist. Sustainability is a current topic in many fields, including Supply Chain Management, which forms the third topic (topic 3, figure 1) that includes the words sustainability, study, and practice. The fourth topic (topic 4, figure 1) includes the words risk, supplier, and decision, and refers to risks associated with decision-making within the supplier segment. The next, fifth topic (topic 5, figure 1) includes technology, data, and information, as modern supply chain management cannot be imagined without modern information technologies for storing/managing data from which information is derived. This can further be expanded to system and network, which, together with the word model, form the sixth topic (topic 6, figure 1).

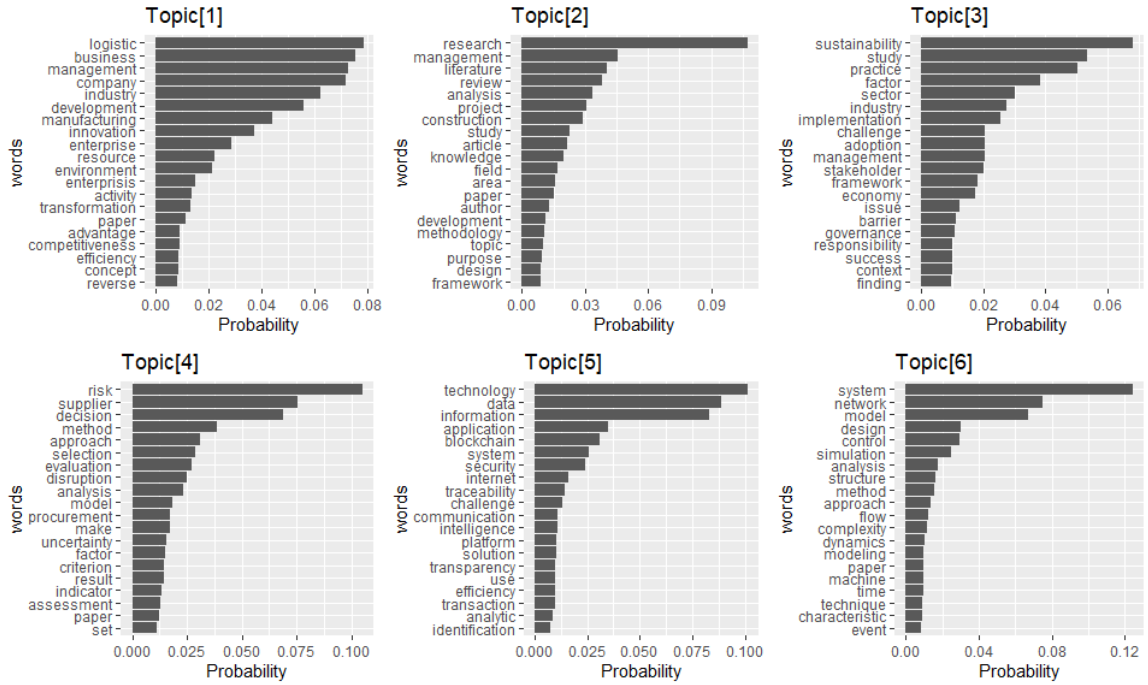


**Figure 1:** Topics 1 to 6
Source: the authors

The next, seventh topic (topic 7, figure 2) is formed by the most frequent words energy, waste, and production. If we look at the other words that follow, it can be concluded that this topic is formed based on the need to manage energy loss within production and environmental protection management. The eighth topic (topic 8, figure 2) includes the words supply and chain. The ninth topic (topic 9, figure 2) refers to manufacturers, distributors, and prices, which is an important component of the supply chain. The problems of forming a cost model for the supply chain, especially the consumption of inventory and time, form the tenth topic (topic 10, figure 2). The eleventh topic (topic 11, figure 2) includes the words food, water, and production. Then, as the twelfth topic (topic 12, figure 2), a supply chain management strategy appears.

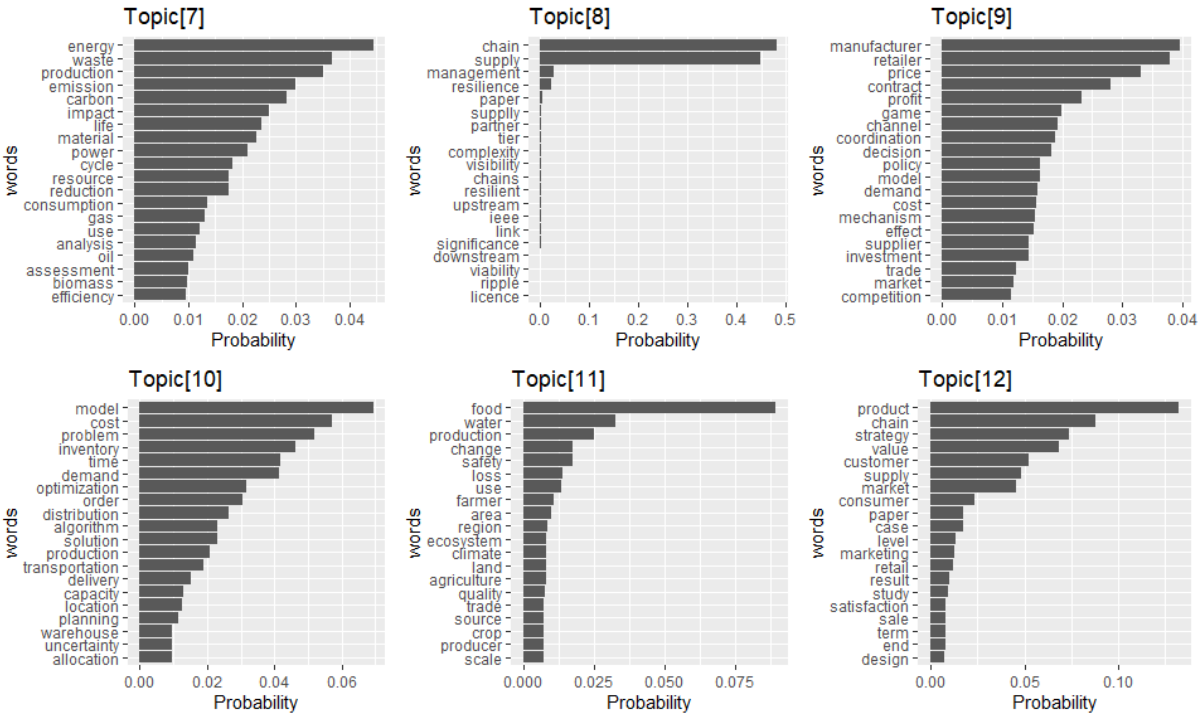


**Figure 2:** Topics 7 to 12
Source: the authors

The thirteenth topic (topic 13, figure 3) mainly includes the words performance, study, and relationship. The recent COVID pandemic influenced an increase in research related to the pandemic itself, so the fourteenth topic (topic 14, figure 3) includes the words health, COVID, and country. Process service management is an important segment of supply chain management, and these words form the final fifteenth topic (topic 15, figure 3).

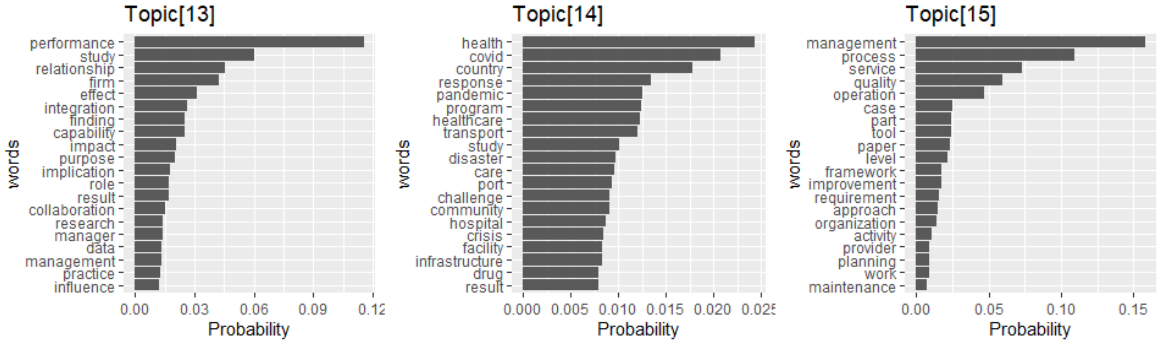


**Figure 3:** Topics 13 to 15
Source: the authors

In the following figure (figure 4), the significance of topics over the years is shown. Of course, the dominant topic throughout the past 15 years has been theme number 8, which contains the themes supply, chain and management. The topic 3, which includes themes such as sustainability, study, and practice, and topic 5 (with themes technology, data and information) has become increasingly popular over the past three years. Additionally, topic 14, which includes health and COVID, was relevant during the COVID outbreak years, but not before or after.

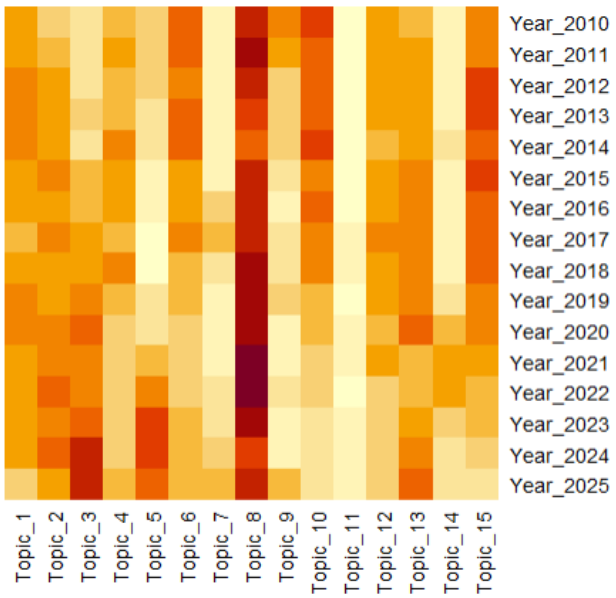


**Figure 4:** significance of topics over the years
Source: the authors

Figure 5 shows the connection between individual topics. This analysis also indicates that topic 8 (supply, chain and management) is connected to the most other topics (topics 1, 2, 3, 4, 5, 9, 10 and 13). It can also be seen that topics 8 and 9 (manufacturer, retailer and price) have strong connection. Additionally, topic 13 (performance, study and relationship) is strongly connected to topic 3 (sustainability, study and practice).

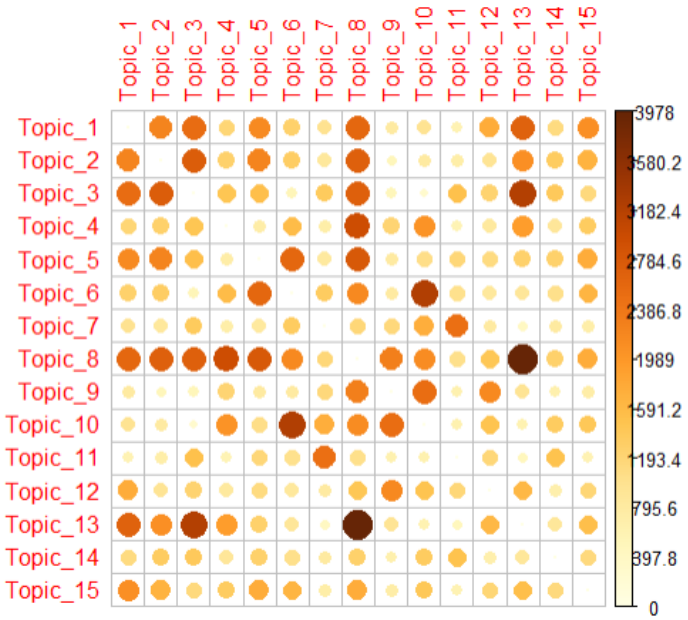


**Figure 5:** Connection between individual topics
Source: the authors

# CONCLUSIONS

Information technology has been changing the world in various spheres for decades. Supply chain management has also not remained immune to the emergence of different technologies, particularly those belonging to the set of Industry 4.0 technologies. To identify key trends in supply chain management over the past 15 years, a study was conducted through a literature analysis using Latent Dirichlet Allocation Analysis on a dataset obtained from the SCOPUS indexed database of scientific papers.

The analysis results yielded 15 topics with the greatest relevance for practice and theory. These topics were formed in a way that includes the most frequently occurring words within each topic, making them a relevant input for identifying current research themes in the scientific community. In addition to the identified topics, the research findings also highlight the significance of certain topics over the past 15 years, as well as the interconnections between specific topics, which may also serve as indicators for future research.

A limitation of the conducted study is the exclusive use of a single citation database of scientific papers. For future research in the field of supply chain management, the authors will use the presented results and select one of the topics to continue further research.

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