Review of Studies Using the Concept of Gamification in the Field of Logistics and Supply Chain

T. Adas[1]

1 Trakya University, Department of Managemet and Organization,
Ipsala, Edirne 22000, Türkiye

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Abstract: The concept of gamification has been used and continues to be used in many areas such as education, sustainability studies, marketing, supply chain. In this research, studies involving the concept of gamification in the field of logistics and supply chain were scanned. The scan was conducted on 15.01.2025 in the Web of Science (WOS) database using the combination of the keywords "logistics, supply chain, gamification, game based learning, gamify, serious game". As a result of the scan conducted in the topics (keyword, abstract, title) field from 2008 to the present, 686 articles, papers and book chapters were reached. It was seen that 323 of the 461 articles in total were SCIE indexed and 192 were SSCI indexed. When it was considered as a research category, it could be said that the most research was conducted in the categories of "Computer Science Information Systems, Education Educational Research, Computer Science Interdisciplinary Applications, Operations Research Management Science"; when it was considered as a subcategory, it could be said that the research was conducted in the categories of "Supply chain & logistics, Educational research". It was observed that the number of studies between 2021-2024 was higher than other years and that the most research was conducted in China and the USA. In the research, a bibliometric analysis of the existing literature was conducted within the scope of quantitative data and a visual summary was presented. The accessible publications were examined through author, country, keyword and source analyses.

Keywords: Logistics, Supply Chain Managemet, Gamification, Bibliometric Analysis

1. Introduction

Supply chain management and logistics are key components of success in today's highly competitive global environment. Supply chain management is the activity of planning, monitoring and controlling all processes that take place from raw materials to the end user of products or services [1].

Procurement encompasses the planning and management of all activities involved in production and logistics management operations. It also includes coordination and collaboration with channel partners such as suppliers and customers. As part of supply chain management, logistics can influence how well a company achieves its goals. Efficient supply chain and logistics management help businesses distribute resources to the right place at the right time. This assists companies in reducing operating costs and providing higher quality services, thereby increasing customer satisfaction [2].

Supply chain management is crucial in helping businesses anticipate and meet consumer demands. However, uncertainties arising from changing technologies, demand fluctuations, environmental factors, and more complicate supply chain decision-making processes. In this context, the traditional theoretical teaching approach may leave future managers inadequately equipped to handle real-world problems. To overcome these challenges, developing practical skills is essential, particularly in disciplines like supply chain management. In this regard, business simulations, game-based learning, serious games, etc., have been proven effective in providing engaging and interactive environments where both students and supply chain professionals can make real decisions and enhance their creativity [3-5].

Gamification is an approach that aims to increase motivation and improve problem-solving skills by adapting game philosophy and game mechanics to non-game contexts. One of the most widely accepted definitions is the use of game design elements in non-game settings. Gamification has been applied and studied in various fields, including customer engagement, education, physical activity, conversion rates, data accuracy, time management, media, and learning. Research indicates that this method generally produces positive outcomes. Although inspired by digital games, its ability to incorporate traditional game elements makes it applicable not only in digital environments but also in many aspects of daily life [6-7].

2. Literature Survey

When previous studies are examined, games such as the Beer Game have been utilized to demonstrate concepts like supply chain coordination [8-11]. Additionally, there are games that address various supply chain concepts such as demand forecasting, production planning, supplier selection based on cost and delivery times, and inventory management [12-13].

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Franke et al.'s 2024 study examines the use of serious games in logistics curricula at German universities by evaluating the design and impact of WareMover, a 2D game developed to teach warehousing processes. This game allows students to learn by experiencing the effects of different order-picking techniques and can be played in single- or multiplayer modes. The objective is to achieve high scores by collecting orders as quickly and accurately as possible. In a session with 14 participants, all found the game user-friendly, educational, and engaging, with the majority expressing a desire to replay it and recommend it to others. The study concluded that the game effectively teaches warehousing and order-picking techniques, and its entertaining elements enhance learner motivation [14].

Hart et al., in their 2022 article, found that playing a hardware-based serious supply chain game enables players to self-regulate their learning and acquire knowledge through in-game experiences. The paper proposes CIST, a serious game designed for hardware security. The CIST game covers risks related to hardware design, production, and integration into systems [15].

Nasution et al., in their 2022 study, conducted a review of serious games in the field of container terminal logistics [16].

Despeisse's 2018 study focuses on serious games and game-based learning in industrial engineering. It examines examples to discuss the benefits and drawbacks of using games as educational tools. The author suggests ways for game developers to align game mechanics with learning outcomes in cognitive and affective domains [17].

William et al., in their 2018 study, explored designing a serious game for humanitarian logistics using Mixed Reality (MR). They analyzed the effects of adding an MR extension to Disaster Relief, a role-based simulation game for humanitarian logistics strategies. The MR extension was tested to determine its impact on improving game visualization and simplicity, enabling players to internalize learning objectives more rapidly [18].

Müller and Haasis, in their 2018 study, proposed game-based learning to train personnel on maritime supply chain security risks, mitigation measures, and the interaction between these themes [19].

Berg et al.'s 2017 study describes a serious gaming approach to provide new opportunities for gaining experience in coordinating construction supply chain activities. The authors designed a board game where players design and construct a skyscraper called the "Tower of Infinity." Game sessions were conducted with 64 construction management students, who played the game and reflected on their experiences in written reports. Content analysis of these reports revealed that serious games can teach students to manage design and construction processes cohesively. The game also helped them consider constructability factors during design and learn how to improve construction supply chain performance by balancing scope, time, and cost throughout a project [20].

Hauge et al., in their 2016 study, emphasized game-based learning for decision-making in supply chains. The paper compares two game-based learning setups with students: one describes a fully game-based course, while the other discusses the integration of a new game on container security into an undergraduate course [21].

The literature analysis summarizes several studies. To facilitate the understanding of practical processes in logistics and supply chain education, researchers have designed various games. Their effectiveness has been examined and presented in related studies. The next section will present the methodology and results of this study.

3. Methods

The aim of this study is to conduct a bibliometric analysis of academic research on gamification and supply chain/logistics since 2008. Bibliometric analysis is an analytical method that, using visualization software, reveals the current state of a field and facilitates the tracking of academic literature. By providing a broad perspective through a literature review, this method helps determine the direction of research while also offering insights into the potential contributions of the study [22].

Accordingly, a search using keyword combinations in the Web of Science database resulted in 686 publications. These publications were analyzed using VOS viewer. The keyword combination used in the search within the Topics field was as follows: (TS=(logistics) OR TS= (supply chain)) AND (TS=(gamification) OR TS=(gamify) OR TS= (game based learning) OR TS= (serious game)). The accessed publications were examined based on co-authorship, country, keyword, and source analyses, and the results are presented in the figures below.

3.1. Co-authorship / authors analysis

In the research conducted using keywords, the names of the authors in the obtained articles were examined. The authors who have published the most studies with these keywords and their interactions with each other were identified. As a result of the author analysis conducted using the co-authorship analysis type and the authors analysis unit, the graph shown in Figure 1 was obtained. By examining these data, it is possible to identify the most prolific author in the field, as well as the names of the authors with the highest total link strength, indicating their influence.

Figure 1 presents the results of the co-authorship analysis. Accordingly, the author with both the highest number of studies and the strongest link strength is Jannicke Baalsrud Hauge. The second most influential author is Matthias Kalverkamp.

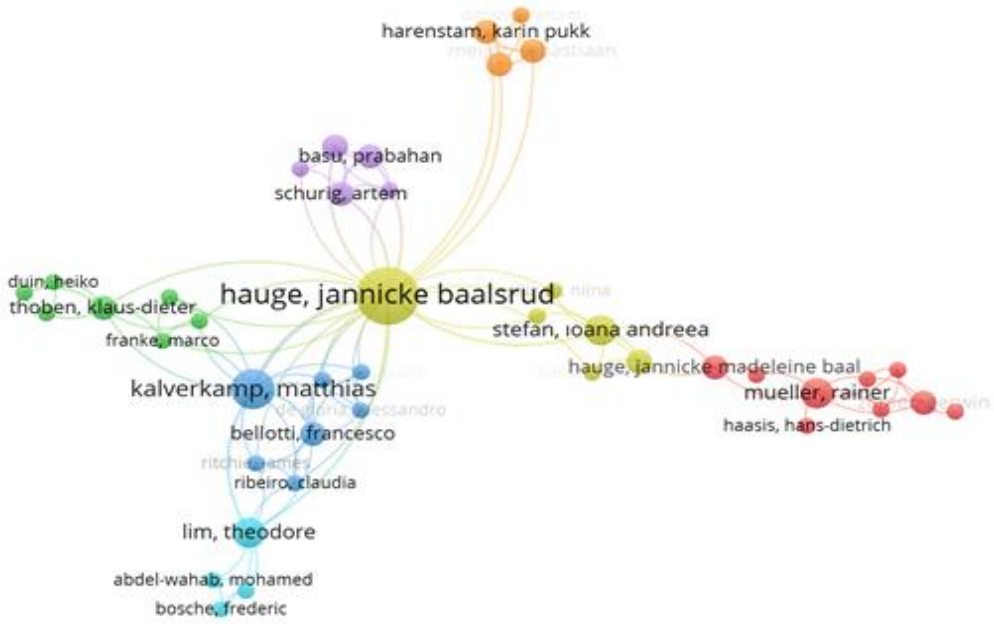

Figure 1. Co-authorship / authors analysis

3.2. Co-authorship / countries analysis

This section examines the countries where the studies were conducted and their connections with other countries. As a result of the country analysis conducted using the co-authorship analysis type and the countries analysis unit, the graph shown in Figure 2 was obtained.

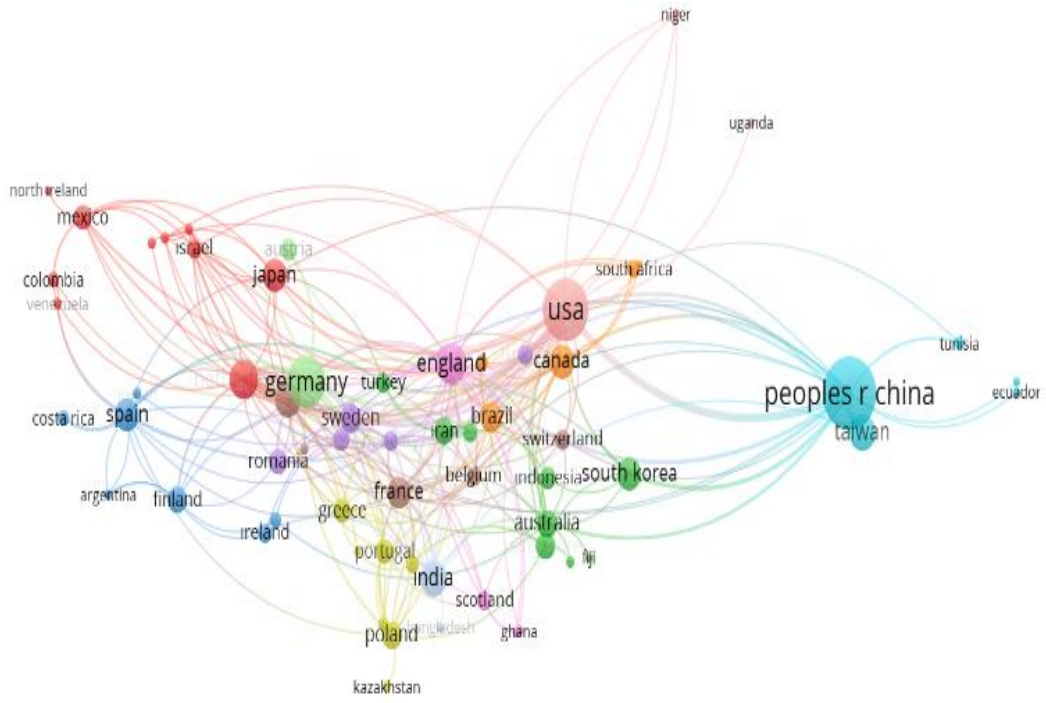

Figure 2. Co-authorship / countries analysis

Figure 2 presents the results of the co-authorship country analysis. Accordingly, the countries with the highest total link strength are the USA, England, China, Germany, and France, respectively. While the countries with the highest number of studies are almost the same, their ranking differs. The countries with the most studies conducted are China, the USA, Germany, England, and the Netherlands, respectively.

3.3. Co-occurrence / author keywords analysis

This section examines which other keywords were used in the articles obtained from the research conducted with a limited set of keywords. The structure of these keywords provides insight into which other fields the studies are related to. As a result of the keyword analysis conducted using the co-occurrence analysis type and the author keywords analysis unit, the graph shown in Figure 3 was obtained.

Figure 3 presents the results of the co-occurrence keyword analysis. Accordingly, the keywords with the highest total link strength are gamification, supply chain management, machine learning, logistics, and serious game, respectively. When analyzed in terms of occurrence (co-occurrence), the keywords remain the same, although slight differences in their rankings have been observed.

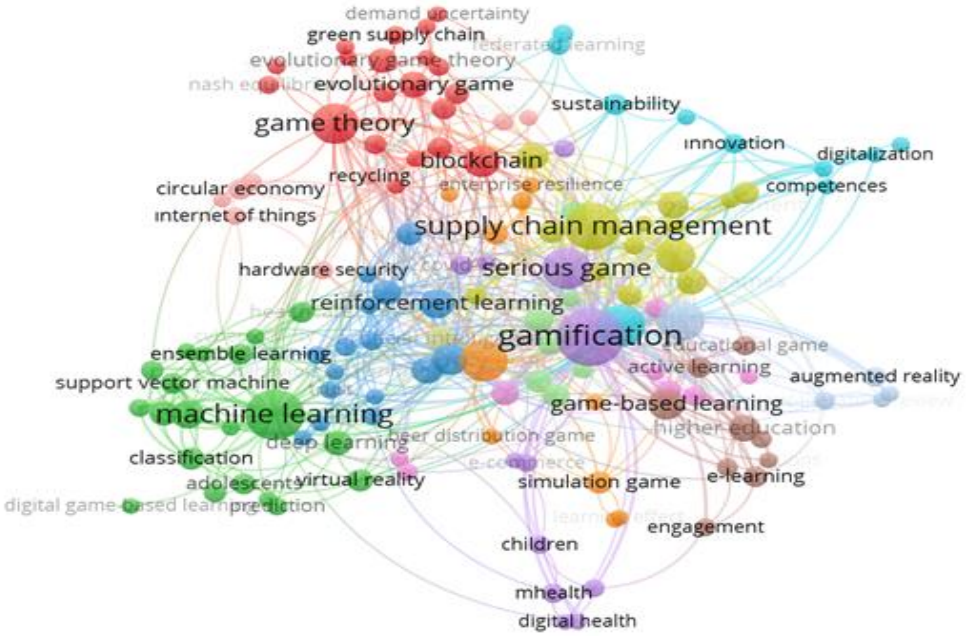

Figure 3. Co-occurrence / author keywords analysis

3.4. Citation / sources analysis

As a result of the source analysis conducted using the citation analysis type and the sources analysis unit, the graph shown in Figure 4 was obtained.

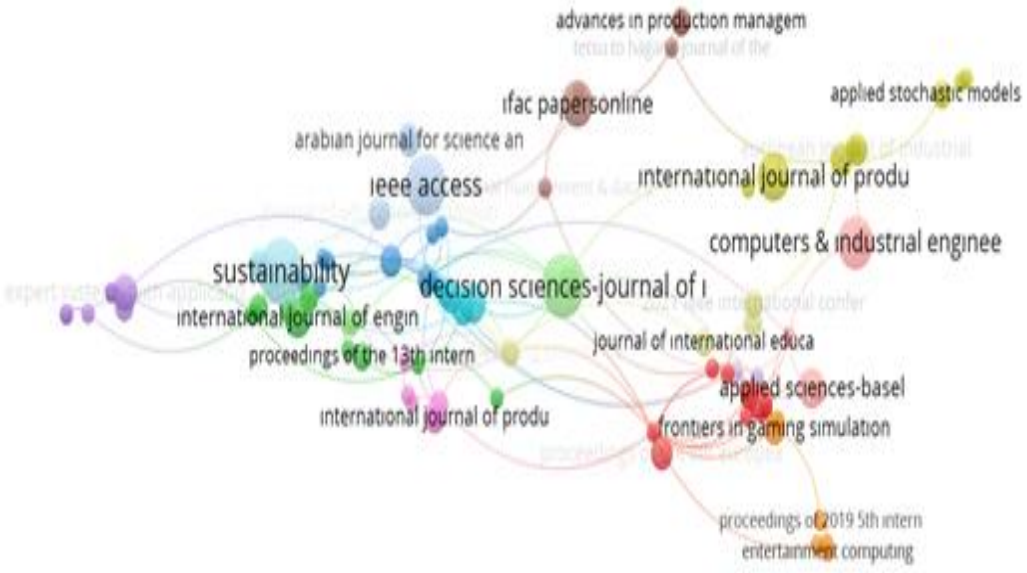

Figure 4. Citation / sources analysis

Figure 4 presents the results of the source analysis. Accordingly, the sources with the highest number of studies are Sustainability, Decision Sciences - Journal of Innovative Education, IEEE Access, and Computers & Industrial Engineering. The sources with the highest total link strength are Journal of Business Research, Logistics - Basel, Decision Sciences - Journal of Innovative Education, and International Journal of Physical Distribution & Logistics Management.

4. Conclusion

Gamification, defined as "the application of game design elements in non-game contexts," has garnered significant interest and widespread application in various fields such as education, business, healthcare, and technology. In recent years, this concept has also been explored through academic studies in the fields of supply chain management and logistics. Gamification is used in logistics and supply chain education to make students' learning processes more effective and interactive. Additionally, it is applied to ease decision-making processes under uncertainties in the logistics sector and to provide managers with better support for making strategic decisions.

Furthermore, gamification techniques are also employed in areas such as sustainable logistics, which consider environmental and economic balance. In all these aspects, gamification has become an important tool in logistics and supply chain management for education, decision-making mechanisms, and sustainability practices.

Various academic studies have been conducted in the field of supply chain management and logistics on gamification, and there is a wide range of research in the literature on this subject. However, the number of bibliometric studies analyzing the academic impact, development, and research trends of gamification in these fields is quite limited. Addressing this gap, this study conducts a bibliometric analysis of academic publications related to gamification, evaluating them under four main categories, and presents the findings in detail.

On January 15, 2025, a search using the keywords "logistics, supply chain management" and "gamification, serious game, gamify, game-based learning" was conducted, resulting in a total of 686 academic works indexed in the Web of Science (WOS) database. In this search, the titles, keywords, and abstracts of the relevant publications were reviewed. The accessed papers were analyzed in terms of author distribution, contributing countries, used keywords, and the academic sources where they were published.

In this study, the bibliometric analysis of academic research on gamification and supply chain management was carried out and evaluated under four main headings.

a. Co-authorship Analysis: According to the analysis results, the author with the highest number of publications and the strongest academic connections in the field of gamification and logistics is Jannicke Baalsrud Hauge, followed by Matthias Kalverkamp. This finding indicates that these authors are among the leading researchers in the field.

b. Co-country Analysis: The countries with the strongest academic connections (total link strength) are the USA, England, China, Germany, and France. However, in terms of the highest number of publications, China ranks first, followed by the USA, Germany, England, and Netherlands. This shows that academic interest in gamification varies across different countries.

c. Co-occurrence Keyword Analysis: In the keyword distribution of the analyzed studies, the terms with the highest link strength are gamification, supply chain management, machine learning, logistics, and serious game. While there are slight differences in their rankings in terms of occurrence (co-occurrence), the same keywords generally stand out. These results show that studies in gamification and logistics are largely associated with machine learning and logistics processes.

d. Source Analysis: The academic journals with the highest number of publications are Sustainability, Decision Sciences - Journal of Innovative Education, IEEE Access, and Computers & Industrial Engineering. In contrast, the journals with the highest academic connections (total link strength) are Journal of Business Research, Logistics - Basel, Decision Sciences - Journal of Innovative Education, and International Journal of Physical Distribution & Logistics Management. These findings demonstrate that gamification and logistics research is published across different disciplines, with strong interactions with fields like sustainability, decision sciences, and engineering.

The bibliometric analysis shows that gamification and logistics have become an important research area in the academic literature, with a concentration around specific authors, countries, keywords, and journals. Particularly, the prominence of studies from China, the USA, and Europe indicates high interest in gamification-focused logistics

research in these countries. Additionally, technological advancements such as machine learning being addressed alongside gamification highlight an emerging trend in the digitalization of logistics processes.

This analysis can guide future research on which authors, countries, and topics to focus on and help in gaining a more comprehensive understanding of the academic impact of gamification in the logistics field.

5. Future Scope

This research has certain limitations, and the results should be evaluated within the context of these constraints.

Firstly, the data search was conducted exclusively using the Web of Science (WOS) database. Therefore, the scope of the research is limited to the studies indexed in WOS. Future studies could benefit from incorporating other academic databases such as ScienceDirect, Scopus, SpringerLink, and Wiley, which would contribute to presenting a broader perspective of the literature.

Secondly, the bibliometric analysis was conducted within a specific framework. In this study, source, author, country, and keyword analyses were addressed; however, other important bibliometric elements such as organization, co-citation networks, collaboration maps, or citation dynamics were excluded from the analysis. Future research could include these additional topics, allowing for a more comprehensive examination of academic studies in gamification and logistics.

Lastly, this study applied only the bibliometric analysis method, and the content of the research was not examined in detail. In addition to bibliometric analysis, future studies could incorporate systematic literature review techniques to provide a deeper analysis of the relevant studies. This approach could help in comparing studies in terms of qualitative, quantitative, and experimental methods, contributing to a better understanding of academic trends in gamification and logistics. In this context, future research should expand the data scope and conduct more detailed content analyses, which would support the academic development of this field.

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