

<https://doi.org/10.35945/gb.2024.18.007>

THE IMPACT OF INDUSTRY 4.0 IN THE CONDITIONS OF GLOBALIZATION: AN OVERVIEW OF LOGISTICS COMPANIES ORIGINATING FROM TURKIYE

Fatmanur Avar Caliskan

Doctor of Business Administration
Lecturer, Izmir Kavram Vocational School, Turkiye
fatmanur.avar@kavram.edu.tr
<https://orcid.org/0000-0001-5831-908X>

Mustafa Gersil

Professor Doctor
Faculty of Economics and Administrative Sciences,
Manisa Celal Bayar University, Turkiye
mustafa.gersil@cbu.edu.tr
<https://orcid.org/0000-0001-5638-5411>

ABSTRACT. The main purpose of this study is to investigate the impact of Industry 4.0 technologies on the survival and competitiveness of logistics companies based in Turkiye, a developing country, within the global landscape. From a qualitative study perspective, it aims to elucidate the positive and negative effects of Industry 4.0 applications on the logistics sector while also discussing recommendations to mitigate or eliminate these negative impacts. Based on the results of the semi-structured interview analysis, it can be asserted that the positive impacts of Industry 4.0 applications increase proportionally with the scale of a firm. Besides, if the R&D investments are enhanced in the logistics industry operating in Turkiye, it is expected that the negative effects will be more likely to be mitigated. According to findings from interviews, the preliminary anticipated effect of Industry 4.0 applications on the logistics sector is improved efficiency, while the primary barrier to its adoption is identified as the inadequacy of infrastructure and education.

KEYWORDS: INDUSTRY 4.0, LOGISTIC SECTOR, DEVELOPING COUNTRIES, GLOBALIZATION

Introduction

The advent of the fourth industrial revolution, also called Industry 4.0, characterized by the integration of advanced technologies such as the Internet of Things (IoT), artificial intelligence (AI), robotics, and big data analytics, has significantly transformed various sectors worldwide.¹ Particularly, one of these sectors, logistics, has experienced profound changes as Industry 4.0 offers potential benefits such as increased operational efficiency, improved supply chain management, and increased global competitiveness. In an era of globalization, where economies are increasingly interconnected, these technological advancements are essential for maintaining competitive advantage.²

As an important developing country, Türkiye, with a strategic geographical location, plays a crucial role in international logistics and trade. The country's logistics sector serves as a vital bridge between Europe, Asia, and the Middle East, making it a key player in global supply chains.

Nonetheless, the adoption of Industry 4.0 technologies in logistics companies originating from Türkiye brings with it both significant opportunities and significant challenges.³

This study aims to investigate the impact of Industry 4.0 on Turkish logistics companies. Using a qualitative research approach, specifically through semi-structured interviews with key industry stakeholders, this research aims to provide a comprehensive understanding of how technological developments associated with Industry 4.0 are impacting the industry. The study will examine both the positive and negative effects of Industry 4.0 applications, highlighting the factors that facilitate or impede their adoption.⁴

- 1 Gilchrist, A. (2016). *Industry 4.0*. Apress, 195.
- 2 Büyüközkan, G., Göçer, F. (2018). Digital Supply Chain: Literature review and a proposed framework for future research. *Computers in Industry*, 97, 174.
- 3 Luthra, S., Mangla, S. K. (2018). Evaluating challenges to Industry 4.0 initiatives for supply chain sustainability in emerging economies. *Process Safety and Environmental Protection*, 117, 169.
- 4 Tatoglu, E., Bayraktar, E., Golgeci, I., Koh, S. C. L., Demirbag, M., Zaim, S. (2016). How do supply chain management and information systems practices influence operational performance? Evidence from emerging country SMEs.

Similar to the literature, findings suggest that larger firms tend to benefit more from Industry 4.0 applications due to their greater resources and scalability.⁵ Conversely, smaller firms may face significant barriers, including inadequate infrastructure and a lack of specialized education and training.⁶ Additionally, increased investments in research and development (R&D) in the logistics sector are expected to alleviate some of the negative impacts and create a more conducive environment for technology adoption.⁷ So, this study aims to provide valuable insights and recommendations for logistics companies in Türkiye, helping them navigate the complexities of Industry 4.0 and enhance their global competitiveness. Through a detailed analysis of the current state of the industry and the challenges faced, this research will contribute to a broader understanding of the impact of Industry 4.0 on logistics in developing countries.⁸

LITERATURE REVIEW

The concept of "Industry 4.0" originated from the 2011 Hannover Fair in Germany and represents the fourth industrial revolution characterized by the integration of advanced digital technologies into manufacturing and service industries.⁹ The revolution paradigm aims to provide uninterrupted connection and automation in processes with

-
- International Journal of Logistics Research and Applications*, 19(3), 188.
 - 5 Sony, M., Naik, S. (2020). Key ingredients for evaluating Industry 4.0 readiness for organizations: A literature review. *Benchmarking: An International Journal*, 27(7), 2214.
 - 6 Ben-Daya, M., Hassini, E., Bahroun, Z. (2019). Internet of things and supply chain management: A literature review. *International Journal of Production Research*, 57(15-16), 4720.
 - 7 Strange, R., Zucchella, A. (2017). Industry 4.0, global value chains and international business. *Multinational Business Review*, 25(3), 175.
 - 8 Phuyal, S., Bista, D., Bista, R. (2020). Challenges, Opportunities and Future Directions of Smart Manufacturing: A State of Art Review. *Sustainable Futures*, 2, 100023, 4.
 - 9 Bag, S., Gupta, S., Kumar, S. (2021). Industry 4.0 adoption and 10R advance manufacturing capabilities for sustainable development. *International Journal of Production Economics*, 231, 107844, 10.

mainly the principles of Cyber-Physical Systems (CPS), Internet of Things (IoT), and Smart Factory principles.¹⁰

The key components of Industry 4.0 include horizontal integration across value chains, vertical integration within production systems, and end-to-end digital integration of engineering processes.¹¹ These dimensions enable real-time data exchange, predictive maintenance, and agile manufacturing capabilities.¹²

Despite its existing and potential benefits, such as improved efficiency, personalization, and sustainability, the adoption of Industry 4.0 is not without its challenges. The high cost of technology implementation, the need for a skilled workforce, and cybersecurity-related concerns are being struggled, especially by small and medium-sized enterprises (SMEs). The literature emphasizes the significance of interoperability, scalability, and adaptive organizational structures as critical factors for successful deployment.¹³

In the logistics sector, Industry 4.0 technologies play a crucial role in enhancing operational efficiency and competitiveness in a global area. Especially the integration of IoT, Artificial Intelligence (AI), and big data analytics in logistics processes enables real-time tracking, improved inventory management, and optimized supply chain operations.¹⁴ Various studies in the literature have shown that these advancements are particularly beneficial in developing countries like Turkiye, where strategic geographical positioning

facilitates global trade connectivity.¹⁵ However, the adoption of Industry 4.0 in the logistics sector also faces significant challenges. Infrastructure limitations, lack of technological awareness, and insufficient workforce skills are the main challenges and obstacles, especially for small-scale logistics companies. To overcome these obstacles and take full advantage of the benefits of Industry 4.0, it is crucial to invest in research and development (R&D) and targeted training programs.¹⁶

The relationship between globalization and Industry 4.0 is also a critical area of study. Industry 4.0 technologies improve global supply chain integration and facilitate more efficient international trade by reducing costs and improving responsiveness to market demands.¹⁷ This is particularly significant for countries like Turkiye, where logistics plays a vital role in connecting Europe, Asia, and the Middle East.

While Industry 4.0 promises transformative advances in manufacturing and service sectors worldwide, ongoing research efforts are crucial to overcome implementation challenges, optimize technological integration, and foster inclusive economic growth in the age of digital transformation.

METHODOLOGY

The study explores the impact of Industry 4.0 technologies on the survival and competitiveness of logistics companies originating from Turkiye within the context of globalization. The research questions are:

- What are the primary impacts of Industry 4.0 technologies on the operational efficiency and competitiveness of logistics companies originating from Turkiye?

10 Rüßmann, M., Lorenz, M., Gerbert, P., Waldner, M., Justus, J., Harnisch, M. (2015). *Industry 4.0: The Future of Productivity and Growth in Manufacturing Industries*, 3.

11 Hermann, M., Pentek, T., Otto, B. (2016). Design Principles for Industrie 4.0 Scenarios. 2016 49th Hawaii International Conference on System Sciences (HICSS), 3930.

12 Ustundag, A., Cevikcan, E., Salkin, C., Oner, M., Ustundag, A., & Cevikcan, E. (2018). A conceptual framework for Industry 4.0. *Industry 4.0: managing the digital transformation*, 17.

13 Frank, A. G., Dalenogare, L. S., Ayala, N. F. (2019). Industry 4.0 technologies: Implementation patterns in manufacturing companies. *International Journal of Production Economics*, 210, 18.

14 Luthra, S., Mangla, S. K. (2018). Evaluating challenges to Industry 4.0 initiatives for supply chain sustainability in emerging economies. *Process Safety and Environmental Protection*, 117, 169.

15 Liao, Y., Deschamps, F., Loures, E. de F. R., Ramos, L. F. P. (2017). Past, present and future of Industry 4.0—A systematic literature review and research agenda proposal. *International Journal of Production Research*, 55(12), 3610.

16 Vogel-Heuser, B., Hess, D. (2016). Guest Editorial Industry 4.0—Prerequisites and Visions. *IEEE Transactions on Automation Science and Engineering*, 13(2), 411–413. *IEEE Transactions on Automation Science and Engineering*, 5.

17 Strange, R., Zucchella, A. (2017). Industry 4.0, global value chains and international business. *Multinational Business Review*, 25(3), 178.

- What are the key challenges and barriers faced by Turkish logistics companies in adopting Industry 4.0 technologies?
- What strategies can be recommended to enhance the adoption and integration of Industry 4.0 technologies in the Turkish logistics sector?

A semi-structured interview method was used for the qualitative design approach. The primary data were collected through interview questions with key stakeholders in the Turkish logistics industry. These stakeholders included executives and managers from a range of logistics companies and industry experts familiar with Industry 4.0 applications.

A purposive sampling technique was employed to determine 20 interviewees who have at least 5 years of experience in the logistics sector. Participants were selected to represent companies of a wide range of sizes, from small and medium-sized businesses (SMEs) to large-scale corporations.

Interviews were conducted via online platforms depending on the availability and time preference of the participants. Each interview lasted between 35 and 50 minutes and was recorded audio and video with the consent of the participants.

DATA ANALYSIS

A thematic analysis procedure was used to analyze the interview data, complete with key tables summarizing the findings. This approach was chosen for its effectiveness in identifying, analyzing, and reporting patterns/themes in qualitative data. The stages of the thematic analysis procedure are as follows:

- Transcription: To ensure accuracy, all interviews were transcribed verbatim.
- Familiarity: The researcher became familiar with the data by reading the transcripts multiple times.

- Coding: Initial codes were created by identifying important expressions and concepts related to the research questions.
- Theme Development: Codes were grouped into broader themes that formed the core of the data. Themes were reviewed and refined multiple times to ensure they accurately reflected the data.
- Interpretation: The themes created were interpreted in the context of the research questions and existing literature to draw meaningful conclusions.

FINDINGS

As a result of the thematic analysis of the interview data, several important findings emerged regarding the impact of Industry 4.0 technological transformation on Turkish logistics companies. These findings are summarized below and supported by relevant tables.

POSITIVE IMPACTS OF INDUSTRY 4.0

Industry 4.0 technologies have created many positive changes in the logistics sector in Türkiye, mainly increasing operational efficiency and competitiveness. The main positive effects identified, their descriptions from interviews, and their frequencies are shown in Table 1.

BARRIERS TO ADOPTION OF INDUSTRY 4.0

Despite the many benefits it provides, it has been determined that there are various ob-

TABLE 1. POSITIVE IMPACTS OF INDUSTRY 4.0

IMPACT	DESCRIPTION	FREQUENCY OF MENTION
REAL-TIME TRACKING	Providing advanced real-time tracking of shipments and assets	18
INVENTORY MANAGEMENT	Increasing accuracy and efficiency in managing inventory levels	15
SUPPLY CHAIN OPTIMIZATION	Improving coordination and optimization of supply chain operations	14
COST REDUCTION	Reducing operational costs due to automation and efficiency improvements	12

TABLE 2. BARRIERS TO THE ADOPTION OF INDUSTRY 4.0

BARRIER	DESCRIPTION	FREQUENCY OF MENTION
INADEQUATE INFRASTRUCTURE	Lack of technological infrastructure required	17
WORKFORCE AND TRAINING	Lack of skilled workforce and training programs	14
HIGH INITIAL INVESTMENT COSTS	Significant amount of capital required for initial implementation	12
CYBERSECURITY CONCERNS	Risks related to data security and privacy	11

stacles to the adoption of Industry 4.0 technologies, especially for small companies. The main barriers to adoption, their descriptions from interviews, and frequencies are shown in Table 2.

DIFFERENCES BASED ON COMPANY SCALE

The impact of Industry 4.0 digital transformation and technologies varies significantly between large companies and SMEs. While larger companies benefit more from these technologies due to greater resource allocation and scalability, SMEs face more significant challenges. The frequencies of positive impacts and barriers that large companies and SMEs mentioned in the interviews are shown in Table 3.

THE ROLE OF R&D INVESTMENTS

Increasing investments in research and development (R&D) were found to play an important role in reducing the negative effects and barriers

of Industry 4.0 technologies. R&D investments foster innovation and better integration and help create a more conducive environment for technology adoption. The main aspects highlight the role of research and development investments in the successful adoption and implementation of Industry 4.0 technologies in the Turkish logistics sector, their descriptions from interviews and frequencies are shown in Table 4.

DISCUSSION

The integration of Industry 4.0 technologies into Turkish logistics companies presents a complex scenario affected by various opportunities and challenges. Based on semi-structured interviews with various industry experts and company representatives, various important information has been revealed that sheds light on the current status and future potential of Industry 4.0 in the Turkish logistics sector.¹⁸

18 Hofmann, E., Rüsç, M. (2017). Industry 4.0 and the

TABLE 3. DIFFERENCES BASED ON COMPANY SCALE

COMPANY SIZE	POSITIVE IMPACTS (FREQUENCY)	BARRIERS (FREQUENCY)
LARGE FIRMS	23	9
SME'S	14	17

TABLE 4. THE ROLE OF R&D INVESTMENTS

ASPECT	DESCRIPTION	FREQUENCY OF MENTION
INNOVATION	Encouraging the development of new technologies and solutions	14
INTEGRATION	Improving existing operations and make more efficient	11
MITIGATION OF NEGATIVE IMPACTS AND BARRIERS	Helping reduce the negative impacts of technology adoption	9

One of the key drivers of the adoption of Industry 4.0 technologies and an important finding of this study is the increase in strategic and operational efficiency offered by this digital transformation. Various technological applications based on Industry 4.0, such as IoT, artificial intelligence, and big data analytics, enable real-time tracking of shipments and improved inventory management. These technologies also optimize supply chain operations.

In this way, operations become easier, and costs are significantly reduced by minimizing manual interventions and errors. While large companies are motivated by strategic advantages such as improved decision-making capabilities, increased efficiency, and increased customer satisfaction, operational benefits such as reduced costs, increased productivity, and better resource management are of particular interest to SMEs.¹⁹ These motivations are consistent with findings in the literature highlighting the various benefits of Industry 4.0 for different types of organizations.

Despite these many potential benefits, numerous challenges may prevent the widespread adoption of Industry 4.0 technologies.²⁰ In the study, a lack of technical skills and expertise was identified as one of the main obstacles. This issue is well documented in the literature, where the lack of skilled labour is often cited as a significant barrier to digital transformation. The relatively slow adaptation of the education system in Türkiye to the demands of Industry 4.0 further aggravates this problem and results in the workforce not being sufficiently prepared for the complexity of new technologies.

Financial constraints create a significant challenge, especially for SMEs.²¹ The high initial costs of

purchasing Industry 4.0 technologies can be a prohibitive constraint, and uncertainty about return on investment can further discourage companies from making these investments. This financial hesitation creates a common theme in the literature that emphasizes the need for significant capital and the risks associated with uncertain outcomes.

Organizational resistance to change is another significant barrier to adoption. Many companies have already established traditional ways of working and are resistant to adopting new technologies. This resistance is mostly due to the lack of understanding of the benefits of Industry 4.0 and the fear of being laid off due to the automation to be installed.²² To overcome this resistance, companies need to create effective change management strategies and clear communication about the long-term benefits of digital transformation.

The interviews also reveal the critical role of government support and policy frameworks in facilitating the adoption of Industry 4.0. In countries with well-developed Industry 4.0 systems, government policies are effective in providing the necessary infrastructure, financial incentives, and training programs to support digital transformation. In Türkiye, stronger government intervention is needed to address gaps in infrastructure, provide financial support to SMEs, and support training initiatives focused on Industry 4.0 skills.

Intercompany collaboration and information sharing emerged as another important factor. Industry 4.0 transformation is not an isolated effort but a collaborative process involving multiple stakeholders, including technology providers, educational institutions, and industry consortiums.²³ Knowledge exchange and partnership platforms can help companies overcome the challenges of

current status as well as future prospects on logistics. *Computers in Industry*, 89, 25.

19 Vogel-Heuser, B., Hess, D. (2016). Guest editorial industry 4.0—Prerequisites and visions. *IEEE Transactions on Automation Science and Engineering*, 13(2), 412.

20 Liao, Y., Deschamps, F., Loures, E. de F. R., Ramos, L. F. P. (2017). Past, present and future of Industry 4.0 — A systematic literature review and research agenda proposal. *International Journal of Production Research*, 55(12), 3612.

21 Phuyal, S., Bista, D., Bista, R. (2020). Challenges, opportunities and future directions of smart manufacturing: A state of the art review. *Sustainable Futures*, 2, 100023, 8.

22 Rübmann, M., Lorenz, M., Gerbert, P., Waldner, M., Justus, J., Engel, P., & Harnisch, M. (2015). Industry 4.0: The future of productivity and growth in manufacturing industries. *Boston consulting group*, 9(1), 62.

23 Bag, S., Telukdarie, A., Pretorius, J. C., & Gupta, S. (2021). Industry 4.0 and supply chain sustainability: framework and future research directions. *Benchmarking: An International Journal*, 28(5), 1430.

digital transformation.²⁴

These findings from our semi-structured interviews are consistent with the broader literature on Industry 4.0, which highlights the interaction between technological, financial, and organizational factors in shaping the adoption environment. For instance, Sony and Naik (2020) identified the increasing complexity of production and logistics networks as a major hurdle that requires advanced data analytics and process integration technologies.

Briefly, while Industry 4.0 offers significant opportunities for Turkish logistics companies, realizing its full potential requires overcoming many fundamental challenges. A multifaceted approach that includes investment in skills development, financial support mechanisms, organizational change management, and improved collaboration among stakeholders is essential. By overcoming these challenges and barriers, Turkish logistics companies can benefit from Industry 4.0 technologies to achieve sustainable competitive advantage and operational excellence.

CONCLUSION AND IMPLICATIONS

The transition to Industry 4.0 presents a dual spectrum of opportunities and challenges that impact its adoption in different types of organizations. This research focused on the specific conditions of Turkish logistics companies, revealing critical insights into the factors driving and inhibiting the adoption of Industry 4.0 technologies.

For large companies, strategic opportunities such as increased efficiency, increased competitiveness, and innovation potential encourage adoption. SMEs, on the other hand, are motivated by operational benefits such as reducing costs and increasing efficiency. The main challenge hindering the adoption of Industry 4.0 is the lack of technical skills and expertise, which are vital for the successful implementation and management of new technologies. Financial constraints, such

as high initial investment costs and uncertainty regarding returns, further complicate the adoption process. Organizational resistance to change due to traditional working methods and fear of dismissal also poses a significant obstacle.

Overcoming these challenges requires a multifaceted approach. For large companies, it is important to continually invest in employee training to develop the necessary technical expertise. SMEs will be able to benefit from government support through financial incentives and grants to reduce initial investment pressure. It will be very beneficial for companies if policymakers focus on developing comprehensive digital strategies that support the adoption of Industry 4.0, including clear guidelines and frameworks.

It is crucial to promote a culture of innovation and digital literacy in organizations. This includes technical training and raising awareness about the strategic importance of digital transformation. Collaboration and information sharing between companies can also help overcome the challenges of digital transformation.

While Industry 4.0 offers significant opportunities to Turkish logistics companies, realizing its full potential requires overcoming many fundamental barriers. A comprehensive approach that includes investment in skills development, financial support mechanisms, organizational change management, and improved collaboration between stakeholders is essential. By overcoming these problems, Turkish logistics companies can benefit from Industry 4.0 technologies to achieve sustainable competitive advantage and operational excellence.

24 Kamble, S. S., Gunasekaran, A., & Gawankar, S. A. (2018). Sustainable Industry 4.0 framework: A systematic literature review identifying the current trends and future perspectives. *Process safety and environmental protection*, 117, 412.

25

BIBLIOGRAPHY:

1. Bag, S., Gupta, S., Kumar, S. (2021). Industry 4.0 adoption and 10R advance manufacturing capabilities for sustainable development. *International Journal of Production Economics*, 231, 107844. <<https://doi.org/10.1016/j.ijpe.2020.107844>>.
2. Bag, S., Telukdarie, A., Pretorius, J. H. C., Gupta, S. (2021). Industry 4.0 and supply chain sustainability: Framework and future research directions. *Benchmarking: An International Journal*, 28(5). <<https://doi.org/10.1108/BIJ-03-2018-0056>>.
3. Ben-Daya, M., Hassini, E., Bahroun, Z. (2019). Internet of things and supply chain management: A literature review. *International Journal of Production Research*, 57(15–16). <<https://doi.org/10.1080/00207543.2017.1402140>>.
4. Büyüközkan, G., Göçer, F. (2018). Digital supply chain: Literature review and a proposed framework for future research. *Computers in Industry*, 97. <<https://doi.org/10.1016/j.compind.2018.02.010>>.
5. Frank, A. G., Dalenogare, L. S., Ayala, N. F. (2019). Industry 4.0 technologies: Implementation patterns in manufacturing companies. *International Journal of Production Economics*, 210. <<https://doi.org/10.1016/j.ijpe.2019.01.004>>.
6. Gilchrist, A. (2016). *Industry 4.0*. Apress. <<https://doi.org/10.1007/978-1-4842-2047-4>>.
7. Hofmann, E., Rüsçh, M. (2017). Industry 4.0 and the current status as well as future prospects on logistics. *Computers in Industry*, 89. <<https://doi.org/10.1016/j.compind.2017.04.002>>.
8. Hermann, M., Pentek, T., Otto, B. (2016). Design principles for Industrie 4.0 scenarios. 2016 49th Hawaii International Conference on System Sciences (HICSS). <<https://doi.org/10.1109/HICSS.2016.488>>.
9. Kamble, S. S., Gunasekaran, A., Gawankar, S. A. (2018). Sustainable Industry 4.0 framework: A systematic literature review identifying the current trends and future perspectives. *Process Safety and Environmental Protection*, 117. <<https://doi.org/10.1016/j.psep.2018.05.009>>.
10. Liao, Y., Deschamps, F., Loures, E. de F. R., Ramos, L. F. P. (2017). Past, present and future of Industry 4.0—A systematic literature review and research agenda proposal. *International Journal of Production Research*, 55(12). <<https://doi.org/10.1080/00207543.2017.1308576>>.
11. Luthra, S., Mangla, S. K. (2018). Evaluating challenges to Industry 4.0 initiatives for supply chain sustainability in emerging economies. *Process Safety and Environmental Protection*, 117. <<https://doi.org/10.1016/j.psep.2018.04.018>>.
12. Phuyal, S., Bista, D., Bista, R. (2020). Challenges, opportunities and future directions of smart manufacturing: A state of the art review. *Sustainable Futures*, 2, 100023. <<https://doi.org/10.1016/j.sftr.2020.100023>>.
13. Rüßmann, M., Lorenz, M., Gerbert, P., Waldner, M., Justus, J., Engel, P., & Harnisch, M. (2015). Industry 4.0: The future of productivity and growth in manufacturing industries. Boston consulting group, 9(1), 54–89.
14. Salkin, C., Oner, M., Ustundag, A., Cevikcan, E. (2018). A conceptual framework for Industry 4.0. In A. Ustundag & E. Cevikcan (Eds.), *Industry 4.0: Managing the digital transformation*. Springer International Publishing. <https://doi.org/10.1007/978-3-319-57870-5_1>.
15. Sony, M., Naik, S. (2020). Key ingredients for evaluating Industry 4.0 readiness for organizations: A literature review. *Benchmarking: An International Journal*, 27(7). <<https://doi.org/10.1108/BIJ-09-2018-0284>>.
16. Strange, R., Zucchella, A. (2017). Industry 4.0, global value chains and international business. *Multinational Business Review*, 25(3). <<https://doi.org/10.1108/MBR-05-2017-0028>>.
17. Tatoglu, E., Bayraktar, E., Golgeci, I., Koh, S. C. L., Demirbag, M., Zaim, S. (2016). How do supply chain management and information systems practices influence operational performance? Evidence from emerging country SMEs. *International Journal of Logistics Research and Applications*, 19(3). <<https://doi.org/10.1080/13675567.2015.1065802>>.
18. Vogel-Heuser, B., Hess, D. (2016). Guest editorial industry 4.0—Prerequisites and visions. *IEEE Transactions on Automation Science and Engineering*, 13(2). <<https://doi.org/10.1109/TASE.2016.2523639>>.