

Key Directions for Transforming Supply Chain Management in Emerging Markets during the Post-COVID-19 Pandemic Period

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ABSTRACT

This research aimed to identify the main directions for transforming supply chains in emerging markets to enable timely managerial responses to the challenges and opportunities during the post-COVID-19 pandemic period. The analysis of theoretical sources resulted in the formulation of the following research hypotheses: (H1) Sustainable development of supply chains in emerging markets during the post-COVID-19 pandemic period can be achieved through the digital transformation of supply chains; (H2) The most promising direction for transforming supply chain management in emerging markets during the post-COVID-19 pandemic period is ensuring digital readiness of supply chains. The research employs a quantitative approach, and its methodological design is based on this approach. Primary data for the study was collected through a structured online survey using Google Forms as the survey tool. During the analysis of the primary data, a combination of general scientific and specialized methods of cognition was applied, including econometric and economic-statistical methods, as well as a graphical representation of data. The developed methodology was validated through its application to the case of BRICS countries. The results of the validation allowed us to establish that the primary direction for the transformation of supply chains during the post-COVID-19 pandemic period should be considered digital transformation. The findings of this research may be of interest to supply chain management professionals in emerging markets and also hold relevance for academic researchers, particularly in terms of identifying promising directions for future investigations.

Keywords: *digital readiness, digital transformation, post-COVID-19 pandemic, supply chain management, sustainable supply chain development*

1. INTRODUCTION

During the first decades of the 21st century, emerging markets encountered numerous global challenges. The rapid advancement of science and technology, driving the intensification of globalization, facilitated increased access to financial resources, advanced technologies, and expanded customer networks for these markets. However, it also brought to the forefront the significant negative implications of globalization, particularly evident within the context of emerging markets (Balsalobre-Lorente *et al.*, 2023; Tazhibekova *et al.*, 2020).

Imperfections in regulatory and legal mechanisms, insufficient infrastructural development, and often a dearth of qualified supply chain management personnel in emerging markets critically constrained the capabilities of domestic producers to effectively compete with transnational corporations during a time when supply chain efficiency emerged as a key competitive advantage for most goods and services (Xu, 2019). However, the situation dramatically shifted in early 2020 when the World Health Organization (WHO) reported the identification of a "previously unknown pathogen causing an unprecedented outbreak of illness" in China (WHO, 2020a). The Chinese government's

unprecedented efforts to contain the outbreak of an infection caused by a previously unknown pathogen only marginally slowed the spread of the epidemic. On March 11, 2020, the World Health Organization (WHO) declared the coronavirus infection (COVID-19) a pandemic, emphasizing the necessity of implementing a comprehensive global strategy aimed at preventing its spread, saving lives, and mitigating the adverse consequences of the disease (WHO, 2020b).

As part of this comprehensive strategy to counter the pandemic, national governments implemented extraordinary quarantine measures, including complete cessation of international travel, significant restrictions on domestic transportation, and various limitations on business operations, including complete shutdowns under lockdown measures. These measures led to negative effects on the development of national economies, comparable to the impact of the Great Recession (Giroud and Ivarsson, 2020). One of the most significant consequences of humanity's first-ever global exogenous crisis was the near-instantaneous disruption of supply chains, which demonstrated exceptional fragility amid the COVID-19 pandemic. Nevertheless, this disruption not only accentuated new requirements for supply chains, primarily focusing on enhancing their resilience, but also presented developing markets with additional growth opportunities. Consequently, during the post-COVID-19 pandemic period, emerging markets faced unique challenges and possibilities in supply chain management. The crises triggered by the pandemic not only exposed vulnerabilities in existing supply chains and spurred their transformation to ensure sustainable development but also necessitated novel approaches to management. This article aims to identify the key directions for transforming supply chains in emerging markets during the post-COVID-19 pandemic period to discern managerial changes critical for ensuring supply chain resilience and achieving competitive advantages in the altered reality.

2. LITERATURE REVIEW

The analysis of contemporary scientific publications on supply chain management revealed a significant increase in research interest over the past decade (Alsmairat and Aldakhil, 2022; Israfilov *et al.*, 2019; Hamoudi *et al.*, 2021; Zhao *et al.*, 2019). This finding reaffirms the importance of supply chains in enhancing the competitiveness of individual enterprises, as well as regional and national economies. Concurrently, upon reviewing theoretical sources, it was noted that before the onset of the COVID-19 pandemic, the primary research focus was on enhancing efficiency (Bonou *et al.*, 2020; Ketokivi and Mahoney, 2020; Stella, 2019) and fostering flexibility and lean practices in supply chains (Liao, 2020; Kawa and Maryniak, 2019; Singh *et al.*, 2019). The shock impact of the COVID-19 pandemic had far-reaching implications both on the real economy and in the realm of academic research. Virtually instantaneously, it disrupted efficient and lean supply chains, making resilience an urgent priority (Debnath and Sarkar, 2023; Ozdemir *et al.*, 2022; Silva *et al.*, 2022).

A significant number of studies during the COVID-19 pandemic have been dedicated to investigating the direct impact of the pandemic on supply chain formation (Ajmal *et al.*, 2023; Sombultawee *et al.*, 2022), as well as enhancing their resilience amidst the influence of adverse factors (Shen

and Sun, 2023; Moosavi *et al.*, 2022; Karmaker *et al.*, 2021). It is worth noting the growing academic interest in supply chain formation issues in emerging markets, as the disruption of previously established supply chains undoubtedly exerts a shock effect on the economy, but can also present promising opportunities for developing markets, providing an additional chance to form competitive advantages through the establishment of sustainable supply chains, including at the global level (Aray *et al.*, 2023; Dadzie *et al.*, 2023; Dwivedi *et al.*, 2023).

In particular, the study conducted by Ali *et al.* (2023) is dedicated to determining the impact of vulnerability reduction strategies on firm performance and assessing the mediating role of supply chain risk. Based on data collected through a survey of 335 representatives from small and medium-sized textile enterprises in China, the authors empirically demonstrated that the adoption of vulnerability reduction strategies significantly reduces supply chain risks, thereby positively affecting firm performance (Ali *et al.*, 2023). Furthermore, they identified a new vulnerability reduction strategy in the context of small and medium-sized enterprises (SMEs) - the supply chain financing (SCF) strategy.

While acknowledging the relevance and practical implications of the previous research, it is essential to note that the study conducted by Ali *et al.* (2023) may offer valuable insights for addressing vulnerabilities in SMEs. The statement accurately points out that the study's limited research scope prevents it from comprehensively analyzing the main directions for transforming supply chains in the post-COVID-19 pandemic period. Silva *et al.* (2023) presents the results of their research on risks and strategies for supply chains in the context of a developing economy, achieved by combining two widely used methods: Multi-Criteria Decision Making (MCDM) and Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS). The application of the proposed methodology demonstrated that the most significant risk for the analyzed sector (the spice industry in Sri Lanka) was the "inability to meet quality requirements," and the key strategy to mitigate the consequences of supply chain risks in this sector was vertical integration (Silva *et al.*, 2023).

Notably, the primary limitations of the previous investigation, characterized by its exploratory nature and the requirement for additional empirical data, underscore the importance of undertaking further research on this topic. Among the most comprehensive studies on supply chain transformation in the context of the COVID-19 pandemic, Panwar *et al.* (2022) conducted research dedicated to the future of global supply chains in the post-COVID-19 world. Drawing on an in-depth analysis of secondary information, including statistical data and findings from previous research, Panwar *et al.* (2022) identified that the unprecedented disruptions in supply chains caused by the impact of the COVID-19 pandemic were influenced by the complex interplay of the following factors: (1) sudden surge in demand for specific products; (2) unforeseen shifts in demand points; (3) supply shortages; (4) logistical crises; and (5) remarkably swift recovery of major economies.

The synergy of these demand and supply-related factors, as posited by previous researchers, became the root cause of the so-called "perfect storm" that devastated supply chains worldwide. Panwar *et al.* (2022) meticulously analyze

the key drivers behind the most significant shifts in consumer behaviour and consumption patterns in recent history in response to the onset of the COVID-19 pandemic. Additionally, they explore the factors responsible for supply crises during the pandemic, leading to the development of four fundamental principles for global supply chains and global value creation chains that ensure resilience to future disruptions: (1) geographical coverage, (2) modernization, (3) management mechanisms, and (4) company-government relations (Panwar *et al.*, 2022). Moreover, the authors emphasize the pivotal role of automation and digitization in reshaping global supply chain configurations.

While acknowledging the unquestionable significance of the study by Panwar *et al.* (2022), it is noteworthy that their research focuses on identifying the fundamental regularities of global supply chains, thus leaving the specific aspects of supply chain transformation in emerging markets beyond the scope of their investigation. The analysis of theoretical sources on the research problem reveals that despite a significant body of scientific literature addressing various aspects of supply chain formation under the influence of COVID-19 (Orlando *et al.*, 2022; Herold *et al.*, 2021; Free and Hecimovic, 2021), including studies on emerging markets (Schilling and Seuring, 2022; Sharma *et al.*, 2021), the exploration of the key directions for transforming supply chains in emerging markets during the post-COVID-19 period remains insufficient. Consequently, the primary motivation behind this study stems from the growing societal demand for research focusing on the fundamental transformational directions of supply chains in emerging markets in the post-pandemic era, aiming to facilitate effective supply chain management in the evolving realities, given the inadequate attention this issue has received from contemporary scientific thought.

The analysis of theoretical sources (Agility, 2023; Lang *et al.*, 2023; Panwar *et al.*, 2022) has enabled the formulation of the primary hypotheses for this study:

Hypothesis 1 (H1): *Ensuring the sustainable development of supply chains in emerging markets during the post-COVID-19 period can be achieved through the digital transformation of supply chains.*

Hypothesis 2 (H2): *The most promising direction for transforming supply chain management in emerging markets during the post-COVID-19 period is the establishment of digital readiness in supply chains.*

This research aimed to identify the primary directions for transforming supply chains in emerging markets to enable timely managerial responses to the challenges and opportunities during the post-COVID-19 period. To achieve this research objective, the following scientific tasks were formulated and systematically addressed: (1) analyzing theoretical sources related to the research topic; (2) developing the methodological design of the research project; (3) conducting an empirical validation of the research project; and (4) presenting the interpretation of the obtained results. This article is structurally divided into five main sections.

3. METHODOLOGY

The research objective was attained through a thorough and multi-stage exploratory study, employing a quantitative

approach. The primary sources of information were identified, considering the key implementation constraint of this research, which was the insufficient availability of current and comparable statistical data regarding supply chain formation in emerging markets. Considering this limitation, the study relied on the use of primary data obtained through a structured survey method. Moreover, due to budgetary constraints, the choice of survey tool was determined to be a structured online survey using Google Forms.

In the development of the survey questionnaire, the Agility Emerging Markets Logistics Index (AEMLI) method, devised by the Agility Group of companies (Agility, 2023), was employed. This method relies on the key AEMLI indicator, which assesses the development of supply chains in emerging markets and serves as a comprehensive integrated metric reflecting the complexity, interconnectivity, and opportunities presented by each market (Agility, 2023). Before 2022, the Agility Emerging Markets Logistics Index encompassed the following comprehensive characteristics: (1) Domestic Logistics Opportunities (DLO), (2) International Logistics Opportunities (ILO), and (3) Business Fundamentals (BF) (Agility, 2023). However, given the profound significance of digitization in supply chain transformation, the inclusion of a comprehensive indicator assessing market readiness for digital technologies, known as Digital Readiness (DR), became imperative. Consequently, starting in 2022, the Agility Emerging Markets Logistics Index takes into account the influence of this additional metric (Agility, 2023).

Each of the characteristics of the Agility Emerging Markets Logistics Index is, in turn, represented by comprehensive integrated indicators. The Domestic Logistics Opportunities (DLO) index characterizes the efficiency of each emerging market, as well as the existing potential for supporting and developing internal demand, and it is formed using the following indicators: (1) volume and dynamics of domestic logistics markets; (2) volume and dynamics of the national economy; (3) population size and dynamics; (4) income equality; (5) level of urbanization; (6) development of business clusters (Agility, 2023).

The International Logistics Opportunities (ILO) index characterizes the internal and external demand for logistics services about intensive trade volume and evaluates the potential of individual emerging markets to facilitate cross-border logistics operations based on the analysis of the following indicators: (1) volume and growth of international logistics markets; (2) volume and growth of logistics-intensive trade; (3) quality and efficiency of infrastructure (Agility, 2023).

The Business Fundamentals (BF) index characterizes each emerging market in terms of openness, reliability, fairness, and strength of the business environment, as well as the rule of law and market freedom (Agility, 2023). The BF index is formed based on the analysis of the following indicators: (1) national regulatory and legal framework; (2) credit and debt dynamics; (3) contract enforcement and anti-corruption measures; (4) inflation and price stability; (5) crime and violence rates; (6) market accessibility and internal stability (Agility, 2023).

Furthermore, since 2022, the Agility Emerging Markets Logistics Index has been constructed using the Digital Readiness (DR) index, which measures the potential

and progress of each emerging market towards transforming into a digitally-oriented, skill-rich, innovation-driven, and sustainable economy in the future (Agility, 2023). The DR index is formulated by utilizing indicators such as (1) emission intensity; (2) mix of renewable energy sources; (3) adoption of digital business models and online commerce; (4) level of entrepreneurial risk; (5) correlation between digital skills and human capital; (6) enterprise financing accessibility (Agility, 2023).

It is important to note that this study is not aimed at calculating an independent Agility Emerging Markets Logistics Index; rather, it utilizes the Agility group's method as a methodological foundation in the development of the survey questionnaire, which accounts for the author's formulations of criteria and the personalized selection of question formats during the survey administration.

The target population for this study consisted of supply chain management professionals from enterprises operating in developing markets, as well as academic researchers in the field of supply chain management. The chosen methodology (structured online survey using Google Forms) determined the characteristics of the sampling process, which was limited to Internet users who were specialists in supply chain management. However, considering the evident prevalence of Internet users among supply chain management professionals, the impact of this limitation within the scope of this study can be deemed negligible, although it may warrant consideration by future researchers. In processing the research findings, a comprehensive set of contemporary general scientific and specialized methods of knowledge acquisition was employed, including correlation analysis, structural analysis, and graphical representation of results.

During the development of the questionnaire, both closed and combined (open-closed) questions with single-choice responses were utilized. To assess specific indicators characterizing the formation of supply chains, a 5-point Likert scale was employed, providing a high level of respondent comprehension, ease of result processing, and unambiguous final interpretation (Vogel *et al.*, 2020).

In this study, to enhance respondent understanding of the questions, a single type of Likert scale was employed – the agreement scale, which determines the level of agreement of the respondent with the given statement, with the following interpretation: disagree - 1 point; somewhat disagree - 2 points; neutral - 3 points; somewhat agree - 4 points; agree - 5 points. The main block of questions is provided in the Appendix to this article. The countries selected for the pilot study were the BRICS nations - an intergovernmental association comprising Brazil, Russia, India, China, and South Africa. The choice of these countries was justified by the fact that they possess attributes of emerging economies while simultaneously holding prominent positions as regional leaders, exerting significant influence on the global economy.

The study was conducted by the authors online from March 5, 2023, to April 5, 2023. Participation in the research was completely anonymous and, therefore, did not require additional consent regarding the processing of personal data. Nevertheless, each provided form contained information stating that completing and submitting the form implied the respondent's consent to the processing and utilization of the research results. In total, 844 questionnaires were received

during the research process, out of which 810 were deemed valid and eligible for further analysis.

4. RESULT

The distribution of respondents by countries is presented in **Figure 1**.

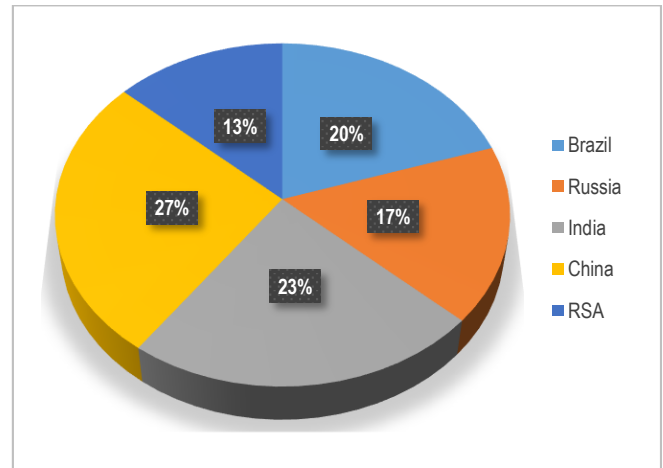


Figure 1 Respondent distribution by countries

The highest proportion of respondents was provided by participants from China (27%), followed by India with 23%, and approximately one-fifth from Brazil. A slightly smaller proportion of respondents came from Russia (17%) and South Africa (13%). These proportions align with comparable economic scales and developmental trends within national economies, ensuring the representativeness of the sample structure.

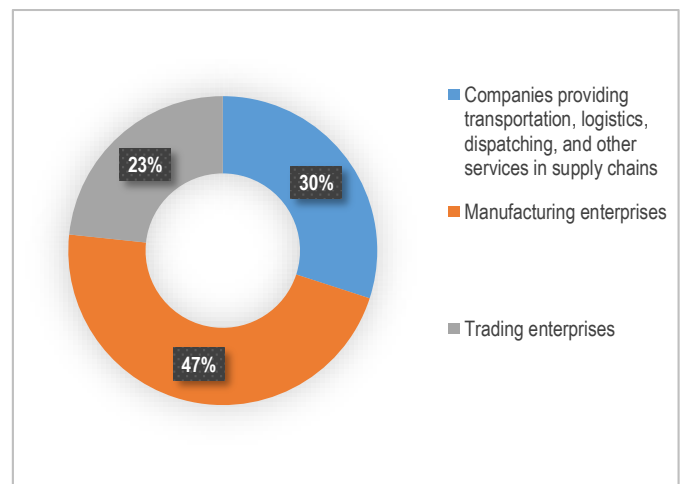


Figure 2 Structure of respondents according to the specialization of their enterprises in supply chains

Figure 2 illustrates the respondents' structure based on the specialization of their enterprises in supply chains. Based on the analysis, nearly half of the respondents (47%) represent manufacturing enterprises, 30% of the respondents are companies engaged in transportation, logistics, forwarding, and other services in supply chains, and an additional 23% of the respondents represent trading enterprises.

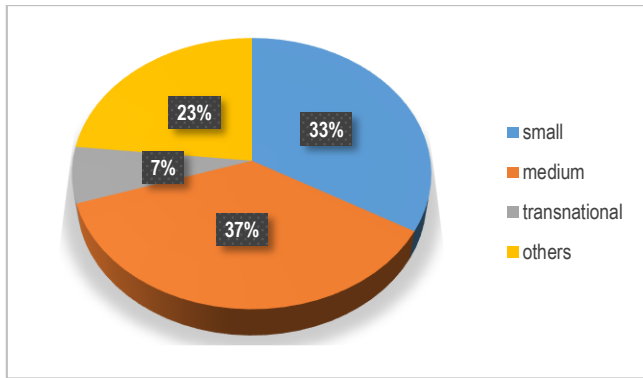


Figure 3 Structure of respondent enterprises by size

The structure of respondent enterprises by size is presented in **Figure 3**. Based on the analysis, the largest share of respondents comprises representatives of medium-sized enterprises (37%), and slightly fewer are from small enterprises (33%). The proportion of representatives from multinational enterprises is relatively small, but the number of multinational corporations in the countries selected for analysis significantly lags behind the number of small and medium-sized enterprises. An additional 23% of respondents selected the "other" option, with the majority not taking advantage of the open-ended response option to specify the size of their enterprise. Analysis of the educational background of the respondents revealed that all participants reported having an education at or above the bachelor's degree level, with 20% of respondents indicating the possession of a confirmed academic degree.

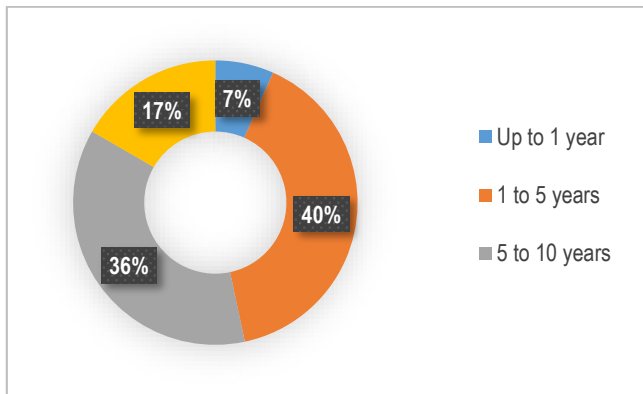


Figure 4 Structure of respondents by tenure in supply chain management

Figure 4 illustrates the structure of respondents based on their tenure in supply chain management. The prevalence of respondents with work experience in supply chain management ranging from 1 to 5 years (40%) and from 5 to 10 years (36%) can be attributed to the active adoption of supply chain management practices over the past decade, particularly in response to the disruptive impact of the COVID-19 pandemic in 2020. Thus, the constructed respondent profile indicates that respondents possess theoretical knowledge and practical experience in supply chain management, while the national and industry structure suggests a relatively harmonious composition of the respondents.

The assessment of the sample's acceptability, normality, and reliability regarding the questions from the main block, utilizing the item-total correlation method, is

presented in **Table 1**.

Table 1 Assessment of acceptability, normality, and reliability of the sample

Question Code	Mean Value	Standard Deviation	item-total correlation
RQ1	3.77	0.94	0.82
RQ2	3.87	0.82	0.81
RQ3	4.10	0.66	0.76
RQ4	3.73	0.69	0.59
RQ5	4.07	0.69	0.83
RQ6	3.77	0.97	0.83
RQ7	3.60	0.81	0.76
RQ8	2.80	0.71	0.56
RQ9	3.73	0.94	0.91
RQ10	3.60	0.86	0.89
RQ11	3.27	0.94	0.79
RQ12	3.80	0.96	0.87
RQ13	3.57	0.94	0.84
RQ14	3.60	0.97	0.81

The mean values of the investigated questions range from 2.8 to 4.1, and the standard deviation does not exceed 0.97. Moreover, all item-total correlation values are above 0.4, indicating a very strong correlation, high sample reliability, and minimal risk of information distortion.

Graphical representations of the research results regarding the primary factors influencing the formation of supply chains are presented in **Figure 5**.

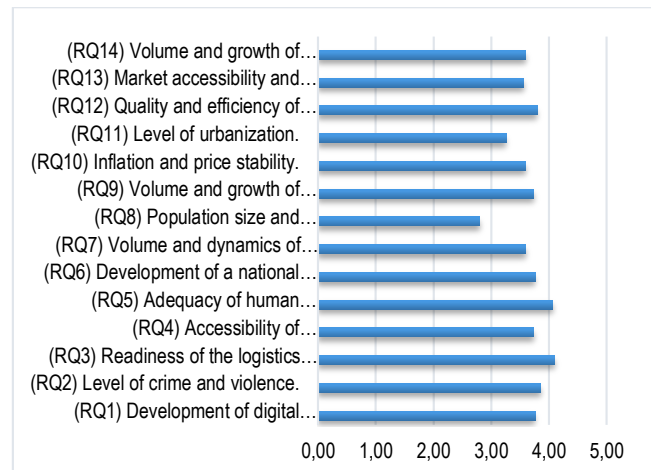


Figure 5 Key factors influencing the formation of supply chains

The results of the evaluation by respondents regarding the significance of the key factors influencing supply chain management indicated a relatively differentiated perception of the importance of individual factors, ranging from 2.80 (RQ8) to 4.10 (RQ3). Consequently, it is advisable to perform additional ranking based on the obtained ratings. The rankings of the assessed factors by mean score are provided in **Table 2**.

The results of the ABC analysis of the main factors influencing the formation of supply chains are presented in **Table 3**.

Table 2 Ranking of selected factors (by mean assessment)

1	(RQ3) Readiness of the logistics infrastructure for digital transformation.	4.10
2	(RQ5) Adequacy of human capital to support digital transformation.	4.07
3	(RQ2) Level of crime and violence.	3.87
4	(RQ12) Quality and efficiency of the infrastructure.	3.80
5	(RQ1) Development of digital business models and online commerce.	3.77
6	(RQ6) Development of a national regulatory framework.	3.77
7	(RQ4) Accessibility of technologies.	3.73
8	(RQ9) Volume and growth of logistics-intensive trade.	3.73

Table 3 ABC analysis of the key factors influencing the formation of supply chains

	Criterion	Mean Rating	%, Cumulative total	Group
1	(RQ3) Readiness of the logistics infrastructure for digital transformation.	4.10	8.00	A
2	(RQ5) Provision of human capital for digital transformation.	4.07	15.93	A
3	(RQ2) Level of crime and violence.	3.87	23.47	A
4	(RQ12) Quality and effectiveness of the infrastructure.	3.80	30.88	B
5	(RQ1) Development of digital business models and online commerce.	3.77	38.23	B
6	(RQ6) Sophistication of the national regulatory framework.	3.77	45.58	B
7	(RQ4) Accessibility of technologies.	3.73	52.86	B
8	(RQ9) Volume and growth of logistics-intensive trade.	3.73	60.14	B
9	(RQ7) Volume and dynamics of domestic logistics markets.	3.60	67.17	C
10	(RQ10) Inflation and price stability.	3.60	74.19	C
11	(RQ14) Volume and growth of international logistics markets.	3.60	81.21	C
12	(RQ13) Market accessibility and internal stability.	3.57	88.17	C
13	(RQ11) Level of urbanization.	3.27	94.54	C
14	(RQ8) Quantity and dynamics of the population.	2.80	100	C

Thus, the most significant factors influencing the formation of supply chains in emerging markets (Group A) are the readiness of the logistics infrastructure for digital transformation (mean rating of 4.1), provision of human capital for digital transformation (mean rating of 4.07), and the level of crime and violence (mean rating of 3.87).

Factors in Group B significantly influence the development of supply chains, including the quality and effectiveness of infrastructure (mean rating of 3.80),

sophistication of the national regulatory framework, and the development of digital business models and online commerce (mean rating of 3.77 for both), as well as the accessibility of technologies and the volume and dynamics of logistics-intensive trade (mean rating of 3.73 for both, respectively).

The least significant factors (Group C), according to the respondents, are as follows: (1) the influence of the volume and dynamics of domestic logistics markets, inflation, and

price stability (mean rating of 3.60); (2) the volume and growth of international logistics markets (mean rating of 3.60); (3) market accessibility and internal stability (mean rating of 3.60); (4) the level of urbanization (mean rating of 3.27); and (5) the quantity and dynamics of the population (mean rating of 2.80).

When examining the two-dimensional distribution (across countries) for the criteria in Group A, no substantial variations were observed in the responses of respondents from diverse countries. In other words, during the post-COVID-19 pandemic period, most supply chain management specialists in emerging markets, regardless of the particularities of national economic development, consider the readiness of the logistics infrastructure for digital transformation, the provision of human capital for digital transformation, and the level of crime and violence as the most significant criteria for supply chain development. Simultaneously, the two-dimensional analysis of criteria belonging to Group B and Group C revealed distinct country-specific characteristics: the influence of criteria characterizing domestic logistics capabilities received, on average, a 20% higher rating from respondents in India and China, while the influence of criteria characterizing international logistics capabilities was proportionally higher-rated by respondents from Brazil, Russia, and South Africa. Additionally, the impact of criteria characterizing the state of core business received a lower rating from respondents in China compared to other respondents. The results of the ABC analysis support the validity of Hypothesis H1.

The assessment of the impact according to the groups of factors (by the Agility Emerging Markets Logistics Index) is presented in **Figure 6**.

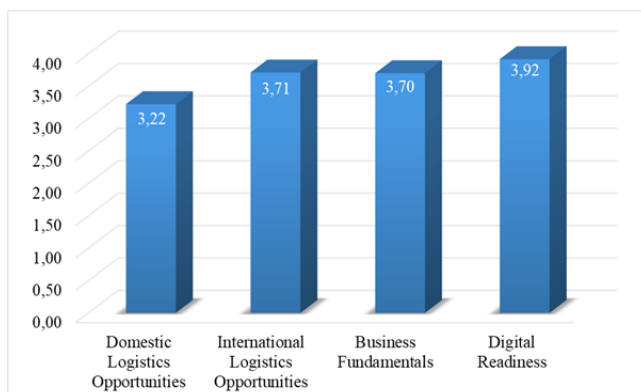


Figure 6 Impact assessment by groups of factors (according to the agility emerging markets logistics index) factors influencing the formation of supply chains

As can be observed, according to respondents' assessments, Digital Readiness (3.92) exerts the greatest influence on the formation of supply chains, with a comparable high level of influence from core business fundamentals (3.7) and international logistics capabilities (3.71). In contrast, the impact of internal logistics capabilities is significantly lower (3.22). Thus, the primary direction of supply chain management in emerging markets within the context of the modern turbulent economy is to ensure the digital readiness of emerging supply chains, confirming hypothesis H2. Thus, through the validation conducted on the example of BRICS emerging markets, both research hypotheses were confirmed. It is noteworthy that

certain structural peculiarities were identified during the assessment of the impact on supply chain development by respondents from China and India, who rated the influence of domestic logistics capabilities higher, as well as respondents from Brazil, Russia, and South Africa, who rated the influence of international logistics capabilities higher. The identified peculiarities in the evaluation cannot be comprehensively analyzed within the confines of this article; however, they present promising opportunities for further research and investigation.

5. DISCUSSION

The immense attention from the practical sector of the economy to supply chain management issues was significantly amplified by the disruptive impact of the COVID-19 pandemic, which rapidly and catastrophically disrupted a substantial portion of supply chains and triggered some of the most profound demand transformations of the 21st century, has driven increased academic interest in this problem (Zhang *et al.*, 2023; Yusuf and Soediantono, 2022; Putro *et al.*, 2022), including in emerging markets (Khan *et al.*, 2023; Chittipaka *et al.*, 2023; Nisar *et al.*, 2022). Herold *et al.* (2021) present the findings of their research on the response and "lessons learned" by logistics service providers (LSPs) in the context of the COVID-19 pandemic's influence and their pursuit of supply chain resilience. Their preceding study is centred on offering new insights into the lessons drawn from the COVID-19 pandemic and explores how logistics service providers managed to achieve supply chain resilience and which changes were most effective in ensuring supply chain stability and financial stability of enterprises. Drawing from primary data collected through semi-structured interviews with respondents from employees of selected LSPs operating on a global scale, Herold *et al.* (2021) demonstrated that the logistics service provider's response to the shock challenges of COVID-19 coalesced into five main directions that formed the foundation for LSP resilience, enabling supply chain resilience during external shocks: (1) revenue stream generation; (2) enhancing operational transportation flexibility; (3) strengthening digitalization and data management; (4) optimizing logistics infrastructure; and (5) optimizing human resources (Herold *et al.*, 2021).

Acknowledging the unquestionable relevance of the predecessors' research, it is worth noting that the study by Herold *et al.* (2021) approaches the issue from a narrower perspective, focusing on identifying the primary directions of logistics service provider's response to the COVID-19 pandemic, while our research examines supply chain management as a whole and is concentrated not only on the impact of the COVID-19 pandemic but also on the peculiarities of supply chain management development in the post-pandemic period.

The findings regarding the assessment of the role of digital technologies in ensuring supply chain resilience for the automotive sector in emerging markets are presented in the results of an in-depth empirical study by Balakrishnan and Ramanathan (2021). Drawing upon primary data collected through questionnaires administered to employees of automotive supply chain organizations, including automobile equipment manufacturers, level 1 component suppliers, and leading logistics service providers in the Asia-

Pacific region, Balakrishnan and Ramanathan (2021) substantiated the pivotal role of digital supply chain technologies. They demonstrated how these technologies enhance supply chain resilience and efficiency for the automotive sector in emerging markets in the post-COVID-19 pandemic context. However, it is important to acknowledge that the study by Balakrishnan and Ramanathan (2021) is primarily focused on understanding a relatively narrow industry segment, with the research field confined to the supply chains of the automotive sector. Furthermore, the preceding researchers concentrate on assessing the role of digital technologies in ensuring supply chain resilience. In contrast, our study is oriented towards identifying key prospective directions for supply chain transformations in the post-pandemic economic landscape.

The study by Soundararajan *et al.* (2021) presents the prospects of flexible management for achieving sustainable supply chain development in emerging markets for transnational enterprises. They used experimental control theory to develop a procedural framework that can be applied in the real economic sector. The framework aims to establish flexible management mechanisms for sustainable supply chain development of transnational enterprises in emerging markets.

It's worth noting that the focus of the predecessors is relatively narrow, concentrating on the supply chain management of transnational corporations. In contrast, our study takes a broader perspective, aiming to identify key directions for supply chain transformations in emerging markets without specific emphasis on enterprises of a particular scale, such as transnational corporations. Furthermore, our study shares certain methodological similarities with the research conducted by Balakrishnan and Ramanathan (2021) and Herold *et al.* (2021). For instance, we utilized primary information collected during the field stage of our investigation. However, the methodological alignment with the study by Soundararajan *et al.* (2021), which is based on the analysis of previous theoretical sources, is minimal.

Additionally, the research process has identified prospective directions for future investigations that extend beyond the scope of this study but hold relevance for supply chain management. The limitations of the information system have restricted researchers' capacity to monitor the dynamics of supply chain management comprehensively. Therefore, conducting annual monitoring, including an examination of the key factors influencing supply chain transformation, is a highly promising avenue. Moreover, in-depth exploration of specific factor groups at both the national and supranational levels is of interest. A comparative analysis between two countries to reveal distinctive differences in supply chain formation proves to be a particularly promising research endeavour. Thus, despite the evident increase in academic interest concerning supply chain management issues in emerging markets, our study not only confirms and enriches the findings of previous research (Balakrishnan and Ramanathan, 2021; Lang *et al.*, 2023), but also provides empirical evidence for hypotheses not previously addressed in the scientific literature. Furthermore, the author's scholarly contribution can be seen in the identification of prospective avenues for future research, as outlined in this article.

6. CONCLUSIONS

This study aimed to identify key directions for supply chain transformations in emerging markets, enabling timely managerial responses to the challenges and opportunities of the post-COVID-19 pandemic period. Through the analysis of theoretical sources, the primary hypotheses of this research were formulated: (H1) achieving supply chain resilience in emerging markets during the post-COVID-19 pandemic period can be attained through the digital transformation of supply chains; (H2) the most promising direction for supply chain management transformation in emerging markets during the post-pandemic period lies in ensuring digital preparedness of supply chains.

In pursuit of the research goals, an extensive multi-phase research endeavour was devised and executed, employing a quantitative methodology. The methodological framework was carefully crafted, considering the influence of critical implementation constraints, such as restricted access to pertinent and comparable statistical data and a constrained research budget. Adhering to these limitations, the current study was founded on the analysis of primary data garnered via a meticulously structured online survey deployed through Google Forms. The development of the survey questionnaire was guided by the Agility Emerging Markets Logistics Index (AEMLI) method, which employs a comprehensive integrated indicator to assess supply chain development in emerging markets. The methodological approach was validated through its application to the BRICS countries (Brazil, Russia, India, China, and South Africa), chosen due to their status as emerging economies, significant economic scale, and substantial influence on the regional and global economy.

The validation results have established that the primary direction of supply chain transformation in the post-COVID-19 pandemic period should be regarded as digital transformation, while the principal vector of supply chain management in emerging markets is ensuring the digital preparedness of evolving supply chains. As a result of the conducted validation, both research hypotheses were confirmed. Moreover, the study findings indicated significant variations in the assessment of the impact on supply chain development between respondents from different countries: respondents from China and India rated the influence of internal logistics capabilities higher, whereas respondents from Brazil, Russia, and South Africa gave a higher evaluation to the impact of international logistics capabilities. Further analysis of these identified disparities is beyond the scope of this study, but it may serve as a promising direction for future research.

Despite the substantial scholarly attention devoted to supply chain formation in emerging markets, our study serves to not only validate and augment the conclusions drawn from earlier investigations but also provides empirical substantiation for hypotheses hitherto unexplored in the academic domain. Additionally, the study contributes to the identification of promising avenues for future research, further enhancing its scholarly contribution. The results of this study may find practical relevance among supply chain management professionals, particularly those operating in emerging markets. Moreover, academic researchers may also benefit from the insights provided, especially

concerning the identification of potential directions for future research.

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APPENDIX

Table A1 Node and network level metrics used to describe the supply network topology.

Question Code	Main Block Questions
	Please rate your agreement with the provided statements on the following scale: Completely agree - 5 points, Tend to agree rather than disagree - 4 points, Neutral - 3 points, Tend to disagree rather than agree - 2 points, Completely disagree - 1 point.
RQ1	In the post-COVID-19 pandemic period, the development of digital business models and online commerce plays a crucial role in shaping resilient supply chains.
RQ2	In the current context, one of the determining factors for supply chain development at the national level is the level of crime (including corruption) and violence in the country.
RQ3	One of the most important factors in forming sustainable supply chains is the readiness of the logistics infrastructure for digital transformation.
RQ4	The accessibility of technologies at the national level is an important factor in the development of supply chains in a country during the post-COVID-19 pandemic period.
RQ5	Human capital's proficiency in digital transformation significantly influences the development of supply chains in the face of multiple external challenges.
RQ6	The development of supply chains at the national level is significantly influenced by the state of the national regulatory framework.
RQ7	The volume and dynamics of internal logistics markets are of critical importance for shaping supply chains in the post-pandemic COVID-19 era.
RQ8	Population size and dynamics exert a significant influence on supply chain formation at the national level.
RQ9	The formation of supply chains in emerging markets during the post-pandemic period is highly dependent on the volume and dynamics of logistics-intensive trade.
RQ10	In the post-pandemic period, the level of inflation and price stability in a country has the greatest impact on the formation of sustainable supply chains.
RQ11	The level of urbanization in a country is a factor that determines the development of supply chains in emerging markets.

Question Code	Main Block Questions
RQ12	The quality and efficiency of infrastructure are crucial factors in shaping supply chains in emerging markets.
RQ13	Market accessibility and internal stability in a country significantly influence the formation of supply chains in emerging markets.
RQ14	The volume and dynamics of international logistics markets have a significant impact on the development of supply chains in emerging markets.

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