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INTEGRATING SUPPLY CHAIN RISK MANAGEMENT TECHNOLOGY INTO ENTERPRISE MANAGEMENT SYSTEM

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In today's globalized business landscape, enterprises face increasing reliance on intricate supply chains to deliver goods and services efficiently. However, this interconnectedness exposes organizations to diverse risks, exacerbated by factors like natural disasters, geopolitical tensions, and technological vulnerabilities. The COVID-19 pandemic further emphasized the vulnerability of supply chains, prompting the urgent need for robust risk management strategies. Interstate conflicts also significantly influence supply chain risks, posing challenges such as trade disruptions and security vulnerabilities. To mitigate these risks, enterprises must adopt proactive risk management strategies, enhance supply chain resilience, and leverage technology-enabled solutions for real-time monitoring and response.

The study examines supply chain risk management (SCRM) practices in healthcare establishments in Algeria and Ukraine, comparing countries with differing healthcare systems. The research aims to identify disparities in SCRM approaches and their consequences. Results reveal that while both countries prioritize technology for predictive analysis, Algerian managers emphasize collaboration with other institutions.

The study suggests integrating SCRM technology into enterprise management system, prioritizing advanced technological solutions, scenario planning, collaborative partnerships, comprehensive risk management plans, continuous monitoring, and strengthening supplier relationships to enhance supply chain resilience and continuity in healthcare service delivery. These findings underscore the importance of efficient SCRM strategies in mitigating supply chain disruptions and ensuring uninterrupted healthcare services. By implementing these strategic measures, healthcare establishments can enhance their SCRM capabilities, thus promoting resilience, efficiency, and continuity in healthcare service delivery across diverse healthcare systems.

Key words: *Supply chain, risk management, management technology, management system, integration.*

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INTRODUCTION

In today's globalized and interconnected business environment, enterprises increasingly rely on complex supply chains to deliver goods and services to customers efficiently and effectively. However, this interconnectedness also exposes organizations to risks, ranging from natural disasters and geopolitical tensions to supplier failures and cyber-attacks. The COVID-19 pandemic further underscored the vulnerability of supply chains, disrupting operations worldwide and highlighting the critical need for robust risk management strategies.

Interstate conflicts significantly influence enterprise supply chain risks, posing challenges related to trade disruptions, supply chain fragmentation, security vulnerabilities, regulatory compliance, and reputational risks. To mitigate these risks, enterprises must adopt proactive risk management strategies, enhance supply chain resilience, diversify sourcing strategies, and embrace technology-enabled real-time monitoring and response solutions. Moreover, collaboration with industry partners, government agencies, and international organizations is essential to address shared challenges and promote stability and sustainability in global supply chains.

Supply chain risk management (SCRM) has emerged as a crucial enterprise resilience and sustainability component. By proactively identifying, assessing, and mitigating potential risks within the supply chain, organizations can minimize disruptions, protect their reputation, and maintain continuity in operations. Moreover, effective SCRM safeguards against adverse events and fosters agility and competitiveness, enabling enterprises to seize opportunities and adapt to changing market dynamics.

However, traditional approaches to SCRM often need to address the complexities and uncertainties inherent in modern supply chains. Manual processes, fragmented data sources, and limited visibility across the entire supply network hinder organizations' ability to anticipate and respond to risks in real time. Consequently, there is a growing recognition of the need to leverage technology to enhance SCRM capabilities and integrate them seamlessly into enterprise management systems.

The integration of SCRM technology into enterprise management system offers several compelling benefits:

1. It enables organizations to centralize and standardize risk management processes, ensuring consistency and alignment with broader strategic objectives.
2. Advanced analytics and predictive modeling capabilities empower decision-makers to anticipate potential risks, prioritize mitigation efforts, and optimize resource allocation.
3. Real-time monitoring and alerting functionalities enable swift response to emerging threats, minimizing the impact on operations and stakeholders.

In light of these considerations, developing and implementing technology-enabled SCRM solutions represent a strategic imperative for enterprises seeking to thrive in today's uncertain and rapidly evolving environment. By embracing innovation and harnessing the power of data and analytics, organizations can transform supply chain risk management from a reactive, compliance-driven activity into a proactive driver of value creation and strategic advantage.

LITERATURE REVIEW

Supply chain risk management (SCRM) has undergone various definitions and conceptualizations over the years, typically centered around its processes, pathways, and objectives. One prevalent model, resembling ISO 31000, delineates SCRM into four key stages: risk identification, assessment, treatment, and monitoring. Another perspective emphasizes selecting and implementing suitable SCRM strategies, encompassing both external coordination with supply chain partners and internal implementation within organizations. From financial and business continuity standpoints, SCRM aims to optimize cash flow, mitigate disruptions, and ensure sustained profitability and operational continuity, enhancing competitive advantage (Yiyi Fan, 2018).

Recent literature has extensively explored SCRM across diverse sectors, examining various dimensions such as definitions, models, methods, and emerging trends. Studies have investigated the impact of factors like relationship dynamics, trust, and shared understanding on SCRM effectiveness, as well as the categorization of supply chain risks into macro, demand, manufacturing, supply, and infrastructural domains. Additionally, research has delved into specific case studies, supply chain disruptions (including those precipitated by events like the COVID-19 pandemic), sustainability considerations, resilience modeling, information sharing risks, and climate change implications (Iris Heckmann, 2015; Vishnu, 2019; Grzybowska, 2021; Pournader, 2020; Gang Li, 2015; William Ho, 2015; Ivanov, 2021; Esteban Koberg, 2019; Mihalis Giannakis, 2016; Ana Beatriz Lopes de Sousa Jabbour, 2020; Golan, 2020; Claudia Colicchia, 2019; Abhijeet Ghadge, 2020).

Despite this extensive research, the healthcare sector's SCRM domain still needs to be explored, particularly in regions with non-profit healthcare systems. Existing studies focus on financial enhancements, overlooking critical areas like medical equipment and supplies, where profit is not the primary concern. This gap underscores the need for further investigation into healthcare supply chain risks and SCRM practices, particularly in countries with free healthcare systems.

With this context in mind, this study aims to address the following research questions:

- What are the potential risks to the healthcare supply chain in countries with free healthcare systems?
- How is SCRM applied to mitigate these risks, and what methods are commonly employed?
- What are the primary differences in healthcare supply chain risk management between Algeria and Ukraine?

AIM. By addressing these questions, this research seeks to contribute to a deeper understanding of healthcare SCRM in non-profit settings and provide insights into improving supply chain resilience and continuity in the healthcare sector.

METHODS. We employed a rigorous methodology involving bibliographic scanning, cross-referencing, and citation searches to gather the necessary information and data for this study. These techniques allowed us to compile a comprehensive collection of scholarly articles and publications related to healthcare supply chain risk management (HCSCRM) from the period spanning 2015 to the present. We utilized a diverse set of keywords, including HCSCRM, SCRM, risk management, supply chain, healthcare, logistics, and healthcare supply chain management, to refine and enhance the accuracy of our search results.

In addition to the literature review, we conducted a structured survey for management and administration professionals in healthcare establishments. This survey was carefully crafted to gather insights from two distinct sources: a free healthcare establishment (Case 1: Algeria) and a paid healthcare establishment (Case 2: Ukraine). The survey encompassed inquiries regarding the establishments' type, size, and organizational structure, as well as the respondents' roles within the supply chain. It also delved into the frequency and nature of supply chain issues, known risks, and methods utilized for risk analysis, prediction, and mitigation and sought managers' perspectives on addressing such risks and their potential consequences.

The questionnaire was meticulously developed in three languages – English, Arabic, and Ukrainian to ensure clarity and comprehension among respondents from different linguistic backgrounds.

This multilingual approach aims to facilitate accurate and meaningful responses, thereby enhancing the reliability and validity of the survey data.

RESULTS

Based on the responses received from Algerian and Ukrainian managers, we extracted the following insights regarding the types of healthcare establishments.

In the Ukrainian context, the predominant type of healthcare establishment was private hospitals, comprising 62.5% of the responses. Educational hospitals followed with a representation of 25%, and city hospitals accounted for the remaining 12.5%. Conversely, city hospitals emerged as the most prevalent type in Algeria, constituting 66.7% of the responses. Educational hospitals were the next most common, representing 22.2% of the establishments surveyed. Private hospitals had the lowest representation at 11.1%, with no responses indicating regional hospitals.

In Ukraine, the distribution of organizational structures among respondents was evenly split, with 50% indicating a rigid hierarchy characterized by many rules, formalized communication, and centralized authority. The remaining 50% reported a collaborative structure featuring fewer rules, informal communication, and decentralized authority. Conversely, in Algeria, most respondents (77.8%) reported working within institutions characterized by a rigid hierarchy and centralized authority. Only a minority (22.2%) indicated working in collaborative establishments with fewer rules.

The distribution of employees in the establishments surveyed ranged from 10-50 employees in 37.5% of cases in Ukraine, with 50% reporting 51-100 employees, while in Algeria, 22.2% had 10-50 employees, 22.2% had 51-100 employees, 22.2% had 101-500 employees, and 33.3% had over 500 employees.

In Ukraine, 37.5% of respondents held general and department manager positions, 12.5% were assistant managers, and one was an orthodontist. In Algeria, the majority (44.4%) were department managers, while other positions included general manager, director, unit manager, doctor, hospital pharmacy manager, laboratory technician, and pharmacist, each comprising 11.1% of respondents.

In Ukraine, supply problems are evenly split between medications and medical consumables, each reported by 37.5% of respondents; 12.5% cited diagnostic equipment issues, and the same percentage reported no problems. Conversely, in Algeria, medical consumables were the most commonly affected, cited by 44.4% of respondents, followed by medications at 33.3%, with diagnostic equipment issues reported by 22.2%.

In Ukraine, 12.5% of respondents indicated that their department or establishment had yet to experience supply problems. In comparison, 25% reported rare occurrences, and the majority, 37.5%, noted experiencing supply issues sometimes (fig. 1). Meanwhile, 12.5% reported frequent problems. The same percentage indicated that supply problems were persistent, occurring constantly. None of the respondents selected "never" or "rarely" options in Algeria. Instead, 22.2% reported occasional supply problems, 33.3% noted frequent occurrences, and the highest proportion, 44.4%, stated that their department or establishment constantly experienced supply problems.

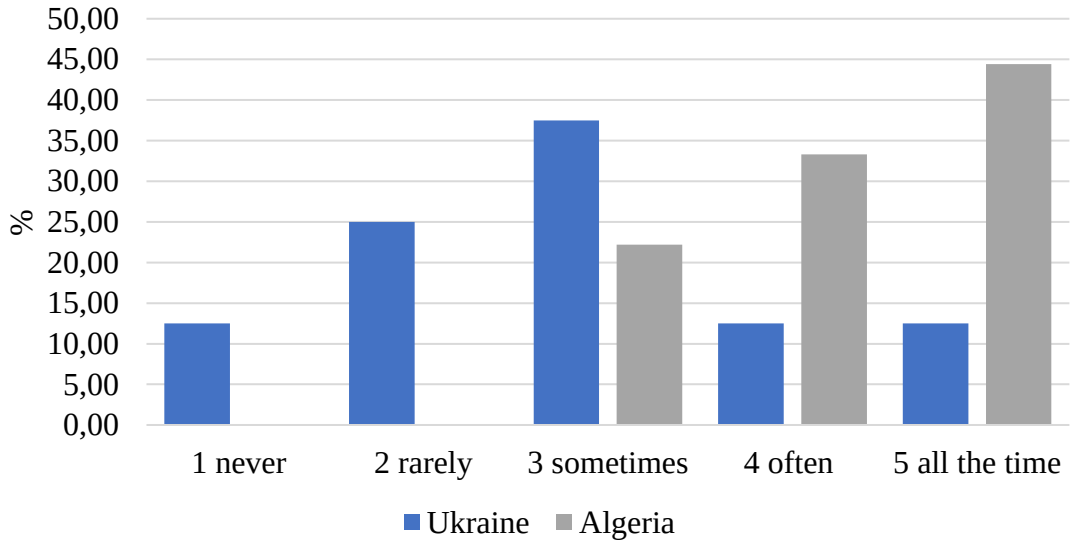

Fig. 1. Frequency of supply chain problems in hospitals: comparison by country

In Ukraine, 12.5% of respondents stated that the cause of supply problems is always known, while 25% reported often knowing the cause. The majority, 37.5%, indicated that the cause is sometimes known, with 12.5% saying it is rarely known and the same percentage noting that it is never known.

Conversely, 11.1% of respondents in Algeria stated that the cause of supply problems is always known, while 22.2% reported often knowing the cause. The majority, 66.7%, indicated that the cause is sometimes known. No respondents selected "rarely" or "never" options in this category.

The leading causes for supply problems vary between Ukrainian and Algerian establishments. In Ukraine, while 11.1% experienced no supply problems, bureaucratic issues affected 22.2% of respondents, with manufacturing problems and price changes each accounting for 11.1%. Additionally, 11.1% cited changes in local suppliers as a cause. However, specific percentages for delivery-related causes were not provided. Conversely, bureaucratic problems were predominant in Algerian establishments, affecting 55.6% of respondents, followed by manufacturing problems at 33.3%. Changes in local suppliers were reported by 11.1% of respondents (fig.2).

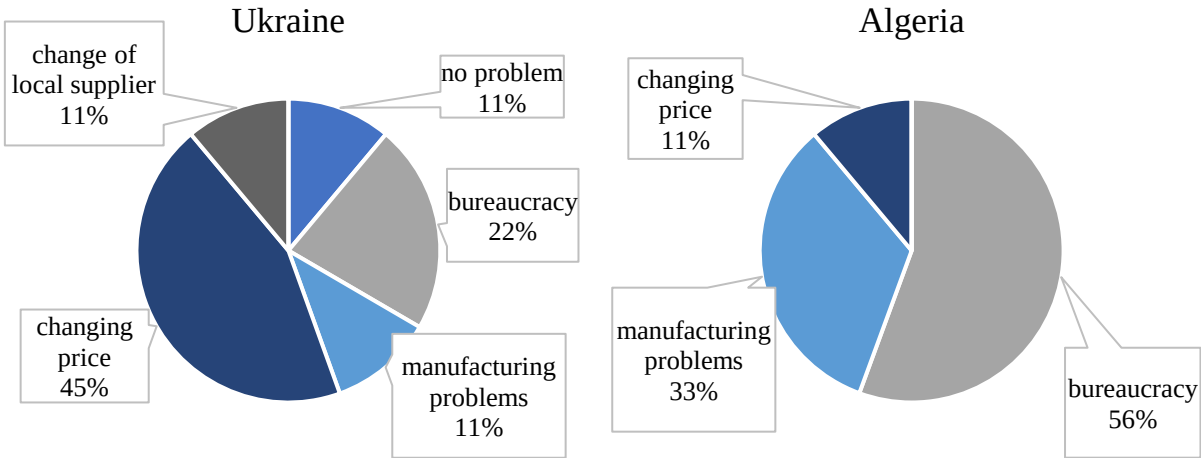

Fig. 2. Primary causes of supply problems in countries

In Ukraine, the most prevalent type of risks seen and likely to occur in healthcare settings are human resources risks, cited by 44.5% of respondents. These risks include errors or negligence by healthcare personnel, as well as issues related to staff shortages or competency. Additionally, financial risks were also identified by 44.4% of respondents, encompassing challenges such as budget constraints, funding shortages, or financial mismanagement. Technical risks, related to equipment malfunction or technological failures, were mentioned by 11.1% of respondents.

Conversely, in Algeria, financial risks emerged as the most commonly seen and likely to occur, reported by 55.6% of respondents. These risks may include funding uncertainties, budget constraints, or economic instability affecting healthcare operations. Human risks, such as errors or negligence by healthcare personnel, were cited by 33.3% of respondents. Technical risks were mentioned by only 11.1% of respondents (fig. 3).

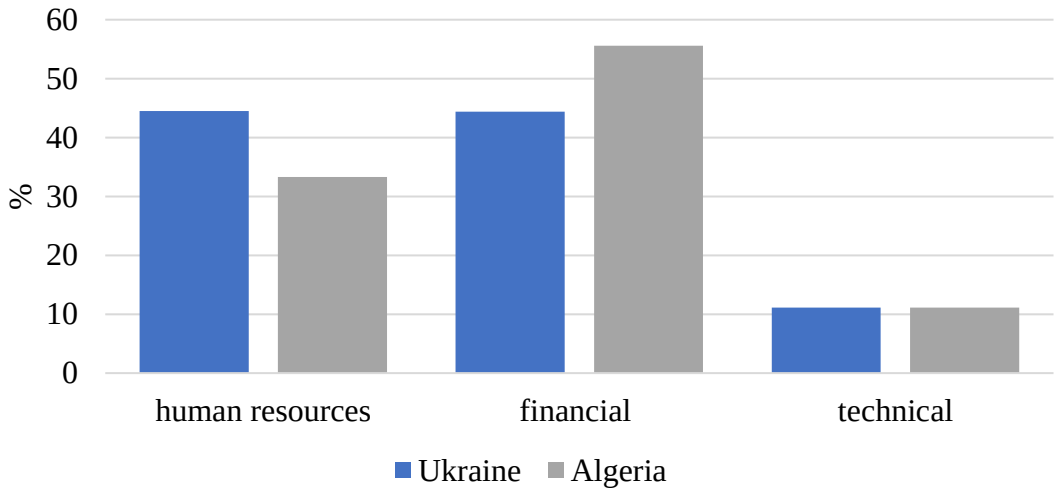

Fig. 3. Prevalence of healthcare risks across countries

In Ukraine, most managers, comprising 66.7% of respondents, believe that problems within their establishments can typically be resolved by internal management without requiring external assistance. Conversely, 33.3% of respondents indicated that internal management cannot resolve specific issues and necessitate external help.

Similarly, in Algeria, a majority of managers, accounting for 55.6% of respondents, expressed confidence in the ability of internal management to address problems autonomously. However, a significant proportion, 44.4% of respondents, believe that some problems cannot be resolved without external assistance.

In Algeria, the predominant managerial tool for assessing and overcoming supply chain risks is the qualitative approach, utilized by 44.5% of respondents. This method involves subjective assessments, interviews, and expert opinions to evaluate risks and devise mitigation strategies. Additionally, 22.2% of respondents employ a quantitative approach involving statistical analysis and modeling to quantify risks and their potential impact. Surprisingly, 11.1% of respondents indicated that they do not use any specific approach, while another 11.1% rely on communication to manage risks. Additionally, 11.1% of respondents reported no specific tools for assessing and overcoming supply chain risks (fig. 4).

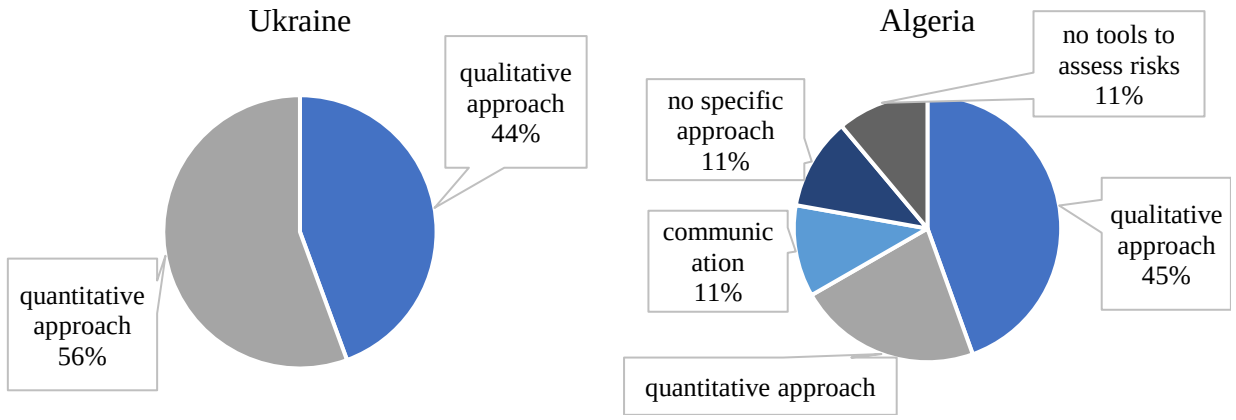

Fig. 4. Managerial approaches for addressing supply chain risks: a comparison between Ukraine and Algeria

In contrast, most respondents (55.6%) in Ukraine utilize a quantitative approach as their primary managerial tool for assessing and overcoming supply chain risks. This method involves data-driven analysis, modeling, and simulation to quantify risks and inform decision-making processes. Meanwhile, 44.4% of respondents employ a qualitative approach involving subjective assessments and expert judgment to identify and mitigate risks.

According to respondents in Algeria, the consequences of supply chain problems on both the establishment and patients include:

- ✓ lack of medicines for patients, which can directly affect their treatment and well-being;
- ✓ operational obstruction across various levels of healthcare services, leading to inefficiencies and delays;
- ✓ delays in conducting medical tests due to disruptions in the supply of supplies and necessary machines, potentially compromising patient diagnosis and treatment;
- ✓ temporary suspension of services, causing inconvenience and distress to patients and their families;
- ✓ inadequate patient care, sometimes resulting in fatalities due to treatment delays or lack of essential resources.

In Ukrainian establishments, the reported consequences of supply chain problems include:

- ✓ ineffectiveness in addressing patient needs, potentially leading to suboptimal care outcomes;
- ✓ slow patient care and treatment, which can negatively impact patient outcomes and satisfaction;
- ✓ loss of clients due to prolonged care times, reflecting negatively on the establishment's reputation and financial sustainability;
- ✓ The dysfunction of machines can hinder the delivery of essential healthcare services and diagnostics.

Regarding improving supply chain risk management, some Ukrainian managers indicated that they had not encountered supply chain issues in their establishment and did not propose any specific actions. However, others emphasized the importance of leveraging technology and preparing for various scenarios by ensuring adequate supplies are available to mitigate potential disruptions.

Conversely, in Algeria, managers provided a range of ideas to improve supply chain risk management:

- ✓ emphasizing adequate planning for the supply process to prevent problems and facilitate timely solutions without causing delays detrimental to the institution;
- ✓ implementing effective inventory forecasting and management practices to optimize resource allocation;
- ✓ planning comprehensively before initiating any supply processes to anticipate potential challenges;
- ✓ estimating appropriate quantities of supplies and preparing for possible malfunctions in advance;
- ✓ collaborating with other institutions to seek assistance and support in managing supply chain issues;
- ✓ addressing problems through effective communication channels to troubleshoot and resolve issues promptly.
- ✓ Maintain surplus supplies to cover shortages and contact suppliers promptly when issues arise.

We are taking necessary precautions to handle supply chain challenges, including ensuring sufficient quantities of essential supplies to mitigate the impact of shortages.

CONCLUSION

Based on our research findings, it is evident that supply chain issues have far-reaching impacts across various sectors. Our study primarily focused on the healthcare sector due to its sensitivity, where supply problems can profoundly affect the institution and patients. We chose to compare two disparate countries: Algeria, reliant on government-funded healthcare where treatment is provided free of charge, and Ukraine, which experiences similar challenges albeit to a lesser extent than Algeria, despite healthcare not being free. The critical disparity lies in the severity of consequences resulting from supply chain problems. At the same time, Ukraine experiences relatively minor impacts, while Algeria faces significantly more severe consequences, including interruptions in patient care and even patient fatalities.

Managers in both countries emphasize the importance of leveraging technology for predictive analysis and preparation to mitigate supply chain challenges. Additionally, Algerian managers highlight the importance of seeking assistance and collaboration from other institutions within the healthcare sector.

Our conclusion underscores the importance of efficient risk identification and prediction in managing supply chain issues. It is crucial for institutions, especially in healthcare, to proactively manage and prepare for such challenges to avoid prolonged disruptions that could have dire consequences.

To effectively integrate supply chain risk management technology into enterprise management systems, Ukrainian and Algerian healthcare establishments can adopt strategic measures based on the insights gathered from their respective contexts.

Firstly, recognizing the paramount importance of technology in mitigating supply chain risks, establishments should prioritize implementing advanced technological solutions such as inventory management systems, predictive analytics, and supply chain visibility tools. These tools facilitate enhanced risk identification, assessment, and monitoring processes, laying a solid foundation for proactive risk management.

Moreover, establishments should embrace scenario planning methodologies, leveraging technology-driven predictive modeling and simulation tools. Organizations can formulate proactive risk management strategies to ensure uninterrupted supply chain operations by anticipating various potential disruptions.

Optimizing inventory levels through effective inventory forecasting and management practices is essential. Utilizing advanced algorithms and data analytics enables establishments to balance adequate inventory levels and minimize excess stock and associated costs.

Collaborating with other healthcare institutions, suppliers, and stakeholders is also crucial. Leveraging technology-enabled communication platforms and collaborative networks facilitate seamless information sharing, risk mitigation, and joint problem-solving efforts.

Furthermore, comprehensive supply chain risk management plans should be developed, encompassing all supply chain stages. Utilizing technology to streamline planning processes ensures alignment with organizational objectives and enhances preparedness for potential disruptions.

Continuously monitoring performance through technology-driven feedback mechanisms is imperative. Real-time data analytics and reporting tools enable establishments to identify areas for improvement and implement corrective actions proactively.

Lastly, strengthening supplier relationships through technology-enabled communication and collaboration platforms is essential. Establishing clear communication channels, sharing performance metrics, and collaborating with suppliers effectively contribute to addressing supply chain risks comprehensively.

By integrating these strategic measures into enterprise management systems and leveraging technology-driven solutions, healthcare establishments can enhance their supply chain risk management capabilities, ensuring resilience, efficiency, and continuity in healthcare service delivery.

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ІНТЕГРАЦІЯ ТЕХНОЛОГІЇ УПРАВЛІННЯ РИЗИКАМИ ЛАНЦЮГІВ ПОСТАЧАННЯ В СИСТЕМУ УПРАВЛІННЯ ПІДПРИЄМСТВОМ

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У сучасному глобалізованому бізнес-ландшафті підприємства стикаються з дедалі більшою залежністю від складних ланцюгів постачання. Це наражає організації на різноманітні ризики, які посилюються такими факторами, як стихійні лиха, геополітична напруженість і технологічна вразливість. Пандемія COVID-19 ще більше підкреслила вразливість ланцюгів постачання, викликавши нагальну потребу в надійних стратегіях управління ризиками. Міждержавні конфлікти також суттєво впливають на ризики ланцюгів постачання, створюючи проблеми в торгівлі та вразливі місця в безпеці. Для пом'якшення цих ризиків підприємства повинні розробити проактивні стратегії управління ризиками, підвищити стійкість ланцюгів постачання та використовувати технологічні рішення для моніторингу й реагування в реальному часі.

У статті розглянуто практику управління ризиками ланцюгів поставок (SCRM) у закладах охорони здоров'я в Алжирі та Україні. Дослідження спрямоване на виявлення розбіжностей у підходах до SCRM та їх наслідків. Результати показують, що обидві країни використовують технології прогнозного аналізу.

У дослідженні пропонується інтегрувати технологію SCRM у систему управління підприємством, віддавати перевагу передовим технологічним рішенням, планувати сценарії, розробляти комплексні плани управління ризиками, здійснювати постійний моніторинг і зміцнювати зв'язки з постачальниками для підвищення стійкості ланцюгів постачання та безперервності в наданні медичних послуг. Ці висновки підкреслюють важливість ефективних стратегій SCRM для пом'якшення збоїв у ланцюгах поставок і забезпечення безперебійного надання медичних послуг. Впроваджуючи ці стратегічні заходи, заклади охорони здоров'я можуть розширити свої можливості, сприяючи стійкості, ефективності та безперервності надання медичних послуг у різних системах охорони здоров'я.

Ключові слова: *ланцюги постачання, управління ризиками, технологія управління, система управління, інтеграція.*