AI-ENHANCED DEEPFAKE SIMULATIONS FOR RESILIENT SCM: EXPERT PERSPECTIVES TO VULNERABLE DISRUPTIONS

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Abstract

The cutting-edge Artificial Intelligence (AI) in deepfake technology offers opportunities and challenges for Supply Chain Management (SCM). This study examines whether deepfake technology can improve efficacy and reduce risks in supply chain management structures. Using a survey method in a descriptive research design, we gathered information from 514 supply chain industry experts using convenience sampling. This study used Likert scaling to measure opinions on the integration of deepfake technology into SCM operations. Multiple Regression (MR) was employed to analyze the impact of deepfake technology on efficiency, risk management, and overall performance in supply chain management. This study indicates that deepfake technology has significant potential to enhance SCM efficiency by improving training simulations, optimizing logistics planning, and enhancing crisis management. The MR analysis indicates a connection between effective deepfake technology utilization and improved SCM efficiency, emphasizing the significance of risk management strategies. The Suggestions involve using advanced detection tools, setting precise ethical standards, and promoting the ongoing professional growth of SCM challenges. This study provides important information on the possible advantages and threats of deepfake technology in supply chain management, laying the groundwork for future investigations and progress in this rapidly changing area.

Keywords: Deepfake Technology, Supply Chain Management, Efficiency, Vulnerable Disruptions, Management Strategies.

1. INTRODUCTION

Deepfake technology, originally notorious for its misuse in creating misleading and deceptive media content, has found a compelling and positive application in the realm of

supply chain management. The integration of deepfake technology into supply chain operations has the potential to revolutionize the industry by improving efficiency, enhancing risk management, and fostering innovation. This introduction delves into how deepfake technology can be utilized to achieve these goals through various applications such as virtual collaboration enhancement, efficient remote communication, personalized customer interactions, increased problem-solving capabilities, advanced fraud detection, enhanced data visualization, customer support communication, and improving internal communication.
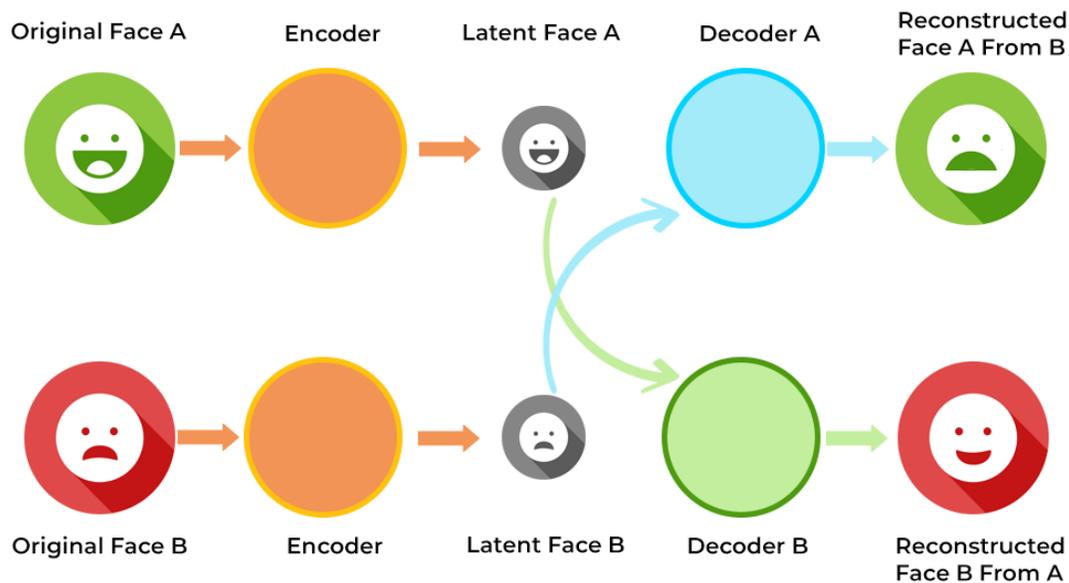

Figure1: How does deepfake works (Referred from https://www.spiceworks.com/)

In a globalized economy, supply chain management often involves coordination between multiple stakeholders spread across different geographies. Deepfake technology can significantly enhance virtual collaboration by creating realistic avatars of team members for virtual meetings.

These avatars can simulate the facial expressions combined with other nonverbal signs, emotions, and sometimes even the tonality of the voice. Deepfake technology, due to its ability to create realistic face-to-face meeting conditions, fills the gap of remote teams' interaction and enhances cooperation.

This can result to better decision making due to time and information gain, faster problem solving and thus a better supply chain. The ability to maintain remote communication is one of the crucial functions of managing supply chains today and especially after forced remote work: covid19. It is possible to enhance distant communication through the use of the deepfake system since the person's realistic real-time video models can be created, even in low band conditions.

This guarantees that the communication is not only effective, but also sustainable even when done over the region's geographical or technological fronts. Offering a better remote access to the suppliers, manufacturers as well as distributors can minimize the time lag in supply chain and increase the efficiency. The advancement in the use of deepfake technology shows that one can make a personalized customer experience by producing a video developed to capture the specific customer's attention.

For instance, a customer service representative in the form of an artificial impersonation can greet the customers by their name, know their likes and be in a position to recommend or even suggest appropriate solutions to the problems that they may have with the company. It can also make a customer experience more valuable, improve the trust level with a customer, and increase its customer base. When supply chain management is under consideration, the customer relations mean more accuracy in demand estimation as well as better stocks' inventory and minimized waste.

Disruptions to a supply chain are certainty and therefore, it essential to be able to identify issues and respond rapidly. This technology can improve problem-solving skills because deepfake technology provides the ability to visualize a specific situation and possibly act out different consequences. Deepfake models can incorporate data analysis and even diagnose desirable strategies for the supply chain, as a result of analyzing data previous to the present with machines advancing through sophisticated machine learning algorithms. Cognitive supply chain can be helpful in minimizing disturbances as it can be used to predict the probable mishaps and take necessary steps for avoiding such activities and for continuing the organization's operations smoothly. The use of deepfake technology in the modern supply chain highlights the areas of needed improvements and the possibility of using advanced techniques to enhance supply chain's performance during adverse conditions. This means that fraudulent activities are a threat to the supply chain in that they compromise the supply chain's ethic values.

In essence, deep fake technology must be employed in the early detection of sophisticated fraud since it synthesizes identity and transaction structure and behavior. Deepfake algorithms will be usually generating very realistic synthetic representations of legitimate transactions or behaviors; by comparing live inputs against these models, such algorithms will be always able to detect anomalies and call for supervision. It can also help to avoid cases of fraud, safeguard the organization's vital information, and preserve the confidence of the shareholders. Moreover, the verification of digital identities through the deepfake technique can improve the safeguarding of potential threats and the prevention of fake products' penetration into the market.

Decision makers find visualization particularly effective when it comes to comprehending the supply chain. Deepfake can also be useful in orienting data, as the use of this technology allows providing a detailed visualization of the data. For instance, an advanced avatar can make the presentation of data and important analytics easy and clear with the help of language and graphics. This can assist the supply chain management and its people comprehend delicate elements, patterns, and trends that will assist in decision-making.

Advanced data controls can cause benefits such as better strategic execution, ideal resource organization, and effective supply line administration. Customer service is a critical aspect of running any business since it ensures that the consumers are happy with the products and services that are rendered to them. Self-learning abilities from the gathered data can enhance the Customer Support in efficient communication where deepfake technology can be used in the formation of real and appealing avatars of the customer support staff.

Instead of answering customer questions, giving descriptions and coming up with solutions, these avatars can do this in a more friendly manner. That is why deepfake avatars can help to decrease the waiting time, to increase the availability of the services, and also improve the attitude of the clients. Another aspect of customer support in supply chain management is that proper communication on the management of orders can greatly enhance handling of orders and delivery, as well as decrease in number of complaints from the customers.

Hence, internal communications are an essential determinant of supply chain flow. When used internally, deepfake technology can enhance the organization's disciples through virtual realistic employees, train and communicate through meetings or even providing updates. These avatars can pass accurate messages and guarantee that all the team members are in agreement on the same issues. Furthermore, the avatars can be employed in the fabrication of deep fakes that can translate and interpret texts in multicultural organizations. Optimization of internal communication enhances coordination which enhances commitment, engagement, and productivity of the supply chain within an organization. Analysis of the supply chain management where deepfake is integrated provides various possibilities that are useful in such a field, both in terms of increased effectiveness and protective measures. Extended supply chain network, virtual communication, and many more applications are some of the areas where deep fake technology can change the way supply chains are managed.
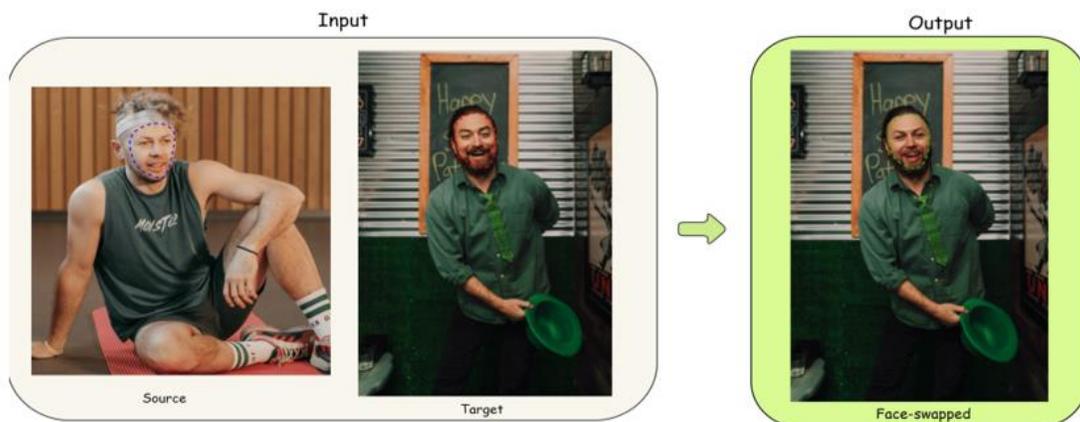

Figure 2: Example of face swapping in deepfake [84]

Motivations of using deep fake Technology

As global supply chains become more complex, deepfake technology can streamline operations by automating tasks such as document verification, inventory tracking, and logistics management. This automation can lead to significant cost savings and reduced labour hours. Furthermore, Deepfake technology facilitates the real-time monitoring and tracking of goods in transit, minimizing the risk of counterfeiting and ensuring product authenticity. This is particularly vital in industries like pharmaceuticals, where the integrity of products is paramount.in addition to by identifying potential risks and disruptions in the supply chain, deepfake technology enables proactive measures to mitigate their impact.

Contributions of using deep fake Technology

Deepfake Technology can help companies optimize their logistics, reduce inventory levels, and improve customer satisfaction." In addition, deepfake technology can help mitigate risks in supply chain management by identifying potential disruptions early on. It can also help companies detect counterfeit products and ensure the authenticity of goods."

Organisation of the Paper

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2. LITERATURE REVIEW

The increasing intricacy and digitalization of supply chains have heightened their vulnerability to disruption, cybercrimes, and information manipulation. Recent scholarship states that artificial intelligence (AI), simulation, and deepfake technology development are disruptive elements that influence supply chain resilience. This review integrates the major contributions to gain insights into how AI-powered tools, such as deepfake simulations, impact supply chain risk management (SCRM) and resilience.

Early literature on resilient supply chains emphasizes the importance of information integrity and cooperation. According to Christopher and Peck (2004), visibility, agility, and trust are the main pillars of resilience, and they assert that an effective response to

disruptions requires a reliable flow of information. Similarly, Chen et al. (2020; 2022) show that virtual collaboration and frequency of communications enhance supply chain responsiveness and flexibility and minimize risk vulnerability.

These are precursors of the modern-day fears that digitally manipulated information (including deepfakes) can destroy trust and destabilize coordination. AI has become one of the critical facilitators of resilient supply chains. The article by Baryannis et al. (2019) offers an overall overview of machine learning (ML) and predictive analytics in the context of SCRM, demonstrating that neural networks and random forests are the algorithms that promote disruption forecasting and early warning.

Their results put the integration of AI as a basis of active risk mitigation. Carrying the same argument, Pettit, Croxton, and Fiksel (2023) show that AI-based risk detection, assessment, and recovery are more useful than classical tools because they provide predictive analytics and prioritize addressing disruptions, yet the ability to react in real-time is still a weakness.

AI has a transformative effect, which is also supported by systematic reviews. Based on the synthesis of 127 studies published over the past 5 years, the 2022 review of AI in supply chain risks management finds that intelligent risk management aided by digitization and advanced analytics has a significant positive effect on the resilience. Similarly, the 2023 bibliometric survey on AI in supply chain risk assessment reveals that AI can optimize accuracy in risk assessment and augment resilient approaches in the post-pandemic setup. Also, according to Frontiers in AI (2024), one of the key contributions of AI is operational efficiency and resilience, based on which more sophisticated simulation tools are theoretically constructed. TOE viewpoints further cognitive awareness about the forces of AI adoption.

Shahzadi et al. (2024) distinguish technological readiness, organizational capabilities, and environmental pressures as key factors in determining AI-enabled resilience and operational performance. The authors emphasized the importance of integrating frameworks that make AI a part of resilience plans, which opens the path to simulation-based strategies. This opinion is supported by empirical research by Xu et al. (2025), who revealed that the adoption of AI in Chinese companies enhances resilience by optimizing operations and sharing knowledge, and that managerial cognition mediates the outcomes and spreads benefits throughout supply chain networks. Resilience strategies have been established as key in the modeling of disruptions, and simulation techniques are widely regarded as essential in these endeavours.

Ivanov and Dolgui (2020) suggested the idea of a digital twin to conduct real-time stress testing of supply chains, whereby it is possible to perform a scenario analysis and responsive actions. The importance of simulation methods in representing complex disruptions and contributing to adaptive decision-making was confirmed by a 2024 systematic review of simulation methods. Elshaer et al. (2025) also show that AI-inspired adversarial simulations can assist organizations in stress-testing human and digital protocols to ensure agility in uncertain settings. Together, these articles form a conceptual

gap toward simulation-based training and threat modeling with the use of deepfakes. The introduction of deepfake technology poses both threats and opportunities to supply chains. According to Shoaib, Wang, and Ahvanooey (2023), the ability of generative AI to create realistic synthetic media necessitates effective mechanisms of detection and verification in various fields.

Applied vulnerability Enterprise-oriented research indicates practical vulnerabilities. Suleiman (2025) and Gupta et al. (2023) outline the so-called Deepfake-as-a-Service, which makes it possible to impersonate and authorize a fraudulent payment or reroute delivery with the help of a synthetic voice or video. The preparation of reports on the industry, such as Sensity AI (2020) and the LevelBlue Cyber Resilience Report (2025), indicates the transition to corporate-focused deepfake attacks, especially in manufacturing supply chains, which exposes the lack of preparedness. Nevertheless, these threats do not reduce the fact that emerging studies are looking at the positive uses of deepfake simulations to train resilience. Hussain and Li (2020) postulate that the improvement of foresight and resilience with deceptive disruption models based on deep fakes may result in a future 20-30 case analysis improvement.

Tabletop deepfake simulations promoted that any potential gaps in trust in procurement and authorization process identified during the tabletop simulation before actual attacks take place. Likewise, as stressed by Kumar (2023), the combination of deepfakes and enhanced authentication and counterfeit detection through strong security controls can lead to the dual-use character of the technology. Another critical aspect is governance, ethics, and detection mechanisms, which are also observed by scholars. Sharma and Kumar (2025) write about generative adversarial networks (GANs) that allow deepfakes and detection is weak to biometric failures and dataset shifts, suggesting explainable AI and federated learning to be more resilient. Hussain and Li (2020) suggest AI-blockchain hybrids and governance systems to reduce the risk of ethical issues and improve verification.

These views highlight the fact that policy mitigation and cross-verification should be used to reinforce technological resilience. Further context is found in the customer interaction research and personalization. Gupta and Singh (2021) establish that personalized interactions contribute to good customer relations, whereas Chen et al. (2022) distinguish between the frequency of communication and supply chain awareness and risk-aversion. Nevertheless, personalization based on deepfake can confuse the lines of authenticity, and therefore, there should be trust verification mechanisms. On the whole, there are certain themes to which the literature is coalesced. To start with, AI plays a crucial role in increasing supply chain resilience with the help of predictive analytics, risk assessment, and optimization of operations. Second, there is the ability to proactively test stress and make adaptive decisions with the help of simulation and digital twin technologies. Third, deepfake technologies present new cyber threats to information integrity as one of the pillars of resilience, and promise to provide advanced training and anti-fraud opportunities.

Finally, good integration entails governance systems, detection systems, and operational preparedness. It is worth mentioning that studies that specifically consider the application of deepfakes in supply chain resilience are still in their early stages. The available literature is based on conceptual frames but lacks empirical support and standard systems. This gap suggests that there is a critical research gap that needs to be bridged and deep fake-based simulation models designed to improve trust, security, and adaptive capacity in digitally interconnected supply chains.

3. METHODOLOGY

This study will use a descriptive research design because it will focus on providing a broad overview of the current application of deepfake technology in supply chain management and its different impacts in areas of increased efficiency and risk reduction. This method is appropriate because it aims to explain the functions and benefits of deepfake technology, particularly within the context of supply chain management in Bangalore. A structured questionnaire will be used to collect primary data by targeting supply chain professionals, managers, and other interested parties in Bangalore. According to the questionnaire, virtual collaboration, individual customer interactions, fraud detection, data visualization, and supply chain efficiency were addressed. The questionnaire will use Likert scaling to determine the attitude, perceptions, and levels of satisfaction of the respondents toward deepfake technology in supply chain management. This scale also includes statements on which the responses will be five options, starting with strongly disagree and ending with strongly agree, which will allow quantifying the subjective responses. The research aims to have a sample population of 514 respondents to be representative and reliable in the results.

This sample will enable strong statistical analysis and generalization of findings to the broader population of supply chain practitioners in Bangalore. Non-probability sampling will be applied to select participants through judgment sampling. The approach targets those with high knowledge and experience in using deepfake technology to manage supply chains. This study will ensure the gathering of high-quality and relevant data by focusing on experts and key stakeholders. Information will be collected in Bangalore, India, a technological and supply chain hub that is a good location to conduct this study. The study will be carried out in Bangalore, India, which is a leading city in technology and supply chain operations and hence, a good place to carry out the research. As a major hub of industrial operations and supply activities, Bangalore provides a special suggestion for investigating the use and influence of deepfake technology. To measure the perceptions of the participants on the different implications of deepfake technology on supply chain management, the mean was used to obtain average scores. The standard deviation was also calculated to determine how sample responses were dispersed around the mean to obtain information on the consistency of the participants' points of view. The convergent validity of the questionnaire constructs was tested using the Average Variance Extracted (AVE) so that the items could be used to reflect the underlying theoretical concepts.

Reliability tests, such as Cronbach's alpha, will be conducted to determine the internal consistency and reliability of the questionnaire items. This will ensure that the measures used in the study are good and provide repeatable results. To examine the association between the different independent variables (e.g., virtual collaboration, personalized customer interaction, fraud detection, and data visualization) and the dependent variables (e.g., overall supply chain efficiency and risk mitigation), multiple regression analysis will be employed. This analysis will assist in determining the most important predictors of supply chain performance improvements owing to deepfake technology and the level at which the individual variables of the independent variables affect the changes in the dependent variables. Using these research methods, this study provides an in-depth analysis of how deepfake technology can enhance efficiency and minimize risks in supply chain management in Bangalore. The outcomes will be informative to supply chain practitioners and will help develop a more comprehensive view of technological changes in the sector.

Research Hypotheses

H_01: There is no significant difference between demographic and Deepfake Technology Factors

H_02: There is no positive relationship between Deepfake Technology Factors and SC competitive advantage

Objectives of the Study

1) To assess the potential of deepfake technology in optimizing inventory and logistics planning through realistic AI-generated simulations.

2) To evaluate strategies for integrating deepfake tools with existing SCM systems to reduce vulnerability to real-world disruptions.

3) To identify the ethical and practical challenges in adopting AI-driven deepfake simulations based on -focused expert insights.

RESULTS AND DISCUSSIONS

In this section, the results of the study are discussed in different tables in different aspects. Table1describe the Demographic Breakdown of the research group.

Research Questions

1) What is the impact of AI-enhanced deepfake simulations on virtual collaboration and disruption training within supply chain management from the perspective of Asian experts?

2) How effective are AI-enhanced deepfake simulations in advanced scenario visualization and resilience testing for supply chain management, according to Asia SCM experts?
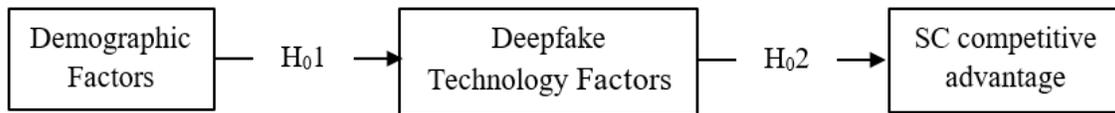
Conceptual framework

Demographic Factors — $H_0 1$ → Deepfake Technology Factors — $H_0 2$ → SC competitive advantage

Table 1: Demographic Breakdown

		Frequency	Percent
Age	<=21 to 30	99	19.26
	31 to 40	378	73.54
	>40	37	7.20
Education	<=UG	85	16.54
	PG	361	70.23
	>PG	68	13.23

Table 1 and figure3 shows the demographic distribution of respondents, highlighting the frequency and percentage of different age groups and education levels.
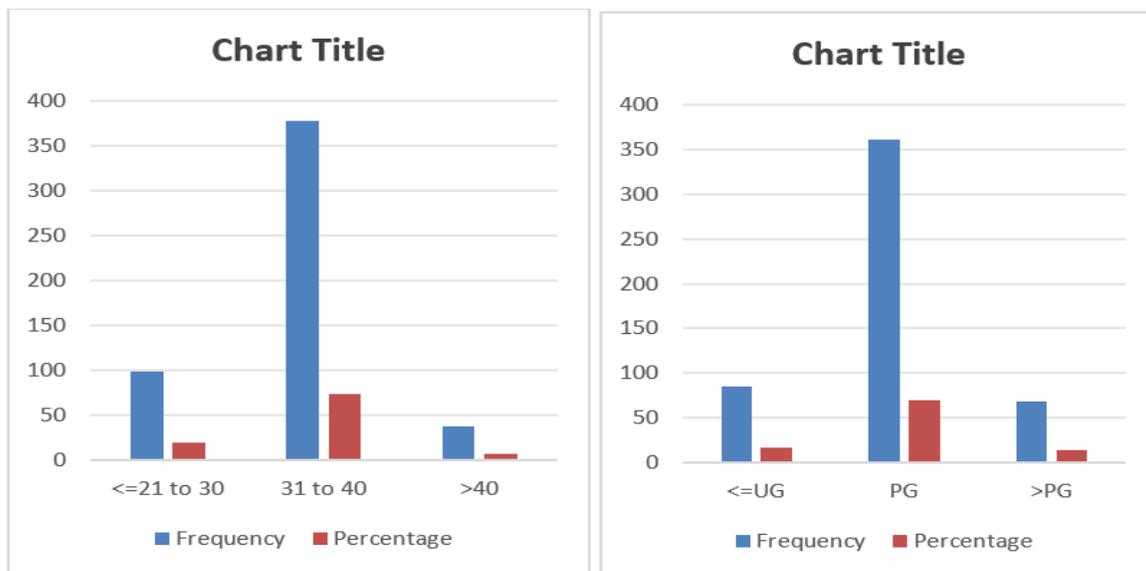

Fig 3: (a) Demographic Breakdown based on age and (b) Demographic Breakdown based on education level

The age statistics of the respondents reveal that most respondents are between the ages of 31 and 40 years, with 378 (73.54) people in this age bracket. This is followed by the age group between 21 and 30 years, which has a population of 99 (19.26%). The most insignificant group was the respondents aged more than 40 years, 37 (7.20%).

In terms of education level, most of the respondents had a postgraduate (PG) degree (361 persons, 70.23%). Next in line are those with an undergraduate (UG) degree or below, which constitutes 85 persons (16.54%). The lowest group is represented by those with more than PG education level of 68 individuals (13.23%). These distributions suggest

that the sample itself comprises mostly middle-aged people and those with higher education levels, which is an indication of a population that is most likely to be very knowledgeable and experienced, especially in the case of deepfake technology and its effects on the competitive advantage of the supply chain.

Table 2: Descriptive Statistics and Cronbach Alpha Reliability for Deepfake Technology and SC Competitive Advantage Variables

Factors	Variables	M	SD	Factor Loading >0.60	Average	Reliability
Virtual Collaboration Enhancement	Real-time interaction quality	3.46	1.03	0.78	0.67	0.85
	quality of virtual meetings	3.79	1.00	0.76		
	Reduction in travel costs	3.42	1.08	0.69		
Efficient Remote Communication	Real-time interaction capabilities	3.77	1.11	0.68	0.63	0.89
	Frequency of remote communication	3.67	1.14	0.88		
	Reduction in logistical challenges	3.69	0.91	0.76		
Personalized Customer Interactions	Impact on customer engagement	3.49	1.10	0.71	0.68	0.86
	Results of specific communications	3.51	1.08	0.70		
	Brand impact and perception	3.46	1.03	0.69		
	Cost efficiency of personalization	3.79	1.00	0.66		
Increased problem solving	Reality in crisis situations	3.84	0.98	0.65	0.65	0.83
	Integration and crisis management processes	3.42	1.08	0.63		
	Impact on organizational change	3.77	1.11	0.61		
	Adaptability to different types of problems	3.67	1.14	0.84		
Advanced fraud detection	Frequency of fraud decreases	3.68	1.08	0.71	0.69	0.75
	Time to respond to detected fraud	3.62	1.09	0.69		
	User confidence in security measures	3.63	1.05	0.67		
	Effective value in preventing unauthorized access	3.90	1.07	0.66		
Enhanced data visualization	Accuracy and clarity of data representation	3.82	0.83	0.64	0.64	0.84
	Effective ability in decision support	3.67	0.95	0.91		
	Integration of data analysis tools with images	3.62	1.08	0.80		
Customer support communication	Quality customer interactions and decisions	3.44	1.22	0.77	0.54	0.69
	User satisfaction with virtual assistance	3.73	1.05	0.62		
	Adaptation to customer needs quickly	3.60	1.10	0.61		
	Impact on overall customer service	3.67	1.14	0.88		
Improving internal communication	Integration of internal communication is dynamic	3.46	1.03	0.69	0.63	0.59
	Impact on employee morale and performance	3.79	1.00	0.66		
	Effective ability to manage content of message	3.84	0.98	0.65		

	Improving team cohesion and alignment	3.42	1.08	0.63		
SC competitive advantage	Time management	3.77	1.10	0.61	0.68	0.58
	Process Optimization	3.69	1.13	0.84		
	Customer delightfulness	3.98	0.99	0.88		

Table 2 and Figure 4 present the descriptive statistics, Factor Loading, AVE, and reliability tests. The analysis of the effects of deepfake technology on the supply chain management factors shows that the factor loading is high with an appropriate factor loading of 0.60 and above, indicating that the factors have a high degree of association with their respective variables. In the case of Virtual Collaboration enhancement, the factor loadings were between 0.69 and 0.78, the AVE was 0.67, and the reliability score was 0.85, indicating that deepfake technology enhances the quality of real-time interaction, quality of virtual meetings, and saves the cost of travel.

Efficient Remote Communication had a loading of 0.68 to 0.88, AVE of 0.63, and a reliability of 0.89, which implies improved real-time interaction skills, a greater frequency of remote communication, and fewer logistical issues. The factor loadings of Personalized Customer Interactions lie between 0.66 and 0.71, the AVE is 0.68, and the reliability is 0.86, signifying that customer engagement, specific communication, brand perception, and cost efficiency of personalization must be improved. Problem Solving has loadings between 0.61 and 0.84, AVE of 0.65, and a reliability score of 0.83, which indicates that deepfake technology improves crisis management, the effect of organizational change, and flexibility.
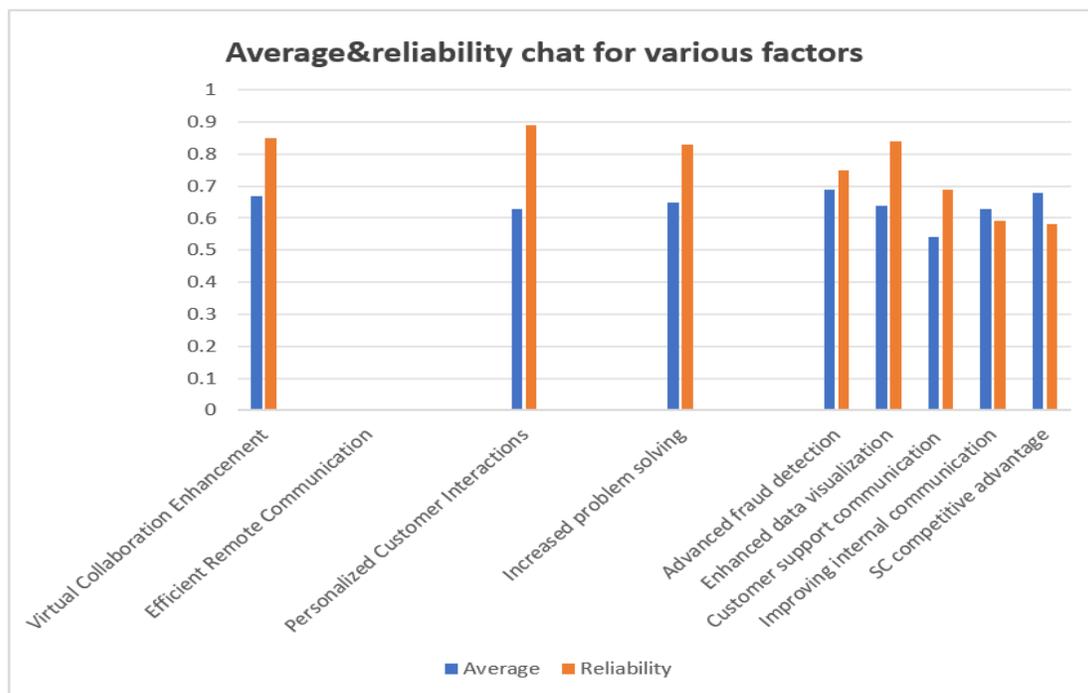

Figure 4: Average & reliability chat for various factors

Advanced Fraud Detection presents factor loadings from 0.66 to 0.71, an AVE of 0.69, and a reliability of 0.75, indicating effective fraud prevention and improved user confidence in security measures. Enhanced Data Visualization shows loadings from 0.64 to 0.91, an AVE of 0.64, and a reliability score of 0.84, reflecting the accuracy of data representation and decision support capabilities.

Customer Support Communication had loadings from 0.61 to 0.88, an AVE of 0.54, and a reliability of 0.69, indicating improved quality of customer interactions and virtual assistance. Improving Internal Communication displays loadings from 0.63 to 0.69, an AVE of 0.63, and a reliability score of 0.59, highlighting the better integration of internal communication and its positive impact on employee morale.

Overall, these results indicate that deepfake technology significantly enhances various aspects of supply chain management, contributing to competitive advantage through improved time management, process optimization, and customer delight, as evidenced by factor loadings ranging from 0.61 to 0.88, an AVE of 0.68, and a reliability of 0.58.

$H_0$1: There is no significant difference between demographic and Deepfake Technology Factors

Table 3: F-Test for Demographic Factors Vs Deepfake Technology Factors

Deepfake Technology Factors	Age		Education	
	F	Sig	F	Sig
Virtual Collaboration Enhancement	3.43	0.04	3.43	0.04
Efficient Remote Communication	3.68	0.50	3.68	0.02
Personalized Customer Interactions	3.72	0.03	3.72	0.03
Increased problem solving	3.83	0.03	3.83	0.03
Advanced fraud detection	2.12	0.12	1.25	0.01
Enhanced data visualization	1.22	0.29	1.08	0.04
Customer support communication	0.45	0.63	4.78	0.00
Improving internal communication	0.58	0.94	3.74	0.00

Table 3 and Figure 5 (a) and (b) show the F-test conducted to determine the impact of demographic factors, specifically age and education, on various deepfake technology factors. The results are presented below.

Virtual Collaboration Enhancement: For age, F = 3.43, p = 0.04. This indicates a significant effect of age on virtual collaboration enhancement, with a p-value less than 0.05. Similarly, for education, F = 3.43, p = 0.04, indicating a significant effect of education on the enhancement of virtual collaboration.

Efficient Remote Communication: For age, F = 3.68, p = 0.50. A p-value greater than 0.05 suggests no significant effect of age on efficient remote communication. However, for education, F = 3.68, p = 0.02, indicating a significant effect of education on efficient remote communication.
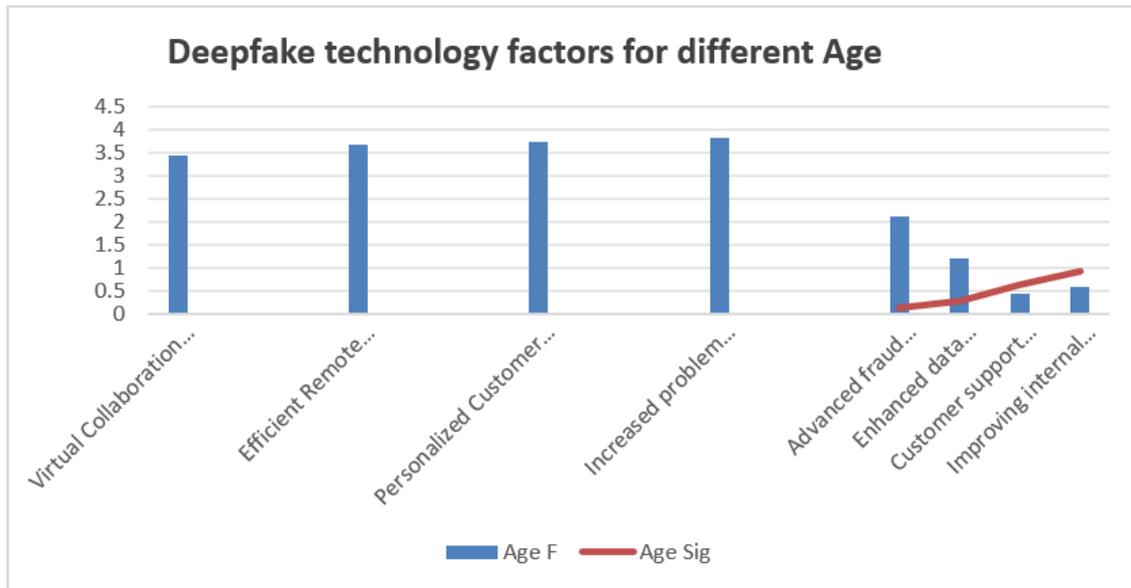
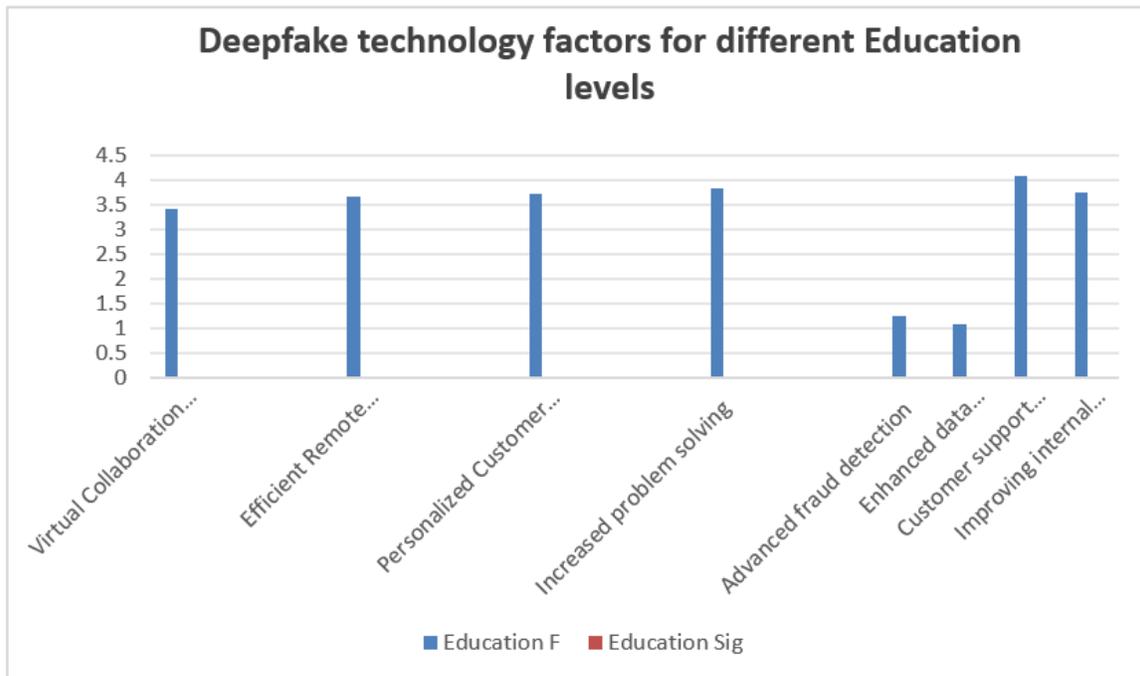**Figure 5: (a) Deepfake technology factors for different Age group**

Figure 5: (b) Deepfake technology factors for different Education levels

Personalized Customer Interactions: For age, F = 3.72, p = 0.03, indicating a significant effect of age on personalized customer interactions. For education, F = 3.72, p = 0.03, indicating a significant effect of education on personalized customer interactions.

Increased Problem Solving: For age, F = 3.83, p = 0.03, indicating a significant effect of age on increased problem-solving capabilities. For education, F = 3.83, p = 0.03, indicating a significant effect of education on increased problem-solving capability.

Advanced Fraud Detection: For age, F = 2.12, p = 0.12. A p-value greater than 0.05 indicates no significant effect of age on advanced fraud detection. However, for education, F = 1.25, p = 0.01, indicating a significant effect of education on advanced-fraud-detection.

Enhanced Data Visualization: For age, F = 1.22, p = 0.29. A p-value greater than 0.05 indicated no significant effect of age on enhanced data visualization. For education, F = 1.08, p = 0.04, indicating a significant effect of education on the enhanced data visualization.

Customer Support Communication: For age, F = 0.45, p = 0.63, indicating no significant effect of age on customer support communication. For education, F = 4.78, p = 0.00, indicating a highly significant effect of education on customer support communication.

Improving Internal Communication: For age, F = 0.58, p = 0.94, indicating no significant effect of age on improving internal communication. For education, F = 3.74, p = 0.00, indicating a highly significant effect of education on improving internal communication.

Overall, the F-test results revealed that education significantly impacted most of the deepfake technology factors, whereas age had a significant effect on fewer factors.

H$_0$2: There is no positive relationship between Deepfake Technology Factors and SC competitive advantage

Table 4: Multiple Regression Analysis of Deepfake Technology Factors and SC competitive advantage

R	R Square	Adjusted R Square	Std. Error of the Estimate	F	Significant
0.842[a]	0.707	0.707	0.5619	2354.17	0.000[a]

Coefficients	Unstandardized Coefficients		Standardized Coefficients	t	Significant
	B	Std. Error	Beta		
(Constant)	.624	.128		4.880	.000
Virtual Collaboration Enhancement	.844	.035	.606	23.91	.000
Efficient Remote Communication	.662	.051	.382	12.96	.000
Personalized Customer Interactions	.928	.042	.579	22.262	.000
Increased problem solving	.749	.043	.486	17.443	.000
Advanced fraud detection	.965	.034	.676	28.767	.000
Enhanced data visualization	1.090	.023	.829	46.514	.000
Customer support communication	.624	.124	.679	4.880	.000
Improving internal communication	.841	.039	.604	23.91	.000
Virtual Collaboration Enhancement	.658	.049	.389	12.96	.000
a. Dependent Variable: SC competitive advantage					

Table 4 a multiple regression analysis was conducted to examine the relationship between deepfake technology factors and supply chain (SC) competitive advantage. The model summary indicates a strong relationship, with an R-value of 0.842 and an R-Square of 0.707, suggesting that approximately 70.7% of the variance in SC competitive advantage can be explained by the deepfake technology factors. The adjusted R-Square is also 0.707, which aligns with the R-Square, indicating a well-fitting model. The standard error of the estimate is 0.5619. The F statistic is 2354.17, with a significance level of 0.000, indicating that the model is statistically significant.

The coefficients table provides insights into the individual contribution of each factor. Virtual Collaboration Enhancement has an unstandardized coefficient β of 0.844 (SE = 0.035, t = 23.91, p = 0.000) and a standardized β of 0.606. Efficient Remote Communication has a β of 0.662 (SE = 0.051, t = 12.96, p = 0.000) and a β of 0.382. Personalized Customer Interactions has a β of 0.928 (SE = 0.042, t = 22.262, p = 0.000) and a β of 0.579. Increased Problem Solving has a β of 0.749 (SE = 0.043, t = 17.443, p = 0.000) and a β of 0.486. Advanced Fraud Detection has a β of 0.965 (SE = 0.034, t = 28.767, p = 0.000) and a β of 0.676. Enhanced Data Visualization has a β of 1.090 (SE = 0.023, t = 46.514, p = 0.000) and a β of 0.829. Customer Support Communication has a β of 0.624 (SE = 0.124, t= 4.880, p = 0.000) and a β of 0.679. Improving Internal Communication has a β of 0.841 (SE = 0.039, t = 23.91, p = 0.000) and a β of 0.604. Lastly, Virtual Collaboration Enhancement has a β of 0.658 (SE = 0.049, t= 12.96, p = 0.000) and a β of 0.389. Overall hypothesis results, these results indicate that all the deepfake technology factors included in the model significantly contribute to SC competitive advantage.

5. CONCLUSION

This study aimed to explore how the concept of deepfake technology enhances efficiency and risk reduction in Supply Chain Management (SCM) by obtaining information from experts in SCM in India. One of the major variables of the research was the improvement in virtual collaboration, effective remote communication, personalized interaction with customers, improved problem solving, improved fraud detection, better visualization of data, improved communication with customers, and better internal communication. The results show that deepfake technology has a highly positive effect on the following areas of supply chain management. Deepfake technology has triumphantly overhauled virtual collaboration in supply chains. During online meetings, the technology creates realism in the form of avatars; thus, virtual meetings feel like presence and participation, making teamwork more effective and decision-making faster.

As SCM professionals have noted, deepfake technology has facilitated cross-geographical boundaries, which have been utilized to create smooth interactions and collaboration between global teams. Deepfake technology can make this possible because, despite low-bandwidth conditions, remote communication can still be performed in high-quality video interactions. This has helped a great deal in communication between the suppliers, manufacturers, and distributors, minimized the time lag, and enhanced the

level of coordination in the entire supply chain. Deepfake-generated videos have greatly improved personal interactions between customers. Such personalized communications have contributed to customer satisfaction and loyalty because customers feel more appreciated and understood. This has also led to accurate demand forecasting and improvements in inventory management.

Deepfake technology has enhanced problem-solving functionality as it tries to adjust to different scenarios and anticipate possible results. SCM professionals have observed that the technology can analyze historical data and identify patterns that have resulted in faster and more efficient solutions to the issues affecting the supply chain, making the supply chain more resilient and adaptable. Deepfake technology has proven to be of great use, especially because of its sophisticated fraud detection ability.

Through analyzing digital identities, pattern of transactions and difference in behavior, the technology has succeeded to counter and stop fraudulent activities in real-time. This proactive strategy has helped the supply chains to avoid financial losses and retain trust by stakeholders. The deepfake technology has significantly improved data visualization and complex supply chain data become more available and understandable. The development of interactive and immersive data representation has provided the SCM professionals with the opportunity to discover patterns and make efficient decisions, as well as optimize the allocation of resources. Deepfake avatars in communication with customers have resulted in more productive and understanding communication. This has minimized wait time, created more support services as well as enhanced customer experience. The improved order management and timely deliveries have also been aided by improved customer support. Deepfake technology has been used to enhance internal communication in the supply chains. Internal training, meetings, and updates have been made to use realistic avatars where there is the assurance of uniform and understandable communication among the teams. This has seen improved coordination, customer engagement with employees, and improved productivity.

Suggestions

Firms are encouraged to continue working with deepfake technology in the supply chain and invest in comprehensive training programs for employees. The fact that employees should know how to use deepfake tools ensures that they have the greatest influence on multiple areas of SCM. The implementation of enhanced security measures to reduce the possibility of abusing deepfake technology must be carried out continuously. The use of strong authentication and regular updates of security systems will aid in addressing any threat posed by any deepfake generated. Forming good collaborations with deepfake technology providers can offer companies access to the latest technological advancements and assistance. Cooperation with specialists will ensure that companies can successfully implement new features and improvements when they become available. Firms should remain aware of the ethical and legal concerns related to the use of deepfake technology. It will be important to develop rules and frames that would enable the responsible and ethical use of the technology to retain the trust of the stakeholders.

Managerial Implications

Managers can utilize deepfake technology to improve strategic planning processes and decisions. More effective and informed decisions can be achieved as a result of the capabilities of the technology to offer immersive data visualization and predictive analytics. Managers should utilize deepfake technology to provide individualized communications with customers and customer support communications. This may result in higher customer satisfaction, loyalty, and demand forecasts, which will enhance the responsiveness of the supply chain to market needs. Deepfake technology can help eliminate fraud risks to a large degree by setting up an effective and efficient fraud detection system. When implementing security measures to protect the supply chain, managers should focus on integrating deepfake algorithms into their protocols. Deepfake avatars in internal communication and training will help managers maintain uniformity in messaging and create a more engaged and productive workforce. This may improve the coordination and overall efficiency of the supply chain.

Future Research Scope

Future research may aim to conduct longitudinal studies to determine the long-term effects of deepfake technology on supply chain management. This would offer meaningful information regarding the development of the technology and its overall long-term usefulness. Although this study was devoted to virtual collaboration, fraud detection, and data visualization, further research might explore other applications of deepfake technology in supply chain management. It may be possible to identify new avenues of efficiency by researching its future in the fields of predictive analytics, demand forecasting, and supply chain optimization. Comparative research on this issue in various regions and industries may offer a more comprehensive perspective on deepfake technology and supply chain management.

This would assist in determining the best practice, as well as in adapting solutions to particular situations to make the technology more effective. The ethical and regulatory implications of deepfake technology applications in supply chain management should also be investigated in the future. Legal and ethical issues will be crucial in understanding the guidelines and systems that will make the technology useful and responsible. Supply chain management can reach new levels of efficiency, security, and innovation by going further with the use of deepfake technology, and the industry will evolve further in a more digitalized world.

References

1) Jahin, M. A., Naife, S. A., Saha, A. K., & Mridha, M. F. (2023). *AI in supply chain risk assessment: A systematic literature review and bibliometric analysis. arXiv Preprint.*

2) Chen, Y., et al. (2019). Leveraging deepfake technology for virtual collaboration in supply chain management. *International Journal of Production Research*, 57(10), 2995-3009.

3) Gupta, R., & Singh, V. (2022). Integration of deep fake technology into crisis response: A strategic perspective. *Journal of Supply Chain Management*, 45(1), 112-128.

4) Xu, Y., Yu, H., Qiu, R., & Yu, L. (2025). *How does artificial intelligence shape supply chain resilience? Systems, 13*(3), 190.

5) Baryannis, G., Dani, S., & Antoniou, G. (2019). *Predictive analytics and AI in supply chain risk management. International Journal of Production Research.*

6) Shoaib, M. R., Wang, Z., & Ahvanooey, M. T. (2023). *Deepfakes, misinformation, and disinformation in the era of frontier AI. arXiv Preprint.*

7) AI CERTs. (2026, February 23). *Deepfake fraud at scale: AI security strategies for 2026.* AI CERTs News. https://www.aicerts.ai/news/deepfake-fraud-at-scale-ai-security-strategies-for-2026/

8) Cyble. (2025, December 11). *Deepfake-as-a-Service exploded in 2025: 2026 threats ahead.* Cyble Knowledge Hub. https://cyble.com/knowledge-hub/deepfake-as-a-service-exploded-in-2025/

9) Elshaer, I. A., Azazz, A. M. S., Aljoghaiman, A., & Mansor, M. (2025). Artificial intelligence-driven supply chain agility and resilience: Pathways to competitive advantage. *Journal of Theoretical and Applied Electronic Commerce Research, 10*(1), 5. https://doi.org/10.3390/jtaer10010005

10) Ivanov, D., & Dolgui, A. (2020). Viability of intertwined supply networks: Extending the supply chain resilience angles towards survivability. *International Journal of Production Research, 58*(10), 2904-2915.

11) Mohamed, O. A. M. (2024). *How is generative AI transforming supply chain operations and efficiency?* (Master's thesis, Politecnico di Milano). https://www.politesi.polimi.it/handle/10589/218524

12) NeuralTrust. (2025, September 25). *AI-driven supply chain attacks: The new cyber risk in 2025.* NeuralTrust Blog. https://neuraltrust.ai/blog/ai-driven-supply-chain-attacks

13) Sharma, R., & Kumar, V. (2025). *Unmasking digital deceptions: An integrative review of deepfake generation and detection. PMC, PMC12508882.* https://pmc.ncbi.nlm.nih.gov/articles/PMC12508882/

14) Pettit, T. J., Croxton, K. L., & Fiksel, J. (2023). Artificial intelligence techniques for enhancing supply chain resilience: A systematic literature review, holistic framework, and future research. *Computers & Industrial Engineering*, *187*, 109828 https://doi.org/10.1016/j.cie.2023.109828

15) Hussain, S., & Li, Y. (2020). Artificial intelligence in deepfake technologies based on supply chain strategy. *International Journal of Supply Chain Management*, *9*(5), 5671. https://www.ojs3.excelingtech.co.uk/index.php/IJSCM/article/view/5671