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Security Issues in Transportation and Logistics: Its Impact on Pakistan's Economy: A Systematic Literature Review

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Abstract

The transportation infrastructure is one of the main elements in economic development. However, due to global uncertainties and thefts, the execution of transportation activities is cumbersome. Hence, this study aims to find the major security and safety issues in the transportation sector of South Asian Nations with a special focus on Pakistan and investigate the way how to mitigate those risks to reduce their impact on the productivity of Pakistan. A systematic literature review collecting papers from 2000 to 2023 was conducted. A total of 252 papers were selected and 46 final papers were included. The findings indicated that major security and safety issues include, terrorist attacks, theft of goods, and inappropriate technological integration, lack of real-time tracking of goods and vehicles. These security issues can affect productivity and can become an economic barrier by disrupting operations, decreasing confidence and investments, damaging Pakistan's reputation, and increasing costs by the implementation of security measures, and insurance premiums. Delays, loss of goods, and inventory can lead to financial losses. This study contributed in providing mitigating strategies, logistics and transportation companies may use guarded parking and storage facilities outfitted with surveillance systems, access restrictions, and security personnel. Real-time tracking of cars and goods is made possible by the installation of GPS tracking systems. These strategies provide implications for organizations to monitor the location, speed, and routes of their inventory, assisting in preventing the possibility of theft, recovery, and timely delivery to promote their profitability and economic growth.

Keywords: Security, Safety, Transportation, Productivity, Economic, Growth

Paper Type: Literature Review

1. Introduction

A holistic approach to understanding global preparation from a transportation perspective is represented by transportation security (Bragdon, 2011a). Global business

And interpersonal connections depend significantly on logistics and transportation. They involve many modes, including air, sea, train, and road, and the transportation of people and products between nations. With a focus on the consequences of these developments for system security, the globalization of transportation and the intermodal sector are examined. Concerns include the function of containerized freight and aviation, as well as the security of land borders, maritime borders, and air entry points (Szyliowicz, 2004). Since Transportation and logistics facilitate the movement of merchandise and trade between nations, transportation, and logistics have a substantial impact on the economy worldwide.

To move products and raw materials across different regions, international trade primarily relies on effective logistics and transportation networks. One of the most important topics in transportation research is safety (Zhao et al., 2012a). But as we become more dependent on technology and networked systems, the security of transport networks has grown to be our top priority. The transportation industry faces a variety of security challenges that require attention, from the rise of cyber threats to the ongoing difficulty of physical weaknesses. It is not only important to protect people's well-being but also to protect economies and maintain societal function that transport networks should be secure. The expenses of the security upgrades have been a major focus of analytical studies regarding the increased security of transportation networks. Benefits have mostly been disregarded or are only briefly mentioned when discussing community safety or the threat of terrorism posed by economic flows (Cowen, 2010a).

Asia's economy, which is home to several of the largest and fastest-growing economies in the world, relies greatly on transportation and logistics. Southeast Asia is a sub-region of international strategic relevance since it hosts some of the busiest and most important chokepoints for marine trade in the world (Khurana, 2004). Several Asian nations, including China, India, Pakistan, and other South Asian nations, have seen their economies rise quickly in recent years. The safety and security of transportation in Asia have been developed lately. Such as safety in marine transport has been more crucial in recent decades, owing mostly to the numerous maritime tragedies that have endangered both human lives and the environment (Kristiansen, 2013). As logistics and transportation grow demand for goods and services has increased as a result of this growth, which has increased the requirement for effective logistics and transportation networks thus high transportation means high security.

Every mode of transportation has its safety hazards such as theft, piracy and armed robbery, maritime terrorism, illicit marine trafficking of drugs, small arms and light weapons, and people, as well as cargo theft and global climate change, concerns over issues like climate change, oil spills, security, and social and political instability have grown over time, which would increase the dangers. Due to Asia's rapidly expanding trade volume, thorough studies are urgently needed to prepare ports for interruptions (Wiegmans et al., 2008). In the Asian continent, transport security is a complicated and varied issue. The area is home to some of the busiest airports, seaports, and transportation networks in the world because of its extensive and quickly expanding infrastructure. However, geopolitical unrest, a variety of internal and external dangers, and the size and diversity of Asian nations present particular security difficulties. Given the growing reliance on digital systems for transportation management, cybersecurity threats such as hacking attempts and data breaches are a serious concern. Present-day cyberattacks are more prevalent than ever; examples include the NotPetya attack on A.P. Moller-Maersk, the infection of Australian immigration and customs, and North Korea attacking the GPS signals of ships off the Korean coast (Lee et al., 2008a).

In addition, maintaining the safety and security of passengers and goods is constantly hampered by the threat of terrorism and insurgencies. Piracy and smuggling are also prevalent

along the region's large coastline and maritime channels, necessitating strong measures to protect vessels and maintain the region's security, congestion and environmental concerns will force an increase in the importance of intermodal freight transportation (Zografos & Regan, 2004). For maximum efficiency and cost-effectiveness, intermodal transportation combines various means of transportation, such as rail, road, air, and sea. Intermodal transportation is a vital component of efficiently transporting goods across long distances and different environments throughout Asia because of its immense size and diverse topography. Intermodal transportation networks enable the efficient movement of commodities within the region and connect Asia to other parts of the world by supplying seamless connectivity between numerous ports, airports, and land transportation hubs.

The location of Pakistan offers a financial advantage for shipping goods from the Indian Ocean to Afghanistan, China, and the Central Asian States (Nazir et al., 2016a). The development of Pakistan's transportation and logistics industry is a vital factor in the growth and development of the economy of the nation. The nation serves as a significant transport hub for trade and business due to its location at the intersection of South Asia, Central Asia, and the Middle East. Pakistan's logistics sector is still in its development, but because of the country's expanding trade and the government's initiatives to upgrade the logistical infrastructure, it is expanding quickly. The logistics business is generally dominated by road transportation, although air and sea transportation are also gaining importance.

In Pakistan, several domestic and foreign logistics services operate, offering a variety of services like shipping, warehousing, and goods forwarding. Military freight, urbanization, motorization, and congestion increase risk to road users (Nazir et al., 2016a). Pakistan's biggest project CPEC is even facing security issues. Security-wise, the China-Pakistan Economic Corridor (CPEC) is now facing difficulties. It is regarded as crucial to relations between China and Pakistan and the extension will connect Kashgar to Gwadar Port (Ibrar, 2016).To solve these problems in Pakistan's transportation security multiple solutions have been drafted. Information regarding unsafe traffic situations or accidents can be transmitted through VANETs (vehicular ad hoc networks), an innovative approach to improving road safety (Al-Douri et al., 2022). However timely solutions can be a cure to these issues. This paper primarily focuses on the security problems that are faced in the logistics industry of Pakistan. Theft, pilferage, and other security threats especially in International Transportation create a significant impact on the logistics of Pakistan. How to mitigate those risks with the help of the latest methods and technology.

1.2. Theoretical Underpinning

Systems-Theoretic Accident Model and Process (STAMP) is incorporated to underpin the topic under discussion which is based on systems and control theory and is proposed by Nancy Leveson. Originally, it was created to discuss the systems of safety engineering however, later the model has been widely incorporated in securities issues of allied subjects (Laracy, 2017; Zipkin, 2005). STAMP-Sec. portrays security issues as a result of inadequate control despite declaring it as a complete failure like Cryptographic device breaking (Rae et al., 2006). Security is an exponential characteristic of a system that is achieved through enforcement of certain constraints. These constraints transformed security issues into control issues for which stringent tools may be implemented. Control structures are described to capture the communication and control system and exemplify the existence and absence of feedback. These are hierarchal in existence and may be incorporated both for the system development and systems operations. STAMP-Sec follows the five steps methodology to convert systems threats to systems control and are mentioned below. Based on these steps we

have incorporated this model in the transportation securities and safety issues in the Southeast Asian nations with special focus to Pakistan.

Five Steps of STAMP-Sec

STAMP-Sec
1. Identify the system level threats. 2. Write security constraints for the threats. 3. Define the static control structure to prevent or mitigate the threats. a. Assign constraints to the system components responsible for implementing them. b. Define the control actions for the components that prevent or mitigate the threats. 4. Identify inadequate control actions that could lead to an insecure state. 5. Determine ways that constraints could be violated and attempt to eliminate them. In particular, use System Dynamics to consider how and why the security control structure might change over time, potentially leading to ineffective controls.

Figure 1 Five Steps approach to STAMP-Sec
Source: Adopted from Laracy (2007)

1.3 Research Questions and Objectives

Q.1 What are the key safety and security issues that logistics and transportation firms in Pakistan deal with?

Q. 2 How do these security and safety issues impact the economy of Pakistan?

Q.3 What safety and security risk mitigation strategies are there that can be used by logistics and transportation firms in Pakistan?

Based on these research questions the research objectives were constructed which are the following

1. Determine the main security risks that Pakistani logistics and transportation companies must deal with.

2. To examine the impact of these issues on the economic growth of Pakistan.

3. To examine the security risk mitigation strategies that can be used by the logistics and Transportation firms in Pakistan.

The rest of the paper is designed as section two discussed the methodology. Section three will address the impact of security issues that logistics and Transportation firms face on the economy and how can they mitigate this risk. We then outline potential research avenues and reflect on logistics and transportation security issues in the economy and how they can be mitigated. The last section of the paper presented the conclusions.

2. Methodology

This study is an organized review of the literature. A thorough evaluation of research findings is known as a systematic literature review (Kristiansen, 2013; Okoli & Schabram, 2010). The primary objectives of the study are to identify security issues in Pakistani transportation and examine potential security mitigation measures. Also, to find out the impact of these security issues on Pakistan's economy.

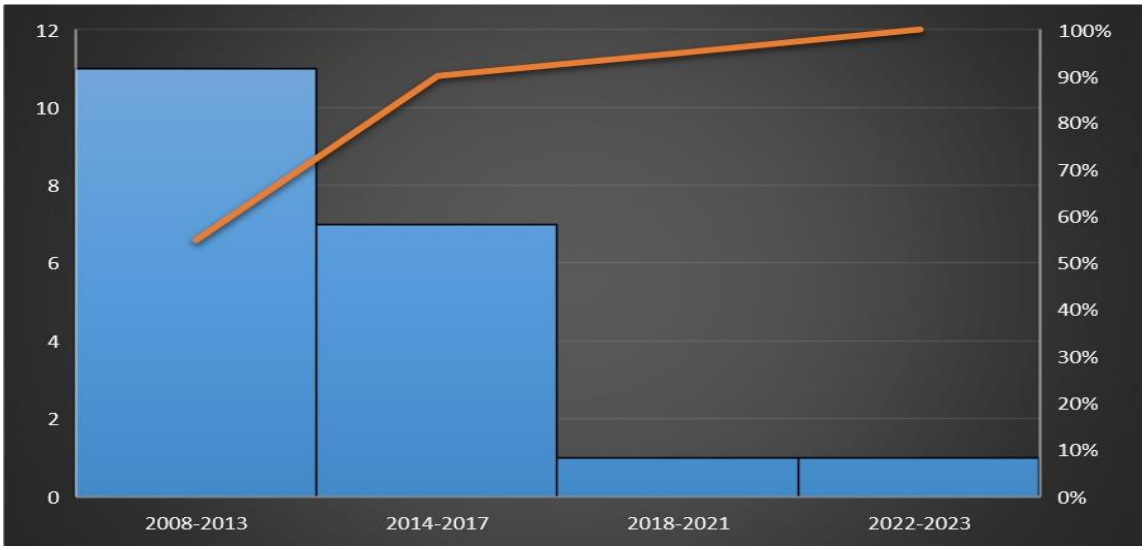

Figure 2 No. of Articles Year wise

2.1 The Search Process

Our keywords were "Transportation and Logistics"," Marine Transportation", "Transportation security", "Land Transportation" and "Pakistan Economy. The reason behind selecting these keywords was to obtain information that is highest linked with the topic of the research and also to search from more articles rather than concisely the choice of selecting the research articles. The goal of our search was to identify articles that offered substantiated research of high caliber. The journals we looked at are the Journal of Transportation Economics and Policy, Transportation Science, and the International Journal of Sustainable Transportation.

2.2 Inclusion and Exclusion Criteria:

The criteria for choosing the articles for our evaluation were created to make sure that we concentrated on accurate and pertinent information about how logistics and transportation affect Pakistan's economy. We sought to find the most recent and reliable literature on the topic by limiting our search to peer-reviewed publications published between 2000 and 2023 and written in English.

We considered articles on the following subtopics during our search:

- Role of infrastructure development in enhancing Pakistan's transportation
- Impact of road transportation on Pakistan's trade
- Economic benefits associated with the transportation sector in Pakistan.

Articles we didn't consider

- Articles not related to economy, transportation, and logistics.
- Articles having research in progress
- Articles except for Transportation and Economy.

2.3 Data Collection

Data taken out from studies are following

- Journal name: To ensure the reliability and legitimacy of the research findings, it is crucial to select a reputable and established academic publication.
- Author: A qualified author improves the research's credibility and has the proper understanding of both the research topic and the research methodologies.
- Findings: The findings section is crucial since it summarizes the main findings of the study.
- Impact of security issues on Pakistan's Economy Research Questions: The study is guided by the research questions, which specify the subject matter of the investigation. They provide the research with a clear structure.

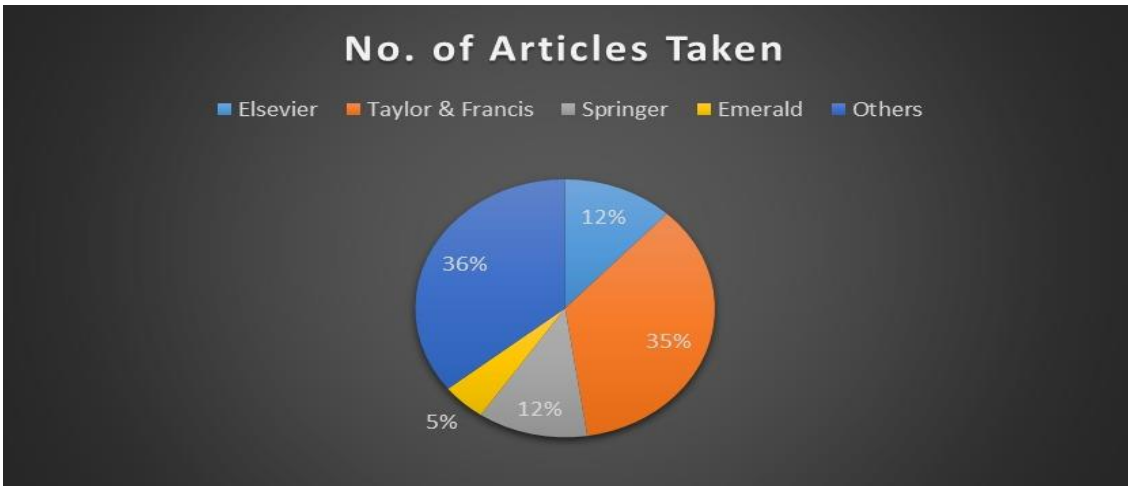

Figure 3. Sources of Articles

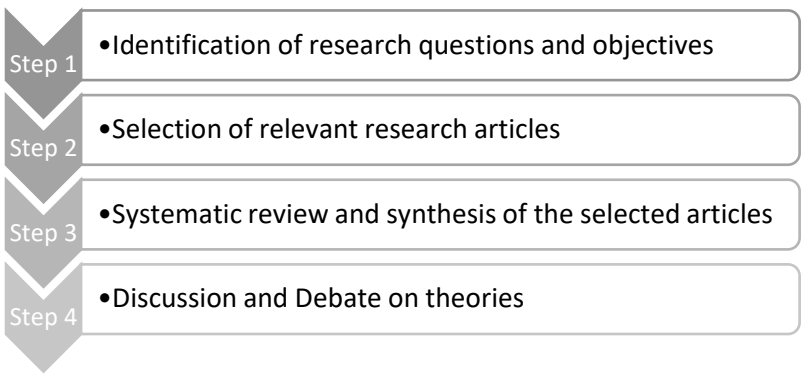

Figure 4 Selection Criteria

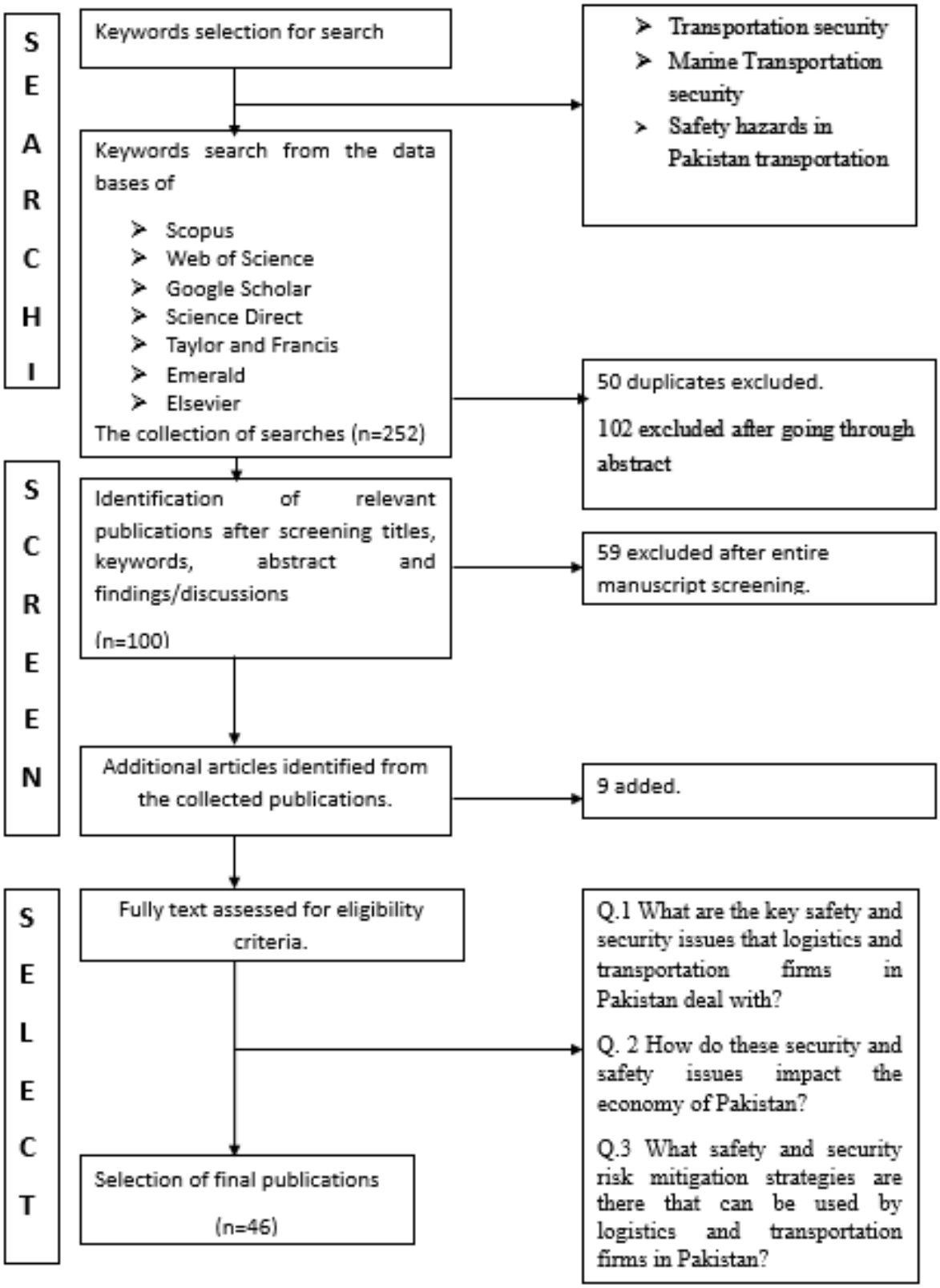

Table 1 Summary of Issues, Impact and Mitigating Strategies

Research Question	Main Points
Security Issues	• Illicit trafficking of drug • low road safety standards • Terrorist Attacks • Theft due to congestion on roads • security of transporting hazardous material • Energy security • safety threats for the project of CPEC i.e., Maritime security, terrorism, infrastructure problems, and geopolitical conflicts
Impact On Economy	• Increases violence • Increase corruption • Lead to instability • Deteriorated law and order • Greater accidents • Mental and physical injuries and fatalities • Increased healthcare expenses • Loss of employment due to injuries • Leads to terrorist activities
Mitigating Strategies	• RFID and GPS to identify drivers • Employee education regarding security hazards • Theft prevention strategies • Promote emergency response procedures • Application of other technological tools • To identify and prevent unauthorized access or suspect activity through video surveillance • Application of access control systems • Biometric authentication • Analytics software application • Use of blockchain technologies • Intelligent Transportation system • Maritime education and training (MET) can be used to mitigate security risk

Author	Key security issues that logistics and transportation firms in Pakistan deal
Batool et al. (2012)	Road safety issues in Pakistan, which was conducted with the purpose of better understanding the country's profile for road safety.
Zhao et al. (2012)	When it comes to addressing the actual hazards, the standardized ITS communication message authenticity solutions are of limited use.
Gkonis & Psaraftis, (2010)	Investments in container inspection systems at ports are the focus of security concerns in container transit.
Nazir et al. (2016b)	The worldwide war on terrorism also expanded freight traffic from Pakistan to Afghanistan which assisted ISAF forces. The military freight, urbanization, motorization, and congestion increased risk to road users.
Bennetts & Charles, (2016)	Security at passenger transport infrastructures is now both anticipated and accepted by the travelling public due to the widespread worry about terrorism. However, it is evident that security measures vary widely from location to location and from mode to mode.
Ahmad et al., (2020)	Potential risks and obstacles related to the CPEC and policy changes to help the situation in Pakistan.
Kacharo et al. (2022)	to evaluate the security and safety of women and girls in transportation systems and to pinpoint the causes of violence
Sahay & Roshandel, (2010)	The necessity for a trade deal between Iran, Pakistan, and India to address their mutual economic, political, and strategic demands as well as the limitations and difficulties that currently prevent such an agreement from reaching its full potential.
Baker, (2020)	Security checkpoints must be breached in order to deny possible aviation terrorist access to secure airport facilities and aircrafts.
Lone et al. (2023)	Study the vehicle network paradigm, the difficulties they encounter, and offer a workable strategy for protecting these weak networks.
Mileski et al., (2018)	The maritime business in cyberspace faces new security risks as automation grows.
Bragdon, (2011)	The National Infrastructure Protection Plan and network of transportation are both addressed.
Johnstone, (2007)	Northwest Flight 253's 2009 attempted suicide bombing was one of many instances involving American aviation in which the attack failed but the attempt led to adjustments in security measures.
Kayani et al., (2020)	There is enough evidence to imply that fatalism is a significant contributing cause of Pakistan's chronic road crash issue, but in order to design effective preventative tactics, it is necessary to have a deeper understanding of how fatalism functions in Pakistan.
Ibrar et al., (2017)	Security-wise, the China-Pakistan Economic Corridor (CPEC) is now facing difficulties. It is regarded as crucial to relations between China and Pakistan and the extension will connect Kashgar to Gawadar Port.
Mustafa, (2005)	Activities such as terrorism, piracy, armed robbery, human smuggling, drug trafficking, gun running, poaching causing marine pollution are major security threats.
Feldt et al., (2013)	The threats to "Maritime Security" come in many forms, including piracy and armed robbery, maritime terrorism, illicit marine trafficking of drugs, small arms and light weapons, and people, as well as cargo theft and global climate change. These difficulties are continuously changing and could be hybrid in nature—a connected and unpredictably combined kind of conventional and unconventional warfare, terrorism, and/or organized crime.
Hahn et al., (2021)	To increase mobility, comfort, safety, and efficiency, intelligent transportation systems (ITS) integrate sensing, control, analysis, and communication technology into travel infrastructure and transportation.

3. Discussion

3.1 RQ.1 Security and Safety Issues

Several definitions of "security", a complex, multilayered concept, have been proposed over time (Szyliowicz & Zamparini, 2022). Due to trends like globalization, geographical integration, and the growing connections between communications and transportation technologies, transportation security has emerged as a major concern and is only likely to become more salient (Szyliowicz, 2004). Local public transport operators, particularly in major cities, have the daily challenge of controlling delays and minor interruptions Pakistani logistics and transportation companies deal with several serious security challenges that might have a negative influence on their output and financial performance. The regional economies that

terrorists help as well as the transportation systems they aim to destroy are malleable (Cox et al., 2011). Key security issues that transportation in Pakistan deals with or is likely to deal with are illicit marine trafficking of drugs, low road safety standards, Terrorist Attacks, Theft due to congestion on roads, security of transporting hazardous material, energy security, and safety threats for the project of CPEC i.e., Maritime security, terrorism, infrastructure problems, and geopolitical conflicts. Due to Pakistan's maritime boundaries, which link it to nearby nations and international waters, Pakistan could serve as a transit point for drug trafficking. Drug trafficking networks frequently operate across borders, compromising the stability and security of neighboring nations. This may have impacts on regional security.

Transnational marine crime is becoming more sophisticated and significant. These crimes endanger people's lives and security (Bruwer, 2020). Any unplanned incident that results in visible harm is considered an accident by the World Health Organization (Rathi, 2018). Because of insufficient safety rules, road accidents result in the loss of precious human resources. The economy, employment, and families are all negatively impacted by this on a social and financial level. Terrorist attacks may be made possible by the lack of security measures in the infrastructure, such as exposed tunnels, bridges, or transit hubs. A critical transportation hub could be attacked, services could be interrupted, people could be harmed, or the infrastructure could be damaged. Pakistan shares borders with several adjacent nations, notably India and Afghanistan, both of which have seen geopolitical upheaval. Political analysts have primarily studied the relationship between conflict and international trade, looking at how conflict affects trade (Alter & Meunier, 2009). As a result of these conflicts, trade routes may be disrupted, borders may be closed, and transporters operating in border regions may face higher security concerns. Many countries think that CPEC is a strategic danger to their military and economic interests and that it has a profound effect on the state. Given the circumstances of a serious geostrategic war, India brutally contributes to the CPEC and provided Pakistan with a strategically advantageous location along the Arabian Sea (Ibrar et al., 2017b).

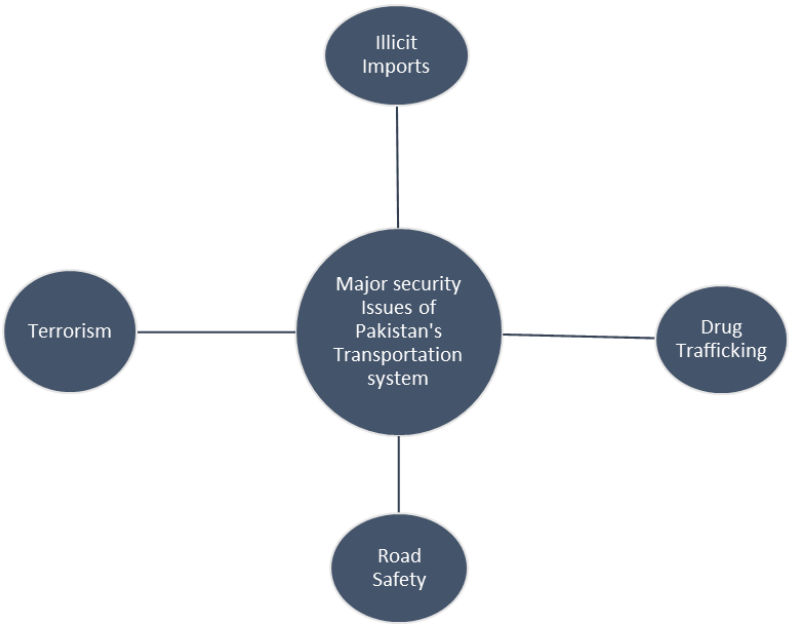

Figure 5 Key Security and Safety Issues

Table 3 Summary of Impact on Economy

Author	security and safety issues impact the economy of Pakistan
Saleemi et al., (2022)	Travelers' knowledge of ITS and their opinions on how well the system has been implemented as part of a safe city initiative in the city of Lahore's traffic
Cowen, (2010)	Labor activities are a major policy focus and are portrayed as security dangers because they interrupt commodities flows.
Tate & Abkowitz, (2012)	The most promising new solutions for the security and safety of hazardous materials (hazmat) shipments, according to a project funded by the Hazardous Materials Cooperative Research Program.
Baldauf et al., (2016)	Important components of maritime education and training (MET) include emergency response, crew resource management, and crisis management.
Liyanage et al., (2017)	The existing state of the transport industry in emerging nations and the challenges to the creation of a sustainable transport system must be identified.
Chang & Khan, (2019)	Why maritime security and growth are important in Pakistan, and what worries China
Ali et al., (2018)	In-depth analysis of local residents' attitude towards road and transport infrastructure (China–Pakistan economic corridor, CPEC) and the wider economic, social, cultural and environmental impact on local people.
Ali et al., (2018)	the region's rising involvement of China, collaboration between India and Iran, and the Indo-Gulf Several recent developments, including the developing Indo-U.S. strategic cooperation, require careful analysis.

3.2 RQ.2 Impact on Economy

Around the world, between 8 and 14 million metric tons of unreported imports may be exchanged illicitly each year, indicating that these imports generate gross earnings of US$9 to US$17 billion (Bruwer, 2020). Drug trafficking can result in more violence, corruption, and instability, which can harm the country's law and order. This may prevent foreign investment and have a detrimental effect on trade and tourism, which could result in lost income and a slowing down of economic growth. Roads were considered to be an essential component of socioeconomic progress (Kayani et al., 2020b). A greater number of accidents, injuries, and fatalities may be caused by poor road safety. As a result, healthcare expenses rise, employment is lost as a result of injuries, and infrastructure and cars are damaged. Additionally, it could discourage tourism and investment, which would harm economic growth. With regard to terrorism losses, many cost comparisons could be made. For instance, direct costs are the immediate damages brought on by a terrorist act or campaign and include destroyed commodities, the cost of lost lives, and the cost of injuries, such as lost wages, demolished buildings, harmed infrastructure, and decreased short-term commerce. In contrast, indirect or secondary costs relate to losses that follow an attack include increased security expenses, higher insurance premiums, and bigger recompense for those high-risk areas and the expenditures associated with attack-related long-term changes in the economy (Khoshavi et al., 2021a).

Fear and uncertainty brought by terrorism can influence consumer and commercial behavior. Frequent attacks can cause supply chains to be hampered, transportation networks to be disrupted, and businesses and the government to incur higher security expenses. Investor reluctance to put money into terrorist-prone areas may hinder the development and expansion of the economy. Hazardous product transportation is an economic activity with potential negative effects on the environment, human health, and transportation safety (Kristiansen, 2013). Transporting hazardous commodities can result in mishaps, environmental harm, and potential health risks due to improper management or security lapses. Such occurrences may expose a corporation to legal responsibilities, expensive clean-up procedures, and reputational harm, which may affect business operations and financial investments.

Table 4 Summary of Mitigating Strategies

Author	Security risk mitigation strategies use by transportation firms in Pakistan
Szyliowicz, (2004)	security of land borders, entrance ports from the sea and the air, as well as the function of containerized cargo and aviation
Sabzehparvar & Alavi, (2015)	The transportation system and related networks play a role in the security management's complexity.
Reggiani, (2013).	Scale-free networks, for example, play a role in the resilience vs. vulnerability of connection network structure.
Zhang, (2013)	An internet-based security solution that tracks the integrity of the load and uses RFID and GPS to identify drivers
Murphy et al., (2021)	The development of evidence on the relationship between transportation insecurity and poverty is hindered.
Zafar, (2021)	National capacity building, marine security, and future goals.
(Lee et al., 2008b)	The population of the world grew aware of the capacity of humans to cause hurt and destruction as well as the susceptibility of transportation networks to similar tragedies.
Rudner, (2015)	International Terrorism has been countering airlines and airports for several years
Szyliowicz & Zamparini, (2022)	Terrorists and multinational criminal groups that engage in crimes like cargo theft, drug trafficking, and people smuggling have historically targeted supply chains and the transportation infrastructure that support them.
Andziulis et al., (2012)	The process of monitoring cargo transportation conditions, cargo information security, and other crucial aspects are insufficiently analyzed in practitioner literature.
Marin et al. (2007)	Airport security line-up procedure for server behavior in response to line-up duration and hypothesis security consequences.
Feldt et al., (2013)	Solutions to Maritime security problems with respect to International maritime organization.
Qureshi et al., (2022)	Due to their complexity and intensive computing processing, the conventional security and authentication procedures have not been practical.
Johnston & Nath, (2004)	The owners and operators of mass transit and passenger rail, freight rail, highway and motor carrier, and pipeline networks, as well as national and municipal authorities, continue to be principally responsible for the security of land transportation. The Transportation Security Administration (TSA) is given the major role in the United States, while the Department of Transportation (DOT)'s modal administrations continue to have significant and occasionally overlapping duties.
Soni et al., (2020)	Distributed Denial of Service attacks, side channel attacks, malware injection attacks, and authentication and authorization attacks are the main security issues and challenges that are present in edge computing. Research is being done to understand and address these issues as well as to help mitigate them.
Ahmed, (2014)	Uprooting the terrorist network of Jihadi and extremist organizations based in Pakistan is ineffectual and detrimental.
Lv et al., (2021)	To address the safety issues with intelligent transportation systems, investigate deep learning.
Khoshavi et al. (2021)	Applying blockchain technology to the field of autonomous vehicles requires a thorough understanding of both historical and present advancements as well as professional observations.

3.3 RQ.3 Mitigating Strategies

The security risk mitigation strategies that can be used for multiple security risks are as discussed, to reduce the danger of theft and unauthorized access to vehicles and goods, logistics and transportation companies may use guarded parking and storage facilities outfitted with surveillance systems, access restrictions, and security personnel. Passengers need to be protected from terrorist attacks with security equipment (Johnstone, 2015). Real-time tracking of cars and goods is made possible by the installation of GPS tracking systems. It will enable

organizations to monitor the location, speed, and routes of their inventory, assisting in preventing the possibility of theft, recovery, and timely delivery. For those who offer logistical services, the development of an extensive transport security management system becomes increasingly crucial (Mileski et al., 2018b).

Companies may put in stringent security measures like driver authentication, tamper-evident seals, and verification procedures at different checkpoints. This guards against unauthorized entry and preserves the integrity of the cargo. An internet-based security solution that tracks the integrity of the load and uses RFID and GPS to identify drivers (Ruijian, 2013; Soni et al., 2020b). Employee education regarding security hazards, theft prevention strategies, and emergency response procedures is made possible via training programs. Employees become more alert to possible dangers and proactive in recognizing and reporting them when a culture of security awareness is promoted. Businesses use technology to improve security precautions. To identify and prevent unauthorized access or suspect activity, this may involve using video surveillance systems, access control systems, biometric authentication, and analytics software. As talked about in the above SLR application of blockchain technologies, Intelligent Transportation Systems, maritime education, and training (MET) can be used to mitigate security risk.

Figure 6 Key Security and Safety Challenges

4. Conclusion

A thorough analysis of the literature has been done to determine the security concerns facing the logistics and transportation sector. We searched the Google Scholar database to find 44 articles, position papers, and book proceedings from 2000 to 2023 that were published in scientific, peer-reviewed publications. The installation of technologies to develop transport with the aid of systems and procedures utilized all over the world has been strongly supported by the literature. In the end, we offered suggestions for future study and their practical implications to mitigate these security vulnerabilities in Pakistan.

Our study has practical implications for freight forwarders, NVOCC, shipping lines, and other transportation bodies. The studies concluded that Theft due to road congestion, security of transporting hazardous materials, energy security, and safety threats for the CPEC project, namely, maritime security, terrorism, infrastructure problems, and geopolitical conflicts, are key security issues that transportation in Pakistan deals with or is likely to deal with, the ongoing threat of terrorist attacks worsens matters with extremist targeting both land and sea transportation infrastructure. Road congestion not only raises the danger of theft but also hinders the efficient flow of goods and people. Transporting hazardous goods requires stringent measures to prevent accidents or purposeful abuse. Furthermore, maintaining ongoing transportation services requires assuring energy security. Furthermore, the ambitious China-Pakistan Economic Corridor (CPEC) project has several safety problems, including marine security issues, potential terrorist activity, infrastructure weaknesses, and geopolitical tensions that might jeopardize its success.

4.1 Implications

This section suggests potential mitigating measures to alleviate transportation security challenges and promote economic growth based on the research findings. Companies may implement strict security measures at various checkpoints, such as driver authentication, tamper-evident seals, and verification procedures. This prevents unlawful entrance and protects the cargo's safety. An internet-based security solution that monitors load safety and utilizes RFID and GPS to identify drivers. Strengthening cross-border commerce facilitation, investing in cutting-edge transportation technologies, and enhancing security measures for transportation infrastructure. The research study can offer insightful information about how security transportation issues affect Pakistan's economic development as well as practical suggestions for enhancing the nation's transportation system and security environment.

4.2 Future Research Direction

We opted for published articles and books. Future studies can be conducted to understand in detail the impact of these security issues and how a resilient and compatible transportation system can be built in all modes of transportation. However, there isn’t a sufficient amount of research on the use of the latest technologies for building a compatible transportation system.

References

Ahmad, R., Mi, H., & Fernald, L. W. (2020). Revisiting the potential security threats linked with the China–Pakistan Economic Corridor (CPEC). *Journal of the International Council for Small Business, 1*(1), 64–80. https://doi.org/10.1080/26437015.2020.1724735

Ahmed, N. (2014). *Pakistan’s Counter-terrorism strategy and its Implications for domestic, regional and international security*. https://shs.hal.science/halshs-00937552

Al-Douri, A. T., Mohammed Kadhim, N., Mohamad, A. A. H., & Abeyie, M. (2022). Simulation of Vehicular Network Use in Emergency Situations and Security Applications on a Pakistan Highway. *Security and Communication Networks, 2022*, e2902263. https://doi.org/10.1155/2022/2902263

Ali et al. (2018a). *CPEC and Maritime Security: An Analysis of Pakistan Navy’s Initiatives - ProQuest*. https://www.proquest.com/openview/de1d7706ede023a643b6f23e3013ee21/1?pq-origsite=gscholar&cbl=616545

Ali, L., Mi, J., Shah, M., Shah, S. J., Khan, S., Ullah, R., & Bibi, K. (2018b). Local residents’ attitude towards road and transport infrastructure (a case of China Pakistan economic

corridor). *Journal of Chinese Economic and Foreign Trade Studies*, *11*(1), 104–120. https://doi.org/10.1108/JCEFTS-08-2017-0024

Alter, K. J., & Meunier, S. (2009). The Politics of International Regime Complexity. *Perspectives on Politics*, *7*(1), 13–24. https://doi.org/10.1017/S1537592709090033

Andziulis, A., Jakovlev, S., Adomaitis, D., & Dzemydienė, D. (2012). Integration of mobile control systems into intermodal container transportation management. *Transport*, *27*(1), Article 1. https://doi.org/10.3846/16484142.2012.665206

Baker, D. McA. (2020). Tourism and Terrorism: Terrorists' Threats to Commercial Aviation Safety and Security. In M. E. Korstanje & H. Seraphin (Eds.), *Tourism, Terrorism and Security* (pp. 163–181). Emerald Publishing Limited. https://doi.org/10.1108/978-1-83867-905-720201012

Baldauf, M., Schröder-Hinrichs, J.-U., Kataria, A., Benedict, K., & Tuschling, G. (2016). Multidimensional simulation in team training for safety and security in maritime transportation. *Journal of Transportation Safety & Security*, *8*(3), 197–213. https://doi.org/10.1080/19439962.2014.996932

Batool, Z., Carsten, O., & Jopson, A. (2012). Road safety issues in Pakistan: A case study of Lahore. *Transportation Planning and Technology*, *35*(1), 31–48. https://doi.org/10.1080/03081060.2012.635415

Bennetts, C. 'Kit,' & Charles, M. B. (2016). Between Protection and Pragmatism: Passenger Transport Security and Public Value Trade-Offs. *International Journal of Public Administration*, *39*(1), 26–39. https://doi.org/10.1080/01900692.2015.1028638

Bragdon, C. (2011a). *Transportation Security*. Butterworth-Heinemann.

Bragdon, C. (2011b). *Transportation Security*. Butterworth-Heinemann.

Bruwer, C. (2020). Smuggling and Trafficking of Illicit Goods by Sea. In L. Otto (Ed.), *Global Challenges in Maritime Security: An Introduction* (pp. 49–73). Springer International Publishing. https://doi.org/10.1007/978-3-030-34630-0_4

Chang, Y.-C., & Khan, M. I. (2019). China–Pakistan economic corridor and maritime security collaboration: A growing bilateral interests. *Maritime Business Review*, *4*(2), 217–235. https://doi.org/10.1108/MABR-01-2019-0004

Cowen, D. (2010a). A geography of logistics: Market authority and the security of supply chains. *Annals of the Association of American Geographers*, *100*(3), 600–620.

Cowen, D. (2010b). A Geography of Logistics: Market Authority and the Security of Supply Chains. *Annals of the Association of American Geographers*, *100*(3), 600–620. https://doi.org/10.1080/00045601003794908

Cox, A., Prager, F., & Rose, A. (2011). Transportation security and the role of resilience: A foundation for operational metrics. *Transport Policy*, *18*(2), 307–317. https://doi.org/10.1016/j.tranpol.2010.09.004

Feldt, L., Roell, D. P., & Thiele, R. D. (2013). Maritime Security – Perspectives for a Comprehensive Approach. *Maritime Security*, *222*.

Gkonis, K. G., & Psaraftis, H. N. (2010). Container transportation as an interdependent security problem. *Journal of Transportation Security*, *3*(4), 197–211. https://doi.org/10.1007/s12198-010-0047-y

Hahn, D., Munir, A., & Behzadan, V. (2021). Security and Privacy Issues in Intelligent Transportation Systems: Classification and Challenges. *IEEE Intelligent Transportation Systems Magazine*, *13*(1), 181–196. https://doi.org/10.1109/MITS.2019.2898973

Ibrar, M., MI, J., Rafiq, M., & Karn, A. (2017a). The China-Pakistan Economic Corridor: Security Challenges. *DEStech Transactions on Social Science, Education and Human Science*. https://doi.org/10.12783/dtssehs/apme2016/8058

Ibrar, M., MI, J., Rafiq, M., & Karn, A. (2017b). The China-Pakistan Economic Corridor: Security Challenges. *DEStech Transactions on Social Science, Education and Human Science*. https://doi.org/10.12783/dtssehs/apme2016/8058

Johnston, V. R., & Nath, A. (2004). Introduction: Terrorism and transportation security. *The Review of Policy Research*, *21*(3), 255–262.

Johnstone, R. W. (2007). Not Safe Enough: Fixing Transportation Security. *Issues in Science and Technology*, *23*(2), 51–60.

Johnstone, R. W. (2015). *Protecting Transportation: Implementing Security Policies and Programs*. Butterworth-Heinemann.

Kacharo, D. K., Teshome, E., & Woltamo, T. (2022). Safety and security of women and girls in public transport. *Urban, Planning and Transport Research*, *10*(1), 1–19. https://doi.org/10.1080/21650020.2022.2027268

Kayani, A., King, M. J., & Fleiter, J. J. (2020a). Fatalism and Road Safety in Developing Countries, with a Focus on Pakistan. *Journal of the Australasian College of Road Safety*, *22*(2), 41–47. https://doi.org/10.3316/informit.990306137579173

Kayani, A., King, M. J., & Fleiter, J. J. (2020b). Fatalism and Road Safety in Developing Countries, with a Focus on Pakistan. *Journal of the Australasian College of Road Safety*, *22*(2), 41–47. https://doi.org/10.3316/informit.990306137579173

Khoshavi, N., Tristani, G., & Sargolzaei, A. (2021a). Blockchain Applications to Improve Operation and Security of Transportation Systems: A Survey. *Electronics*, *10*(5), Article 5. https://doi.org/10.3390/electronics10050629

Khoshavi, N., Tristani, G., & Sargolzaei, A. (2021b). Blockchain Applications to Improve Operation and Security of Transportation Systems: A Survey. *Electronics*, *10*(5), Article 5. https://doi.org/10.3390/electronics10050629

Khurana, G. S. (2004). Maritime security in the Indian Ocean: Convergence plus cooperation equals resonance. *Strategic Analysis*, *28*(3), 411–426. https://doi.org/10.1080/09700160408450145

Kristiansen, S. (2013). *Maritime Transportation: Safety Management and Risk Analysis*. Routledge.

Laracy, J. R. (2017). A Systems-Theoretic Security Model for Large Scale, Complex Systems Applied to the US Air Transportation System. *International Journal of Communications, Network and System Sciences*, *10*(05), 75–105. https://doi.org/10.4236/ijcns.2017.105005

Lee, A. J., Nikolaev, A. G., & Jacobson, S. H. (2008a). Protecting air transportation: A survey of operations research applications to aviation security. *Journal of Transportation Security*, *1*, 160–184.

Lee, A. J., Nikolaev, A. G., & Jacobson, S. H. (2008b). Protecting air transportation: A survey of operations research applications to aviation security. *Journal of Transportation Security*, *1*(3), 160–184. https://doi.org/10.1007/s12198-008-0014-z

Liyanage, C., Dias, N., Amaratunga, D., & Haigh, R. (2017). Current context of transport sector in South Asia: Recommendations towards a sustainable transportation system. *Built Environment Project and Asset Management*, *7*(5), 490–505. https://doi.org/10.1108/BEPAM-10-2016-0051

Lone, F., Verma, H. K., & Sharma, K. P. (2023). A systematic study on the challenges, characteristics and security issues in vehicular networks. *International Journal of Pervasive Computing and Communications*, *ahead-of-print*(ahead-of-print). https://doi.org/10.1108/IJPCC-04-2022-0164

Lv, Z., Zhang, S., & Xiu, W. (2021). Solving the Security Problem of Intelligent Transportation System With Deep Learning. *IEEE Transactions on Intelligent Transportation Systems*, *22*(7), 4281–4290. https://doi.org/10.1109/TITS.2020.2980864

Marin, C. V., Drury, C. G., Batta, R., & Lin, L. (2007). Server Adaptation in an Airport Security System Queue. *OR Insight*, *20*(4), 22–31. https://doi.org/10.1057/ori.2007.21

Mileski, J., Clott, C., & Galvao, C. B. (2018a). Cyberattacks on ships: A wicked problem approach. *Maritime Business Review*, *3*(4), 414–430. https://doi.org/10.1108/MABR-08-2018-0026

Mileski, J., Clott, C., & Galvao, C. B. (2018b). Cyberattacks on ships: A wicked problem approach. *Maritime Business Review*, *3*(4), 414–430. https://doi.org/10.1108/MABR-08-2018-0026

Murphy, A. K., Gould-Werth, A., & Griffin, J. (2021). Validating the sixteen-item transportation security index in a nationally representative sample: A confirmatory factor analysis. *Survey Practice*, *14*(1).

Mustafa, M. Q. (2005). Maritime Security: The Role of Pakistan Navy. *Strategic Studies*, *25*(4), 158–190.

Nazir, E., Nadeem, F., & Véronneau, S. (2016a). Road safety challenges in Pakistan: An overview. *Journal of Transportation Security*, *9*, 161–174.

Nazir, E., Nadeem, F., & Véronneau, S. (2016b). Road safety challenges in Pakistan: An overview. *Journal of Transportation Security*, *9*(3), 161–174. https://doi.org/10.1007/s12198-016-0172-3

Okoli, C., & Schabram, K. (2010). A Guide to Conducting a Systematic Literature Review of Information Systems Research. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.1954824

Qureshi, K. N., Alhudhaif, A., Haidar, S. W., Majeed, S., & Jeon, G. (2022). Secure data communication for wireless mobile nodes in intelligent transportation systems. *Microprocessors and Microsystems*, *90*, 104501. https://doi.org/10.1016/j.micpro.2022.104501

Rae, A., Fidge, C., & Wildman, L. (2006). Fault evaluation for security-critical communication devices. *Computer*, *39*(5), 61–68. https://doi.org/10.1109/MC.2006.161

Rathi, R. (2018). *Road traffic accidents—Burden on society*.

Reggiani, A. (2013). Network resilience for transport security: Some methodological considerations. *Transport Policy*, *28*, 63–68. https://doi.org/10.1016/j.tranpol.2012.09.007

Rudner, M. (2015). Intelligence-Led Air Transport Security: Pre-Screening for Watch-Lists, No-Fly Lists to Forestall Terrorist Threats. *International Journal of Intelligence and CounterIntelligence*, *28*(1), 38–63. https://doi.org/10.1080/08850607.2014.962352

Ruijian. (2013). *A transportation security system applying RFID and GPS*. https://upcommons.upc.edu/handle/2099/13112

Sabzehparvar, M., & Alavi, S. H. (2015). The role of key parameters in public transportation security. *Journal of Transportation Security*, *8*(1), 37–40. https://doi.org/10.1007/s12198-015-0154-x

Sahay, A., & Roshandel, J. (2010). The Iran–Pakistan–India Natural Gas Pipeline: Implications and Challenges for Regional Security. *Strategic Analysis*, *34*(1), 74–92. https://doi.org/10.1080/09700160903354815

Saleemi, H., Rehman, Z. U., Khan, A. H., & Aziz, A. (2022). Effectiveness of Intelligent Transportation System: Case study of Lahore safe city. *Transportation Letters*, *14*(8), 898–908. https://doi.org/10.1080/19427867.2021.1953896

Soni, N., Malekian, R., & Thakur, A. (2020a). *Edge Computing in Transportation: Security Issues and Challenges* (arXiv:2012.11206). arXiv. https://doi.org/10.48550/arXiv.2012.11206

Soni, N., Malekian, R., & Thakur, A. (2020b). *Edge Computing in Transportation: Security Issues and Challenges* (arXiv:2012.11206). arXiv. https://doi.org/10.48550/arXiv.2012.11206

Szyliowicz, J. S. (2004a). International Transportation Security. *Review of Policy Research*, *21*(3), 351–368. https://doi.org/10.1111/j.1541-1338.2004.00080.x

Szyliowicz, J. S. (2004b). International Transportation Security. *Review of Policy Research*, *21*(3), 351–368. https://doi.org/10.1111/j.1541-1338.2004.00080.x

Szyliowicz, J., & Zamparini, L. (2022a). Freight transport security and the robustness of global supply chains. *Transport Reviews*, *42*(6), 717–724.

Szyliowicz, J., & Zamparini, L. (2022b). Freight transport security and the robustness of global supply chains. *Transport Reviews*, *42*(6), 717–724. https://doi.org/10.1080/01441647.2022.2127243

Tate, W. H., & Abkowitz, M. D. (2012). Emerging Technologies Applicable to Hazardous Materials Transportation Safety and Security. *Journal of Transportation Safety & Security*, *4*(3), 244–257. https://doi.org/10.1080/19439962.2012.657286

Wiegmans, B. W., Hoest, A. V. D., & Notteboom, T. E. (2008). Port and terminal selection by deep-sea container operators. *Maritime Policy & Management*, *35*(6), 517–534. https://doi.org/10.1080/03088830802469329

Zafar, N. (2021). Building Maritime Security in Pakistan—The Navy Vanguard. In C. Bueger, T. Edmunds, & R. McCabe (Eds.), *Capacity Building for Maritime Security: The Western Indian Ocean Experience* (pp. 73–96). Springer International Publishing. https://doi.org/10.1007/978-3-030-50064-1_4

Zhang, R. (2013). A transportation security system applying RFID and GPS. *Journal of Industrial Engineering and Management*, *6*(1), 163–174.

Zhao, M., Walker, J., & Wang, C.-C. (2012a). Security challenges for the intelligent transportation system. *Proceedings of the First International Conference on Security of Internet of Things*, 107–115. https://doi.org/10.1145/2490428.2490444

Zhao, M., Walker, J., & Wang, C.-C. (2012b). Security challenges for the intelligent transportation system. *Proceedings of the First International Conference on Security of Internet of Things*, 107–115. https://doi.org/10.1145/2490428.2490444

Zipkin, D. S. (2005). *Using STAMP to understand recent increases in malicious software activity* [Thesis, Massachusetts Institute of Technology]. https://dspace.mit.edu/handle/1721.1/32285

Zografos, K. G., & Regan, A. C. (2004). Current Challenges for Intermodal Freight Transport and Logistics in Europe and the United States. *Transportation Research Record*, *1873*(1), 70–78. https://doi.org/10.3141/1873-09