



SUPPLY-CHAIN RESILIENCE AND ECONOMIC SECURITY

Building Reliable Economies in an Interconnected World

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Abstract: *Modern economies depend on complex networks that move raw materials, components, information, and finished products across borders. These networks support economic growth and specialization, but they can also transmit shocks when a supplier, transport corridor, factory, or digital system fails. This article examines the relationship between supply-chain resilience and economic security, focusing on the risks that emerge from excessive concentration, geopolitical tensions, public-health emergencies, climate-related events, logistics bottlenecks, and cyber threats. It reviews lessons from the COVID-19 pandemic, semiconductor shortages, and disruptions to major maritime routes, and compares several strategies available to firms and governments. The article argues that resilience does not require countries to produce everything domestically. Instead, it requires a balanced approach that combines supplier diversification, targeted reserves of critical goods, transparent information, flexible transport networks, digital risk monitoring, and international cooperation. Particular attention is given to Uzbekistan, a landlocked economy for which reliable cross-border transport connections and predictable border procedures are especially important. The article concludes that economic security is strongest when countries reduce dangerous dependencies without abandoning the benefits of international trade.*

Keywords: *supply-chain resilience; economic security; global value chains; diversification; logistics; semiconductors; Uzbekistan; international trade.*



1. Introduction

A modern car may contain thousands of components produced in several countries. A smartphone combines minerals, chips, software, specialist machinery, and assembly work from different parts of the world. Food on a supermarket shelf may have travelled through farms, processing plants, warehouses, ports, and distribution centres before reaching a consumer. These examples show that the global economy is not simply a collection of national markets. It is a network of connected production and delivery systems. This network allows businesses to specialize, access larger markets, lower costs, and offer consumers a wider range of goods.

However, the same connections that make trade efficient can also spread disruption. If one factory stops producing a critical component, a company thousands of kilometres away may be unable to complete its own products. If a major shipping route becomes unsafe or a port is closed, delivery times can increase even for businesses that are not directly involved in the original incident. When goods become scarce, firms may pay more for transport and inputs, pass some of those costs to consumers, postpone investment, or reduce production. Supply-chain problems can therefore become problems of inflation, employment, productivity, and national economic security.

The COVID-19 pandemic made these relationships visible to the public. Factory closures, sudden changes in demand, port congestion, shortages of containers, and restrictions on movement affected the delivery of medical supplies, electronics, industrial materials, and consumer products. The pandemic did not create every weakness in global supply chains, but it exposed how limited inventories, concentrated suppliers, and insufficient contingency planning could make some systems fragile. Later events, including geopolitical conflict and disruptions around important maritime routes, reinforced the lesson that supply chains operate in a world of uncertainty [1; 2].

This article explores one central question: how can countries and businesses protect economic security while continuing to benefit from global trade? It addresses



three related objectives. First, it explains the concepts of supply-chain resilience and economic security. Second, it identifies major risks and examines lessons from recent disruptions. Third, it discusses practical strategies for businesses, governments, and international partners, with particular attention to Uzbekistan's geographic and economic position.

The main argument is that resilience should not be confused with complete self-sufficiency. Producing every good at home may be too expensive, technically difficult, or environmentally inefficient. A more realistic goal is to identify the dependencies that could cause serious harm, develop credible alternatives, and ensure that essential goods can still reach people and firms during a shock. Resilience is therefore not the absence of international dependence; it is the ability to manage that dependence intelligently.

2. Understanding Supply-Chain Resilience

2.1. What is a supply chain?

A supply chain includes the organizations, people, resources, activities, and information involved in moving a product or service from its original inputs to its final user. A typical chain may include extraction of raw materials, processing, component manufacturing, assembly, storage, transportation, customs clearance, wholesale distribution, retail, and after-sales support. In practice, these stages rarely form a simple line. A manufacturer may rely on hundreds of suppliers, and each supplier may depend on other firms. The result is a network with many connections and different levels of visibility.

Global value chains describe the way production stages are spread across countries, with value added at different points. A country may export a product assembled locally even though many of its components were imported. Another country may supply specialized machinery, design services, or raw materials used in that product. Such specialization can raise productivity, but it can also make the availability of a final product dependent on decisions and events in multiple locations [3].



2.2. The meaning of resilience

Supply-chain resilience is the ability of a network to prepare for disruption, absorb its effects, adapt operations, and recover while maintaining an acceptable level of service. It involves more than responding after a crisis begins. A resilient organization tries to understand its exposure before a shock, decide which goods and processes are essential, prepare alternatives, and learn from previous interruptions. Resilience can be assessed through indicators such as delivery reliability, recovery time, the availability of alternative suppliers, inventory coverage for critical items, and the speed with which information reaches decision-makers.

Resilience is not identical to robustness. Robustness refers to the ability to continue functioning under pressure, while resilience also includes adaptation and recovery. A robust system may withstand a specific disruption because it has strong capacity or protective measures. A resilient system can also reorganize when the disruption is different from what was expected. This distinction matters because companies cannot predict every future crisis. Their planning must therefore include flexible responses, not only fixed emergency procedures.

2.3. Efficiency and resilience: a necessary balance

For many years, companies competed by reducing costs, limiting inventory, and concentrating purchases with suppliers that offered attractive prices. These practices can be rational in stable conditions. Holding inventory ties up money and requires storage space; maintaining several suppliers may involve additional contracts, quality checks, and administrative work. Just-in-time production can reduce waste when deliveries are dependable.

Yet an operating model designed only for the lowest short-term cost may have hidden risks. A business that relies on one supplier for a critical component may save money every month but suffer large losses if that supplier fails. A company with no spare inventory may stop production after a short delay. The correct decision is not to hold unlimited stock or duplicate every supplier. It is to compare the cost of



prevention with the potential cost of interruption, taking account of the importance of each input and the likelihood and duration of disruption.

OECD analysis emphasizes that diversified global value-chain links can give firms alternative sources and markets, while poorly managed attempts to bring all production home may reduce the benefits of trade [1; 4]. Resilience therefore requires a careful balance between efficiency, flexibility, and preparedness.

3. Economic Security in a Globalized Economy

Economic security concerns a country's ability to maintain the economic conditions needed for stability, prosperity, and the well-being of its population. It includes the reliable availability of essential goods and services, the continuity of critical infrastructure, the ability of firms to operate, and the capacity of public institutions to respond to shocks. Economic security overlaps with national security, but it is broader than military protection. It also concerns food, energy, medicine, communications, transport, finance, industrial inputs, and technological capability.

Supply chains are central to economic security because modern production depends on imported and domestic inputs. A disruption in one sector may affect several others. For example, an energy shortage can reduce industrial output, increase production costs, and interrupt the cold storage of food or medicine. A shortage of electronic components can affect vehicles, household appliances, telecommunications equipment, and industrial machinery. If essential imports are unavailable for a long period, households may face higher prices and businesses may postpone investment.

Economic security does not mean that every import is dangerous. International trade allows countries to obtain goods that are expensive or impossible to produce efficiently at home. Imports can also provide access to advanced technology, specialist skills, and larger markets. The relevant question is whether a dependency is manageable. A country that imports a product from many independent suppliers may be less vulnerable than one that depends on a single source, even if both import the same share of that product.



A useful distinction is between ordinary commercial dependence and strategic vulnerability. Ordinary dependence is part of specialization and can create mutual benefits. Strategic vulnerability arises when the loss of a supplier or route would cause serious harm and no realistic substitute is available within an acceptable period. Policy should focus especially on critical goods for which substitution is difficult, supply is concentrated, and disruption would affect public health, essential infrastructure, or major industries.

Governments face a difficult task: they must protect essential economic functions without using security as a reason for unnecessary barriers to trade. Broad restrictions, excessive subsidies, and duplicated domestic capacity can increase costs and reduce competition. A better approach combines risk assessment with targeted measures, open communication with trading partners, and clear criteria for identifying genuinely critical dependencies [1; 4].

4. Major Risks and Vulnerabilities in Global Supply Chains

4.1. Geopolitical conflict and trade restrictions

War, sanctions, diplomatic disputes, export controls, and sudden changes in trade policy can interrupt the flow of goods or make transactions more expensive. Conflict may damage factories and infrastructure, prevent workers from reaching workplaces, or make transport routes unsafe. Even when production facilities remain intact, companies may be unable to obtain payments, insurance, shipping services, or permission to trade. The effects can spread to countries that are not directly involved in the conflict because they depend on the same materials or routes.

Geopolitical risk is particularly important when a product is produced by only a few countries or firms. If alternative sources do not exist, buyers cannot quickly switch suppliers. Companies may respond by diversifying their sourcing, increasing stocks of selected inputs, or redesigning products to use more widely available components. Governments may also negotiate supply agreements with partner countries. These measures should be based on evidence and proportional to the risk,



because excessive restrictions can create new vulnerabilities by reducing access to international markets.

4.2. Pandemics and public-health emergencies

A pandemic can affect both supply and demand at the same time. Restrictions may close factories or reduce the number of available workers, while consumers and businesses change what they purchase. At the beginning of the COVID-19 pandemic, demand patterns shifted rapidly, logistics operations faced new restrictions, and some production facilities could not operate normally. Ports, shipping companies, warehouses, and inland transport systems experienced delays and capacity constraints. UN Trade and Development reported that global maritime trade contracted by 3.8 percent in 2020 before rebounding by more than 3 percent in 2021 [5].

The crisis showed that emergency planning cannot be limited to hospitals or government agencies. Companies need continuity plans for staff absences, supplier closures, transport delays, and sudden demand changes. Governments need reliable information about stocks and production capacity, while border agencies and logistics operators need procedures that allow essential goods to move safely. Communication is crucial: uncertainty can lead firms to place excessive orders, worsening shortages for other buyers.

4.3. Natural disasters and climate-related events

Earthquakes, floods, storms, droughts, wildfires, and extreme temperatures can damage factories, roads, railways, ports, energy systems, and agricultural production. Climate change may increase the frequency or severity of some hazards and can place additional pressure on water availability, cooling systems, and transport infrastructure. A supplier may be efficient and financially healthy yet still be vulnerable because its facility is located in a region exposed to a specific hazard.

Risk assessment should therefore consider not only the country where a supplier is based but also the precise location of its factories, warehouses, energy sources, and transport links. Businesses can reduce exposure by using suppliers in



different geographic areas, designing products that allow substitution, and preparing emergency logistics arrangements. Public investment in resilient infrastructure, flood protection, early-warning systems, and reliable electricity also supports supply-chain resilience.

4.4. Logistics bottlenecks and transport disruptions

Transport is the physical connection between different stages of production. A shortage of truck drivers, a blocked railway, congestion at a port, or the closure of a major canal can delay goods even when factories are ready to ship. Alternative routes may be longer, more expensive, or limited by border procedures and infrastructure capacity. Delays can also create secondary problems: containers may arrive late for the next shipment, production schedules may be disrupted, and firms may need to pay for storage or expedited delivery.

Recent disruptions to maritime routes have highlighted the importance of route diversity. The OECD's 2025 Supply Chain Resilience Review discusses how drought reduced traffic through the Panama Canal in 2023 and how attacks on commercial shipping in the Red Sea since late 2023 disrupted traffic through the Suez Canal corridor [2]. Rerouting can preserve trade, but it may require additional vessels, fuel, time, and capacity. A route is only a credible alternative if the infrastructure, border processes, and logistics services can handle the extra flow.

4.5. Cybersecurity and technological failures

Supply chains increasingly depend on digital platforms for inventory management, shipment tracking, customs documentation, payment processing, and communication between firms. These tools can improve visibility and coordination, but they also create risks. A cyberattack on a logistics company or port operator can interrupt operations beyond the organization that was attacked. Software failures, inaccurate data, or unauthorized access can lead to delayed shipments, incorrect orders, and exposure of commercially sensitive information.

Companies should treat cybersecurity as part of operational resilience rather than as a separate technical issue. Basic measures include access controls, secure



backups, staff training, incident-response plans, and procedures for continuing essential work when digital systems are unavailable. Digitalization should be accompanied by clear responsibility, data protection, and tested manual alternatives for critical operations.

4.6. Concentration and limited visibility

One of the most important vulnerabilities is dependence on a small number of suppliers. A company may know its direct supplier but have little information about the firms that supply the supplier. This creates a hidden network of dependencies. A disruption several levels upstream can stop production even when the direct supplier appears financially stable. Concentration can also arise in specialized machinery, software, raw materials, and transport services.

Mapping supply chains is therefore a basic step toward resilience. Firms need to identify critical inputs, understand where they originate, estimate how quickly substitutes could be found, and determine whether several suppliers depend on the same underlying source. The purpose is not to eliminate all concentration. Some products require rare expertise and cannot be produced competitively in many locations. The purpose is to make important dependencies visible and decide how they should be managed.

5. Lessons from Recent Global Disruptions

5.1. COVID-19 and the limits of lean operations

The COVID-19 crisis became a stress test for the global production and logistics system. During different stages of the pandemic, factories faced closures or staffing shortages, shipping schedules changed, ports experienced congestion, and consumers shifted spending between services and goods. The combination of supply constraints and changing demand created delays that were difficult to solve quickly. Research on maritime transport found that the pandemic affected port activity, shipping networks, and the balance between supply and demand in ways that differed from earlier crises [6].



One lesson was that lean inventory can be efficient but may leave too little time to respond when deliveries stop. However, the experience does not prove that every firm should return to large inventories. Some goods become obsolete quickly, and storing all components would be prohibitively expensive. A more effective lesson is to classify inputs by importance and risk. Everyday items with many substitutes may need only routine inventory, while critical components with long replacement times may justify safety stocks or reserved capacity.

A second lesson concerns information. In a crisis, companies may not know whether a delay will last two days or two months. Without timely information, buyers may over-order, suppliers may struggle to allocate scarce output, and governments may respond too late. Better data sharing and coordinated planning can reduce these problems. Public authorities and businesses should establish communication channels before a crisis rather than trying to build them during one.

5.2. Semiconductor shortages: a small component, a large effect

Semiconductors, often called chips, are essential to computers, smartphones, vehicles, medical equipment, industrial machinery, and communication systems. Their production requires specialized facilities, equipment, knowledge, and substantial investment. Different stages of the value chain are concentrated in a limited number of locations and firms, so buyers cannot always replace a supplier quickly. The OECD notes that semiconductor shortages have caused disruptions in downstream industries and that the sector has important cross-country dependencies [7].

The pandemic contributed to semiconductor shortages through a combination of factors. Demand for computers and other electronic devices increased as remote work and study expanded, while demand for vehicles recovered after an initial decline. Factory interruptions and logistical problems constrained supply. The market was also affected by weather events and other production incidents. The result was not simply a shortage of chips; it was a shortage of chips in the specific categories required by different industries. A chip designed for one purpose cannot



always be substituted for another without changes to product design, testing, and regulatory approval [8].

The case illustrates three principles. First, criticality matters more than size: a low-cost component can stop a high-value product. Second, capacity cannot always be expanded immediately because advanced production facilities take years and large investments to develop. Third, resilience requires cooperation across the value chain. Firms can improve forecasting and diversify suitable inputs, while governments can support research, skills, infrastructure, and international partnerships. Building a domestic semiconductor industry may be appropriate for some economies, but it is not a realistic solution for every country or every chip type.

5.3. Maritime chokepoints and the cost of rerouting

International shipping depends on a network of ports, canals, straits, and inland connections. Certain chokepoints are especially important because they connect major producing and consuming regions. When one route becomes unavailable, ships may need to travel around a longer path. Longer journeys increase transit time and can reduce the effective capacity of the shipping fleet because each vessel completes fewer trips in a given period.

The Red Sea and Suez Canal disruptions demonstrate how a regional security problem can become a global logistics challenge. The Panama Canal's reduced capacity during the 2023 drought provides a different example: a natural event can also constrain a route that businesses normally treat as dependable. The OECD argues that route alternatives, flexible border procedures, transparency, and sufficient infrastructure are important for responding to such disruptions [2].

These examples show that resilience depends on the whole transport system, not just the main route. A country may identify an alternative corridor, but that corridor will not be useful if border crossings are slow, rail capacity is limited, customs documents are inconsistent, or logistics firms cannot provide enough vehicles. Effective contingency planning must therefore assess the entire journey from origin to destination.



5.4. What these cases have in common

The pandemic, chip shortages, and maritime disruptions had different causes, but they reveal shared weaknesses. First, complex networks can transmit problems across borders and sectors. Second, concentration and limited visibility make it difficult to find substitutes quickly. Third, transport and production capacity cannot always be expanded at short notice. Fourth, poor communication can magnify a shortage when businesses react defensively. Finally, no single tool can solve every problem. Inventory, diversification, infrastructure, technology, and cooperation work best as parts of a coordinated strategy.

6. Strategies for Building Resilient Supply Chains

6.1. Supplier diversification

Diversification means avoiding unnecessary dependence on one supplier, firm, country, or route. A company may qualify a second supplier for a critical component, purchase from different geographic regions, or redesign a product so that more than one input can be used. Governments can support diversification by maintaining trade relationships with a range of partners and avoiding policies that make alternative sourcing unnecessarily difficult.

Diversification should be meaningful rather than merely numerical. Two suppliers may appear independent but rely on the same factory, raw material, or transport corridor. A firm should therefore examine the dependencies behind each supplier. It must also consider quality, cost, lead time, and the practical ability of an alternative supplier to increase production during a crisis. A backup source that has never been tested may not provide reliable protection.

6.2. Strategic reserves and selective inventory

Safety stocks can provide time to respond when deliveries are interrupted. Strategic reserves may be especially useful for essential medicines, selected energy products, food supplies, and critical industrial inputs. The correct amount depends on the expected duration of disruption, shelf life, storage cost, domestic production capacity, and the availability of substitutes.



Reserves are not a universal answer. Excessive stock can expire, become obsolete, or tie up money that could be invested elsewhere. Poorly designed public stockpiles may distort markets or discourage private investment. A sound approach identifies priority goods, establishes transparent rules for releasing reserves, and periodically tests whether the stored products remain usable. Public and private planning should complement one another rather than duplicate effort without purpose.

6.3. Flexible production and product design

Resilience can be improved before goods enter the supply chain. Product designers can reduce the number of unique components, allow approved substitutes, and make it easier to switch between materials or suppliers. Manufacturers can train workers for multiple tasks, maintain some flexible capacity, and use production systems that can be adjusted when demand changes. Such flexibility may involve additional costs, but it can reduce the time required to recover from a disruption.

Not every product can be redesigned quickly. Changes to medical devices, aircraft components, medicines, and safety-critical equipment may require testing and regulatory approval. For this reason, resilience planning should begin early in the product-development process. The aim is to make substitution possible where it is safe, technically realistic, and economically justified.

6.4. Digital visibility and early warning

Digital tools can help companies understand where goods are, when they are likely to arrive, and which parts of the network are under pressure. Shipment tracking, inventory dashboards, supplier databases, demand forecasting, and risk alerts can improve decision-making. Artificial intelligence may help identify unusual patterns in delivery times, supplier performance, weather data, and demand. However, digital tools are only as reliable as the data and assumptions behind them.

A useful early-warning system should connect information to action. For example, if a supplier's delivery time rises sharply, the company should know who reviews the alert, which alternative suppliers are available, and when management



must approve a change. Firms should also test whether essential operations can continue if a platform fails. Technology is valuable when it improves visibility and response, not simply when it produces more data.

6.5. Logistics alternatives and resilient infrastructure

Governments and private operators can strengthen resilience by maintaining more than one feasible transport option. This may involve roads, railways, ports, airports, dry ports, warehouses, and cross-border logistics facilities. The goal is not to build duplicate infrastructure everywhere. It is to identify bottlenecks whose failure would have a large economic impact and ensure that alternative routes can handle a realistic share of disrupted traffic.

Infrastructure must be paired with efficient administration. Digital customs systems, predictable fees, consistent documentation, coordinated inspections, and reliable border operating hours can reduce uncertainty. In emergencies, procedures should allow rapid movement of essential goods while maintaining legitimate safety and security checks. Better connections between transport modes can also help firms shift freight when one mode becomes unavailable.

6.6. Collaboration and supplier relationships

Resilience is difficult to achieve when every firm keeps its information secret and focuses only on its own inventory. Buyers and suppliers can cooperate through longer-term contracts, shared forecasts, joint risk assessments, and agreed emergency procedures. Industry associations may help identify common risks, while public agencies can provide information about infrastructure, weather, border changes, and critical shortages.

Collaboration does not require companies to reveal all commercially sensitive information. It requires them to share the information needed for continuity and to establish clear expectations before a disruption. Trust, transparency, and regular testing make emergency coordination faster. Small and medium-sized enterprises may need support because they often have fewer resources to map suppliers, invest in digital systems, or hold safety stocks.



6.7. Sustainability as part of resilience

Environmental sustainability and resilience are closely connected. Water scarcity, extreme weather, resource depletion, and energy insecurity can disrupt production and transport. Reducing energy use, improving water efficiency, recycling materials, and using more diverse energy sources can lower exposure to some risks. However, sustainability measures should also be assessed for their own supply-chain dependencies. For example, technologies that reduce fossil-fuel use may rely on minerals and components that are concentrated in particular regions.

A resilient strategy considers the full life cycle of products and materials. Recycling, repair, and reuse can reduce the need for new raw materials, while responsible sourcing can lower environmental and social risks. The objective is not to choose between resilience and sustainability, but to design systems that can operate reliably while reducing long-term harm.

7. The Role of Governments and International Organizations

Businesses make many day-to-day supply-chain decisions, but governments influence the conditions under which networks operate. Public authorities provide transport infrastructure, border administration, energy systems, education, research support, emergency services, and the legal framework for trade. They can also help identify systemic risks that individual firms may overlook because they do not see the entire network.

A first priority is to establish a clear risk-assessment process. Governments should identify essential goods and services, map critical dependencies, estimate the consequences of interruption, and distinguish between short-term shortages and structural vulnerabilities. Risk assessments should be updated regularly and developed with input from businesses, researchers, logistics providers, and relevant public agencies. A static list can become outdated as technologies, suppliers, and trade routes change.

A second priority is to maintain reliable trade and transport systems. Investment in roads, railways, digital customs, energy networks, and storage



facilities can improve the ability to move goods during ordinary periods and crises. Predictable trade rules and transparent procedures help firms plan ahead. International cooperation is also necessary because no government can manage a cross-border network alone. Shared standards, information exchange, and coordination among customs and transport agencies can make alternatives more usable.

A third priority is targeted support for critical capabilities. Public policy may support workforce training, research, emergency stockpiles, domestic production where it is strategically justified, and partnerships with reliable foreign suppliers. Such measures should be evaluated against clear objectives and costs. Subsidizing an industry does not automatically make its supply chain resilient; the industry may still depend on imported machinery, materials, software, or energy.

International organizations can contribute by collecting data, sharing good practices, supporting trade facilitation, and helping countries improve infrastructure and preparedness. UN Trade and Development highlights the importance of business continuity plans, worker support, cooperation among stakeholders, digital solutions, and improved inland connections in maritime supply chains [5]. OECD research likewise stresses that diversification can reduce exposure to supplier-specific shocks, while excessive localization may deliver limited additional benefits and weaken the gains from global sourcing [4].

The central policy challenge is to avoid two extremes. The first is to assume that markets will always provide substitutes quickly, even for highly concentrated and essential goods. The second is to assume that economic security requires isolation from international trade. Both approaches are incomplete. Governments should build the ability to respond to disruption while preserving competition, innovation, and mutually beneficial economic relationships.



8. Supply-Chain Resilience and Economic Security in Uzbekistan

8.1. Geographic position and transport dependence

Uzbekistan's landlocked position makes international transport connectivity an important part of its economic security. Goods moving between Uzbekistan and many overseas markets must pass through other countries and depend on road, rail, air, or combined transport corridors. The reliability of customs procedures, border crossings, transit agreements, logistics services, and regional infrastructure therefore affects the cost and predictability of trade. A delay at a border or a disruption on a transit route can influence the delivery time of imported equipment and materials as well as the competitiveness of exported products.

For a landlocked economy, route diversification has a particular meaning. It is not enough to identify another line on a map; the alternative must be commercially viable, operationally reliable, and supported by infrastructure and cross-border coordination. Different corridors may vary in travel time, fees, capacity, security, and exposure to political or natural risks. Businesses and policymakers should compare these factors rather than relying on one route simply because it has historically been convenient.

8.2. Opportunities for stronger connectivity

Uzbekistan can strengthen resilience by improving the quality and reliability of its road and rail links, logistics centres, warehousing, and multimodal connections. Better coordination with neighbouring countries can reduce administrative delays and make alternative routes more practical. Digital documentation and more predictable border procedures can help firms estimate delivery times and respond when a route becomes congested. Training in logistics management and supply-chain analytics can also improve the ability of businesses to plan international shipments.

Regional cooperation can create benefits that no country could achieve alone. Transport corridors require compatible procedures, sufficient capacity, and communication across borders. Cooperation can include shared information on congestion, coordinated border operations, transparent transit charges, and



contingency plans for rerouting essential goods. By improving the reliability of regional networks, Uzbekistan can reduce the impact of disruptions while supporting trade and investment.

8.3. Critical goods, industrial inputs, and domestic capacity

Supply-chain resilience also involves deciding which goods require special attention. For Uzbekistan, as for other economies, a practical assessment could consider medicines and medical equipment, selected food products, energy-related inputs, agricultural supplies, industrial components, and equipment needed to maintain transport and communications. The appropriate response will differ by product. Some goods may justify strategic reserves; others may be better managed through multiple import sources, longer-term contracts, local maintenance capacity, or regional production partnerships.

Domestic production can improve resilience when local firms can produce essential goods competitively and reliably. It may also create employment, develop technical skills, and support industrial upgrading. Nevertheless, domestic production does not eliminate external dependence automatically. A local factory may rely on imported machinery, spare parts, chemicals, packaging, or energy. Policies should therefore evaluate the entire chain, including the inputs required to keep local facilities operating.

For example, increasing local food processing may reduce dependence on some imported finished products, but the sector still needs reliable agricultural inputs, refrigeration, packaging, transport, and access to markets. Similarly, producing more industrial goods locally may require imported technology and components. The strongest strategy combines feasible domestic capability with diverse international sourcing and reliable logistics.

8.4. Practical recommendations for Uzbekistan

First, public institutions and industry associations could develop sector-specific supply-chain risk maps that identify critical imported inputs, the concentration of suppliers, and realistic substitution times. Second, firms could be



encouraged to test alternative suppliers and routes before a crisis occurs. Third, border and customs procedures should remain transparent, predictable, and increasingly digital, while preserving necessary controls. Fourth, logistics education and professional training should be expanded so that businesses can use modern forecasting, inventory, and risk-management methods.

Fifth, public-private coordination can help identify which shortages would cause the greatest economic harm. Emergency planning should clarify which agency is responsible for communication, what information firms should provide, and how essential goods will be prioritized if capacity becomes limited. Sixth, regional partnerships should focus not only on announcing new corridors but also on their day-to-day reliability, capacity, cost, and ability to serve as genuine alternatives.

Finally, resilience policy should be measured. Possible indicators include the number of qualified suppliers for critical goods, the share of essential imports passing through a single corridor, average border-processing time, the availability of alternative routes, and the time required to restore a disrupted service. These indicators can help policymakers see whether investments are reducing risk rather than merely increasing spending.

9. Future Trends and Recommendations

9.1. Artificial intelligence and predictive risk management

Artificial intelligence and advanced analytics may improve demand forecasting, supplier monitoring, route planning, and early-warning systems. By combining data on orders, transport times, weather, prices, and supplier performance, firms can identify patterns that may signal a developing problem. Predictive systems can help decision-makers compare alternative responses before a disruption becomes severe.

Nevertheless, AI cannot remove uncertainty. Models may produce misleading results when data are incomplete, historical patterns no longer apply, or suppliers conceal relevant information. Firms should use AI to support informed decisions rather than replace human responsibility. They should also protect



confidential data and test systems against unusual scenarios, including cyber incidents and sudden policy changes.

9.2. Nearshoring, reshoring, and friend-shoring

Some firms are moving parts of production closer to their main markets, bringing selected activities back to their home country, or building stronger relationships with countries considered reliable partners. These strategies can reduce some transport risks and improve oversight. However, they may increase labour, energy, or production costs and may simply shift dependence to another narrow set of suppliers.

The choice should depend on the product and the nature of the risk. For goods that are essential and difficult to substitute, additional regional or domestic capacity may be justified. For goods with many reliable suppliers, global sourcing may remain the most efficient option. The aim should be to create options, not to replace one form of dependence with another.

9.3. Recommendations for businesses

Businesses can take several practical steps. They should map critical suppliers beyond the first tier, assess the consequences of losing each major input, and distinguish between high-risk and low-risk items. They should maintain relationships with qualified alternative suppliers, test emergency procedures, and agree on communication channels in advance. Inventory policy should be based on criticality and replacement time rather than a single rule for all products.

Companies should also review cybersecurity, insurance, contract terms, and the resilience of logistics providers. A written continuity plan is useful only if employees know their roles and the plan is tested. After each disruption, managers should examine what worked, what failed, and which changes would reduce recovery time. Small businesses can begin with simple risk registers and supplier lists before investing in more advanced systems.



9.4. Recommendations for policymakers

Policymakers should prioritize evidence-based risk management. They can improve trade and transport data, remove avoidable administrative bottlenecks, support infrastructure maintenance, and promote regional coordination. Targeted reserves may be appropriate for essential goods with long replacement times. Support for domestic production should be evaluated against full supply-chain dependencies, fiscal cost, competitiveness, and the availability of international alternatives.

Public policy should also support skills and innovation. Supply-chain professionals need knowledge of procurement, logistics, data analysis, cybersecurity, and international trade rules. Universities and training institutions can develop courses that connect economic theory with practical risk-management problems. Research partnerships between universities, businesses, and public agencies can improve the evidence base for decisions.

9.5. Measuring resilience rather than assuming it

A common mistake is to treat a policy announcement or investment as proof that a supply chain has become resilient. Resilience should be assessed through performance under plausible stress scenarios. Organizations can simulate the loss of a major supplier, a week-long transport interruption, a cyber incident, or a sudden increase in demand for a critical product. Such exercises reveal weaknesses in communication, authority, data, and capacity.

Useful indicators should reflect the outcomes that matter. These may include time to recover, the percentage of critical demand that can still be met, the number of independent supply options, the cost of switching suppliers, and the reliability of alternative transport routes. No single indicator provides a complete picture, so decision-makers should use a small set of measures and review them regularly.

10. Conclusion

Supply-chain resilience has become a central issue for economic security because modern economies depend on networks that cross sectors and national borders. These networks support specialization, innovation, and access to global



markets, but they can also transmit shocks when a supplier, factory, transport route, or digital system fails. The COVID-19 pandemic, semiconductor shortages, and disruptions to maritime chokepoints demonstrate that a local problem can create wider economic consequences when alternatives are limited and information is incomplete.

The evidence reviewed in this article points to several conclusions. First, resilience begins with visibility: businesses and governments must understand which inputs are critical, where they come from, and how quickly they can be replaced. Second, diversification is often more useful than attempting complete self-sufficiency. A network with several genuinely independent sources can offer more options during a disruption, although diversification must be tested and balanced against cost. Third, targeted reserves, flexible production, digital monitoring, cybersecurity, and contingency planning can reduce recovery time. Fourth, infrastructure and predictable border procedures are essential because alternative routes are valuable only when they can be used in practice.

Governments have an important role in supporting infrastructure, reliable institutions, critical capabilities, and cooperation, but policies should be targeted and evidence-based. Excessive localization may increase costs without eliminating hidden dependencies. International trade remains a source of resilience when it provides access to multiple suppliers, technologies, and markets. The objective is therefore not to close economies, but to make their international connections more reliable and less vulnerable to severe shocks.

For Uzbekistan, resilience is closely connected with transport connectivity, regional cooperation, digital border procedures, and the careful management of critical imports. Improving route alternatives and logistics capacity can strengthen trade reliability, while domestic production and strategic reserves may be appropriate for selected goods. These measures should be planned around measurable risks and the actual needs of businesses and households.



Ultimately, a resilient supply chain is not one that never experiences disruption. It is one that can recognize danger early, adapt when conditions change, continue delivering essential goods, and recover without causing unnecessary economic damage. In an interconnected world, economic security depends not on eliminating interdependence, but on managing it with foresight, flexibility, and cooperation.

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