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Rethinking interdependence: From self-reliance to irreplaceability

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Abstract
Governments increasingly view economic interdependence not simply as a source of shared gains, but also as a potential source of strategic vulnerability, as goods, technologies, and infrastructure can be turned into instruments of coercion. Building on on Keohane and Nye's distinction between sensitivity and vulnerability alongside the literatures on weaponized interdependence and network centrality, this paper argues that the dominant policy response, self-reliance, addresses only half the problem. Self-reliance reduces a state's own exposure to disruption, but it does not make that state harder for others to replace. The paper develops irreplaceability as a distinct strategic objective with two dimensions- withstanding the loss of a relationship, and raising the cost others bear from losing access to what the state provides. Through case evidences of the United States, the EU, Japan, China, and India, it shows that much of current economic-security strategy, including friend-shoring, de-risking, and new economic-security legislation, remains concentrated on the first dimension. China's processing dominance and Taiwan's position in semiconductor fabrication illustrate the second dimension, though reducing dependence can itself erode the capabilities that sustain it. India's shift from Atmanirbhar Bharat toward strategic indispensability captures this tension directly. The paper concludes that irreplaceability is neither permanent nor guaranteed by reduced dependence alone; it must be actively sustained within the global networks that others continue to need.

Keywords: Economic interdependence, weaponised interdependence, self-reliance, irreplaceability, economic security, global valie chains

Introduction

The world is more interconnected today than ever, and governments are ever more concerned about this increasing interdependence. Economic linkages once seen as largely benign are now being treated as potential security vulnerabilities (European Commission, 2023) [19]. The paradox is clear, states are trying to reduce the risks of interdependence without giving up interdependence itself.

Keohane and Nye's framework of complex interdependence emphasises the multiple channels through which states are connected, including economic, political and social ties (Keohane & Nye, 2012) [37]. But interdependence does not mean equal dependence. As Keohane and Nye (2012) [37] point out, it is the asymmetry in dependence that becomes a source of power. The less dependent side has greater room to withstand changes in the relationship [1]. This asymmetry can also exist within wider networks, where control over central nodes gives some states greater influence over how goods, money and information move (Farrell & Newman, 2019) [20]. Interdependence, therefore, is shaped not only by who depends on whom, but also by where states are positioned within the networks connecting them. This makes vulnerability central to understanding the politics of interdependence.

When Interdependence Becomes Vulnerability

Not every dependence creates the same vulnerability. Keohane and Nye distinguishes between "sensitivity", or the immediate costs of a change elsewhere, and "vulnerability", which persists even after a state tries to adjust (Keohane & Nye, 2012) [37] [2]. What matters, therefore, is not only how dependent a state is, but how easily it can find alternatives and at what cost. A state with few or costly alternatives has far less room to absorb a disruption. In global value chains, even creating those alternatives can be difficult because sunk costs and specialised investments make existing relationships resistant to change. Marvasi describes these GVCs as "sticky" and "less responsive to change."(Marvasi, 2022) [44]. The difficulty is visible in the economics of diversification. The IEA estimates that capital costs for new critical-mineral refining projects are 20 per cent to more than 150 per cent higher outside dominant suppliers, while operating costs are around 50 per cent higher on average (IEA, 2026).

The COVID-19 pandemic brought these vulnerabilities into sharp focus. Between February and Apil 2020, global industrial production declined by 15 per cent, while world trade contracted by almost 17 per cent (Marvasi, 2023) [45]. Disruptions to global supply chains showed how difficult it could be to replace suppliers when production was highly concentrated (Javorcik, 2020) [33]. The problem was not interdependence itself, but the concentration of dependence in systems built primarily for efficiency. The pursuit of efficiency had itself contributed to the concentration that made some supply chains difficult to replace. Global value chains did not disappear after the shock; they proved more resilient than a simple deglobalisation narrative would suggest (Marvasi, 2022) [44]. Greater domestic production does not automatically eliminate vulnerability. As Marvasi notes two things- (i) "the idea that resilience can be obtained by increasing the reliance on domestic production does not find support in the facts." and, (ii) "reshoring provides protection from foreign shocks at the cost of increasing the already high exposure towards domestic shocks", since greater diversification can sometimes come from sourcing more inputs internationally rather than less (Marvasi, 2022) [44].

The shift from economic dependence to strategic vulnerability became clearer with recent geopolitical shocks. Russia's weaponisation of energy assets during the Ukraine

war has shown how dependence on a critical resource could become a security risk (LaBelle, 2023) [19]. The same pattern and logic is seen in semiconductors and critical minerals, as now supply chains have become closely tied to national security and great-power competition (Luo and Van Assche, 2023) [43]. Meanwhile, the concentration is particularly higher at the refining stage with the average share of the top refined supplier across energy minerals reached around 72 per cent in 2025 [24], up from 70 per cent in 2020 (IEA, 2026) [32]. This is explicitly mentioned in the US policy and White House order on processed critical minerals being essential for "economic and national security", directed a Section 232 investigation into their national-security implications (White House, 2025) [67].

The strategic importance of these dependencies also depends on where they sit within wider networks. Control over central nodes or "chokepoints" gives states influence beyond the value of the resource itself, particularly when such nodes are difficult to bypass (Farrell & Newman, 2019) [20]. The Red Sea disruption shows the vulnerability in physical networks. During January and February 2024 [64], Suez Canal trade was 50 per cent lower than its level a year earlier. While rerouting around the Cape of Good Hope increased average delivery times by 10 days or more (Kamali *et al*., 2024). By mid-2024 [35], diversions from the Red Sea and Panama Canal have raised global vessel demand by 3 per cent and container-ship demand by 12 per cent relative to the level that would otherwise have been required without the disruptions (UNCTAD, 2024) [29].

In critical minerals also, for instance, processing can become a source of leverage because downstream industries may depend on a small number of specialised processing networks (Deberdt *et al*., 2026) [14]. China has been the leading refined-material producer for 19 out of all 20 minerals analysed by the IEA in 2025 [13], accounting for an average market share of approximately 70 per cent (IEA, 2025) [13]. Economic interdependence, therefore, is no longer being viewed only through the lens of trade and efficiency; it is increasingly being treated as a question of security.

Managing the Strategic Dependence

The United States experience reflect this shift. Washington is building domestic capacity in critical technologies while also reshaping its external supply chains. The CHIPS Act seeks to secure US semiconductor production, while the policy of friend-shoring encourages companies to diversify supply chains among allies or trusted partners. "Friend-shoring" refers to building and deepening relationships with geopolitical partners who share common values and approaches in the global economy (Yellen, 2022) [71]. However, semiconductor production itself is largely international, with different stages of production that are spread across countries (Kwon, 2026) [7]. The aim is to identify those dependencies that benefit and those where disruption would carry disproportionate strategic costs. Washington is trying to decide where dependence is acceptable and where it is not. In critical sectors, the effort is to create alternatives at home and among trusted partners.

The European Union has taken a similar approach through "open strategic autonomy" and de-risking. Rather than seeking to decouple from major trading partners, the EU aims to address specific vulnerabilities while preserving most of its economic links with the world. Its Economic Security Strategy therefore stresses "precision" and "proportionality" in dealing with risks. This approach extends to EU's treatment of dual-use technologies with both civilian and strategic applications, such as advanced semiconductors, quantum technologies, and artificial intelligence, where fears of technology leakage have become part of economic-security policy (European Commission, 2023; Chaudfontaine Group, 2026) [9, 19]. This sums to what Juncos and Vanhoonacker describe as a "reluctant geopoliticisation" of economic policy where security concerns are now shaping economic instruments without displacing the broader commitment to open markets (Juncos and Vanhoonacker, 2024) [34] [3]. The approach reflects an attempt to make interdependence safer without abandoning it (Von der Leyen, 2023) [68].

The US has promoted friend-shoring, while the EU has adopted de-risking and open strategic autonomy. The objective is therefore to reduce exposure to dependencies that are difficult to replace. These approaches seek to reduce dependence in critical areas while preserving the wider benefits of global trade and investment (European Commission, 2023) [19].

There is also an important limit to the pursuit of self-reliance, as measures taken to reduce dependence can sometimes weaken the capabilities that make a state difficult for others to replace. Luo and Van Assche warn that "national security goals... can conflict with the competitive survival of the very firms the state seeks to protect" (Luo and Van Assche, 2023) [43]. When companies are required to restructure their global supply networks or bring parts of production back home, this can increase costs and slow technological development. Such changes can lead to "higher production costs, slower technology diffusion, potential misalignment with climate timelines" (Deberdt *et al*., 2026) [14]. The implication is that reducing dependence too far can also weaken the global scale, technology and market integration that make a state difficult for others to replace (Marvasi, 2022) [44].

From Self Reliance to Irreplaceability

Self-reliance gives way to a different strategic objective-irreplaceability. States try to ensure that they are less vulnerable to the loss of any one relationship while becoming harder for others to replace. The idea builds on a longer literature on asymmetric dependence. Albert Hirschman provides an early foundation for understanding how asymmetries in dependence can generate power (Hirschman, 1980) [28]. Keohane and Nye developed this insight with "vulnerability" as not simply whether states are dependent, but how costly it is for them to adjust when a relationship is disrupted (Keohane and Nye, 2012) [73]. The development of global networks adds another layer as dependence is not only between two states but can be concentrated in particular hubs and nodes through which wider economic flows pass. Farrell and Newman show how "network centrality" can become a source of power (Farrell & Newman 2019) [20]. In a dyadic relationship, states may be able to find alternatives more easily. But when dependence is embedded in wider networks, exit can become more difficult because alternatives are not simply a matter of finding another bilateral partner. Drezner, Farrell and Newman distinguish "dyadic patterns of asymmetric dependence" from dependence embedded in "networked structures", where there are fewer exit options (Drezner *et al*., 2021) [15]. Irreplaceability brings these strands together

by asking not only how exposed a state is to disruption, but also how difficult it is for others to substitute for what that state provides.

Japan has articulated a similar dual objective in its economic-security strategy- "strategic autonomy" to reduce excessive dependencies and, "strategic indispensability" by developing technologies and industries that are difficult for others to do without (Armstrong *et al*., 2025) [2]. It not only seeks to protect core functions from external coercion but also to make Japan integral to the global chain. Japan's Economic Security Promotion Act (ESPA) of 2022 [54] created a four-part framework covering the security of critical product supplies, the continuity of essential infrastructure services, support for research development of specified critical technologies through public-private R&D, and introducing a system for the nondisclosure of sensitive patent applications (Kawai, 2025) [36].

Japan subsequently extended this economic-security architecture to the handling of sensitive information in the private sector. In May 2024 [29], the Diet approved a security-clearance system that extended background checks to private-sector actors in areas such as space and cyber, facilitating the government's provision of sensitive information concerning technology gaps and critical infrastructure. As Armstrong, Solís and Urata note, the system was intended to extend economic-security coordination beyond the state and into strategically important private-sector activities (Armstrong *et al*., 2025) [2].

Self-reliance focuses on reducing dependence on others. Irreplaceability shifts the focus to whether others can offord to lose you. That is the conceptual shift. This creates two dimensions of irreplaceability as, (a) the self-reliance already discussed as reducing one's own vulnerability by building domestic capacity and diversifying suppliers, and, (b) increasing one's value to others by becoming difficult to replace. The first is about being able to withstand disruption. The second is about making it costly for others to lose what you provide. A state can become more self-reliant without necessarily becoming more important to others. Irreplaceability adds this second side of dependence, not only reducing what you need from others but making what others need from you harder to replace. The first reduces the cost of being cut off; the second raises the cost of cutting you off.

China's Dual Circulation Strategy places greater emphasis on domestic demand and productive capabilities without withdrawing from international markets and trade. For China has elevated technological self-reliance as a strategic priority. China's 14th Five-Year Plan links this technological push to a "new type of nationwide system" for mobilising national capabilities around key and core technologies, while also calling for Chinese products, technologies and standards to expand globally (National People's Congress, 2021). At the same time, Beijing has recognised that its own position in global markets can be a source of leverage, seeking to use existing dependencies on China to strengthen its position (Sutter & Sutherland, 2021) [61]. This creates a different form of resilience- reducing vulnerability at home while retaining influence through dependencies abroad.

The second dimension depends on reducing substitutability. A state becomes difficult to replace when what it provides cannot be reproduced elsewhere quickly, cheaply or at comparable scale. Being economically important is not enough. What matters is whether others can readily find an alternative. The availability of alternatives is therefore central to irreplaceability. Marvasi notes that "effective diversification" requires high substitutability between suppliers. Where inputs are standardised, substitution is easier, but where production depends on "highly complex and customized inputs", finding alternative suppliers can be difficult and costly. This means that irreplaceability does not arise simply because a state produces something important; it arises when replacing what that state provides involves substantial adjustment costs, time and technical difficulty (Marvasi, 2022) [44].

Irreplaceability can come from different sources- technological leadership, control over critical processing, or the ability to supply goods at a scale that others cannot easily replicate, market size or specialised capabilities accumulated over time. Taiwan shows the first as some of the world's leading technology companies rely heavily on one Taiwanese firm. Luo and Van Assche citing Capri (2022) [8], note that Google, Apple, and Amazon rely on Taiwan Semiconductor Manufacturing Company (TSMC) alone for nearly 90 percent of their chip production. This is a position built on decades of accumulated fabrication expertise rather than raw material endowment (Luo & Van Assche, 2023; Capri, 2022) [8, 43]. China's position in critical mineral processing shows another route to irreplaceability- its influence derives not simply from mineral reserves, but from its concentration in the processing stages on which downstream industries depend.

Physical infrastructure creates a distinct form of irreplaceability as seen in case of Red Sea earlier, because substitution may require rerouting, additional capacity, time and higher costs and not simply finding another supplier. Unlike a standardised good, where substitution may be achieved by shifting to another producer, physical networks are embedded in infrastructure that cannot always be replicated or expanded quickly. The network's value therefore depends on what passes through them, also on how easily the network itself can be bypassed, and on how exclusive is the position.

Irreplaceability can create leverage, but the two are not the same. A state may be difficult to replace without deliberately using that position to pressure others. Its importance lies first in the structure of the relationship; leverage emerges when that position can be used to influence the choices of others. Irreplaceability is therefore a position within the relationship.

Critically, a state's structural irreplaceability is also never permanent. As Farrell and Newman observe, states remain locked into existing network structures only until the costs of staying outweigh the benefits, prompting targets to pursue "transitions to new arrangements" and entire network reconfigurations (Farrell & Newman 2019) [20]. These asymmetric vulnerabilities encourage targets to actively develop "work-arounds" through disruptive innovation to avoid ceding political concessions (Drezner *et al*., 2021) [15]. In critical mineral supply chains, for example, downstream firms were able to pursue "techno-nationalist strategies" and perform chemical substitutionsto bypass cobalt-dependent processing centers and to erode the dominance of a key supplier's space (Deberdt *et al*., 2026) [14].

The Bharat Way

India's approach reflects the same tension in a different form. Atmanirbhar Bharat was not intended to be disengagement from global economy. In fact, its a way to strengthen India's domestic capabilities while remaining connected to global markets (PMO, 2020) [33]. This has translated into efforts to reduce dependence in strategic sectors, including defence and critical minerals, while India continues to deepen technological and economic partnerships with other countries. Evident in KABIL's acquisition of a 15,703-hectare area in Argentina for lithium exploration and mining and its subsequent cooperation with Australia on potential joint investment in lithium and cobalt assets (PIB 2025a; PIB 2025b). The emphasis, therefore, is not simply on producing more at home, but again on reducing vulnerabilities in areas where external dependence can become strategically costly while using international partnerships to build capabilities that cannot be developed overnight. India's National Critical Mineral Mission covers the mineral value chain, including extraction, beneficiation, processing and recycling. It also covers acquistion of mineral assets abroad (GoI, 2025; Dutta *et al*., 2026) [16, 24].

India's experience during pandemic also showed how domestic capability can create external value. The country supplied paracetamol and hydroxychloroquine medicines to approximately120 countries in the early phase of the pandemic (Singh, 2021) [15]. No major economy can realistically produce everything it needs. The more useful question is whether a country can withstand the disruption of a particular relationship while remaining connected to others. This is where the idea of self-reliance begins to move towards strategic resilience.

For India, this means that Atmanirbharta cannot be an end in itself. Its very essence lies in combining domestic resilience with international integration. India has to build strategic reserves of critical goods while at the same time make itself a preferred supplier of cutting-edge technologies to other major global economies. NITI Aayog roadmap envisions a move for India from its position as a major semiconductor market towards becoming a “critical node in the global value chain.” (NITI Aayog, 2026). The Economic Survey 2025 [25, 52]-26 frames India's trajectory as a movement from “strategic resilience” towards “strategic indispensability”, with global value-chain integration. The significance of this shift is not simply expanding dmoestic outcome, but that it becomes harder to bypass within global production networks. The strategy is therefore not simply to embed Indian firms in global production systems, but also to embed global production within India (GoI, 2026) [22]. The strongest states will not be those that need nobody, but those that can withstand being denied access to others while remaining difficult for others to replace.

Conclusion

The broader implication is that economic interdependence is becoming a field of strategic positioning. The value of a state within a global network cannot be judged only by the volume of what it produces or trades. It also depends on whether its position can shape the choices available to others. This places a limit on the idea that reducing dependence is, by itself, a measure of success. A state may become safer without becoming more influential, just as a state may become highly influential without being secure itself. The more consequential position lies at the intersection of the two- security from external disruption and significance within the networks that others continue to need.

Technological leadership can be challenged by new production capabilities; concentrated processing can be reduced through alternative technologies and suppliers; and network centrality can weaken as infrastructure and production patterns change. Irreplaceability is therefore sustained not only by possessing a critical capability but also by continuously improving it, by scaling it up and the expertise, and remaining in networks that others continue to value. The question, therefore, is not whether interdependence will survive. It is what kind of interdependence states will build- and where they will position themselves within it.

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