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Finnish pharmaceutical sector in the shifting geopolitics

European Union's role in managing strategic dependencies

International Business, Department of Marketing and International Business

Master's thesis

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Abstract

The main object of this research is to provide an understanding of the EU's intermediate role of managing Finland's strategic dependencies in pharmaceuticals, and how it reflects on the national economic security and security of supply. EU's risk mitigating role is assessed in the light of stressed transatlantic relations followed by the tariff wars of early 2025 and China's involvement in the active pharmaceutical ingredients' (API) production as well as the trade war with the U.S.

First, Finland's position in the pharmaceutical supply chains is examined through Global Production Network (GPN) and network embeddedness theories. This provides a background on the structures behind the dependencies and power dynamics. After that, the nature of dependencies and possible interdependencies, as well as possibilities for weaponization are examined. Then these findings are framed into the political economy framework, and the vulnerabilities are observed through the process of securitization, linking the vulnerabilities to economic security and security of supply. Lastly, the EU level mechanisms are applied to the phenomenon. The literature review shows that political economy framework's explanation of both the socio-economic and political factors stemming inside and outside the observed economy affect the industry performance and market outcome of the GPN. The internal socio-economic and political factors include, for example, domestic regulation, reimbursement systems, security of supply mechanisms, market size, industrial competitiveness, and state-industry relations. The external factors consist of geopolitical trade tensions, global market structures, power asymmetries between states, international competition, trade policy actions, and the organization of global production networks. Securitization further explains the contexts when the vulnerabilities are deemed strategic.

This research also utilizes Finland's trade data of 2025 to compute the import and export dependencies. These results showed high concentrations of pharmaceuticals on extra-EU destination countries and countries of origin. This information is valuable, as import concentration affects the security of supply, and export concentration affects the economic security. The flagged products are then reviewed for trade dependencies with the U.S., China, and India. Additionally, the strategic relevancies of the product groups are considered.

The results of this thesis provide a theoretical basis for positioning the EU's tools on the global pharmaceutical production network, while considering Finland's security of supply and economic security. The findings provide new insights into the existing academic literature. Previous literature has focused on the pharmaceutical industry of the EU as a whole, disregarding the uniqueness of healthcare and security of supply systems of each member country. This makes the proposed process new in the academic literature in the IB field. Additionally, this research proposes conditions when pharmaceuticals can be turned into strategic matters through the securitization process. The analysis agrees on findings on the external powers' behavior patterns affecting economic security and the institutional responses of regional states.

Keywords: pharmaceutical industry, security of supply, economic security, global production networks, strategic dependence, the EU's role in risk control

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Tiivistelmä

Tämän tutkimuksen pääasiallisena tavoitteena on selvittää, millainen välittäjän rooli EU:lla on Suomen strategisten riippuvuussuhteiden hallinnassa lääkealalla ja miten tämä heijastuu kansalliseen taloudelliseen turvallisuuteen ja huoltovarmuuteen. EU:n riskienhallintaroolia arvioidaan huomioon ottaen jännittyneet transatlanttiset suhteet, joita seurasivat vuoden 2025 alkupuolella käydyt tullisodat, Kiinan osallistuminen lääkeaineiden tuotantoon sekä kauppasota Yhdysvaltojen kanssa.

Suomen asemaa lääkkeiden toimitusketjuissa tarkastellaan globaalien tuotantoverkostojen (GPN) sekä tuotantoverkostojen kytkeytymisen asteen kautta. Tämä tarjoaa taustatietoa riippuvuuksien ja voimadynamiikkojen taustalla olevista rakenteista. Riippuvuuksien ja mahdollisten keskinäisriippuvuuksien luonnetta ja aseistamisen mahdollisuutta tarkastellaan. Nämä havainnot sijoitetaan poliittisen talouden viitekehykseen, ja haavoittuvuuksia tarkastellaan turvallistamisen prosessin kautta, liittäen haavoittuvuuden taloudelliseen turvallisuuteen ja toimitusvarmuuteen. Lopuksi ilmiöön sovelletaan EU-tason mekanismeja. Kirjallisuuskatsaus osoittaa, että poliittisen talouden viitekehyksen selitys sekä sisäisistä että ulkoisista sosioekonomisista ja poliittisista tekijöistä vaikuttaa toimialan suorituskykyyn ja markkinatuloksiin, kun taas turvallistaminen selittää tarkemmin, milloin haavoittuvuudet katsotaan strategisiksi.

Tässä tutkimuksessa hyödynnetään myös Suomen ulkomaankauppatietoja vuodelta 2025 tuonti- ja vientiriippuvuuksien laskemiseksi. Tulokset osoittavat lääkkeiden korkean keskittymisen EU:n ulkopuolisiin alkuperä- ja kohdemaihin. Tämä tieto on arvokasta, sillä tuonnin keskittyminen vaikuttaa toimitusvarmuuteen ja viennin keskittyminen taloudelliseen turvallisuuteen. Analyysissä esille nousseiden tuotteiden riippuvuudet Yhdysvaltojen, Kiinan, ja Intian suhteen lasketaan. Lisäksi tuoteryhmien strategiset keskeisyydet otetaan tarkasteluun.

Tämän opinnäytetyön tulokset tarjoavat teoreettisen perustan EU:n kauppapoliittisten välineiden sijoittamiselle globaaliin lääkkeiden tuotantoverkoston huomioon ottaen Suomen huoltovarmuuden ja taloudellisen turvallisuuden. Tulokset tuovat uutta näkemystä olevassa olevaan akateemiseen kirjallisuuteen. Aikaisempi kirjallisuus on keskittynyt EU:n lääketeollisuuteen kokonaisuutena jättäen huomiotta kunkin jäsenmaan terveydenhuolto- ja huoltovarmuusjärjestelmien erityspiirteet. Tämä tekee ehdotetusta vaikuttamisprosessista uudentyyppisen kansainvälisen liiketoiminnan akateemisessa kirjallisuudessa. Lisäksi tutkimuksessa esitetään edellytykset, joiden täytyessä lääkkeet voidaan nostaa strategisiksi kysymyksiksi turvallistamisprosessin kautta. Analyysi tukee havaintoja ulkoisten toimijoiden käyttäytymismalleista, jotka vaikuttavat taloudelliseen turvallisuuteen, sekä alueellisten valtioiden institutionaalisista reaktioista.

Avainsanat: Lääketeollisuus, huoltovarmuus, taloudellinen turvallisuus, globaalit tuotantoverkostot, strateginen riippuvuus, EU:n rooli riskienhallinnassa

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EQUATIONS

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ABBREVIATIONS

Equation 1. HHI computation. CDI1 criterion	52
Equation 2. CDI2 criterion	53
Equation 3. CDI3 criterion	53
ACI Anti-Coercion Instrument	
API Active pharmaceutical ingredient	
CDI Core Dependency Indicator	
CMA Critical Medicines Alliance	
EDQM European Directorate for the Quality of Medicines	
EMA European Medicines Agency	
FDI Foreign Direct Investment	
HERA Health Emergency Preparedness and Response Authority	
HHI Herfindahl-Hirschman Index	
IP Intellectual Property	
OSA Open Strategic Autonomy	
R&D Research and Development	

1 Introduction

Between August 2025 and May 2026, the 47th president of the United States of America, Donald J. Trump, has issued 42 executive orders, four memoranda, and 12 proclamations related to trade and tariffs during his presidential term which started in January 2025. In January 2025, Trump signed America First Trade Policy memorandum into law. (Ballotpedia 2026.) Major reforms in the U.S. reflect on the global political economy, as the U.S. has the largest economy in the world with over 30 trillion USD GDP in 2025. In comparison, the second largest economy, China, has a GDP of 19 trillion USD, and the EU's largest economy, Germany, lags with a GDP of over 4 trillion USD. (Statista 2025.) Economic globalization involves a growing interdependence of economies due to increasing cross-border trade of commodities and services, the flow of international capital, and the spread of technologies (Alkharafi & Alsabah 2025; Yeung & Coe 2015). Increasing international transactions also reinforce mutual dependencies of countries (Keohane & Nye 2012, 7). Given the U.S.' and China's overpowering global economic power, such trade barriers and policy reforms reduce trade dramatically, disturb the global value chains, and cause uncertainty for MNEs and investors (Alkharafi & Alsabah 2025, 3; Alschner 2025, 498).

For the European Union, the U.S. accounts for one of the largest trading partners in terms of exports outside of the union, alongside China. The exports made by the U.S. reached 600 billion USD in 2024. As for imports, the U.S. was one of the main suppliers of the region with 450 billion USD in 2024. (OEC 2025.) The U.S. accounts roughly for 5% of the Finnish imports of 74 billion euros and 10% of the Finnish exports of 72 billion euros (Finnish Customs 2026). Figure 1 showcases the Finnish imports in 2025 based on the Finnish Customs database Uljas, highlighting the importance of Chinese imports of the total import amount.

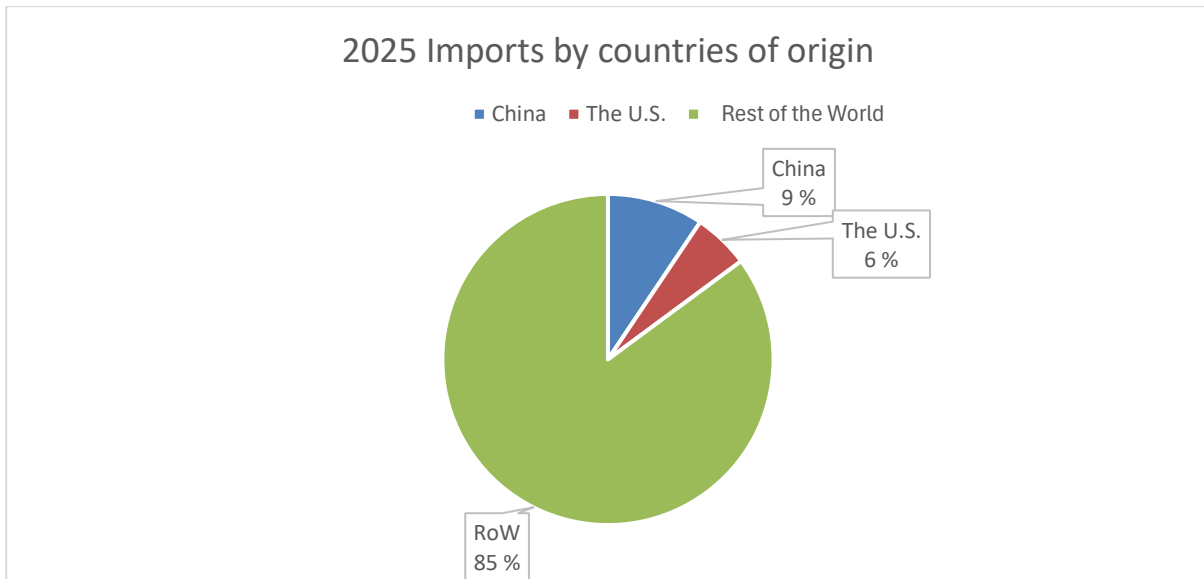


Figure 1. Finland's imports in 2025, China, the U.S. and rest of the world (Finnish Customs, 2026)

Figure 2 on the other hand illustrates the Finnish exports in 2025. The share of the U.S. in the total exports is larger than China's, showcasing the importance of the transatlantic trade relation.

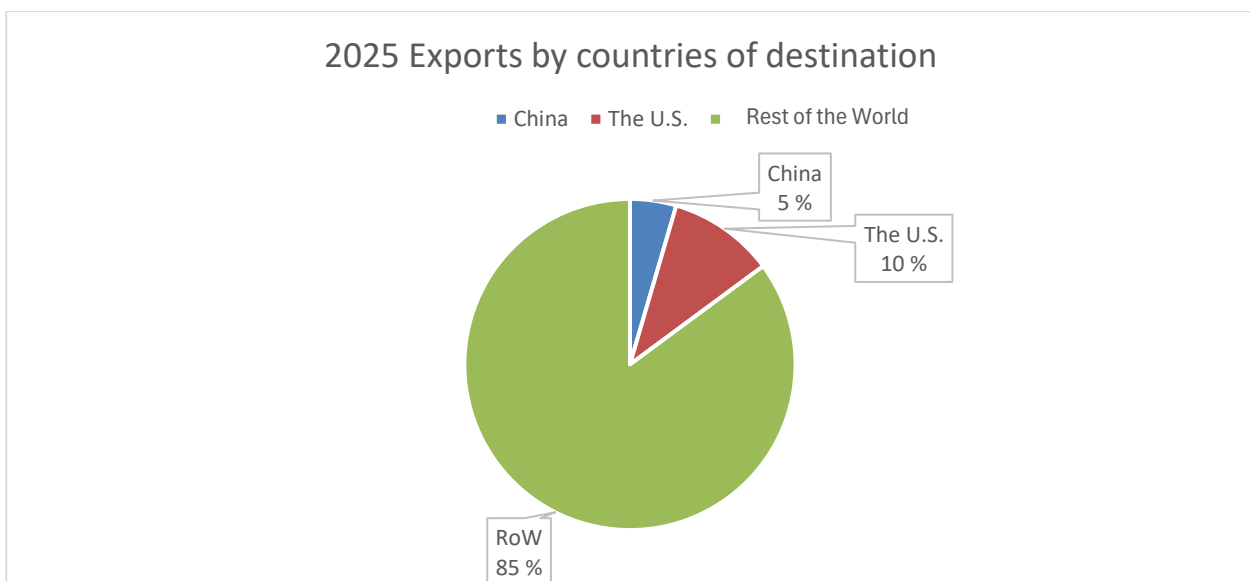


Figure 2. Finland's exports in 2025, China, the U.S. and rest of the world (Finnish Customs, 2026)

The trade policies of the world's biggest economies affect the rest of the world. Firms in Europe selling to the US had a relative decline in revenue during the U.S. – China trade war starting in 2018 (Benguria 2023, 844). As Fajgelbaum & Khandelwal (2026) emphasize, the consumers in the tariff-imposing countries' bear the costs of tariffs through higher consumer prices and a lowered real income. As the U.S.-China trade war is highly complex regarding taxes and extensive geopolitical implications, close trade partners and overall global macroeconomy is affected by the trade war. The trade conflict exceeds the bilateral dimension and marks the global economy. (Chen

2024, 5.) On a global scale, the U.S. – China trade dispute is seen as a threat to world economy's growth due to their embeddedness in the global economy (Goulard 2020, 57; Dong et al. 2019). Additionally, these two economic superpowers increasingly challenge the rule-based global trade system and WTO norms (Alschner 2025; Cha 2023). While the US has unilaterally increased tariffs in violation of global regulations under the 2nd Trump administration, China's dependence on non-market tactics threatens the competitive equality among WTO members. This has sparked conversation of the EU being caught between economic superpowers and reducing the EU's dependencies on these actors. (Alschner, 2025, 498.)

The trade dispute between the world's largest economies has been proved to have spill-over effects on other economies (Goulard 2020, 57). Some emerging economies might benefit from the trade dispute by seizing short-term opportunities. However, most of the countries face the threats posed by the trade dispute, which means that EU is facing some of the effects as well. The impact is difficult to analyze due to the complexity of the European economies. This calls for the EU to develop a policy addressing the trade tensions between two of its main trade partners and seize the opportunities presented by the dispute. In the future the EU-China relations may deepen if China continues to open its economy to foreign investors. (Goulard 2020, 63 – 65; Alschner, 2025 506 – 508.) As the future remains unclear due to the quickly shifting tariffs threats and uncertainty over the spillover effects, it is beneficial to research one industry with high relevance to the society. By focusing the research on Finnish pharmaceuticals, the results will provide understanding beyond the surface level when observing the EU economies as one entity.

As the EU's economy is deeply integrated with other bigger economies such as the U.S. and China, the shifts in the trade relations will inevitably reflect onto the European economy. For example, the trade deal signed by the US and China to solve the trade conflict started during the first Trump administration has proven to negatively affect the economy of European economy. (Chowdry & Felbermayr 2020.) The uncertain geopolitical landscape and trade relations have drawn more attention to the dependencies stemming from the integration of economies (Alschner, 2025). Additionally, the pharmaceutical industry has both societal and economic importance, which makes the dependencies riskier. Should trade relations or geopolitical tensions escalate and pharmaceutical industry is affected, the effects on society might be significant.

1.1 Pharmaceutical industry and geopolitical shifts

The pharmaceutical industry refers to the companies engaging in research and development (R&D), manufacturing, and distributing drugs intended for diagnosis, cure, mitigation, treatment, or

prevention of disease and products affecting the structure or any function of the human body. This definition includes components of drugs. (International Trade Administration 2025.) The manufacturing of these drugs has two categories: active pharmaceutical ingredients (API) and finished-form manufacturers. The former manufacturers produce the raw materials used for medicine, and the latter produce the finished product to be sold to the market and consumed by patients. Drug products are divided into two categories: generic drugs and branded drugs. Branded drugs are the main source of revenue, making intellectual property (IP) rights relevant for this sector, as the innovator has a monopoly on the product for the patent period. Generic drugs can be further divided into quality generic, and low-value generic drugs. The former refers to the off-patent products with international approvals and multiple equivalent products of same quality products available. The latter refers to off-patent products sold mainly in emerging economies' markets, where price often sets entry barriers for market access, (de Borja Reis & Pinto 2022, 128.) Figure 3 demonstrates the types of producers and end-products of the pharmaceutical industry.

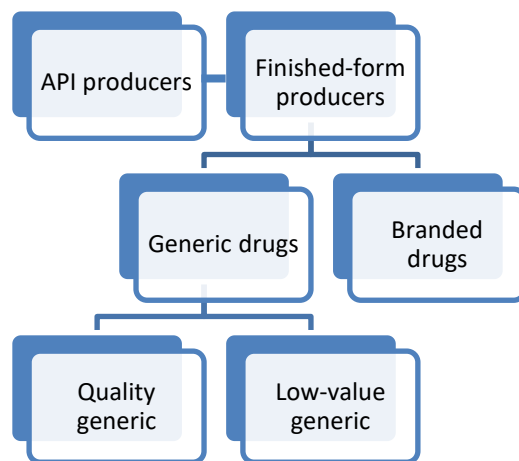


Figure 3. Producers and end-products of pharmaceuticals (de Borja Reis & Pinto 2022)

Above the API producers and finished-form producers are actors engaging in R&D. Although R&D is not directly producing pharmaceutical products, the trade relationships affect it, as pharmaceutical value chains have been reorganized in the last decades by outsourcing certain activities and developing partnerships. R&D is highly relevant for branded drugs. According to de Borja Reis & Pinto (2022, 129), “R&D activities, such as analytics, discovery research, and chemical synthesis are among the most important being outsourced due to financial reasonings”.

The U.S. holds the predominant market share of the pharmaceutical market with a 53% share of the total pharmaceutical prescription drug market worldwide in 2024. The second largest market,

China, follows with nearly 8% share. However, the large difference in values can be explained by the international differences in drug prices. The prices of prescription medications in the U.S. rose significantly between 2011 and 2019 to maintain pharmaceutical manufacturers' profits. (Statista 2025b.)

The R&D-based pharmaceutical industry is highly important not only for the European economy but also for society. Innovative pharmaceutical industry drives the increasing well-being of society and aims to turn R&D into widely available and accessible treatments. However, the R&D is gradually migrating to developing economies such as China due to the rapid growth of research and market environments, which leaves the European markets lagging. (EFPIA 2025; Guinea & Espés 2021; Toshev et al. 2025.) As R&D is highly relevant for branded drugs, which are the main sources of income in the industry, the shift is a concern for the European economy. Other concerns for the industry, besides inadequate R&D levels compared to the competing markets, are the balance between access and affordability, simplifying the regulatory framework, reducing the environmental impact, and securing global value chains to prevent shortages or interruptions. On 20th November 2020, the European Commission launched the pharmaceutical strategy for Europe to address these concerns. (Buendia 2024.)

Besides the R&D migrating away from Europe, another vulnerability for security of supply chains in geopolitical uncertainty is active pharmaceutical ingredients (API) and critical raw materials, which are mainly imported from India and China (Guinea & Espés 2021; LabNews 2025). Although the EU has a major trade surplus with the U.S. in the pharmaceutical sector, the supply chains are highly integrated, and both the EU's and the U.S.'s most important group of products from each other are pharmaceutical products. 22.5% of all EU exports to the U.S. and 13.8% of all imports from the U.S. are pharmaceutical products. (LabNews 2025.) China dominates the global API market with a 40 – 45 % market share and is up to 90 % self-reliant. Due to aggressive state support, companies such as North China Pharmaceutical Group (NCPC) and Hubei Biocause dominate the global markets in producing key APIs. (Vagh 2025; Toshev et al. 2025.) Up to 95% of U.S. and EU-imported ibuprofen, 70% of the world's paracetamol, 80% of key antibiotic APIs, and 80% of metformin treatment for type 2 diabetes originate from China. This dominance exposes the global production networks (GPNs) to global fragility. (APIFDF Analytics 2025.)

As the U.S. government announced a 15% tariff on branded pharmaceutical products imported from the EU, the pharmaceutical industry is directly affected by the tensions in geopolitical trade negotiations. The industry has warned that the implementation of tariffs will elevate the costs and

increase volatility across the value chains, as drug development, manufacturing, and distribution are of a global nature. (Pharmaceutical Technology 2025.) The U.S. has previously applied tariffs of 25 % on Chinese pharmaceuticals (Huld 2025). Applying tariffs to pharmaceutical GPNs poses a direct threat to the medicine supply, which could jeopardize public health and access to medicines (Pliner 2025).

The pharmaceutical sector makes up a significant share of Finland's public economy and is expected to boost the economy with billions of euros invested by 2030. The sector is one of the few industries that have experienced an increase in investment within the country and exports. Due to the high standards of competence and an environment for research excellence, Finland has a promising potential in the international competition, and in 2024, the biggest value increase in exports was from chemical industry products, out of which pharmaceutical products increased their value by 23,4%. (Orion Corporate Press 2025.)

Given the importance of pharmaceuticals for the Finnish economy, the recent developments in the global economy and pharmaceutical markets affect the national economic security and the security of supply. The EU has recognized both the benefits and downsides of economic interdependence due to the recent developments in the geopolitical landscape. Thus, the term of economic security has risen in European politics. (Kristeri 2025; Alschner 2025.) Economic security refers to the interconnectedness between national economic welfare and national security, affected by the impact of non-state actors, shifts in the economic environment, vulnerability and sensitivity to international markets, as well as economic and political volatility caused by international markets. (Lee 2014, 35.)

As pharmaceuticals are socio-economically highly relevant to Finland and the geopolitical shifts are rather unpredictable, it is highly valuable to understand EU's role in mitigating the possible risks arising from the uncertainties on the important industry. Besides the existing theories on global production networks (GPNs) and economic dependencies, there is no theoretical basis for combining the EU's role in affecting a member state's one specific industry in a geopolitical context. This research aims to complement the already existing theory by zooming in on the Finnish pharmaceutical industry and taking both state- and EU-level effects into consideration.

The IB field doesn't offer a theory to attempt explaining how the EU can mitigate the risk imposed by shifts in the geopolitical field, nor how these risk mitigation systems affect the member states' economic security and security of supply. This research aims to offer a theoretical framework to link the EU's trade policy mechanisms and tools with the actors and variables of the pharmaceutical

production networks. Global Production Network (GPN) theory is used to examine how the pharmaceutical industry operates through globally fragmented production and trade networks, where production phases, inputs, and markets are geographically dispersed (Yeung & Coe 2015; Hess 2021). Second, economic interdependence and network embeddedness theories are applied to explain the emergence of vulnerability and asymmetry of power arising out of dependency and concentration within the network structure. (Rowley et al. 2000; Dong et al. 2019; Kauppila et al. 2025; Keohane & Nye 2012).

In addition, the political economy framework is used to analyze how domestic and external socio-economic and political structures shape the operational environment of the pharmaceutical industry and influence market outcomes (Dong et al. 2019; Stern & Reve 1980). The research also applies the concept of weaponized interdependence to examine how states may use trade dependencies and central positions within global networks as instruments of political influence (Cha 2023; Farrell & Newman 2019). Finally, securitization theory is incorporated to understand the conditions under which such dependencies become matters of strategic importance related to economic and supply security. (Waeber 1995; Buzan et al. 1998; Bown 2024; Pitakdumrongkit 2022; Peltonen 2025; Aitlahti 2019; Vicard & Wibaux 2023).

The theoretical discussion is further linked to the EU's recent economic security and trade policy initiatives, such as Open Strategic Autonomy and the Pharmaceutical Strategy for Europe, which aim to mitigate strategic vulnerabilities while maintaining openness in global trade.

1.2 Research gap and relevance

The topic of this research is highly relevant due to the fast-shifting nature of trade relations. While the global economy is highly integrated, decisions made at the EU level and in the U.S. not only impact the member countries of the EU but also affect global value chains, which have a broader impact on entire industries. As the pharmaceutical industry is both economically and socially remarkable and vulnerable to geopolitical shifts, focusing on that specific industry is relevant. The EU's trade policy tools for risk and dependency mitigation are well-studied. For example, Guinea & Espes (2021) focus on the EU's pharmaceuticals' production and trade structures with structural analysis of trade flows. The European Commission's strategy to enhance European economic security (2023) focuses derisking and critical dependencies with a security-oriented trade governance approach. While these examples showcase the EU-level dependencies and how the EU conceptualizes dependencies on macro-level strategy, less attention has been given to how these dynamics materialize at the member-state level, particularly in smaller economies such as Finland

and within the pharmaceutical sector specifically. There is a gap in the literature regarding the implications for the member countries' specific critical, globally integrated industries, especially given the radical changes in the geopolitical landscape in the 2020s.

The addition to understanding how EU trade policy tools mitigate current risks in relation to a member state's national economic security is crucial in estimating the spillover effects of those tools and the recent development in the geopolitical landscape on a single member country. De-risking, referring to reducing the vulnerabilities arising from economic interdependence and managing risks from geopolitical factors, has become a central theme in the European Commission's strategies (Kristeri 2025, 2). This research exclusively focuses on the Finnish pharmaceuticals operating within the EU. The findings of this research could potentially be applied to Finland's other industries or to other EU countries' pharmaceutical industries. The research results could help with better decision-making in the EU, country, and industry levels.

This thesis addresses a significant research gap in strategic economic dependencies, as the research conducted on Finland has mainly focused on the economic risks but not taken the safety aspect into account. The previous Finnish research has been relatively one-sided, as it has largely focused on medicine availability, stockpiling, and domestic preparedness mechanisms (e.g. Fimea; National Emergency Supply Agency; Ministry of Social Affairs and Health). Existing analyses emphasize operational resilience and national security of supply, while less attention has been paid to export dependencies, global production network structures, and geopolitical dimensions of pharmaceutical trade. Sarnola & Linnolahti (2019) explore the availability of pharmaceuticals and national regulatory factors. While acknowledging the global nature of medicine shortages, the research doesn't focus on the geopolitical factors and structures of pharmaceutical supply chains. Tuominen et al. (2023) include the EU-level aspect to their research and compare the national and European competences in maintaining security of supply. However, the research doesn't include systematic dependency mapping or take the embeddedness of global pharmaceutical networks into consideration.

Additionally, possible export dependencies and complex nature of global production networks haven't been considered on a sufficient level. Lastly, no systematic dependency analysis has been conducted with sufficient locating dependencies with qualitative analysis. (Kristeri, 2025.) This research aims to fill this gap in research by taking export dependencies into account, focusing on a specific industry, and locating dependencies with qualitative analysis. The secondary quantitative

data and methods work as supplementary and descriptive information to support the data gathered with qualitative methods.

1.3 Purpose and structure of the study

This research aims to provide an understanding of the EU's intermediate role of managing Finland's strategic dependencies in pharmaceuticals, and how it reflects on the national economic security and security of supply. EU's risk mitigating role is assessed in the light of stressed transatlantic relations followed by the tariff wars of early 2025 and China's involvement in the API production as well as trade war with the US. Thus, the main research question is *How can the EU's trade policy address Finland's strategic dependency on pharmaceutical supply chains considering China's API dominance and U.S.–EU trade relations?*

The main research question has been divided into further sub-questions (SQ) to gain deeper understanding of the topic. The sub-questions are:

- SQ1: What is Finland's position in global pharmaceutical supply chains, given China's API dominance?
- SQ2: How have U.S.–EU and U.S.–China trade tensions reshaped Finland's vulnerability in pharmaceutical supply chains?
- SQ3: How are pharmaceutical supply chain vulnerabilities interpreted as strategic dependency in Finland?
- SQ4: How can EU trade policy instruments mitigate Finland's dependencies in the pharmaceutical sector?

The findings of this research could potentially be applied to other industries or to other countries' pharmaceutical industries. The research results could help with more effective policy planning on EU, country, and industry levels. The results could also provide valuable information on the dependencies to create more effective policies.

2 Theoretical framework

This chapter provides the theoretical framework for observing and researching the phenomenon. First, theory of global production networks and network embeddedness is introduced, as it assists in explaining the structures of the global pharmaceutical production and how different actors, such as the Finnish state or Finnish companies, are positioned in the global scene. Second, economic interdependence and power relations are introduced. Economic interdependence refers to the mutual dependencies of two or more economies. If the dependency-level is not even, it gives the less-dependent part a power leverage. Third, political economy describes the political and socio-economic environment where the global production networks operate, highlighting the political and socio-economic aspects of the pharmaceutical industry. Lastly, the EU mechanisms and initiatives are introduced.

2.1 Global production networks and network embeddedness

Global production networks (GPNs) can be defined as transnational, organizational network platforms that allow different regional and national economies and actors compete or cooperate for value creation, transformation and capturing with geographically dispersed economic activities (Yeung & Coe 2015, 29). The theory of GPNs is explicit in the incorporation of state institutions in shaping the constitution of GPNs (Neilson et al. 2014, 3). Briefly, GPNs can be described as organizational agreements, coordinated by leading firms, and linking suppliers, producers, consumers and states in the world economy (Hess 2021, 20). GPNs can be analyzed with input-output structure analysis, territoriality or geography, chain governance, or institutional context (Selwyn et al. 2025, 4). The analysis on GPNs facilitates understanding of cross-border linkages between firm and non-firm actors operating in the global value chain (Sinkovics et al. 2018, 261).

Global industries can be viewed with bottom-up or top-down vantage points. The bottom-up view analyses the possibilities of upgrading suppliers and other local actors. Upgrading refers to the possibility of firms, countries, regions and other economic stakeholders moving to a more profitable or skill-intensive economic niches to increase the value-added. On the contrast, the top-down approach connects the lead-firm buyers to a geographically dispersed supplier base. The governance of this top-down relationship is a major focus as the position in the network determines how resources are allocated and flow within the network, mainly focusing on lead-firms and organization of global industry. (Sinkovics et al. 2018, 261 - 263.; Gereffi & Lee 2012, 25.) As this

research is considering the management of GPNs rather than upgrading to more skill-intensive economic niches, top-down vantage point is opted for.

Given the economic importance of these global networks to national economies, states have interest in participating in GPNs. Thus, agents in GPNs are both states and firms. State influences GPNs but also GPNs influence the state and its policy choices. (Hess 2021, 20.) The state can act as a facilitator, producer, buyer or regulator within the GPN (Hess 2021, 21; Pavlínek 2024, 143).

Three competitive dynamics interact with agents of the GPN under uncertain market conditions and influence the strategy choices of why GPNs are organized and governed in certain ways. First, competition in optimizing cost-capability ratios in variables such as labor, technology, and capital, drives the globalization of production and conceptualizing greater firm-specific capabilities and value capture. Second, sustaining market development refers to reach and access, dominance, time-to-target, customer behavior and preferences. Both producers and customers are involved in market creation through seeking more revenues with market expansions and creating different markers by becoming more demanding for better products with lower prices. Thus, the emergence of GPNs is an organizational outcome of this iterative market development process. Third, working with financial discipline compels firms' strategies toward developing and expanding their GPNs. (Yeung & Coe 2015, 32 - 42.)

In addition, value, power and embeddedness affect the agents and structures of GPN. Value refers to not only the traditional thought of creating a surplus but also creating value through multiple types of rents. After determining value characteristics of the given GPN, considering value enhancement through firm-to-firm processes of knowledge and technology transfer and industrial upgrading is possible. Lastly in the value chain it is necessary to consider which firms in which locations in the GPN succeed in capturing the value. Power derives from the possibility of one actor to affect behavior of others, or alternatively the extent to which actor can resist an unwanted imposition by another actor. Power can be relational amongst the actors in the GPN and while the relationships rarely are symmetric, the actors are dependent on each other and gain mutual benefit from working together. Power can derive from corporate assets and their mobilization, collectively from trade associations and institutionally from power held by the state. Lastly, embeddedness refers to the relative similarity and connections on societal and network levels. Territorial embeddedness refers to how firms are tied onto different geographic locations. (Coe & Yeung 2015, 16-18.)

As illustrated in Figure 4, the construction of GPNs is an iterative process, where the market outcome, shaped by the agents' actions together with the given structures, further reflect onto the categories. The categories then again shape the agents' actions and the structures.

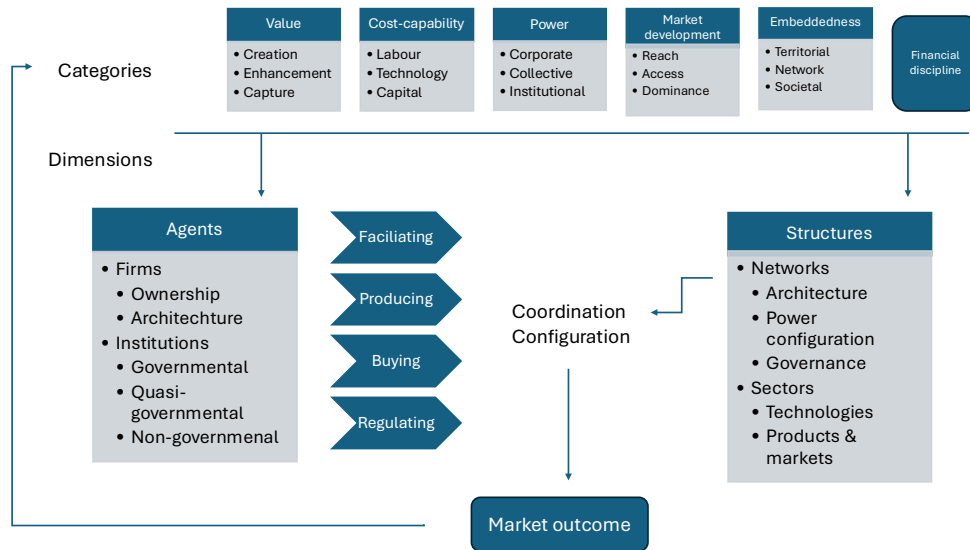


Figure 4. Global production networks (Coe & Yeung 2015; Hess 2021)

The theory of GPNs help illustrate the complexity of pharmaceutical production in a global landscape. The theory will also assist in positioning Finland within the global production.

As shown by Figure 4, embeddedness is one of the variables affecting agents and structures of GPN. Embeddedness in business context is defined as concrete and intense relationships between the actors, such as sharing sensitive information, mutual gain and reciprocity (Dong et al. 2019, 1068). The network embeddedness in the context of international trade can be “measured by the frequency of interaction between partners and their level of resource commitment to the relationship” (Rowley et al. 2000, 371). The embeddedness can be viewed through the nodes, representing actors or locations of the networks, and ties between these nodes. The embeddedness of the node is the number of ties connecting it to other nodes. The pattern of nodes and links is the structure of the network. (Farrell & Newman 2019, 50.)

The exchange of high-quality information and tactic knowledge and social control mechanism to govern member firms' behavior benefit the organizations in the network. (Dong et al. 2019, 1068.) However, in contrast to the benefits, network embeddedness serves as a base of power advantages, which can lead to asymmetric access to resources, which in turn can affect firm's behavior and performance (Dong et al. 2019, 1069; Rowley et al. 2000, 369).

Scholars, such as Rowley et al. (2000) and Dong et al. (2015), have contradictory implications whether strong or weak embeddedness is positively related to firm performance. The level of embeddedness is linked to economic interdependence, as strategic alliances among the networks can lead to asymmetric access to resources and encourage central distributors to act opportunistically. (Rowley et al. 2000, 369; Dong et al. 2015, 1659.)

The theory of GPNs with a further focus on network embeddedness provides background for SQ1 *What is Finland's position in global pharmaceutical supply chains, given China's API dominance?* as the theory considers the categories shaping the environment and supply chains for domestic pharmaceutical firms while acknowledging the role of the state, including Finland and other trade-partners. This enables to research the global nature of pharmaceutical sector and position the Finnish industry into the complex pattern. The network embeddedness demonstrates, how integrated the Finnish industry and market are to the global central trade nodes.

2.2 Economic interdependence, power and weaponization

Interdependence is defined as mutual dependence between national economies generated by increasing cross-border flows of goods, services, money and people. The contrast between mere dependence is the shared dependence on each other. (Keohane & Nye 2012, 7.) Interdependence is used in a situation where the actors are both state and non-state actors, and they are dependent upon one another (Rana 2015, 291). The key aspects to analyze are the relative gains and distributional issues, and the possible asymmetries of the relationship. These aspects contribute to the power relations in the economic relationship. Power derives from sensitivity and vulnerability. Sensitivity refers to the extent of how quickly changes in one country bring costly effects to the other, and how great these costly effects are. Vulnerability refers to the extent to which actors can control their policy responses to avoid the costs imposed by external events. Asymmetry is a tool to control the outcomes or the resources. (Keohane & Nye 2012, 7 - 11.) This means that the asymmetry in vulnerability and sensitivity result in asymmetric power in the relationship. However, the less vulnerable actor isn't necessarily the less sensitive, but the one left with lower costs after altering the situation. Weaker states are more vulnerable due to bearing higher costs when adjusting to the changes. (Rana 2015, 294.)

Systemic interdependence derives from structures, which can control security, production, financial markets and knowledge (Kauppila et al. 2025, 4). The structures are formed by, for example, the GPNs. Interdependence can form between states or firms - the topography of the networks of interdependence intersects with domestic institutions and norms while shaping coercive autonomy.

(Farrell & Newman 2019, 44.) As Table 1 shows, the asymmetric and systemic dependence types have similarities. Both impose the risks of supply disruptions and cut-offs of critical technologies. The more powerful party demonstrates supply chain dominance and core technology control. However, as asymmetric interdependence derives from asymmetric control over resources, the risks imposed also include security risks of foreign ownership, and competences of great powers include investment leverage due to the control. Table 1. Interdependence types (Kauppila et al. 2025) Table 1 presents the differences between asymmetric and systemic interdependencies.

Table 1. Interdependence types (Kauppila et al. 2025)

	Asymmetric	Systemic
Source of power	Control over resources	Structures
Risks	Security risks of foreign ownership	
	Supply disruptions	
	Cut-offs of critical technology	
Competences of great powers	Investment leverage	
	Supply chain dominance	
	Core technology control	

The type of interdependence shapes the relationship between the actors, as the risks, competences and sources of power vary. However, it should be noted that not all dependence is interdependence. If dependence is mutual, it is interdependence. Interdependence itself is not something to be avoided; although great powers' abilities to use their relative power are emphasized through asymmetric and systemic interdependencies, smaller powers still have agency. Additionally, it's not possible to attain a high level of economic specialization and have no external dependencies at the same time. This way, interdependence can be beneficial. Interdependence becomes non-beneficial, if the power relations become disproportionate and interdependence is weaponized on a systemic level. (Kauppila et al. 2025, 4.)

Trade networks or GPNs can be used for economic coercion by compelling the target state to reverse or withhold its actions that are deemed to be against the weaponizing state's best interest. (Cha 2023, 95 - 96.) Complex structural systems tend to form asymmetric network structures, giving leverage to some states to use these interdependent structures as a coercive tool. Considering the embeddedness of the networks, the states with political authority over the central nodes of the

network structures through which money, goods, and information flow, can impose the costs on others. States can gain advantages through weaponization of interdependence if they have the domestic capabilities to gather information, choke off economic and information flows, exploit vulnerabilities, compel policy changes, or deter unwanted actions. Two strategies of weaponization are deterred: panopticon and chokepoint effects of networks (Farrell & Newman 2019, 46). The former refers to the advantaged states using their network position to gather informational advantages vis-à-vis adversaries. The latter refers to the ability to cut off adversaries from network flows. (Farrell & Newman 2019, 43 - 46.)

The theory on interdependence provides background for SQ2 *How have U.S.–EU and U.S.–China trade tensions reshaped Finland’s vulnerability in pharmaceutical supply chains?* as the trade war between the U.S. and China and the U.S.’ tariff threats on the EU can be seen as utilizing economic dependencies to coerce other actors to change their behavior. This might affect Finland’s vulnerabilities in pharmaceutical supply chains.

2.3 Political economy

The framework of political economy integrates major sociopolitical and economic forces in and out of the networks, which affect the behavior within the networks (Dong et al. 2019, 1065 – 1067). Political economy views a social system as interacting sets of significant economic and sociopolitical influences affecting group performance and behavior (Stern & Reve 1980, 53). The network consists of two major systems: internal and external political economies, both of which consist of polity and economy. Polity and economy interact with each other. In internal political economy, the interactions of internal polity and economy form a channel relationship, which describes the channel’s task environment. The channel approach in turn explores the firm dependence as firm’s need to maintain and improve relationships with their partners to achieve its goals (Dong et al. 2019, 1066). Internal political economy thus consists of internal structuring and functioning of the distribution channel. Internal economy consists of both internal economic structures and processes, which can be characterized by dependence asymmetry or joint dependence. Internal polity consists of internal socio-political structures and processes, which for example include relation-specific investments. (Dong et al. 2019, 1066; Stern & Reve 1980, 54.)

External economy refers to the external economic environment, which consists of business networks. External polity refers to the external socio-political environment, which consists of governmental networks. These internal and external political economies always operate within a socioeconomic environment. Dependence asymmetry is a configuration of the internal polity which

affects the partners' relationship specific investments. (Dong et al. 2019, 1065 - 1067; Stern & Reve 1980, 54.) As Figure 5 illustrates, the external political economy affects the internal one. Both internal and external political economies shape the channel performance, or industry performance, together.

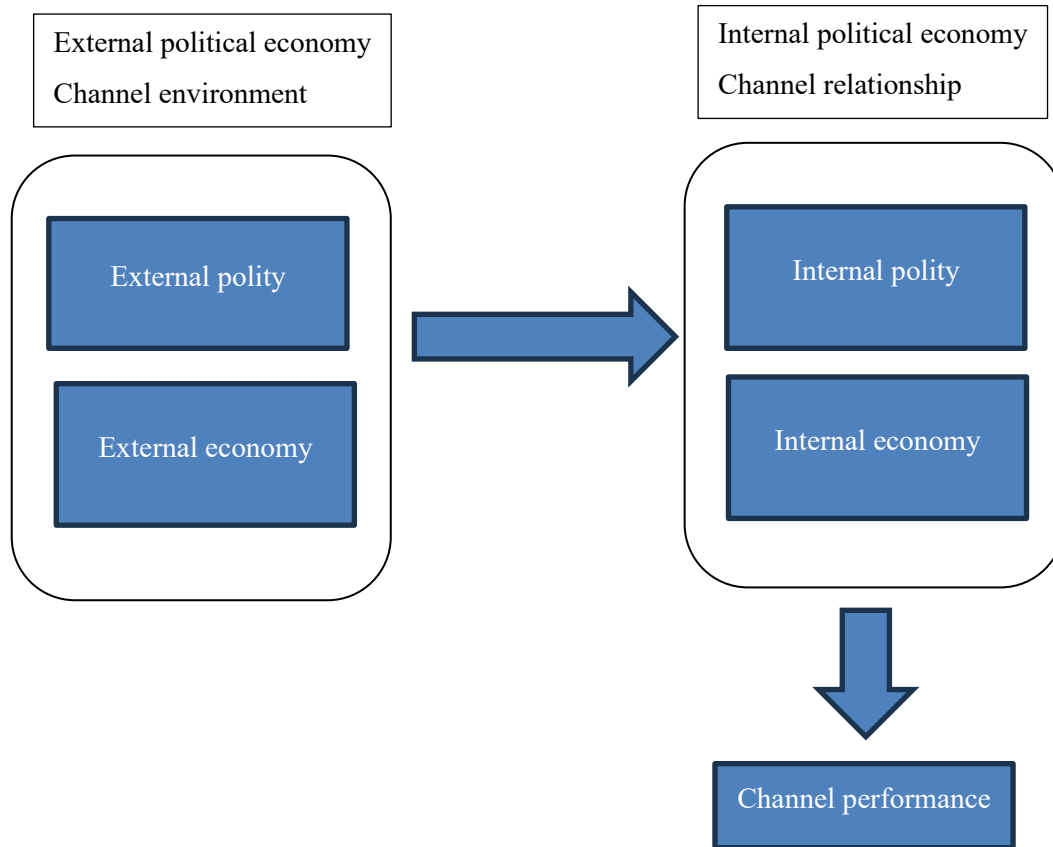


Figure 5. External political economy and internal channel performance (Dong et al. 2019; Stern & Reve 1980)

The global political economy shapes the environment where the GPNs operate. The GPNs are formed between internal political economy and one or multiple external political economies, and the interactions between these political economies might be shaped by possible interdependencies. GPNs explain the structure of the networks, network embeddedness explains the position of an actor within the GPN, and interdependence or dependency describe the relationships between the actors. The theory of political economy helps explain why these dependencies exist and persist. The theory explains how the system is organized on a socio-economic and political level.

2.3.1 Securitization

The concept of security has evolved to a broader idea of security of both state and people, either as individuals, or as global or international collectives. Security issues are events that pose a particularly serious risk to a state's political order and independence. (Waever 1995.) Securitization

theory aims to explain how political issues are turned into security issues (Buzan et al. 1998). Thus, strategic dependencies can be framed as security concerns, if the risks affect economic security of the state or security of supply of pharmaceuticals. In these cases, the state perceives a loss of control, or the disruption threatens public health.

Although interdependence accounts for the structural development of vulnerabilities, and political economy emphasizes the compromises between efficiency and security, securitization theory clarifies the circumstances and methods through which these vulnerabilities are reinterpreted as strategic threats that necessitate policy action.

2.3.2 Economic security

Economic security in the national context is still an emerging concept. Bown (2024) defines economic security as preventing bad economic outcomes and should the risk be realized, then minimizing the damage by lowering the volatility of welfare. Nesadurai (2005) on the other hand, defines economic security as a condition where countries can ensure their integrity or robustness of the market to generate welfare and growth in their society. Economic security can be visualized by comparing the likelihood of negative events and threats to the country's ability to withstand these risks and threats. The situation with low likelihood and high ability is the most favorable situation. (Karanina & Kartavyh 2018, 3.) The ability to withstand the risks and threats requires ensuring competitiveness of the national economy, but in terms of international economy, the dependence on import of resources affects the economic security (Tsenkov 2020, 8).

The ability to affect a country's economic security derives from asymmetric power relations. Given that the independent variable affecting economic security of a state is major extra-regional powers' behavior, economic security can be affected by external powers' competition, economic statecraft, and advantages in existing negotiations. Firstly, the major external powers are economically important in the global economy by providing large markets for goods and services and having abundant capital for investments (Pitakdumrongikt 2022, 402 – 407). As discussed before, the U.S. constitutes one of Finland's most significant trading partners and export destinations (Vanttinen 2024). In addition, U.S.-based multinational corporations represent an important source of capital investment in Finland. For example, Microsoft's large-scale data centre investments have generated employment, infrastructure development, and broader economic spillovers in local economies. (Microsoft 2025.)

Competition among major external powers may result in rising protectionism, which interrupts the GPNs, causing losses for smaller states in opportunities to capitalize GPNs and produce growth and welfare to society (Pitakdumrongkit 2022, 402 – 407). In the Finnish context, potential U.S.–EU trade tensions or tariff measures could weaken Finnish export performance. Even the threat of new U.S. tariffs on European goods has raised concerns about adverse spillovers for Finland’s trade-dependent economy. (Yle 2025.)

Additionally, major external powers’ economic statecraft positions smaller economies in weaker policy autonomy position, as powerful nations might threaten freezing bilateral trade or investments should the smaller state practice unfavorable policy. This causes opportunity losses for the smaller states. (Pitakdumrongkit 2022, 402 - 407.) As Finland is an EU member state, it is partly bound by EU-level regulatory frameworks, which have occasionally created tensions with the U.S. For example, the digital taxation and technology regulation of the EU has sparked critique from the U.S. government, claiming that the EU is targeting American technology firms. The U.S. has then threatened retaliatory measures. This dynamic illustrates how smaller states may face indirect pressure. (Martin 2025.)

Lastly, advantages in existing negotiation frameworks poses the major powers with possibilities to push their initiatives, which might not be favorable for the smaller state (Pitakdumrongkit 2022, 402 - 407). In the context of Finland-U.S. relations, the NATO security and defense cooperation works as an example. The U.S. has played a major role in shaping defence procurement and cooperation frameworks in NATO. Additionally, Finland’s acquisition of U.S. FF-35 fighter jets and participation in U.S.-led military procurement programs show the extent of U.S. influence in determining the conditions of engagement. (U.S. Department of State 2025a; U.S. Department of State 2025b.) While such arrangements bring security and technological benefits, they also reflect structural asymmetries in bargaining power, where smaller states must often adapt to frameworks and standards largely defined by major power (Pitakdumrongkit 2022, 402 – 407).

Small players have three strategies to respond to threatened economic security. Under the circumstances of external powers’ competition, small players tend to opt for institutional hedging. This refers to adopting a middle position – focusing on advancing cooperation without siding with any disputing parties. In the case of major powers’ economic statecraft hurting the smaller players, the latter opts for either inclusive or exclusive institutional balancing. This refers to including or excluding the external actor to participate in non-financial parts of institutions. In inclusive balancing, arrangement terms allow external powers to participate in the non-financial mechanisms.

Should the external power be included, other external powers are brought in to balance the situations. In exclusive institutional balancing, agreement details exclude external powers from joining financial mechanisms or institutions. (Pitakdumrongkit 2022, 402 - 407.) Table 2 illustrates the types of external powers' effects on smaller players' economic security and the typical ways of response. If external power is affecting economic security through spill-over effects of competition among other great powers, institutional hedging is the most effective response of the regional state. If external power uses economic statecraft to undermine economic security, inclusive or exclusive institutional balancing is the most effective response. Lastly, if external power has advantage in negotiations, inclusive or exclusive institutional balancing combined with international negotiations is opted for.

Table 2. External powers' effects on economic security and optimal responses (Pitakdumrongkit 2022, 403)

		Regional states' institutional responses		
External powers' behaviour	Competition among other powers	<i>Institutional hedging</i>		
	Economic statecraft		<i>Inclusive institutional balancing</i>	<i>Exclusive institutional balancing</i>
	Advantage in negotiation frameworks		<i>Inclusive institutional balancing + international negotiation</i>	<i>Exclusive institutional balancing + international negotiation</i>

Should there be interdependencies within the global political economies, the less powerful state may seek to secure its position in GPNs by the institutional responses listed above. However, if the relationship is shaped by merely dependence, the less powerful party loses power in negotiations, as the more powerful party is not significantly dependent on it.

2.3.3 Security of supply

On a state-level within the EU, experts divide security of supply into four levels. Firstly, the rescEU storages around Europe support the security of supply on the EU-level. (Peltonen 2025.) RescEU provides the EU member states with additional disaster preparedness by stockpiling strategic reserves of emergency response capacities. Medical capacities are included in the rescEU in case of disruptions in supply chains. (European Commission 2025b.) The storages are scattered around the EU, including Finland. Medicines intended for the use in the event of radiation, and biological and chemical threats are stored in Finland. The medicines are to be shared with all the EU states. The

decision on the use is made through the Emergency Response Coordination Center (ERCC) mechanism. (Peltonen 2025.)

Whereas the rescEU focuses on crisis specific medicines, the Finnish storing focuses on the citizens' general needs in the case of supply disruptions (Peltonen 2025). On the national level the security of supply of Finnish pharmaceuticals is ensured through obligatory storing of medicines, which is defined in the Finnish Criminal Code. The purpose of obligatory storing is to secure availability of medicines and the security of medicines with a critical medical importance affecting patient safety in situations where normal availability has been hindered or prevented. (Act on the Obligatory Stockpiling of Medicines 979/2008; Fimea 2025.)

The act is applied on pharmaceutical companies operating in Finland, importers of medical products, healthcare units and the Finnish National Institute for Health and Welfare (THL). Parties subject to the act must maintain storage facilities in Finland for medicinal substances, medicinal products, excipients and additives used in the manufacture of medicinal products, and packaging materials. The storage obligation is divided into three groups, in which the size of the obligatory stock is equivalent to 10, 6, or 3 months of normal consumption. The Ministry of Social Affairs and Health may, on the proposal of the Finnish Medicines Agency, decide that the quantity of goods subject to the obligation may be less than the quantity specified in the Act if there are widespread problems with the availability of medicines. The Finnish Medicines Agency monitors compliance with the obligations and may order the party responsible for storage to fulfill its obligations within a specified period. The Security of Supply Fund shall pay compensation for storage costs to importers and manufacturers subject to the storage obligation. (Edilex 2026.) However, the experts criticize the obligatory storing as it lacks administrative aspect and causes medical waste (Peltonen 2025). The need to develop the legislation is acknowledged in the latest report 10/2023 (Pelkonen 2024).

The last two levels are regional and local. The obligation of preparedness falls on welfare services, private operators, and citizens, who are required to maintain a 72-hour supply at home. (Peltonen 2025.)

Domestic shortages are reported on Fimea's website. As of December 2025, 726 notifications of medicine shortages have been issued. Pharmaceutical companies are responsible for keeping the medicines on the market and issuing and updating the notification on the shortages. (Fimea 2025b.) There is no individual reason behind the shortages, and some of the factors are out of the influence of the Finnish actors. (Aitlahti 2019.) The listed reasons behind possible medical shortages in Finland are: (Aitlahti 2019; Fimea 2025c)

- Shortages in raw materials, quality problems in the production process or other production disruptions, leading to disruptions in the GPNs,
- Disruptions in the foreign shipping,
- Small domestic markets and rapid changes in demand or,
- The product lacks market authorization in Finland.

The European pharmaceutical regulatory authorities cooperate to notify those impacted by any availability issues affecting pharmaceuticals. This practice ensures that patients have access to the needed treatments. (Fimea 2025c.)

Despite the EU-level cooperation regarding the security of supply, the primary form of preparedness for medicines is national. Other European states, such as France and Germany, are implementing similar plans for preparedness, taking after Finland. (Peltonen 2025.) Both on Finland's self-assessment and on international levels, Finland's preparedness for health security of supply has been on a good level. After the COVID-19 pandemic, preparedness and contingency plans have been updated, which may have improved the scores on the assessment. (ECDC, 2024.) The advanced level of the Finnish system and extensive experience in system maintenance positions Finland in a stronger position relative to most of the EU member states.

Regarding pharmaceuticals, the security of supply in Finland is carried out by both the public and private sectors. The national planning is based on legislation and healthcare organizational structures. (ECDC, 2024.)

The EU has multiple organizations operating together with member states to develop security of supply of medicines, both ensuring availability of critical medicines and following drug shortages. The former refers to pharmaceuticals necessary for the treatment of serious illnesses or symptoms with no other suitable treatment options available. The latter refers to a situation where the supply of medicines does not meet demand, and the shortages affect patient care at national and EU levels. (Pelkonen 2024.)

2.3.4 Strategic dependence

The European Commission (2021, 8) defines strategic dependence as dependencies on all critical strategic interests of the European member states', such as energy, security, safety and health. In other words, when dependency impacts health or the possibility of EU or a member state to exercise its foreign and security policy based on its own values, the dependency is deemed strategic.

Strategic dependencies are products for which EU or a member state is dependent on foreign suppliers in strategic economic systems with the risk of weaponization posed. As health is one of the critical interests of the EU and its member states, strategic dependencies on pharmaceuticals can be turned into strategic vulnerabilities. (Vicard & Wibaux 2023, 2 - 7.)

To identify strategic dependencies and strategic vulnerabilities, the European Commission has conducted a bottom-up approach with three criteria of measuring concentration of extra-EU imports, the importance of demand and the substitutability with EU production (European Commission 2021, 20 & Vicard & Wibaux 2023, 2). Trade protection is linked to have an impact on strategic dependencies by not only reducing the level of imports of a specific product but also by artificially hiding the dependence. The strategic dependencies highly featured on the policy agendas highlight the risks associated with the dependencies. Geographic origin of imports is one of the aspects of these risks. The underlying structures of dependencies have not changed for the EU, but rather the perceived risks associated with the source countries based on their different alignment in the geopolitical landscape and increasing risks of supply chain disruptions due to pandemics or natural disasters. Strategic vulnerabilities result from a shift in perception of the consequences of trade relationships. (Vicard & Wibaux 2023, 7.)

The theory of political economy provides background for SQ3 *How are pharmaceutical supply chain vulnerabilities interpreted as strategic dependency in Finland?* as the theory takes the external actors' economy and polity as a variable affecting the domestic political economy. The framework will enable analyzing China and the US as external factors affecting domestic internal political economy. Both economic security and security of supply can be viewed as goals in the global political economy, shaping the decisions based on the characteristics of the interaction, whereas these goals can be securitized after a certain trigger event. The characteristics could be interdependence or merely dependence, which on the other hand, shape the GPNs and their market outcome.

2.4 EU mechanisms for trade policy and security of supply

During the recent years after COVID-19 pandemic and the Russian attack on Ukraine, the EU has strived to strengthen its strategic autonomy. Scholars have discussed whether policies are needed or are firms and industries adjusting on their own to external shocks. Although many of the shocks are new and assessment of the impacts hasn't been made yet, the evidence from previous studies shows that shocks affect firms and supply chains. (Bown 2024, 7.) Lafronge-Joussier, Martin & Mejean (2023) find that French firms sourcing inputs from China before the early COVID-19 lockdown

experienced a larger drop in imports compared to the firms sourcing from elsewhere. However, the firms who had diversified their input sources did not perform better than others – rather, firms stockpiling performed better exposed to the same disruptions. The disruptions on the sourcing channels revealed over-reliance on few suppliers in sourcing.

COVID-19 pandemic revealed the limitations of European Health Institutes and trade policy mechanisms. Although they allowed the exchange of information, expertise and the best practices with the US, Chinese, Canadian etc., the heterogeneity between member states' data quality and collection methods limited the possibilities for effective action. Moreover, the limited remit and powers of the institutions posed major challenges in managing the start of the COVID-19 pandemic. The member states turned into practicing nationalistic decisions to secure scarce resources for their own populations despite discussing solidarity and cooperation within the EU to mitigate the socioeconomic and medical impacts of COVID-19. After the pandemic the EU's trade policy mechanisms and institutions have undergone some reforms based on the outcomes of the COVID-19 pandemic to prevent similar occurrences from arising. The COVID-19 pandemic demonstrated the importance of European strategy, solidarity and coordination in cross-border emergency responses. (Forman & Mossialos 2021, 60 - 65.)

To provide a clear distinction between all the mechanisms and their hierarchical order, the chapters' order follow this logical sequence: first, broader strategic policy frameworks are presented (OSA and Pharmaceutical Strategy for Europe). Second, a policy instrument and a legal tool on operational level are presented (ACI). Lastly, implementation and governance bodies on executive level are presented (EMA, HERA, EDQM). Briefly explained European Commission, European Parliament and the Council of the European Union set the legal and strategic frameworks. OSA is a broad strategy, including multiple industries, whereas Pharmaceutical Strategy for Europe is a sectoral policy. Trade policy tools are used externally in line with these policies while executive institutions practice these policies within the EU.

2.4.1 Open Strategic Autonomy

The European Commission introduced Open Strategic Autonomy (OSA) to enhance the capacity of EU to act autonomously, without foreign interference, in strategically important policy areas while maintaining international openness, cooperation and partnerships to achieve this goal. OSA recognizes that no region or country can be completely independent or self-sufficient due to the global interconnected nature of today's world. (Kroll 2024, 3 - 4.) This concept is nothing new, as the roots of OSA stretch back to pre-Cold War, after which the concept was updated to have an

explicit focus on economic matters, discarding the defense matters (Mariotti 2025, 2). The presence of OSA depends on country's domestic capabilities. Provisional autonomy is defined by the relation of own capacity and external dependency, current focus on external dependencies and how easily the partners could be substituted by others, and manifest and latent risks, complexities and tensions with these partners. Should all these criteria be realized, the country can be considered to have achieved OSA. (Kroll 2024, 4.) As suggested by Kroll (2024), these factors of achieving OSA are considered in the calculation of critical import and export products. This is further visible in Equation 1, Equation 2 and Equation 3 in chapter 3.4.2. The building of the equations shows some of these criteria: the focus on external dependencies, substitutability of the trade partner, and own production capacity.

Despite being adopted by the Commission, the debate over OSA has sparked criticism among scholars (Mariotti 2025; Gehrke 2022). Firstly, if OSA undermines the efforts of existing multilateral bodies such as WTO, OSA will fail to uphold the EU's commitment to multilateralism. Second, OSA must reaffirm that technological and industrial advancements would happen globally without declining productivity and causing long-term stagnation by restricting the international flow of technologies, data and innovation. Lastly, OSA should address the security dilemmas looming over international relations while promoting industrial strategies. (Mariotti 2025, 19–20.) In addition, OSA lacks a clarification on the rhetoric of diversification of trade. Although highlighting international cooperation as a key solution, there isn't an outlining of how such cooperation could strengthen resilience to geo-economic shocks. (Gehrke 2022, 75 - 76.)

The failure to meet the criteria could stem from the EU's unwillingness or inability. Unwillingness to adhere could possibly intensify the conflicting and unilateral stances, further worsening international disorder and internal fragmentation within the EU by promoting nationalistic behavior. The inability could stem from unresolved strategic rivalries. In that case, the "openness" of OSA remains only as a rhetorical idea, ultimately leading to economic losses due to "slower technological progress, reduced productivity and diminished growth." (Mariotti 2025, 21.) Instead, rather than trying to reconcile competing interests on the openness-autonomy spectrum, the EU should attempt to balance them. Whether this is achievable remains to be seen, but in the meantime OSA is already responding to some significant shifts in the global economy. (Gehrke 2022, 77–78.)

2.4.2 Pharmaceutical Strategy for Europe

During the COVID-19 pandemic, the European Commission adopted a new pharmaceutical strategy for Europe on November 25th, 2020. Resulted after multiple rounds of consultations with

stakeholders and the public, the strategy aims to “ensure the quality and safety of medicines while boosting sector’s global competitiveness”. (European Commission 2020; Garattini et al. 2021, 1.) The strategy is based on four pillars. First pillar is ensuring access to affordable medicines for patients and addressing unmet medical needs. Second pillar focuses on supporting competitiveness, innovation and sustainability of the EU’s pharmaceutical industry and the development of high-quality, safe and effective medicines. The third pillar focuses on enhancing crisis preparedness and response mechanisms by diversifying and securing supply chains and addressing medical shortages. Lastly, the fourth pillar aims to ensure EU’s strong position in the world by promoting a high level of quality, efficacy and safety standards. (Garattini et al. 2021, 2.) The Commission, The European Medicines Agency (EMA), the pharmaceutical regulatory bodies of each member state and within the European Economic Area (EEA) work together to fulfil these four pillars (European Commission 2020). The Pharmaceutical Strategy explicitly refers to OSA (Bayerlein 2023).

2.4.3 Anti-Coercion Instrument (ACI)

As the line between economy and security has become more blurred due to the growing importance of state-owned and state-influenced enterprises in the world economy challenging the neoliberal concept of a clear division of states and markets. Ownership and control of critical infrastructure and information technology networks and outlets combined with the digitalization of most economic activity and interaction has turned into a potential security threat. Lastly, the recent geo-economic turns of both China and the US included reinforcing economy policy tools to serve their geopolitical ambitions. (Freudlsperger & Meunier 2024, 1066.)

As stated by Freudlsperger & Meunier (2024, 1066), “the EU’s legal system is built on the principle of ‘conferral’ (Article 5 TEU), whereby the EU acts only within the limits of the competences that EU member states have conferred upon treaties”. In the context of tight trade-security nexus the EU lacks an even competence base and necessary legal competence to link security and trade and to act swiftly on economic sanctions in a situation where prerogatives are threatened by outside interference or coercion. This is what ACI aims to tackle. (Freudlsperger & Meunier, 2024)

As Article 2.1 defines, economic coercion is all instances where an external power “applies or threatens to apply a measure affecting trade or investment to prevent or obtain the cessation, modification or adoption of a particular act by the EU or a member state” (Freudlsperger & Meunier 2024, 1069). ACI is implied in a four-step procedure. First, there needs to be an examination whether economic coercion is at play. This can be started through European Commission’s own initiation, market participants’ or member states’ requests. (Freudlsperger & Meunier 2024, 1069.)

2.4.4 European Medicines Agency (EMA)

European Medicines Agency (EMA) coordinates actions on medicine availability issues at EU level in cooperation with national authorities and industry stakeholders. EMA also ensures the availability of critical medicines at EU level. (Pelkonen 2024.) Regulation (EU) 2022/123 enables the EU to better prepare for and react to health crises more quickly by formalizing some of the structures and processes of EMA. To do this, EMA collects data directly from national competent authorities and marketing authorization holders through the European Shortages Monitoring Platform. (EMA 2026a.)

EMA's Executive Steering Group on Shortages and Safety of Medical Products (MSSG) provides recommendations and action plans for preventing medicine shortages. It also provides recommendations for production and authorization processes and resolving medicine shortages at EU level. (Pelkonen 2024.) MSSG's responsibilities are in line with EMA's crisis preparedness and management role and cooperates with European Commission's Critical Medicines Alliance to discuss long-term measures to address vulnerabilities (EMA 2026b).

Critical Medicines Alliance (CMA) works in cooperation with pharmaceutical industry and Member State representatives in addition to EMA. CMA develops short- and long-term measures to ensure the availability of medicines. (Pelkonen 2024.) CMA provides a consultative platform and strategic reports on vulnerabilities in critical medicines supply chains. (European Commission 2026.)

2.4.5 Health Emergency Preparedness and Response Authority (HERA)

As a result of the COVID-19 pandemic, the European Commission established the Health Emergency Preparedness and Response Authority (HERA) to strengthen its role in preparedness planning and response. The duties of HERA are scanning for "major threats to health and potential countermeasures, funding R&D, supporting manufacturing capacity and stockpiling of essential medical supplies and equipment." (Anderson et al. 2021, 1.) Despite some overlapping in the roles with other EU bodies and systems, HERA is especially designed to mitigate the effects of increased trade restrictions on health goods. As illustrated by the COVID-19 pandemic, the restrictions strain health systems due to supply shortages and price increases. This might also harm the EU's internal markets, as member states might feel compelled to act unilaterally to meet their own medical needs. HERA's work aligns with the OSA framework as HERA's work includes identifying import dependencies. (Bayerlein 2023.) Additionally, HERA cooperates with the European Centre for

Disease Prevention and Control (ECDC) to strengthen knowledge in preparedness and response to medical countermeasures regarding pandemic risks (European Commission - Public Health, 2023).

2.4.6 European Directorate for the Quality of Medicines (EDQM)

European Directorate for the Quality of Medicines (EDQM) is under the European Council. Its main responsibilities include supporting national authorities and healthcare providers on methods for selecting non-authorized products and manufacturing stockpile products in public health crises. It also conducts monographs on medicinal products not authorized for marketing, manufacturing and testing methods for situations where authorized medicinal products are not available. (Pelkonen 2024; EDQM 2026.)

2.5 Synthesis

The chosen theories provide a scientific lens, supporting the realization of the empirical study. As the operationalization in Table 3 shows, each sub-question is answered through at least one theory. It should be noted that the fourth sub-question utilizes the EU's provided frameworks as theories. By utilizing already existing theories, empirics and theory are drawn together, which further helps to create an interview framework.

Table 3. Operationalization table

Research topic	Research question (RQ)	Sub-questions (SQ)	Theory
Finnish pharmaceutical sector in the shifting geopolitics – European Union's role in managing economic dependencies	How can the EU's trade policy address Finland's strategic dependency on pharmaceutical supply chains considering China's API dominance and U.S.–EU trade relations?	SQ1: What is Finland's position in global pharmaceutical supply chains, given China's API dominance?	Global production networks (GPN)
			Network embeddedness
		SQ2: How have U.S.–EU and U.S.–China trade tensions reshaped Finland's vulnerability in pharmaceutical supply chains?	Economic interdependence
			Weaponized interdependence

		SQ3: How are pharmaceutical supply chain vulnerabilities interpreted as strategic dependency in Finland?	Political economy
			Securitization
			Economic security
			Security of supply
			Strategic dependencies
		SQ4: How can EU trade policy instruments mitigate Finland's dependencies in the pharmaceutical sector?	OSA
			HERA
			EMA
			EDQM
			Pharmaceutical strategy for Europe
			ACI

The operationalization table ensures that the sub-questions are consistent with the research question. Additionally, it ensures that the chosen theories correspond to the sub-questions.

The preliminary theoretical framework argues that the EU, state and firms are all connected to the industry, but with different interests to outcomes and approaches to management. As illustrated in Figure 6, GPNs are formed through domestic and foreign industries. Both exist in a global political economy, which in turn consists of internal political economy and external political economies.

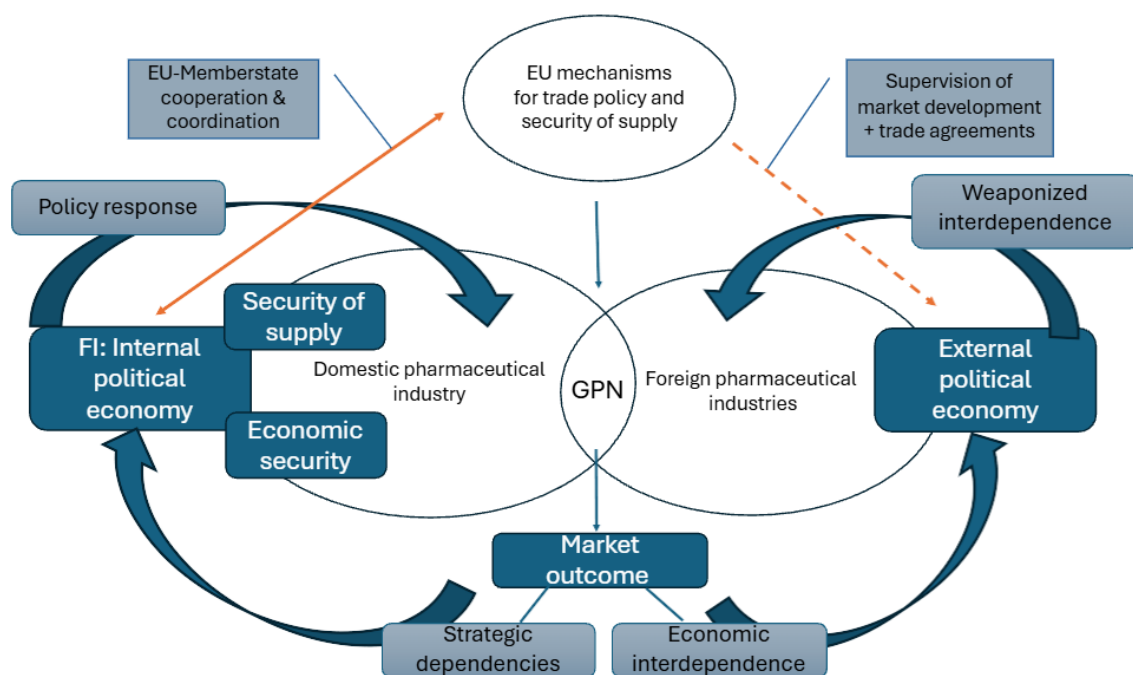


Figure 6. Preliminary theoretical framework

As for Finland, the security of supply and economic security are major concerns, which shape the domestic political economy and thus, the domestic industry. The securitization of the pharmaceuticals links it to economic security and security of supply. As Finland is a member state of the EU, it applies the set of mandates required by the EU to its internal political economy, reflecting onto the domestic industry. Although the EU itself is not participating in the GPN, it is supervising the market development due to the strategic nature of pharmaceuticals. The EU also can negotiate trade deals with the external actors, thus shaping their actions as agreed.

The Finnish industry is a part of the GPN together with the foreign industries. The market outcome could be strategic dependencies or economic interdependencies. Both the internal and external political economies adjust their responses based on the market outcome. Finland's response shapes the domestic industry, and vice versa.

If the market conditions allow, the more powerful external actor could weaponize the interdependence to gain negotiation leverage either in negotiations with Finland or the EU. Should there be weaponization of the interdependence or growing concern over security of supply or economic security, Finland can inform the EU of these concerns. The EU then can utilize its mechanisms for trade policy and security of supply. The EU participates in the GPN, as it has a role in regulating its internal markets through the market authorization process of pharmaceuticals.

3 Research design

The research design provides ideas and viewpoints for the theoretical framework, data collection, method choices and makes sure that the research questions are governing the choice of method (Eriksson & Kovalainen 2015, 27). This chapter discusses the research process from the qualitative approach to evaluation of trustworthiness and ethical considerations.

3.1 Research context

The time and space setting of the research is directly related to the geopolitical dynamics of recent times and the supply chains of the pharmaceutical industry. The study took place from 2025 to 2026, a time when the trade policy in international affairs was greatly influenced by trade relations between the US and China and the question of strategic dependence. At that time, there were also the implications of the tariffs imposed by the US in 2025, causing uncertainty and doubts about the fragility of supply chains in the pharmaceutical industry.

The physical setting is defined by the role that Finland plays within the European Union and production networks in the global pharmaceutical industry. Finland is a part of the EU internal markets and participates in the production networks of the international pharmaceutical industry, which entails a fragmented structure of manufacturing processes with the distribution of production, R&D, inputs, and markets in various countries.

Geopolitical shifts, trade policies, and concerns regarding economic security make the context of this research particularly important since all those elements affect how strategic dependencies can be considered and approached. It should also be mentioned that the effects of recent initiatives within the European Union, such as Open Strategic Autonomy and the Pharmaceutical Strategy for Europe, have yet to be fully realized at the point of writing this thesis.

The research process started in the summer of 2025, where the trade data for only 2024 was available. However, at the time of conducting the collection of larger quantitative data sets for processing, trade data was available for the year 2025. Nevertheless, the introduction chapter was later updated with newer data wherever possible.

3.2 Mixed methods study with a qualitative research emphasis

The method chosen should be relevant and appropriate for answering the research question, but it's noteworthy to emphasize that methods are interwoven into epistemological and ontological

assumptions. Thus, methods are not used in a vacuum during qualitative research, although differing in methodological assumptions. (Eriksson & Kovalainen 2015, 29 – 30.) In addition, the research design should follow the principle that the analytical process is guided by the research question, rather than an inflexible methodological framework (Ruusuvuori et al. 2019, 11).

In this research, both qualitative and quantitative methods are utilized. However, the focus lies in the qualitative approach. The aim of using mixed methods in this research is to capture a complete and holistic picture of the researched phenomena, which might be missed with a simpler research design (Hurmerinta-Peltomäki & Nummela 2004, 164). Additionally, a mixed method study has potential for increasing validity and creating knowledge through innovative designs (Hurmerinta-Peltomäki & Nummela 2006, 439).

The quantitative data is collected parallel to the qualitative data. However, the processing of the quantitative data is conducted after completing the analysis of the qualitative data. The quantitative data is in a supporting role in relation to the qualitative data. Lastly, the purpose of including quantitative data is topic-related, as the research handles a topic that is rather unexplored. (Hurmerinta-Peltomäki & Nummela 2004, 165 – 166.) The quantitative trade data allows identifying dependencies and concentration which might be impossible to identify using only interviews and policy analysis. The use of concentration measures and trade figures allows to detect any possible dependencies within Finland's pharmaceutical sector. In addition, the quantitative data can be used to compare dependency structures within the country's pharmaceutical trade with the discussions concerning dependencies on EU-level dependency discussions, thereby strengthening the analytical depth and contextual understanding of the phenomenon.

Qualitative research approach as a tool is opted for when aiming to interpret and understand the reality of empirical phenomena. Qualitative approach is more sensitive to the social and cultural context of the issues studied. (Eriksson & Kovalainen 2015, 4; Eskola & Suoranta 1998, 6.) Qualitative approach is well-suited for locating the meanings around events, structures, and processes and further connecting these meanings to the social world they take place in. Qualitative approach enables the capturing the complexity of the phenomena by collecting rich and holistic data embedded in real context without the aim for statistical generalization. (Miles et al. 2019, 7; Eriksson & Kovalainen 2015, 3; Eskola & Suoranta 1998, 61.)

This research aims to comprehend the meaning of geopolitical shifts in Finnish pharmaceutical industry and the role that EU plays in this configuration. Since the research question of this research

focuses on a topic which is rather difficult to quantify, a qualitative approach is suitable for producing knowledge. Thus, a qualitative approach is chosen.

The research process is iterative and continuous. As Ruusuvuori et al. (2010) suggest, the stages of the study are closely intertwined. The figure below presents all the phases of conducting research.

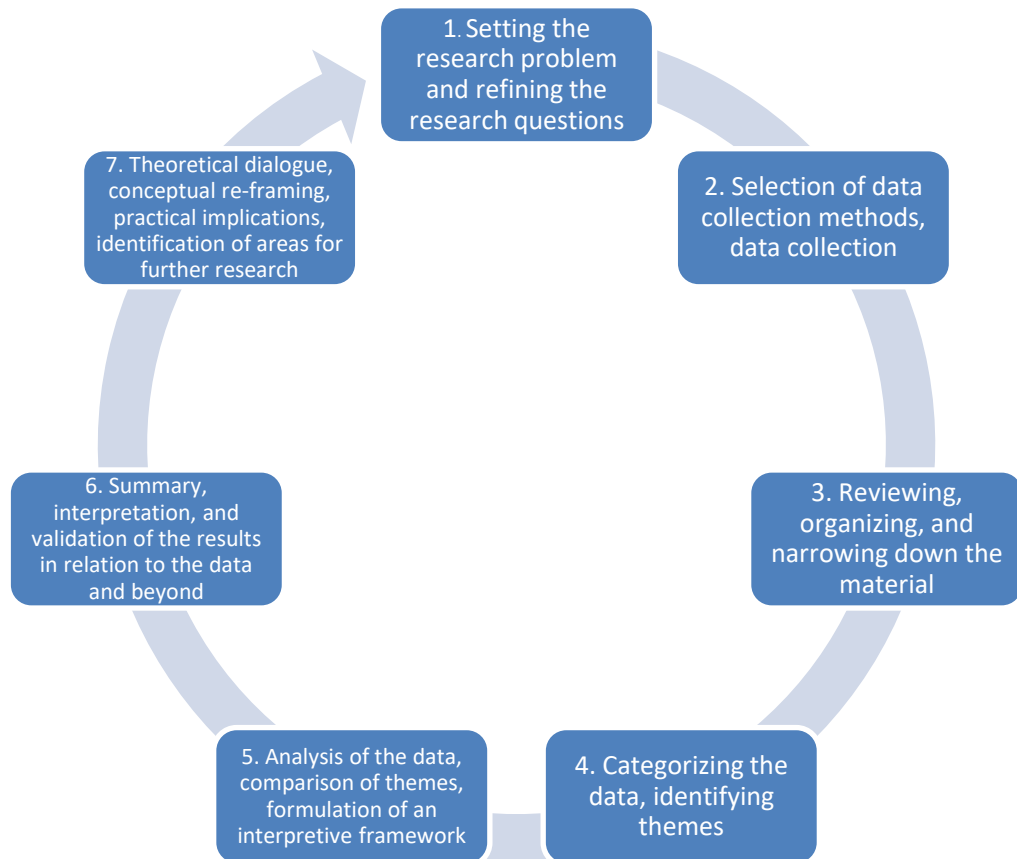


Figure 7. Phases of an iterative research process (Ruusuvuori et al. 2010)

As Figure 7 shows, the research process is continuous, and all the phases are connected to each other. Additionally, the phases can be simultaneous. For example, data collection can happen at the same time as reviewing and organizing data already collected.

The research questions are refined and reflected upon the research process to assess the appropriateness of the decisions taken (Agee 2009, 432). Qualitative approach expands the snapshots of *what* and *how many* to understanding *why* and *how* (Miles et al. 2019, 7). The research questions in qualitative research are divided into *what*, *why* and *how*. *What* questions generate descriptions of processes, situations and states, meanwhile *why* questions generate explanations of them. *How* questions provide understanding of how these processes, situations, processes or states take place, work or interact. (Eriksson & Kovalainen 2015, 42.)

Shaping the research questions have been considered in this research. SQ1 *What is Finland's position in global pharmaceutical supply chains, given China's API dominance?* aims to describe and explore the state of the global pharmaceutical industry and Finland's position in the global scene, thus a what question with a descriptive approach is chosen. SQ2 *How have U.S.–EU and U.S.–China trade tensions reshaped Finland's vulnerability in pharmaceutical supply chains?* adopts a more cause and consequence focused approach to understand the spill-over effects of the growing trade tensions. SQ3 *How are pharmaceutical supply chain vulnerabilities interpreted as strategic dependency in Finland?* also focuses on the cause and consequences of the phenomena to understand the formation of a strategic dependency and how it is linked to supply chain vulnerabilities. SQ4 *How can EU trade policy instruments mitigate Finland's dependencies in the pharmaceutical sector?* adopts both the cause consequence approach as well as an aim to describe the nature of different EU trade policy mechanisms and tools, and which part of the pharmaceutical sector's concerns they affect.

The role of theory in research is both a tool and a goal. As a tool, theory guides the research by offering a background against which the collected data is examined. As a goal, the aim of the research is to further develop the theory while systematizing the collected data. The reporting of findings is mostly a discussion between theory and empirics. (Eskola & Suoranta 1998, 82 – 83.) As qualitative research relies on constant interplay between empirics, theory and interpretation, theory is often viewed as a collection of ideas. This gives the researcher more flexibility in conceptualizing their own theoretical framework and working with the connections between theories, concepts and methods. (Eriksson & Kovalainen 2015, 44.) Theories chosen should be organized around the research questions of the study while not blinding the researcher from potential interesting findings (Eriksson & Kovalainen 2015, 46; Koskinen et al. 2005, 48).

This research is interview-based. Before choosing the interview method, it is crucial to consider if other research methods are more suitable for gaining information. Like any other method, interview method must be well-justified for research. Interviews are well-suited for collecting information on given meanings and interpretations of phenomenon. (Koskinen et al. 2005, 104 – 106.) As this study aims to understand the role of EU in Finnish pharmaceutical sector and the meaning of shifting geopolitics to it, it's beneficial to conduct interviews to gain these insights from experts. Koskinen et al. (2005) note that interviews as an only method should be avoided, when the information is distributed among many people. To solve this, the chosen interviewees are from different representative bodies associated with the research topic. Both public and private sectors are interviewed. The secondary quantitative data supports the interpretation of the interviews and

possible interesting results of the quantitative analysis could be further discussed with some of the interviewees in a follow-up interview.

3.3 Data collection

3.3.1 Collection of qualitative data

The data is collected with guided and semi-structured expert interviews. Semi-structured interviews are opted for, as it allows the researcher to slightly modify the wording and set of questions according to the expertise of the interviewee (Eriksson & Kovalainen 2015, 93). The interview questions are drawn from the sub-questions to enable a more detailed and nuanced exploration of the research topic. Whereas the research questions address broader themes, the interview questions focus on more specific aspects and finer details to enable deeper insights into the topic. (Eriksson & Kovalainen 2015, 93.) Semi-structured interviews are supported by the interview guide, that organizes the interview questions and makes sure everything important is discussed. The interviews consist of 8 – 12 open-ended questions which the interviewee can answer with their own words. The first question is a warm-up question, which opens the discussion deeper into the research topic. The interview guide with the interview questions is provided in Appendix 1 Interview themes and general questions translated to English. The interview questions were chosen or modified from the interview guide based on the expertise of the interviewee.

After the substantial questions, the last question is a closing question to end the discussion. (Koskinen et al. 2005, 108–110.) In addition, an open-ended question of whether the interviewee has something to add to their previous answers, a comment on the research setting, or something in mind that wasn't brought up by the researcher, was asked. The purpose of these interviews was to gain insights whether the Finnish pharmaceutical sector is affected by the shifting geopolitical scene and whether the EU can reduce the negative effects of strategic dependencies on security of supply and strategic dependencies.

The process of choosing the interviewees to contact happened through preliminary studying of the research topic and getting familiar with the different areas of expertise revolving around the topic. That way multiple organizations, both Finnish and international and both public and private, of different viewpoints to the research topic were identified. The potential interviewees were approached via the Turku university's email. All the potential interviewees' email addresses were gained from public resources. The first email included an introduction to the research and a request for an interview of approximately one hour. Enclosed was the research information sheet based on

the Turku School of Economics model file, filled with the details of this study. If the potential interviewee accepted the request, a consent form to be signed by the interviewee and the researcher with possible interview times was sent. The researcher notified GDPR and data management plan were available, and a hyperlink to both was added to the consent form.

The interview questions were open-ended to encourage reflective answers. For example, instead of asking whether the EU's systems of supporting member state's security of supply are adequate, the question invited the experts to more broadly discuss the complex nature of security of supply, the EU's effects, and pharmaceutical industry. The interview questions were drawn from the themes revolving around the research topic while keeping the chosen theories in mind but not merely relying on the theories to prevent becoming blind to theories and losing the flexibility to discover that a chosen theory isn't a good fit to research this topic. The themes included Finnish pharmaceutical industry's strengths and weaknesses, responsibility over security of supply, China's position in the GPN (market share/ political leverage), changes in pharma supply chains recently, U.S. – China tensions effect on the EU, the EU's approach the US and China, monitoring dependencies in Finland and in EU, the line between openness, competitive advantage, security of supply and protectionism, the line between dependency and strategic dependency and weaponized dependency, EU's role in mitigating risks (if any), EU trade policy tools, and derisking. The interview questions translated into English can be found in Appendix 1 Interview themes and general questions translated to English

The semi-structured interview approach allows the researcher to adjust the questions based on the interviewee's area of expertise. The approach allowed the researcher to maintain within the thematic structure of the interview guide while also giving the experts freedom to elaborate on issues within their expertise or what they found particularly relevant. As this research topic is highly interdisciplinary with aspects from supply chain governance, geopolitics, economic security, security of supply and socio-political dimensions, this flexibility in the approach style is essential. Throughout the interview process, some questions were reframed according to the interviews that had already been conducted. The general question sheet can be found in the appendices in Appendix 1 Interview themes and general questions translated to English. The question sheet for the follow-up interview can be found in Appendix 2 Follow-up interview themes and questions translated to English

The interview questions' wording was carefully thought out and reviewed multiple times to ensure neutrality of the questions. Additionally, the process of shaping the interview questions also helped

to shape the research questions, as the participants shouldn't be able to directly answer the research questions, nor should the researcher be able to conduct answers by simply reorganizing the answers given by the interviewees (Eriksson & Kovalainen 2015). Thus, the research question and sub-questions were reframed throughout the research process to ensure that the research answers them. The title of the research was finalized at the end of the research process to correspond with the research focus and content.

Each interview lasted approximately 45-60 minutes and was conducted either via Microsoft Teams, Zoom meetings or in person. All interviews were recorded with consent to have transcriptions for the analysis process. The permission was always asked for at the beginning of the interview, after again explaining the aim of this study. Doing this in addition to the participants signing the consent form in Appendix 9 Thesis information and interview consent form ensured that the participants had fully understood the purpose of the audio taping and the study they are participating in. Below is a list of the interviews conducted.

Table 4. Conducted interviews

Participant	Area of expertise	Interview date and place	Interview duration
Expert 1	Trade policy, international trade	20.10.2025, Zoom	50min
Expert 2	Pharmaceutical industry, strategic dependencies	22.10.2025, Turku	1h
		20.4.2026, Zoom	45min
Expert 3	Trade policy, the U.S.	31.10.2025, Zoom	45min
Expert 4	Pharmaceutical industry	5.11.2025, Turku	45min
Expert 5	Geopolitics	7.11.2025, Zoom	1h 15min
Expert 6	Pharmaceutical industry	8.11.2025, Teams	45min
Expert 7	Pharmaceutical industry	14.11.2025, Zoom	1h
Expert 8	Security of supply	21.11.2025, Teams	45min

Eight interviews were held in October – November of 2025 either in person or on an online platform. All the interviews were recorded with the permission of the interviewee to help with the transcribing process and ensure that no information, possibly highly relevant for the research, is forgotten. The duration of the interviews varied from approximately 45 minutes to an hour. As this research includes quantitative secondary data and handles a very complex and dynamic topic, one follow-up interview was conducted with one participant in April 2026. This ensures that the quantitative data is fully integrated in the analysis rather than remaining as a detached addition. Additionally, the follow up interview ensures that the preliminary findings are consistent with the expert's views. However, it should be noted that the whole interview process was much longer than Table 4 might suggest. The table below illustrates the true scope of the process.

Table 5. Full interview process

Emails sent	Email responses	Interviews conducted
16	12	8 + 1 follow-up

As Table 5 illustrates, in total 16 emails requesting an interview for the thesis were sent. Four denied the request, eight accepted and four did not respond. Despite contacting multiple EU bodies for a chance of an interview, all the interviews conducted were from Finnish agencies.

3.3.2 Collection of quantitative secondary data

Collecting and analyzing secondary quantitative data provides insight on the importance of Finland's trade partners and the possibility of substitution of supply. Focusing on pharmaceuticals alone gives a possibility of recognizing dependencies on both imports and exports. It's important to understand the nature of dependencies on both sides of the relationship, meaning that both Finland's dependencies on trade partners and trade partners' dependencies on Finland should be considered. The found dependencies' criticality for the functioning of society and domestic business should be considered as well.

The quantitative data was collected from Finnish Custom's webservice Uljas in March 2026. The data included trade value of Finland's both exports and imports of pharmaceuticals (HS30) on an HS6-level during 2025. After entering Uljas, the option to view international trade statistics was chosen. From there, the data was chosen to be viewed by CN (The Combined Nomenclature of the EU) classification from the year 2002 onwards. The accuracy of CN6 was opted for, and CN30 codes on CN6-level were extracted from imports and exports. CN30 stands for pharmaceutical

products. Due to download limitations in Uljas, the dataset was constructed in a master Excel file by combining multiple extracts covering all partner countries. The data was downloaded in four sets: the countries' tariff codes from A to F, to G to I, J to P and from Q to Z. Care was taken to ensure full country coverage to avoid bias in concentration measures such as the Herfindahl-Hirschman Index.

After gathering the data to a master Excel, all aggregate categories such as "All countries together" were removed to avoid double counting in the calculation of concentration indices. The analysis focuses on extra-EU trade, as intra-EU trade does not reflect external strategic dependencies due to the integrated nature of EU single market. In addition, obsolete or non-sovereign entities (e.g. Netherlands Antilles, Yugoslavia) were excluded to ensure consistency with the current international trade structure.

3.4 Data analysis

3.4.1 Qualitative data analysis

For the research to have a contribution, the researcher must not only describe the collected data but also interpret the data. Interpretation and analysis of the data is a distinction between science and common sense. (Koskinen et al. 2005, 229.) This research utilizes a thematic analysis, as it's a versatile tool suitable for both inductive and deductive research approaches and it offers a structured and flexible approach to identifying themes within the dataset. The method emphasizes researcher's reflexivity and theoretical transparency. (Ahmed et al. 2025, 1.) Thematic analysis is a method suitable for a wide range of epistemologies. It is a method for "identifying, analyzing, organizing, describing, and reporting themes found within the data sets." (Nowell et al. 2017, 2.)

All interviews were transcribed as soon as the interviews were held. The recordings of the interviews were then erased. The transcription process worked as the first step of familiarizing oneself with the dataset and observing the initial bigger themes arising from the data. The researcher's existing knowledge on research themes, such as interdependence and trade policy, assisted in gaining comprehensive understanding of the experts' arguments, reasoning and possible assumptions shaping their assessments of EU policies.

After the data transcription and thoroughly reading the dataset, initial codes were generated for organizing the data. The themes emerge from both the interview as well as theoretical background, as the interview questions were formed with the research questions and theory in mind. The initial themes help systematically identify and label meaningful features and trends across the dataset.

After this, similar themes are merged to form broader entities with iterative refinement. Then, the themes are reviewed by refining boundaries and lastly the themes are named and defined. (Ahmed et al. 2025, 3.)

To provide a clear link between sub-questions, theories, and empirical findings, the original operationalization table was created. Table 4 illustrates the links between theories, emerging themes from both theories and analysis, and analysis chapters and empirical findings, which are added to the operationalization table. The updated operationalization table is presented below.

Table 6 Revisited operationalization table

Research question (RQ)	Sub-questions (SQ)	Theory	Themes emerging from theory	Themes emerging from analysis	Analyses (chapter number)	Findings
How can the EU's trade policy address Finland's strategic dependency on pharmaceutical supply chains considering China's API dominance and U.S.–EU trade relations?	SQ1: What is Finland's position in global pharmaceutical supply chains, given China's API dominance?	Global Production Networks Network embeddedness	Geographical dispersion and specialization of production Location of different stages of value chains in different countries Key “hubs” and control over them Embeddedness: the ties that bind actors to specific networks and locations	Finnish industry's characteristics Global industry's characteristics Finnish market and economy Global market and economy	4.1	Peripheral and non-central position - limited bargaining power within global production networks Finnish firms' dual strategy Deep-rooted operating models – costly and slow to change Small market size and high regulation hinder competitiveness
	SQ2: How have U.S.–EU and U.S.–China trade tensions affected the Finland's vulnerability in	Economic interdependence Weaponized interdependence	Interdependence vs. asymmetric dependence Sensitivity vs. vulnerability	Trade tensions Geopolitical and trade-related risks in supply	4.2	Trade tensions increase uncertainty and administrative costs for businesses The U.S.-China conflict

	pharmaceutical supply chains?		Direction of dependencies (imports vs. exports) Substitutability and availability of alternative suppliers Control of key hubs as a source of power The use of dependencies as a political tool	Dependence and power relations Dependency and concentration risks in supply		could cause trade flows to shift disproportionately toward the EU China's dominant role as a supplier of critical inputs increases risk Geopolitically the EU is caught in the middle between the major powers The diversion of investment away from the EU weakens long-term resilience Risk of long-term dependency lock-in
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	SQ3: How are pharmaceutical supply chain vulnerabilities interpreted as strategic dependency in Finland?	Political economy Securitization Security of supply Strategic dependencies	the interplay between government and corporate interests the impact of regulation, subsidies, and market structures framing economic issues as security issues Managing economic dependencies from a security perspective Identifying critical sectors and resources Ensuring the availability of critical products Storage, production capacity, and supply chains The roles of the public and private sectors the concentration of dependencies in critical sectors high concentration and low substitutability	Security of supply risks Security of supply strengths Market-related risks on supply	4.3	Low reimbursement rates and high concentration increase vulnerability Import dependency → supply risk Export dependency → market risk Geopolitical uncertainty increases the “securitization” of risks Unintentional undermining of Finland's competitiveness Limited options to react enhance strategic dependence
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			impact on the functioning of society			
	SQ4: How can EU trade policy instruments mitigate Finland's dependencies in the pharmaceutical sector?	EU mechanisms for trade policy and security of supply	Balancing openness and strategic autonomy Reducing dependencies without decoupling Diversifying supply chains Strengthening strategic sectors in the EU The EU's ability to respond to external coercion The use of trade policy as a geopolitical tool Ensuring the availability and safety of medicines Regulation of market access Monitoring of critical medicines	EU strategy for security of supply EU trade policy Finland's trade policy Role of the Finnish state	4.4	Unintentional undermining of the EU's competitiveness Aim to balance between open trade and economic security The impact of trade policy tools varies by sector and product EU decision-making is slow due to differences among member states Not all dependencies can be shifted within the EU for cost reasons Companies make final decisions on where to locate production Contradictions between the interests of industry and politics

The themes presented in Table 6 emerged from the eight interviews conducted after carefully reading each of the transcriptions and shaping the text form by adding paragraph breaks between the speakers and themes. Initially 15 themes were created from reading through the transcriptions one by one and adding the codes on the separate Word files with the comment function. It should be

noted that the themes were not predefined – they were created while interpreting the collected data. If an already existing theme didn't seem to describe the answer of the interviewee, a new theme was created. The factors market under a theme could include a word, a sentence, or a paragraph. For example, one paragraph could include sentences or words of multiple different themes. Then, all the sentences under every theme were collected to a different file under that specific theme, so that the theme specific information from every interview was in the same place for further analysis.

After reading the notes under the themes and positioning the themes under the sub-questions, four new themes were created: market-related risks, geopolitical and trade-related risks, dependency and concentration risks, and security of supply risks. Creation of these themes also corrected partial overlaps between the themes. Market-related risks derived from the themes Finnish market and economy, and Global market and economy. Geopolitical and trade-related risks derived from the later fully dispersed theme China and Trade tensions. Dependency and concentration risks derived from theme Dependencies and power relations. The theme Security of supply risks emerged from theme Challenges of security of supply. The finalized themes are presented in Table 6.

After finalizing the themes and positioning them under each sub-question, the notes from the transcriptions were carefully read through once again to ensure reflectivity. The analytical process was iterative and continuous, and the working logic evolved alongside both data collection and the analysis of the data.

3.4.2 Quantitative data analysis

European Commission's product analysis is the utilized method for assessing import dependencies. This method is optimal, as it considers EU's internal market in calculations. Thus, only the EU-external dependencies are considered. (Kristeri 2025, 15.) The product analysis for Core Dependency Indicators (CDI) starts with the Herfindahl-Hirschman index (HHI), followed by a bottom-up approach based on the findings. HHI identifies the concentration of import products for which Finland's imports in value are highly concentrated in a few extra EU markets. Only extra-EU countries' concentration is considered, since the extra-EU trade has a higher risk for disruptions. HHI is computed as below:

Equation 1. HHI computation. CDI1 criterion

$$CDI_1 = \sum_{i=1}^n (s_i^2)$$

where s_i is the market share of the extra EU supplying country i in Finland's imports and n is the total number of extra EU supplying countries. (European Commission 2021, 20.)

After computing the HHI for all the products, the ones with a value greater than 0,4 were chosen for further processing. If $HHI > 0.4$ the importance of extra EU imports in total demand is calculated. This allows identification of products for which Finland relies on extra EU countries. The importance is computed as the share of extra EU imports in Finland's total imports:

Equation 2. CDI2 criterion

$$CDI_2 = \frac{\text{extra EU import value}}{\text{total FI import value}}$$

Should $CDI_2 > 0.5$, these products are chosen for further processing. The last indicator of foreign dependencies is the substitutability of extra EU imports with domestic production. This captures the ability to cover the extra EU imports with domestic production in case of trade disruptions. The substitutability of each product is determined by the ratio between the extra EU import value and Finland's total export value (i.e. intra and extra EU), which is computed as below:

Equation 3. CDI3 criterion

$$CDI_3 = \frac{\text{extra EU import value}^{EU}}{\text{total FI exports}}$$

Should $CDI_3 > 1$, most the total value of Finland imports come from extra EU imports. "The higher the ratio, the less able Finland is to substitute extra EU imports with EU production in case of a trade disruption" (European Commission 2021, 22). The combination of these three indicators and their ranks measure the overall foreign extra EU dependency of each product. (European Commission 2021, 22.)

For export dependencies, the gross exports are processed through HHI, which measures the exports across all the partners by summing up the squared values of bilateral trade sharers. Bilateral trade dependencies exist if the gross exports of given product on CN6 level are highly concentrated and the exports to a specific partner account for a relatively high share of the overall exports of the product. The thresholds thus are country-level exports $HHI \geq 0.2$. (Arriola et al. 2024, 109.)

Both the import and export aspects of trade are considered to gain a throughout picture of Finland's trade dependencies. Imports have a connection to security of supply, whereas exports are linked to economic security.

In total 18 import products were flagged for a high HHI ($>0,4$) as listed in Appendix 3 Import CN30 high HHI flagged products. These products were chosen for further observation. As for CDI2, six products were flagged for high value, which are listed in Appendix 4 Import CN30 high HHI + CDI2 flagged products. Within those products, five were flagged with the final CDI3 criterion. Thus, these five products are the most critical regarding extra-EU import dependencies. The products are listed in Appendix 5 Import CN30 high HHI + CDI2 + CDI3 flagged products.

As for exports, the export data is in the same master Excel. After conducting the HHI with the same logic as with imports, 26 products were flagged for high HHI ($>0,2$). This HHI calculation includes only extra-EU countries in relation to extra-EU trade, as the research focuses on extra-EU dependencies. The products are listed in Appendix 6 Export CN30 products flagged with high HHI.

To make a more comprehensive interpretation of the trade dependencies detected, the CN-coded pharmaceutical products identified by concentration levels (CDI3 for imports and HHI for exports) were categorized into relevant groups. Specifically, this means that the products in question are those product groups, where Finland's trade with the outside world beyond the EU is most concentrated.

Further classification was performed by dividing the products based on their functional use within pharmaceutical chains and policy implications. More specifically, these classifications include: (1) high technology biopharmaceuticals (including immunological products, vaccines, and cell products), (2) biological components (including blood products and organ extracts), (3) regular pharmaceuticals (antibiotics, etc.), (4) hormones and drugs targeting chronic conditions (including insulin), (5) low-technology and auxiliary medical products (including first aid kits and diagnostic products), and (6) diagnostic products (including diagnostic reagents). The grouping of the products with total trade values and China's, USA's, and India's shares are provided in Appendix 7 Flagged export and import CN30 products' classification and trade values.

By grouping the products based on their function, more detailed analysis on the type of dependencies can be conducted, including vulnerabilities on the side of suppliers, dependencies on foreign markets, and dependencies related to strategic sectors. In addition, we can now compare our results with those of existing dependency analyses at the EU level, since these are also made according to the same criteria. More specifically, the analysis of Guinea & Espés (2021) was used as a benchmark to analyze the quantitative data.

3.5 Evaluation of study

Qualitative research has been criticized for the vagueness of its evaluation criteria, as the distinction between data analysis and evaluation of research is not as clear as in quantitative methods. Eskola & Suoranta (1998) emphasize that the starting point of qualitative research is that the researcher is a tool for the research – the primary criterion of trustworthiness is the researcher self. Thus, the evaluation of trustworthiness must consider the whole research process. (Eskola & Suoranta 1998, 209 – 211.) To ensure the quality of this research, the conducted study is evaluated through the terminology of trustworthiness, which can be considered from four perspectives: in terms of realism, credibility, cooperation, and evaluation as criticism (Eskola & Suoranta 1998, 213).

3.5.1 Realism

In terms of realism, the issue is how accurately the research text describes the subject being studied. Theoretical and conceptual definitions should be consistent, and interpretations and conclusions should be valid in relation to the data. These issues can be considered by ensuring the significance and adequacy of the data, as well as the comprehensiveness, assessability, and repeatability of the analysis. Significance can be supported by being aware of the cultural context of the material and the conditions under which it was produced. (Eskola & Suoranta 1998, 213 – 216.) In case of this research, being aware of the researcher's position during the interview process and active participation in data production supports the significance of the collected data.

Adequacy of material is connected to the comprehensiveness of analysis. The adequacy of the material is assessed by reaching the saturation point, meaning that new cases don't produce new information in terms of the research problem. (Eskola & Suoranta 1998, 62, 216.) Some level of thematic saturation was reached during the data collection process as during the interview process, the perspectives, concerns and arguments were similar.

The comprehensiveness of analysis means that interpretations are not based on random selections from the material (Eskola & Suoranta 1998, 216). For this reason, the thematic analysis was chosen as a method. The method ensures that the collected material is taken as a whole, and interpretations are based on the whole material.

Assessability of the analysis means that the reader can follow the researcher's reasoning. Repeatability means that another researcher can reach the same conclusions from the material by applying the classification and interpretation rules used in the analysis of the research. (Eskola & Suoranta 1998, 217.) These issues are considered by providing a clear listing of data, breaking down

interpretations into small steps and specifying rules for solutions and interpretations, as presented in Table 6.

3.5.2 Credibility and cooperation

Credibility sees the research text connected to research practice. The research text is the ultimate demonstration of credibility of the research and is the context from which words gain meaning. The internal consistency of the text determines the criteria for assessing credibility. To ensure credibility, coherence, participant orientation, new problems, and productivity must be considered. All of these, except participant observation, focus on reviewing credibility at the level of the data and the report. (Eskola & Suoranta 1998, 221 – 223.) In this research, the chosen method of thematic analysis allows the data to be reflected upon multiple times during the whole process. This reflexivity safeguards transparency and ensures capturing rich and complex qualitative data into concise text. (Ahmed et al. 2025, 5.) Participant orientation is considered by listening to the participant's interpretations of the analysis. New problems and productivity are linked to each other, as good analysis should raise implications for future research with its new information or perspectives. (Eskola & Suoranta 1998, 223.) Thus, the contributions and implications for further research are presented at the end.

Cooperation emphasizes the role of research subjects as researchers. This way trustworthiness becomes a result of joint negotiations between the parties. Reflective conversations increase the relevance of the research in terms of its reflective practice. (Eskola & Suoranta 1998, 224.) In this research, only one further discussion was conducted with the research participants after the interview due to time constraints. However, having more follow-up interviews would have been extremely beneficial to increase reflexivity.

3.5.3 Evaluation as criticism

The previous evaluation criteria are from the researcher's point of view. Evaluation as criticism focuses on the reader's point of view. The persuasiveness of the research and significance of the findings are criticized. The reader should be convinced and understand the research. (Eskola & Suoranta 1998, 225 – 230.) This is considered by presenting the research plan as well as the operationalization table as a part of the thesis seminar participation. This enables gaining comments from peer students and the course supervisor along the whole research process. Additionally, two interim reports were submitted to the thesis seminar group. These reports were this thesis in its

unfinished form during those times. This ensured peer evaluation, as well as comments from the supervisor.

3.5.4 Data evaluation

To ensure the quality of the data of this research, the criteria on trustworthiness created by Guba and Lincoln (1985) are utilized. The framework consists of aspects on confirmability, dependability, transferability and credibility.

Credibility in this context refers to the evaluation of the truthfulness of the presented results (Guba 1981, 79 – 80). Lincoln & Guba (1985, 301) suggest that “activities such as prolonged engagement, persistent observation, data collection triangulation and researcher triangulation address credibility”. The topic of this research was already familiar to the researcher before the beginning of the research. In addition, peer and supervisor debriefing were used as external checks on the research process and examining preliminary findings and interpretations against the raw data. Additionally, the findings and interpretations of both the quantitative and qualitative data were checked with one participant, which also increases the credibility of the data sets. Furthermore, quantitative data was checked with an external actor to the research to minimize the occurrence of computing or interpretation mistakes.

Transferability refers to the assessment of how well the findings apply to different situations that are comparable to the original study's setting (Guba 1981, 81). However, a researcher cannot know in advance in what contexts the results will be applied. Therefore, it is the researcher's responsibility to describe the context of the research in sufficient detail so that others can assess the applicability of the results to their own circumstances. Extensive descriptions of this research have been provided, so that the actors who wish to transfer the findings to their own site can judge the transferability. (Lincoln & Guba 1985.)

Dependability means that the researcher must provide readers with material that demonstrates the rational, traceable, and documented research procedure for the study to be repeatable (Guba 1981, 80-81). The researcher presented a detailed report on the data analysis process, highlighting themes found during the study process as well as how and why specific conclusions were reached. This improves process transparency and helps the reader grasp how the presented findings were derived from the data. The interview questions used in the interviews are also included in Appendix 1 and Appendix 2 Follow-up interview themes and questions translated to English which provides confirmation of the fundamental format of the interviews. As the readers are provided with access

to examine the research process, they are better at judging the dependability of this research (Lincoln & Guba 1985).

Confirmability ensures that the questions and outcomes are authentic and that readers can comprehend the connections between the data and interpretation (Guba 1981, 80-81). This research includes reasons for theoretical, methodological, and analytical choices throughout the entire study, which helps the reader understand how and why certain decisions were made. Additionally, this study's academic research is thorough and comprehensive and corresponds to the findings drawn from the empirics. While analyzing the data, the researcher also participated in a number of reflective exercises. A thorough explanation of the data analysis procedure also improves confirmability since it establishes connections and supports the findings and their interpretation by giving the findings context. The material delivered to participants is displayed in Appendix 9 Thesis information and interview consent form which demonstrates that the individuals who supplied data for this study were aware of its goal.

3.6 Assessment of research ethics

Considering ethical questions are present during the whole research process, as the researcher is posed with multiple decisions. The ethical considerations are present in both information acquisition and use. In acquiring the information, ethical problem areas are consent to research, problems related to research data, exploitation of research subjects, problems related to participation, and communication about research. (Eskola & Suoranta 1998, 52 – 53.)

According to ALLEA (2023) good research practices are based on the principles of reliability, honesty, respect, and accountability. Reliability refers to ensuring the quality of research, which should be reflected throughout the whole research process. Honesty is required in whole research to ensure transparency in an unbiased manner. Respect must be shown towards all involved in the research, and accountability must be taken for the research. These research practices must be shown in the context of research environment, research procedures, safeguards, data practices and management, reviewing and assessment, and publication and dissemination. (ALLEA 2023, 5 – 6.)

In this research, these ethical questions have been considered and acted upon during the whole research process. Firstly, the research participants clearly stated their consent before the actual data collection. An information sheet of the research was provided to the participant, with information on the purpose and characteristics of the research, confidentiality, and right to withdraw from the study. After participant's confirmation of taking part in the study, a document titled "interview

consent” was provided. This included a brief recap of the information sheet and confirmation of voluntarily consenting to the study with sufficient information on ethical matters. This consent form included a General Data Protection Regulation (GDPR) notice and a data management plan. The participant was encouraged to contact the researcher with a low threshold about any questions regarding the research.

As the information was acquired from a semi-structured interview, the ethical dilemma between wanting as much information as possible while respecting the integrity of the participant must be considered (Brinkmann & Kvale 2005, 169). To tackle this, the research questions were reviewed carefully on multiple occasions before conducting the interview. The researcher aimed to remain as objective and neutral as possible to ensure the adequacy of data and respecting the participant’s boundaries. Total objectivity is not possible due to human nature. However, in the process of writing, acknowledging the influence of the researcher on the narrative and analysis outcomes has been considered by aiming to produce a coherent and transparent narrative to present the findings.

3.7 Use of AI in the research process

The instructions of Turku School of Economics (TSE) working group on AI (2025) on the use of AI have been followed through the whole research process. More detailed information on the exact tools and prompts is provided in Appendix 8 Explanation of the use of AI. According to this guideline, this research is based on the individual responsibility of the researcher, who is solely responsible for everything presented in this thesis. As generative AI is not capable of critical thinking or conducting logical analyses, the thesis is based on the researcher’s own scientific thinking, and the researcher bears full responsibility of the final content of the research. (TSE working group on AI 2025.)

AI has been used in this research for formulating the research sub-questions into a more academic manner. However, AI has not substituted the researcher’s own line of thought, which is strictly prohibited. AI has not been used to outsource the analysis of the data, or to ghostwrite ready-made sections of text or key arguments for this thesis. Additionally, as the interviews conducted are confidential material, no information regarding the interviews was subject to AI tools in any way. This ensures the confidentiality of the interviews, as many publicly available AI tools save user-entered data by default and may use it for software development. Thus, if non-public material is entered, this may constitute a data breach and a violation of confidentiality agreements or data protection regulations. (TSE working group on AI 2025.)

4 Findings and discussion

This chapter presents the collected and analyzed data. The sub-chapters correspond to the sub-questions of the research. The findings of the interviews and quantitative data analysis are linked to the existing literature previously presented in chapter 2. Lastly, a revisited theoretical framework is suggested based on the findings of the data analysis.

4.1 Finland's position in the pharmaceutical GPN

This sub-chapter explores the findings related to SQ1. To understand where Finland stands in the GNP, the global picture must be understood. Thus, this sub-chapter is divided into two parts. The findings are then linked to the previously presented theories corresponding to the sub-question.

4.1.1 The global picture

The global pharmaceutical industry is highly integrated on a global scale, and international cooperation's importance has grown during this century. The manufacture of a single drug involves around 300 production factors around the world. In general, the industry consists of major global producers with extensive economic and technical capacities, who produce most of the supplies on the markets. In addition, there are smaller, innovative actors, who focus on developing the products on the markets. The industry's production has shifted to Asian countries due to the pressure to optimize costs and efficiency, as suggested by Yeung & Coe (2015).

The core of the pharmaceuticals is the APIs, as they are the effective ingredients around which the other technical ingredients are produced. Technical know-how and capacity to produce these is the core of the pharmaceutical industry. This is in line with the theory of the top-down view of GPNs, as the lead-firms producing APIs shape the resource allocation and flow within the GPN (Sinkovics et al. 2018; Gereffi & Lee 2012). Some ingredients require highly specific producing steps, and there are only a few production units in the world. This limits the ability to choose the producer of these specific ingredients. After the medicine substance has been produced, the end-product, for example a tablet or an injection, might have more production capacity. However, even the end-products might include specific ingredients in production or analytics. Due to this, in the pharmaceutical industry, it is not always possible to double production, even if desired. (Sinkovics et al. 2018; Gereffi & Lee 2012.)

Although branded drugs are the most valuable products for businesses, generic drugs have a major societal significance. The generic drugs are sold on a lower price due to price competition. Typical

examples are products that have been on the markets for long, which usually are cures for common diseases. These are the medications where security of supply is emphasized, as these medications are affordable and a significant amount of the population relies on the availability of these medications. The aftermath treatments of not being able to get the medication for a prolonged time is very expensive for society.

China is the world's largest producer in the chemical industry and one of the major API producers. India exports mainly end-products, but also a small amount of API raw material components. India is trying to expand its API producing capacity. The front-end products' volumes typically are massive, which makes it technically and economically challenging to start producing these products. In addition, in the current global market with a maximum production capacity of certain products, building more production facilities would end up in declining prices, which is not an optimal business case. Building new production facilities and getting licenses to operate is a time-taking and expensive investment for a business to make. This makes China highly embedded to the pharmaceutical GPN, whereas India is trying to increase its embeddedness (Rowley et al. 2000; Farrell & Newman 2019).

The model, where the global pharmaceutical markets have developed into, is facing challenges. To export pharmaceuticals, they need to pass certain product quality controls. These controls have become increasingly politicized, as usually states are the buyers and states' reimbursement systems increase the costs for them. The criteria of the pharmaceuticals to be accepted into the system have become stricter and vary across the states due to different healthcare systems. This phenomenon is not new, as Europe has a history of requiring a certain percentage of the product originating from specific countries to get the product onto the markets. After this was forbidden, the requirement shifted to executing clinical trials in specific countries. Today, some countries require access to a part of sales permit document before releasing the product to the markets. Usually, this part is only available to officers due to the risk of misuse of the knowledge. Thus, the categories of the pharmaceutical GPNs have been under a shift (Coe & Yeung 2015; Hess 2021).

In addition, the markets for pharmaceuticals have increased in Asia, as the general attitude towards western medicine has changed. If the domestic demand in Asia is higher, the businesses might prioritize their domestic markets. In addition to this, the development of technology will shape the markets and further challenge the current model the markets are operating in. New technology not only advances innovation but makes producing end-products possible for new actors. (Coe & Yeung 2015; Hess 2021.)

Geopolitical challenges have also challenged the model of pharmaceutical industry, such as the U.S.' tariff war starting in the beginning of 2025, and the Russian attack on Ukraine. The tariffs cause heavy managerial burden for pharmaceutical companies due to the global nature of the industry. The threat of tariffs brings additional costs to businesses, and the country-specific tariff percent might bring competitive edge to countries and industries with a lower tariff. Regarding the war in Ukraine, some states in Asia have a decreased trust on Russia and shifted to cooperate with other parties.

4.1.2 Finnish industry in the global picture

Firstly, it should be noted that there are multiple Finnish actors involved in the pharmaceuticals. The state of Finland is involved in the domestic markets by regulating but also shape the GPNs by its EU member state influence. The Finnish firms on the other hand are more involved in the GPNs more intensively as they are the ones interacting through trade. (Hess 2021; Pavlínek 2024.)

Finland has in-state pharmaceutical production with some production capacity in manufacturing finished pharmaceutical products, packaging of medicines, storage and logistics, and production of APIs. Some forms, such as vaccines, cannot be produced in Finland. The pharmaceutical industry is part of the chemical industry, which accounts for one of Finland's largest export shares. The exports have continued to grow the recent years, although Finnish pharmaceutical sector basically relies on two firms, one of which is Finnish-owned. The U.S. is Finland's biggest export destination regarding pharmaceutical sector's products with an approximate 40% export share. Considering the clustering of production and big firms of the industry, the Finnish firms tend to position themselves with a dual strategy. This refers to competing on both high-end product and bulk-product markets. However, most of the exports consist of high-end products. The strength of Finnish pharmaceutical industry lies in the high-tech sector in health-technology.

Regarding the security of supply aspect, majority of the bulk products are imported. The Finnish industry lacks specific production processes of these products and is import-dependent. Reducing these dependencies would be highly costly and very prone to risks, as shifting the location of production is a major investment, that will take multiple years before starting to pay off. This makes the supply chain vulnerable, as substituting highly specific ingredients is difficult, shifting production is costly and time-consuming. (Coe & Yeung 2015.) Besides lack of production capacity, branded drugs under a patent cannot be produced.

Like in many countries, branded drugs are granted a sales permission by the local authority (Neilson et al., 2014). The Pricing Committee under The Ministry of Social Affairs and Health (STM) grants a reimbursable price for a medicine if it is considered to have significant positive effects on a particular disease. These are the most expensive pharmaceuticals for society. Medicines have different reimbursement categories, and each category has a price cap above which the government reimburses the cost to its citizens. The reimbursement system encourages innovation; without such an incentive, few would engage in medical research due to the lengthy and costly research process.

The strengths of Finnish pharmaceuticals are the technical know-how and innovation and some production capacity of different phases. However, the question is, how can pharmaceutical production stay in domestic ownership in the long run. Due to the geographic location and the small market size, the Finnish market is not so lucrative for foreign operators. The pharmaceutical industry is competing amongst other major industries, such as forestry, for state subsidies. If production is not profitable, production lines or even factories will be closed and re-opening them is lengthy and costly. However, Finland produces only a very small proportion of the range of medicines that patients need. The range of medicines is largely dependent on international production, especially when it comes to critical crisis-specific production. Even with the production capacity, the role of Finland in the GPNs is very small. (Coe & Yeung 2015.)

The characteristics of domestic markets are an explaining factor to the small role in GPNs; not only is the geographic location hard to reach and the demand small on a global scale. Small market size does not bring competitive advantage and attract more investments or actors. The markets are also highly regulated. This makes importing pharmaceuticals more challenging. (Coe & Yeung 2015; Hess 2021.) The two distributor channels also affect, how the market's structure can develop. The idea of these regulations is to prevent counterfeit medicines from entering the market and prevent market monopolization. Thus, the state institutions are highly incorporated in shaping the constitution of GPNs, as suggested by Neilson et al. (2014).

4.1.3 Interpretation of findings

As Hess (2021) suggests, the state of Finland is a participant in the GPN of pharmaceuticals. Finland is both a facilitator and a buyer, but not a producer. Finland sets laws and regulations to be followed by the foreign and domestic firms to enable businesses to operate but also to prevent negative outcomes. Being a part of the EU and thus gaining access to the free trade agreements negotiated on an EU level but also negotiating trade arrangements on the state level also facilitates more business possibilities. As pharmaceuticals require compulsory licensing and the state also

subsidizes the pharmaceuticals to its citizens. The production facilities in Finland are not state-owned.

The categories affecting the organization of GPNs as suggested by Yeung & Coe (2015) are present in the pharmaceutical GPNs. Competition in cost-capability ratios and working with financial discipline explain the shift of production into Asian countries, as labor costs are lower and some of the technology is rooted in specific countries due to the costly and lengthy implementation process. This optimization process allows firms to achieve greater firm-specific capabilities and value capture over time. Finnish firms can enhance their firm-specific capabilities with their dual strategy and maintain their industrial leadership in the domestic markets. (Yeung & Coe 2015, 35 – 39.)

Sustaining market development, based on the collected data, is not a strength of the Finnish industry on a global scale. Due to the small market size and distant geographic location, the reach and access in the GPNs is limited. Additionally, the dominant leading firms are located elsewhere. On a global scale, Finland is a very small actor and only a fraction of the markets. Thus, the main interest is elsewhere due to chances of gaining bigger revenues due to greater demand. The domestic markets are characterized by only a few firms, which leads to very few substitutes for the consumers. However, due to the state compensation system, the prices stay low. (Yeung & Coe 2015, 35 – 39.)

The value characteristics of the GPN of pharmaceuticals delve from the branded drugs. The Finnish firms are involved in both branded and generic drug production with their dual strategy. Although Finnish firms export in addition to sourcing to the domestic markets, the most successful firms in pharmaceuticals are not located in Finland. The most value captured in the GPN is elsewhere. Considering the power aspect, Finnish firms do not have a lot of power on a global scale, as their export products could be substitutable by another actor. (Yeung & Coe 2015, 35 – 39.)

The pharmaceutical GPNs are highly embedded, as suggested by Dong et al. (2019), Rowley et al. (2000) and Farell & Newman (2019). The network's trade intensity globally is very high due to the specialization of different phases or intermediates of the production process. The network embeddedness' central node is not in Finland or in the EU, although they are both linked to the network. The lack of central nodes in Europe indicates that the power advantages are also somewhere else. Despite the benefits, the asymmetric access to resources increases the trade dependence and lowers the negotiation power of Finland. (Dong et al. 2019; Rowley et al. 2000.) These findings are illustrated in Figure 8.

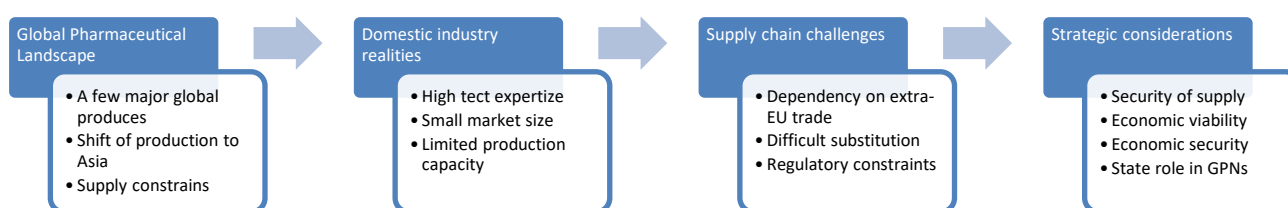


Figure 8. SQ1 findings illustrated.

Figure 8 illustrates how the global pharmaceutical landscape affects the domestic industry realities. These realities, combined with the GPN landscape characterized by concentration of producers, transform to supply chain challenges. These challenges are further enhanced by the regulatory constraints. All these factors imply strategic considerations. The security of supply is at risk due to high dependencies on few actors, as supply chain is then more sensitive to disruptions. Economic viability of domestic industry is challenged by the cost-pressure and relocation to Asian countries. These events affect economic security, as pharmaceutical industry is highly relevant for the Finnish economy.

4.2 Trade tensions' effect on Finland's vulnerability in pharmaceuticals

The trade tensions escalating to a dramatic rise of tariffs in 2025 have increased uncertainty among many industries, pharmaceuticals included. Although most of the major actors of the global markets, the EU and the U.S. included, are a part of the WTO agreement of exemption of tariffs on pharmaceuticals, the U.S. has threatened to apply the tariffs on pharmaceuticals as well. The statements regarding the tariffs have changed rapidly, so the effects on the whole GPN are uncertain. Nevertheless, the tariffs are ultimately borne by consumers, not businesses. (Chen, 2024; Fajgelbaum & Khandelwal, 2026; Goulard, 2020.) The evaluation of effects is difficult, as the tariffs apply to physical goods, but the high-tech including pharmaceuticals' value comes from data or knowledge. In this case, the market price of the product is divided into two parts: the physical product and the know-how. So far, the royalty of know-how is not subject to tariffs in pharmaceuticals. Overall, the tariffs have weakened the trust in the rule-based world trade and cause an additional managerial expense to keep track of the situation and map the supplier countries.

The pharmaceutical industry's concern of the trade tensions is the possibility of dramatic shift in flow of goods. Should the flow of goods from several Asian countries, especially China, to the U.S. to end, it could result in over-production and state-subsidized imports into the EU at unfairly low-price levels. The tariff actions of the U.S. are seen as an attempt to reduce their trade dependency of

China and attract more investments to the U.S. markets. (Chen, 2024; Fajgelbaum & Khandelwal, 2026; Goulard, 2020.) China has pursued such a policy in the past, which the U.S. is now pursuing, albeit more subtly, by withdrawing from world trade. China's development model is based on interacting with Western companies in a way that benefits China, i.e., by seeking technology transfers that enable expertise to remain in China. There have also been illegal transfers of ownership rights to China. In Europe and especially in the United States, these are seen as unfair trade practices. However, China is such a powerful actor in pharmaceuticals because of price competition that there is not much room for negotiation (Rana 2015; Kauppila 2025).

China is an actor that seeks to use its economic power to influence political processes as well. The trade war affects how China views other countries besides the U.S. and what kind of pressure tactics it will use. The EU is the disadvantaged party in the trade war between the U.S. and China, as it is caught between two fires and forced to balance between the superpowers. As the GPN is highly integrated and relies on global cooperation, the separation of production chains from each other is highly problematic for the EU. Differentiation would force the EU to choose sides, and the EU is very rigid in such matters. The trade war between the two major powers may make it more difficult to obtain certain materials in Finland, raise prices, or alternatively harm domestic production due to unfairly low prices in trade flows from Asia. (Farrell & Newman 2019; Vicard & Wibaux 2023.)

The attraction of investments is another concern for the EU, as the EU will remain disadvantaged in market competitiveness, which sparks a concern of how companies can be encouraged to ensure that import investments continue to be made in Europe. Bilateral agreements between countries have become more common in the current geopolitical situation, which shapes the markets. Company-specific decisions are made in domestic and global markets to mitigate the negative spill-over effects of the tariffs. This leaves Finland vulnerable, as the small role in GPNs combined with the small market size may discourage companies to increase their investments, and rather encourage to relocate their operations elsewhere to avoid the impact of tariffs (Kauppila et al. 2025).

The price competition in pharmaceuticals is highly beneficial for societies as it enables access to medicines in terms of price. However, the import dependency on especially on China might be problematic. Europe has painted itself into a corner by concentrating most of its pharmaceutical industry in Asia in pursuit of savings, as the products cannot be replaced by European manufacturing. Building a new factory is a very expensive and lengthy process, and the investment will only pay for itself after several years (Coe & Yeung 2015). In addition, the pharmaceutical

industry in Asia has developed in its own unique way, and not all products necessarily meet the requirements, which vary from country to country.

The clear one-sided dependencies undermine the power in negotiations and pose risks. For example, nearly 40% of paracetamol in Europe is made in India. If the trade flow would diminish as threatened at some point, it would result in many European markets running out of paracetamol. Despite the European production capacity and ability to scale it up, 40% is difficult to cover in a sudden situation. Finland has some API production, but not enough capacity to produce for the whole population. However, it should be noted that the levels of the dependencies are firm-specific and material-specific.

The foreign dependency relations of Finland on pharmaceuticals cannot be characterized by interdependence. Although Finland exports a major amount to the U.S., those trade flows can be replaced by other actors. Regarding China, the number of Chinese imports to Finland are merely a fraction of China's total exports. Thus, Finland is not a significant destination market for China, and is easily substituted. However, when the EU markets are viewed as a whole, the relationships begin to take on characteristics of interdependence. The markets size of the EU is significant, and the world trade actors start to be dependent on each other to ensure the continuation of trade. (Keohane & Nye 2012.) Between the EU and the U.S. and the EU and China, the interdependence in pharmaceuticals is both asymmetric and systemic. Regarding China, the power leverage China has comes from the control over specific resources, technology, and know-how. However, the structures of the GPN are also a source of power leverage, as the GPN has been organized the way it is due to comparative advantages and aiming to cost-savings. (Kauppila et al. 2025.)

Reflecting onto Finland, keeping in mind that both the state and the firms are acting in the GPN, the dependencies are manifesting onto them differently. Although Finland's dependency is one-sided, the key aspects of interdependence can still be analyzed to further understand the dynamics of the relationship, separately for both the state and the domestic firms. Regarding sensitivity, the speed of the costly effects from changes of the U.S. or China are somewhat rapid as firms must invest more resources into monitoring the GPN field. As both are great players in the global picture, the tariff war between the two sparked a lot of worry in the Finnish markets. The costs themselves are not major, as the firms have not been forced to outsource production as the tensions haven't reflected onto the part of GPN where Finland is involved. (Keohane & Nye 2012; Rana 2015.)

However, the possibility of these costs should be taken into consideration. Should the situation escalate between the U.S. and China, the firms could be exposed to the overly cheap trade flows

from China. This would force the firms to lower their prices, which leads to major revenue losses and possibly unprofitability of business. In this situation, the tax revenues collected by the state would decrease. Should the trade tensions between the U.S. and EU escalate further with tariff increases, the businesses would adapt. The major losses would be borne by the state, as the investments would be transferred to the U.S. (Keohane & Nye 2012; Rana 2015.)

Regarding vulnerability, Finnish industry can control their policy responses to reduce their sensitivity. However, the cost of these policy responses could be very high and take a long time before the benefits would be realized. The Finnish state alone is relatively vulnerable, as the domestic policies set cannot be used as negotiation leverage in the international setting due to the small market size. Also, as the great powers have investment leverage, companies have greater incentives to relocate their business activities elsewhere. (Kauppila et al. 2025; Keohane & Nye 2012.)

Both tariff acts and export restrictions can be viewed as weaponizing the trade dependencies under certain conditions. Regarding the tariffs, threatening with placing high percentage on the actors which actions are viewed as undesirable fits the definition of weaponized dependency (Cha 2023.) As suggested by Farrell & Newman (2019), the states with political authority over the central nodes, China and the U.S. in this context, impose the costs over each other. Although the trade wars are not directed towards Finland, as an EU member state the actions towards EU reflect to Finland as well. The threat of continuous weaponization of dependencies through tariffs or export restrictions is more present ever since the escalation of trade wars, which emphasizes the one-sided vulnerability of Finland. The operating patterns of pharmaceutical GPNs are deeply rooted, and the situation is difficult to leave.

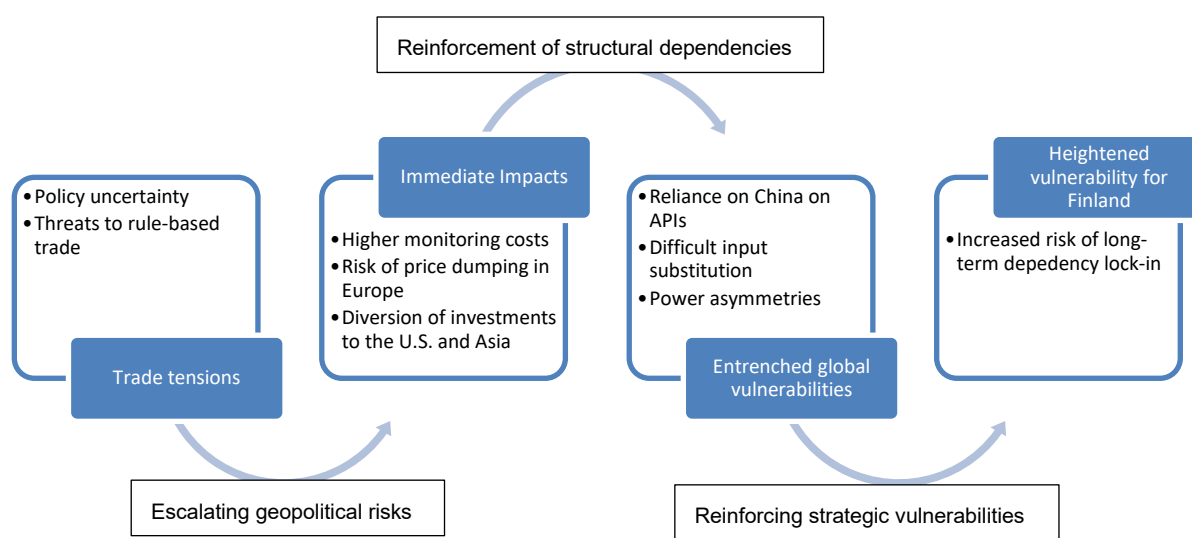


Figure 9. SQ2 findings illustrated

As illustrated in Figure 9, the trade tensions, if escalating, pose immediate impacts on the Finnish markets. These impacts further reinforce the structural dependencies, entrenching the global vulnerabilities, and further increasing the risk of long-term dependency lock-in for the EU and Finland. This would heighten the vulnerability for Finland. However, if the geopolitical risks are not escalated, only the immediate impacts are realized.

4.3 Pharmaceutical supply chain vulnerabilities as strategic dependencies

The security of supply in pharmaceuticals is both in the interest of society and of businesses. Finland has a high-quality pharmaceutical industry, and security of supply is relatively advanced compared to other European countries. Although the mandatory stockpiling system is a cost for the businesses to bear, it has proved itself to perform well under exceptional circumstances such as the COVID-19 pandemic despite the change in the usage profile of the drugs. Supply chain management is implemented in cooperation with public authorities and the private sector businesses. (Peltonen 2025; Pelkonen 2024; ECDC, 2024.)

However, there are some risks imposed by the current Finnish model of the security of supply in pharmaceuticals (Pelkonen 2024). If the firms taking part in securing supply order just in time, they are very sensitive to any changes in the supply chains, whether the change is caused by an accident or a weaponization of dependency. Secondly, the mandatory storage system is collected based on the history, so in exceptional circumstances the storages might not include enough or at all

pharmaceuticals needed. Thirdly, the pharmaceuticals for the mandatory storage system are sold by reverse auction. The business with the lowest price wins the reversed auction and gets a contract of one or two years. Should one win the reversed auction, the obligatory stockpiling takes place the next year based on the year's demand. There's a risk of creating pharmaceutical waste if the firm is relying on winning the reverse auction following year and keeping a storage of those pharmaceuticals. In this situation, there's no market to sell those leftover pharmaceuticals, which will result in a major financial loss. Goods subject to compulsory storage may not be loaned for normal use without the permission of the authorities. Interest is paid by authorities on capital tied up in mandatory reserves, but it is relatively small. The system does not treat all operators equally, even though it should be competition neutral.

Maintenance of the security of supply is expensive, at highest 230 million euros per year, and requires long-term work. In the case of long-term disruption, the mandatory storage systems will not hold up the security of supply, as the pharmaceuticals will expire at some point. In that case, security of supply depends on whether Finland is competitive in market economy terms, i.e. can Finland pay enough for products. The excess regulation and the government pressure to save money, which is being felt in all sectors of the economy, combined with the small market size, undermines competitiveness. (Tsenkov 2020.)

Finland is import dependent on certain pharmaceutical products and vulnerable to geopolitical changes due to the geographic location. Balancing the burden from regulations and price competition would be important to enhance competitiveness. As the production has been moved away from Finland as an answer to the price competition, expertise in pharmaceutical manufacturing and the pharmaceutical industry is at risk of draining out as well. (Karanina & Kartavyh 2018; Tsenkov 2020.)

The weakened competitiveness undermines the security of supply (Nesadurai 2005; Bown 2024; Karanina & Kartavyg 2018). It can show as decreasing investments but also as some pharmaceuticals disappearing from the market or not being introduced to the market at all. The system to ensure security of supply cannot be viewed to directly contribute to the undermining of competitiveness, but it is one of the factors that contribute to it. It may not be profitable for companies to operate in Finland, and sales of pharmaceutical companies will not change significantly, regardless of whether medicines are sold in Finland or not. Finland accounts for approximately 0.3% of global sales. Additionally, access to markets has become politicized.

As mentioned before, the geographic position of Finland imposes risks on the security of supply. Finland is highly dependent on the Baltic Sea for freight traffic in both exports and imports. Should the traffic at the Baltic Sea stop for reason or another, the amount of freight would be very difficult to move due to the lack of infrastructure capacity.

Taking these factors into account, the extra-EU dependency combined with the weakening competitiveness, loss of expertise and small market size, the dependency on extra-EU countries who have shown willingness to weaponize these dependencies on pharmaceuticals is strategically important (Vicard & Wibaux 2023). Although the mandatory stockpiling system is effective in short-term disruptions, in the long run it cannot be the only factor to rely on. Moreover, even if the supply chain was under domestic control, it would not guarantee resilience and crisis resistance.

Moreover, the experts emphasize the importance of considering how strict logistics and storage optimization should be applied to different products. As an example, the ship stuck at the Suez Canal increased the delivery time from two to three weeks. The modern world is prone to more short-term logistics disruptions. The current operating model has been in use for decades, and efficiency has cost advantages for the consumers. However, even one disruption has far-reaching and wide-ranging effects. The prices of certain products may spike, and fixing the disruption takes time. Finding alternative mechanisms takes time.

4.3.1 Findings of the quantitative data

The identified dependencies differ significantly between imports and exports. There is a distinct duality of dependency relations found in the Finnish pharmaceutical industry. First, exports are heavily dependent on high-tech pharmaceuticals (incl. blood, vaccines, antisera and mRNA vaccines) mainly to the USA. Second, imports involve diverse product groups, but there is high dependency on low-tech medical goods and some biological materials from China, India, and the USA. Such a configuration is in line with empirical findings at the European Union level, where despite the EU's dominance in exporting high-end drugs, it still relies heavily on other countries for important intermediate inputs and processes (Guinea & Espés, 2021). Additionally, the high-technology exports, including immunological products, vaccines, and cell-based therapies, show a strong degree of orientation toward the US. These export categories correspond to premium value-added segments of the pharmaceutical business where Finland's strength is its technological capacity and innovative power. Such trends reflect overall EU dynamics, whereby the production and export of high-value pharmaceuticals occur within advanced economies while still relying on international markets for value creation (Guinea & Espés, 2021).

From a dependence perspective, such situation results in a form of market dependence when access to the sole major export destination proves crucial for the performance of the domestic industry. These dependencies become a source of potential strategic vulnerability when access to the market is threatened by geopolitics, legislation, or policies. This kind of dependence is not related to problems with supplies of inputs but concerns the availability of foreign markets. However, this does not mean dependence on supply of inputs but vulnerability to external policies that determine accessibility of the market, and, thus, create an asymmetry of economic relations.

A second group includes biological factors, including blood products and other biologically based substances. Such imports feature fairly concentrated imports and low substitutability, since there is specialization in the global production of medicines.

Such dependency corresponds quite well with the EU-listed dependencies, especially regarding intermediate components. In terms of vulnerability, disruption in such supply chains might have immediate consequences for pharmaceutical production and healthcare services, since there is no viable way to switch sources, nor can the production of those goods be moved elsewhere. This finding strongly aligns with prior research, which highlights the EU's structural dependence on Asian countries, particularly China and India, for active pharmaceutical ingredients and upstream production stages (Guinea & Espés, 2021).

However, dependency becomes strategically important once these factors are coupled with high societal relevance and low substitutability. In such a situation, disruption will have direct impacts on the healthcare system and transform the issue from purely economic into one of economic security and security of supply.

The importations of medical products characterized by low technology, including first aid packages and other standard medical equipment, have a high concentration towards China. As noted by Guinea & Espés (2021), such dependencies are often driven by cost-efficiency considerations and global specialization, rather than strategic vulnerability per se. Even though this shows a dependency on supply, these products can easily be substituted because of their standardization and easy availability unlike the highly technological inputs and crucial drugs.

Therefore, even though these dependencies have a high concentration, they are unlikely to fall under the strategic dependency category in the short run. However, they fall under operational dependency, meaning that there will be some difficulties in case there is a disruption since the issue

can be addressed in the long run. Table 7 presents the formed categories' dependency types and strategic relevancies for Finland.

Table 7. Product categories' strategic relevancies for Finland

Category	Trade flow	Main partner	Dependency type	Strategic relevance
High-tech core	Export	USA	Market dependency	High
Biological inputs	Import	USA / China / India	Supply dependency	Medium-High
Generic / mass pharma	Export	USA	Market dependency	Medium-High
Low-tech medical products	Import	China	Supply dependency	Low-Medium

Among the results of calculation of the most concentrated exports and the most concentrated, difficult to subsidize imports, the product categories above are highly dependent on either the U.S., China, or India. However, the strategic relevancies of the product categories differ. High-tech core pharmaceuticals' exports bring remarkable value to the Finnish economy and can focus on more niche markets, whereas export of generic or mass pharmaceuticals could be easier to find an alternative export market for. Regarding imports, biological input's dependency is relatively fragmented, but more difficult to subsidize compared to low-tech medical products, that most likely are outsourced to China for cost-efficiency reasons.

4.3.2 Interpretation of findings

Based on the European Commission's (2021) approach for recognizing strategic dependencies, the quantitative data shows some dependencies on the pharmaceutical sector in both imports and exports. These calculations highlight the dependencies only during 2025, but it should be noted that global trade flows of Finland typically do not dramatically change within a few years.

Both the internal and external political economies affect the development of GPN and may turn the dependencies more strategic depending on the dynamics and capabilities of the political economies. As suggested by Dong et al. (2019), the more dependent counterpart, in this case the state of Finland, has a dependence disadvantage and weaker relative power. The channel relationship in the internal economy is characterized by joint dependence and cooperation of the pharmaceutical industry and state. On one hand, the pharmaceutical industry needs the state authorization for permit to the markets and state subsidies boost the industry output. On the other hand, the state needs the

industry to support its security of supply and economic security. Internal polity is characterized by the socio-political process of cutting of state budget. The socio-political dimension of pharmaceuticals can be further analysed through securitization. The external political economy regarding pharmaceuticals can be drawn from the GPN structures, as the external polity and economy consist of networks. (Dong et al. 2019; Stern & Reve 1980.)

While pharmaceutical supply chain dependencies are structurally embedded in global production networks, interview data suggests that these dependencies are not inherently perceived as problematic. Rather, they become framed as strategic vulnerabilities when they are associated with critical medicines, limited substitutability, and potential supply disruptions. This reflects a process of securitization, where market-based dependencies are reinterpreted as security concerns requiring policy intervention. (Buzan et al. 1998.) This securitization of perceived risk turns dependency strategic.

Strategic dependencies affect not only the economy but also the functioning of the society at risk if weaponized. The less strategic dependencies, the more secure the economy on a state level. As suggested by Vicard & Wibaux (2023) and the interview data, the underlying structures of dependencies have not changed for the EU and not remarkably for Finland, but the risks associated with trade partners and their geopolitical alignments. The Finnish stance on China has become more cautious due to the unfair practices, although traditionally Finland has been in good terms with China, which implies that the Finnish state hasn't been subject to their countermeasures. Finland's official stance on the U.S. has not changed. The EU's statements reflect the main interest in sustaining open trade. Even before the trade war and arising geopolitical tensions, pharmaceuticals have been identified as strategic industry. After the inflammation of relations and the realization of possibility for weaponization, the strategic nature of this industry has been highlighted.

Economic security is linked with pharmaceuticals in Finland's case, as the industry is economically highly relevant for the state. As defined by Bown (2024), the economic security is partially realized through the pharmaceutical sector due to its importance to state's economic outcome and contribution to welfare. However, the definitions of Bown (2024), Karanina & Kartavyh (2018) and Nesadurai (2005) in addition to the interview data suggest that economic security is undermined by the small and geographically distant market, loss of competitiveness and expertise, and excessive administrative burden. These factors undermine the ability to prevent bad economic outcomes, lowering the volatility of welfare and ensuring robustness of market to generate welfare and growth. These theories, however, do not distinguish the difference in fixed variables and relative variables.

It could be useful to further analyze the risks in long- or medium-term and short-term variables. The likelihood of risks and abilities withstand them vary depending on whether the variables are fixed or relative and in long- or short-term. The remote geographic position of Finnish market is long-term risk factor, whereas the possibility to expand the infrastructure to an additional port in the North Sea or railway system from Sweden to Finland would make it medium-term.

The interview data reveals that economic security of both the EU and Finland is affected by external powers' behavior, as suggested by Pitakdumrongkit (2022). The trade war between the U.S. and China is a prime example of competition among external powers, whereas the tariff threats between the U.S. and the EU showcase economic statecraft. However, the EU is not facing disadvantages in existing negotiation frameworks, as the EU has been able to pursue negotiations. The experts view EU balancing between the U.S. and China, which is counted as institutional hedging:

The EU has traditionally relied on the idea that [global open trade and cooperation] lead to better living standards for everyone ... We still view that open trade and cooperation would make the most sense. But of course, there's nothing we can do about it ... If others don't go along with it, we'll have to adapt to the situation. (Expert 2.)

The U.S. is the EU's largest trade partner and China is the second largest, so we kind of have to balance between these two superpowers (Expert 5).

The EU has strong economic interests towards China, so this relationship is beneficial to maintain ... but now Trump has actively pushed the EU to move away from China (Expert 5).

Institutional hedging as a reaction is as suggested by the literature. In terms of economic statecraft, the EU has practiced exclusive institutional balancing, as its non-financial institutions are exclusively for the EU and its closest economic partners, such as the Schengen area. As Finland is a member of the EU, it has adopted the same responses.

Regarding the security of supply, the rescEU storages were mentioned during the interviews, but the main emphasis was on domestic responsibility. Although European Commission (2025) introduces rescEU as a shared stockpiling strategic reserves in case of disruptions in the supply chains, the interviewees highlighted the events during Covid-19, where the member states practiced nationalistic behavior with some pharmaceutical products. Also, again the geographic peripheral position of Finland undermines confidence in the mechanism's effectiveness.

As for the domestic security of supply, the interview data agrees with the literature of the other EU member states taking after the Finnish system (Peltonen 2025). However, international literature does not mention the issues with the current system (ECDC 2024). The current system is not

economically viable for the private sector, and there could be an incentive system introduced to further secure the participation of the private sector without further undermining competitiveness.

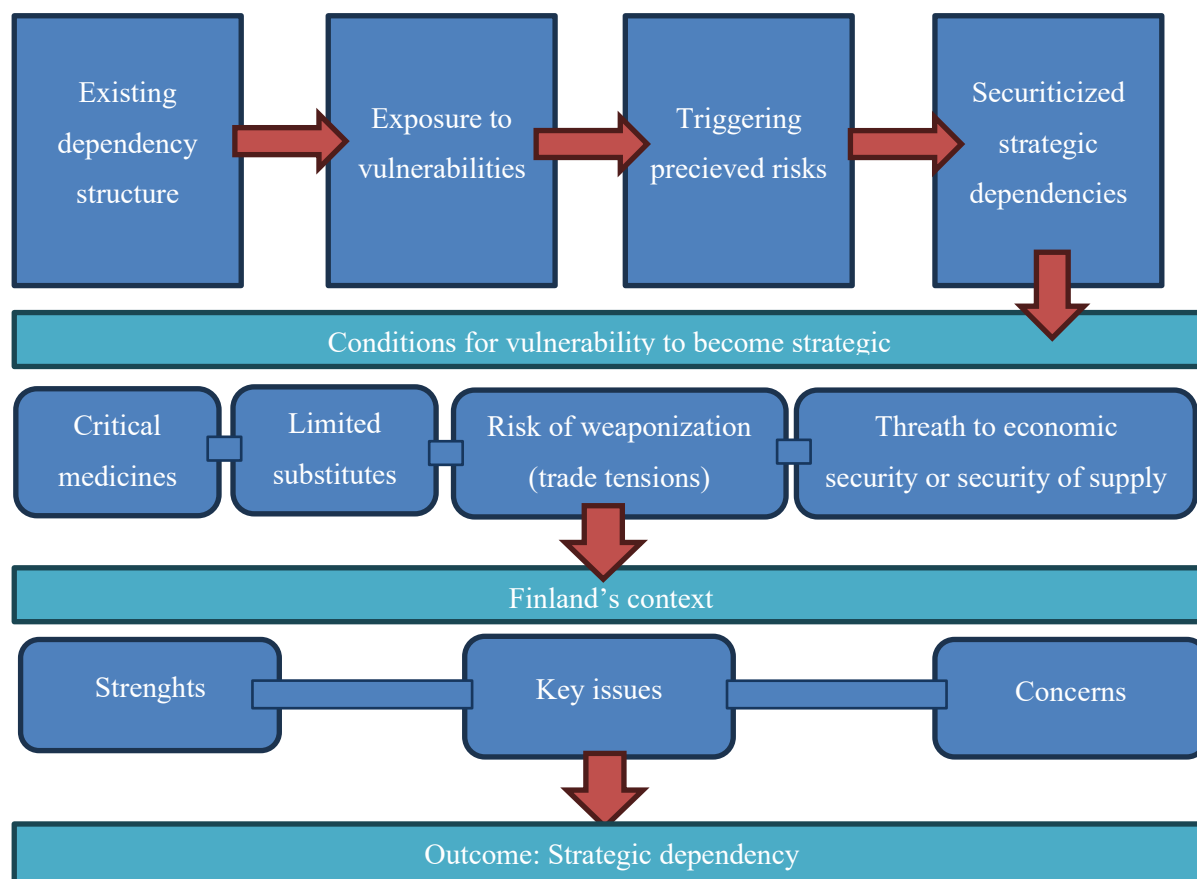


Figure 10. SQ3 findings illustrated

As illustrated in Figure 10, the vulnerabilities stemming from the existing dependencies are not automatically deemed as strategic dependencies. The existing dependencies come from the concentration of GPN central nodes, import dependency on certain products and concentration of the export markets. The vulnerabilities include limited substitutability, exposure to both short- and long-term disruptions, and cost pressure, relocation and loss of expertise. The triggers are perceived increased risks regarding critical medicines, state's economic security, security of supply and possible weaponization. Additionally, if the conditions listed in Figure 10 are met, the vulnerability becomes strategic. In such cases, the dependency and vulnerability are framed as security issues, requiring policy attention either domestically or on the EU-level.

In Finland's context, the strength is the current security of supply system, which is internationally recognized and has proven to work during the Covid-19 pandemic. The key issues are sensitivity to disruptions, stockpiling being based on historic usage profile, pharmaceutical waste, capital lock-in, and high costs for firms, and lack of competition neutrality. The concerns include declining

competitiveness, excessive regulation and state budget cuts, loss of expertise and high dependency on the Baltic Sea. The outcome results in deeming vulnerability as strategic, again, if the conditions are met.

4.4 The EU's effect on managing Finland's strategic dependencies

The EU's discourse has handled economic security more in recent years due to the geopolitical uncertainties, which have further reflected onto the trade policy agenda of the EU. The security of supply has been linked to economic security by the EU, as the worries regarding the security of supply arise from dependencies, which may also be economically highly important for member states. Especially the Russian invasion in Ukraine has sparked more discussion on security of supply in certain industries. However, sustaining balance between open trade and economic security is sparking worry among experts, as member states might practice protectionist policies in the name of OSA. Regarding the pharmaceutical sector, there are a lot of differences between member states in healthcare. This combined with limited resources undermines the possibilities for making shared decisions on this matter. The experts view the EU's medicine act as an effort to increase the self-sufficiency of the EU and the trade policy tools as possible means of influence to answer to the external actors' unfair practices.

The EU's trade policy balances between maintaining good relations with its main trading partners China and the U.S. whose relations between each other have become more inflamed, while also remaining self-sufficient. The previous ideology of open and rule-based trade does not hold in the current state of the world, although the EU wanted to position itself as the forerunner of global trade cooperation. The EU still emphasizes the benefits of open trade, but if the other countries do not cooperate the EU must adapt to the situation. Both EU and Finland view extending trade agreements to other countries and finding new partners to cooperate with. However, the EU's broad policy stances on values limit the formation of partnerships, as these values do not resonate everywhere.

The trade policy instruments of the EU can be viewed to protect the EU market with a case-by-case approach, and the industry-specific organizations lobbying at the EU level influence the decision-making outcomes. However, since the pharmaceutical giants are not in Finland, their interests may conflict. In addition, the interests of politics and pharmaceutical industry may conflict from time to time both on national and EU levels. Moreover, activation of the trade policy tools is slow due to having to verify the situations.

The openness aspect comes with costs of negotiating partnerships, but reasonably the EU cannot produce everything itself due to the lack of raw materials and components. Discarding the openness aspect would be costly for the consumers, as the prices would rise due to the loss of economic productivity. Consumers wouldn't be able to afford the products, which would further put strain on the healthcare system. Some criticize the openness aspect of undermining security of supply, and some member states justify protectionist measures under the name of OSA. However, experts emphasize that this is based on the feeling of security when production is under their control, not on economic arguments.

Experts emphasize that before making drastic movements, the EU should truly recognize the products, where the worry of security of supply is highly relevant and relocating the production would be beneficial. Nevertheless, the EU has made efforts to relocate production with some investments in pharmaceutical production. In the end, it's the businesses' decision to relocate the industry, and as the process is highly costly, merely the promises from the EU of financial support are not enough to cover the risks.

Although awareness on the EU-level regarding security of supply in pharmaceuticals has increased, the experts worry that the efforts will remain on a superficial level. The strategies work as frameworks with some legislative proposals and regulatory aspects. This works to frame it with a positive narrative of driving change, but it might not actually have a drastic effect on real situation. The amount of EU's financial incentives is a fraction on a global scale. The EU's tools have been criticized for being insufficient; although pharmaceuticals have been recognized as a critical sector, the initiatives and frameworks were non-existent before COVID-19. Now with the existing frameworks the issue is the global nature of the sector. The EU cannot alone regulate the sector and assume that global firms are going to change their ways drastically. To advance OSA, global dialogue is needed.

The EU has the willingness to advance its member states' security of supply in pharmaceuticals as it has taken a more active approach to it. However, some of the Commission's regulations conflict with this intention. Various experts working within the industry cite the EU Wastewater Directive, in which the Commission has obligated two industries, including pharmaceuticals, to clean microcontaminants in wastewater. Despite the good intentions this directive will impose significant administrative costs on all 27 member states. As a result of these cumulative effects, the range of medicines available throughout the EU may narrow. This is an indirect risk for the security of supply, as the pharmaceuticals stocked in the future might be a narrower variety. Even though there

are mandatory stockpiling regulations—which now exist in more countries besides Finland—the stockpile is based on the existing product range. In addition, this directive might further undermine the competitiveness of the EU.

Nevertheless, the EU increases the possibilities of Finland for international cooperation and coordination regarding the pharmaceutical industry in both economic and security of supply aspects. The deterrent effect of trade policy tools counterbalances asymmetry in dependencies and prevents weaponization of these asymmetries, although Finland's stance on ACI has been relatively critical, as it should be merely used as a threat. In addition, the EU initiatives such as OSA advance both economic security and security of supply. However, the data emphasizes that the initiatives and frameworks tend to remain on superficial levels.

Despite Finland being a small member state, it has some ability to exert influence, as in uncertain times experts view the Commission to be open for proposals, if they are convincing and justified. It is also important to cooperate with like-minded member states. This way the ability to influence is greater than the formal share of the vote in EU-decision-making might suggest.

Besides the benefits from the EU membership, the state of Finland plays a more important role in sustaining the security of supply, as it is a domestic matter. Although the market location can be a hindrance, the location and knowledge on our eastern neighbor also awakens interest in current and potential trade partners. Diversifying trade agreements by creating and updating free trade agreements (FTAs) is one of the ways of building resilience from the Finnish state's point of view. Finland has been approving towards foreign direct investment (FDI) screening unless the underlying issue concerns competitiveness or other economic factors. Finland has been and still is favorable to free trade and emphasizes the openness aspect of OSA: Capital flows that are as unrestricted as possible are in the best interests of Finland and its business community.

Additionally, the importance of IP rights is highlighted in the interview data. Ensuring IP rights of the know-how, especially high-tech core pharmaceuticals, is crucial in maintaining the profitability of these products.

The Finnish state has traditionally supported the pharmaceutical industry. The Finnish state has traditionally supported production and invested in its own pharmaceutical industry. Now the priority may have declined due to reductions in the state budget and prioritizing support for export-oriented sectors such as the forest industry. Pharmaceuticals are heavily regulated by the Finnish state not only with the local product control but also on drug distribution level. The legislation on

the ownership structure of pharmacy chains and retailers is strict, and there are two pharmaceutical distributors in Finland through which all medicines are brought to market. Drug manufacturers may not have their own distribution, which prevents the market from monopolizing. Business supervision has been largely voluntary, meaning that companies have cooperated on a voluntary basis. However, foreign companies haven't always been understanding. These aspects affect the market development of Finnish pharmaceuticals domestically and on how competitive the Finnish pharma is on global level.

Both Finland and the EU are unable to change the global operating model, even if the pharmaceutical industry would come to be defined as a matter of national security. What Finland alone can do, is to improve competitiveness and highlight why it's worth it for certain operators in Finland to be part of that supply chain—or even try to bring the entire chain to Finland. However, the smaller the market, the harder it would be to seek a national solution like this; Finland should look for international solutions, and Europe is perhaps the more appropriate player and actor in this regard than an individual member state. Finland can implement its own national measures to promote the Finnish market or mitigate risks facing Finland. However, regulatory approval is a major obstacle to moving production to the EU. There are very few countries where public opinion would be particularly supportive of building more chemical plants.

As suggested by Bown (2024), shocks affect firms and supply chains. In this research context, the shocks of tariff threats and tariff wars have not been realized yet. However, the EU policies' intention is to support advancing member states' security of supply and economic security. As Forman & Mossialos (2021) suggest, the experts also question the EU's actual power due to the heterogeneity between member states' healthcare systems and limited remit and powers of the institutions. Whereas Forman & Mossialos (2021) call for solidarity and cross-border coordination, the experts emphasize the EU's good intentions but unintentionally suboptimal outcomes as for the Wastewater Directive.

The experts give credit to OSA for trade diversification, although some scholars have criticized the lack of (Gehrke 2022, 75 - 76). The threat of tariffs boosted the process of However, the experts confirm the critique listed by Mariotti (2025) that the OSA does provide member states with possibilities for protectionist measures and restrict the international flow of technology, data, and innovation. The protectionist measures though are practiced by individual member states and not the EU. As trade partners may view OSA as protectionist and challenge all restrictions of trade, the experts emphasize flagging the products or services with actual relevant worry about the supply and

clearly draw the line between that and protectionism. If the EU starts using the narrative of national security and adopts different measures based on that, it loses its credibility among not only trade partners but also the member states. The experts agree on the reduced international flow of technology, knowledge and data, but also emphasize the possibility of protecting intellectual property rights violation by China and thus enhancing the competitiveness of the EU.

Mariotti (2025) and the experts agree that the failure to meet the criteria for OSA to be effective stems from the EU's inability. As Mariotti (2025) concludes the inability to stem from unresolved strategic rivalries, the experts add the scarcity of resources. Both the experts and Gehrke (2022) agree on OSA responding to significant shifts in the global economy. EU is not showcasing unwillingness, as the funding mechanisms are improved, and EU is working on duplicating the purchases of pharmaceuticals.

Although the pillars of the Pharmaceutical Strategy for Europe listed by Garattini et al. (2021) go hand in hand with security of supply and economic security, only a few experts highlight it among the relevant instruments. Although important, the strategy is merely a framework, inside which different actors work. Also, the results of the strategy have not been realized yet, so its presence is somewhat small for now. The strategy for security of supply has taken a lot of influences from the Finnish system, as the strategy is based on previous Finnish president Niinistö's white paper. The experts view that Finland already has had good strategy for pharmaceuticals, whereas the rest of the EU is now starting to implement the same principles of securing supply in addition to increasing funding.

EMA itself as an institution is not highlighted by the experts, but its function of ensuring the availability of critical medicines is highlighted by both Pelkonen (2024) and the experts. However, the cooperation with EMA did not arise from the experts' points of view. The Finnish pharmaceutical industry and the Finnish public sector work with closer cooperation, which can be explained by the mature security of supply model of Finland. The possibility of closer cooperation with EMA such as consultation and the availability of strategic reports enhance the security of supply for the state of Finland.

HERA is highlighted by experts as one of the most relevant factors on the EU level. This corresponds to the scholars' distinction of HERA being specifically designed to mitigate the effects of increased trade restrictions on health goods (Bayerlein 2023). HERA is viewed to both enhance the state-level security of supply and the firm-level profitability by funding R&D and manufacturing capacity, which again reflects onto the state-level economic security due to the

importance of pharmaceuticals in the GDP. HERA is viewed as a very present body directly affecting different actors in Finland; there are people in Finnish ministries working in a double role, meaning that in addition to the ministry, they also answer to HERA. This enhances the communication and cooperation channels between HERA and actors in Finland.

EDQM has rarely been highlighted due to the nature of its activities and area of responsibility. Nevertheless, in a situation of critical or difficult medicine shortage, where non-authorized products would have to be distributed, the EDQM could support maintaining a security of supply in Finland. As it comes to the economic security of the state and profitability of the firms, EDQM does not possess the necessary authority or tools to enhance them.

The experts view ACI as a concrete tool against economic coercion with China's unfair trade policies in mind. It is the most extreme procedure but also the most flexible in terms of modifications. However, the activation of such tool is slow due to the verification process. Whether ACI will be utilized or not will remain to be determined. The possible effects of ACI also remain unknown. However, even the presence of ACI does leverage the EU's competence base and legal competence to link security and trade. (Freudlsperger & Meunier, 2024.) Despite the narrative of providing basis for swift reaction to economic coercion, the willingness to utilize the tool has been questioned. Even if the situation, such as the U.S. tariffs on the EU, would have justified the situation, the EU favors diplomatic negotiations over escalating the trade war. Even with the ACI instrument, the EU would be the disadvantaged party in a trade war due to smaller comparative advantages. ACI as a deterrent gains power from mutual dependence, even if the EU is relatively more dependent than the other counterpart. ACI is thus enhancing economic security.

4.5 Revisited theoretical framework

Combining all the findings from each sub-question, the preliminary framework is revisited. Although the current literature agrees with some of the findings, the gathered data suggests and highlights other points. Below is presented the revisited theoretical framework.

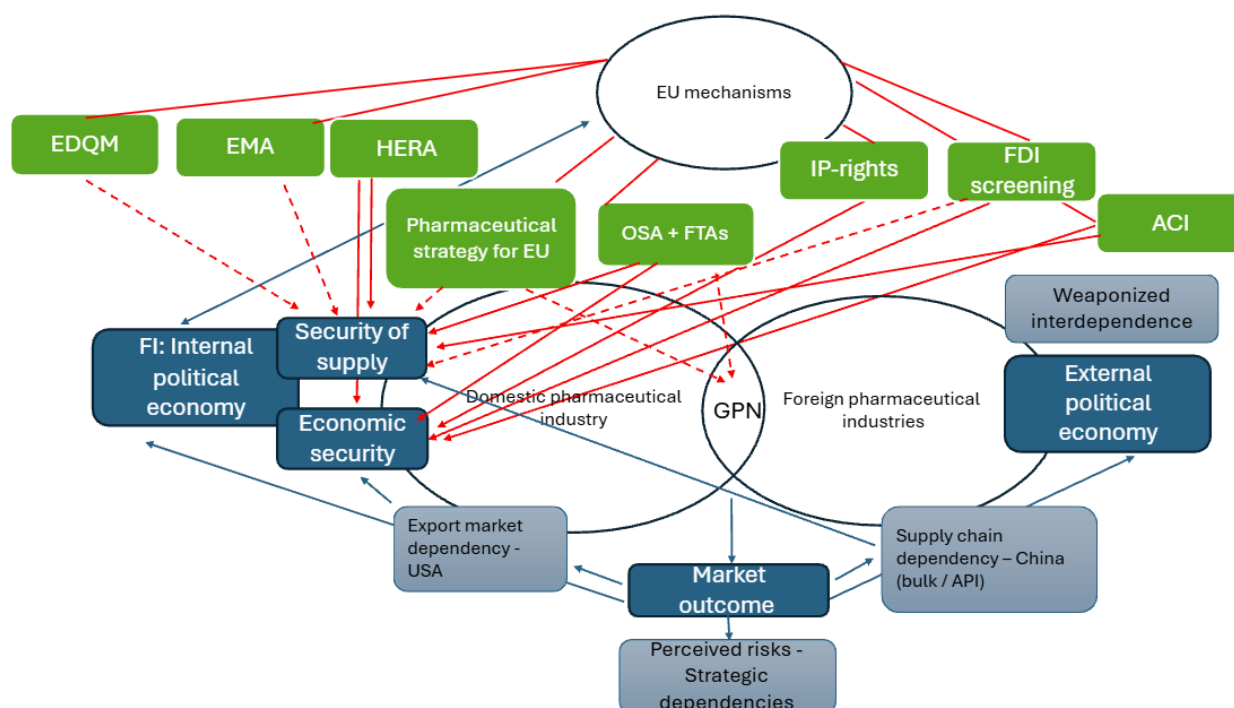


Figure 11. Revisited theoretical framework

As Figure 11. Revisited theoretical framework illustrates, the preliminary framework was changed based on the findings of all four sub-questions and the quantitative data. Based on the quantitative data, the market outcome of pharmaceutical GPNs for Finland constitute of export market dependency on the USA and supply chain dependency on China. The supply chain dependency is further linked to security of supply, as the APIs are needed in the production processes. Additionally, Finland is supply dependent on some bulk products. The export market dependency on the U.S. affects economic security, as the exports are highly concentrated on one market and the trade tensions between the EU and the U.S. increase uncertainty of market access and additional costs due to tariffs. The market outcome's perceived risks turn into strategic dependencies, if the conditions discussed in chapter 4.3 are met. Should these dependencies be weaponized, ACI mobilization can be started by a member state's request.

All the EU trade tool mechanisms contribute to security of supply or economic security indirectly or directly. However, the EU mechanisms themselves in a bigger picture, do not participate in GPNs, as suggested by the preliminary framework. Instead, the EU mechanisms are indirectly affecting the formulation of GPNs by diversifying trade with new FTAs and according to the OSA framework. The EU mechanisms also do not affect the external political economy, although practicing diplomacy and policy balancing between the U.S. and China. The diplomacy rather affects the formulation of FTAs. Screening of foreign direct investments (FDI) ensures not only that

dependencies on particularly critical matters does not grow, but also fair competition between EU and foreign investors, supporting economic security. This ensures economic security and indirectly security of supply. Additionally, ensuring the IP rights of especially high-tech core pharmaceuticals is crucial in maintaining the profitability of these products. Lastly, the information of possible unfair practices come from the member states. However, the dynamics between the EU mechanisms and member states is bilateral, as the member states have ways of exercising power and affecting the negotiation outcomes regarding the trade policy tools and frameworks within the Commission.

Pharmaceutical strategy for Europe is affecting the GPN but only the intra-EU side of it. As mentioned earlier, strategy is merely a framework, in which the actors operate. The effect on the Finnish security of supply is not so drastic, as the strategy has taken a lot of influence from the current Finnish system.

Lastly, EDQM, HERA, and EMA all affect the security of supply, but in slightly different ways and moreover the effects vary case-by-case. Although not highlighted in the analysis, due to EDQM's nature of responsibilities. Nevertheless, in a situation of critical or difficult medicine shortage, where non-authorized products would have to be distributed, the EDQM could support maintaining a security of supply in Finland. This, however, would only apply in a situation where there is a serious long-term disruption. EMA's role in ensuring security of supply was highlighted by both the literature and interview data. However, there's room for deepening cooperation. Lastly, HERA was clearly highlighted as most relevant regarding ensuring the security of supply and economic security by both scholars and interview data.

5 Conclusions

This chapter presents conclusions for each sub-question, finally answering the main research question. The theoretical contribution and policy implications are then presented. Lastly, there are the limitations of this study and the suggestions of further research.

5.1 What is Finland's position in global pharmaceutical supply chains, given China's API dominance?

Finland's role on the global scale is very small despite engaging in exporting. Finland has a peripheral and non-central position in pharmaceutical GPNs. The GPNs are characterized with highly concentrated production, with the key capabilities and resources located outside of the EU. Chinese dominance in API production structurally limits supply diversification. Finnish pharmaceuticals firms specialize in high-value and technology-intensive segments with dual-strategies, and their exports are highly dependent on the U.S. market.

Despite the specialization and dual strategies, the domestic pharmaceutical market is small, regulated and relatively unattractive for large-scale investments. Due to the import-dependency in bulk and generic pharmaceuticals, concentration of value capture in GPNs outside of Finland, and the costly, slow, and economically uncertain nature of shifting production geographically, Finland has very limited bargaining power within GPNs. Strong network embeddedness increases dependency on external actors. The Finnish state acts primarily as a regulator and facilitator, and as an influencer through the EU.

5.2 How have U.S.–EU and U.S.–China trade tensions affected the Finland's vulnerability in pharmaceutical supply chains?

Escalating U.S.-EU and U.S.-China trade tensions have increased systemic uncertainty in pharmaceutical GPNs. Substitution of critical inputs is difficult, slow, and costly, increasing exposure to external shocks. Although pharmaceuticals have traditionally been excluded from tariffs, the rapidly changing tariff policies have weakened the trust in the rule-based trade system. Trade tensions introduce policy unpredictability, complicating long-term planning for firms.

The immediate direct effects for firms include increasing administrative and monitoring costs due to policy unpredictability. Tariff threats create cost pressures and regulatory complexity in global operations. The tariff risks primarily affect physical supply chains, whereas high-value knowledge components remain less directly impacted.

As for global markets, the potential disruption of China-U.S. trade flows could lead to oversupply and price dumping in EU markets, causing market disruptions and posing a risk to domestic production viability in Europe and Finland. Trade tensions may redirect global investment flows, risking of capital relocation to the U.S., while Finland's small market size and peripheral position increase vulnerability to investment diversion. Additionally, increasing use of bilateral agreements attempting to dodge the tariff threats is fragmenting global trade structures. The fragmentation of GPNS would be highly disruptive.

China's API dominance creates structural dependency with very limited alternatives, and the substitution of critical inputs is slow, costly and often technically constrained. Supply chain disruptions in key inputs would lead to availability risks in Europe. As key resources are concentrated in few countries, power asymmetries are reinforced.

The EU is positioned between the U.S. and China, which limits its strategic flexibility. Fragmentation of GPNs would be highly disruptive for the EU. Pharmaceutical trade relations exhibit systemic and asymmetric interdependence at the EU level. Regarding Finland, its small market size and peripheral position increase exposure to external shocks. Finland is import-dependent in critical pharmaceutical inputs, especially through EU-level supply chains. As the bargaining power is limited, Finland cannot independently influence global trade dynamics significantly. Sensitivity to geopolitical shocks is high, as firms must rapidly adapt to external policy changes.

Possible escalation of trade tensions could lead to price pressure from low-cost imports, which leads to declining competitiveness of domestic firms. This relocation of investments away from the EU and Finland reduces the tax revenues and undermines the economic security of the state, as well as the security of supply. Finland's ability to respond is constrained, as adjustment measures are costly and slow, and large economies possess investment and market leverage.

Trade policy tools, such as tariffs against the WTO rules and export control, function as instruments of weaponized interdependence. Power is exercised by actors controlling central nodes of GPNs. Finland is indirectly exposed to these dynamics through EU-level integration. Persistent geopolitical tensions increase the risk of long-term dependency lock-in.

5.3 How are pharmaceutical supply chain vulnerabilities interpreted as strategic dependency in Finland?

Not all dependencies are problematic. They become strategic when linked to perceived risks. Securitization is triggered when dependencies are associated with critical medicines, limited substitutability, risk of weaponization, or threats to economic security or security of supply.

Economic security and security of supply are the two core dimensions of strategic dependency. Economic security is primarily a state interest, including competitiveness, viability of domestic industry, industry-specific expertise and economic resilience. Security of supply is in the interest of both state and business, including availability, continuity of care, and market functioning.

Finland's security of supply system is strong but has weaknesses. The system is sensitive to disruptions, based on the historical usage profile, not business-viable, leads to waste and capital lock-in, is costly to maintain and not fully competition-neutral. Mitigating long-term vulnerabilities call for competitiveness and resilience. If disruptions are prolonged, Finland's ability to remain competitive in market terms is critical. Excessive regulation and state budget cuts from subsidies and research weaken competitiveness, which undermines security of supply.

Extra-EU dependencies increase perceived risk. The quantitative data showcases import dependence on certain products and export concentration to certain markets. Additionally, the expertise draining to other countries is a risk, if the market is not competitive. Logistics are highly dependent on the Baltic Sea. Some of the extra-EU suppliers have shown willingness to weaponize the import and export dependencies. However, domestic control would not guarantee resilience.

Short-term disruptions are expected to increase. The modern world is seen to be more prone to these short-term shocks, e.g. the Suez Canal incident. Establishing alternative systems is time consuming.

Interpretation of vulnerabilities can be done on domestic and external levels. The internal political economy is characterized by joint dependence and cooperation between state and industry. External political economy is embedded in the GPN structures. Underlying structures of dependence have not changed significantly, but the perceived risk has increased.

In conclusion, the results confirm previous findings that indicate that the dependence on pharmaceutical products in Europe is highly rooted within the international production system characterized by efficiency and specialization. The quantitative findings confirm the export dependency on high-tech core pharmaceuticals, whereas import product categories' dependencies

could be explained by cost-efficiency based reasons. Nevertheless, this research offered a more refined analysis, showing that all dependencies cannot be considered strategic; rather, they become such when they meet structural dependencies combined with social necessity, non-substitutability, and high geopolitical risk.

5.4 How can EU trade policy instruments mitigate Finland's dependencies in the pharmaceutical sector?

The EU's discourse has shifted more towards economic security as a response to geopolitical tensions, and security of supply is increasingly linked to economic security. OSA aims to balance sustaining both, while still promoting open trade. The EU aims to balance its trade policy between the U.S. and China.

The EU does possess central tools and policies for enhancing security of supply and economic security. EU Medicines Act and Pharmaceutical Strategy for Europe strengthen self-sufficiency. Negotiating new Free Trade Agreements (FTAs) diversifies trade. HERA and EMA promote the availability of critical medicines and coordination at the EU level, whereas EDQM promotes standardization and quality assurance of pharmaceuticals. ACI is a tool for countering economic pressure. FDI screenings ensure fair competition for both EU and foreign investors.

As for the dependencies, the trade policy instruments diversifying supply chains directly decrease dependency. This includes new FTAs and OSA. EMA and HERA ensure the availability of critical medicines. ACI boosts the EU's negotiating power through a deterrent effect. However, not all production can or should be moved to the EU. Disregarding open trade would be costly for consumers, and the EU does not possess the technologies or raw materials needed. Additionally, IP rights enhance economic security by maintaining valuable know-how within Finland.

Effectiveness of the EU's tool and policy assortment depends on the case. Heterogeneous healthcare systems hinder joint decision-making within the EU, and the implementation of EU policies is relatively slow. Additionally, many of these measures are still new, and their full impact has not yet been seen. However, the EU measures have a risk of remaining superficial on a global scale and limited in relation to market forces.

The market logic imposes limitations. Companies make the final decisions regarding the location of production and investments. Relocating production to the EU is expensive, slow, and risky. EU financial support is often insufficient to encourage relocation.

There are some internal tensions within the EU. Firstly, there is tension between economic security objectives and competitiveness. Some regulations may undermine competitiveness and thus undermine security of supply. Additionally, the principle of open and rule-based trade seems to be crumbling on the global levels, creating normative conflicts.

Finland has influence within the EU, but to a limited extent. For example, Finland has influenced the creation of ACI. Finland's national role is particularly evident in security of supply. The state plays an active role, but strict regulation may limit market development.

Overall, the EU has a clear political will to reduce dependencies, but the practical impact is still limited, and global production structures constrain change. EU trade policy can mitigate risks, but it cannot eliminate structural dependencies.

5.5 Theoretical contribution

The main object of this research was to provide an understanding of the EU's intermediate role of managing Finland's strategic dependencies in pharmaceuticals, and how it reflects on the national economic security and security of supply. EU's risk mitigating role was assessed in the light of stressed transatlantic relations followed by the tariff wars of early 2025 and China's involvement in the API production as well as trade war with the U.S. For successful implementation, Finland's position in the pharmaceutical supply chains was interpreted through the GPN and network embeddedness theories (Coe & Yeung 2015; Hess 2021; Farrell & Newman 2019; Dong et al. 2019; Rowley et al. 2000). The theoretical lens of interdependence of Keohane & Nye (2012) was applied to explore the international trade relations, whereas the lens of weaponized dependence of Cha (2023) and Farrell & Newman (2019) was utilized to examine the trade tensions. Lastly, the political economy framework of Stern & Reve (1980), securitization by Buzan et al. (1998), and economic security introduced by Bown (2024), Nesadurai (2005), Karanina & Kartavyh (2018) and Tsenkov (2020) were applied to further examine the political aspects of the trade issues and the risk perceived with them. The security of supply was drawn from the Finnish law, and the EU trade policy tools and mechanisms were taken as they were.

A process of securitization of pharmaceuticals in Finland and EU trade policy tools' role of mitigating the perceived risks was proposed, linking pharmaceutical dependencies, economic security concerns, and EU trade policy responses into a single analytical framework. The contribution of this research is not limited to the identification of dependencies, but instead it aims to explain how normal trade dependencies can eventually become strategic and security

vulnerabilities amid evolving geopolitical realities. This is because dependencies acquire political salience in relation to the availability of certain drugs, minimal substitution options, prolonged disruption of supplies, and possibility of external economic coercion.

The proposed framework combines perspectives from Global Production Network (GPN) theory, economic interdependence, political economy, and securitization theory. Previous literature has largely examined these themes separately. Also, the escalation of the U.S.-China and EU-U.S. trade tensions is relatively recent. The previous literature, such as the EU's white papers, has focused on the pharmaceutical industry of the EU as a whole, disregarding the uniqueness of healthcare and security of supply systems of each member country. This makes the proposed process new in the academic literature in the IB field. By connecting Finland's domestic pharmaceutical system and market features with EU-level geopolitical changes, the study thereby presents a more multifaceted picture of pharmaceutical dependency.

This research broadened the theoretical frameworks of GPN and network embeddedness onto more specific levels, adding not only Finland but also EU, in which Finland operates in the GPN. The inclusion of EU trade policy tools and initiatives in the GPN was suggested, and the results add to the academic literature by further exploring the EU's role with the member state in the GPN. The results of this study support the theory of interdependence as suggested by Keohane & Nye (2012), Rana (2015) and Kauppila et al. (2025) regarding the EU's relationship with China and the U.S.

Furthermore, the research agrees with the political economy framework's explanation that both domestic and external socio-economic and political structures shape industry performance and market outcomes. In the Finnish pharmaceutical sector, the internal political economy consists of factors such as the reimbursement system, security of supply mechanisms, regulation, market size, and state-industry cooperation, whereas the external political economy is shaped by global production networks, geopolitical trade tensions, external market dependencies, and international competition. Together, these internal and external structures influence how Finnish pharmaceutical firms operate within the global markets and how vulnerable the industry is to external shocks.

Political economy alone cannot sufficiently address what leads to the perception of vulnerabilities being strategic threats. That is why securitization theory has been adopted as an additional concept for understanding how the pharmaceutical dependencies get securitized in terms of economic security. The study argues that pharmaceutical dependencies are not by default considered strategic. Rather, vulnerabilities become securitized based on some specific factors, such as dependence on medicines vital for societal functioning, lack of substitutable products or ingredients, high

vulnerability of supply chains, long-term disruption risks, or potential ability of another party to leverage its dependency by imposing trade restrictions or other coercive measures. The analysis agrees with findings on the external powers' behavior patterns affecting economic security and the institutional responses of regional states as suggested by Pitakdumrongkit (2022).

5.6 Policy implications

The findings of this study could have implications for managing and recognizing the dependencies regarding pharmaceuticals. This can help policymakers in both EU and Finland to strengthen economic security and security of supply while increasing resilience. While the EU initiatives, tools and mechanisms together with the Finnish state's mechanisms are important in enhancing security of supply and economic security, the results of this research suggest that not only maintaining the current level of resilience but also further increasing resilience requires specific policy considerations.

First, the results of this research call for more concrete actions from the EU, besides its frameworks. The analysis shows that the EU is often viewed to have a good will and willingness to address the issues related to the pharmaceutical sector but is unable to truly act. The frameworks' contributions may remain superficial. The experts also emphasize the importance of sufficient resources. As both China and the U.S. possess remarkably more resources to support the competitiveness of their pharmaceutical industries, the EU is at risk of falling behind. Ways of boosting competitiveness of the EU market would be needed to secure the continuation of production in the EU.

Second, reviewing the interests between industry and politics would be necessary to minimize contradictions. As mentioned earlier, the EU recognizes the importance of pharmaceutical industry. However, the Wastewater Directive indirectly affects the economic viability and unintentionally undermines competitiveness of pharmaceutical industry, as it poses major additional expenses. The Finnish law on mandatory stockpiling of medicines could be reviewed from a cost-effectiveness perspective. Thus, closer cooperation and consultation would be needed to ensure the compatibility of policies and competitiveness.

Third, continuing closer cooperation between the public and private sector in Finland would be valuable. The analysis revealed that cooperation has been beneficial for exchanging views and revealing weaknesses of the system.

The regulatory complexity of both Finland and the EU increases stress on the industry. Although regulation is important for preventing counterfeit medicines, there is some room for simplification of the regulatory framework.

Lastly, the findings of this research could be utilized in observing other EU member states' security of supply or economic security. Additionally, other industries with strategic dependencies could utilize the findings of this research. The transfer of findings, however, is based on the judgment of experts in those fields or geographic regions.

5.7 Limitations and suggestions for further research

For this research, all invited EU representatives from any EU institution declined the interview or did not provide a response. For further research, having the expertise from the Commission, Parliament, EMA, or HERA could be highly beneficial. However, thematic saturation at least to some level was noticed. The perspectives and concerns were quite similar in the interviews. Nevertheless, including participants from both public and private sectors offered a wide range of perspectives.

Additionally, due to the complexity and geopolitical sensitivity of pharmaceutical supply chains, this analysis focused mainly on Finland's extra-EU dependencies, especially focusing on the U.S. and China aspects. However, the EU trade disputes were not taken into further consideration. Additionally, the EU's ongoing new FTA negotiations were not considered while thinking about the dependencies. This is due to the time constraints as well as gaining a deeper focus on merely the already-existing dependencies and having a research topic not too broad for a master's thesis.

Many of the EU initiatives regarding economic security or security of supply are relatively new. The EU's rhetoric regarding these issues have changed ever since the Russian invasion of Ukraine. Thus, the full effects of these initiatives, frameworks and trade policy tools have not been fully realized yet. Therefore, the analysis focuses on the potential and realistically possible outcomes of these initiatives given the conditions while conducting the research.

Future developments in the EU's trade policies, pharmaceuticals' regulatory framework and member state's actions will shape the perception of strategic dependencies, pharmaceutical security of supply, economic security and the effectiveness of the EU tools and mechanisms. Researching the effectiveness of, for example, OSA, would be fruitful some years later to have the full effects available. Additionally, simulating the effects of ACI regarding the U.S. or China trade for example, would be beneficial.

Transfer of findings regarding research outside the Finnish context could be somewhat difficult. Finland's security of supply system differs from other EU member states, and the geographic location of Finland imposes additional challenges. However, some of the results from this study can be applied to other countries with similarly small market economies and high dependency on imports. For instance, the issues associated with economic efficiency, competitiveness, security of supply, and dependency may not only apply to Finland but also other smaller EU member countries with limited production capacity. The suggested mechanism of securitization of pharmaceuticals could be useful in a wider international context, since there have been numerous examples of countries and international organizations perceiving problems associated with pharmaceutical dependence as an economic security or security of supply threat. Additionally, the results concerning the embeddedness of networks within the pharmaceutical industry, the challenges of relocating manufacturing processes, and supply chain weaknesses could be applicable to other countries participating in the GPN.

Regarding quantitative data, the methodology has some limitations. Although utilized by the EU itself, the quantitative methodology cannot consider situations where trade is triangulated through a third country. This triangulation of trade distorts data, as the trade data does not show the exact country of origin. The methodology also fails to recognize situations where critical materials have been used to produce a product which is directly imported to Finland.

The accuracy of CN codes used in this research was CN6. However, with this accuracy, some dependencies may have been missed or unnecessarily flagged. If the accuracy is too small, dependencies may be flagged too high, even if the dependency is high for only a few singular products within the same CN code. If the accuracy is too wide, the bigger picture of dependencies might be missed, although singular products show limited dependency. For further research, the codes of CN29 and CN90, which stand for organic chemicals and optical, photographic, measuring, checking, precision, medical or surgical instruments and apparatus, are worthwhile considering, as they are linked to the production and usage of pharmaceuticals. Especially since APIs' CN codes fall under category CN29 (organic chemicals), API-specific CN-codes per country would be beneficial to extract and observe. The CN-codes on CN4 accuracy are (1) 2914 antibiotics and derivatives, (2) 2933 heterocyclic compounds for drugs, and (3) 2924 carboxamide compounds. (Tse, 2025.) Finally, the calculations were based on value, not on volume. Adding the volume aspect would provide a more profound picture of the trade flows.

6 Summary

The main objective of this research was to provide an understanding of the EU's intermediate role of managing Finland's strategic dependencies in pharmaceuticals, and how it reflects on the national economic security and security of supply. EU's risk mitigating role was assessed in the light of stressed transatlantic relations followed by the tariff wars of early 2025 and China's involvement in the API production as well as trade war with the U.S.

First, Finland's position in the pharmaceutical supply chains was examined through Global Production Network (GPN) and network embeddedness theories. This provided a background on the structures behind the dependencies and power dynamics. After that, the nature of dependencies and possible interdependencies, as well as possibilities for weaponization were examined. Then these findings were framed onto the political economy framework, and the vulnerabilities were observed through the process of securitization, linking the vulnerabilities to economic security and security of supply. Lastly, the EU level mechanisms were applied to the phenomenon. The literature review provided the thesis with academic background, while the EU mechanisms were drawn from the empirical data. The literature review showed that political economy framework's explanation of both the socio-economic and political stemming inside and outside the observed economy affect the industry performance and market outcome of the GPN, whereas the securitization further explains when the vulnerabilities are deemed strategic.

The results of this thesis provided a theoretical basis for positioning the EU's tools on the global pharmaceutical production network, while considering Finland's security of supply and economic security. The findings provided new insights into the existing academic literature. The previous literature, such as the EU's white papers, has focused on the pharmaceutical industry of the EU as a whole, disregarding the uniqueness of healthcare and security of supply systems of each member country. This makes the proposed process new in the academic literature in the IB field.

Additionally, this research proposed conditions, when pharmaceuticals can be turned into strategic matters through the securitization process. The analysis agrees on findings on the external powers' behaviour patterns affecting economic security and the institutional responses of regional states.

Finally, this research also utilized Finland's trade data of 2025 to compute the import and export dependencies. These results showed high concentrations of pharmaceuticals on extra-EU destination countries and countries of origin. This information is valuable, as import concentration

affects the security of supply, and export concentration affects the economic security. The higher the concentration, the more vulnerable the supply chain and its actors are.

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Appendices

Appendix 1 Interview themes and general questions translated to English

May I record the interview for transcription purposes?

THEME 1: The Finnish pharmaceutical industry

- What are the key strengths and weaknesses of the Finnish pharmaceutical industry?
- How dependent is the Finnish pharmaceutical industry on raw materials and components supplied by China or other Asian countries?
- What are the obstacles to relocating production to Europe?
- How do you assess China's actual influence on pharmaceutical industry supply chains?

THEME 2: Trade Policy Tensions and Supply Chains

- What are critical bottlenecks or dependencies in supply chains?
- How will the trade policies of the Trump 2.0 era affect risk assessments in the pharmaceutical industry?
- What concerns might customers, wholesalers, or hospitals have regarding potential U.S. export restrictions (e.g., technology, medical devices)?
- How will the strained relations between the EU and the US affect European companies' decisions or investments?
- How will competition between the US and China affect, directly or indirectly, the EU and Finland?
- How might China's counter-sanctions or investment restrictions manifest in pharmaceutical or API supply chains?
- What risks do you foresee if the EU and the United States begin competing for the same "de-risking" investments?

THEME 3: Interdependencies and Strategic Dependencies

- From the perspective of Finland's security of supply, have any critical medicines or raw materials been identified where dependence is significant?

- How does your company balance cost-effectiveness, globalized value chains, and growing security of supply obligations?
- How should transparency, competitiveness, and security of supply be balanced?
- To what extent do the private sector and public administration collaborate in identifying and preparing for risks?
- What are the key strengths and weaknesses of Finland's pharmaceutical industry from the perspective of supply security?

THEME 4: The Role of the EU

- How does the EU balance its economic and political relations with the United States and China?
- How do the national security of supply strategy and EU-level decisions overlap?
- What is Finland's influence on EU-level decisions?
- How do you assess the EU's role and trade policy tools in ensuring the security of the supply of medicines?
- How can the EU maintain openness and competitiveness while reducing strategic dependencies?

Is there anything else we haven't discussed that you feel is relevant to the study?

Do you have any questions regarding the study?

May I contact you regarding a possible follow-up interview?

Appendix 2 Follow-up interview themes and questions translated to English

May I record the interview for transcription purposes?

THEME 1: Validating database

- How well does a database like this grasp the full picture of the trade?
- Are there things, that the data and way of processing the data might miss?

THEME 2: Ways of utilizing the data, case-product

- This medicament product has a 35% focus to the U.S. markets in all exports. How do you read into this dependency?

- In which ways could the data be organized to be more readable for the reader?
- In which ways could the data be more embedded into the analysis, without it remaining as a

THEME 3: Validating the theoretical framework

- I have drafted a framework, where GPNs for dependencies, which can turn into vulnerabilities and under certain conditions into strategic dependencies, and the EU tools can be positioned into the framework regarding the member state's interests. How realistic does this sound?
- Is there something missing from this framework?
- Is there something you would like to emphasize more in this framework?

Is there something relevant to the research, the data processing or the framework that we haven't yet discussed?

Appendix 3 Import CN30 high HHI flagged products

- 300120 (2002--.) Extracts of glands or other organs or of their secretions, for organo0therapeutic uses
- 300213 (2017--.) Immunological products, unmixed, not put up in measured doses or in forms or packings for retail sale
- 300251 (2022--.) Cell therapy products
- 300259 (2022--.) Cell cultures, whether or not modified (excl. cell therapy products)
- 300290 (2002--.) Human blood; animal blood prepared for therapeutic, prophylactic or diagnostic uses
- 300320 (2002--.) Medicaments containing antibiotics, not in measured doses or put up for retail sale (excl. medicaments containing penicillins or derivatives thereof with a penicillanic acid structure, or streptomycins or derivatives thereof)
- 300339 (2002--.) Medicaments containing hormones or steroids used as hormones, not containing antibiotics, not in measured doses or put up for retail sale (excl. those containing insulin)

- 300349 (2017--.) Medicaments containing alkaloids or derivatives thereof, not containing hormones, steroids used as hormones or antibiotics, not in measured doses or put up for retail sale (excl. containing ephedrine, pseudoephedrine INN, norephedrine or
- 300410 (2002--.) Medicaments containing penicillins or derivatives thereof with a penicillanic acid structure, or streptomycins or derivatives thereof, put up in measured doses incl. those in the form of transdermal administration or in forms or packings
- 300431 (2002--.) Medicaments containing insulin but not antibiotics, put up in measured doses incl. those in the form of transdermal administration or in forms or packings for retail sale
- 300432 (2002--.) Medicaments containing corticosteroid hormones, their derivatives or structural analogues but not antibiotics, put up in measured doses incl. those in the form of transdermal administration or in forms or packings for retail sale
- 300442 (2017--.)
- 300443 (2017--.) Medicaments containing norephedrine or its salts, not containing hormones, steroids used as hormones or antibiotics, put up in measured doses incl. those for transdermal administration or in forms or packings for retail sale
- 300449 (2017--.)
- 300450 (2002--.) Medicaments containing provitamins, vitamins, incl. natural concentrates and derivatives thereof used primarily as vitamins, put up in measured doses incl. those in the form of transdermal administration or in forms or packings for retail
- 300630 (2002--.) Opacifying preparations for x-ray examinations; diagnostic reagents for administration to patients
- 300650 (2002--.) First-aid boxes and kits
- 300693 (2022--.) Placebos and blinded or double0blinded clinical trial kits for a recognised clinical trial, put up in measured doses

Appendix 4 Import CN30 high HHI + CDI2 flagged products

- 300213 (2017--.) Immunological products, unmixed, not put up in measured doses or in forms or packings for retail sale

- 300290 (2002--.) Human blood; animal blood prepared for therapeutic, prophylactic or diagnostic uses
- 300339 (2002--.) Medicaments containing hormones or steroids used as hormones, not containing antibiotics, not in measured doses or put up for retail sale (excl. those containing insulin)
- 300630 (2002--.) Opacifying preparations for x-ray examinations; diagnostic reagents for administration to patients
- 300650 (2002--.) First-aid boxes and kits
- 300693 (2002--.) Placebos and blinded or double-blind clinical trial kits for a recognised clinical trial, put up in measured doses

Appendix 5 Import CN30 high HHI + CDI2 + CDI3 flagged products

- 300213 (2017--.) Immunological products, unmixed, not put up in measured doses or in forms or packings for retail sale
- 300290 (2002--.) Human blood; animal blood prepared for therapeutic, prophylactic or diagnostic uses
- 300339 (2002--.) Medicaments containing hormones or steroids used as hormones, not containing antibiotics, not in measured doses or put up for retail sale (excl. those containing insulin)
- 300630 (2002--.) Opacifying preparations for x-ray examinations; diagnostic reagents for administration to patients
- 300650 (2002--.) First-aid boxes and kits

Appendix 6 Export CN30 products flagged with high HHI

- 300120 (2002--.) Extracts of glands or other organs or of their secretions, for organo-therapeutic uses
- 300190 (2002--.) Dried glands and other organs for organo-therapeutic uses, whether or not powdered; heparin and its salts; other human or animal substances prepared for therapeutic or prophylactic uses, n.e.s.
- 300212 (2017--.) Antisera and other blood fractions

- 300213 (2017--.) Immunological products, unmixed, not put up in measured doses or in forms or packings for retail sale
- 300214 (2017--.) Immunological products, mixed, not put up in measured doses or in forms or packings for retail sale
- 300215 (2017--.) Immunological products, put up in measured doses or in forms or packings for retail sale
- 300241 (2022--.) Vaccines for human medicine
- 300249 (2022--.) Toxins, cultures of microorganisms and similar products, e.g. plasmodia (excl. yeasts and vaccines)
- 300251 (2022--.) Cell therapy products
- 300259 (2022--.) Cell cultures, whether or not modified (excl. cell therapy products)
- 300290 (2002--.) Human blood; animal blood prepared for therapeutic, prophylactic or diagnostic uses
- 300339 (2002--.) Medicaments containing hormones or steroids used as hormones, not containing antibiotics, not in measured doses or put up for retail sale (excl. those containing insulin)
- 300410 (2002--.) Medicaments containing penicillins or derivatives thereof with a penicillanic acid structure, or streptomycins or derivatives thereof, put up in measured doses incl. those in the form of transdermal administration or in forms or packings
- 300420 (2002--.) Medicaments containing antibiotics, put up in measured doses incl. those in the form of transdermal administration or in forms or packings for retail sale (excl. medicaments containing penicillins or derivatives thereof with a penicillani
- 300431 (2002--.) Medicaments containing insulin but not antibiotics, put up in measured doses incl. those in the form of transdermal administration or in forms or packings for retail sale
- 300432 (2002--.) Medicaments containing corticosteroid hormones, their derivatives or structural analogues but not antibiotics, put up in measured doses incl. those in the form of transdermal administration or in forms or packings for retail sale
- 300449 (2017--.)

- 300450 (2002--.) Medicaments containing provitamins, vitamins, incl. natural concentrates and derivatives thereof used primarily as vitamins, put up in measured doses incl. those in the form of transdermal administration or in forms or packings for retail
- 300490 (2002--.) Medicaments consisting of mixed or unmixed products for therapeutic or prophylactic purposes, put up in measured doses incl. those for transdermal administration or in forms or packings for retail sale (excl. containing antibiotics, hormo
- 300510 (2002--.) Adhesive dressings and other articles having an adhesive layer, impregnated or covered with pharmaceutical substances or put up for retail sale for medical, surgical, dental or veterinary purposes
- 300630 (2002--.) Opacifying preparations for x0ray examinations; diagnostic reagents for administration to patients
- 300640 (2002--.) Dental cements and other dental fillings; bone reconstruction cements
- 300650 (2002--.) First0aid boxes and kits
- 300670 (2002--.) Gel preparations designed to be used in human or veterinary medicine as a lubricant for parts of the body for surgical operations or physical examinations or as a coupling agent between the body and medical instruments
- 300691 (2007--.) Appliances identifiable for ostomy use
- 300693 (2022--.) Placebos and blinded or double-blinded clinical trial kits for a recognised clinical trial, put up in measured doses

Appendix 7 Flagged export and import CN30 products' classification and trade values

Trade flow	CN-code	Classification	Total trade value	USA share	China share	India share
Export	300212 – Antisera	High-tech core	8,584,148	0.71%	4.60%	0.00%
Export	300213 – Immunological products (unmixed)	High-tech core	1,158,947	59.93%	9.13%	0.05%
Export	300214 – Immunological products (mixed)	High-tech core	31,051,576	20.34%	30.19%	0.35%

Export	300215 – Immunological products (retail)	High-tech core	2,402,044	0.5%	0.00%	0.09%
Export	300241 – Vaccines	High-tech core	27,857	0.00%	0.00%	0.05%
Export	300249 – Toxins, cultures of micro-organisms and similar products, e.g. plasmodia (excl. yeasts and vaccines)	High-tech core	59,517,009	94.95%	0.69%	0.01%
Export	300251 – Cell therapy products	High-tech core	147	0.00%	0.00%	0.00%
Export	300259 – Cell cultures	High-tech core	5,084,456	82.52%	0.1%	0.00%
Export	300120 – Extracts of glands or other organs or of their secretions, for organo-therapeutic uses	Bio-inputs	3,574	83.38%	4.06%	0.00%
Export	300190 – Dried glands other organs for organo-therapeutic uses	Bio-inputs	608,387	0.79%	0.00%	0.00%
Export	300290 – Human/animal blood	Bio-inputs	228,290	1.79%	0.00%	6.80%
Export	300410 – Medicaments containing penicillins or derivatives thereof	Generic / mass pharma	4,464,046	0.00%	0.00%	0.00%
Export	300420 – Medicaments containing antibiotics	Generic / mass pharma	4,425,979	0.00%	0.00%	0.00%
Export	300432 – Medicaments containing corticosteroid hormones	Generic / mass pharma	4,588,806	0.00%	0.00%	0.00%
Export	300449 – Other medicaments	Generic / mass pharma	1,093,665	47.05%	0.00%	0.00%
Export	300490 – General medicaments	Generic / mass pharma	1,507,547,275	34.63%	3.70%	0.00%
Export	300339 – Medicaments containing hormones	Hormones and drugs targeting chronic conditions	1,058	0.00%	0.00%	0.00%

Export	300431 – Medicaments containing insulin	Hormones and drugs targeting chronic conditions	336,617	0.00%	0.00%	0.00%
Export	300510 – Adhesive dressings	Low-tech / support	183,679,102	27.79%	0.01%	0.00%
Export	300630 – Diagnostic reagents	Low-tech / support	57,065	0.00%	0.00%	0.00%
Export	300640 – Dental cements	Low-tech / support	11,380,042	0.00%	0.00%	0.00%
Export	300650 – First-aid kits	Low-tech / support	188,581	0.12%	0.00%	0.00%
Export	300670 – Medical gels	Low-tech / support	1,242,611	0.13%	0.00%	0.00%
Export	300691 – Ostomy products	Low-tech / support	1,534	24.19%	0.39%	0.00%
Export	300693 – Clinical trial kits	Low-tech / support	9,401	98.30%	0.00%	0.00%
Import	300213 – Immunological products	High-tech core	3,168,493	0.10%	0.09%	0.00%
Import	300290 – Blood products	Bio-inputs	3,090,222	51.15%	0.22%	10.27%
Import	300339 – Medicaments containing hormones or steroids	Hormones and drugs targeting chronic conditions	1,441,492	0.00%	0.00%	0.00%
Import	300630 – Diagnostic reagents	Diagnostic products	6,395,705	1.13%	0.00%	0.02%
Import	300650 – First-aid kits	Low-tech / support	3,681,478	1.07%	34.01%	0.15%

Appendix 8 Explanation of the use of AI

I have used generative AI to support my thesis process at various stages and for various purposes. The tools I used, the purpose of their use, and the steps I took to verify the AI's outputs are described below. I hereby affirm that I have used AI tools with due care, have disclosed their use in accordance with current guidelines, and take full responsibility for the content of this work in its entirety.

1. Tool used: OpenAI's ChatGPT (GPT-4 version)

- Stage of use: brainstorming topics and formulating research questions, improving language, checking Excel formulas
- Purpose of use: I used ChatGPT to brainstorm preliminary research topics, formulate more precise sub-questions, and check complex Excel formulas.
- Example of entered data (8.9.2025): Suggest narrowing the research focus based on the following criteria: I am interested in Finland's economic (inter)dependence, I want to focus on trade policy, particularly tariffs during the Trump2 era, and I may want to combine quantitative data with qualitative data.
- Verification: The AI suggested narrowing the research focus to strategic dependencies, as well as limiting the topic to a specific sector, such as high-tech products. Ultimately, after familiarizing myself with the semiconductor sector, I decided to conduct research on the pharmaceutical sector due to data availability and the sector's strategic nature, as defined by the EU.

Other prompts:

10.9.2025: Help me formulate two separate sub-questions on trade tensions (U.S.-EU, U.S.-China) and strategic dependency. I need a clear distinction between the two separate sub-questions.

3.2.2026: Find the issue in the following Excel function in the following screenshot. Also explain how I can exclude the EU countries from the HHI calculations with an Excel function.

5.4.2026: Help me to rephrase the following sentences more academically...

20.4.2026: Help me to rephrase the following sentences more academically...

2. Tool used: DeepL

- Stage of use: Translation
- Purpose of use: I used DeepL for Finnish-English and English-Finnish translations and searching for synonyms. No full sentences were entered to the tool.
- Example of entered data (15.10.2025): "lähestymistapa riippuvuuksien hallintaan"
- Verification: DeepL suggested "an approach to addiction management". However, this was not suitable for this context. After searching for synonyms, I translated the entered data to "an approach in managing dependencies"

Appendix 9 Thesis information and interview consent form

TIEDOTE TUTKIMUKSESTA / DESCRIPTION OF THE STUDY

Tutkimuksen nimi / Name of the research

Suomen lääkeala muuttuvassa geopolitisessa tilanteessa – EU:n lähestymistapa taloudellisten riippuvuussuhteiden hallintaan

Finnish pharmaceutical sector in shifting geopolitics – EU's approach in managing economic dependencies

Pyyntö osallistua tutkimukseen / Invitation to participate in the research

Tämän tutkimuksen tavoitteena on ymmärtää EU:n välittäjänä toimivaa roolia jäsenmaiden strategisten riippuvuussuhteiden hallinnassa ja sen vaikutusta kansalliseen taloudelliseen turvallisuuteen. Arvioin erityisesti viimeisimmän Yhdysvaltojen ja EU:n välisen kauppasopimuksen vaikutusta Suomen strategiseen riippuvuuteen lääketeollisuudessa. Tähän tutkimukseen valitut henkilöt ovat asiantuntijoita yhdellä tai useammalla tutkimuksen teemalla (EU, lääketeollisuus, transatlanttiset suhteet, Kiina, kansainvälinen kauppa jne.). Tutkimukseen osallistuu noin 5–10 henkilöä.

This research aims to provide an understanding of the EU's intermediate role of managing its member countries' strategic interdependencies, and how it reflects on the national economic security. I will especially assess the most recent U.S.–EU trade deal's effect on Finland's strategic dependence in the pharmaceutical industry. People selected for this study showcase expertise in one or more of the research themes (EU, pharmaceutical industry, transatlantic relations, China, international trade etc.). Approximately 5–10 people will participate in this research.

Osallistumisen vapaaehtoisuus / Voluntary consent

Tähän tutkimukseen osallistuminen on vapaaehtoista. Voitte kieltäytyä osallistumasta tutkimukseen tai peruuttaa suostumuksenne syytä ilmoittamatta, milloin tahansa tutkimuksen aikana ilman, että siitä aiheutuu Teille minkäänlaisia kielteisiä seuraamuksia. Jos päätätte peruuttaa suostumuksenne, peruutukseen mennessä jo kerättyä aineistoa käytetään tutkimustarkoitukseen anonymisoituna ja luottamuksellisesti. Lukekaa rauhassa tämä tiedote. Jos Teillä on kysyttävää, voitte olla yhteydessä tutkijaan, jonka yhteystiedot löytyvät asiakirjan lopusta. Jos päätätte osallistua tutkimukseen, Teitä pyydetään allekirjoittamaan oheinen suostumus.

Participation in this research is voluntary. You can withdraw from the research or cancel your participation at any time without assigning a reason for this decision. Withdrawing or cancelling your participation does not result in any negative consequences. In case you decide to withdraw your consent, the data collected until that point will be used for the purpose of this study in an anonymized and confidential form. Please, read this description of research with care. If you have any questions, you can be in contact with the researcher. The contact details are provided at the end of this document. If you decide to participate in this study, please sign the attached consent form.

Tutkimuksen toteuttaja / Responsible researcher

Tämän tutkimuksen toteuttamisesta vastaa Turun yliopiston kauppakorkeakoulun kansainvälisen liiketoiminnan pääaineopiskelija Venla Vuolle. Tutkimuksen rekisterinpitäjä on Venla Vuolle, joka vastaa tutkimuksen yhteydessä tapahtuvan henkilötietojen käsittelyn lainmukaisuudesta.

Tieteellisessä tutkimuksessa henkilötietojen käsittely perustuu yliopistolaissa annettuun tehtävään ja sillä toteutetaan yleistä etua.

The responsible researcher of this study is Venla Vuolle as a master's student with International Business major at the Turku School of Economics at the University of Turku. Venla Vuolle operates as the keeper of the register and thereof is responsible for the lawful processing of the personal information gathered within the research. In scientific research the processing of personal data is based on the societal task of universities defined in the university law and it progresses public good.

Tutkimusmenetelmä / The research method

Tässä tutkimuksessa käytettävät laadullisen tiedon keräämisen menetelmät ovat puolistrukturoidut kasvokkain tai verkossa tehtävät henkilökohtaiset haastattelut ja asiakirjojen tarkastelu.

Puolistrukturoidut haastattelut ammattilaisten kanssa, joissa esitetään sama joukko avoimia kysymyksiä, mahdollistavat lisäkysymysten esittämisen haastateltavan asiantuntemuksen perusteella. Määrällistä tietoa käytetään toissijaisena aineistona. Haastattelujen keskimääräinen kesto on 45 minuuttia. Haastattelujen tavoitteena on saada käsitteellinen ymmärrys strategisista riippuvuuksista, EU:n kehittyvästä lähestymistavasta, lääketeollisuuden tilanteesta muuttuvassa geopoliittisessa tilanteesta ja siitä, miten Suomen lääketeollisuus sopii tähän yhtälöön.

Haastateltavan luvalla haastattelut äänitetään ja litteroidaan tekstiksi.

The methods for qualitative data collection used in this research will be semi-structured face-to-face or online personal interviews and document revision. Semi-structured interviews with professionals,

asking the same set of open-ended questions, allow posing further follow-up questions on the topics based on the interviewee's expertise. Quantitative data is used as a secondary material. The average duration of interviews is 45 minutes. The aim of the interviews is to gain conceptual understanding of strategic dependencies, EU's evolving approach, the situation of pharmaceutical industry in shifting geopolitics and how Finnish pharmaceutical industry fits into this equation. With the permission of the interviewee, the interviews will be audio recorded and transcribed to text.

Tietojen luottamuksellisuus ja tietosuojat / Confidentiality and data privacy

Tutkimuksessa henkilöllisyytenne on ainoastaan tutkijan tiedossa, ja tutkija on pro gradu-tutkielman tekijänä salassapitovelvollinen. Kaikkia Teistä kerättäviä tietoja käsitellään luottamuksellisesti, eikä tietojanne voida tunnistaa tutkimukseen liittyvistä tutkimustuloksista, selvityksistä tai julkaisuista.

Tutkimusrekisteriin tallennetaan vain tutkimuksen tarkoituksen kannalta välttämättömiä henkilötietoja. Tutkija ei anna teidän nimeänne tai yhteystietojanne ulkopuolisille.

Tutkimustuloksissa ja muissa asiakirjoissa Teihin viitataan vain tunnistekoodilla, esimerkiksi nimikirjaimin tai pseudonyymillä. Rekisteriä säilytetään Turun yliopiston käyttämässä pilvipalvelussa ja tutkijan tietokoneella, kunnes tutkimus on päättynyt. Rekisteritietoja ja tutkimustietoja säilytetään erikseen. Jos päätätte peruuttaa suostumuksenne, peruuttamiseen mennessä kerättyä aineistoa käytetään tutkimuksessa anonymisoituna ja luottamuksellisesti.

In this study, Your identity will only be known to the researcher, who is bound by confidentiality as the author of a master's thesis. All information collected about You will be treated confidentially, and Your information cannot be identified in research results, reports, or publications related to the study. Only personal data necessary for the purpose of the study will be stored in the research register. The researcher will not disclose Your name or contact details to third parties. In the research results and other documents, You will only be referred to by an identification code, such as initials or a pseudonym. The register is stored in a cloud service used by the University of Turku and on the researcher's computer until the research is completed. Register data and research data are stored separately. If You decide to withdraw your consent, the data collected up to the point of withdrawal will be used in the research in an anonymized and confidential manner.

Tutkimuksen kustannukset ja rahoitus / Costs of research and funding

Tutkimukseen osallistuminen on Teille maksutonta. Tutkimuksesta ei makseta palkkiota, eikä tutkimukseen osallistumisesta aiheutuvia mahdollisia ansionmenetyksiä tai matkakustannuksia korvata.

Participation in the study is free of charge. No remuneration will be paid for participating in the study, nor will any loss of earnings or travel expenses incurred as a result of participating in the study be compensated.

Lisätietoja / Further information

Jos Teillä on kysyttävää tutkimuksesta, voitte olla yhteydessä tutkijaan. Hänen kanssaan voitte keskustella kaikista tutkimuksen aikana mahdollisesti ilmenneistä kysymyksistä ja muista mieltänne askarruttavista asioista.

If You have any questions about the study, please contact the researcher. You can discuss with her any questions that may arise during the study and other matters that are on Your mind.

Yhteystiedot / Contact details:

Venla Vuolle, *email address, phone number*

CONSENT FORM

Title of research project: Finnish pharmaceutical sector in shifting geopolitics – EU's approach in managing economic interdependencies

Researcher's contact details: Venla Vuolle, *email address, phone number*

Brief description of the research project and its aim:

This research aims to provide an understanding of the EU's intermediate role of managing its member countries' strategic interdependencies, and how it reflects on the national economic security. Thus, the main research question is:

How can the EU's trade policy address Finland's strategic dependency on pharmaceutical supply chains in light of China's API dominance and U.S.–EU trade relations?

The methods for qualitative data collection used in this research will be semi-structured face-to-face or online personal interviews and document revision. Quantitative data is used as secondary material.

I have read the above information and certify the following: (i) I have received sufficient information regarding the study, data collection, data storage, and later use, and I have understood this information. (ii) I have received information regarding the processing of personal data. (iii) I

have had enough time to consider my participation in the study. (iv) I have received sufficient information regarding my rights, as well as the risks and benefits of the study. (v) I understand that my personal data is handled confidentially and will not be disclosed to third parties. (vi) I understand that I have the right to discontinue my participation at any time without disclosing the reason and without any negative consequences to myself. (vii) I understand that if I elect to withdraw at any time, any data collected will not be used in the study. (viii) I have not been persuaded or pressured into participating in the study. I understand that participation is voluntary. (iv) I have had the opportunity to ask for additional information. If I have asked any questions, they have been answered to my satisfaction.

Additional information: [GDPR Privacy notice](#) and [data management plan](#)

Place and date	Place and date
Signature of research participant	Signature of researcher