



## RESEARCH ARTICLE

# Post-Pandemic Vulnerabilities and Policy Directions in Indonesia's Pharmaceutical Supply Chain

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### Abstract

The COVID-19 pandemic has revealed significant vulnerabilities in Indonesia's pharmaceutical supply chain, especially due to the very high dependence on imports of Active Pharmaceutical Ingredients (API), which reaches more than 90% of the national demand. This dependency poses risks such as distribution delays, price fluctuations, and protectionist policies from exporting countries. This condition is urgent and needs improvement to prevent disruption to the national pharmaceutical supply chain in the future. This study analyzes Indonesia's pharmaceutical supply chain post-pandemic, identify the key risks faced, and evaluate the role of government policies in strengthening national pharmaceutical resilience. Using a literature review method, this study examines findings from relevant journals, government reports and policy documents in the past five years. The results show that import dependency creates major risks, including distribution delays, raw material price fluctuations, and the impact of exporting countries' protectionist policies. Although the government has initiated strategic policies such as change source and domestic component level policy, their implementation still faces obstacles, such as limited local production capacity and complex regulations. Therefore, a holistic approach is needed that includes diversifying raw material sources, investing in local technology, and strengthening logistics infrastructure. In conclusion, this strategic step is not only important to reduce import dependency, but also to ensure Indonesia's future pharmaceutical resilience.

**Keyword:** pharmaceutical supply chain, drug raw materials, pharmaceutical resilience, pharmaceutical policy

### Introduction

The COVID-19 pandemic that has hit the world since late 2019 has had a significant impact on various sectors. One of the affected sectors includes the pharmaceutical sector. As one of the main pillars in the health system, the pharmaceutical supply chain is facing major disruptions due to limited raw materials, disrupted distribution, and a surge in demand for medicines and medical devices (Khot, 2020). Indonesia, which still relies on imports for most of its pharmaceutical raw materials, faces the additional challenge of dependence on a global supply chain that is vulnerable to disruption. The 90% reliance on raw material imports causes delays in the production and distribution of essential medicines when exporting countries impose trade restrictions. This highlights the need for strategic measures to strengthen the resilience of domestic pharmaceutical supply chains to reduce vulnerability to future disruptions (Isnaeniah et al., 2023).

Post-pandemic, the urgency to build pharmaceutical supply chain resilience has become even more relevant, especially given the possibility of similar crises emerging in the future. Supply chain resilience is the ability of a system to survive, adapt, and recover from disruptions quickly and efficiently. Supply chain resilience is one of the critical elements in ensuring the future availability of essential medicines. This resilience involves not only the ability of the supply chain to recover from disruptions, but also the ability to adapt to changes that occur, including market dynamics and global policies (Tarigan et al., 2021).

However, there are currently several gaps in the pharmaceutical supply chain system in Indonesia. One of them is that government policies are often not well coordinated between the central and regional levels, which causes distribution bottlenecks in the field. In addition, local production capacity for drug raw materials is still very limited, while most of the raw material needs still have to be imported. This dependency creates vulnerability to global supply chain disruptions, as happened during the COVID-19 pandemic. The government has a strategic role in ensuring this resilience through policies that support domestic production, incentivize technological innovation, and strengthen logistics infrastructure (Mahendradhata et al., 2021).

This study aims to identify the condition of the pharmaceutical supply chain in Indonesia post-pandemic, identify the main risks faced, and analyze the role of the government in managing the pharmaceutical supply chain. Using a systematic framework based on a literature review, this research is expected to provide a comprehensive understanding of the challenges and opportunities in strengthening the national pharmaceutical supply chain. To that end, this study will answer several main questions, which are what is the condition of the pharmaceutical supply chain post-pandemic, what are the main risks faced, and how government policies affect the management of these risks. This research is expected to serve as a foundation in understanding the condition of the national pharmaceutical supply chain and the challenges that need to be overcome to achieve pharmaceutical supply chain resilience in the future.

### Method

This research uses the literature review method to identify, evaluate and synthesize findings from various literatures related to pharmaceutical supply chains and government policies in the context of post-pandemic Indonesia. This method was chosen because it allows in-depth analysis of secondary data to gain a comprehensive understanding of the state of the

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pharmaceutical supply chain without requiring primary data collection.

The literature used in this study includes academic journals, government reports, policy documents, and other relevant scientific articles. Inclusion criteria for literature selection included studies that addressed the post-pandemic state of Indonesia's pharmaceutical supply chain, risks in the

After the literature collection stage, the literature was analyzed using a thematic approach. This process included identification of key themes, such as supply chain risks, government policies, and mitigation strategies; categorization by grouping themes based on their relevance to the research objectives; and synthesis by integrating findings from various sources to build a coherent narrative. With this approach, the research is expected to provide comprehensive insights into the condition of pharmaceutical supply chains in Indonesia, the main risks faced, and government policies in post-pandemic supply chain management.

## Results and Discussion

### *Indonesia pharmaceutical supply chain condition*

The pharmaceutical supply chain is a series of stepwise processes that aim to ensure medicines are available to patients in adequate quantities, guaranteed quality, and on time. It involves various parties, including pharmaceutical suppliers, drug manufacturers, distributors, and healthcare providers (Kapoor, 2018). According to Ochonogor et al. (2022), the pharmaceutical supply chain consists of five main stages starting from raw materials to the final product ready for distribution to the market. The process starts with raw

pharmaceutical supply chain, and Indonesian government policies during and after the COVID-19 pandemic. The selected literature was published within the last five years to ensure relevance and actuality of the findings. Literature sources were obtained through databases such as Scopus and Google Scholar, as well as official documents from government agencies.

materials, such as petroleum products, organic materials, and minerals, which are processed into fine chemicals. These fine chemicals are ultra-pure materials used exclusively for pharmaceutical purposes. The next stage is the production of active pharmaceutical ingredients through chemical processes, where active ingredient become the main component in the effectiveness of drugs. Next, the API is mixed with inactive ingredients and packaging materials to produce the final dosage form. The final dosage form is then distributed to the market, including pharmacies, hospitals, and retail outlets. A simple diagram that can illustrate the process in the pharmaceutical supply chain can be seen in Figure 1 (Ochonogor et al., 2022). Meanwhile, a diagram of Indonesia's pharmaceutical supply chain can be seen in Figure 2.

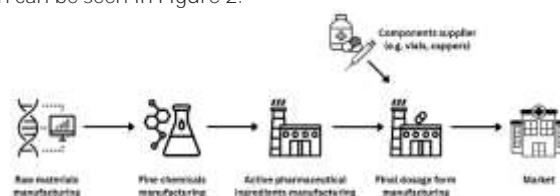


Fig 1. Pharmaceutical supply chain

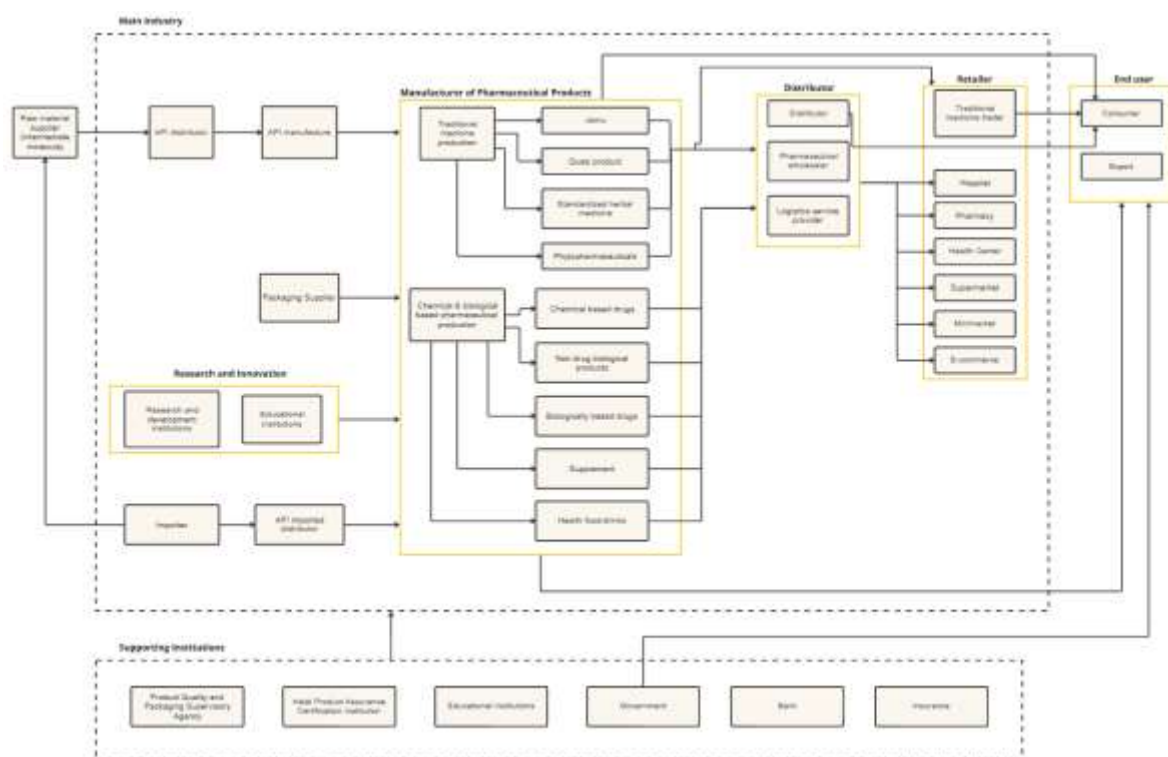


Fig 2. Indonesia's pharmaceutical supply chain

Comparing the global pharmaceutical supply chain with the pharmaceutical supply chain in Indonesia, it can be seen that Indonesia's pharmaceutical supply chain has not fully covered the upstream sector. Indonesia has only started the production of active pharmaceutical ingredients on a small scale, while most of the active ingredient needs are still dependent on imports. In fact, to produce active ingredient in the country, raw materials in the form of intermediate compounds used are also still imported. This condition shows that there is still a significant need to increase domestic production capacity and

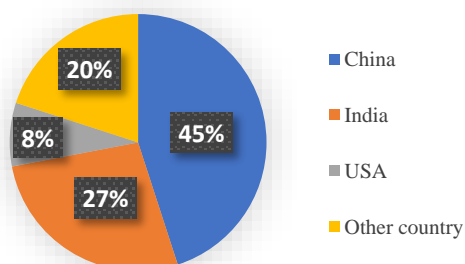
independence to strengthen the resilience of Indonesia's pharmaceutical supply chain, especially in the face of potential global disruption.

According to Wenang et al. (2021), Indonesia's pharmaceutical supply chain, which involves various stages from raw material procurement, drug production, to distribution to health facilities, also has challenges in terms of distribution. The unique geographical challenges of being the largest archipelago in the world make drug distribution to all regions very challenging. Remote areas in Indonesia face

significant access gaps due to limited transportation infrastructure, such as roads, ports and airways. This leads to delays in drug delivery and increased logistics costs, which in turn impacts the inequitable availability of essential medicines. Indonesia's reliance on manual systems in pharmaceutical logistics management is also a major obstacle. Inaccurate inventory data often leads to stock shortages in health facilities, especially in remote areas. This problem is exacerbated by the lack of coordination between distribution centers and local health facilities. In addition, the distribution of sensitive medicines that require a cold chain is often disrupted due to limited temperature-controlled storage equipment in rural areas.

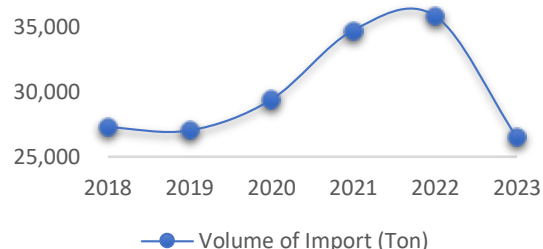
### *Key risks in the pharmaceutical supply chain*

Indonesia with its large and growing population is one of the largest pharmaceutical markets in Southeast Asia. Indonesia is experiencing an increase in drug consumption and demand for healthcare services. In 2021, the value of Indonesia's pharmaceutical market is estimated to reach IDR141.6 trillion (USD10.11 billion), with an estimated pharmaceutical industry growth of around 12-13 percent per year (Sutrisno, 2021). The contribution of the pharmaceutical industry to Indonesia's GDP has also increased in recent years (Kusnandar, 2022). This increase reflects the strategic role of the pharmaceutical industry in supporting the national economy. However, despite its great potential, Indonesia's pharmaceutical industry faces significant challenges. One of the major challenges experienced by the pharmaceutical industry is the dependence on imported products. The very high dependence on imports, especially imports of active pharmaceutical ingredient, is indicated by more than 90% of drug raw materials still being imported from countries such as India and China (Isnaeniah et al., 2023). According to data from the Ministry of Industry, data on the country of origin of imported APIs are presented in Figure 3.

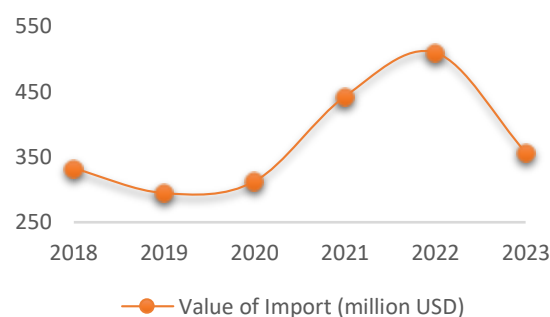


**Fig 3. Country of Origin of Raw Material Imports**

From the Figure 3, data on the country of origin of imported medicinal raw materials with the largest contribution coming from China at 45%, India 27%, and the United States 8% (CNN Indonesia, 2024). Meanwhile, the import trend has increased in recent years (Rizky, 2024). In recent years, the import volume of medicinal raw materials showed a significant increasing trend from 2020 to its peak in 2021-2022 as shown in Figure 4, with the import volume reaching more than 35,000 tons. However, there was a sharp decline in 2023. The import value also shows a similar trend, with the highest value occurring in 2022 reaching 550 million USD before falling back in 2023 as shown in Figure 5.



**Fig 4. Import Volume Trend of Medicinal Raw Materials**



**Fig 5. Import Value Trend of Medicinal Raw Materials**

Based on the trend, it can be seen that the COVID-19 pandemic drove a surge in import growth for the national pharmaceutical industry in 2020 and 2021, and peaked in 2022, which then began to stabilize in 2023 as the pandemic ended. This dependence on imports creates vulnerability to global supply chain disruptions, as seen during the COVID-19 pandemic. During the pandemic, problems arose in the pharmaceutical supply chain, such as delays in drug procurement, shortages of drug raw materials, and increased costs, which further emphasized the urgency of strengthening national pharmaceutical resilience (Kardoko, 2020; Nurkartika, 2021). This import dependency results in a high risk of delays in the distribution of essential medicines during global disruptions. In addition, dependence on imported raw materials makes the supply chain vulnerable to price fluctuations and protectionist policies of exporting countries (Mahendradhata et al., 2021).

According to Simanjuntak (2024), the pharmaceutical drug industry in Indonesia faces various challenges that affect the availability and price of drugs in the domestic market. In addition to a high dependence on imported raw materials, the limited number of drug raw material producers in the country makes local production capacity unable to meet national needs. In addition, the prices of local raw materials are often higher than those of imported raw materials, as domestic production has not yet reached optimal economies of scale. The process of developing finished drugs also requires significant time and cost, especially to fulfill stability and bioequivalence tests. Strict regulations and standards, including the time-consuming product registration process at the **Indonesia's Food and Drug Authority**, are also an obstacle. On the other hand, Indonesia has to compete with countries such as India and China that have more advanced BBO production technology and infrastructure. According to Hermawan et al. (2023), challenges in developing the pharmaceutical raw material industry in Indonesia are the price of local raw materials that are less competitive than imported products, for example, local clopidogrel costs USD 210 per kg, while imports can start from USD 150 per kg.

In addition, research and development activities are critical for improving the quality of pharmaceutical products and expanding market reach. The pharmaceutical industry is highly reliant on knowledge and innovation, being one of the most

research-intensive and science-based sectors. However, this process requires high costs and uncertainty of results. Based on Isnaeniah et al. (2023), developing a new drug typically takes 10-12 years and requires an estimated investment of USD 750-850 million (IDR 10.5-11.9 trillion). The R&D budgets of pharmaceutical companies in Indonesia are also relatively small, such as PT Kimia Farma which only allocated 0.2% of its total sales for R&D in 2021 (Hermawan et al., 2023). For pharmaceutical businesses in Indonesia, the high costs, lengthy timelines, and uncertain market success of new drugs have deterred significant investment in R&D. As a result, the pharmaceutical sector in Indonesia struggles to compete with more advanced markets in terms of innovation and drug development (Isnaeniah et al., 2023).

Regarding drug availability, according to the Ministry of Health in the Indonesian Health Profile 2023, drug availability still faces challenges, especially in remote, hard-to-reach areas that have limited access to logistics and infrastructure (Ministry of Health, 2024). The distribution of medicines to remote areas in Indonesia faces major challenges caused by geographical factors, inadequate infrastructure, and lack of integration of logistics systems (Wenang et al., 2021). As an archipelago, Indonesia has significant infrastructure gaps between urban and remote areas. This causes delays in the distribution of essential medicines, especially in hard-to-reach areas (Kuntardjo, 2020). The manual system still used by many health institutions in remote areas often results in urgent drug shortages, or even inefficient duplication of deliveries. To overcome these challenges, a comprehensive overhaul of the pharmaceutical supply chain is needed by managing it efficiently, increasing local production capacity, and conducting strategic collaboration among various stakeholders (Ferdous et al., 2023; Francis, 2020; Meliawati, 2020).

### ***Government role and the policies during and after the pandemic related to supply chain management***

The Indonesian government has recognized this urgency and responded by enacting a number of policies, such as Law No. 17 of 2023 and Presidential Instruction of the Republic of Indonesia No. 6 of 2016 that emphasize the accelerated development of the domestic pharmaceutical industry. This initiative is carried out to reduce dependence on imports through diversifying the raw material supply chain, strengthening integrated pharmaceutical supply chain governance, and increasing domestic production capacity to achieve national pharmaceutical resilience (Ruskar et al., 2021). Regarding distribution, the government has carried out initiatives such as e-catalogue and digitalization of distribution, which are opportunities to improve the efficiency and equity of drug distribution (Ministry of Health, 2024).

The government through the Ministry has established a policy to localize the source of pharmaceutical raw materials known as the change source policy. This policy aims to encourage the domestic pharmaceutical industry to replace imported raw materials with local raw materials. As part of the support, the government provides incentives in the form of bioequivalence test financing to ensure the quality and equivalence of local pharmaceutical products with international standards. With the provision of these incentives, it is hoped that the acceleration of the development and resilience of the pharmaceutical industry as stipulated in Law No. 17 of 2023 can be realized. Through this policy, it is also expected that the domestic pharmaceutical industry will be able to increase the competitiveness of local products while reducing dependence on imported raw materials (BPK, 2023).

In addition to providing incentives for bioequivalence testing, the government through the Ministry of Industry also supports the change source policy by establishing a domestic component level policy. This policy, as stipulated in the Minister

of Industry Regulation No. 16 of 2020, requires the use of local raw materials in the pharmaceutical production process (Ruskar et al., 2021). This regulation includes the calculation of the domestic component level value with a weighting of 50% for active pharmaceutical ingredient, 30% for the research and development process, 15% for the production process, and 5% for the packaging process. Pharmaceutical products that achieve a domestic component level value of more than 52% will be prioritized in government procurement of goods and services (Direktorat Jenderal Farmasi dan Alat Kesehatan Kemenkes, 2023). With this policy, it is expected that the development of local active ingredient can be encouraged, while increasing the contribution of the pharmaceutical industry in supporting national pharmaceutical security.

To improve distribution efficiency, the government has initiated the digitization of the pharmaceutical supply chain through the e-catalog platform. This system enables more transparent and coordinated drug procurement, reducing the risk of distribution delays. This initiative also aims to reach remote areas that were previously difficult to access due to geographical and logistical constraints (Sulistiadi, 2023). In addition, Indonesia's high dependence on imports of pharmaceutical raw materials, particularly from China and India, creates vulnerability to global supply chain disruptions. In response, the government encourages diversification of raw material sources through cooperation with ASEAN countries and international partners. This diversification aims to ensure the stability of raw material supply, especially in situations of global crisis (Bright Ojo, 2024). The government is also encouraging the adoption of blockchain technology in the pharmaceutical supply chain to improve data transparency and accuracy. This technology enables better oversight of the drug production and distribution process, and helps prevent the circulation of counterfeit drugs, which remains a major challenge in Indonesia (Meyliana et al., 2021). In addition, complex regulations are often a barrier to the development of the local pharmaceutical industry. The government is working to simplify the registration process of raw materials and drugs at Indonesia's Food and Drug Authority, as well as reduce bureaucratic barriers in raw material procurement. These reforms aim to accelerate drug production and distribution, so that the needs of the community can be better met (Sulistiadi, 2023). The government recognizes the importance of cross-sector collaboration to strengthen the resilience of the pharmaceutical supply chain. This includes cooperation between the government, pharmaceutical industry and academia to develop new technologies, simplify regulations and increase local production capacity. Studies show that this kind of collaboration can drive innovation and create long-term solutions to strengthen national pharmaceutical resilience (Bastani et al., 2021).

In general, these government policies aim to increase local production capacity, strengthen cross-sector collaboration, and provide incentives for industries investing in pharmaceutical raw material production. However, their implementation faces various obstacles and has not yet achieved maximum results. This can be seen from the information provided by the Government regarding the number of BBO imports that have not been significantly reduced until 2024 as reported by CNN Indonesia, CNBC Indonesia, and tirto.id (Azzahra, 2024; CNN Indonesia, 2024; Salsabilla, 2024). Some of the obstacles that arise during its implementation include the lack of strategic collaboration between stakeholders, fierce global competition due to lack of economy of scale, quality that needs to be proven by stability and bioequivalence tests, which is a long and time-consuming process, and the capacity of the national active pharmaceutical ingredient industry that is not yet qualified (Simanjuntak, 2024). This requires synergy by the government, pharmaceutical industry players, and regulatory agencies to strengthen the national pharmaceutical supply chain.

### **Conclusions and Recommendations**



This study identifies the condition of the pharmaceutical supply chain in Indonesia after the COVID-19 pandemic, the main risks faced, and the role of government policies in managing these risks. Based on the results of the literature review, it was found that Indonesia's pharmaceutical supply chain remains underdeveloped, particularly in the upstream sector. Indonesia's pharmaceutical supply chain is still highly dependent on imports of pharmaceutical raw materials or active pharmaceutical ingredients, with more than 90% of active ingredients needs being met from abroad. This dependency creates significant vulnerability to global supply chain disruptions, especially in crisis situations such as the COVID-19 pandemic, which causes active pharmaceutical ingredients shortages, delays in drug distribution, and increased production costs. Furthermore, geographical challenges and insufficient logistics infrastructure exacerbate distribution delays, particularly in remote areas, impacting equitable access to essential medicines.

The key risks in Indonesia's pharmaceutical supply chain include high dependence on imported active pharmaceutical ingredients, limited local production capacity, and logistical challenges, particularly in remote areas. The global supply chain disruptions during the pandemic highlighted these vulnerabilities, leading to shortages of critical medicines, increased costs, and delays in distribution. Import dependency makes the pharmaceutical supply chain vulnerable to price fluctuations and protectionist policies of supplying countries, as happened during the pandemic. Also, complex regulations and limited economies of scale in the local production sector further worsen the resilience of the national pharmaceutical system. Additionally, the limited R&D budgets and high costs of innovation deter pharmaceutical companies in Indonesia from advancing domestic production capabilities or developing new drugs. This constrains the country's ability to compete with more advanced pharmaceutical industries globally.

The Indonesian government has taken several strategic steps through policies such as change source policy, which encourages the use of local raw materials, and the domestic component level policy, which incentivizes manufacturers with high local content. These policies aim to reduce dependency on imports and encourage local production. Initiatives like e-catalog digitalization aim to streamline drug procurement and improve distribution efficiency. However, the implementation of these policies still faces various obstacles, including high local production costs, time-consuming regulations due to regulatory complexities, and a lack of coordination between the public and private sectors and all stakeholders. While these policies represent a step in the right direction, their impact has been limited due to systemic and structural barriers.

To strengthen the resilience of the pharmaceutical supply chain, a holistic approach is needed that includes diversifying sources of raw materials, increasing investments in local production and R&D, regulatory reform, and strengthening logistics infrastructure to address the logistical challenges particularly in remote areas. By supporting cross-sector collaboration between government, industry, and academia, Indonesia has a great opportunity to reduce import dependency, improve the competitiveness of the national pharmaceutical industry, and build a resilient pharmaceutical system to face future challenges. This research highlights the urgency of addressing the structural vulnerabilities within **Indonesia's pharmaceutical supply chain**. With the right strategies and sustained policy reforms, Indonesia can enhance its pharmaceutical resilience and be better prepared for future disruptions.

### ***Recommendations to strengthen national pharmaceutical resilience***

To strengthen the resilience of the pharmaceutical supply chain in Indonesia, diversification of raw material sources is an urgent strategic step. The government and industry players need to establish cooperation with ASEAN countries and

international partners to reduce dependence on certain countries. This could involve trade alliances or bilateral agreements to ensure the stability of raw material supply in a global crisis situation. In addition, increasing local production capacity should be a top priority. The government can encourage investment in the pharmaceutical raw materials sector by providing tax incentives and subsidies to local producers, especially in the early stages of production. Advanced technologies, such as biotechnology-based synthesis, can also be adopted to improve the efficiency and competitiveness of local production. In this context, the active involvement of the private sector is essential to achieve optimal economies of scale.

Regulations also require reform to support the development of the pharmaceutical industry. The registration process for raw materials and drugs at **Indonesia's Food and Drug Authority** needs to be simplified to accelerate the production and distribution of pharmaceutical products. In addition, the government can formulate more investment-friendly policies by reducing bureaucratic barriers in raw material procurement and licensing. Strengthening logistics infrastructure is also an important element in the pharmaceutical supply chain. A more efficient logistics system can be achieved through digitizing drug stock management and optimizing distribution channels. The main focus should be on strengthening distribution in remote areas, where unequal access to medicines remains a major problem. Cross-sector collaboration needs to be improved, especially between the government, universities and pharmaceutical industry players. This synergy can encourage innovation in research and development of local pharmaceutical raw materials, while creating long-term solutions to strengthen national pharmaceutical resilience.

### ***Recommendations for further research***

Future research could focus on the empirical evaluation of implemented policies, such as the domestic component level policy and change source policy. This analysis is important to measure the extent to which these policies are effective in increasing local production capacity and reducing import dependency. This research can also provide practical insights for future policy improvements. In addition, a quantitative study is needed to evaluate the impact of raw material source diversification on production costs and efficiency of the national pharmaceutical supply chain. This study can provide a detailed picture of the economic benefits of source diversification compared to the risks of dependence on a particular country.

Comparative analysis with countries such as China, India, Vietnam, or Brazil could also be conducted to understand successful strategies in building pharmaceutical resilience. Such studies can identify relevant best practices that can be adapted to the Indonesian context. Technology adoption in the pharmaceutical supply chain is also an interesting topic to research. Technologies such as blockchain for supply chain management can improve the transparency and efficiency of drug distribution. This research will be relevant in supporting the development of a more modern pharmaceutical logistics system in Indonesia. Finally, in-depth research on the challenges of pharmaceutical distribution in remote areas is needed. This study can explore the specific constraints faced, such as limited infrastructure and high logistics costs, as well as solutions that can be implemented to reduce inequalities in access to essential medicines.

### **References**

- Azzahra, Q. (2024). *Kemenperin Akui 90 Persen Lebih Bahan Baku Farmasi Masih Impor*.
- Bastani, P., Dehghan, Z., Kashfi, S. M., Dorosti, H., Mohammadpour, M., Mehralian, G., & Ravangard, R. (2021). Strategies to improve pharmaceutical supply chain resilience under politico-economic sanctions: the case of Iran. *Journal of Pharmaceutical Policy and*

- Practice*, 14(1). <https://doi.org/10.1186/s40545-021-00341-8>
- BPK. (2023). *Undang-undang (UU) Nomor 17 Tahun 2023*.
- Bright Ojo. (2024). Resilience of supply chains for essential goods and services. *International Journal of Science and Research Archive*, 12(2), 2113–2123. <https://doi.org/10.30574/ijrsra.2024.12.2.1480>
- CNN Indonesia. (2024). *Kemenperin Akui RI Doyan Impor Bahan Baku Obat dari China Dkk*. <https://www.cnnindonesia.com/ekonomi/20240709172753-92-1119313/kemenperin-akui-ri-doyan-impor-bahan-baku-obat-dari-china-dkk>
- Direktorat Jenderal Farmasi dan Alat Kesehatan Kemenkes. (2023). *Keputusan Menteri Kesehatan Nomor HK.01.07/MENKES/1333/2023 tentang Peningkatan Penggunaan Sediaan Farmasi yang Menggunakan Bahan Baku Produksi Dalam Negeri*.
- Ferdous, J., Medhekar, A., Akbar, D., Khandaker, G., & Hossain, R. (2023). DEVELOPING AN ANALYTICAL FRAMEWORK TO DEPICT DISRUPTIONS IN THE PHARMACEUTICAL SUPPLY CHAIN DURING COVID-19: A SCOPING REVIEW. In *Australasian Journal of Regional Studies* (Vol. 29, Issue 01).
- Francis, J. R. (2020). COVID-19: Implications for Supply Chain Management. *Frontiers of Health Services Management*, 37(1), 33–38. <https://doi.org/10.1097/HAP.0000000000000092>
- Hermawan, E., Hadiyati, N. A., Adiarso, A., Setiyadi, E. D., Zunuraen, S., Hidayat, D., Wahyudi, A., & Ru'yi, H. A. (2023). CHALLENGES AND POLICY SUPPORTS IN INDONESIAN PHARMACEUTICAL RAW MATERIALS INDUSTRY. *Indonesian Journal of Health Administration*, 11(2), 196–211. <https://doi.org/10.20473/jaki.v11i2.2023.196-211>
- Isnaeniah, R. W., Prakoso, L. Y., & Saputro, G. E. (2023). *Pharmaceutical Industry Independence Strategy in Supporting Defense Economic Post-Covid-19*. 8(2), 674–685.
- Kapoor, D. (2018). An Overview on Pharmaceutical Supply Chain: A Next Step towards Good Manufacturing Practice. *Drug Designing & Intellectual Properties International Journal*, 1(2). <https://doi.org/10.32474/ddipij.2018.01.000107>
- Kardoko, H. (2020). *Revolusi Industri Farmasi di Tengah Pandemi Covid-19*. <https://ekonomi.bisnis.com/read/20201022/257/1308478/revolusi-industri-farmasi-di-tengah-pandemi-covid-19>
- Kementerian Kesehatan. (2024). *Profil Kesehatan Indonesia 2023*.
- Khot, U. N. (2020). Navigating Healthcare Supply Shortages During the COVID-19 Pandemic: A Cardiologist's Perspective. *Circulation: Cardiovascular Quality and Outcomes*, 13(6), E006801. <https://doi.org/10.1161/CIRCOUTCOMES.120.006801>
- Kuntardjo, C. (2020). Healthcare Logistics & Supply Chain Management in Health Industry of Indonesia Based on the Telemedicine. In *Int. J Sup. Chain. Mgt* (Vol. 9, Issue 3). <http://excelingtech.co.uk/>
- Kusnandar, V. B. (2022). *Nilai dan Pertumbuhan PDB Industri Kimia, Farmasi dan Obat Tradisional (2010-2021)*.
- Mahendradhata, Y., Andayani, N. L. P. E., Hasri, E. T., Arifi, M. D., Siahaan, R. G. M., Solikha, D. A., & Ali, P. B. (2021). The Capacity of the Indonesian Healthcare System to Respond to COVID-19. *Frontiers in Public Health*, 9. <https://doi.org/10.3389/fpubh.2021.649819>
- Meliawati, R. (2020). Kebijakan Industri Farmasi pada Masa Pandemi COVID-19. *Jurnal Farmasi Udayana*, 72. <https://doi.org/10.24843/jfu.2020.v09.i02.p02>
- Meyliana, Surjandy, Fernando, E., Cassandra, C., & Marjuki. (2021). Propose Model Blockchain Technology Based Good Manufacturing Practice Model of Pharmacy Industry in Indonesia. *2021 2nd International Conference on Innovative and Creative Information Technology, ICITech 2021*, 190–194. <https://doi.org/10.1109/ICITech50181.2021.9590120>
- Nurkartika, Andini. (2021). *Revolution and Policy of the Pharmaceutical Industry in the Middle of the Covid-19 Pandemic*. <https://ssrn.com/abstract=3829097>
- Ochonor, K. N., Osho, G. S., Anoka, C. O., & Uwakonye, M. (2022). The Effect of COVID-19 on Supply Chain Management: Pre and Post-COVID-19: Case Study of CVS Pharmacy, Inc. *Int'l Journal of Management Innovation Systems*, 7(1), 35. <https://doi.org/10.5296/ijmis.v7i1.20408>
- Rizky, D. (2024, July 10). *Tren Impor Bahan Baku Obat Meningkat 5 Tahun Terakhir*.
- Ruskar, D., Hastuti, S., Wahyudi, H., Dewa Ketut Kerta Widana, I., & Khoirudin Apriyadi, R. (2021). LAFIAL: Pandemi COVID-19 Sebagai Momentum Kemandirian Industri Farmasi Menuju Ketahanan Kesehatan Nasional. *PENDIPA Journal of Science Education*, 5(3), 300–308. <https://doi.org/10.33369/pendipa.5.3.300-308>
- Salsabilla, R. (2024). *Bahan Baku Obat Impor, Masalah Bertahun-tahun yang tak Kunjung Selesai*.
- Simanjuntak, A. K. M. (2024). *Obat di Indonesia Mahal, Ini Sederet Tantangan Besar Industri Farmasi*. [https://validnews.id/ekonomi/obat-di-indonesia-mahal-ini-sederet-tantangan-besar-industri-farmasi?utm\\_source=chatgpt.com](https://validnews.id/ekonomi/obat-di-indonesia-mahal-ini-sederet-tantangan-besar-industri-farmasi?utm_source=chatgpt.com)
- Sulistiadi, W. (2023). Health Policy Reform through Strengthening Indonesia's Health Resilience System. *Journal of Indonesian Health Policy and Administration*, 8(3), 106. <https://doi.org/10.7454/ihpa.v8i3.7321>
- Sutrisno, E. (2021, May 22). *Potensi Besar Industri Kesehatan Dalam Negeri*.
- Tarigan, Z. J. H., Siagian, H., & Jie, F. (2021). Impact of internal integration, supply chain partnership, supply chain agility, and supply chain resilience on sustainable advantage. *Sustainability (Switzerland)*, 13(10). <https://doi.org/10.3390/su13105460>
- Wenang, S., Schaefer, J., Afdal, A., Gufron, A., Geyer, S., Dewanto, I., & Haier, J. (2021). Availability and Accessibility of Primary Care for the Remote, Rural, and Poor Population of Indonesia. *Frontiers in Public Health*, 9. <https://doi.org/10.3389/fpubh.2021.721886>