

Re-Viewing Sumitro's Policy and Industrial Maturity: Powering Downstream and Manufacturing Industries for Economic Growth and Sustainable Society

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Abstract:

During the 1950s, Sumitro Djojohadikusumo contributed in a significant manner to the construction of the economy of Indonesia, along with other figures, namely Mohammad Hatta, Sjafruddin Prawiranegara, and Djuanda Kartawidjaja. During this period, Sumitro promoted policies to drive industrialization in Indonesia and self-reliance to transform Indonesia from a colonial economy into a developing nation. Soemitro Djojohadikusumo's economic policies were pivotal in shaping Indonesia's post-colonial economy; focusing on production and industrial sovereignty, he emphasized reducing dependency on imports by fostering domestic industries, especially strategic sectors like heavy industry and natural resource processing, which he saw as crucial to national sovereignty. Soemitro also promoted stimulating economic activities through both public investment and private sector engagement, aiming to diversify the economy and drive sustained growth. Many of the challenges Soemitro addressed, such as infrastructural gaps and weak technological readiness, which remain relevant today. This research analyzes to what extent the economic policy shaped by Sumitro impacts Indonesia's development. This analysis has significance in understanding Indonesia's contemporary economic planning and trends, particularly in terms of economic policy shaped by the newly elected President of Indonesia, Prabowo Subianto. Analysis of Sumitro's policy is conducted through the lenses of the industrial maturity concept, which is relevant to growth theory, resource-based view, and development economics. Indonesia's pursuit of industrial maturity is crucial for transforming its raw resource-based economy into one that competes globally by adding value to domestic production. The need to revitalize manufacturing and strengthen downstream industries is critical for boosting competitiveness and integrating circular economic principles that emphasize sustainability. Soemitro's vision of empowering society aligns with modern approaches to creating a more inclusive economy. However, infrastructure bottlenecks, a lagging education system, and regulatory complexities continue to slow the progress. Addressing supply chain challenges through regional industrial clustering and focusing on efficiency will be vital for overcoming these

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barriers. Further empirical research is needed to explore how infrastructure, education reform, and regulatory simplification can enhance Indonesia's industrial maturity and sustainable economic development.

Keywords: industrial maturity, industrialization, economic policy, development economics, Sumitronomics

1. Introduction

As Indonesia's newly elected president, Prabowo Subianto has outlined an ambitious economic vision, particularly in the industrial sector, building on the policies of his predecessor, Joko Widodo. Prabowo aims to continue expanding the downstream industries policy, which focuses on maximizing the value of Indonesia's natural resources by processing raw materials domestically rather than exporting them in their raw form. The tendency of elected president Prabowo to support industrialization sparked its connection to Sumitro's economic idea. This strategy, especially applied to Indonesia's nickel industry, has attracted significant foreign investment, particularly from China. *It* is a key component of Indonesia's efforts to boost its industrial base and create more jobs.

However, this approach comes with challenges. For example, the oversupply of processed nickel has caused price volatility. Prabowo will need to manage this by potentially slowing the construction of new smelters while ensuring continued growth in value-added industries. He has committed to leveraging Indonesia's vast natural resources, including nickel, to fuel industrial development and increase the nation's economic resilience. At the same time, Prabowo has highlighted the need for greater domestic industrial capacity to ensure that the benefits of Indonesia's natural wealth are more broadly shared among its population (Bland, 2024).

In addition to focusing on natural resource processing, Prabowo has set a lofty target of 8% economic growth, with a significant emphasis on industrial and infrastructure development. He plans to modernize Indonesia's industrial base while ensuring better governance and efficiency, particularly in state-owned enterprises. Prabowo's vision also includes boosting the role of private sector contributions and adopting best practices from leading Asian

economies like China and India to enhance Indonesia's industrial and economic competitiveness (J. Rachman, 2024).

Reflecting on the past challenges faced before, Indonesia, in the 1950s and 1960s, was grappling with the challenges of building an independent economy after centuries of colonial exploitation. The country's primary industries were geared towards exporting raw materials, with little capacity for domestic manufacturing. Sumitro's industrial policies aimed to reverse this trend by encouraging domestic production, developing key industries, and reducing import dependency (Lindblad, 2019; Wie, 2010).

Sumitro Djojohadikusumo, a key figure in Indonesia's economic development, was pivotal in shaping the country's industrial policies. His policies during the early years of Indonesia's independence aimed to drive industrialization and foster economic self-reliance. Revisiting his economic and industrial policies offers valuable insights into Indonesia's successes and challenges as it transitioned from a colonial economy to a developing nation with ambitions for industrial growth. In this technocrat economic style, Sumitro was not alone. Along with the productive national economy thought are Mohammad Hatta, Sjafruddin Prawiranegara, and Djuanda Kartawidjaja, even though they came from different political parties (Dick, Houben, Lindblad, & Thee, 2002; Wie, 2010).

This article examines Sumitro's economic policy on industrialization and its impact on Indonesia's development. It will explore how his vision of industrialization influenced the nation's economic trajectory and assess its relevance in today's context. New business trends like VUCA, Sustainable Development Goals, Industrial Revolution 4.0, digital disruptions and post-pandemic economics need innovative solutions (Afifi, 2024; Bennett & Lemoine, 2014; Karmaker, Al Aziz, Ahmed,

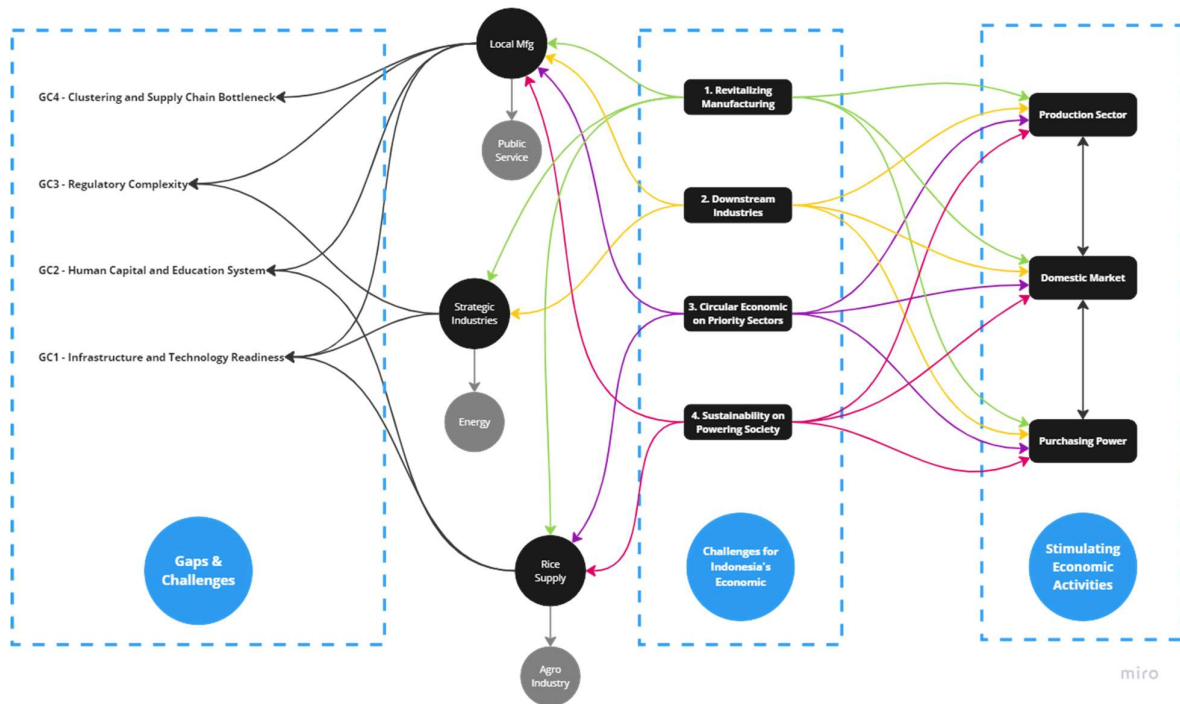


Figure 1. Mapping of Industrialization Policy

Misbauddin, & Moktadir, 2023). By reviewing his policies, the study aims to provide a nuanced understanding of their strengths and limitations and the lessons that can be drawn from contemporary economic planning and trends. Sumitro's policy will be discussed along with industrial maturity, which has relevance in growth theory, resource-based view and development economics (Afifi, Arifin, & Kiswanto, 2019; Finch & Bloch, 2005; Stiglitz, 1986).

Industrial policies are often rooted in broader economic theories, such as developmental economics and state intervention. In Sumitro's case, his policies reflected a belief in the state's central role in guiding industrial growth, consistent with the prevailing economic thought of the time. His approach was influenced by the need for state intervention in capital-poor, post-colonial economies to establish a strong industrial base.

2. Sumitronomics and development

Sumitro Djojohadikusumo was an influential Indonesian economist and politician widely known for his contributions to

Indonesia's economic and industrial policies during the early years of independence. Born in 1917, Sumitro was educated in economics in the Netherlands, which shaped his understanding of modern economic theories and state-led industrialization. Upon returning to Indonesia, he played a pivotal role in shaping the nation's development policies, particularly during the administrations of Presidents Sukarno and Soeharto (Dick et al., 2002; Djojohadikusumo, 1986; Wie, 2001).

Sumitro's most notable contributions came through his efforts to establish a strong industrial base in Indonesia. Today, this policy strategy is known as import substitution industrialization (ISI). He believed that economic independence was crucial for the newly independent nation. Thus, he advocated for the state to play a central role in the economy, particularly in strategic industries such as steel, oil, and heavy machinery. His policies, including establishing state-owned enterprises, aimed to reduce import dependency and build a self-sufficient economy. While his efforts faced significant challenges, his vision laid the foundation for Indonesia's industrial development (Dick et al., 2002).

Beyond his role as an economist, Sumitro was also a key political figure. He served in various high-level government positions, including Minister of Finance and Trade. However, his political career was not without controversy, as he often found himself at odds with political leaders, particularly during the transition between Soekarno and Soeharto's regimes. Despite these challenges, his influence on Indonesia's economic policy and industrialization remains a significant part of his legacy (Liddle, 1991; Wie, 2001).

2.1. Sumitro's views on the production

Sumitro's vision for Indonesia's economy was grounded in achieving industrial self-reliance. He believed Indonesia could only become independent if it developed its industrial capacity. His policies emphasized the creation of state-owned enterprises in strategic industries, including steel, oil refining, and heavy machinery. This was accompanied by efforts to foster domestic entrepreneurship and reduce reliance on foreign investment (Wie, 2010).



Figure 2. Sumitros' view on production and development

Sumitro also highlighted the reduction of government expenditures that do not align with people's welfare. He agrees with Sjafruddin's mention that the rice import activities seem to continue over time and that solutions are needed to increase productivity. Sumitro highlighted that government policies must be weighed for production activities, not just export-import trade activities. The failure of the

state to stimulate production activities will cause economic difficulties (Wie, 2010).

The priority issue faced by Indonesia after independence is a foreign debt caused by the Netherlands' demand to take over civil administration expenses by NICA (Netherlands Indies Civil Administration) and asset nationalization of late Dutch companies. Even though Sumitro suspects the expenses also include the cost of Dutch military colonialization operations. Despite that, the other important issue was the lack of national private companies and traders that could take over the role of Dutch companies to support development. These conditions resolute the Benteng program to stimulate national development by assisting national business (Wie, 2012).

2.2. Industries for sovereignty

In Sumitro Djojohadikusumo's vision, strategic industries played a pivotal role in safeguarding Indonesia's economic sovereignty and reducing dependency on foreign powers. As one of the key architects of Indonesia's industrial policy in the early years of independence, Sumitro believed that building a robust industrial base was essential for national security and long-term prosperity (Wie, 2010). He identified industries that could provide Indonesia with the resources and capabilities needed to sustain itself, particularly in sectors like energy, manufacturing, and infrastructure development (Wie, 2012). His policies focused on enabling the production of goods domestically, which would reduce reliance on imports and protect Indonesia from the volatility of global markets. These views are relevant to economic development and growth (Banerjee & Duflo, 2005; Stiglitz, 1986).

For Sumitro, the establishment of state-owned enterprises (SOEs) or BUMN (Badan Usaha Milik Negara) in key industries was a critical step toward achieving industrial self-sufficiency. He promoted the development of industries in areas such as oil, steel, textiles, and agriculture, which he considered strategic for economic reasons and political independence. By strengthening these sectors, Indonesia could reduce its vulnerability to external pressures,

especially from former colonial powers. The state-led industrialization aligned with Sumitro's broader goal of nationalizing industries to achieve economic development. This policy also highlighted the reclaiming of control over Indonesia's natural resources, which had been exploited during the colonial era (James, 2000; Wie, 2012).

Sumitro's views on strategic industries were also tied to the idea of technological advancement. He understood that for Indonesia to compete internationally and ensure sovereignty, it needed to develop its own technological capabilities. His policies encouraged the creation of research institutions and partnerships with other nations to transfer technology and expertise to Indonesia. By fostering innovation in key sectors such as defence, aviation, and heavy machinery, Sumitro sought to ensure that Indonesia could build the tools necessary for its defence and development, reducing its dependency on foreign technology and expertise. Sumitro's emphasis on strategic industries was connected to the broader goal of economic nationalism, which aimed to firmly place control of the economy in Indonesian hands. His policies reflected a deep concern for protecting national interests in an increasingly globalized world. By prioritizing industries that were crucial for Indonesia's autonomy, he hoped to create a self-sustaining economy that could not only provide for the needs of its people but also assert itself as a sovereign nation capable of standing independently on the global stage (Rice, 1969).

Sumitro Djojohadikusumo recognized the immense potential of Indonesia's raw materials and natural resources as fundamental pillars of the nation's industrial development. He viewed the country's vast reserves of oil, gas, minerals, and agricultural products as strategic assets that could be harnessed to fuel domestic industries, particularly in refining and processing these raw materials into higher-value products. Sumitro firmly believed that by focusing on resource-based industries, Indonesia could break the cycle of merely exporting raw materials and instead move toward creating finished goods domestically. This shift would

add value to the economy and increase employment and technological know-how in key sectors like energy, mining, and agribusiness. By controlling the processing of its own natural resources, Indonesia could reduce its dependency on international markets and achieve greater economic self-reliance (Thomas & Panglaykim, 1969).

In addition to raw materials, Sumitro placed a significant emphasis on the development of heavy industries, which he believed were critical for Indonesia's long-term economic independence. Heavy industries, such as steel production, shipbuilding, and machinery manufacturing, were seen as the backbone of a self-sustaining economy. Sumitro understood that these industries would form the foundation for more advanced sectors like construction, defence, and transportation, providing Indonesia with the necessary tools to modernize and defend itself. By investing in these industries, Indonesia could build a more diversified and resilient economy capable of supporting domestic needs and playing a more competitive role in international trade. Sumitro's strategic focus on heavy industries aimed to ensure that Indonesia could develop its industrial infrastructure rather than relying on imports, thus fortifying its economic sovereignty.

2.3. Stimulating economic activities

Sumitro Djojohadikusumo's approach to stimulating economic growth in Indonesia was rooted in the belief that industrial development should be at the heart of the nation's economic strategy. He advocated for a state-driven industrialization policy, where the government played a significant role in establishing key industries, particularly those that would reduce Indonesia's dependency on foreign imports. Sumitro believed that the state should provide the initial push for industrialization by investing in strategic sectors like manufacturing, energy, and infrastructure. This idea of state-driven has run well until now when Indonesia has not really adopted the concept of a liberal market economy. By doing so, Indonesia could gradually build a self-sufficient economy capable of supporting its development and

strengthening its position in global trade (Rice, 1969).

Another critical aspect of Sumitro's economic philosophy was his focus on import substitution industrialization (ISI). He recognized that for Indonesia to gain economic independence, it needed to produce goods domestically rather than rely heavily on imports. Through ISI, Sumitro sought to nurture domestic industries, allowing them to grow behind protective barriers such as tariffs and quotas. He believed that once these industries reached a certain level of maturity, they could compete on the global stage. This strategy was particularly focused on heavy industries such as steel and petrochemicals, which were seen as the backbone of a modern economy.

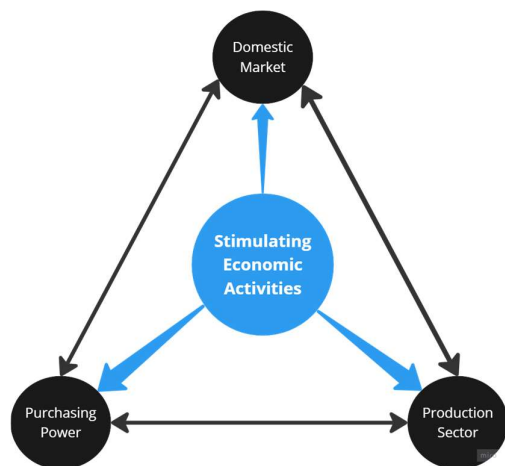


Figure 3. Sumitro's on stimulating economic activities

However, Sumitro also recognized the importance of balancing state intervention with private sector growth. While he championed state-led initiatives in strategic industries, he also encouraged the development of small and medium-sized enterprises (SMEs) to diversify the economy. He understood that SMEs could drive job creation, foster innovation, and provide a broader foundation for economic resilience. By supporting both large-scale state enterprises and encouraging private sector participation, Sumitro's vision was to create a mixed economy that could adapt to both domestic needs and the demands of global markets. His economic ideas remain relevant today as Indonesia navigates new challenges

and seeks to modernize its industrial sector (Djojohadikusumo, 1972, 1978).

2.4. Relevant criticisms

Sumitro Djojohadikusumo's policies, although visionary in laying the foundation for Indonesia's industrial development, have been criticized in several areas, particularly when viewed through the lens of modern economic challenges. One of the most significant critiques is related to overemphasis on state-led industrialization. Sumitro's approach leaned heavily on state intervention in key industries, with a strong focus on the development of strategic industries such as energy, steel, and manufacturing. While this was essential at the time for fostering industrial self-reliance, in today's more dynamic, globalized economy, such a state-centric model may no longer be as effective. Modern economic environments require greater participation from the private sector, innovation, and flexibility to remain competitive. Relying too heavily on the state may stifle competition and slow down the adoption of more efficient business practices (Liddle, 1991).

A second criticism relates to resource-based industrialization. This policy exploited Indonesia's abundant natural resources, focusing on industries related to raw materials like oil, gas, and minerals. However, the failure to diversify beyond these resource-based sectors has left Indonesia vulnerable to fluctuating global commodity prices today. The current global emphasis on renewable energy, sustainability, and green technologies highlights the limitations of a development strategy rooted primarily in exploiting natural resources. The challenge is how Indonesia can shift its focus from a resource-extractive economy to one emphasizing value-added manufacturing and technology-based industries, thus reducing its vulnerability to commodity price shocks (Rice, 1983).

Another critique is the policy's focus on heavy industries, which sometimes led to neglecting the development of smaller industries and the broader economic ecosystem. Even though on the other side of Sumitro's policy, he acknowledges the importance of

powering local industry and SMEs. Heavy industry requires significant capital investment and infrastructure, but smaller, more adaptable industries, such as small and medium-sized enterprises (SMEs), have proven to be key drivers of economic growth in many countries. In today's context, empowering SMEs and creating an environment where they can thrive is crucial, as they can offer greater employment opportunities, flexibility, and innovation. This shift would help diversify the economy and distribute economic benefits more evenly, especially in rural and underdeveloped regions (Dick et al., 2002; Rice, 1983).

Sumitro's policies were also criticized for being overly protectionist. His vision of building self-sufficient industries included implementing protectionist policies to safeguard domestic industries from foreign competition. While this was appropriate for nurturing nascent industries at the time, protectionism has been shown to limit competitiveness and innovation in the long run. In today's global economy, open trade and integration into global supply chains are critical for maintaining competitiveness and fostering industrial growth. The challenge for Indonesia today is to strike a balance between protecting key industries and ensuring they remain competitive on the global stage by embracing more liberal trade policies (Rice, 1969).

Bureaucratic inefficiencies and the complexity of regulatory environments that arose from Sumitro's state-led approach remain persistent challenges today. His policies often created a sprawling government apparatus, which became a bottleneck for industrial progress. Today, Indonesia still grapples with regulatory complexities and inefficiencies that slow down business operations and discourage investment. Streamlining regulations and improving bureaucratic transparency and efficiency are essential for ensuring that Indonesia's industrial sector can grow in a competitive global economy (Djojohadikusumo, 1952).

In a comprehensive view, Sumitro's policies are a pragmatic approach influenced by internal and global geopolitical conditions to solve the problem contextually. Once upon a time, this

approach successfully brought Indonesia a leap with its development. Addressing these critiques requires Indonesia to adopt a more flexible, market-driven approach, integrate with global markets, update the knowledge-based solutions and foster innovation to thrive in the modern economic landscape (Allison, 1969).

3. Challenges for Indonesia's economic

Sumitro's vision of economic sovereignty through strategic industries focused heavily on industrial self-sufficiency, national control of natural resources, and the establishment of key sectors like heavy industry and manufacturing. His approach, rooted in the mid-20th century, aimed to reduce Indonesia's dependence on foreign imports by building a domestic base for raw material processing and heavy industry. Sumitro believed that controlling the nation's natural resources and focusing on industries like steel, oil, and machinery would fuel Indonesia's economy and enhance its political sovereignty. His ideas were largely shaped by the post-colonial context, where newly independent nations sought to build strong economic foundations to protect themselves from external exploitation (Dick et al., 2002; Rice, 1983).

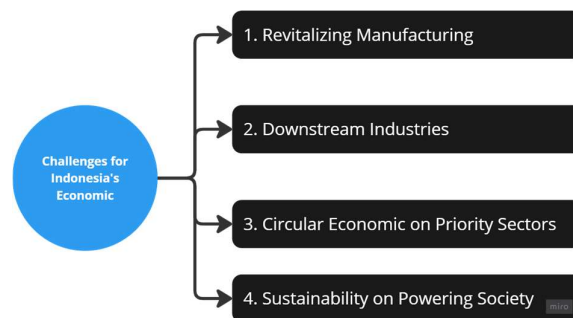


Figure 4. Industrial maturity and challenges for Indonesia's economic

Today's modern economic challenges present new complexities that differ from Sumitro's era. Globalization has intensified economic interdependence, making it harder for any single country, including Indonesia, to achieve the level of self-sufficiency that Sumitro envisioned. For instance, while raw materials like palm oil, coal, and gas remain

crucial to Indonesia's economy, the challenge today is controlling these resources, ensuring sustainable practices, and integrating them into global value chains. Modern economies are now driven by technological advancement, innovation, and digitalization in the context of heavy industries. While Sumitro focused on heavy industries on self-reliance, today's industrial growth relies on collaboration, technological transfer, and foreign investment to compete in high-tech sectors like electronics and renewable energy (Mack, Khare, Krämer, & Burgartz, 2015; World Bank, 2022).

Without a doubt, environmental sustainability and climate change are pressing issues that were not as prominent during Sumitro's time. Modern industrial policies must now grapple with the need for green energy transitions, which contrasts with Sumitro's emphasis on traditional resource-based industries. Today, Indonesia faces the dual challenge of advancing industrial growth while reducing its carbon footprint. The shift towards cleaner energy sources like solar, wind, and bioenergy is critical, and industries now need to align with global sustainability standards. Thus, while Sumitro's vision of industrialization remains influential, modern economic policies must address a wider array of global challenges, such as technological disruption, environmental responsibility, and the complexities of global supply chains (Dincer, 2000).

3.1. Industrial maturity

Industrial maturity refers to the stage where industries within a country have reached a level of sophistication in terms of technology integration, production efficiency, and competitiveness on a global scale. Measuring and developing industrial maturity is crucial for ensuring that a nation's economy can sustain growth, adapt to global changes, and create value across sectors (Afifi et al., 2019; Finch & Bloch, 2005; Mack et al., 2015). To evaluate industrial maturity some technology-driven resource metrics such as technology infrastructure, human resources, data management, and organization structure are relevant to be considered. For instance, an

Industrial Maturity Development Index (IMDI) can help track progress and identify areas that need improvement. By identifying gaps in these areas, governments can prioritize policies and investments that boost industrial efficiency, upgrade technological capabilities, and improve supply chain management, making industries more competitive in global markets. This process is essential for long-term economic resilience, allowing industries to navigate disruptions, such as global supply chain shifts or economic crises (Afifi, 2011; Afifi et al., 2019).

The relevance of industrial maturity is especially clear when considering the role of raw resources in the global economy. Nations with rich natural resources, like Indonesia, have the potential to become major global players, but without mature industries, they risk being relegated to simply exporting raw materials. To get the full value of these resources the countries must develop industries that can process and refine raw materials domestically (in-sourcing), creating higher-value products and integrating them into the global supply chain (Hartman, Ogden, & Hazen, 2017). This is where industrial maturity plays a key role, enabling countries to leverage their natural resources competitively. Additionally, industrial maturity supports a circular economy model, where industries prioritize sustainability by reducing waste, recycling materials, and using renewable energy sources. By developing mature industries that integrate circular economic principles, countries can maintain their competitiveness while simultaneously contributing to global sustainability goals (Afifi, 2011; Arifin, Afifi, Samreen, Hafriz, & Muchtar, 2023; Livesey, 2012).

Industrial maturity also intersects with sustainability and empowering society, particularly for small and medium enterprises (SMEs). Mature industries often create a more inclusive economy by fostering ecosystems where SMEs can thrive, supporting job creation, innovation, and entrepreneurship. With better infrastructure, technology, and financing options—such as microfinance or government-backed programs—SMEs can scale up their operations and contribute more

significantly to the economy. In Indonesia, for example, promoting industrial maturity in sectors like manufacturing or sustainable agriculture can help SMEs develop into major contributors to the sustainable supply chain. Furthermore, these efforts bolster economic growth and ensure that growth is more evenly distributed across society, making the economy more resilient and inclusive (Afifi, 2024; Afifi et al., 2019).

3.2. *Revitalizing manufacturing*

Manufacturing remains a vital engine for economic growth in today's modern business landscape, serving as the foundation for regional development and economic resilience (Rowthorn, 1997). It drives productivity and innovation, provides high-quality jobs, and stimulates related sectors like logistics, supply chains, and services. As countries face increasing global competition, a strong manufacturing base is essential for securing long-term economic success, empowering local regions to thrive through industrial clusters that generate wealth and opportunities. Manufacturing continues to be a cornerstone for economic stability and growth for emerging economies like Indonesia and developed ones (such as the UK, Germany, Japan, Korea and others). These are relevant for inward-looking business approaches, along with the insourcing concept, balancing the outsourcing concept nowadays (Hartman et al., 2017; Roeslan & Zuhdi, 2019).

A notable example is the Midlands region in the UK, which has historically been the country's industrial heartland and continues to focus heavily on its manufacturing sector. The region is home to key automotive, aerospace, and rail manufacturing industries, with major companies like Jaguar Land Rover, Rolls-Royce, and Bombardier operating in the area (Amison & Bailey, 2014). This focus on manufacturing has helped the Midlands region maintain its status as an economic powerhouse, with initiatives like the Midlands Engine strategy supporting further development (Bentley, 2018). By promoting innovation and improving infrastructure, the region is retaining its traditional manufacturing strength and

adapting to modern business needs through advanced manufacturing and technology integration. This has led to significant regional growth, attracting both domestic and foreign investment and boosting local employment (Disney, Haskel, & Heden, 2003; Green & Rossiter, 2019).

Another case is Germany, whose economy is widely recognized for its robust manufacturing base, particularly in the automotive, machinery, and chemicals sectors. Cities such as Stuttgart and Munich have become global hubs for high-tech manufacturing, home to companies like BMW, Bosch, and Siemens (Hertwig, Lentes, Zimmermann, & Dangelmaier, 2019; Sternberg & Tamasy, 1999). These manufacturing industries contribute significantly to Germany's exports and overall GDP while supporting local regions' development through specialized labour markets, research centres, and strong linkages to global supply chains (Hüttenhain & Kübler, 2021). Germany demonstrates how a strong manufacturing foundation can empower regional growth and national economic stability by continuously investing in research, development, and workforce skills (Schwab, 2016).

In Japan, several cities have built their economies around manufacturing, serving as hubs for both domestic and global production. One prominent example is Toyota City, located in Aichi Prefecture, which is home to the Toyota Motor Corporation and a major centre of automobile manufacturing (Jacobs, 2002). The city's economy is deeply intertwined with the automotive industry, with numerous ancillary industries, such as parts suppliers and logistics companies supporting the sector. Similarly, Kawasaki and Yokohama in the Kanagawa Prefecture are known for their heavy industrial zones, with major steel, chemical, and shipbuilding production facilities (Suwa, 2020). These cities demonstrate how manufacturing drives local economies and shapes employment and regional development, with ripple effects felt across Japan's supply chain and export markets. Their reliance on innovation and skilled labour in these sectors serves as a model for other nations aiming to

revitalize their manufacturing bases (Carvajala & Watanabe, 2011; Ishida, 1956).

Ulsan stands out as a major manufacturing hub in South Korea, driving much of the country's industrial economy. Known as the "Industrial Powerhouse of South Korea," Ulsan is home to large-scale industries such as shipbuilding, automotive, and petrochemicals. The city hosts Hyundai Heavy Industries, the world's largest shipbuilding company, and Hyundai Motors, one of the largest car manufacturers globally, dominating the region's economic landscape (Jacobs, 2011). Similarly, Pohang has become synonymous with steel production, housing POSCO, one of the largest steel producers in the world. These cities reflect South Korea's heavy reliance on manufacturing to fuel its rapid post-war industrialization and economic growth, setting a global example in advanced manufacturing and export-oriented industries (Auty, 1990; Lee, Sosin, & Hong, 2005).

All these countries already developed their economies with the development of industrial regions. These highlights show the central role that manufacturing plays in building resilient, competitive economies. These examples provide a blueprint for emerging economies like Indonesia, which can harness manufacturing as a core driver of both regional empowerment and national development (Christopherson, Martin, Sunley, & Tyler, 2014; Sjoberg & Sjobholm, 2004). If Indonesia can successfully scale up its home industries to manufacturing-level productivity, the economic benefits would be substantial and transformative for the nation's economy. Home industries, particularly textiles, furniture, handicrafts, and small-scale food production, represent an untapped potential for driving national growth. By transitioning from small-scale production to more structured, efficient manufacturing operations, Indonesia can significantly increase productivity, create more jobs, and enhance product quality. This shift would enable these industries to meet higher domestic demand and penetrate global markets, generating export revenues and increasing Indonesia's competitiveness in international trade (Porter, 2012).

Scaling home industries into manufacturing can foster regional development by decentralizing economic growth away from major cities like Jakarta and Surabaya. Rural areas and smaller cities could become hubs for specific industries, benefiting from infrastructure, technology, and skills development investments. For instance, regions with strong agricultural bases can develop agro-industries that process raw materials into higher-value products, such as turning rubber into tyres or converting palm oil into consumer goods. This would stimulate regional economies, reduce inequality between urban and rural areas, and encourage balanced national growth (Sjoberg & Sjobholm, 2004).

Scaling home industries to manufacturing levels would be transformative for Indonesia, driving higher productivity, economic empowerment at the regional level, and increasing global competitiveness. Indonesia could tap into its vast workforce and natural resources more effectively by supporting small-scale industries to evolve into more robust manufacturing operations. This transition would allow local economies to grow, reduce regional disparities, and foster innovation by creating jobs and encouraging entrepreneurship. Additionally, increasing manufacturing capacity will help Indonesia participate more actively in global supply chains, boosting exports and reducing import dependency. Over time, the expansion of home industries into manufacturing would lay a strong foundation for sustainable, long-term economic growth, positioning Indonesia as a more prominent player in global trade and industry. This shift would also align with global trends toward localized production, resilience in supply chains, and the growing demand for value-added goods (Montes & Olleros, 2020; Nahm & Steinfeld, 2014).

A shift to manufacturing-scale industries would contribute to better integration into global supply chains. Countries like Vietnam and Thailand have effectively leveraged manufacturing to transform their economies, making them attractive destinations for foreign direct investment (FDI) (Prajogo, Laosirihongthong, Sohal, & Boon-Itt, 2007).

With its large population and access to abundant natural resources, Indonesia is well-positioned to replicate these successes. By modernizing home industries into manufacturing sectors, Indonesia can attract more FDI and boost innovation, as manufacturers tend to invest in research and development (R&D) and automation technologies, further increasing productivity and economic resilience.

3.3. Downstream industries as competitiveness

Indonesia's focus on downstream industries presents a key opportunity to enhance its global competitiveness, especially in sectors rich in natural resources. Downstream industries involve processing raw materials into higher-value products, thereby capturing more value domestically instead of exporting raw materials for processing abroad. This strategy is particularly relevant for Indonesia, a nation endowed with abundant natural resources such as coal, palm oil, nickel, and bauxite. By moving further along the value chain, Indonesia can create more jobs, increase revenue, and reduce its dependency on volatile commodity prices, which often leave the economy vulnerable to global market fluctuations (Aswicahyono & Rafitrandi, 2017; Porter, 2012).

One of the most prominent examples of this downstream push is in the nickel sector, where Indonesia has implemented export bans on unprocessed ore to encourage local processing into stainless steel and battery-grade nickel. This policy has attracted significant foreign investment, especially from China, which has partnered with Indonesian firms to build smelters and manufacturing plants. By focusing on downstream production, Indonesia is positioning itself as a key player in the electric vehicle (EV) supply chain, as nickel is a crucial component in lithium-ion batteries. This move boosts the country's export value and aligns with global trends toward green energy and sustainability (Schröder & Iwasaki, 2023).

Palm oil processing is another sector in which Indonesia's downstream strategy is proving beneficial. As the world's largest palm oil producer, Indonesia has long exported crude

palm oil (CPO) to countries that refine it into finished products. However, recent efforts have focused on expanding domestic refining capacity and encouraging local biodiesel production, cooking oil, and other palm oil derivatives. This shift reduces Indonesia's dependency on foreign buyers for raw palm oil and creates a more self-sustaining industry that adds significant value to its exports. Additionally, it helps address environmental and social issues by creating more opportunities for sustainable practices within the country (Aria Wisena, Daryanto, Arifin, & Oktaviani, 2014; Arsyad, Amiruddin, Suharno, & Jahroh, 2020).

Scaling up downstream industries also has a profound impact on regional development. Regions with rich natural resources, such as Sulawesi for nickel and Sumatra for palm oil, stand to benefit from infrastructure improvements, increased employment, and a boost in local economies. By encouraging investments in these regions' processing plants and manufacturing hubs, Indonesia can decentralize its economic growth, reducing the wealth gap between urban and rural areas. Furthermore, these downstream industries can contribute to Indonesia's goal of industrial maturity, moving from being a raw material exporter to a country with a sophisticated, value-added production base capable of competing in global markets (Hameri, McKay, & Wiers, 2013; Livesey, 2012).

3.4. Circular economic on priority sectors

A circular economy is an economic model designed to minimize waste and make the most of available resources by keeping products, materials, and energy in use for as long as possible. This system contrasts with the traditional linear economy, which follows a "take, make, dispose" model that often leads to excessive resource extraction and environmental degradation. In a circular economy, the focus is on closing the loops in production and consumption processes, ensuring that materials are reused, recycled, or repurposed to create more sustainable economic growth. By embedding these principles into key sectors and policies, nations

can reduce environmental harm, conserve natural resources, and promote long-term economic resilience (Hossain, Park, Suchek, & Pansera, 2024; Lieder & Rashid, 2016).

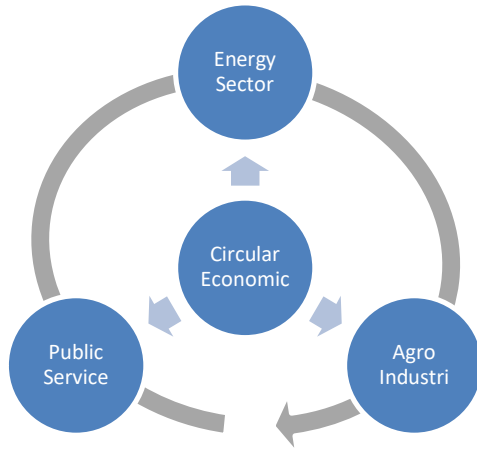


Figure 5. Circular economic priority sectors

For Indonesia, three priority sectors in the transition to a circular economy include 1) the energy supply chain, 2) the agriculture supply chain, and 3) the public service supply chain. These sectors are vital due to their high consumption of resources and potential for waste reduction. In the energy supply chain, transitioning to renewables and enhancing energy efficiency can reduce the environmental impact. In agriculture, reusing organic waste for bioenergy and compost promotes sustainability. By adopting eco-friendly practices and green procurement policies, the public sector can set a standard for businesses and individuals to follow. Prioritizing these supply chains allows Indonesia to lead in sustainable development while driving regional economic growth (Djojohadikusumo, 1974; Lieder & Rashid, 2016).

Developing a circular economy in Indonesia presents a strategic opportunity to transform the nation's sustainability landscape by focusing on key sectors such as the energy supply chain, agriculture supply chain, and public service supply chain. A circular economy aims to minimize waste, maximize resource efficiency, and promote the recycling and reuse of materials throughout the production and consumption processes. By prioritizing these sectors, Indonesia can address environmental

concerns, boost economic growth, and reduce its dependence on finite resources, aligning itself with global sustainability trends (Hossain et al., 2024).

In the energy supply chain, Indonesia can benefit significantly by adopting circular economy principles, particularly through renewable energy sources and improving energy efficiency. Transitioning from fossil fuels to renewable energy sources such as solar, wind, fuel cell and bioenergy would reduce waste and emissions, promoting a cleaner energy system. Developing energy-efficient infrastructure, smart grids, and recycling systems for batteries (especially as the electric vehicle industry grows) would reduce the environmental impact and create a more resilient and sustainable energy network. Engaging customers in these efforts—by encouraging energy conservation, promoting energy-efficient products, and adopting decentralized energy systems—will also enhance public participation in the circular economy (Arifin et al., 2023; Arioz, Yıldızbası, Özceylan, & Yılmaz, 2024; Jenniches, 2018; Varbanov et al., 2023).

The agriculture supply chain plays a crucial role in Indonesia's economy and provides another significant area for implementing circular economy practices. By focusing on sustainable farming, the use of organic fertilizers, and waste management, Indonesia can reduce the environmental impact of agricultural production. Agro-industrial waste, such as crop residues, husks, and by-products, can be repurposed into bioenergy or organic compost, thus closing the loop in agricultural production. Implementing systems where food waste is collected, processed, and reused as biofertilizers or biofuels can further enhance efficiency in the supply chain. This approach benefits producers and consumers, reducing costs for farmers and providing sustainable food systems for communities (Chiaraluce, Bentivoglio, & Finco, 2021; Marsden, Murdoch, & Morgan, 1999; Toop et al., 2017).

Lastly, the public service and office supply chain is another area where Indonesia can make impactful changes by embracing circular economy principles. Public offices and

institutions can lead by example by implementing sustainable procurement policies prioritizing using recycled materials, energy-efficient equipment, and sustainable office supplies. Implementing paperless systems, proper recycling programs for e-waste, and energy-saving initiatives in public buildings would significantly reduce resource consumption and waste generation. By adopting green building practices and setting up more recycling hubs within public service networks, Indonesia can enhance the circularity of public sector operations and encourage businesses and individuals to follow suit (Alhola, Ryding, Salmenperä, & Busch, 2019; Klein, Ramos, & Deutz, 2020; Sienkiewicz-Malyjurek & Szymczak, 2024).

A circular economy in these key supply chains would reduce environmental impacts and create new economic opportunities. This approach would promote innovation, job creation, and resource efficiency across sectors, positioning Indonesia as a leader in sustainable development. By focusing on energy, agriculture, and public services, the country can build a more resilient economy that supports long-term growth while protecting the environment.

3.5. Sustainability: powering the civil society and public sectors

Sustainability is increasingly becoming a strategic imperative for businesses, civil society, and the public sector (Lambin & Thorlakson, 2018). In a world facing environmental challenges such as climate change, resource depletion, and biodiversity loss, the need for sustainable practices has never been more pressing. For civil society, sustainability offers an opportunity to advocate for social and environmental justice, while for the public sector, it is a responsibility to lead by example. Governments and public institutions play a crucial role in setting policies, regulating industries, and implementing programs that promote sustainability. By embedding sustainability into public governance, countries can foster a more resilient, equitable, and eco-friendly society (Alinska, Filipiak, & Kosztowniak, 2018; Klein et al., 2020).

By powering civil society, sustainability efforts can significantly uplift communities by enabling them to participate in environmentally conscious initiatives and access economic benefits. Civil society organizations (CSOs), non-governmental organizations (NGOs), and local communities are essential in promoting sustainability and advocating for policies that address critical issues such as deforestation, pollution, and waste management. Providing these groups with knowledge, resources, and financial access makes them more effective in driving sustainable change (Afifi, 2024; Djojohadikusumo, 1953; Porter, 2014; Vandyck, 2017). Microfinance access plays a crucial role in this process, offering communities—particularly marginalized groups—the financial means to start eco-friendly ventures, adopt sustainable agricultural practices, or invest in renewable energy. This financial empowerment ensures that even small-scale, grassroots movements have the capacity to scale up their efforts and influence broader policy changes, making sustainability initiatives more inclusive (Pratt, 2016; Seibel & Parhusip, 1998; Yunus, Moingeon, & Lehmann-Ortega, 2010).

By leveraging microfinance tools, grassroots movements can strengthen their advocacy for policies that protect natural resources and improve local livelihoods. Microfinance programs can finance smallholder farmers, helping them transition to sustainable farming techniques, reduce environmental degradation, and create more resilient ecosystems. This, in turn, strengthens rural economies and supports the livelihoods of people in areas prone to environmental harm. In Indonesia, for instance, microfinance has been essential in empowering communities to manage deforestation risks and protect indigenous land rights while promoting sustainable agricultural practices. Microloans allow these communities to invest in eco-friendly infrastructure, tools, and training programs, enabling them to participate more actively in sustainability movements (Djojohadikusumo & Rahardjo, 1989; Mapanje, Karuaihe, Machethe, & Amis, 2023; Yi, Wang, & Chen, 2021).

In Indonesia, numerous community-based businesses hold the potential for financial empowerment through microfinance, crowdfunding, and peer-lending programs. For instance, cooperatives (*koperasi*), which are deeply rooted in Indonesian culture, have long provided a platform for pooling resources to support small-scale businesses (M. A. Rachman & Syamsuddin, 2019; Wongkaren, 2007). These cooperatives, particularly in agriculture, fisheries, and crafts sectors, can benefit from microfinance loans to invest in sustainable practices or expand their operations. For example, farmer cooperatives focusing on organic farming or eco-friendly fisheries can utilize microfinance to improve yields while reducing environmental impact (Kauer et al., 2024; Stephens, Knezevic, & Best, 2019).

With the rise of digital platforms, crowdfunding and peer-to-peer (P2P) lending have become popular ways to finance local businesses, especially among younger entrepreneurs. Platforms like *KitaBisa* and *Amartha* are gaining traction in Indonesia, offering communities and small business owners access to alternative funding. These platforms allow local businesses—such as small-scale renewable energy projects, eco-tourism ventures, or sustainable product startups—to gain financial backing from larger communities. Blending traditional cooperative structures and modern crowdfunding or P2P lending gives Indonesian communities more inclusive access to capital, empowering them to contribute to local economic development and broader sustainability goals (Anshari, Almunawar, Masri, & Hamdan, 2019; Mapanje et al., 2023).

By increasing access to financing, civil society can collaborate more effectively with the public sector to ensure that sustainable development is both inclusive and economically viable. The partnership between civil society, government institutions, and financial services enhances participation from various sectors of society, ensuring that sustainability initiatives are not only top-down policies but also community-driven actions. In Indonesia, this integration of microfinance access with civil society's environmental

advocacy can create a more robust and participatory model for sustainable development, ensuring that policies reflect the needs and aspirations of local communities while promoting long-term environmental stewardship.

In the public sector, sustainability is equally vital for ensuring that the government leads by example in promoting eco-friendly practices. Public institutions consume significant energy and resources, including government offices, schools, hospitals, and transportation systems. By adopting sustainable procurement policies, green building standards, and energy-efficient technologies, the public sector can reduce its environmental footprint and set a benchmark for private sector practices. In Indonesia, for example, government initiatives to promote renewable energy adoption, such as the push for solar energy projects and the development of electric vehicle infrastructure, are crucial for transitioning to a greener economy. These efforts demonstrate Indonesia's commitment to sustainability and encourage businesses and citizens to adopt similar practices, thus creating a ripple effect across the nation (Arioz et al., 2024; Klein et al., 2020).

In the Indonesian context, the idea of strategic sustainability is highly relevant, given the country's environmental challenges and economic aspirations. Indonesia is rich in natural resources, but unsustainable practices such as deforestation, mining, and palm oil production have led to environmental degradation. By aligning public sector policies with sustainability goals—such as reducing carbon emissions, protecting biodiversity, and promoting sustainable land use—the government can both safeguard natural ecosystems and stimulate economic growth. Moreover, empowering civil society to participate in these initiatives actively helps create a balanced approach to development, ensuring that local communities benefit from sustainable practices while contributing to Indonesia's overall economic and environmental resilience. This strategy, where civil society and the public sector collaborate on sustainability, will be crucial as Indonesia

navigates its path toward a greener and more inclusive future.

4. Gaps and challenges

Indonesia's industrial development stands at a crossroads, where the choices made today will significantly influence the nation's long-term economic trajectory. As global competition intensifies, Indonesia must overcome several internal challenges to move toward industrial maturity, a stage where industries are fully capable of competing internationally. The Industrial Maturity Development Index (IMDI) serves as a critical framework for assessing Indonesia's position and identifying the areas that require the most attention. IMDI evaluates the extent to which industries have integrated advanced technology, developed infrastructure, and nurtured human capital, all of which are essential for an economy aiming to transition into a high-tech, sustainable industrial base (Afifi et al., 2019; Nugroho, Afifi, Kiswanto, & Prianto, 2011).



Figure 6. Economic gaps and challenges

The concept of industrial maturity reflects more than just economic growth; it emphasizes a nation's ability to utilize modern infrastructure, adopt cutting-edge technologies, and cultivate a skilled workforce to meet the demands of global markets. For Indonesia, this means addressing the persistent gaps in critical areas like infrastructure, where weaknesses in transportation, logistics, and energy systems hinder efficient industrial operations (Afifi, 2011; Sharif, 2009). The World Bank and other global observers have noted that these

bottlenecks limit industrial output and increase production costs, delaying Indonesia's ability to position itself as a manufacturing and logistics hub in Southeast Asia (World Bank, 2022).

4.1. Infrastructure and technological readiness

Indonesia faces significant infrastructure and technological readiness gaps that hinder its potential for long-term industrial growth and economic development. While major improvements have been made in urban areas, particularly in cities like Jakarta and Surabaya, the country's overall infrastructure remains underdeveloped, especially in rural regions. Inadequate transportation networks, including roads, railways, ports, and energy grids, continue to limit connectivity between Indonesia's islands and across regions. This creates logistical bottlenecks that drive up transportation costs and slow down the movement of goods and services. As a result, businesses face higher operational costs, reducing their competitiveness in domestic and international markets (Moldabekova, Philipp, Satybaldin, & Prause, 2021; Susilo, 2020).

Moreover, Indonesia's technological readiness is lagging, particularly in sectors critical to the country's industrial advancement. While digitalization has progressed, many industries still rely on outdated technologies and lack access to modern equipment. For instance, in manufacturing, sectors like textiles and automotive face challenges integrating automation and robotics, which are necessary for increasing productivity and maintaining competitiveness in the global market. The slow adoption of technologies such as the Internet of Things (IoT), artificial intelligence (AI), and cloud computing further intensified the issue, leaving Indonesian companies behind in the shift toward Industry 4.0. As global industries rapidly embrace these technologies, Indonesia risks falling further behind unless these gaps are addressed (Moirangthem & Nag, 2022; Propris & Bailey, 2020).

A significant challenge in closing these infrastructure and technology gaps is the urban-rural divide. While urban centres benefit from better connectivity, reliable power supply, and

access to advanced technologies, rural areas face starkly different realities. Many regions across Indonesia's archipelago suffer from poor internet access, limited transportation infrastructure, and unreliable electricity. This disparity limits the potential for rural-based industries to grow and compete, particularly in sectors such as agriculture and small-scale manufacturing. Bridging the infrastructure and technological divide between urban and rural areas will be crucial in creating balanced economic growth across the country and ensuring that all regions can participate in and benefit from industrial advancement (Salam et al., 2018; Susilo, 2020; Tumiwa, Tuegeh, Bittner, & Nagy, 2022).

The lack of technological infrastructure such as broadband internet, data centres, and smart energy grids limits the country's ability to integrate fully into the digital economy. This affects businesses, public services, education, and healthcare. For Indonesia to successfully transition to a digital, technologically advanced economy, there is a critical need for investments in physical infrastructure, such as roads and power systems, and digital infrastructure, which will provide the foundation for innovation and productivity growth. Boosting infrastructure and technological readiness across the nation will enhance Indonesia's competitiveness on the global stage and create new opportunities for industrial and economic development.

4.2. Human capital and education system

Indonesia faces significant human capital gaps that pose challenges to its economic development, particularly in relation to its education system and workforce capabilities. Despite a growing young population, the quality of education and training remains insufficient to meet the demands of modern industries, especially those requiring advanced technical and vocational skills. This gap is most evident in sectors such as manufacturing, technology, and high-skilled services, where there is a shortage of qualified workers capable of operating advanced machinery or managing digital systems. As Indonesia seeks to move up the global value chain and embrace Industry

4.0, addressing these human capital deficiencies is critical for sustainable growth and competitiveness (Adam & Negara, 2015; Burgess, Dayaram, Lambey, & Afrianty, 2020).

One of the primary challenges lies in the education system itself, which struggles to provide students with the necessary skills for the evolving demands of the workforce. Although Indonesia has made strides in expanding access to education, particularly at the primary and secondary levels, the quality of instruction remains a significant concern. Many schools still focus on rote learning, with little emphasis on critical thinking, problem-solving, or creativity. As a result, students often graduate without the practical skills required by industries, particularly in STEM (Science, Technology, Engineering, and Mathematics) fields. Furthermore, there is a disconnect between the curriculum and the needs of the labour market, meaning that even university graduates may find themselves ill-prepared for employment in high-demand sectors (Achelia, Juwita Asmara, Maulana, Grace Berliana, & Tasrif, 2018; Adam & Negara, 2015).

The lack of emphasis on technical and vocational education further exacerbates the human capital gap. While higher education institutions focus on prioritizing academic degrees, there is limited focus on vocational training, which is crucial for equipping individuals with industry-specific skills. This has created a mismatch between the supply of labour and the demand for skilled workers in industries such as manufacturing, construction, and IT services. Countries with strong vocational education systems, such as Germany and South Korea, have demonstrated that this education is essential for fostering a highly skilled workforce. Indonesia's challenge lies in revamping its technical education system to provide more targeted training that aligns with industry needs, thereby reducing the skills gap (Allen, 2016; Fleckenstein, Lee, & Mohun Himmelweit, 2023).

Another significant issue is the limited access to lifelong learning opportunities and professional development programs. Many workers, particularly those in rural areas, lack access to continuous education or training that

would allow them to upskill or reskill in response to technological advancements. As automation and digital technologies continue to disrupt industries, the ability to learn new skills throughout one's career will be essential for remaining competitive in the job market. In conjunction with public and private sector initiatives, Indonesia's education system must focus on creating flexible learning pathways that support workers at all stages of their careers. This will improve the workforce's quality and ensure that Indonesia can adapt to future technological and economic changes.

4.3. *Regulatory complexity*

Indonesia's regulatory complexity significantly challenges the business environment and industrial development. The country's legal and regulatory framework is often seen as awkward, with overlapping and sometimes conflicting rules issued by various government agencies. This complexity can create confusion for businesses, particularly in manufacturing, technology, and infrastructure development industries, where compliance with numerous permits, licenses, and regulations is required. For foreign and domestic investors, navigating Indonesia's bureaucratic maze can delay projects and increase costs, making it less attractive as a destination for industrial investment. As a result, regulatory complexity is a significant barrier to improving the ease of business in the country (Di Vita, 2023; Spiegel, 2012; Surianta & Patunru, 2021).

Indonesia's decentralization has created organizational challenges that further complicate regulatory enforcement. Since the country implemented decentralization reforms in the early 2000s, provincial and local governments have been granted more authority to regulate businesses and industries within their jurisdictions; while this has brought decision-making closer to the local level, it has also led to inconsistent enforcement of national regulations. Different regions may interpret or apply laws differently, leading to regulatory fragmentation. For businesses operating across multiple provinces, this can mean dealing with a patchwork of regulations, which adds to operational costs and complexity. Moreover,

there is often limited coordination between the central and local governments, leading to policy gaps that undermine the effectiveness of national industrial strategies (Hidayat & Negara, 2020; Ryde Nord, Leroy, & Soreide, 2016).

The permit and licensing process is one of the most significant regulatory uncertainty. Businesses often face long delays when applying for licenses to operate or expand their facilities. The process typically involves multiple agencies, each with its own requirements, making it time-consuming and costly. Even with the implementation of the Online Single Submission (OSS) system—a digital platform designed to streamline business permits—many industries still report inefficiencies and bureaucratic delays. These issues are particularly pronounced in industries that require environmental permits, land-use approvals, or energy licenses, which are critical for large-scale industrial operations. The delays impact businesses and slow the country's industrial growth and infrastructure development (Hendra & Firdaus, 2020; Yunari, Santoso, Harto, & Bachry, 2022).

Observing organizational challenges, Indonesia's institutional capacity for regulatory enforcement remains limited. Corruption and inefficiency in certain government sectors contribute to regulatory uncertainty, further discouraging investment. For example, businesses may encounter inconsistencies in how regulations are applied, with some industries or regions facing more stringent enforcement than others. This unpredictability makes it difficult for companies to plan long-term investments, particularly in capital-intensive industries (Di Vita, 2023; Kuncoro, 2006).

The regulatory complexity degrades due to the lack of quality public services and knowledge transfer management. The bottleneck of this complexity was caused by insufficient infrastructure and low literacy by public servants. As an alternative solution, the regulation needs to be more of a localized assisting approach than a centralized directive approach. The self-assessment that compliance with the requirements should be promoted to

simplify the bureaucracy (Afifi & Abbas, 2019). Indonesia must streamline its regulatory processes, enhance coordination between different government levels, and improve regulatory enforcement transparency to improve industrial competitiveness (van der Eng, 2013). Reducing these complexities will make the country more attractive to local and foreign investors, accelerating its path toward industrial maturity.

4.4. Clustering and supply chain bottleneck

Regional industrial clustering can solve supply chain bottlenecks, particularly downstream industries that often suffer from transportation, logistics, and communication inefficiencies. By creating geographically concentrated industrial clusters, businesses can minimize the distance between suppliers, manufacturers, and distributors, improving coordination and reducing the time and costs associated with moving goods. This proximity allows for faster production cycles and more reliable access to raw materials, as seen in successful industrial clusters globally. In Indonesia, developing regional clusters tailored to specific industries such as automotive, electronics, palm oil, agriculture, or textiles could alleviate some of the bottlenecks in transportation networks, especially in remote areas (Bergman & Feser, 2020; Deichmann, Kaiser, Lall, & Shalizi, 2005).

Industrial clusters help foster collaboration and innovation within a regional supply chain. When businesses within the same sector are concentrated in a defined area, they can share resources, collaborate on innovation, and quickly respond to market demands or disruptions. This interaction boosts overall efficiency, allowing firms to streamline operations, reduce redundancy, and improve access to key suppliers and technology. Regional clustering offers a robust framework for reducing production delays and increasing competitiveness for downstream industries like food processing or petrochemicals, where timely access to raw materials and consistent quality control are critical (Rizal, 2018; Skokan, 2009; Yufriadi, Syahrani, & Afifi, 2024).

Regional clustering can strengthen Indonesia's position in global supply chains by integrating local businesses into larger international networks. Clusters enable businesses to attract foreign investment more easily, as investors are more likely to engage in regions with a solid industrial base. This integration can enhance downstream industries' ability to source critical inputs and components from international suppliers while improving their capacity to export finished goods. With strong regional clusters, Indonesia can reduce its import dependency and boost its export capabilities, particularly in sectors like electronics, automotive, and processed goods. This ensures the country becomes a more attractive and reliable player in global markets (De Marchi, Di Maria, & Gereffi, 2017; Feser, 1998).

5. Conclusion

Reflecting on Sumitro Djojohadikusumo's contributions, his focus on establishing strategic industries during Indonesia's early years of independence laid the groundwork for the nation's industrial policy. He emphasized reducing foreign dependency and building domestic manufacturing capacity in key sectors, such as energy, heavy industries, and natural resource-based industries. Sumitro's vision for self-reliance sought to harness Indonesia's rich natural resources and turn them into pillars of national economic strength. While his policies played a foundational role, they now serve as a point of reflection in understanding how modern challenges require an evolved approach to sustain growth and competitiveness.

Today, Indonesia faces critical infrastructure and technological challenges that limit its progress toward industrial maturity. While infrastructure development has improved, particularly in urban areas, bottlenecks remain in transportation, logistics, and energy distribution, especially in rural regions. The nation's technological readiness is also a significant hurdle, with industries struggling to adopt advanced technologies such as automation, AI, and IoT. As global industries rapidly advance, Indonesia risks falling further

behind unless it makes substantial investments in physical and digital infrastructure. The country's path toward industrial maturity depends on closing these gaps to foster innovation, efficiency, and global competitiveness in manufacturing and other strategic sectors.

Human capital development is another area that demands urgent attention. Although improved in terms of access, Indonesia's education system still faces quality issues. The gap between what is taught in schools and what industries require is wide, particularly in technical skills and STEM education. Education system reform should emphasize traditional knowledge, critical thinking, creativity, and hands-on vocational training. This would help address the skills mismatch in high-demand sectors like manufacturing, technology, and construction. Additionally, lifelong learning programs are essential for the workforce to continually upskill and reskill, ensuring adaptability in the face of evolving industrial needs and technological disruptions.

The issue of regulatory complexity remains a persistent challenge that slows down industrial progress and discourages investment. Bureaucratic inefficiencies and regulatory fragmentation due to decentralization create uncertainty for businesses and potential investors. Streamlining processes for business

permits, improving inter-governmental coordination, and ensuring clear, consistent enforcement of regulations are essential to making Indonesia a more attractive environment for domestic and foreign investment. Simplifying regulatory frameworks can unlock the country's industrial potential and encourage innovation and expansion across sectors.

Further research and follow-up could explore the role of regional industrial policies that account for Indonesia's unique geography and socio-economic diversity. It would be useful to study how provinces can better align local regulations with national policies while considering their specific strengths and challenges. Another comparative research on successful education reform models from countries with similar developmental trajectories could help identify best practices for aligning Indonesia's education system with industrial demands. Investigating how other countries have successfully navigated technological transformation and infrastructure development is important, as it could provide Indonesia with a roadmap for closing its industrial maturity gaps. These focus areas will ensure that Indonesia's industrial policies evolve and remain relevant in a fast-changing global economy.

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