CSIS Research Report

Economic Impacts of Local Content Requirements in Indonesia

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Centre for Strategic and International Studies

Research Report by CSIS Indonesia

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1 Background

Local content policy, or local content requirements (LCRs), refers to a policy promoting the use of domestic inputs in industrial production. LCR policy, one of many tools of industrial policy since the mid-20th century, was generally adopted as a means of promoting industrial development. This policy has made a resurgence in the 21st century, especially after the 2008 Global Financial Crisis.

It emerges in major developing and developed economies such as the US, Canada, Russia, several EU states, China, India, and Brazil. It has been applied in a variety of economic sectors, among which are oil and gas, minerals, automotive, renewable energy, pharmaceuticals, and medical devices.

In Indonesia, local content policy has been implemented as an integral part of Industrial development. The policy was present in Indonesia's history as early as the 1950s but was applied more comprehensively from 1974 onwards, specifically in the automotive industry. During the 1998 Asian Financial Crisis, the use of LCR was abandoned following an IMF bailout and subsequent reforms, but the policy returned in the 21st century when it was made a condition for firms that want to participate in government procurement.

The government argues that the reintroduction of the recent local content policy aims to increase the effectiveness of government spending in promoting Indonesian welfare, establish greater economic independence, provide better protection from external shocks, and pursue long-held goals of achieving steady industrial development and economic growth.

However, local content policy is not without problems. The use of LCRs was criticized as a policy that generates short-term gains, requiring firms to use local inputs and subsequently increasing industrial output and employment, at the expense of incurring higher production costs and consumer prices.

Supporters of the policy argue that the costs of LCRs are justified since it may generate learning benefits and long-term industrial or technological development. However, successful cases are few, and the debate on local content policy has yet to be settled. It may be in the best interest of policy-makers to evaluate the effectiveness and impact of LCR policy in the Indonesian context.

There have been several studies examining the impact of LCR policies on some specific industries in Indonesia. Among these studies were Thee (1997) and Aswicahyono, Basri, and Hill (2000) who investigated the effects of LCR policies implementation in the automotive industry. The former revealed that LCR policy promoted significant industrial development in the motorcycle industry which outperformed its four-wheeled counterpart by achieving greater scales of production and high levels of local content.

Meanwhile, the latter discovered that the policies generated small-scale production in the four-wheeled car industries, and this different outcome was largely due to differences between the two markets' structures and the relatively lower technological complexity of motorcycle production. Furthermore, both studies found that LCR policy was plagued with high production costs and high consumer prices, and the industry had low R&D capabilities and exported very little compared to its ASEAN peers.

Similar results have also been found in the more recent studies on LCR policies in Indonesia, such as Negara (2018). He investigated the effect of LCR in manufacturing in Indonesia, especially in the case of machinery and transport industries. By using the large and medium scale manufacturing survey data for the period of 1990-2013, he found no evidence that the implementation of LCRs reduced firm's dependency on imported inputs.

Instead, he discovered the positive effect of imported inputs on firm-level productivity, value added, output, export, and employment on the manufacturing sector in Indonesia. Based on these findings, he argued against the implementation of a stricter LCR as it may harm both the country's industrial performance and its competitiveness.

This present study aims to re-examine the impact of local content policy in Indonesia and to see whether the implementation of LCRs achieves government-held objectives. Unlike the previous studies, this study uses mixed research methods, combining qualitative and quantitative approaches, with the latest available data. It conducts a brief overview of relevant literature on LCR policy and its impacts as well as in-depth interviews and focus group discussions with key stakeholders from both public and private sectors.

In addition, this study quantitatively assesses the ex-ante and ex-post effects of LCR policy using computer general equilibrium (CGE) and econometric modelling. The analysis in this study is conducted both at overall manufacturing industries and at specific sectoral level, namely ICT industries and pharmaceutical and medical devices as example. These sectors are selected as they are the dominant sectors receiving the current LCRs in Indonesia[1].

The remainder of this report is organized as follows. It firstly reviews the relevant literature on local content policies and its outcomes and then briefly discusses LCR regulations and policies in Indonesia. Afterwards, it explains and analyzes the quantitative assessments of LCR policy's economic impacts in Indonesia. Lastly, the study will conclude with policy suggestions derived from the preceding information.

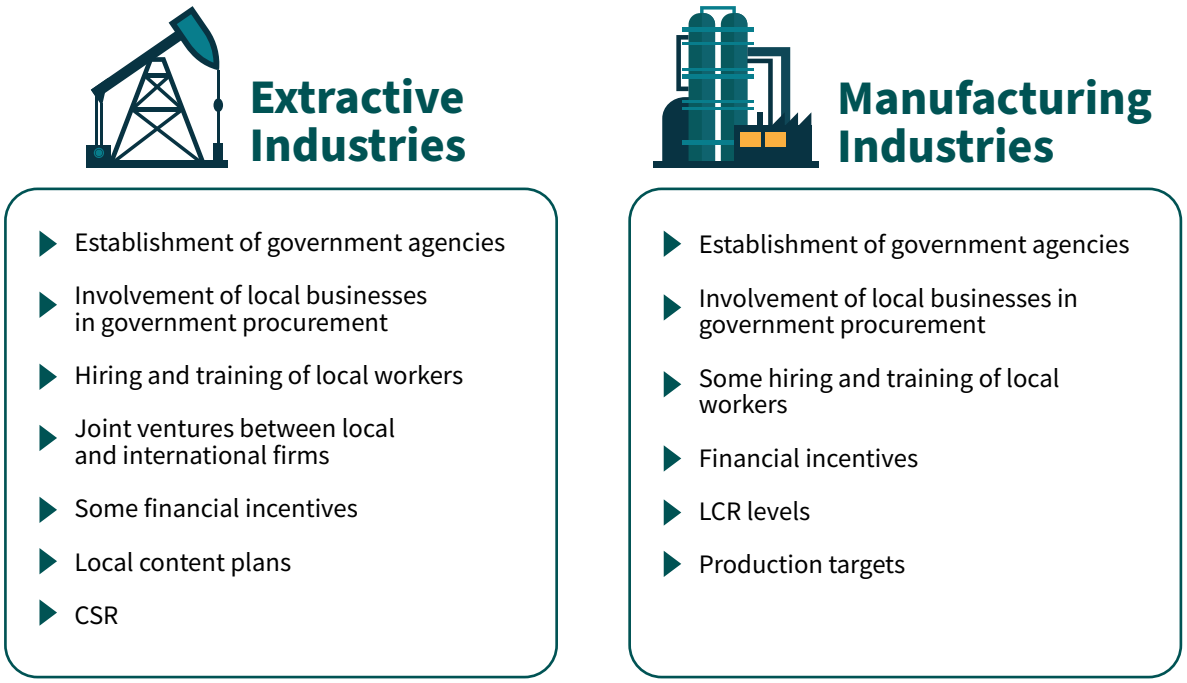
2 Literature Review

This section reviews the literature on local content policies. It looks at the definition of local content policies, the impact of local content policies in theoretical and empirical studies.

2.1 Local Content Policy: Types and Objectives

While local content policies promote the use of domestic inputs in local production, the type of domestic input that is considered by the policy can vary greatly. The most common and relatively simple inputs to measure are actual physical parts (Richardson 1991; Richardson 1993) or proportion of value-added (Belderbos and Sleuwaegen 1997; Grossman 1981; Krishna and Itoh 1988). Other examples include employed human capital and labor (Heum 2008; Stone, Messent, and Flaig 2015; Weiss 2016), technology transfers, or financial investments in production or R&D processes (Belderbos and Sleuwaegen 1997; Weiss 2016).

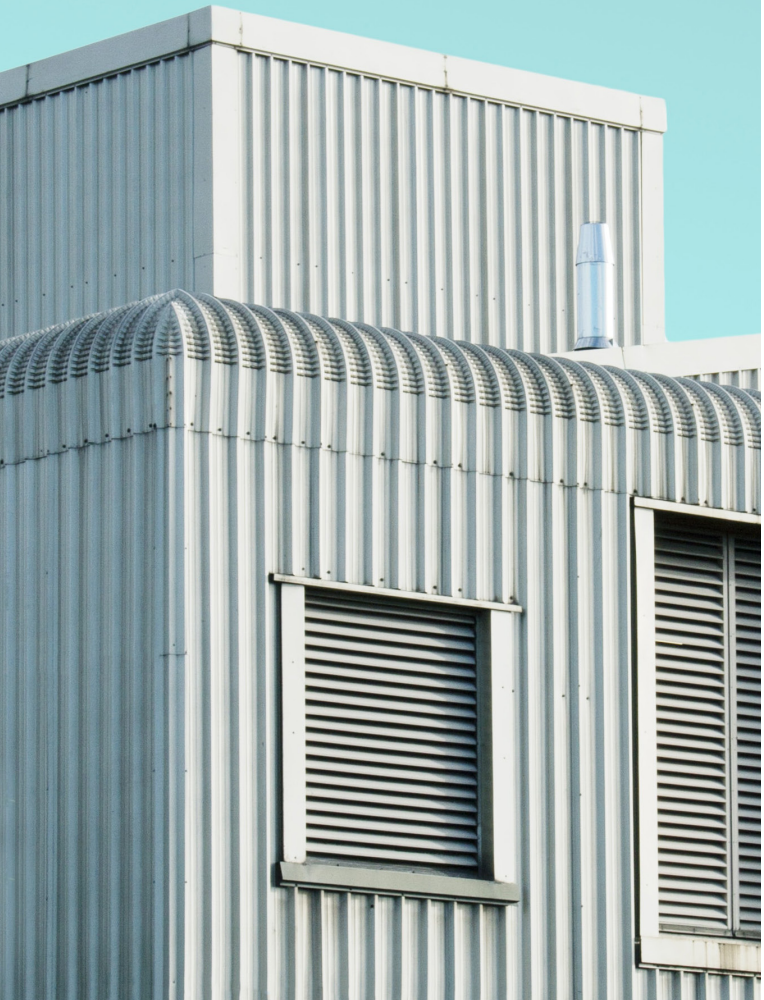
Figure 1: Differences in Local Content Policy According to Industries



Source: (Deringer et al. 2018; Heum 2008; Kuntze and Moerenhout 2013; Ovadia 2015; Pugatch Consilium 2016; Ramdoo 2016; Stone, Messent, and Flaig 2015; Weiss 2016)

The usage of different measurements of local input, as shown in Figure 1, usually depends on the industry. For example, the LCRs of manufacturing activities tend to be more quantitative in nature, measuring the percentage of locally-produced components or costs incurred using local inputs such as labor. The policy may also set production targets for the future, requiring firms to use certain inputs locally and increasing their local content levels over time (Deringer et al. 2018; Kuntze and Moerenhout 2013; Pugatch Consilium 2016; Stone, Messent, and Flaig 2015; Weiss 2016).

> *Although local content policies promote the use of domestic inputs, the type of domestic input that is considered by the policy can vary greatly, depending on the industry*



In contrast, the LCRs for primary sector activities such as the oil, gas, and mineral industries tend to be more qualitative and wide-ranging in nature. Examples include requiring foreign firms to do joint-ventures with local firms or institutions, the hiring and training of local workers, the implementation of CSR initiatives, and the drafting of local content plans explaining how the firm's operation will include local business and promote the development of these businesses or the local community as a whole (Heum 2008; Ovadia 2015; Ramdoo 2016; Weiss 2016).

Meanwhile, local content policy may aim to achieve a wide-range of objectives, sometimes simultaneously. Promoting industrial development and economic growth is usually the main goal of the policy, but as the Indonesian example shows, they may also achieve other aims such as promoting general economic welfare. During the 2008 crisis, LCRs were implemented as means to promote job creation and employment (Deringer et al. 2018), and it was most likely true in 2021 as well, for example in the US's "Buy American" policy (The White House, 2021).

There are also cases where local content policy was implemented for the benefit of other countries. In order to promote growth in least-developed countries (LDCs), some developed countries allowed LDCs to export goods to their markets with favorable tariffs with the condition that the LDC's exported good is a genuine local product and met certain LCRs in its production (Deringer et al. 2018; Grossman 1981; Weiss 2016). However, more often than not, local content policy was used and perceived as a protectionist policy by both developed and developing countries (Belderbos and Sleuwaegen 1997; Davidson, Matusz, and Kreinin 1985; Grossman 1981; Kala and Itoh 1998; Lin and Weng 2020; Richardson 1993).

2.2 The Theoretical Models of Local Content

Grossman's (1981) model remains the seminal paper that defines local content studies to date, though it did make references to earlier works. In a perfectly competitive market, Grossman showed that LCRs will raise the level of domestic intermediate inputs demanded in the market, and suppliers of the input will then raise production. However, the rise in demand also raises the input's costs to final-good producers.

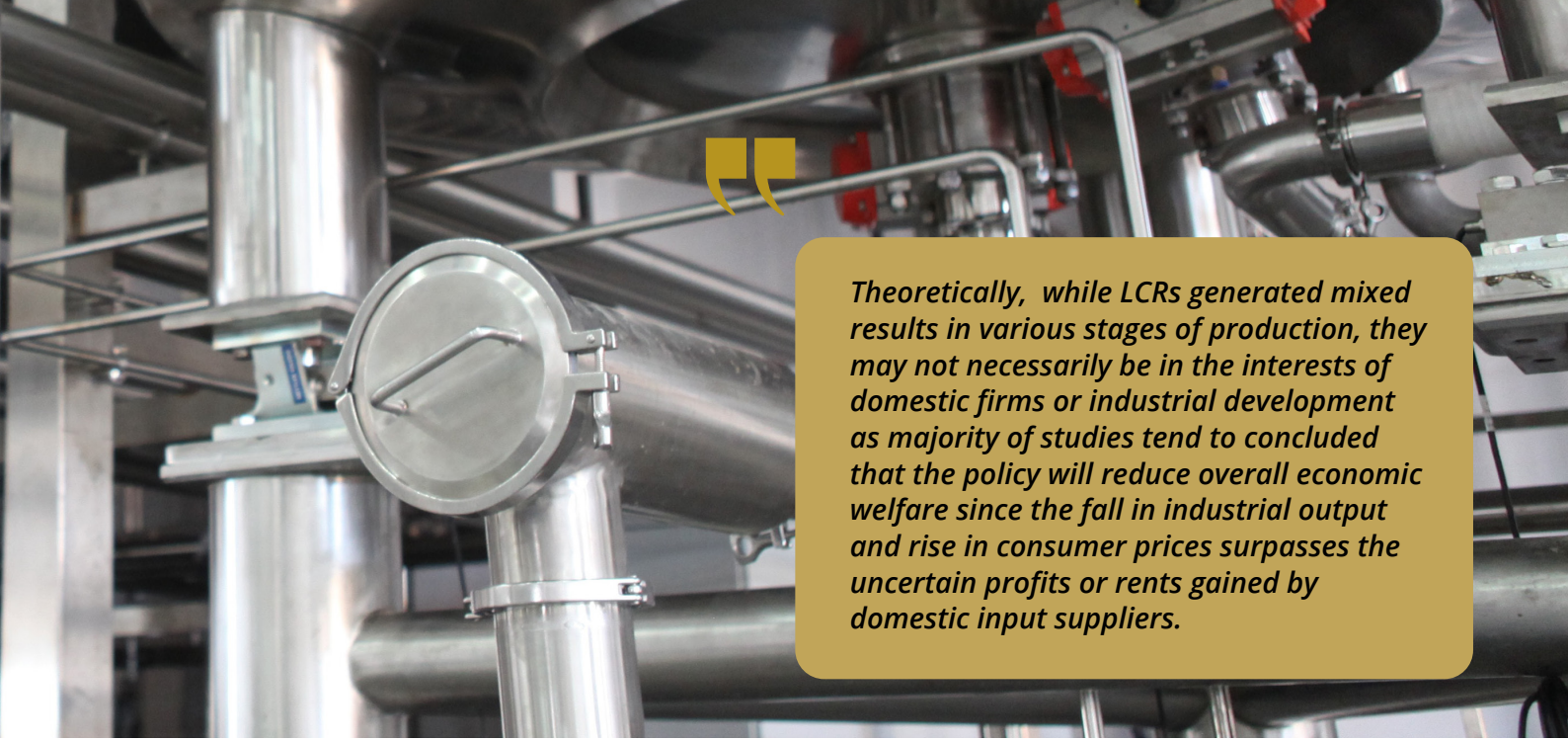
This rise in production costs will then raise final-good prices for consumers, lower consumer demand for the final good, and eventually lower the market demand for the intermediate input. Grossman noted that the final outcome of an LCR policy depends on the intermediate input's price elasticity of supply and how sensitive final good production is to the changes in input prices. His main conclusion was that LCRs may go against its original aims of promoting industrial development and increasing industrial output.

Subsequent models on local content policy were based on Grossman's (1981) work and applied in different contexts and settings. They had been applied for a duopoly of final-good producers (Davidson, Matusz, and Kreinin 1985; Richardson 1991; Richardson 1993), a duopoly of input suppliers (Krishna and Itoh 1988), and an oligopoly of input and final-good producers (Belderbos and Sleuwaegen 1997). These studies were similar to Grossman (1981) in showing that LCRs generated mixed results in various stages of production and may not necessarily be in the interests of domestic firms or industrial development overall.

Almost all these studies agreed that the policy will reduce overall economic welfare since the fall in industrial output and rise in consumer prices surpasses the uncertain profits or rents gained by domestic input suppliers (Davidson, Matusz, and Kreinin 1985; Grossman 1981; Krishna and Itoh 1998; Richardson 1991; Richardson 1993).

Only Belderbos and Sleuwaegen (1997) maintained an optimistic tone. They suggested that the distortions caused by an LCR policy can be mitigated if the domestic input market is competitive enough to prevent the input market from excessively capitalizing the increase in input demand. Moreover, they noted that foreign companies who are committed to maintaining their presence in the market will choose to produce inputs locally rather than accept the higher-priced domestic inputs available, further contributing to local intermediate input production, development, and competition.

The aforementioned studies only focused on LCR policy's benefit for increasing local output levels, and supporters of LCR argued that these studies neglected a key aspect of the policy which may change the final outcome, i.e.: learning opportunities and spillover. Learning in production becomes one of the bases for the infant industry argument. Chang and Andreoni (2020) noted that mainstream economics have long neglected to study the intricacies of the production process, and learning is one of the key aspects of this process.



> ***Theoretically, while LCRs generated mixed results in various stages of production, they may not necessarily be in the interests of domestic firms or industrial development as majority of studies tend to concluded that the policy will reduce overall economic welfare since the fall in industrial output and rise in consumer prices surpasses the uncertain profits or rents gained by domestic input suppliers.***

They claimed that protectionism for a new industry gives room for domestic producers to learn and master the industry's production process. This argument is used by LCR policy supporters to justify the policy's interventions in the market (Deringer et al. 2018).

Veloso (2006) was a well-cited example of an LCR policy study that integrated learning dynamics and spillovers in his economic model. Veloso referred to studies showing how FDI generated spillovers and learning opportunities vertically in the production chain by allowing domestic firms, specifically input suppliers, to work with more technologically advanced foreign firms producing final goods, and he then argued that this spillover's presence means LCRs may be economically welfare-enhancing in the long-term by generating social surpluses that surpass the negative short-term impacts such as higher production costs and consumer prices.

Using System Cost Modelling (SCM) on a case study of France and Brazil, Veloso (2006) then concluded that the optimal level of LCR depends on the opportunity costs of investing capital in the industry, the opportunity costs for the government to subsidize firms' adjustment costs to mitigate rising prices, and the scale of production (and the resulting unit costs) in the domestic sector. However, Veloso did not specify how these opportunity costs can be measured, providing only general examples to illustrate their point.

Lin and Weng (2020), meanwhile, suggested that obtaining productivity spillovers or gains from LCR policy may not be so straightforward. In their study, the authors found two direct and indirect effects LCR policy has for both industrial output and productivity. Their observations regarding output were familiar to the literature: LCRs can directly increase an intermediate input's production by raising its demand, but, due to the rise in prices, it may indirectly reduce the overall demand for the final good and eventually reduce intermediate input production as well.

As for productivity, moreover, they pointed out that LCRs may force downstream firms to become less productive by working with inefficient input suppliers. However, the LCR may also increase productivity. An increase in the final good's production cost forcing its producers to directly increase its selling price may indirectly reduce the overall demand for both final good and intermediate inputs and force their producers to become more productive to survive.

Lin and Weng noted that the overall net-effect depends on the initial level of LCR already present in the economy or sector. If the initial LCR level is low, a stricter LCR will raise output levels but lower productivity. Past a certain point, however, productivity will rise but output will fall. In short, an LCR cannot promote industrial productivity and output simultaneously, and the appropriate tipping point where LCRs raise output and productivity may differ for each country. Similar to Veloso (2006), this means governments will still have to find the necessary information before deciding on a course of action.

2.3 Empirical Studies on the Impact of Local Content Policy

Evidence from some empirical studies on local content policy echoed the conclusions of the theoretical literature. Using Computable General Equilibrium (CGE) modelling and ad valorem equivalents (a method to quantify the effects of LCRs in the form of tariffs), Stone, Messent, and Flaig (2015) discovered results confirming Grossman's (1981) expectations.

While LCRs initially raised the output of intermediate goods produced, they ended up raising production costs and final goods prices. However, they also found a substitution effect in which households and industries not targeted by the LCR ended up purchasing more imported inputs and goods in response to the rising consumer prices.

In the report for the OECD, Stone, Messent, and Flaig (2015) further suggested that the lowering of imports due to LCRs may initially lead to a currency appreciation which then makes imports cheaper. They also discovered that in all but two of the countries studied, LCRs have resulted in a net increase in imports rather than a net-increase in exports, and exports and imports overall are calculated to have declined compared to their pre-LCR state.

In short, they argued against the effectiveness of LCRs and called for policy alternatives such as broad institutional reforms or targeted policies against market failures with the help of public-private coordination.

A similar ECIPE study by Deringer et al. (2018) reached the same conclusion. Using CGE modelling and ad valorem equivalents to study the impact of LCRs on heavy vehicles in the BRICS economies, they found that LCRs seem to be reducing overall trade (import and export volumes), increasing vehicle prices for firms and consumers, and increasing the output of the heavy vehicles sector while reducing the output of related sectors in the economy.

It should be noted, however, that the impacts observed by Deringer et al. (2018) and Stone, Messent, and Flaig (2015) were statistically significant but small. For example, in the former study, industry output increases for the heavy vehicles sector ranged from 0.2% to 10.37% depending on the country's previous level of production, and the reduction in other industrial output observed ranged from -0.16% to -0.37% (Deringer et al. 2018). Prices were also forecasted to rise from 0.2% to 5.4% (Deringer et al. 2018). Meanwhile, in the latter study, the observed changes in trade, production, and labor were negative but generally ranged between 0% to -1% with some outliers present (Stone, Messent, and Flaig 2015).

In short, these quantitative reports noted one-sidedly that there was little indication so far that the LCRs observed were supporting overall industrial development or generating positive spillovers, and they then argued that the policies, once implemented, tend to remain in place (Deringer et al. 2018) and may have cumulative negative impact in the long-run (Stone, Messent, and Flaig 2015).

Qualitative case studies on the impact of LCRs were much more abundant, yet with mixed results. On one hand, the success stories of Norway's oil and gas industry and Spain and China's wind turbine industry shows that LCRs promoted the establishment of a previously non-existent industry, facilitated productive collaboration between foreign and local firms, and established a local firm that grew to be competitive globally (e.g. Statoil Hydro, Gamesa, Sinovel) (Heum 2008; Kuntze and Moerenhout 2013).

On the other hand, there were also plenty of LCR case studies with negative or unexpected results in the renewable energy industries in Greece, Italy, France, India, Canada, Brazil, South Africa, and the US (Kuntze and Moerenhout 2013; Johnson 2013) as well as automotive industries in Australia (Pursell, 2001) and in Indonesia (Aswicahyono, Basri, and Hill 2000).

In these cases, LCR policy was plagued with high production costs, high consumer prices, and WTO trade disputes without showing significant industrial development or increase in industrial output. The policies also had unintended effects of promoting inefficient technologies (Johnson 2013), discouraging R&D due to tight profit margins (Johnson 2013; Pursell 2001), generating small-scale production (Aswicahyono, Basri, and Hill 2000; Pursell 2001), and, in the case of the EU, benefitting established input producers in more industrialized EU countries rather than the less-industrialized ones (Kuntze and Moerenhout 2013).

Likewise, studies on the impact of LCRs in African oil and gas industries showed inconclusive results (Ovadia, 2015). Angola and Nigeria represent relatively successful cases of local content policy implementation being relatively transparent and achieving state-set targets of integrating local businesses into the operations of foreign oil companies as measured by the number of firms participating and the total value of contract bids won.

However, other nations such as Ghana, Mozambique, and Uganda struggled with the existence of front companies where foreign companies perform all the work and where the local company's involvement and learning opportunities are limited. He then attributes the latter's different outcomes to unclear definitions of local content, unclear definitions of local companies, and the lack of provisions for promoting joint ventures.

Three main points that can be derived from the studies above on the effects of LCR policy. First, LCRs generate short-term costs for the firm and the economy, and the failure to address these costs adequately may lead to significant consequences for the economy and the government. Second, while LCRs can increase output, increase employment levels, and establish new industries, it is still uncertain whether they increase productivity, induce innovation, and provide a durable competitive edge for the industries involved. Third, measuring the impact of learning gains and spillovers from local content policy and determining how these gains emerge remains difficult. Until this last point is verified, a final verdict on the policy remains uncertain.

Evidence from some empirical studies on local content policy has also confirmed the conclusions of the theoretical literature, suggesting that there was little indication so far that the LCRs observed were supporting overall industrial development or generating positive spillovers.

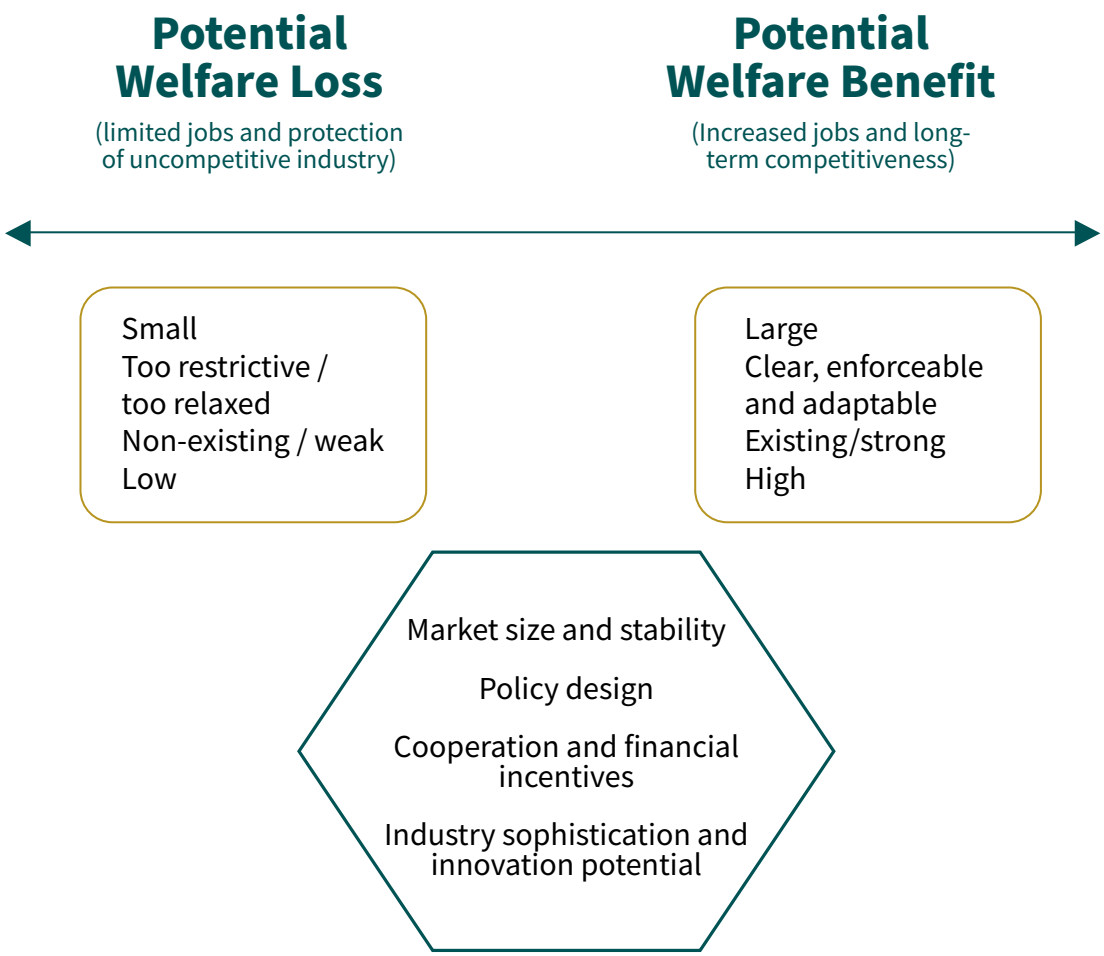
3 International LCR Policies and Regulations

This section discusses the lessons learned from other countries' experiences in designing and implementing LCR policies. Furthermore, it explains LCR policies from the perspective of international regulations and commitments.

3.1 Lessons Learned from Other Countries Experiences

In their study of LCRs for renewable energy, Kuntze and Moerenhout (2013) and Johnson (2013), who adapted the former's work, compiled a list of conditions that may influence the success or failure of LCR policy. First, LCRs are far more likely to succeed if the market size is large and the market's demand is stable. Small or unstable markets may prevent firms from taking advantage of economies of scale, exacerbating the rise in production costs that result from LCR policy implementation (Johnson 2013; Kuntze and Moerenhout 2013; Veloso 2006).

Figure 2: Kuntze and Moerenhout's LCR Assessment Framework



Source: (Johnson 2013), adapted from (Kuntze and Moerenhout 2013)

Second, LCRs must be designed appropriately. If LCR levels are set too high, production may become prohibitively difficult or expensive for firms, but if LCR levels are too low, they may have little to no impact and merely add to a firm's administrative costs. Kuntze and Moerenhout (2013) acknowledged, however, that what the optimal level of LCR exactly was remains unclear (Veloso 2006; Lin and Weng 2020), and it will require government initiative to find this information (Johnson 2013; Stone, Messent, and Flaig 2015).

Kuntze and Moerenhout (2013) in particular noted that in setting the appropriate LCR is to implement them in multiple phases, gradually increasing the LCR from lower to higher levels to give time for domestic industrial capacity to adapt. In addition, Heum (2008) and Fernando and Ing (2022) noted that successful LCR policies aimed for capacity-building only gave preference to domestic firms that were competitive in terms of price and quality.

Third, LCRs must be implemented in tandem with the private sector and complemented by financial incentives. Involving the private sector in LCR policy-making allows the government to design their LCRs better and simultaneously provide information and certainty for the firms affected by the policy (Kuntze and Moerenhout 2013; Stone, Messent, and Flaig 2015).

This two-way communication may specifically allow the government to set the right LCR levels according to industrial readiness, channel government support to the right parts of the production chain, evaluate the effectiveness of the policy's implementation or reforms, etc. (Johnson 2013; Kuntze and Moerenhout 2013; Veloso 2006). Such a cooperation would be an iterative process in which the government constantly makes use of private sector information to refine its ability to coordinate industrial efforts via LCR policy as efficiently as possible.

However, this cooperation could be subject to regulatory capture or corruption. Ramdoo (2016), moreover, added that governments lacking institutional capacities may be unable to implement LCR policies effectively or transparently, either in cooperation with the private sector or even within its own bureaucracy.

Lastly, LCRs are more likely to have enduring, long-term effects if there is potential for innovation and learning in the industry receiving support (Johnson 2013; Kuntze and Moerenhout 2013). Although it was unclear how this potential can be determined, several suggestions were that it depends on the industry's complexity (Johnson 2013; Hausmann 2016) and the technological or skills gap between the local industry and the international market (Johnson 2013; Veloso 2006).

Furthermore, implementing an LCR when there is a lack of potential for innovation and learning will merely result in short-term effects, such as an increase in output or employment, without the longer-term effects of positive spillovers or competitiveness (Johnson 2013), which is necessary to justify the claim that an LCR is overall welfare enhancing despite its initial costs (Veloso 2006).

These four points can be seen in both successful and unsuccessful cases of LCR. The successful case of Norway's oil and gas industry examined by Heum (2008), for example, showed that it enjoyed a sizable and stable global market. This was especially true during the oil crisis of the 1970s, which made investments in Norway attractive despite the presence of LCRs.

To communicate the LCR policies to the private sector and connect local firms with foreign ones, moreover, the Norwegian government communicated closely with the private sector while at the same time maintaining a healthy distance and encouraging competition. It also provided financial incentives in the form of tax reductions.

Finally, the government invested not only in offshore extraction capabilities, which is far more complex than onshore extraction (Weiss, 2016), but also in R&D capacity, allowing Norway's oil and gas industry to develop specialized skills and compete internationally despite price fluctuations, shrinking oil fields, and other challenges. This last part adds an important condition on the implementation of LCR policy: LCR policies only affect industrial development indirectly and must be used in tandem with government technology, research, and innovation policies, policies which Norway had established well before their discovery of oil.

China's wind turbine industry represented a similar case of success (Kuntze and Moerenhout 2013). China enjoyed a large supply of domestic wind resources and the benefits of a large and growing domestic market. LCR levels were set in multiple phases from 1997-2009 starting from 20% in 1997, 50% in 2003, and 70% in 2004, and meeting them were necessary for firms to become eligible for government projects or build wind farms with more than 50 MW of capacity.

The LCR levels themselves were apparently also set flexibly, depending on the government's review of China's technological progress. In addition, fiscal incentives were provided in the form of a higher electricity purchasing rate or tariff (i.e. feed-in-tariffs) which firms were eligible for, depending on whether they met the LCR levels set and whether the company was a Chinese-owned company or Chinese joint-venture.

Finally, China's wind energy technology was initially low, so there was room for technological transfer and learning-by-doing. China arguably experienced a significant increase in its wind power capacity which rose from 56.6 MW in 1996 to 25,805 MW in 2009, the world's second largest total capacity at the time. By 2009, 87% of the share of manufacture domestically were held by Chinese companies compared to just 30% in 2005. Despite this progress, however, Kuntze and Moerenhout (2013) were uncertain whether the emergence of the Chinese companies in China and the global market was due to productivity gains or due to price competition and reductions in quality.

In contrast, India's solar panel industry represented a less successful case of LCRs for renewable energy (Johnson 2013). The country met its deployment targets for its first phase of solar panel installation of establishing 1000 MW of solar power capacity between 2010-2013 through feed-in-tariffs, a variety of state-level incentives, an obligation for utility companies to purchase solar electricity, and an LCR of 30% for solar cells used in India. A national study and firm interviews by Johnson (2013) reported, however, that the policy and project in the end made the overall industry less competitive.

The reported problems surrounding the LCRs in India's solar panel industry included business losses due to difficulties in transitioning firm orientations from the international market to the domestic market; a bias towards less efficient but LCR-exempt thin film solar cells rather than expensive LCR-regulated crystalline silicon solar cells; and reduced spending in R&D due to financial difficulties and the withdrawal of foreign firm support due to the LCR.

Using Kuntze and Moerenhout's (2013) framework, these problems represented a sizeable but unstable market (i.e. the solar panel products required in India were different in type and scale from the export market), unforeseen impact of the LCR's policy design (in supporting technologically inferior thin-film solar cells), and the lack of cooperation between government and businesses in policy design or implementation (e.g. locally manufactured solar cells were taxed more than imported solar cells).

India's case in particular seems to have highlighted the struggle governments face in discovering what exactly is the appropriate level and design of an LCR policy for the economy (Johnson 2013; Kuntze and Moerenhout 2013; Lin and Weng 2020; Veloso 2006) and the potential role of the private sector in achieving this (Stone, Messent, and Flaig 2015). It also stands in stark contrast to China and Norway's case since LCR was seemingly responsible for less R&D resources in the private sector and foreign firm withdrawal instead of sparking innovation and technology transfer from abroad.

The success or failure of LCR policy may be determined by four conditions: market size and stability, policy design, cooperation and financial incentives, and industry sophistication and innovation potential.

In the same vein, Australia's automotive industry represented a similarly less successful case of LCR due to overprotection and a case of regulatory capture in its policy design and cooperation with the private sector (Pursell 2001). Automotive LCR policy began in 1960 when imported cars entered the market. Policies changed multiple times.

They included tariff reductions for meeting an 85% LCR in (small-scale) production, the need to create local content plans, tariff reductions for LCR-compliant production of all scales, two increases in the standard import tariffs, import restrictions, and an export-promotion scheme that reduced the LCR level of 85% and further reduced tariffs if firms exported a certain number of cars.

The final result was high production costs, fragmented production with few economies of scale, reduced total employment, reduced capability to invest in R&D due to high costs (similar to India's solar panel case), inefficient decision-making (firms exported at prices below production costs for government incentives), and high transaction costs due to the rampant lobbying and conflicts between the government and the automotive manufacturers.

Using Kuntze and Moerenhout's (2013) framework, these problems represented a small market, poor policy design, and poor forms of cooperation between the government and businesses. Australia's case represented, perhaps, the worst-case scenario of LCR implementation where the fears of high costs, entrenched interests, and counter-intuitive final results mentioned in local content policy studies were manifested most clearly (Deringer et al. 2018; Grossman 1981; Stone, Messent, and Flaig 2016).

3.2 International Regulations on LCRs

Despite its proliferation, the international regulatory environment is generally not in favor of local content policies which are counted as regulations that discriminate against imported goods. The international agreements that apply for LCRs are as follows (Deringer et al. 2018; Fernando and Ing 2022; Kuntze and Moerenhout 2013; Limenta and Ing 2022; Weiss 2016):

- Article III on the National Treatment on Internal Taxation and Regulation in the GATT
- Article 2 on the Agreement on Trade-Related Investment Measures (TRIMs)
- Article 3 on the Agreement on Subsidies and Countervailing Measures (ASCM)
- Article III on the Agreement on Government Procurement (GPA)

Article III of the GATT introduced the "national treatment principle" in which governments are forbidden from treating imported products less favorably than their domestic counterparts once they have entered the market. Article 2 of the TRIMs agreement built on the GATT's national treatment principle and applied it beyond the sale and use of products (goods only, not services) and into investment, saying that the implementation of any trade-related investment measures that go against Article III (and XI) of the GATT was forbidden. Meanwhile, Article 3 of the ASCM prohibited governments from implementing export and local content subsidies which may affect trade and adversely affect trade partners. Finally, Article III of the GPA required signatory parties to not give domestic goods, services, and suppliers special treatment during government procurement.

Asides from international trade regulations, the LCR policies were also subject to a regional and bilateral agreement on free trade and investment. The agreements typically include commitments between the signatories to liberalize trade and investment between them. Most of the free trade agreements (FTAs) usually make references and apply some WTO rules into the agreement, including the national treatment principle, the prohibition of performance requirements in investment, and the prohibition of subsidies. Many of these FTAs usually do not add new requirements other than those already present in existing international trade regulations. As a result, LCR policies are likely to violate both WTO regulations and FTAs, implying that international regulations and commitments discourage the use of local content policy in pursuing domestic development.

These international regulations and commitments have been the subject of debate. Critics have called these regulations a form of "ladder-kicking," preventing many developing countries from using the same policy options as developed countries historically used in the Industrial Revolutions of the 19th century and restricting their ability to catch-up to the level of development of today's developed countries (Weiss 2016). In reality, however, developing countries and LDCs are given plenty of exemptions from these rules, especially if they are not signatory to the agreements. In addition, many countries are generally still able to implement various local content policies such as government procurement, technology transfer, human capital investment, joint ventures, investments in green technology, etc. (Weiss 2016).

In short, policies that go beyond the traditional LCR definition of measuring the percentages of local components or value-added (Grossman 1981) are generally free to be used provided they do not infringe on the national treatment principle. This allows developing countries to retain more policy options while simultaneously preventing excessive import discrimination from occurring, an important boon for these same countries once they have climbed up the development ladder.

The enforcement of these international agreements, moreover, seems to be complicated and time-consuming. Very few countries choose to raise a complaint against LCRs, and even fewer are penalized (Weiss 2016). India's solar panel LCRs were often highlighted as the rare example when WTO's dispute settlement was initiated and successfully completed with a verdict against a developing country (Limenta and Ing 2022; Johnson 2013; Limenta and Ing 2022; Weiss 2016), but the majority of disputes that occurred were actually between developed countries (Weiss 2016). These problems in the settlement system are unlikely to be resolved soon given how the overall agenda for WTO reform is still ongoing (Deringer et al. 2018), suggesting that most developed countries will retain their room for maneuver in the medium-term (Weiss 2016).

> ***LCR policies are likely to violate both WTO regulations and FTAs, implying that international regulations and commitments discourage the use of local content policy in pursuing domestic development.***

4 Indonesia's LCR Policies and Regulations

This section briefly reviews LCR policies and regulations in Indonesia. It begins by first looking at Indonesia's international commitments on LCR policy. Afterwards, it will focus on the general development and evolution of Indonesia's LCR policies to this day. Finally, it will look at LCR policy's role in the public sector, specifically as a part of the Indonesian government's public procurement and import substitution policies before closing with a summary of the main characteristics of Indonesia's LCR policy and a description of its local content calculation formulae.

4.1 Indonesia's International Commitments on LCR

In the international sphere, Indonesia pursues a so-called "multi-track" strategy in which it displays active involvement in many international forums at a multilateral, regional, as well as bilateral level. On a multilateral level, Indonesia is an original and an active member of the WTO. Under the WTO framework, Indonesia is a signatory party to the GATT, TRIMs, and ASCM but not the GPA. As explained in the previous section, these international regulations prohibit the signatory parties on implementing LCR policies that discriminate against foreign products or investors in favor of their domestic counterparts.

On a regional and bilateral level, moreover, Indonesia is also actively involved in numerous free trade agreements. Currently, the country is involved in 7 FTAs as part of its membership in the Association of Southeast Asian Nations (ASEAN) and 6 bilateral FTAs between Indonesia and other countries (Australia, Chile, Japan , Pakistan, South Korea, Mozambique). Many of these FTAs made references to and applied the national treatment principle, the prohibition of performance requirements in investment, and the prohibition of subsidies found in international trade regulations into the FTAs. While government procurement is exempted from regulation, the Regional Comprehensive Economic Partnership (RCEP), one of Indonesia's latest FTAs, did require signatory parties to implement government procurement transparently and cooperatively with other countries.

Thus, Indonesia's LCR policies are also subject to FTAs, although the FTAs themselves do not necessarily add new requirements other than those already present in existing international trade regulations. A list of these FTAs and the regulatory provisions that apply to them can be found in Table 1 below.

Table 1: Indonesia's Free-Trade Agreements and List of Provisions Relevant to Local Content Requirements

No.	Trade Agreement	National Treatment	Subsidy	Performance Requirements in Investment
1	ASEAN Comprehensive Investment Agreement (ACIA)	Article 6a	Article 87b	Article 7 of ACIA, as amended by 4th Protocol of ACIA
2	ASEAN–Australia–New Zealand Free Trade Area Agreement	Article 4a of Chapter 2	N/A	Article 5 of Investment Chapter

No.	Trade Agreement	National Treatment	Subsidy	Performance Requirements in Investment
3	ASEAN – Hong Kong, China Free Trade Agreement	Article 5a of Chapter 2	Article 1b of Chapter 7	N/A
4	ASEAN – China Free Trade Agreement	Article 2a	Article 7b	N/A
5	ASEAN – India Free Trade Agreement	Article 3a	N/A	N/A
6	ASEAN – Japan Comprehensive Economic Partnership	Article 15a of Chapter 2	N/A	N/A
7	ASEAN – Korea Free Trade Agreement	Article 2a	N/A	Article 6c
8	Indonesia – Australia Comprehensive Economic Partnership	Article 2.4a	N/A	Article 14.6
9	Indonesia – Chile Comprehensive Economic Partnership Agreement	Article 3.3a	Article 8.2a	N/A
10	Indonesia – Pakistan Free Trade Agreement	Article 5a	Article 5b	N/A
12	Indonesia – Japan Economic Partnership Agreement	Article 19a	N/A	Article 63c
13	Indonesia – European Free Trade Association Free Trade Agreement	Article 2.9a	Article 2.14b	N/A
14	Indonesia – Mozambique Free Trade Agreement	Text not available	Text not available	Text not available

No.	Trade Agreement	National Treatment	Subsidy	Performance Requirements in Investment
15	Indonesia – Korea Free Trade Agreement	Text not available	Text not available	Text not available
16	Regional Comprehensive Economic Partnership (RCEP)	Article 2.3a	Article 7.11b	Article 10.6c

Source: (Fernando and Ing 2022)

All in all, Indonesia's LCR policies are likely to be inconsistent with WTO regulations and FTAs (Fernando and Ing 2022; Limenta and Ing 2022). As the subsequent sections will show, although Indonesia's LCR policies are mostly voluntary and applied to both domestic and foreign firms indiscriminately, some or all of the policies attempt to encourage firms to use local products; attempt to confer advantages upon LCR-compliant firms, including through the use of tariff reductions or exemptions; and may create a disadvantage for imported products. Indonesia's decision to make LCRs mandatory for government procurement may also still be subject to regulation even though Indonesia is exempt from the GPA depending on how it was implemented (Limenta and Ing 2022).

> ***In conclusion, Indonesia's LCR policies are likely to be inconsistent with WTO regulations and FTAs.***

4.2 The Evolution of LCR Policies in Indonesia

LCRs have continuously been used by Indonesia as part of its industrial policy despite its prohibition under WTO regulations and FTAs. Local content policy had existed in Indonesia less than a decade after its independence in 1945, reflecting the nation's tendency of promoting economic development through government intervention.

The earliest program was the Benteng Program in 1950 which aimed to promote indigenous entrepreneurs to replace Dutch and Chinese entrepreneurial influence inherited from the colonial era (Negara 2018). Local entrepreneurs received import licenses and a cheaper currency rate to promote their trading activities, but they only ended up "renting out" their licenses to more established importers (Boediono 2016).

During Soeharto's era, the Deletion Program (1974-1993) was issued to promote the use of locally-produced parts for manufacture. However, with the exception of the motorcycle industry (Thee 1997) the policy struggled to create usable supporting industries for the car assembling industry due to the low technologies of local suppliers, lack of economies of scale, and the large amount of investment needed to establish these local suppliers (Aswicahyono, Basri, and Hill 2000; Negara 2018). Eventually, the program was then aborted in 1993 as liberalization pressures forced the government to abandon non-tariff barriers implemented under its protectionist and import-substituting trade regime.

The government then issued the Incentive Program as a replacement for its Deletion Program. It lowered import tariffs depending on the level of local content achieved, switching mandatory enforcement and penalties for friendlier incentives (Aswicahyono, Basri, and Hill 2000; Negara 2018). To accelerate this program, the government also launched a National Car Program in 1996, aiming to raise local content targets for automobile production over the course of three years.

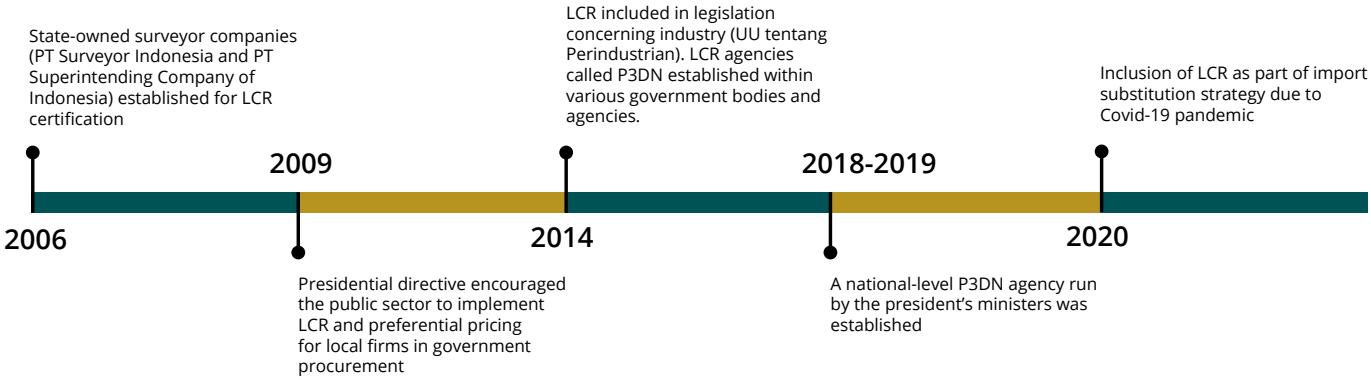
In this program, the automotive industry would be granted lower import duties if they were able to attain local content levels of at least 20 percent in the first year, 40 percent in the second year, and 60 percent in the third year. However, this program did not last very long as the policy struggled to take off due to patronage suspicions (Aswicahyono, Basri, and Hill 2000) and eventually ceased completely due to the Asian Financial Crisis (Boediono 2016; Negara 2018).

The crisis and subsequent liberalization, however, did not dash the hopes of policy-makers in promoting economic and social development via government intervention, including LCR policy. The earliest primary legislation where LCRs were mentioned since the start of the 21st century was Law No. 22/2001 concerning Oil and Natural Gas. In this law, the government appealed to firms engaged in the oil and gas industry to prioritize local goods, labor, services, technology, and designs as much as possible (Limenta and Ing 2022).

Although the specific implementation of the law was not available until 9 years later through the Minister of Industry Regulation No. 48/2010 (Limenta and Ing 2022), the 2001 Law revealed Indonesia's enduring political ambitions for development and penchant for government intervention despite still undergoing the after-effects of the Asian Financial Crisis and the subsequent chaotic transition to democracy (Boediono 2016).

LCR policies remained afterwards and are in increasing trend recently following rising economic nationalism and protectionism in Indonesia. Figure 3 highlights the important milestones in Indonesia's pursuit of LCR policy in the 21st century[2] which is primarily centered on domestic procurement. To monitor and implement LCRs, the government mandated state-owned surveyor companies, PT Surveyor Indonesia, and PT Superintending Company of Indonesia (SUCOFINDO) in 2006. A presidential directive encouraging the public sector to implement LCR and preferential pricing for local firms in government procurement was then issued in 2009.

Figure 3: 21st century Milestones in Indonesia's Local Content Policy



Source: Collected from various sources

Following the primary legislation or law No. 22/2001, in 2014 the government enacted another LCR-related law, i.e. Law No.3/2014 concerning Industry, and established LCR agencies called P3DN within various government bodies and agencies. Subsequently, during the period 2018-2019, the government established and consolidated a national-level P3DN agency run by the government ministers, presumably in coordination with one another.

Lastly, in 2020, the government announced that it will begin working towards reducing the dependence of Indonesian industry on imports. This policy was partly due to the supply chain disruptions and import price fluctuations caused by the pandemic (Kementerian Perindustrian Republik Indonesia 2020b).

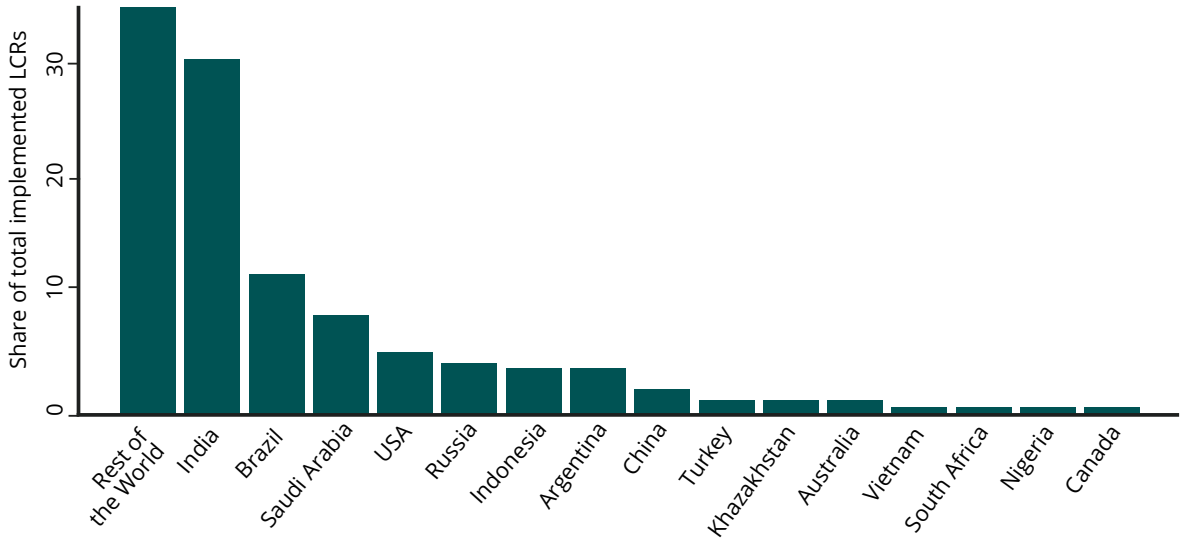
Aside from those general LCR policy milestones, there were also various sectoral LCR policies and regulations issued by the government of Indonesia. For example, in 2009 the Ministry of Finance issued regulation 176/PMK.011/2009 concerning duty exemptions on imported machines, goods and material if overall production used a minimum of 30 percent of domestic components. This regulation was later on amended by regulations 76/PMK.011/2012 and 188/PMK.010/2015, aiming to extend the tariff exemption to the motor vehicle and construction industries.

Similarly, in 2014, the Ministry of Industry issued regulation 80/M-IND/PER/9/2014 introducing local content requirements on motor vehicles. In addition to machinery and automotive industries, LCRs also affect other sectors, such as in electricity, oil and gas, franchise businesses, and telecommunication industries. In 2017, for example, the new regulation made meeting 30-40 percent local content for 4G/LTE equipment.

To this day, along with India, Brazil, Saudi Arabia, the United States, and Russia, Indonesia has one of the highest utilization rates of LCR worldwide (see figure below). A detailed list and explanations of other sectoral regulations related to LCRs can be seen in the next section and the appendix.

> ***Indonesia has continuously used LCRs as part of its industrial policy and right now it has one of the highest utilization rates of LCR worldwide.***

Figure 4. Share of Globally Implemented LCR Policy by country (%)



Source: Global Trade Alert in Deringer (2018)

4.3 LCRs in Public Sectors: Import Substitution and Government Procurement

The more recent use of LCR policy reflects the emergence of a larger government procurement policy and import substitution drive in Indonesia's economic agenda. As the timeline above indicated, LCR policy in domestic procurement initially began during the tenure of Indonesia's sixth president, Susilo Bambang Yudhoyono (2004-2014).

Afterwards, Indonesia's current president, Joko Widodo, has also eagerly supported the policy's continuation, making spirited remarks requesting Indonesia's local governments to cooperate with the central government's domestic procurement policy and prioritizing LCR-compliant products in government purchases (Widodo 2022).

The government hopes that this import substitution drive and public procurement policy will not only advance Indonesia's long-term agenda of supporting industrial development and competitiveness but also strengthening local production resiliency in response to the international supply chain disruptions caused by the Covid-19 pandemic (Kementerian Perindustrian Republik Indonesia 2020c).

The recent LCR policy plays a central role in the Ministry of Industry's import substitution plan. Based on 2019 data, the Ministry of Industry aimed to reduce imports by 35% in 2022, and they aimed to do so not just by reducing imports through import controls but also by filling the gap through domestic production (Kementerian Perindustrian Republik Indonesia 2020a).

They aim to promote domestic production by pursuing four strategies: developing Indonesia's industrial structure, increasing industrial utilization, introducing supportive regulation or incentives, and optimizing the implementation of Indonesia's LCR policies (Kementerian Perindustrian Republik Indonesia 2020a; Kementerian Perindustrian Republik Indonesia 2022c).

The ministry actively monitored the industries with the highest import values, and they have focused their efforts on seven industries, namely the F&B, textiles and apparel, automotive, electronics, chemical, pharmaceutical, and medical devices industries (Kementerian Perindustrian Republik Indonesia 2020a; Kementerian Perindustrian Republik Indonesia 2021a; Kementerian Perindustrian Republik Indonesia 2021b; Kementerian Perindustrian Republik Indonesia 2022a).

The success of Indonesia's import substitution attempts in these seven sectors seems to depend on a carrot and sticks approach, i.e. how well the government implements LCR and import controls while attracting private sector investment and securing market opportunities (Kementerian Perindustrian Republik Indonesia 2020c).

While import substitution was implemented in Indonesia before from the 1960s to 1980s (Anas et al. 2019; Boediono 2016), the import substitution currently espoused takes a different approach. The former, on the one hand, involved intensive protection, extensive nationalization, and the prohibition of foreign investment (Anas et al. 2019).

The latter, on the other hand, emphasizes the importance of private sector investment and the reutilization of existing industrial capacity which were idle due to the pandemic (Kementerian Perindustrian Republik Indonesia 2020a; Kementerian Perindustrian Republik Indonesia 2020b; Kementerian Perindustrian Republik Indonesia 2020c; Kementerian Perindustrian Republik Indonesia 2021b).

To support its recent LCR policies, the government embodied LCRs into its procurement system. The main legal bases for LCR policy in the public sector are found in Law no. 3/2014 concerning Industry, Governmental Regulation No. 29/2018 and Presidential Regulation No. 16/2018 (as amended by Presidential Regulation No. 12/2021). Regulations that reiterate and confirm these policies include Minister of Industry Regulation No. 16/2011, No. 2/2014, and No. 3/2014.

Governmental Regulation No. 29/2018 in particular obligates government bodies to use products that meet at least 25% LCR and a score of 40% when its 25% LCR score is combined with the product's "firm importance ranking" (BMP), a score that captures the social contributions of a firm's investment and production activities in Indonesia mainly measured by its involvement with micro, small, and medium-sized enterprises (MSMEs).

A maximum price preference of 25% can be given to firms in the government procurement bidding process if their products reach the minimum LCR requirement.

Government bodies are obligated to use LCR-compliant products or prioritize them first in government procurement of goods and services, and failure to do so will yield administrative and financial penalties for the government body or procuring party involved.

Recently, the government procurement process is increasingly becoming digitalized. The Ministry of Industry's P3DN body keeps a database of the firms and products that have received an LCR-compliance certificate and are eligible for inclusion in government procurement processes (Kementerian Perindustrian Republik Indonesia. N.d.b.). As of the writing of this report, there are currently 16,325 active LCR certificates issued across twenty different sectors. From the total of active and inactive LCR certificates, 8,028 products have reached the minimum 25% LCR, and 15,203 have reached above 40% local content level.

The National Public Procurement Agency (LKPP) also provides an e-catalog for government bodies to search for various products and their prices, including pharmaceutical products and medical devices which have received prioritization due to the Covid-19 pandemic (Kementerian Republik Indonesia 2022b).

Finally, the LKPP also provides an electronic procurement service where government bodies can input their contracts and firms, who have registered an account in the LKPP website, can register for these contract bids online (Kementerian Republik Indonesia 2022b). Tai (2021) mentioned, however, that many firms are still struggling to understand the electronic catalog and procurement process, a sign that the digitalization of the government procurement process and Indonesia's overall LCR policy still has a long way to go.

> ***The recent LCR policy plays a central role in the government's import substitution plan and it is embodied into the government's procurement system.***

4.4 Indonesia's LCRs in a Nutshell

In a nutshell, the features of recent Indonesia's LCR policies can be summarized as follows. First, its primary goal is to aid Indonesia's larger efforts to reduce imports. Increasing industrial output or promoting industrial development, the traditional goals of LCR, seem to have become somewhat subordinate to reducing imports and replacing them with domestic products.

Second, the majority of the LCRs are applied only for government procurement on a voluntary basis. With the exception of a few sectors (see Chapter 6), Indonesia's LCRs are not applied to the private sector in general, and firms are only required to comply with LCRs if they wish to be eligible for bidding for government contracts.

Third, Indonesia's LCR policy seems to primarily take a "penalty first" approach. While the government may be providing incentives, subsidies, or other forms of support outside its LCR policy, the LCR policies themselves provide no reward to compliant firms except the removal of market-access barriers to the public sector. This is very different from the 1994 Deletion Program which rewarded LCR-compliant firms with lower import tariffs, potentially a source of competitive edge against competitors.

Fourth, the calculation of local content level makes use of cost-based, product-based, or process-based approaches depending on the situation. In the cost-based approach, the local content level of a product is calculated based on how much of the product's production costs (components, labor, overhead costs) were sourced locally.

For the procurement of services (e.g. construction services) the LCR involved covered more specific requirements: (1) at least 50% of the service's contract value was done by a local company (30% if the service was done off-shore), (2) at least 50% of the local company's shares is owned by the Indonesian government or an Indonesian citizen and two-thirds of the company's directors are Indonesian citizens, and (3) 50% of the service's contract value was done in Indonesian territory.

Meanwhile, the product-based approach calculates the local content level of a product by assigning weighted scores to its components, materials and services. Specific components, materials, and services used for the selected final product are listed in the regulation and given scoring weights, and the individual local content levels of these components, materials, and services are then re-calculated to produce a new total score for the final product involved. This approach is usually used for calculating the local content level of power plants, telephones, laptops, and tablets.

The last approach, found in regulations for pharmaceutical products, electronic devices, telematic products, and electric vehicle batteries, is the process-based approach. In collaboration and extensive communication with the private sector, the approach calculates local content based on the weighted-score of the various processes involved (e.g. production, R&D, packaging, etc.). Each process in the creation of the product is determined to have a certain level of local content depending on the various requirements specified in the regulation (e.g. certain amount of investment, use of local materials, use of local workers, Indonesian R&D or coding documents, etc.).

> ***The recent Indonesia's LCR policies are characterized as follows: its primary goal is to aid Indonesia's larger efforts to reduce imports; the majority of the LCRs are applied only for government procurement on a voluntary basis; Indonesia's LCR policy seems to primarily take a "penalty first" approach; and the calculation of local content level makes use of cost-based, product-based, or process-based approaches depending on the situation***

5 Economic Impact of LCR Policy

This section will elaborate on the effects of LCR policies on key economic indicators in Indonesia, such as output growth, productivity, pricing, and exports. This part will be one of this study's main contributions to existing research by attempting to fill the gap in the literature about the impact of LCR policy in Indonesia, which is currently limited.

The approach used in this discussion was an ex-post type of analysis. Using Industry Statistics published by the Indonesian Statistical Agency and Local Content Certification data recorded by the Indonesian Ministry of Industry, we run a linear regression analysis in order to determine the effects of past LCR policies on the performance of Indonesia's manufacturing firms.

5.1 Regression Analysis

The Model

The regression analysis used in this study follows the work of Negara (2016). It starts by assuming that every firm in the economy has a Cobb-Douglas production function:

(1) Yit = Ait Kit α Lit β Mit ɣ Dit

where output in firm i at time t, Yit, is a function of capital, Kit , labor, Lit, imported intermediate inputs and raw materials, Mit and, domestic intermediate inputs and raw materials, Dit. This Cobb-Douglas technology assumes that the mix of inputs of production used by industries does not change over time. Taking the natural logs of equation (1), and denotes the variables by lowercase letters, the equation become

(2) Yit = β0 + βlkit + β2lit + β3mit +β4dit

Equation (2) is then estimated and the residual of the regression can be used as a proxy for the firm's Total Factor Productivity level.

Data and Its Caveats

This study uses data from the Manufacturing Survey of Large and Medium-Sized Firms (Survei Industri, SI) published by the Indonesian Statistical Agency, locally known as Badan Pusat Statistik (BPS). The SI data is based on an annual census of manufacturing firms in Indonesia with 20 or more employees.

The data covers firm-level information such as production value, export value, import value, employment, capital, foreign ownership, and value added among others. The data on value-added is calculated from the firm's output minus its intermediate inputs.

As an indicator of local content specific to each sector, this study uses local content certificates obtained by scraping the Ministry of Industry database available at the Ministry' website *(http://tkdn.kemenperin.go.id)*. Based on this data, this study uses the actual percentage of LCR in each sector as a proxy for LCR policies.

This approach complements and improves the proxy of LCR policy used by Negara's (2016) study. To proxy the LCR policy, Negara (2016) used the share of a firm's imports of intermediate inputs to its total inputs, which he obtained from SI data on total firm's expenditure on both domestic intermediate inputs and imported intermediate inputs. This variable is used as an indicator of whether there have been changes in a firm's dependency on imported inputs due to the LCR policy.

He argued that since LCR policy aims to control or reduce firm's imports of foreign, the effectiveness of the policy can be shown by a declining trend in the share of imported inputs without adversely affecting firm-level productivity, value added, outputs, exports, and employment over time.

Although from a theoretical perspective, this argument is logically valid, we argue that it may not really reflect the actual implementation of LCR policy. The variability of the trend of imported inputs share is not an appropriate proxy for LCR policy as it may reflect the influence of imported inputs more than the influence of the policy itself. For this reason, this study uses the actual implementation of LCRs recorded in the Ministry of Industry's database of local content certificates and merges it into the sectors in the SI data.

This study expects that the firm's performance in the SI data is influenced by the LCR policies applied in each sector. Here, we assume that the information of LCRs percentage and the sector of the firms submitting the local content certificates really indicate the actual LCRs implemented in each sector.

It should be mentioned, however, that the data in this study has its own limitations. First, the SI data is only available up to 2019. Second, from 2017 onwards, the data is only available for 2-digit KBLI (Standard Classification of Indonesian Business Fields) sectoral codes whereas prior to that 5-digit KBLI sectoral codes were available.

In addition, from 2017 onwards, firm identification codes were randomly assigned for each firm every year. Third, the database on local content ratio is recorded in 5-digit KBLI code but only started being recorded by the Ministry of Industry from 2018 when LCR policy itself has been applied several years before then.

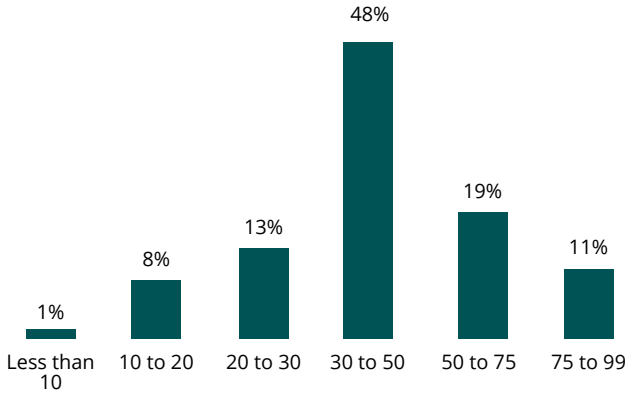
Due to these limitations, we converted the sectoral codes in both the SI and the Ministry of Industry's local content certificate database into 2-digit KBLI codes, and the time period for the regression only covers 2018-2019. We also conducted pooled data regression, instead of panel data regression. Furthermore, as the data is on the 2-digit KBLI code, we could not directly and precisely identify specific sectors like ICT, medical equipment, and pharmaceuticals in the database.

Data Description and Stylized Facts

Figure 5 shows the share of LCR ratio groups and the share of LCR certificates with 30-50% local content ratios at 2-digits ISIC sectors that are calculated based on the Ministry of Industry's LCR certificate database. It reveals that nearly half of all manufacturing firms' LCR certificates contain a local content score 30 percent to 50 percent.

Furthermore, the dominant sectors with this local content level are pharmaceuticals (21) and computer, electronics & optics (26) sectors. These sectors together accounted for about 85% of all LCR certificates with local content ratios of 30-50%.

Figure 5: The share of LCR ratio groups and the share of LCR certificates with 30-50% local content ratio at 2-digits ISIC sector



Share of LCR 30 to 50% Ratio at 2 Digits ISIC Sector

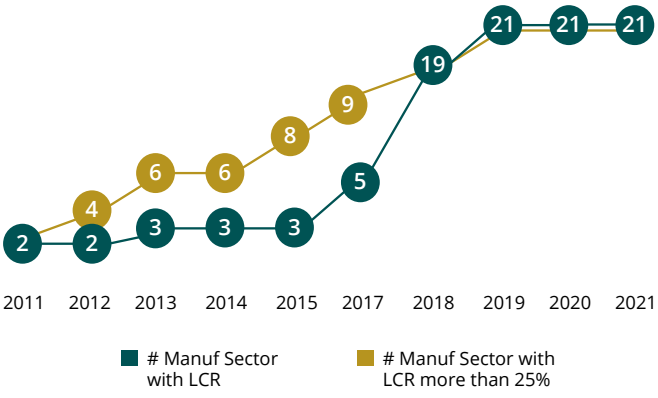
Source: Calculated from MoI Data

As seen in figure 6, moreover, the coverage of LCR policy is expanding, and its score is increasing. During the period of 2018-2021, the total number of LCR manufacturing firm certificates submitted to the Ministry of Industry has increased from only less than 2,700 to nearly 13,000 certificates. Furthermore, five sectors dominated the number of LCR manufacturing certificates submitted to the Ministry of Industry.

They are the electric equipment sector (27) with 9,358; the pharmaceuticals sector (21) with 4,920; the basic metals sector (24) with 3,498; the chemicals sector (20) with 3,168; and the computer, electronics & optics sector (26) with 2,734.

Figure 6: Coverage of LCR at 2-Digit ISIC manufacturing and Number of LCR manufacturing firm Certificate in Effective

Coverage of LCR at 2-Digit ISIC Manufacturing



Number of LCR Manufacturing Firm Certificates in Effective

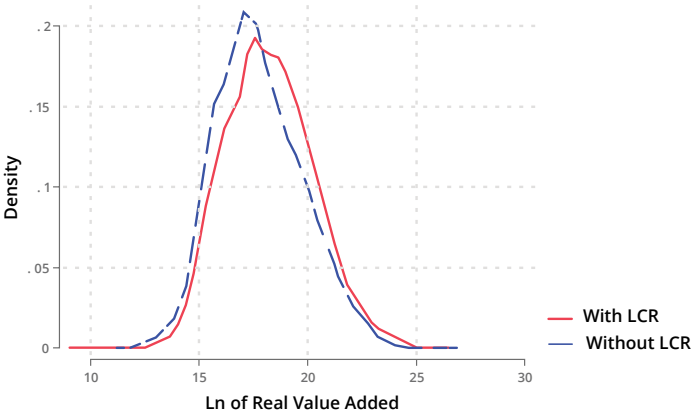
ISIC 2D	2018	2019	2020	2021
10	0	13	37	40
11	0	0	0	0
12	3	3	3	3
13	6	13	18	28
14	16	19	44	49
15	30	38	71	73
16	0	0	0	0
17	4	8	13	13
18	0	2	8	10
19	91	202	294	310
20	349	630	1007	1182
21	17	18	2393	2492
22	140	209	393	519
23	178	286	605	826
24	277	646	1239	1336
25	154	363	571	669
26	323	581	861	969
27	737	2173	3125	3323
28	277	515	748	837
29	17	25	27	28
30	18	27	32	34
31	18	60	143	153
32	34	53	125	179
33	0	0	0	0

Source: Calculated from MoI Data dan various regulations

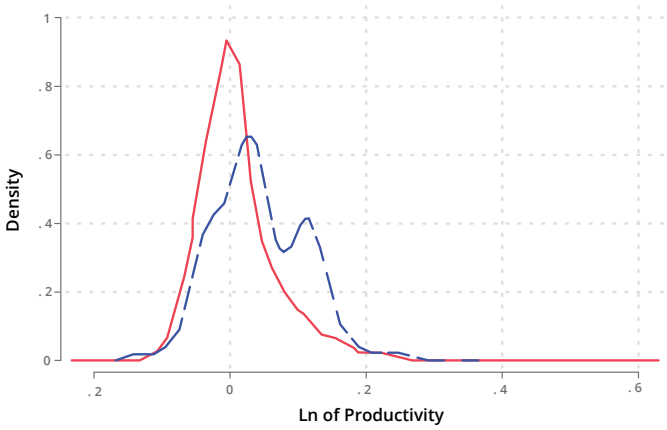
Figure 7 shows the distribution curve of manufacturing firms' performances with and without LCR from 2018 to 2019. This figure shows that Manufacturing firms with LCR policies tend to have higher value-added but lower productivity.

Figure 7: The distribution curve manufacturing firms' performance

Value-Added Performance Manufacturing Firms with or without LCR, 2018-2019



Productivity Performance Manufacturing Firms with or without LCR, 2018-2019



Source: Calculated from MoI Data

Estimation Strategies and Its Results

Due to the data limitations mentioned above, this study ran a pooled data regression using SI data and the Ministry of Industry LCR database for the period of 2018-2019. This study expected a positive and significant effect of imported inputs and LCR rate on a firm's performances, including productivity, value added, output, export, and employment level.

Moreover, we hypothesized that if LCR policy worked effectively, the share of imported inputs in the production of goods should decrease over time. In addition, we also expect that the implementation of LCR, as represented in the LCR rate variable, will adversely affect the various firm performances above.

To test these hypotheses, this study estimated the following reduced-form function:

(3) Outcomeit = f (import_shareit, t, t*import_shareit, Xit, μi, εit)

On the left side, there are five dependent variables used as proxies for firms' manufacturing performances, including: firm-level factor productivity (ln_tfp), real output (ln_y), real export (ln_x), labor (ln_l), and real value added (ln_va). On the right side, following Negara (2016), we also used some key independent variables, namely firm's share of imported inputs to its total inputs (Imp share) and the interaction variables between import share and time trend (t*imp shr).

Here, time-trend (t) is a variable which is equal to the time index in a given year (i.e. time trend variable equals 1 for 2018 and 2 for 2019). This allows us to control for the exogenous increase in the dependent variable which is not explained by other variables and it can also be used as a proxy for technical progress. Moreover, the interaction of time trend with the import share variable is used to capture change in firms' use of imported inputs overtime.

In addition to these variables, we also add another variable of interest, namely the average of local content ratio in their 2 digits sector classification (lcr rate) gathered from the Ministry of industry local content certificate database. To control for the effects of these variables of interest, we include some independent variables, including foreign ownership dummy (ff) and firm exporting dummy (fx). Notably, TFP variable was measured using the Olley-Pakes method, and all variables with Rupiah values have been deflated using the wholesale price index (base year 2010).

Estimation Results

Table 2 shows that LCR policy was negatively correlated with productivity, output, export, workers, and value-added in Indonesia's manufacturing sector. For example, a one percent increase in the lcr rate is associated with -0.0027 percentage point decrease in a firm's total output. These findings are consistent with earlier theoretical research indicating that the LCR policy will have an influence on the decline of industrial production (Grossman, 1981).

Moreover, lcr policy is negatively correlated with productivity metrics as well. This model reveals that a one percent rise in the lcr rate would result in a -0.0039 percentage point decline in the total factor productivity of a company, assuming all other variables remain constant. The LCR policy limits businesses to acquire raw materials with higher levels of productivity. The firm's overall production will likewise fall as a result of the decline in its productivity. Consequently, the total production of the economy would decline.

Similar to the findings of Negara (2016), this analysis also discovered that import shares were favorably linked with all performance proxies. This demonstrates the significance of imports as a source of raw materials for Indonesian industry. Obviously, in the present global value chain setting, raw materials can be sourced both locally and internationally. In an effort to boost overall productivity, firms will seek for raw materials that are both cost - effective and of high quality.

Consequently, limits on import-origin inputs will have an effect on business productivity. The government's attention should be trained on the means through which domestic manufacturing might periodically improve its productivity. Increasing the productivity of these enterprises will eventually make Indonesian firms more competitive, allowing them to participate in the global value chain.

> ***According to our model, we find that the proportion of local content certificates were negatively correlated with the industrial performance. Doubling the proportion of local content certificates lowered the firm's output by 0.27 percentage point and it also reduces firm's productivity by 0.39 percentage point.***

Table 2: Regression results overall manufacturing industries

	(1) ln_tfp	(2) ln_y	(3) ln_x	(4) ln_l	(5) ln_va
imp share	0.0327** (0.0157)	0.0211 (0.0131)	0.0776** (0.04)	0.0004 (0.01)	0.0241* (0.01)
t	0.0394* (0.02)	0.0517** (0.02)	0.0340 (0.05)	0.0349*** (0.01)	0.0362* (0.0204)
t*imp shr	-0.0008 (0.00)	0.0000111 (0.00)	-0.00414** (0.00)	0.0004 (0.00)	0.0000113 (0.00)
ff	1.494*** (0.0309)	1.422*** (0.0277)	2.158*** (0.0996)	0.852*** (0.0185)	1.382*** (0.03)
fx	0.351*** (0.03)	0.202*** (0.03)		0.717*** (0.02)	0.1203*** (0.03)
lcr rate	-0.0039*** (0.00)	-0.0027*** (0.00)	-0.0066*** (0.00)	-0.0004* (0.00)	-0.0013*** (0.00)
_cons	15.22*** (0.426)	17.63*** (0.400)	0.603 (1.018)	3.395*** (0.220)	16.98*** (0.392)
N	31435	58836	58836	58836	58836
R^2	0.167	0.124	0.019	0.115	0.146

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

6 A Case Study of LCR Policy in ICT and Health Industry in Indonesia

After exploring the impacts of Indonesian LCR policy for its general economy, this section will look at LCR policy's impact on emerging and relatively new economic sectors in Indonesia, particularly in the ICT, medical equipment/devices, and pharmaceutical industries. This section will describe the current state of the ICT and healthcare industries in Indonesia, present the LCR policies applied to these sectors, and explore the effects of LCR policy on their performance.

6.1 Characteristics of ICT, Pharmacy, and Medical Equipment Industries in Indonesia

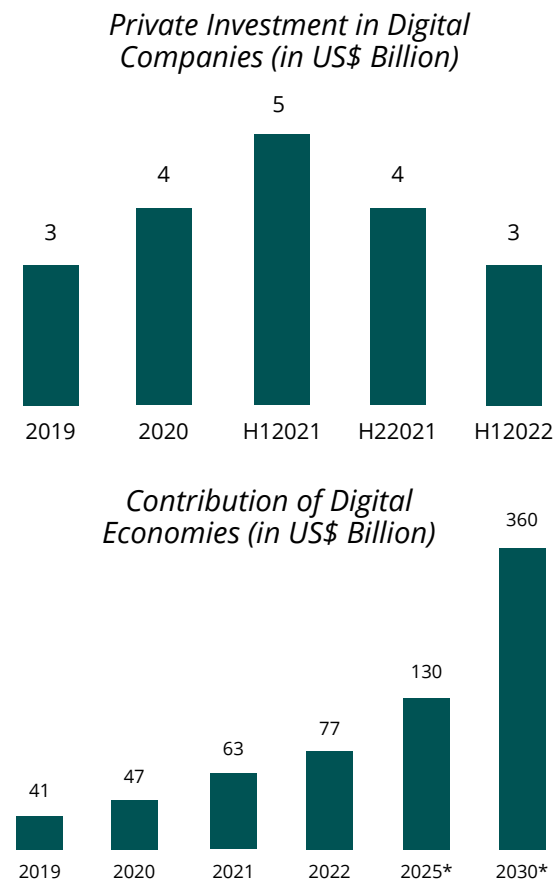
Indonesia's ICT and health industry are two of Indonesia's fastest growing industries, driven by structural changes in the economy. The ICT sector has added Rp695 trillion, 4.5% of Indonesia's total GDP, to the economy (Google, Temasek, and Bain&Company 2022). The health industry, specifically the pharmaceutical and medical equipment/devices industries, is also worth USD 9 billion and USD 4.5 billion respectively in 2019 (Medina 2020).

The ICT sector has become an important input provider for various industries in Indonesia with a forward linkage value of 1.45, greater than 1, and it is also an equally significant user of inputs with backward linkage value of 1.21. Meanwhile, the 2014 introduction of the National Health Insurance (JKN) program, one of the world's largest, is one of the main drivers for the health sector's rapid expansion (Medina 2020).

Finally, the Covid-19 pandemic only accelerated their growth further with mobility restrictions increasing internet adoption and the use of more digital services in the workplace (Google and Temasek 2022) and global supply chain disruptions resulting in unmet demand for medical equipment and pharmaceuticals in the midst of a health crisis.

In the meantime, the fast expansion of ICT was also fueled by a rise in FDI. At least, investment realization data for the Indonesian telecoms sector increased prior to the pandemic. Nonetheless, after the COVID-19 epidemic, FDI in this industry decreased significantly. Moreover, private investment in digital enterprises had a similar trend up until the pandemic. Increasing internet penetration and use of digital services continue to drive this investment's growth.

Figure 8. Economic Contribution and Investment in Digital Economy

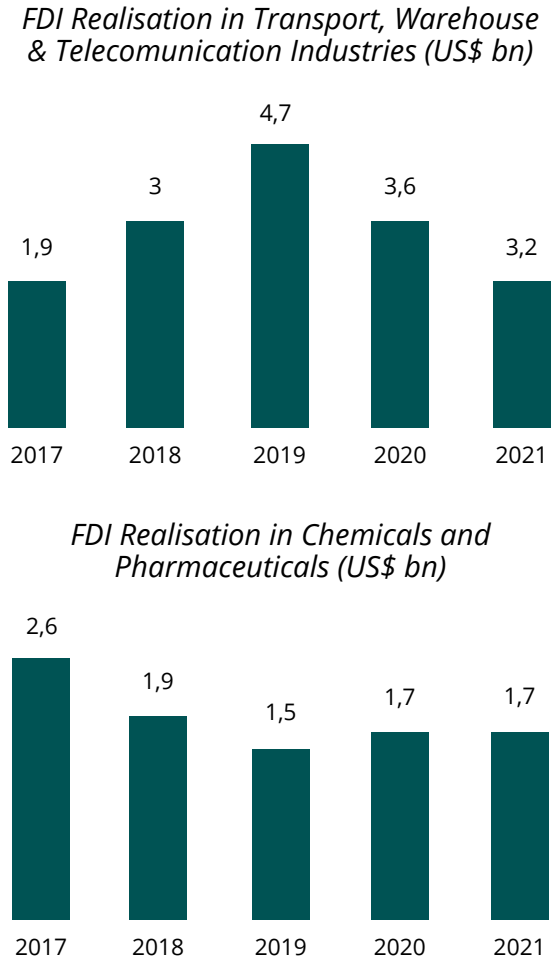


Source: Google, Temasek, and Bain&Company (2022)

Despite this, the COVID-19 epidemic also led to a considerable fall in private investment, as many investors attempted to increase their profits in other sectors. Additionally, a number of regulations, such as data localization, are believed to be obstacles that limit additional FDI investment into Indonesia's information and communications technology (ICT) sector. As mentioned in the Cory and Dascoli's (2021) report, data localization and other restrictions to data flows negatively affect the economy.

Meanwhile, foreign direct investment has not kept pace with the expanding healthcare sector in Indonesia. There has been a plateau or even a decline in foreign direct investment (FDI) in the pharmaceutical business for at least the past five years. Improvements to business climate, such as permitting 100 percent foreign ownership on the revised list of negative investments, are insufficient to attract foreign investors. Patented pharmaceuticals are required to be manufactured domestically after five years, and local content requirements are one of the issues that make it difficult for Indonesia to attract international investment in the pharmaceutical business.

Figure 9. Indonesia's FDI Realisation in ICT and Pharmaceuticals Sectors

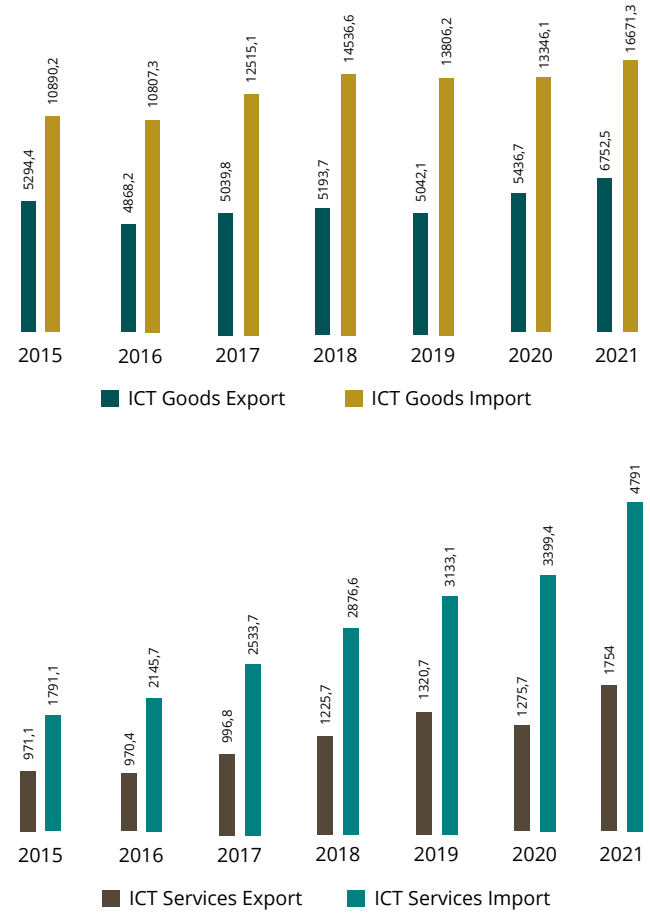


Source: BKPM (2022)

What is equally noteworthy of these two sectors is the role imports play in their operation. With a total value of USD 13.6 billion, Indonesia's ICT product imports outpaced the country's ICT exports, which totaled just US$ 4.6 billion. Similarly, the import value of ICT services in Indonesia surpassed USD 3.4 billion, exceeding the export value of USD 1.3 billion.

In addition, the value of domestic manufacturing in Indonesia is lower than what is required to sustain the country's electronics and communications sector, according to the country's Input-Output data (a ratio equal to 1.62 or excess demand).

Figure 10. Indonesia's Export and Import for ICT Goods and Services



Source: UNCTAD (2022)

Furthermore, imports play an essential role in providing most of the ICT sector's inputs. Non-metallic products, iron and metal products, and machinery and equipment are the three industries that contribute the most to the ICT industry's inputs. The following table depicts the proportion of imported inputs to domestic inputs in these three industries.

The Information Communication and Technology (ICT) industry's primary raw materials are Non-Metal Products, of which 0.9% are sourced domestically and 99.1% are imported from foreign countries. In addition, ICT industry products utilize Iron and Metal goods, of which 33% are domestically supplied and 67% are imported. 52% of ICT sector machinery and equipment are obtained domestically, while 48% is imported.

Table 3. Input for ICT Products

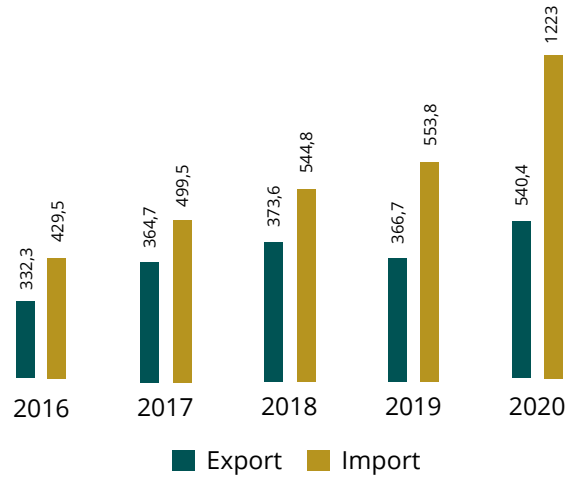
Product	Domestic (%)	Import (%)
Non Metal Product	0.9	99.1
Iron & metal products	33	67
Machinery & Equipment	52	48

Source: Input Output Table

Imports play a similar role in the health sector's trade and production. It is estimated that imports satisfy 90% of the demand for pharmaceutical raw materials (EMIS insights, 2021), while imports supply 65% of the demand for medical devices (ASPAKI, 2021). In addition, a very significant increase in imports was observed in 2020 when the COVID-19 pandemic occurred. As for inputs, according to 2016 Input-Output data from Central Bureau of Statistics (BPS), two primary inputs for the medical devices industry are mostly imported with 81% of Iron and Metal Goods and 92.5% of Electronic Products being sourced abroad rather than domestically.

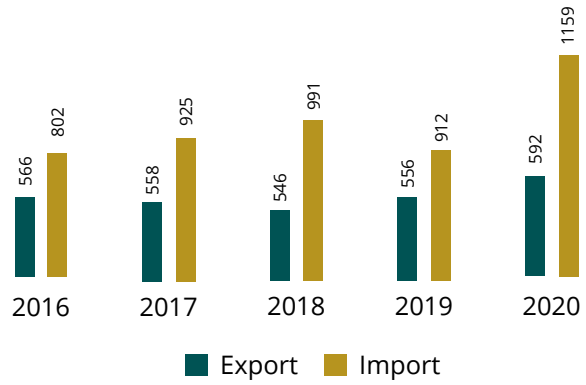
A third primary input source, Machinery and Equipment, is still 49% sourced by imports, nearly half of their goods, for domestic medical devices production. The pharmaceutical industry shows relatively less import reliance with the need to import 47%, 49%, and 30% of its Basic Chemicals, Chemical Products, and Other Chemicals input for local production, but it is clear that imports remain an important contributor for the industry's operations.

Figure 11. Indonesia Export-Import for Medical Devices (US$ million)



Source: EMIS insights (2021)

Figure 12. Indonesia Export-Import for Pharmaceuticals (US$ million)



Source: EMIS insights (2021)

Table 4. Input for Medical Devices Products

Product	Domestic (%)	Import (%)
Machinery & Equipment	51	49
Iron & metal products	19	81
Electronics products	7.5	92.5

Source: Input Output Table

Table 5. Input for Pharmaceutical Products

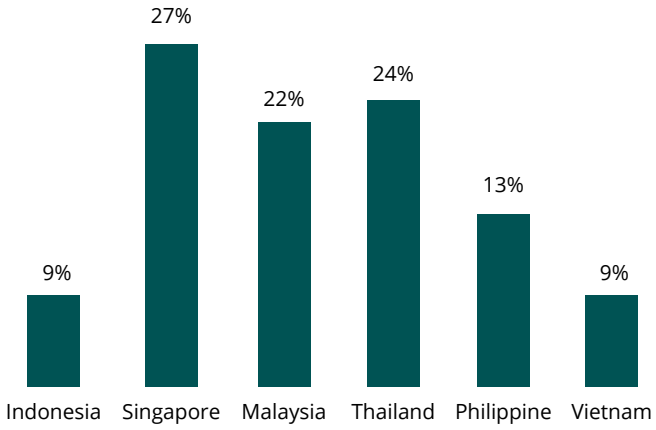
Product	Domestic (%)	Import (%)
Basic Chemicals	53	47
Chemical Products	51	49
Other Chemical	70	30

Source: Input Output Table

Lack of industrial development and competitiveness is a major reason for the dominant role imports play in these three industries. The medical devices sector is extremely fragmented. The vast majority of companies fall into the category of either small or medium-sized businesses, and ten of the 332 medical device manufacturers account for 40% of the market. Similarly, a lack of economies of scale among Indonesia's suppliers of raw materials makes the country's pharmaceutical industry's upstream sector unattractive for foreign investors.

These factors, coupled with the regulatory restrictions such as inadequate patent systems , have made Indonesia one of the countries with the lowest availability of new medicines compared to neighboring countries (see figure 13). In addition, there might be a wait of up to 40 months before new drugs become available in Indonesia (Phrma, 2022).

Figure 13. Percentage of New Medicines Available (Launched in 2012-2021)

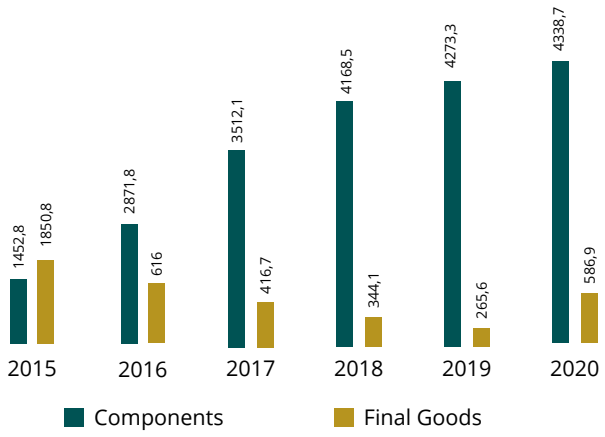


Source: Phrma (2022)

Meanwhile, production is primarily centered on simple and labor-intensive processes. Indonesian LCR policy has pushed ICT firms, specifically producers of cellphones, PCs, and tablets, to do assembly activities in Indonesia and employ local laborers. However, while imports of final goods did decrease over time, imports of components have surged in value, a sign that hi-tech inputs are still out of reach domestically.

Similarly, Indonesian medical device manufacturers have specialized in low-technology medical products such as surgical gloves and masks while pharmaceutical firms have predominantly produced generic products which make up 70% of Indonesia's drug sales (Medina 2020).

Figure 13. Percentage of New Medicines Available (Launched in 2012-2021)



Source: Ministry of Industry (2022)

Table 6. Number of Firms in Pharmaceutical

Type of Firms	Number of Firms
Finished drugs firms	241
Raw materials producers	17
Traditional medicine producers	132
Natural product extract producers	18

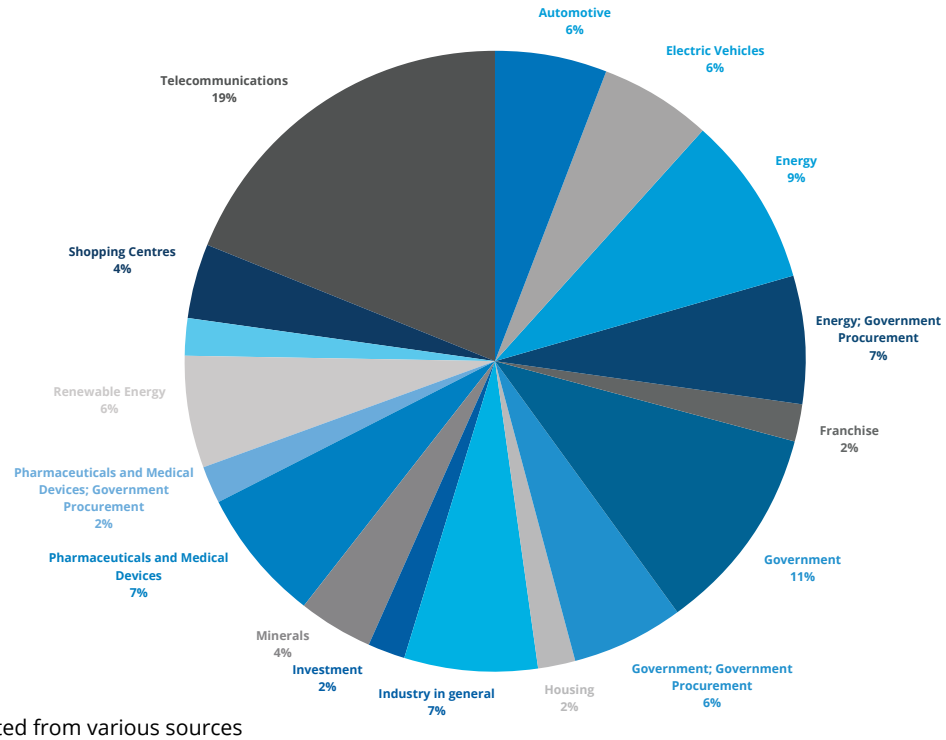
Source: EMIS Insights (2021)

6.2 LCR Policy in ICT, Pharmacy, and Medical Equipment in Indonesia

Despite these two sectors' reliance on imports, they have been receiving regulatory attention under the government's import substitution drive and LCR policy. Figure 15 shows that among the 58 LCR regulations reviewed in this study (see Annex 1), the sector receiving the most share of LCR regulations is the ICT and telecommunications sector (18.87%). It is then followed by energy (9.43%), the general manufacturing industry (7.55%), automotives (5.66%), electric vehicles (5.66%), and renewable energy (5.66%) when ignoring regulations related to government procurement and administration measures. Thus, the telecommunications sector receives the largest share of LCR regulation.

Meanwhile, the pharmaceutical sector has received far less regulation, especially compared to the telecommunications sector. However, the release of Presidential Instruction No. 6/2016 reveals that the government has identified the health sector as an important part of their development and LCR agenda, and the latest LCR regulations during 2020-2022 are dominated by pharmaceutical and medical devices related regulation. Thus, the ICT and health sectors may expect more policies in the future as they continue to develop in Indonesia.

Figure 15: Share of Sectors Regulated by LCR Policies



Source: Collected from various sources

As shown in Table 7, there are currently twenty LCR policies related to telecommunications and pharmaceutical products or devices. The LCRs on telecommunications cover wireless broadband services, digital television receiver set-top boxes, Long-Term Evolution (LTE) or 4G products, LTE base stations, cellphone/handphones, laptops, tablets, internet protocol television (IPTV) set-top boxes, Digital Video Broadcasting — Second Generation Terrestrial (DVB T2) set-top boxes, Wavelength Division Multiplexing tools or devices, and digital/non-digital electronic and telematic devices. The LCRs range from 20%-70% with gradual increases for wireless broadband, digital television, LTE products, and IPTV set-top boxes. Some of these LCRs, usually those issued by the Ministry of Communication and Informatics, are mandatory in nature, presented as technical requirements for electronics producers to achieve in their operations.

Meanwhile, the LCRs on the pharmaceutical sector are fewer and less specific. Of the four LCR policies found covering the sector, only two policies specify LCR targets calculated using the government's process-based approach for health sector products. One policy requires pharmaceutical products (medicines and ingredients) to meet 50% LCR in packaging, 30% LCR in R&D, 15% LCRs in production, and 5% LCRs in packaging. The other policy requires medical equipment or devices to 80% LCRs in production and 20% LCRs in R&D.

The remaining two policies are requirements for the government to prioritize local or LCR-compliant products in government procurement and the government's official action plan for the pharmaceutical industry's development. The two presidential directives in 2021 and 2022 have been issued to promote the inclusion of local MSMEs in the government procurement process, especially in the e-catalog being developed for it. These two directives are general in their scope, but their application thus far has been experienced strongly by health sector firms which have found their listings frozen from the e-catalog, effectively barring them completely from government procurement processes which, as mentioned in section 4.3, initially allowed non-LCR products to be procured when LCR-compliant products are unavailable or do not meet quality standards or maximum price preferences. Finally, Minister of Health Regulation No. 1010 instituted since 2008 requires the distribution of imported drugs to be done by local companies and obligates these imported drugs to be produced locally within 5 years of their entry into the Indonesian market.

In short, while LCRs are generally treated as voluntary regulation to access the government procurement market, the design or implementation of LCRs in Indonesia's ICT and health sectors seem to be more obligatory in nature, preventing private market access and firm operations should foreign and local businesses fail to comply.

Table 7: Indonesia's LCR Policies Regarding the Telecommunications and Pharmaceutical Sectors

Year	Name	Sector	Summary Description
2008	Minister of Health Regulation No. 1010/2008	Pharmaceuticals	Imported pharmaceutical products can only be distributed by a registered local pharmaceutical company in Indonesia and must be produced locally within 5 years for out of patent products
2009	Minister of Communication and Informatics Regulation No. 7/2009	Telecommunications	Wireless broadband services must achieve a 30% or 40% LC level depending on whether they are a subscriber or base station respectively. LC levels must reach 50% within 5 years. Meeting LCRs is a technical required to make the product eligible for private market distribution
2013	Minister of Communication and Informatics Regulation No. 32/2013	Telecommunications	Digital television receiver devices (set-top box) must achieve a 20% LC level. LC levels must reach 50% within 5 years. Meeting LCRs is required to make the product eligible for private market distribution
2015	Minister of Communication and Informatics Regulation No. 27/2015	Telecommunications	LTE products must meet 20%-30% LCR depending of it is a subscriber or base station. By 2017, it must reach 30%-40% LCR
2016	Presidential Directive No. 6/2016	Pharmaceuticals and Medical Equipment/Devices; Government procurement	The Ministry of Health must prioritize local products and devices during government procurement. The ministry must also monitor LCR implementation in the industry
2017	Minister of Industry Regulation No. 29/2017	Telecommunications; ICT	70%, 20%, and 10% LCR for the manufacture, development, and application of handphones, laptops, and tablets. Each component's scoring is described in detail
2017	Minister of Health Regulation No. 7/2017	Pharmaceuticals and Medical Equipment/ Devices	The Ministry of Health's action plan to develop the industry to become an exporter of pharmaceutical raw materials in the future. The plan confirms Presidential Directive No. 6/2016

Year	Name	Sector	Summary Description
2017	Minister of Communication and Information Regulation No. 6/2017	Telecommunications	Internet Protocol Set-Top-Boxes must have 20% LC levels and must reach 50% in 5 years. Meeting LCRs is a technical standard required to make the product eligible for private market distribution
2019	Minister of Communication and Informatics Regulation No. 4/2019	Telecommunications	20% LCR for transmission and receiver devices for DVB-T2 Television and Internet Protocol Set-Top-Boxes. Meeting LCRs is a technical standard required to make the product eligible for private market distribution
2019	Minister of Communication and Informatics Regulation No. 9/2019	Telecommunications	Wavelength Division Multiplexing tools or devices must comply with LCRs. Meeting LCRs is a technical standard required to make the product eligible for private market distribution
2019	Minister of Communication and Informatics Regulation No. 10/2019	Telecommunications	Internet Protocol Network must comply with LCRs. Meeting LCRs is a technical standard required to make the product eligible for private market distribution
2019	Minister of Communication and Informatics Regulation No. 12/2019	Telecommunications	Obligates telecommunications providers to meet LCRs for capital and operational expenses with a calculation method specified in the regulation
2020	Minister of Industry Regulation No. 22/2020	Telecommunications	Digital electronic and telematic products must meet 70% and 30% LC levels for the manufacturing and development processes. Non-digital electronic and telematic products must instead meet 80% and 20% LC levels
2020	Minister of Industry Regulation No. 16/2020	Pharmaceuticals	The LCR score of pharmaceutical products will be calculated based on the weighted total LCR score of the products materials (50%), R&D (30%), production (15%), and packaging (5%). The calculation for each section is described in detail
2021	Presidential Directive No. 12/2021	Government Procurement	Governments must prioritize LCR-compliant and MSME products in government procurement
2021	Minister of Communication and Informatics Regulation No. 13/2021	Telecommunications	Subscriber stations must meet 30% LC levels and reach 35% LC levels six months after the issuing of this regulation. LTE base stations must meet 40% LC levels in the station's construction and maintenance. Meeting LC levels is a technical standard required to make the product eligible for private market distribution
2022	Minister of Industry Regulation No. 31/2022	Medical Equipment/ Devices	Medical equipment/devices LCRs in production (80%) and R&D (20%)
2022	Presidential Directive No. 2/2022	Government Procurement	A government-run electronic catalog promoting primarily LCR-compliant and MSME products must be established and promoted by the relevant government ministries

Source: (Limenta and Ing 2022), (Limenta and Ing 2022), (Negara 2018), (Kementerian Perindustrian Republik Indonesia 2022b), (Kementerian Perindustrian Republik Indonesia N.d.a.), and (Tai 2021).

6.3 Economic Impact of LCR Policy in ICT, Pharmacy, and Medical Equipment in Indonesia

Thus, despite the two sectors' reliance on imports for their productivity, the government has instituted LCR policies to the ICT, pharmaceutical, and medical devices industries in Indonesia. While the policy was implemented in order to reduce these sectors' reliance on imports, in the short-term it will add to the importing costs of these firms, their ability to invest in capital goods such as machinery, and reduce their productivity (World Bank 2022). High value-added manufacturing activities, including pharmaceuticals and electronics, and exporting firms are expected to face a greater increase in their production costs than their counterparts (World Bank 2022).

Moreover, in the long-term, some of these sectors are unlikely to be developed in Indonesia. Semiconductor assembly, for example, faces high barriers to entry with more than 48% of the global supply chain and 75% of global manufacturing occurring in East Asia alone (Varas et al. 2021), not to mention the concentration of R&D activities in the US and Europe (Reinsch, Benson, and Arasasingham 2022; Varas et al. 2021).

Meanwhile, Indonesia's pharmaceutical industry is consistently outperformed by countries with non-discriminatory development policies in various indicators such as the number of clinical trials or research performed and the level of employment in high-tech or R&D sectors (Pugatch Consilium 2016), even though the Ministry of Health Regulation 1010/2008 has been implemented for over a decade to promote technological transfer, local production, and R&D for innovative drugs (Martawardaya and Nugroho 2020).

To summarize, the LCR literature on the ICT and health sectors echo the general literature reviewed in the previous sections in saying that LCRs tend to add to production costs, raise consumer prices (Ewen, Kaplan, and Gedif 2016; Ewen et al. 2017), and should be considered alongside alternative or complementary policies (Beall, Kuhn, and Attaran 2015; Martawardaya N.d.; Pugatch Consilium 2016; Reinsch, Benson, and Arasasingham 2022; Varas et al. 2021; World Bank 2020). As such, it is important to take a look at how LCRs impact the performance of the ICT and health sectors in Indonesia.

6.3.1 Regression Analysis

In addition to the regression of all manufacturing data, which is discussed in the previous chapter, this study also specifically estimated similar models using only ICT, medical equipment, and pharmaceutical industries data. As shown above, these sectors are considered as having high local content ratios. We wanted to compare the impact of LCR policy on these sectors to the impact of the policy on the general manufacturing sector. In terms of specific sectoral codes, these sectors are identified as follows:

Table 8: KBLI code for ICT, Medical Equipment, and Pharmaceuticals

Industry	KBLI 2009	KBLI 2005
ICT	262	30 & 32
Medical Equipment	23122	26122
	2660	331
	325	
Pharmaceuticals	21	242

Source: Central Bureau of Statistics Indonesia

Due to SI data being limited to 2018 and 2019 and only having two-digit KBLI sectoral codes reported, we simplified the table above as follows. Firstly, the ICT industry in KBLI 2009 is coded “26”. Secondly, the Medical equipment industry in KBLI 2009 is coded “23” and “32”. Thirdly, the Pharmaceuticals industry in KBLI 2009 is coded “21”.

Table 9 shows the estimation results of the same regression model specified in chapter 5 using only ICT, medical equipment, and pharmaceutical industry data. The results indicated that LCR policy was negatively correlated with the productivity, output, export, worker productivity, and value-added of these specific manufacturing sectors.

Interestingly, the magnitude of LCR policy’s impact was different for these specific industries and the overall manufacturing sector. The productivity of ICT, medical equipment, and pharmacy industry firms was impacted twice more by LCR policy compared to the general manufacturing sector. This result may have been caused by the fact that these sectors, among others, were sectors with high local content ratios.

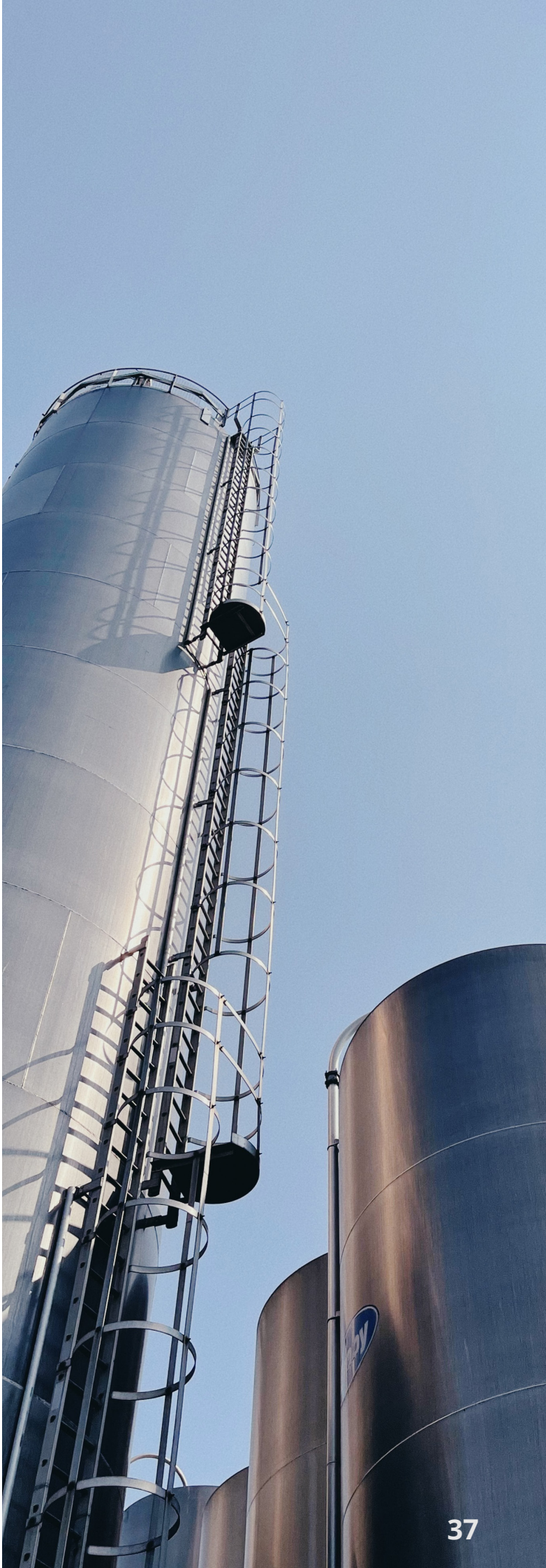


Table 9: Regression results of ICT, medical equipment, and pharmacy industries

	(1)	(2)	(3)	(4)	(5)
	ln_tfp	ln_y	ln_x	ln_l	ln_va
imp share	0.0436	0.0113	0.127	0.00181	0.0133
	(0.04)	(0.03)	(0.08)	(0.02)	(0.03)
t	0.0223	0.0249	0.0505	0.0410	-0.00653
	(0.06)	(0.06)	(0.12)	(0.03)	(0.06)
t*imp sh	-0.0016	0.0003	-0.0066	0.0003	0.0002
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
ff	1.446***	1.312***	2.176***	1.040***	1.320***
	(0.09)	(0.08)	(0.29)	(0.05)	(0.08)
fx	0.252**	0.0487		0.772***	0.146
	(0.10)	(0.11)		(0.07)	(0.10)
lcr rate	-0.00623***	-0.0037*	-0.0185***	-0.0087***	-0.0057***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
_cons	15.47***	18.07***	0.784	3.645***	18.01***
	(1.245)	(1.21)	(2.31)	(0.57)	(1.13)
N	3473	6439	6439	6439	6439
R^2	0.188	0.131	0.033	0.221	0.153

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

6.3.2 CGE Model

In addition to the sectoral ex-post analysis above, we also conducted an ex-ante analysis to estimate the potential macroeconomic impacts of the most recent LCR policy, which have not been captured yet in the existing available data. Input-Output based CGE model was used in this analysis to estimate the impact of LCR policy in the selected industries, i.e.: ICT, pharmaceuticals, and medical equipment industries.

Computable General Equilibrium (CGE) is a model that specializes in the ability of analyzing the impact of changes in certain economic variables on other dependent variables. The CGE model can identify, simulate, and jointly analyze the impact of the implementation of one or more economic policies on economic conditions at the macro and sectoral levels based on a microeconomic structural basis.

CGE models are flexible and can be used to simultaneously estimate direct and indirect impacts an industry variable has on labor supply, government budgets, production, and total consumption. For instance, using the inter-regional CGE model, Yusuf (2019) estimated that the adoption of new technology has the potential to enhance Indonesia's GDP growth by up to 11% between 2020 and 2040.

The CSIS (2022) study also used the CGE model to find that using cloud computing in the public sector has the potential to increase GDP by 0.37 percentage points in Indonesia. Multi-sectoral CGE models have the capacity to undertake broader macroeconomic policy analyses and capture behavior changes for firms and consumers. Thus, CGE models are ideally suited to analyzing the impact of LCR policy in Indonesia.

Many LCRs are defined as a percentage share of inputs and are assumed to affect imports only when a specific LCR is binding. The underlying assumption of the model is that the company's observed intermediate input use is based on optimal allocation at given prices, and thus it will change this input allocation only if prices change or if it is required to because of the LCR policy put in place.

The policy is not binding as long as a company is already fulfilling the LCR. For example, if the current local content in inputs is 60% and the related LCR is 50%, there will be no need to adjust the composition of imported and domestically produced intermediate inputs.

When the LCR becomes binding – for example if the current local content in inputs is 40% and the related LCR is 50% – the company must reduce its use of imports and increase its inputs sourced domestically to a minimum of 50%.

We used the constructed 2016 CGE based Input-Output table and adjusted it into 45 sectors to meet the objective and scope of the research (details regarding the disaggregated sectors used in this study can be seen in the appendix 1.2). In addition, we use the import substitution document from the Strategic Plan of the Ministry of Industry 2020–2024 as a proxy of LCR policy in Indonesia. This document was made in relation to the recently announced Indonesian government's objective of reaching an average 40% local content ratio 2024.

To analyze the impact of LCR on Indonesia's economy (including but not limited to manufacturing sector for healthcare and ICT sector), the following simulations of the CGE model were carried out:

1. Simulation of a Decrease on imports of input for ICT products, pharmaceuticals and medical equipment due to LCR Policy Implementation

2. Simulation of an Increase on investment of input in ICT products, pharmaceuticals and medical equipment

3. Simulation of an Increase on productivity of input in ICT products, pharmaceuticals and medical equipment

These three different scenarios were run in order to do a comparative analysis on the effects of the three different policy interventions (details regarding these three simulations can be seen in the appendix). We used the targets set in the Ministry of Industry's Strategic Plan as a basis for the reduction of imports in the first simulation and the increase in investment in the second simulation. For the third simulation, we used the average growth of national productivity to simplify the shock of a productivity increase in our selected sectors.

Since the LCR policy will have a higher influence on the upstream industry than on the downstream industry, the simulations were run for the input of ICT, pharmaceuticals, and also medical equipment industries. Three industries with the strongest backward linkage to the ICT, pharmaceutical, and medical equipment sectors each were chosen as the input sector (see table below).

Table 10. Highest backwards linkage industry

No.	ICT	Pharmaceuticals	Medical Equipment
1	Non Metal Product	Basic Chemical	Machinery & Equipment
2	Iron & metal products	Chemical Product	Iron & metal products
3	Machinery & Equipment	Other Chemical	Electronics products

Source: Indonesia I-O Table

Simulation of the Impact of LCR policy on Indonesia's Macroeconomy

In the first CGE simulation, an LCR policy on the chosen goods (ICT, pharmaceuticals, and medical equipment) would decrease GDP growth by 0.025%. This result is consistent with the theory developed by Grossman (1981). This drop in GDP may be attributed, in large part, to a general fall in the quantity of production from industrial sectors. Due to the significant use of imported inputs in these three industries, domestic input producers would be unable to make up for the gap created by the lack of imported inputs.

Additionally, the simulation discovered a drop in exports of up to 0.17%, suggesting that LCR policy and the reduction of imports may not immediately make it easier for Indonesian products to penetrate foreign markets or enter global value chains. In addition, the simulation's findings also demonstrated that investment stagnated after the LCR policy was introduced. This would be another reason why LCR policy would fail to develop the local industries.

These results are complemented by FGD findings conducted with the private sector. The adoption of LCR policy, at a time when the ICT and health industries are still largely reliant on imports for inputs, triggered uncertainty in Indonesia's investment climate. This affected how corporations make their investments in Indonesia, with some even opting to reduce the scale of their businesses rather than increase them.

In the second CGE simulation, we examined the impact of increasing investment in the ICT, pharmaceutical, and medical equipment industries' three major input goods. Increasing investment based on government targets could reduce imports by 0.25 percent, an intriguing conclusion. Investments in the upstream sector would improve domestic input capacity and decrease reliance on imported goods.

As a result, capacity expansion in the domestic input industry contributed to a 0.01% increase in GDP. These results suggest that policies designed to promote investment may be more successful than policies restricting imports, as implemented through LCR policy. This is mainly due to the former's ability in lowering the economy's reliance on imported inputs while simultaneously fostering industrial growth.

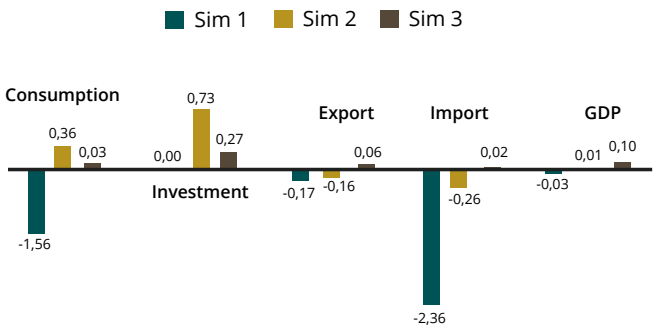
The third scenario analyzes the potential impact of productivity increases in the ICT, medicines, and medical equipment sectors. It revealed that an increase in input sector productivity would boost GDP growth by 0.097 percentage points. Furthermore, greater productivity in the input industry could help make Indonesia's ICT and health industries more competitive by raising exports by 0.058%.

This outcome is reminiscent of Japan and South Korea's developmental history in which they achieved industrial growth by importing advanced technology from abroad to boost production efficiency locally, eventually transitioning the economy from import substitution-oriented to being export-oriented (Aswicahyono, Basri, and Hill, 2000).

Following all these, it is clear that Indonesia only limiting imports and implementing LCR policy, as specified in the first simulation, would only negatively impact its GDP. In contrast, alternative methods of industrial development, such as boosting investment and productivity in the upstream sector, have better chance of helping Indonesia achieve its industrial goals, expand its contribution to global value chains, and accelerate its economic growth.

According to Belderbos and Sleuwaegen (1997), a competitive input industry is a prerequisite for the success of LCR policy. Therefore, should Indonesia choose to continue its LCR policy, various supplementary policies to promote investment and increase productivity would still be required, e.g. tax breaks, human resource development programs, mutually lucrative technology transfer schemes, etc.

Figure 16. The impacts of LCR on Indonesia's Macroeconomy



Source: Ministry of Industry (2022)

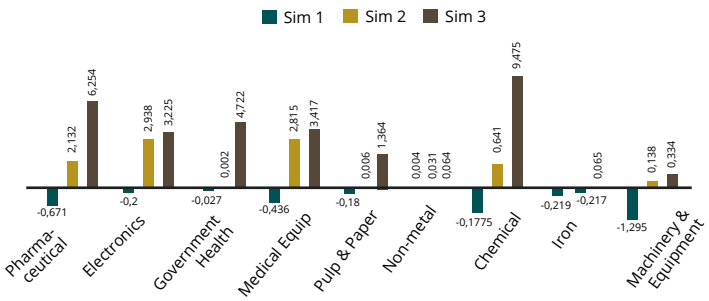
Simulation of the impact of LCR Policy on Sectoral Output

This section examines the impact of the LCR policy on sectoral output in further detail. The graphic below demonstrates how the upstream industry's output will decline due to LCR policy. The chemical and machinery & equipment industries were the two industries experiencing the greatest drop, 1.8% and 1.3% respectively. Without supplementary policies for investment and productivity accompanying LCR, it will be extremely difficult for the upstream industry to flourish, resulting in a decline in the output of final products in the downstream industry.

In the second and third simulations, policies designed to boost investment and productivity were present. Consequently, there will be a beneficial influence on industrial outputs if the policy focuses more on strategic efforts to raise the performance of the domestic sector rather than imposing LCR policy. These steps should be taken in order to increase the competitiveness of the local industry. This favorable effect is not only observed in the upstream business, but also in the downstream industry (ICT, pharmaceuticals, and medical equipment).

Given the aforementioned findings, we believe that policies excessively restricting the use of imported inputs may have a negative impact on the industrial performance of a company, particularly in industries with a large proportion of imported inputs. Adopting more stringent LCR policies will only raise the cost of inputs for local businesses, which will lead to a decline in output of final goods. The objective of fostering industries can only be met if LCR policy is accompanied by a number of additional policies that boost the competitiveness of local industry.

Figure 17. The impacts of LCR on Sectoral Output



Source: Ministry of Industry (2022)

7 Problems in LCR Policy Implementation in Indonesia

One of the objectives of the LCR policies carried out by the Indonesian government was to support and develop local production. However, the narrative brought in the public discourse was how the LCR policy used as a tool to reduce imports and also improve trade balance. How effective is implementation of the LCR strategy in achieving these objectives? What difficulties have been encountered in the implementation of the LCR policy?

As it has been discussed in the previous chapter, according to our quantitative modelling, LCR policy has not really supported Indonesia's industrial development and instead may very likely undermine economic growth. This research shows that the LCR policy is linked to decreased productivity from manufacturing firms, which in turn lowers the competitiveness of firms in Indonesia. In addition, investment prospects in Indonesia might be hampered by the sector's lack of competitiveness.

FDI data in pharmaceuticals industry shows a downward trend due to the requirement to produce imported pharmaceuticals locally after a given length of time. Moreover, the reduction in company productivity has an effect on Indonesia's macroeconomic level. The CGE simulation demonstrates that the LCR policy has the ability to diminish the Indonesian GDP by 0.025%. Another point made by the research is that LCR policies don't always succeed in its intended purpose of lowering imports. This is seen by the rising trend of importing electrical components used in the electronics sector.

In this section, we will apply Kuntze and Moerenhout's (2013) framework to identify the problems or issues that may be responsible for Indonesia's LCR policy's results. Stakeholders from the public and private ICT and health sectors were consulted through focus group discussions (FGDs) and interviews in the process of identifying these issues. Using focus groups and interviews, we were able to identify a handful of obstacles that have prevented LCR from being fully effective in Indonesia.

These included: a lack of clarity on the policy's intended objectives; an inability to accurately map the country's economic potential; a lack of performance-linked monitoring and assessment; the presence of possible rent-seeking activities; and an absence of the local industrial ecosystem's requisite conditions.

7.1 Unclear Objectives for Indonesia's LCR Program

The perceived lack of clarity in the Indonesian LCR policy's stated goals is one issue that needs to be brought to attention. A lack of well-defined policy objectives in the design of LCR or any industrial policy could generate what Kuntze and Moerenhout (2013) mentioned as "unintended consequences" during the policy's implementation. It could lead to a failure in accomplishing the country's industrial development goals and, at its worst, damage broader parts of its economy beyond the industrial sector or the industries initially targeted.

Indonesian LCR policy is currently being presented as a cure-all for a variety of Indonesia's economic objectives and challenges. The narrative frequently being espoused by government officials is that LCR policy will build local industry independence and resilience, minimize reliance on imports, and maximize the benefits of government procurement funds by ensuring it is circulated domestically. From the president to its ministries, the Indonesian government has made it clear that they have high expectations for the LCR policy's success and are committed to its implementation.

The reality, however, is that LCR policy is not the answer to all of Indonesia's industrial ambitions, and it must be supplemented by other policies. In an attempt to reduce final goods imports, the government has ended up raising the number of intermediate goods imports as previously shown in section 6.1, and responding by once again restricting imports of technologically complex inputs necessary for production could generate further unintended consequences, e.g. for industrial output or productivity.

If the government wants to improve its trade balance and reduce imports, there are several other policy options that are more transparent and easily measurable, such as establishing import duties or providing export training programs and facilitation services. If the government wants to promote industrial competitiveness, productivity, value-added, and innovation, it should consider fiscal or non-fiscal incentives promoting R&D, scaling up industrial operations, or workforce development.

Setting LCR targets could very well be a means of maximizing the effectiveness of procurement funds circulation for domestic firms, but it seems unlikely that LCR policies on their own could achieve other objectives such as building domestic firm competitiveness or integrate them into the global value chain. The government needs to look at their industrial development objectives separately and then design the appropriate policy instruments to meet these objectives, assigning one policy for one objective. The government should not be beholden to LCRs or any one policy instrument to the detriment of its ultimate goals.

7.2 Inadequate Mapping of Indonesia's Economic Potential and Industrial Characteristics

The absence of industrial mapping prior to the formulation of LCR policies and targets is another aspect of the implementation of LCR in Indonesia worth mentioning. Indonesia's LCR is currently being implemented almost uniformly across the board with no regard for Indonesia's comparative advantage, and this poses a problem given how Kuntze and Moerenhout (2013) have cited adaptability as one of many important elements in designing and implementing LCR policies.

The economic costs associated with the implementation of LCR in industries lacking a comparative advantage will be very costly, and even if these endeavors were to end successfully in the long run, the opportunity costs that will be incurred will be too high since the government would have lost the opportunity to use the same amount of time and resources in the creation of other goods and services that Indonesia has a greater competitive advantage in the international market.

However, without a clear map illustrating the existing conditions and potential of Indonesia's domestic industries, it will be challenging for the government to successfully implement LCR policy that is feasible and appropriate to existing industrial capabilities.

Designing a policy timeline based on industrial mapping is important for effectively implementing LCR policy. Industries with comparative advantages and potential in terms of ecosystem and resources (e.g. low-tech, labor-intensive medical equipment) could be emphasized more during the first phases of LCR, and the short-term LCR targets for these comparatively advantageous industries should be set accordingly so that firms are not overburdened but also underchallenged.

Meanwhile, sectors that are not within Indonesia's comparative advantage (e.g. high-tech, high-skilled medical equipment) but still deemed strategic by the government could be subjected to LCR at a later date or given an appropriate transitional period to allow the local industry to improve. In determining these targets and timeline, cooperation with the private sector would prove essential given that they are the stakeholders who know best what industrial conditions and production activities look like currently (Kuntze and Moerenhout 2013; Stone, Messent, and Flaig 2015).

Box 1. The Case of High-Tech Medical Devices and Microchips in Indonesia

Indonesia's vision of creating high-tech medical devices by 2025 exemplifies a lack of adequate planning and industrial mapping in its LCR policy. Indonesia is a net importer of advanced medical equipment; several items, such as MRI and CT-scan devices, cannot be made locally. Massive resources in terms of technology, human resources, and financial investment will be required to be able to develop these technologies that Indonesia does not have a competitive advantage in. According to the Fiscal Policy Agency (BKF) of the Ministry of Finance's estimates, the R&D expenses for a single piece of high-tech medical equipment may surpass USD 20 million. Consequently, based on a cost comparison study, the plan is likely to incur disproportionately high costs in relation to its uncertain result.

Another illustration of this would be high-tech electronic products such as semiconductor microchips. Taiwan, China, and South Korea are the current manufacturers of this technology. Indonesia's intention to create its own microchips will need a substantial investment, as the ecosystem has not yet been established and microchips are not a product for which Indonesia has a latent competitive advantage. Therefore, the opportunity cost of making microchips will be quite high.

The significance of industrial mapping extends beyond identifying which industry is a priority for adopting LCR measures. Determining and applying the proper calculation pattern for the LCR formula requires the identification of industrial characteristics as well. Applying the same pattern of LCR calculations across all industries will instead impede the industry's ability to meet stipulated LCR objectives and once again create unintended negative repercussions for the sector's industrial development.

The high-tech sector is one industry that needs a specialized LCR calculating method. In the high-tech industry, which the Indonesian government has identified as important for moving up the industrial value-chain, innovation and knowledge transfer play a larger role than manufacturing and assembly activities as is common in low-tech industries. Consequently, the pattern of cost-based calculations most common in Indonesian LCRs is unsuitable for the high-tech industries since it applies more emphasis on measuring local inputs or value-added in manufacturing and assembly activities rather than the R&D activities the industry specializes in or even solely focuses on. The emphasis of the formula for calculating LCR in these industries, then, must be based on research and development components and capacity building programs.

R&D and capacity building initiatives play an essential role, particularly as a form of long-term investment in the country. Nonetheless, in current age of globalization, the components of R&D activities are frequently undervalued, given that they may be conducted anywhere. On the other hand, the formula for assessing local content is very complex and cannot be applied across all industries. As a result, it is critical to examine the features of each industry in formulating the appropriate local content formula for each industry.

Box 2. Strengthening Ecosystem through Capacity Building

Apple Academy is a thriving illustration of the R&D-based LCR calculation method in use in Indonesia. Apple Academy seeks to facilitate and build an ecosystem through knowledge transfer in Indonesia especially in the areas of software development. With the growing importance of software as an input for ICT, it is believed that focusing more on the sector may increase the number of Indonesian enterprises joining the value chains of technological corporations in the future.

Similar to Apple Academy, Pfizer has also initiated a capacity building program called HigherHeight to support the health sectors in Indonesia. Focusing more on medical biotechnology, the program allowed both students and lecturers to have opportunities to connect with national and global research communities. In the future, the methodology for determining local content based on R&D must be widened and expanded, particularly in the context of high-tech sectors, in order to facilitate the focused growth of the domestic industry.

7.3 The Absence of Performance-Linked and Thorough Assessment and Review on LCR Policy

A third issue that needs to be addressed is the need for thorough assessment and review of its implementation. China and India's experience working with LCR policy involved the monitoring of the targeted industry and market performance before moving on to the next phase of their policy or setting new LCR or production targets (Kuntze and Moerenhout 2013; Johnson 2013). Without the presence of a policy assessment and review process, it will be hard to tell if the LCR policy being implemented still in line with the industrial development objectives or still applicable to the constantly changing conditions of the target industry.

According to FGD participants from the private sector, the government lacks effective and relevant policy indicators for assessing and reviewing whether the implementation of its LCR policy is on the right track to achieve its perceived economic objectives. FGD participants from the government, in turn, answered that the only indicators currently implemented by the government are the volume of imports and the number of LCR certificates issued.

As previously mentioned in section 7.1, these two metrics fall short in gauging the LCR program's performance in fostering domestic industry growth, e.g. in measuring industry productivity, innovativeness, or competitiveness. There is a need for improved market and criterion-based performance measures, such as export volume or cost-per-product productivity, in assessing the impact of LCR policy implementation so that it may align more with industrial development objectives.

LCR policies, similar to other industrial policy, are meant to be temporary protection or support for local input industries, so "sunset provisions" are often set which stipulate the conditions under which a policy intervention would be gradually phased out when the defined performance requirements have been reached. South Korea is an example of a country that has used this sunset strategy in its policy initiatives.

However, the FGD with government participants revealed that no such provision is set in the present LCR policy framework. In addition, policy assessment and review will also be helpful in determining the real or opportunity costs of LCR policy implementation as mentioned in section 7.2, and it could very well be used to determine whether or not the policy in question should be continued, improved upon, or discontinued.

In short, LCR policies require regular assessment and review not only to determine whether the policy's final goal has been achieved, but also to ensure its interim goal has been achieved when moving from one phase of implementation to another. However, it will be difficult to do so without clear indicators for the policy.

7.4 Potential Rent Seeking and Fiscal Leakage

There is a potential for rent-seeking with practically every policy intervention, but this is particularly true with measures that require license or certification and those that provide preferential treatment. Although Kuntze and Moerenhout (2013) and Stone, Messent, and Flaig (2015) encouraged public-private cooperation in the implementation of LCR, Weiss (2016) and Pursell (2001) also warned that such cooperation in LCR implementation could also lead to rent-seeking, regulatory capture, and corruption. Indeed, one of the reasons for the failure of the LCR strategy in the Australian automotive industry is the high transaction costs due to the lobbying of firms trying to escape excessive LCR restrictions or ensure those restrictions remained on their competitors (Pursell 2001).

In Indonesia's LCR, one element in need of attention is the formula for calculating LCR. Three LCR calculation methods exist in Indonesia, namely cost-based, product-based, and process-based approaches, and according to the results of private sector FGD, the calculating procedure for local content is still occasionally unclear. For example, a more detailed description of the calculation for research and development indicators in process based LCR is needed. Research and development projects often span many years and include a significant amount of trial and error, as well as the possibility of the project being unsuccessful, but there is no clear explanation regarding which of these elements can be included in calculating local R&D in a firm's LCR.

Uncertainties in R&D and other elements of LCR calculation provide potential loopholes for rent-seeking or human error when providing local content certification. Indonesia currently only has two surveyor agencies assigned to evaluate the local content levels of millions of firms seeking certification to gain access to government procurement or, in some sectors, to gain access to the market as a whole.

This concentrated responsibility given to the surveyors and the strong motives provided to firms seeking certification provides an opportunity for collusion, to the detriment of the government's finances or industrial development goals. Even in the case of human error, which is likely given how few surveyors are assigned to the task of certifying Indonesia's private sector, the government will still find itself vulnerable to state financial losses and fiscal leakage.

Our FGDs have already revealed, for instance, that there are several cases where a product that is truly imported is treated as if it were made in Indonesia just because its supplier is situated there. Outside of the issue of certification, there is also an increased likelihood of input materials imported from the black market to make up for the gap in inputs available domestically. In this scenario, the circulation of government procurement funds intended for locally manufactured items would not be realized, and the LCR will also fail to accomplish its purpose of reducing reliance on imported commodities.

7.5 The Long-Term Need to Develop Indonesia's Local Industrial Ecosystem in Indonesia

During the FGD sessions, participants identified a variety of other factors that hindered their ability to increase their local content levels to meet government-set targets. Ranging from input availability, human resources, infrastructure, and innovation policy, these factors were broad in their scope and refer to matters regarding Indonesia's industrial ecosystem rather than LCRs *per se.*

Nevertheless, as previously mentioned in section 7.1, LCR policy on its own is not capable of encouraging industrial development even as it retains its essential role in promoting the circulation of government procurement funds locally. Improving Indonesia's industrial ecosystem is important for not only helping firms meet LCR targets but also promoting industrial development, and insofar as industrial development was one of the original objectives behind LCR policy's implementation, it would be prudent for these broader issues regarding the industrial ecosystem to be discussed in this paper.

The first matter to address, and the most related to LCR policy, is the availability of local inputs for production. To comply with LCR policy, downstream companies need to substitute their input materials for production from local sources in the relevant upstream industries. However, local and foreign input materials are not always perfectly substitutable.

For domestic firms to participate in or join the current manufacturing chain, they must meet a number of production standards which have been established by firms in order to preserve product quality, including its ability to be replaceable. Should Indonesian-based firms choose to use local inputs and compromise with these standards, the quality of goods and services produced would deteriorate and primarily hurt consumers. In some cases, local production could halt entirely.

Asides from quality, another factor to consider is price. The cost of producing finished goods will increase if the input goods are of the same quality as their imported counterparts but have a higher price tag attached to them. Consequently, customers will incur increased expenses for final products, eventually resulting in reduced market demand and sales overall.

Thus, before implementing LCR policy the government must ensure that the domestic industry, specifically input producers upstream, is ready to meet basic standards for input production enough to ensure that local production will not be disrupted by the transition in input procurement. Then, although an increase in consumer prices is inevitable when implementing LCR policy, the government must also ensure that the domestic upstream industry is capable of meeting production standards without generating excessive price hikes for consumers and dampening the overall market. The government is already following this policy in setting a maximum price preference of 25% in public procurement and should consider a similar policy when enforcing LCR in specific parts of the private sector.

Box 3. Incorporating Consumer Needs in Industrial Policy Design

Consumers are often forgotten in the designing of industrial policy even though they are the stakeholders who are the most impacted by the effects of LCR policy. Based on the information we obtained from our FGDs, there is a real difference in quality between imported and domestically produced syringe needles. Even though they are cheaper, health workers often prefer to use imported syringe needles because they are of better quality and less painful for their patients. The need to remember or even emphasize consumer needs is also one of the keys in building industrial policy framework in general.

Naturally, there are many factors at play in determining the quality and price of domestic inputs, and the government will have to work on tackling these issues, many of which are beyond the scope of LCR policies. One such factor mentioned are the quantity and quality of Indonesia's human resources. The PISA scores of Indonesian students in mathematics, reading, and science fall below the global average, and when compared to its Southeast Asian neighbors, Indonesia's score is significantly lower than that of Singapore, Malaysia, Brunei Darussalam, and Thailand.

In addition, according to QS ranking, there are only four Indonesian colleges within the top 500 in the discipline of Engineering and Technology. Both upstream and downstream firms in Indonesia are already having difficulty incorporating local elements in existing manufacturing activities, let alone invest in R&D or scaling up production, so the development of Indonesia's human resources and education system will remain an enduring component in Indonesia's economic and industrial development.

Infrastructure and logistics are also important factors for a nation's industrial competitiveness, and inadequate infrastructure will add to the increase in product prices consumers already have to bear due to LCR, ultimately making domestic goods more expensive than international counterparts. Indonesia was ranked 51 in the 2018 Logistics Performance Index (LPI) report, well behind neighboring nations such as Singapore (5), Thailand (34) and Malaysia (35). The customs sub-sector received the lowest score. Despite various initiatives to shorten the docking time of cargo vessels through expedited procedures and green line systems, the actual time necessary for goods to enter or leave the port remains relatively long, e.g. imported products on average require four days to leave the port. Additionally, the limited number of available containers relative to the volume of trade frequently delays the delivery of goods.

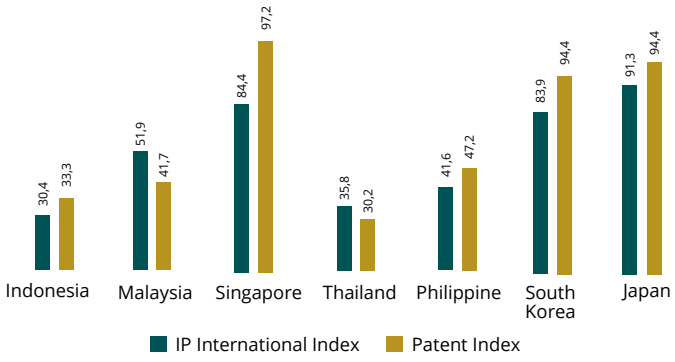
Box 4. The Absence of Adequate Lab Production in Indonesia

Aside from basic infrastructure, supporting infrastructure for domestic R&D also represents an important element that needs to be prepared before implementing LCR policy. One example of how Indonesia is lacking supporting infrastructure is the presence of production labs for pharmaceutical drugs in Indonesia. As of now, there are only 19 testing labs that are available for pharmaceutical production in Indonesia. This lack of testing labs becomes one of the factors impeding innovation and the creation of Indonesian medicines. Without the presence of a good ecosystem, including the presence of testing labs, developing Indonesia's domestic pharmaceutical industry will be a challenging endeavour.

A further obstacle in the way of enhancing regional industrial ecosystems is Indonesia's innovation policy. In 2020, the World Bank estimates that Indonesia's research and development expenditures account for only 0.28 percent of GDP. In contrast, developed nations, like China, Japan, and South Korea, devote more than 2% of their gross domestic product on research. The need to invest in research and development (R&D) is a fundamental prerequisite to sustaining, if not accelerating, the growth of Indonesia's economy.

Intellectual property rights (IPR) are also a significant obstacle to innovation in Indonesia. The assurance provided by strong IPR regulation is a major factor in motivating foreign corporations to collaborate with local firms and conduct R&D in Indonesia, contributing to the nation's industrial upgrading. According to international rankings, the value of Indonesia's worldwide IP index and the subcomponents pertaining to Indonesian patents continue to lag behind even those of neighboring countries. One of the primary problems keeping Indonesia's ratings poor is that its patent standards deviate from international norms and firms are often required to manufacture domestically. In order to attract more FDI and innovation, Indonesia must enhance and strengthen its patenting environment.

Figure 18. International IP and Patent Index 2022 (in %)



Source: US Chamber of Commerce (2022)

Finally, despite government efforts to increase coordination as mentioned in section 4.2, Indonesia's LCR policy was mentioned to be lacking coordination with other non-LCR but adjacent or related policies. Two policies regarding the electronics sector, for example, were discussed in detail during one of the FGDs.

In 2017, the Ministry of Industry established mandatory LCR targets for the local industry to meet for a variety of electronic products, including mobile phones, PCs, and tablets. However, while import duties and taxes are levied on components used in the electronic sector's production (presumably to encourage the use of local inputs in production and raise LCR targets), import duties were, at the same time, not imposed on imported, finished electronic goods.

Local downstream firms were then given perverse incentives to sell imported electronics in the Indonesian market while simultaneously exporting locally produced electronics abroad. This is a clear example of poor policy design not of the LCR per se but of the policy mix as a whole which was similarly observed in India's solar panel case (Johnson 2013).

Indonesia's trade and taxation policies need to be aligned with Indonesia's LCR policy or industrial policy goals in general. In this instance, domestic industrial development policy initiatives might benefit from a more lenient trade policy. By lowering tariff and non-tariff barriers, domestic industries may acquire crucial, non-substitutable inputs for production at their cheapest, most competitive prices.

Furthermore, eliminating trade barriers in general may also be a necessary means of promoting the introduction of new, advanced technologies that are still not able to be manufactured in Indonesia, hence expediting domestic innovation through tacit knowledge transfer. In addition, the government needs to implement a productivity linked incentive program to encourage businesses to boost their output and productivity, which in turn will help to draw in more foreign direct investment and further domestic industry growth.

8 Policy Recommendation

LCR policy has become a part of industrial development policy implemented by Indonesia from year to year. Nonetheless, our study demonstrates that the LCR policy frequently falls short of its intended purpose of fostering the growth of local industry. These results are also consistent with prior research (Grossman, 1981; Belberdos & Sleuwaegen, 1997; Stone, Messent, & Flaig, 2015; Deringer et al., 2018).

Using Ministry of Industry statistics on the proportion of local content, this study concludes that local content is associated with lower levels of firm production in general. The decrease in the company's output is the result of downstream businesses being obliged to employ inputs from less competitive local upstream companies, resulting in a decline in downstream industrial output. Utilizing inputs from less competitive upstream enterprises has diminished the competitiveness of Indonesian businesses in general. In the end, this will make it more challenging for Indonesian firms to compete with international firms, especially in terms of entering the global value chain.

Additionally, the objective of limiting imports through the LCR policy is frequently not met. While it was true that imports of final goods of electronic devices have declined, the value of imports components for electronic devices increased over time as stated in the preceding section.

Looking at the adverse impact resulting from the LCR policy, this study also attempts to uncover a variety of variables that have led to the ineffectiveness of the LCR policy in Indonesia. The first involves the government's role in spotting issues in industrial development and determining how to address them. Any action taken in the name of policymaking must be in response to a well-defined issue. In the meanwhile, the present LCR strategy appears to be utilized to address a variety of existing issues, including industrial development, raising added value, improving trade balance, etc.

A second issue is the blanket implementation of LCR in industry, which does not take into account the specific opportunities and characteristics of the Indonesian industry. Aside from this, there is also no defined monitoring and assessment program based on industry performance, such as productivity and exports, as better indicators of the domestic sector's progress. Last but not least, Indonesia's industrial environment in general has struggled to promote industrial growth and attract foreign direct investment.

Examining some of the obstacles posed by the LCR policy, one of the most intriguing findings of this study is how important it is to keep exploring alternative policies to promote competitiveness and boost industrial productivity in Indonesia. Throughout simulations numbers two and three of the CGE model of this study, efforts to increase FDI attractiveness and productivity must be prioritized by the government in order to promote industrial strengthening, competitiveness, and national economic growth. In the meantime, LCR policies are not always successful in luring investors and boosting economic growth (simulation one).

In light of these difficulties and by exploring alternative industrial policies, this chapter will discuss further how the government must take the strategic measures to minimize the policy's negative effects on the economy, allowing this industrial policy intervention to be implemented and ultimately promote domestic industry growth, boost productivity, and bolster Indonesia's economy.

8.1 Revisiting LCR Policy

8.1.1 The needs for Industrial Mapping Prior to the Policy Making Process

It is quite natural that every country will undertake a number of measures to increase the added value of its domestic industries. LCR policy or legislation compelling firms to use domestic resources for raw materials, employment, R&D, and other purposes is an example of such intervention. As good as this policy is meant to be, there are a lot of considerations that must be made to ensure its success. For instance, the implications of this policy will vary greatly from sector to sector due to the unique characteristics of each industry. Therefore, the LCR strategy cannot be widely implemented across all industries.

The competitiveness of a country is the first factor to examine. To increase the effectiveness of the LCR policy, interventions can be done in industries with a high level of upstream competitiveness. When import substitution takes place in these industries, the degree of competitiveness at the downstream level will not diminish much. As a result, there won't be a major change in the final product's quality or price. Considering the little change in the quality and specifications of raw commodities, worker productivity will not decline as well.

In addition, the characteristics of the industry must be considered while determining the local content calculation method. In the context of a high-tech or innovation-focused industry, the R&D component of determining local content must be prioritized above the raw materials calculation component. As a result, the LCR strategy may also promote innovation and development within the sector.

The second stage is to consider the structure of the industry. Before adopting LCR policy, it is necessary to examine the number of market players and the size of the Indonesian market. In the context of a small market, it will be difficult for local businesses to acquire the minimal scale necessary for self-production. For example, Indonesia's pharmaceutical industry represents barely 0.7% of world commerce (ASPAKI, 2021).

It will be futile to implement an LCR policy under such circumstances since if local industrial circumstances are forced to function in a limited market, it will be impossible for businesses to attain economies of scale. This strategy will ultimately leave the company uncompetitive. Without proper mapping in place for LCR rules, this policy action will simply serve to further reduce the domestic industry's appeal to potential investors and may even cause some to reconsider doing business in Indonesia altogether. Furthermore, the LCR strategy is not going to be successful in fostering industrial growth unless capital is invested.

Therefore, it is essential that the Ministry of Industry and the Ministry of Trade collaborate to create a roadmap for the Indonesian industry. The aim of this mapping process is to identify Indonesian industries that provide comparative advantages relative to foreign competitors, have access to sufficient infrastructure and qualified labor, and operate in a growing and stable market.

After that, the information obtained from this industrial mapping will then be used as a reference by each technical ministry when formulating LCR policies before any industrial-related regulations are issued. Thus, every policy decision is based on robust information regarding industrial potential, free from any unrelated problems and considerations such as political interests. Consequently, industrial development strategies will be more quantifiable and more effective, particularly for accomplishing industrial development goals such as achieving greater productivity.

8.1.2 Build a Clear, Transparent, and Performance Linked Policy Assessment and Review

Assessing and reviewing the program is necessary for establishing whether policy objectives have been accomplished and to measures the effectiveness of program interventions. Regrettably, the government has not yet implemented a transparent mechanism to assess whether the implementation of its LCR policy has been aligned with its original policy objectives.

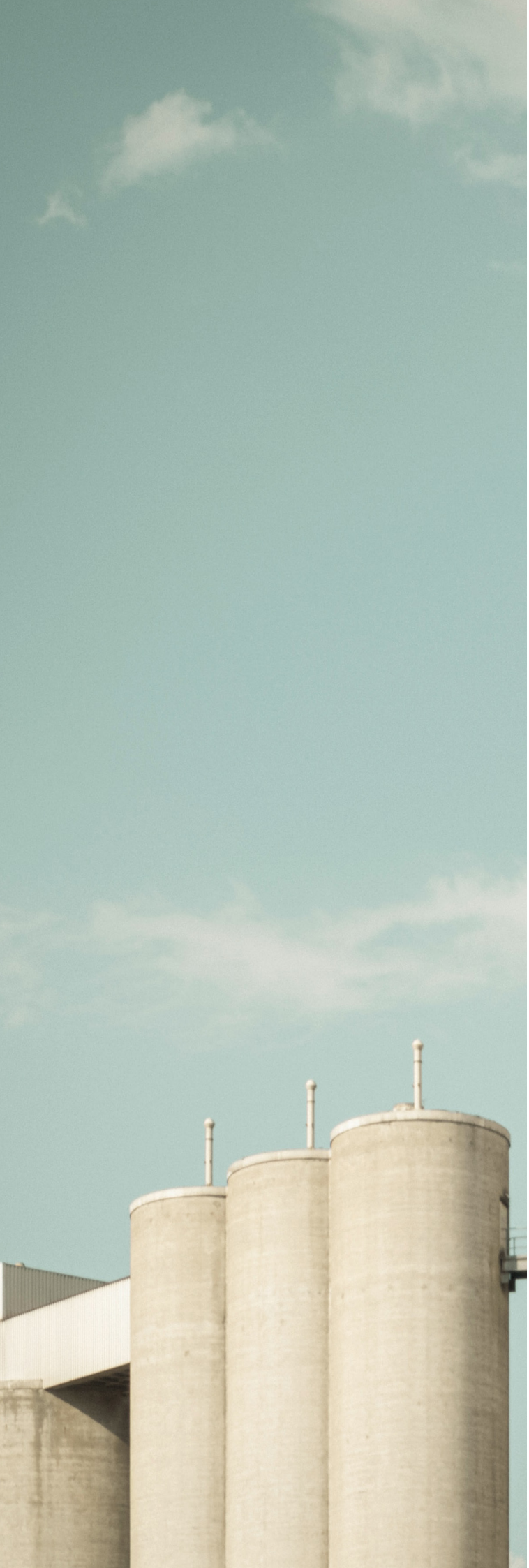
Thus far, the government only uses the value of imports and domestic output as a metric to assess the performance of its LCR policy. Meanwhile, reviewing process of LCR policy must take into account the impacts on other more important indicators, including productivity, job creation, FDI, innovation and technological diffusion, and involvement in global value chains (export). Similarly, customer-related indicators (such as item quality and pricing) are also an important aspects that have rarely been mentioned in the context of developing this approach.

As has been done in a number of other countries such as South Korea and India, the Indonesian Ministry of Industry in collaboration with Ministry of Finance must develop several stages of implementation plan for the LCR strategy. As a tool for program assessment, the Ministry of Industry must set sound economic indicators that align with the aims of developing the domestic industry in each of these phases/stages.

Productivity, exports, FDI, and employment are only few of the factors that should be primarily considered. If these indicators are not met during the first period, then the LCR policy needs further assessment. Does the LCR policy require more stringent supervision, improved infrastructure, or other industrial policies that might be the key to the program's success? Once the goals of the designated indicators have been met, the LCR policy can be terminated ("sunset policy") as the domestic industry does not require involvement in later phases.

8.2 Prioritize Strengthening and Developing Local Industrial Ecosystems

As mentioned in the preceding sections, LCR policy does not always have a favorable effect on the economy. This study also showed that LCR policy also has the potential to reduce GDP by 0.025 percentage points. In addition, the authors acknowledge that the immature state of local industrial ecosystems contributes to the unfavorable economic effects of the LCR. Without empowering these ecosystems, LCR policy as a means for promoting economic expansion will fail.



To support domestic industry, there are a number of fundamental concerns that must be addressed, beginning with the formation of a healthy ecosystem. Findings from the CGE model (2nd and 3rd scenarios) employed in this research highlight the importance of foreign direct investment (FDI) and productivity in driving growth in Indonesia's domestic economy. It has been estimated that a ten percent increase in upstream investment would add 0.01 percentage point to GDP growth. In order to attract more foreign direct investment (FDI) and foster the growth of Indonesia's local industry, the LCR policy has to be accompanied with reforms to the country's industrial environment.

The first concern is pertaining logistics. Transformative measures are necessary to strengthen Indonesia's infrastructure by constructing better connectivity between raw material hubs, ports, and markets, enhancing current systems at ports, optimizing online single windows to expedite licenses and procedures at ports, etc. Further, the government also has to invest more in high-tech industry infrastructure, such as test labs and research centers, to facilitate the growth of these sectors. The absence of test labs in Indonesia, particularly in the pharmaceutical industry, is one of the causes contributing to the low level of research and development in this industry.

Another concern pertains to innovation policy. One way to expand the country's manufacturing sector is by bolstering regulations that encourage and facilitate the innovation process. In order to stimulate innovation in Indonesia, the government must provide the private sector with incentives such as tax cuts and grants to embark on R&D activities. Given that research is not often immediately successful, multi-year funding incentives are also necessary.

Aside from this, the requirement for robust and enforceable intellectual property rights is a crucial aspect of enhancing innovation strategy. Evidence suggests that robust ecosystem patents might encourage investment by fostering innovation (Jaffe, 2000; Gallini, 2022 in OECD, 2004). For this reason, the government must amend patent rules to worldwide standards, encourage voluntary collaboration between foreign rights holders and local enterprises, and modify patent terms to strengthen patent regulations in Indonesia (Geneva Network, 2022).

Additionally, to support an innovation-based industrial ecosystem, human resources development in Indonesia must be enhanced. The PISA scores of Indonesian students fall below the global average. Accordingly, to increase the quality of the human resources, it is vital to reform the curriculum as well as the learning system in Indonesia. Evidently, the allocation of 20% of the state budget to the education sector is still ineffective in enhancing the quality of the country's human resources.

Additionally, a work-based learning system is also necessary to facilitate the entry of qualified Indonesian human resources into the labor market. In addition, the government can emulate Singapore's successes story in the science-based industry in order to make investment more appealing, such as by sponsoring worldwide headhunting of the world's best scientists and expanding scholarship programs at the world's finest institutions (Geneva Network, 2022).

Predictability and stability of domestic policy are among the most essential factors in efforts to promote FDI. Changes to the new minimum wage formula at the end of 2022 by a Labour Ministerial Regulation without amending the Laws (UU) and Government Regulation (PP) are one example of the lack of predictability behind Indonesian policy. Additionally, it is also crucial that policies that support investment are consistent with one another.

In order to attract foreign investment and develop Indonesia's industrial environment, particularly for new emerging sectors like high-tech electronics and pharmaceuticals, the country must provide facilities like tax incentives (i.e. tax holidays, tax allowances, lower VAT and import tariffs) and relaxation of foreign ownership rules. However, these facilities should only be utilized to attract investment and develop a new ecosystem; it should not be burdened by additional obligations, such as requirement to produce products to substitute for imported goods and meeting local content standards.

By enhancing the quality of the ecosystem, the domestic industry's competitiveness will improve, hence facilitating its entry into the global value chain. The authors believe that the industrial development policy's primary objective of national resilience is too narrow. Policies for industrial growth need to be geared toward productivity enhancement and getting domestic industries integrated into international supply value chains. As such, Indonesia can switch from import substitution to export oriented.

Appendix

1. 1 Calculating Potential Impact of LCR Using Computable General Equilibrium (CGE) Method

Computable General Equilibrium (CGE) is a model that specializes in analyzing the impact of changes in economic variables on other variables. The CGE model can identify, simulate, and jointly analyze the impact of the implementation of one or more economic policies on economic conditions at the macro and sectoral levels based on a microeconomic structural basis. Ever since the introduction of this model by Johansen in 1960, CGE models have become popular among scholars to quantify the impact of policy interventions (Hosoe et al., 2010).

Hosoe et al (2010) argue that the CGE model is used widely since it has several advantages. First, it can capture a much broader aspect of the economy of a country. Secondly, it requires relatively small data, although the size of the model that will be developed in these studies is quite big. This advantage is very important in the case of developing countries such as Indonesia where the availability of consistent data over a long period is lacking (Hosoe et al, 2010). Related to objectives, this study uses the CGE model to estimate impacts of Local Content Requirements (LCR) Policy on economy.

Many LCRs are defined as a percentage share of inputs and are assumed to affect imports only when a specific LCR is binding. The underlying assumption of the model is that the company's observed intermediate input use is based on optimal allocation at given prices and thus it will change this input allocation only if prices change or it is required to because of the LCR policy put in place. As long as a company is already fulfilling the LCR, it is not binding.

For example if the current domestic content in inputs is 60% and the related LCR is 50%, there will be no need to adjust the composition of imported and domestically produced intermediate inputs. When the LCR becomes binding – for example if the current domestic content in inputs is 40% and the related LCR is 50% – the company must reduce its import use and increase inputs sourced from domestic production to a minimum of 50%.

Computable General Equilibrium (CGE) model is used in order to provide a full analysis of the potential macroeconomic and sectoral impact of Local Content Requirements Policy. CGE models are flexible and can be used to simultaneously estimate direct and indirect impacts of any policies on productivity, production, labor supply, government budgets, and any specific sectors. In addition, multi-sectoral CGE models have the capacity to undertake broader macroeconomic policy analyses, and capture behavior changes for firms and consumers. Therefore, our CGE model is ideally suited to analyzing the impact of LCR policy in Indonesia.

The CGE model contains 185 producer goods and services produced by 185 corresponding industries. In this case, each industry produces a single output so the set of commodities coincides with the set of industries. The various industries of the model are classified as either 'export-oriented' or 'import-competing'. The level of exports of an export-oriented industry is treated as being endogenous, while the exports of an import-competing industry are treated as being exogenous. In every sector, it is assumed that there is constant elasticity of substitution (CES) production technology with diminishing returns to scale to variable factors alone.

However, we introduce a sector specific fixed factor in every sector to assure that there are constant returns to scale in production to all factors. The assumption of constant returns means that all factor demand functions are homogeneous of degree one in output. In each sector, there is a zero-profit condition, which equates the price of output to the minimum unit cost of production. This condition can be thought of as determining the price of the fixed factor in that sector.

The mobility of factors of production is a critical feature of any general equilibrium system. 'Mobility' in this case refers to mobility across economic activities (industries), rather than geographical mobility. The greater the factor mobility that is built into the model, the greater is the economy's simulated capacity to respond to changes in the economic environment. It is clearly essential that assumptions about the mobility of factors of production be consistent with the length of run that the model is intended to represent.

The Equation System
Following Horridge et al. (1993), the equation system is organized into 16 blocks. These are:

1. demands for labor
2. demands for primary factor
3. demands for intermediate inputs
4. demands for composite primary factor and intermediate input
5. commodity composite of industry output
6. demands for investment goods
7. household demands
8. export and other final demands
9. demands for margin
10. purchaser's prices
11. market clearing condition
12. indirect taxes
13. GDP from the income and expenditure sides
14. trade balance and other aggregates
15. rates of return, indexation
16. investment-capital accumulation equation

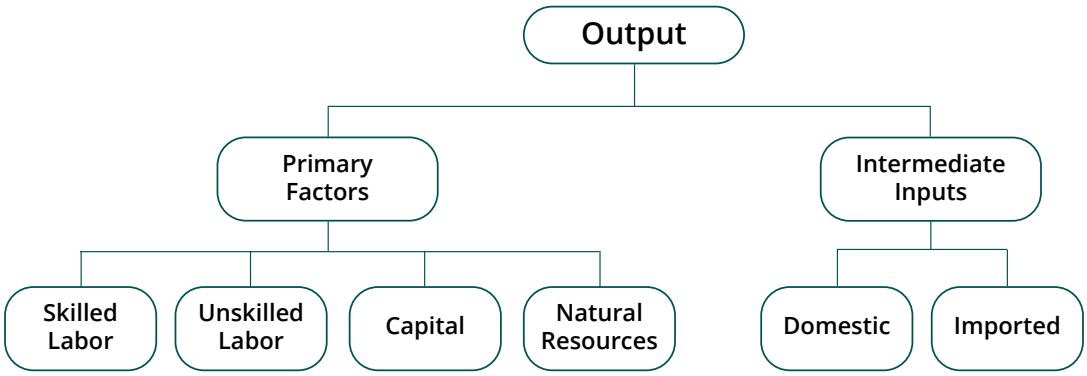
The structure of production in a given industry is depicted in Figure ii. In the production process, each industry can produce several commodities. Industries use both intermediate and factor inputs. Each intermediate input can be sourced domestically or imported. Factor inputs for each industry are labor, capital and land or natural resources.

Key simplifying assumptions made in this production model include input-output separability and the multi-stage, hierarchical structure based always on constant elasticity of substitution (transformation) production (transformation) functions except for the combining of intermediate goods and aggregate primary factors, a stage which uses the Leontief or fixed proportions technology.

This structure together with further assumptions about firm behavior and market structure determines the demands for labor, other primary factors and intermediate input and the supply of commodities by the industry. These market and behavioral assumptions are:

1. Producers and consumers are price takers in both input and output markets.
2. Producers seek to maximize profit by choosing input levels subject to the depicted production technology; and therefore choose the least cost combination of inputs for any given level of output.

Figure ii. Structure of Production



1.2. Aggregation and Simulations in the CGE Model

We used CGE model based on the 2016 Input-Output table and aggregated into 45 sectors. The focus of the aggregation is on industries that are not the primary focus of this study. In the meantime, disaggregation is performed in sectors and input industries within the sectors that are the subject of this study, such as the ICT, pharmaceutical, and medical device sectors, to fit the scope and objectives of the research.

Table ii. Aggregation of sectors in research (45 sectors) based on the I-O Table 2016

No.	Sector	No.	Sector
1	Agriculture	24	Other electrical appliances
2	Mining and Extraction	25	Electric generator & electrical motor
3	Food & Beverages Product	26	Motor vehicle except motorcycle
4	Textile & Leather Product	27	Motorcycle
5	Footwear Product	28	Other transport
6	Wood and Paper Product	29	Medical equipment
7	Pulp, paper and printing	30	Other manufacturing industries
8	Petroleum refineries products	31	Electricity, Gas and Water
9	Basic chemical	32	Construction
10	Fertilizer	33	Trade
11	Synthetic resins, plastic & fibber	34	Transportation Services
12	Pesticide	35	Restaurant and Hotel
13	Paints, varnishes & Lacquers	36	Communication
14	Soap & cleaning preparation	37	Financial Services
15	Cosmetics	38	Real estate & dormitory
16	Chemical Product	39	Business services
17	Pharmaceutical Products	40	General government services
18	Rubber Product	41	Government educational services
19	Non-Metal Product	42	Government health services
20	Basic Iron & Steel	43	Private educational services
21	Iron & metal products	44	Private health services
22	Electronics products, communication equipment & apparatus	45	Other services
23	Machinery & Equipment		

One of the objectives of this study is to estimate the impacts of LCR on Indonesia's economy, including but not limited to the manufacturing sector for pharmaceutical, medical devices, and ICT sector. The findings of the study will be the foundation in constructing policy recommendations on the optimum strategy to implement LCR policy that will benefit the Indonesian economy in general.

To analyze the impacts of LCR on Indonesia's economy (including but not limited to manufacturing sector for pharmaceutical, medical devices, and ICT sector), a simulation of the CGE model is carried out including:

1. Simulation of a Decrease on imports of input for ICT products, pharmaceuticals and medical equipment due to LCR Policy Implementation
2. Simulation of an Increase on investment of input in ICT products, pharmaceuticals and medical equipment
3. Simulation of an Increase on productivity of input in ICT products, pharmaceuticals and medical equipment

The table below shows the numerical shocks that were given on our simulation following the official document of Ministry of Industry on Import Substitution.

Table 12. The numerical shocks given on each CGE simulation

Sector	% Shock Sim 1	% Shock Sim 2	% Shock Sim 3
Electronics products	5.95%	10.4%	1.35%
Non Metal Product	14.5%	10%	1.35%
Iron & metal products	14.5%	10%	1.35%
Machinery & Equipment	14.5%	10%	1.35%
Basic Chemical	23.5%	6.9%	1.35%
Chemical Product	23.5%	6.9%	1.35%
Other Chemical	23.5%	6.9%	1.35%

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