

INDUSTRIAL TARGETING IN INDONESIA: AN EMPIRICAL APPROACH FOR GROWTH DIAGNOSTICS

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Abstract: Historical experiences underline the positive impact of industrial policies on economies across the development spectrum, sparking extensive debates within the realm of industrial policy. Nevertheless, there has been a scarcity of research delving into the methodology for judiciously selecting sectors for targeted industrial policies, a void that this study endeavors to fill. This study adopts a multi-dimensional approach, employing Indonesia as a case study and incorporating diverse development scenarios to facilitate informed decision-making for governments in sector selection. The conceptual framework and empirical insights presented herein contribute significantly to the literature on industrial targeting.

Keywords: Industrial Targeting; Industrialization; Industrial Policy; Promotional Strategies; Binding Constraint

JEL Codes: L16, L52, O25

1. Background

Indonesia embarked on a swift industrialization journey following a significant political transition and economic reforms in 1966-67, orchestrated by President Soeharto (Aswicahyono et al., 2011). The primary objective was to replace strategic imports such as cement, steel, and fertilizers with locally produced goods, emphasizing job creation and the development of raw material industries. Additionally, the Soeharto administration focused on fostering labor-intensive sectors like textiles and food processing to boost exports. Consequently, there was a substantial shift in terms of value-added and employment from agriculture to industry.

This industrial policy of import substitution and export orientation changed after Indonesia was hit by the Asian financial crisis in 1997. In response, the government swiftly implemented strategies for recovery, including consolidation, restructuring, and revitalization of the national industry. Indonesia adopted an export-led recovery approach to overcome the crisis (Jacob, 2004). However, this reform inadvertently impacted the industrialization trajectory. In the early 2000s, the country shifted its focus towards exporting raw commodities, such as wood, and later, coal and palm oil. The absence of a coherent industrial policy led to a peak in manufacturing contributions in the early 2000s. The share of industry-based exports in traded sectors dwindled, while natural resources-based exports continued to gain strength until recently.

Dasgupta and Singh (2006) refer to this phenomenon as "premature deindustrialization," where a decline in the manufacturing share occurs at a lower level of income per capita. Under these circumstances, a country may face developmental challenges and risk falling into the middle-income trap, failing to advance technologically in their manufactured goods and missing the opportunity to join the ranks of high-income nations (Atolia et al., 2018).

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Historical experiences from Japan, South Korea, and Taiwan from the 1960s to the 1990s suggest that targeted industrial policies can stimulate structural transformation and foster economic development. Economic imperfections, distortions, and market failures often justify the need for industrial policy interventions (Liu, 2019; Krugman 1983). Such policies can enhance investment efficiency and support industries with untapped potential. Salazar-Xirinachs et al. (2014) argue that countries at all development stages can implement targeted industrial policies for purposes including economic development, job creation, poverty reduction, technological advancement, integration into global value chains, provision of clean energy, and promoting a green economy.

Indonesia's weak industrialization performance can be attributed to various factors, including inadequate infrastructure and logistics, unreliable energy supply, and an unfavorable industrial credit environment (Puspitawati, 2021). It is essential to recognize that each sector faces unique challenges or opportunities. For instance, Indonesia's non-metal mineral sector cannot compete in international markets without reliable electricity, and the food and beverage sector relies on adequate freshwater facilities. Sector-specific obstacles hinder development, and a pro-industrial policy aims to address critical inputs and eliminate barriers according to each sector's specific needs.

With limited fiscal resources, the Indonesian government must prioritize and address issues in industries that have the most significant short- and long-term economic impact (Hausmann and Rodrik, 2006). This selective approach may perpetuate the status quo, as underdeveloped but high-potential sectors struggle to gain a foothold in the economy.

Rather than relying solely on market mechanisms, governments can proactively assess market potential and economic opportunities, identify high-impact industries, and engage with leading investors and industry associations. After identifying these high-potential industries, the next step is to analyze and address the most pressing constraints hindering their development. These binding constraints are those whose resolution would yield the most significant growth gains. While not all problems are binding, for example, water shortage affects all sectors but may be a binding constraint for agriculture due to its high water usage intensity compared to other industries.

It is crucial to emphasize that targeting specific industries does not imply neglecting non-targeted sectors. The government should foster an environment conducive to the growth of all sectors. However, given limited resources, it makes sense to prioritize the most promising sectors that can deliver the greatest positive economic impact.

Guisan, Aguayo, and Exposito (2014) compare the evolution of manufacturing and non-manufacturing real value-added per capita of Indonesia with other countries from Asia and Pacific for 2000-2010. They include the estimation of an international econometric models, of Asia-Pacific and of 132 countries of the World, that show the positive impact of Manufacturing on Non-Manufacturing. Guisan (2024) presents a comparison of several indicators of economic development, including manufacturing production per capita, in the 164 countries of the World for the period 1995-2019, with a special focus on Asia in chapter 6 of the book.

The remainder of this paper is organized into four sections. Section 2 briefly explains the methodology to select the industries and their binding constraints. Section 3 describes the result of the high-potential industry shortlist and the bottlenecks that have to deal with. The final section summarises the chapter with possible extensions and next steps for further research in this area. Appendix A is dedicated to the sources of data and

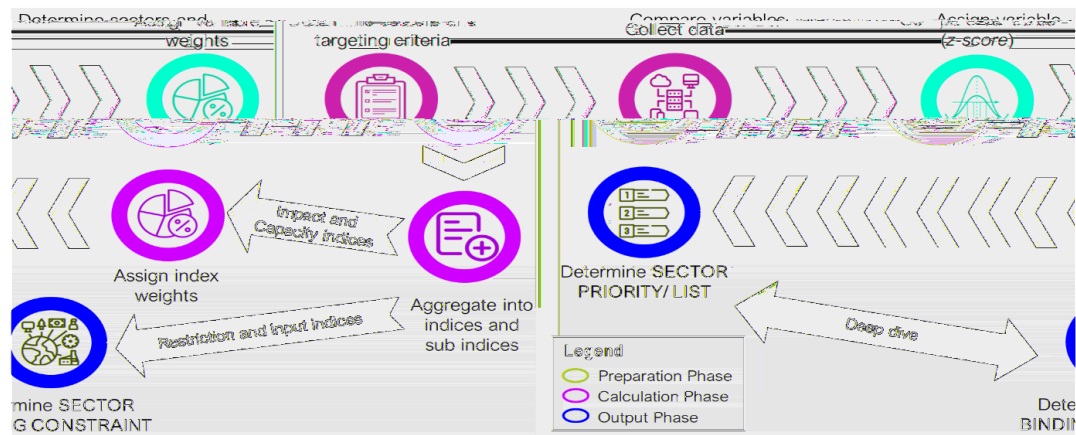
Appendix B to some supplementary data on Indonesia in comparison with the world average.

2. Methodology

The methodology follows a similar concept from Malalgoda et. al (2018) work in Sri Lanka with some differences. This study successfully implements the possible extension gap of that work In Sri Lanka. The first extension is related to data exploration and extended years of coverage. The study in Sri Lanka only uses one or two-year data while this case for Indonesia utilizes a five-year dataset. Moreover, this study also utilized more sources of data such as input-output (IO) table and national business survey. Moreover, this study can fill the methodological gap arising from previous work. As outlined in the next few sections, this study calibrates the weights of different development scenarios.

In general, the study will be divided into two stages. The first stage is to determine the list of industries and the second stage is to examine the development promotion strategies required to improve the sector’s performance. The conceptual framework of the methodology is presented below in Figure 1.

Figure 1. Conceptual Framework



2.1 Sector and Targeting Criteria

This study uses the 2-digit International Standard Industrial Classification (ISIC) Revision 3.1 as the main classification reference of industry with a total of 59 sectors including services (ISIC code 01 until 93). The reason is that the 2-digit level provides the most consistent availability of data for value-added, trade, jobs, and so on. Although the 4-digit level of ISIC will give a more granular and detailed description of a sector, the data availability for different economic indicators remains scarce.

The targeting criteria will be divided into impact and current capacity category. The idea is to select the sector based on how big the potential benefits are and the time needed to develop the sectors based on current competitiveness. There are four criteria included to evaluate the impact: Job, Market Size, Investment, and Multiplier. These four objectives are used interchangeably for the government's intention when supporting industries. Similarly, Job Specialization and Trade Frontier will be included to calculate the current

capacity index. Each of these consideration will have subindices and subsequent variables (see Appendix A for further details). These indices consider the sectors' potential benefits to the economy with their attractiveness, current competitiveness, and the ability for Indonesia to develop the sectors.

2.1.1 Impact Criteria

Job Impact. To gauge the potential employment benefits across sectors, the Job Impact Index for the Indonesian economy comprises three subindices: Job Creation, Job Quality, and Job Inclusion, encompassing a total of eight variables. The Job Creation subindex assesses a sector's capacity to generate employment and utilizes the jobs per value-added metric. The Job Quality subindex considers variables such as the sector's mean wage rate. Both job creation and job quality incorporate comparative data from Malaysia and the United States for a comprehensive assessment. Meanwhile, the Job Inclusion subindex evaluates the potential for job creation among women and in regions beyond the Western area. This aspect is pivotal in addressing regional inequality and fostering greater inclusivity.

Market Size Potential. Moving on to the Market Size Potential Index, it comprises two subindices: Domestic Market Size and World Market Size, incorporating a total of five variables. Firstly, it is imperative to identify sectors with substantial domestic demand, particularly those capable of substituting imports and conserving foreign reserves. This assessment relies on three key variables: nominal import value (in log USD), import intensity (comparing Indonesian per capita import to global imports per capita), and the growth in imports for Indonesia over the past five years. To gauge the global market opportunity for a particular sector, the World Market Size subindex considers nominal trade figures and the growth in world trade over the last five years.

Investment Attractiveness. The Investor attractiveness index was calculated using 3 subindices: Investment intensity, realization, and sentiment. These 3 subindices consist of 6 variables. The investment intensity subindex measures the ratio of both foreign and domestic investment against GDP. Similarly, the investment growth subindex captures the ongoing growth trend of investment in sectors over a certain period of time. Lastly, the investor confidence subindex consists of one variable only, which is the business tendency index, to see the perception of foreign investors to invest in Indonesia.

Multiplier Effect. The multiplier effect in Indonesia index indirectly estimates how sophisticated the economy is and its linkages to other products and sectors in Indonesia. The multiplier effect index consists of sophistication and linkages potential subindex. The former comprises only one variable, the product complexity index (PCI) from Hidalgo, Klinger et al. (2009). This variable analyzes export patterns to ascertain the level of diversity and sophistication in the productive knowledge needed for product manufacturing. For example, only a few countries can produce the most complex products such as sophisticated machinery, electronics and chemicals, compared to the least complex products like raw materials and simple agricultural products that nearly all countries can produce. Furthermore, specialized machinery is said to be complex as it requires a range of know-how in manufacturing, including the coordination of a range of highly skilled individuals' know-how. The latter subindex consists of opportunity gain, from Hausmann et al. (2014) and the Input-Output multiplier variable. Opportunity gain measures the sector's similarity to new sectors which are non-existent in Indonesia. Sectors with high opportunity gain scores could carry precious new linkages for further diversification while the IO multiplier calculates current product interlinkages. In other

words, opportunity gain sees the future linkages whereas the IO multiplier estimates the existing linkages in the Indonesian economy.

2.1.2 Current Capacity Criteria

A current capacity index is brought to assess the current competitiveness of the sector given the context of the Indonesian economy. It consists of two subindices: Job Specialization and Export Frontier, which altogether consist of 3 variables. The former is to calculate a sector's employment competitiveness in Indonesia and it is composed of one variable, the employment intensity. It will compare Indonesia's employment in a sector against the sector's employment included in ILO database. The bigger the figure shows that Indonesia has high labor quantity and quality in that particular sector. It is important to notice that the calculation of the employment intensity is similar to Revealed Comparative Advantage (RCA) that has been popular in trade area.

Meanwhile, the export frontier subindex will measure Indonesia's export competitiveness in sectors.

First, it is important to see which sectors have been enjoying high export competitiveness for various reasons. This can be using RCA as the basic calculation for comparative advantage concept.

Another aspect to consider is how close the country's know-how to export related products with similar capabilities. This prediction can be calculated using the Product Space Density index (Klinger and Hausmann, 2007) or commonly called the distance index. This variable uses patterns in country exports to predict the next products that may have the potential for export extensification. For instance, countries exporting textile fibers tend to also export shirts and underwear. Those countries are also expected to have latent capability in manufacturing other types of garments that are not yet exported.

This implies that countries can utilize a similar kind of capability to produce both products. In other words, the distance index can be seen as a risk level of entering new sectors, where closer distance indicates similar relatedness to current know-how and inputs to enter production of the new sectors and, hence reducing risk.

2.1.3 Binding Constraint

The selected sectors will be curated into the sector's promotion strategies. The development involves the availability of regulatory restrictions and binding constraints in inputs. Barriers in regulations will be calculated by trade barriers (tariff and non-tariff) as well as the foreign ownership limit. The final part assesses the binding constraints in inputs required by a sector.

It comprises two types of inputs: eight groups of hard input (such as road, electricity, and water) and four groups of soft input (such as skilled workers and trade & border administration). The assessment of binding constraints has two parts: input competitiveness (the input's relative cost or performance) against countries in Asia and sector requirements (the demand for the inputs). This approach suggests that different sectors do not consume all inputs equally.

First, the author also estimated each hard and soft input competitiveness in Indonesia. To do this, the author used data from World Economic Forum, the World Bank and

others to compare Indonesia's performance against peer countries in Asia¹. All inputs performance considers the cost, quality, and access as long as the data is provided. For instance, data from the World Bank revealed that Indonesia's electricity price stands at a competitive 10.8 USD cents per kWh, which is lower than the average among its peer nations. However, when evaluating electricity in Indonesia, two critical factors emerged: access and quality. Electricity access in Indonesia extends to 93% of the population, and the quality accounts for 95% of the total electricity output, both figures falling below the peer average. To standardize these values, the z-score formula was employed, yielding a z-score of 0.15 for Indonesia's electricity input. This score situates Indonesia within the third quintile, denoting a "moderate competitive" standing in the electricity input.

The subsequent stage involves computing the input usage intensity for each sector, utilizing data from the Indonesian and U.S. Input-Output tables, weighted at 80% and 20%, respectively. The primary reason to include the USA is to determine what the input requirement looks like for a sector in Indonesia if Indonesia moves toward a high-income country. Additionally, input requirement will be calculated towards its sector intensity compared to average electricity use in all sectors. For example, it appears that the food and beverage sector in Indonesia consumes electricity lower than other sectors (about 0.2 times of the sector's total electricity input), while textile consumes more. We replicate this method for The USA Input-Output table and apply the weighting accordingly.

The third step is determining a binding constraint for the sectors by combining z-score of input competitiveness with input intensity of the sector. Thus, sectors for which the required inputs are competitive in Indonesia can be targeted for investment and capability or know-how from abroad, whereas in the sectors for which required inputs are not competitive the enhancement of required inputs is necessary before supporting those sectors for investment and know-how².

2.2 Data Source and Collection

In this targeting study encompassing 12 subindices, the author diligently curated data sources to provide quantitative evidence for each targeting question. Whenever possible, multiple data sources were harnessed to offer a comprehensive perspective within each index and subindex. Take, for example, the Job Quality subindex, which incorporates three variables: (i) average wage in Indonesia, (ii) average wage in Malaysia, and (iii) average wage in the United States. This amalgamation of variables facilitates the estimation of the potential for quality job within each sector.

The datasets utilized predominantly spanned the period from 2015 to 2019 (please refer to Appendix A for an exhaustive list of data sources employed)³. A substantial volume of data was gleaned from surveys conducted by the Indonesian National Statistics Office (BPS), including the Labor Force Survey and Input-Output Table. Additionally, external

¹ Competition within Asian countries was chosen given the fact that most offshoring and reshoring opportunities are coming to Asia, despite some incentives from developed nations to keep the production in their home (UNESCAP, 2022)

² It is important to emphasize that there's no necessity for these inputs to undergo enhancement uniformly across the entire nation to bolster investment attractiveness. Essentially, input improvements can be tailored in specific location(s) where the targeted sectors may thrive

³ Note that the study does not include the COVID-19 pandemic and its subsequent recovery period to see how the sector dynamics look like in normal condition

data sources such as Trademap for trade data and Harvard Atlas for product space configuration enriched the dataset. It is worth noting, however, that this data may not precisely capture sectors currently in their nascent or less competitive stages in Indonesia—a significant concern for a study focused on structural transformation into emerging sectors. Consequently, data from Malaysia was also collected for comparison due to its regional proximity and comparable development phase. Furthermore, data from high-income countries like the USA was deemed essential to assess sector performance within the context of a high-income economy, essentially serving as a benchmark or frontier for these sectors as national income per capita rises. Care was taken to meticulously attribute the origins of each data source throughout the study.

Datasets exhibited variances in sector specificity and coverage, with some being highly aggregated and others detailing specific products or activities. The preference was inclined toward disaggregated data, which could be flexibly re-aggregated using suitable concordance schemes when required. Furthermore, an emphasis was placed on datasets with broad sector coverage, as some were limited to traded sectors like mining and manufacturing.

Consequently, substantial effort was dedicated to unearthing datasets encompassing service activities and services trade, even if it meant relying on proxies such as food and accommodations services to represent the tourism sector. Given the diverse sources of data, concordance tables translating between different product and industry classifications (e.g., HS Code for trade, SIC Code for the US industry) were essential to align with the ISIC Revision 3.1 classification. Additionally, considerations were made for the volatility of variables in growth terms, which could introduce outliers due to low baseline effects. To mitigate this, the author chose to smooth growth rates by aggregating similar sectors into divisions. This approach ensured a more robust and reliable analysis of the data.

2.3 Estimation

One widely adopted approach involves the transformation of variables into rankings or percentiles, facilitating comparisons across different units. For instance, it allows us to identify which sector attracts the highest foreign investment in Indonesia (measured in millions of USD) or which sector exhibits the most substantial economic linkages, often assessed through multipliers.

However, rankings or percentiles have their limitations, primarily failing to elucidate the extent of variation among sectors. While rankings can pinpoint the sector with the highest foreign investment, they do not reveal how this magnitude compares to the overall average. Moreover, it is essential to employ a measurement that is robust to outliers, ensuring that unusually low or high values in one sector do not unduly influence the scores of other sectors.

One measurement that effectively addresses these requirements is the standard score, commonly referred to as the "z-score." The concept behind the z-score is to gauge the relative performance of a particular sector in comparison to all other sectors. While it entails some complexity beyond a simple ranking, its calculation and interpretation are relatively straightforward.

A higher (lower) z-score above zero signifies stronger (weaker) performance relative to the average. Notably, the z-score fully captures the variation of the variable and exhibits lower sensitivity to outliers, thanks to its reliance on the standard deviation. It is worth

noting that the z-score lacks a finite scale, theoretically ranging from negative to positive infinity. However, under the assumption of a normal distribution, approximately 95.4% of its values fall within the range of -2 to 2.7, providing a practical context for interpretation.

For each gathered variable, a z-score was computed to assess the sector's performance relative to other sectors within the economy:

$$z - score = \frac{x - \mu}{\sigma}$$

where x symbolizes the value of a particular sector's variable (indicating the sector's performance), μ signifies the mean value of the variables across all sectors (representing the average performance), and σ denotes the standard deviation of the variables across all sectors (reflecting the extent of variation within sectors).

It is important to note that, in numerous cases, variables with extensive magnitudes, such as the import volume of sectors (which can range from tens of thousands to millions of USD), are first transformed logarithmically for more meaningful analysis. When the z-score is equal to zero, it indicates that the sector's value precisely aligns with the average value. Conversely, a z-score of one signifies that the sector's value surpasses the average by one standard deviation. Furthermore, using the presumption that the variable values conform to a normal distribution, the z-scores can be equally divided into five quintiles. These are:

- i. **very low** (lower than -0.85)
- ii. **low** (between -0.85 and -0.25)
- iii. **average** (between -0.25 and 0.25)
- iv. **high** (between 0.25 and 0.85), and
- v. **very high** (higher than 0.85)

Index and Variable Weighting

Following the standardization process into z-scores, these variables were amalgamated into subindices, which, in turn, were assembled into indices in alignment with the stipulated sector targeting criteria. The computation of aggregate impact index scores ensued through a weighted summation of the z-scores of these indices. Notably, the weights assigned to subindices and variables typically ranged from 10% to 50%, contingent on the economic significance of each objective.

This weighted summation approach served a dual purpose. First, it accounted for the varying degrees of importance attached to different subindices within the team's rationale for each index. For instance, in the assessment of job impact, the team's primary focus was on job creation rather than job quality. Consequently, subindices related to Indonesian job creation received higher weightings compared to those covering job quality. Second, it accommodates the disparity in the number of representative variables within each subindex. For instance, when evaluating the domestic market potential of each sector, this was appraised using three variables (Indonesia's current import levels, import intensity, and import growth) whereas several subindices relied on a single variable for measurement.

Figure 2. Weighting Scenario

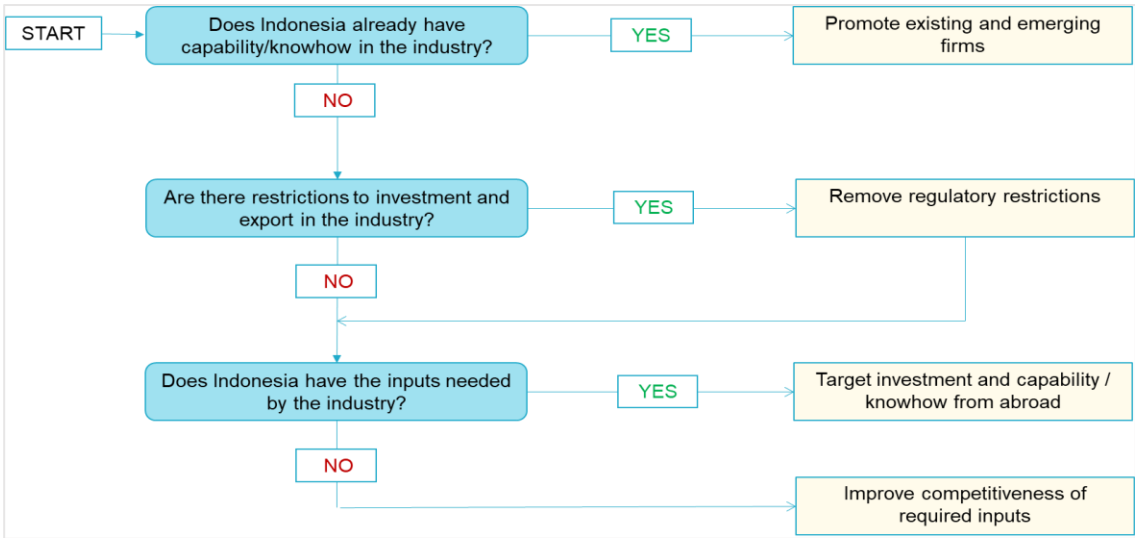
Balanced			
Jobs 30%	Market size 30%	Investment 20%	Multiplier 20%
Go for Growth			
Jobs 15%	Market 20%	Investment 25%	Multiplier 40%
Go for Jobs			
Jobs 50%	Market size 20%	Investment 15%	Multiplier 15%
Go for Market			
Jobs 20%	Market size 50%	Investment 15%	Multiplier 15%

For the sake of the study, the preliminary analysis will use a “balanced” approach where the development priority is merely equal across impact criteria. To assess other possibilities, there will be different scenarios in weighting to involve possibilities when the priority impact changes (Figure 2). For example, more weighting will be allocated to market size potential criteria if the Indonesian government wants to focus on market expansion. This implies that the sector chosen for targeting may be different if the development criteria are adjusted.

2.4 Sector Promotion Strategies

In this section, the analysis proceeded intending to determine the suitable promotional strategies for the identified priority sectors using the decision tree based on current capacity/know-how and input competitiveness. Figure 3 shows how the decision tree is created for promotional strategies for high-priority sectors. First, the study prepares the available regulatory restrictions that hold the industries back from thriving.

Figure 3. Decision Tree of Sector Development Strategy



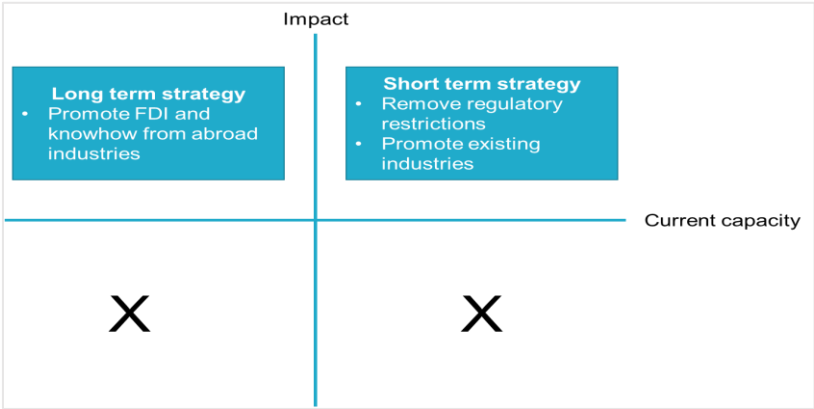
The current capacity index will be combined with impact index in order to create a matrix that separates the prioritized sectors whether they require a short-term or long-term strategy.

The short-term strategy is the promotion of existing and emerging firms as well as the removal of regulatory restrictions. This will apply for sectors that have high potential impact index and high current capacity index. The practical approach for the promotion of existing firms is to encourage big firms to expand their production facilities and/or engage in joint ventures. Policymakers can also remove trade and investment restrictions that hinder the development in the sectors. For example, the garment sector has more than average performance in terms of both impact and current capacity in Indonesia, and thus it fits for sector promotion.

Then, the long-term strategy considered is by targeting of investment & know-how from abroad and improving the competitiveness of required inputs. The long-term strategy appears when the high-priority sectors have high potential impact index but low current capacity index. It is important to highlight that the availability of competitive input will be applied first if the prioritized sectors have no competitive inputs required for them to operate efficiently. For this, the author uses binding constraint through the estimation of input competitiveness and intensity required for each sector.

To embrace short and long-term strategies, Indonesia needs to remove regulatory restrictions in the sectors. Restrictions can be related to trade, services, foreign investment, and so on. In addition, not each sector requires the removal of the same restrictions as some sectors may be more restrictive than others for various reasons. For example, mining sector is closed to foreign equity ownership while electronics sector is more welcome to foreign investment as electronics are heavily linked to the global value chain (GVC).

Figure 4. Mapping of Impact and Current Capacity Index



At this point, our attention is directed solely toward high-priority sectors for which we possess an extensive array of descriptive data, comprising data points from over 32 variables. These sectors are the focal point for the development of a customized promotional strategy. Subsequently, the following section will present the outcomes of this analysis.

3. Result

With the data collection and methodology outlined, this section proceeds to explain the targeting outcomes derived from the analysis: consolidated index of impact and current capacity criteria. To enhance the result, sensitivity analysis of different scenarios is applied to see whether the results are different when impact criteria move away from baseline results. Lastly, development strategies are presented to see the optimal promotion mechanism for prioritized sectors regarding the restriction removal and improving binding input.

3.1 Targeting Result

3.1.1 Baseline

As described above, the sectors were ranked based on the impact z-score using a “balanced” development approach, which is a weighted z-score of the “Job Impact,” “Market Size Potential”, “Investment Attractiveness”, and “Multiplier Effect” indices. Table 1 below grey covers the sectors with the high range or better impact (weighted z-score > 0.25):

Of which top seven sectors above, manufacturing sectors dominate the highest priority sectors except for electricity & gas sector. Another interesting fact from the table above is apart from electricity and gas, all of them are categorized as high-tech manufacturing sectors. This notion implies that Indonesia will have to target these sectors for its future industrial policy.

Table 1. Impact Index Score for Top Priority Sectors

Rank	ISIC 3.1	Description	Impact Criteria (Z-Score)				
			Overall	Job Impact	Market Size	Invest ment	Multi plier
1	29	Machinery and equipment	0.54	-0.12	0.93	-0.36	1.70
2	34	Motor vehicles	0.38	-0.34	0.52	-0.46	1.80
3	40	Electricity and gas	0.37	-0.09	-0.24	1.54	0.25
4	24	Chemicals	0.33	0.00	0.59	0.05	0.68
5	30	Computers	0.29	-0.04	0.31	-0.59	1.50
6	33	Medical & precision instruments	0.25	-0.14	0.51	-0.98	1.61

Moving on to each impact criterion, revealing result shows that those prioritized sectors are expected not to have much on employment, particularly for absorption. Nonetheless, these sectors provide more quality jobs in terms of salary for their workers. The biggest strength of these high-priority sectors is due to market size and multiplier effect.

Those products within the selected sectors are in high demand, globally and in Indonesia, due to various emerging trends. For example, demand for motor vehicle products will rise due to electric vehicle penetration and an increase in per capita income worldwide.

For multiplier effects, these high-impact sectors are associated with the production of complex and high-linkage products that require multiple inputs (and suppliers), advanced technology production processes, and abundant skilled workers. Construction machine (HS 1992 code: 8457), which are categorized in machinery and equipment sector, for instance has product complexity index (PCI) of 2.22 in 2019.

Making such products requires complex processes that only a few countries can produce. If Indonesia can enter to produce it, the growth effect will be huge as it includes a series of highly specialized process divisions that create high-value added along the value chain.

3.1.2 Sensitivity Analysis

As the development target may prioritize one aspect over another, the author tries to check whether the result in the baseline holds. For example, the Indonesian government may want to secure employment first rather than focusing on multiplier effect. This notion will target some sectors with high job creation. Table 2 below grey covers the top 6 sectors for each scenario.

Table 2. Top Priority Sectors under Different Scenario

Rank	Scenario (Z-Score)			
	Balanced	Go for Growth	Go for Jobs	Go for Market
1	Machinery and equipment (0.54)	Machinery and equipment (0.76)	Garments (0.39)	Machinery and equipment (0.64)
2	Motor vehicles (0.38)	Motor vehicles (0.66)	Refined petroleum (0.35)	Refined petroleum (0.46)
3	Electricity and gas (0.37)	Computers (0.51)	Machinery and equipment (0.33)	Chemicals (0.4)
4	Chemicals (0.33)	Medical and precision instruments (0.48)	Tourism (0.25)	Motor vehicles (0.4)
5	Computers (0.29)	Electricity and gas (0.42)	Chemicals (0.23)	Leather and footwear (0.38)
6	Medical & precision instruments (0.25)	Chemicals (0.4)	Government (0.22)	Garments (0.35)

Table 2 above indicates that the list of sectors in the baseline result is consistent under different scenarios, particularly for chemical as well as machinery and equipment industry. Both sectors will be the safest option for targeting in any circumstance. These scenarios also imply that the manufacturing and some service sub-sectors are the priority for the future industry targeting in Indonesia. The situation is consistent with the structural transformation needed for Indonesia to move toward knowledge-based sectors to avoid the middle-income trap.

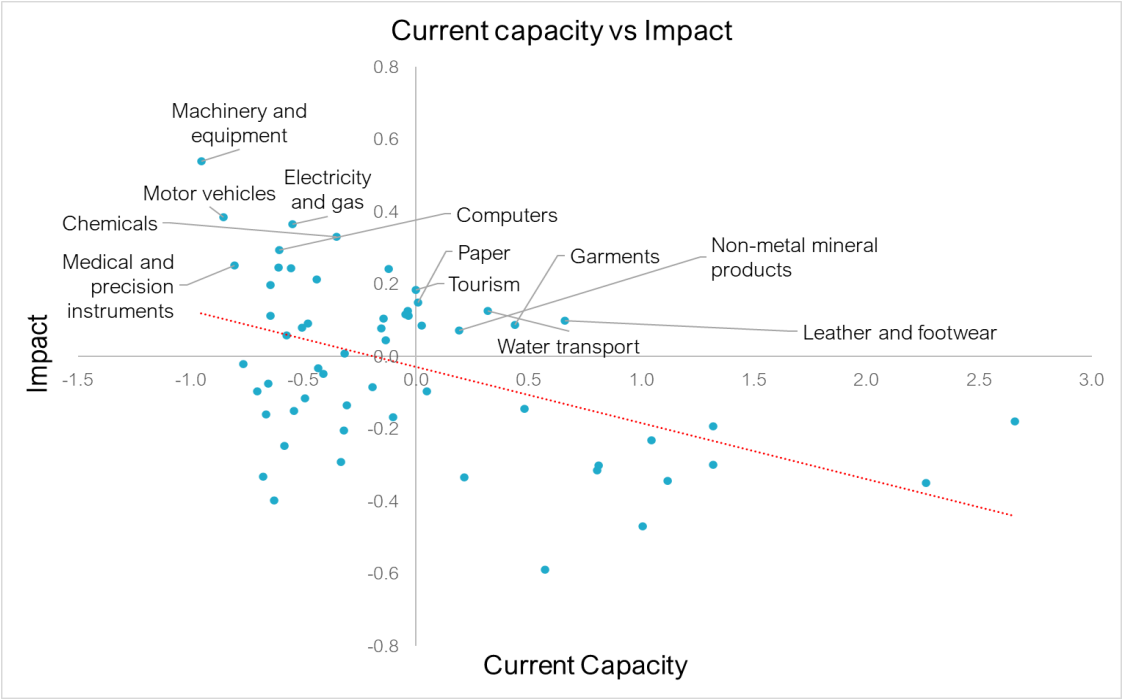
3.2 Sector Promotional Strategies Result

3.2.1 Time-Bound

The list of priority sectors in Table 2 includes activities that have the potential to provide job opportunities, promote greater market size, attract investment, and induce a multiplier effect. However, these sectors alone do not provide the complete context to determine whether they are viable for short-term pursuit or necessitate strategic, long-term actions. In cases where these sectors are challenging to pursue due to limited current capacity in Indonesia, yet they hold substantial potential for impact and give a significant contribution to structural transformation, they can be categorized as "innovative" sectors.

These are the sectors that Indonesia can only attain if substantial changes are enacted in the long run to create an investment climate that encourages innovation. Meanwhile, the expanded roster of priority sectors includes those situated in the top-right quadrant, denoting both high current capacity and significant impact potential. This inclusion seeks to strike a balance between short-term strategic gains and long-term transformation. The rationale behind this approach is to secure some low-hanging fruit as a safe buffer while Indonesia continues its journey toward a comprehensive structural transformation.

Figure 5. Impact and Current Capacity Index, by Sector



The stark difference appears in Figure 5 above. All high-impact sectors are located in top-left quadrant, meaning that these sectors have little presence in Indonesia at the moment. This indicates that Indonesia will have to acquire fresh business expertise for these sectors from external sources, potentially through avenues like foreign direct investment (FDI) and technology transfer. On the other hand, several sectors such as garments and tourism provide a “quick fix” for the government to continue maintaining these strong existing industries. The loss or decline in these sectors will strongly harm

the Indonesian economy. To keep these industries afloat, the government has to remove regulatory restrictions and promote their business sustainability.

Thus, the complete priority sectors will be high-impact sectors plus all sectors in the top right quadrant of Figure 5. These sectors are closely linked to substantial positive economic impacts and might be the most accessible to promote, leveraging existing export capacities and Machinery and equipment labor strengths. These are:

1. Motor vehicle
2. Electricity and gas
3. Chemicals
4. Computers
5. Medical and precision instrument
6. Tourism
7. Paper
8. Water transport
9. Non-metal mineral products
10. Garments
11. Leather and footwear

The first six sectors need long-term and consistent improvement to make the know-how from abroad feasible while the remaining ones need short-term promotion to maintain the existing presence in Indonesia. The priority sectors majority consist of manufacturing subsectors and a bit of services. The result confirms that Indonesia should gradually move towards a more complex manufacturing sector to reverse the persistent deindustrialization.

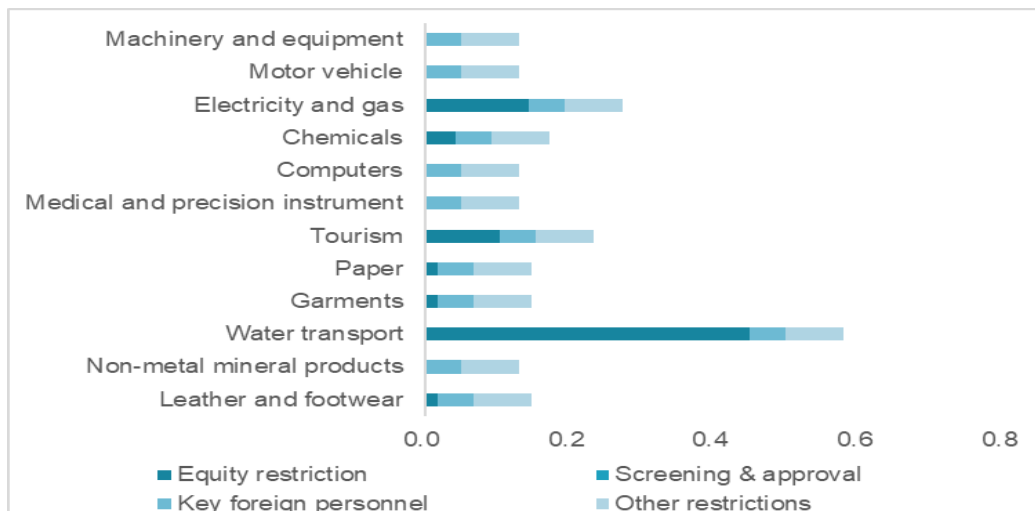
3.2.2 Regulatory Restriction

This study will limit the restrictions only for FDI restrictions index from OECD database⁴. Figure 6 below shows that Indonesia has relatively less restrictions in the form of foreign equity restrictions except for electricity and gas as well as water transport. However, restriction to FDI in Indonesia lies in the regulations to allow foreign workers and other things such as government procurement, business licensing process, and other operational restrictions.

The implication of these figures is different for the highest impact and highest capacity sectors. A less restrictive FDI regime will help the attractiveness for the former to target knowledge from abroad but the strategic implementation is still there to be done to create the necessary environment for the sectors to thrive in the distant future. Meanwhile, easing FDI barriers will immediately enhance the latter as these sectors are having a huge presence in Indonesia today.

⁴ Tariff and non-tariff barriers are also important trade restrictions. However, robust comparison analysis between traded and non-traded sectors are difficult to perform due the different nature of both.

Figure 6. OECD FDI Restrictiveness Index by Top 12 Sector, 2019



3.2.3 Input's Binding Constraint

The previous section included the promotional strategies from the time perspective, which evaluated sectors' urgency for promotion given the current presence. However, the analysis will be complemented by the need and intensity of inputs required to promote them in their own right. In this case, inputs will be separated into hard and soft categories.

Before gauging the significance of soft and hard inputs for specific sectors, this study evaluated the overall cost competitiveness of these inputs within Indonesia. To compile the requisite data, a diverse array of sources, including WEF, ILO, and the World Bank, were consulted. The benchmarking data were collected covering seven hard inputs (Road, Port, Airport, Logistic Support, Electricity, Fresh Water, and ICT Infrastructure) and five soft inputs (Engineer & Scientist, Managers, Shipping and Border Administration, R&D Utilization, and Financial Intermediaries). All inputs incorporate cost/ price, access, and quality depending on data availability.

To gauge Indonesia's performance relative to its Asian counterparts, we employed the calculation of "z-scores" for each variable, as detailed in Table 3. The findings unveiled that Indonesia does not exhibit strong competitiveness across various soft and hard inputs, particularly earning notably low z-scores in categories like R&D utilization, road infrastructure, and ICT framework. However, it is worth noting that Indonesia maintains a relatively moderate level of competitiveness when it comes to ports and trade border factors. In contrast, the nation garners a competitive edge in electricity infrastructure and logistics. Additionally, inputs related to highly skilled workers, such as engineers and scientists, showcase competitiveness. A noteworthy observation stems from the paradox of lacking innovation despite having an abundant and cost-competitive pool of engineers and scientists, primarily due to inadequate R&D utilization.

Table 3. Evaluation of Input Competitiveness and Requirement, Top 12 Sectors

Input	Input Competitiveness		Input Requirement	
	Z-score	Category	Relative to All Sectors (x)	Category
R&D	-0.56	Poor	2.10	Most Important
Road	-0.54	Poor	0.70	Important
ICT	-0.42	Poor	0.95	Important
Financing	-0.38	Poor	0.73	Important
Water	-0.34	Poor	0.88	Important
Ports	-0.18	Average	1.35	Most Important
Trade Border	-0.16	Average	0.37	Less Important
Electricity	0.15	Average	1.91	Most Important
Logistics	0.20	Average	1.49	Most Important
Managers	0.23	Average	1.37	Most Important
Engineer/ Scientist	0.29	Competitive	6.43	Most Important
Air transport	0.62	Very competitive	0.69	Important

The study's subsequent analysis delved into the input requirements of the top 12 prioritized sectors. This examination underscored the significance of R&D, ports, electricity, and highly skilled workers for these sectors, followed closely by road infrastructure, ICT, finance, and water resources. Nevertheless, it's imperative to highlight that while Indonesia demonstrates satisfactory competitiveness in certain crucial inputs, it significantly lags in terms of R&D. Similarly, competitiveness levels are subpar for other pivotal inputs. These findings necessitate a comprehensive consideration in determining Indonesia's strategic priorities for enhancing input performance. Notably, Table 3 underscores the pressing need for improvement in R&D utilization and port infrastructure, especially in areas of the highest priority.

4. Conclusion

This study aimed to quantify the sectors that require government support in Indonesia. Historically, sector-specific fiscal and non-fiscal incentives were provided without a robust quantitative basis. What sets this study apart is its distinctive approach, drawing from a wide range of sector-level data sources, encompassing international trade data, labor force survey, investment statistics, and other datasets.

This data-driven approach has yielded intriguing insights. For example, Indonesia's highest impact sectors are not conventional sectors such as garments and tourism but underdeveloped sectors like chemicals and machinery & equipment. This implies that Indonesia will create enormous gains when doing an economic structural transformation from low to high technology manufacturing sector. Meanwhile, these traditional sectors must be still supported in the short run as they have existing capability and above-average impact on the Indonesian economy.

This analysis indicates that these are important restrictions (e.g., FDI restrictions) to loosen for policy targeting, given that not all sectors have some existing capabilities to contribute to the economy. Sectors with strong capabilities today will have the biggest leverage when the restrictions are eased. However, non-strong sectors today will need multiple strategic policies to make the sectors more attractive. In other words, This holds paramount significance when policymakers are deliberating on prospective targeted sectors and contemplating the necessary enabling environment, inputs, and other essential prerequisites for an industry's success.

Indonesia cannot solely rely on market mechanisms to support industrialization, nor can it expect investors to venture into new promising sectors due to the substantial associated risks. Instead, the nation must transition towards a proactive approach, involving the removal of regulatory barriers and the enhancement of crucial input factors.

This study marks the initial phase: identifying the most promising sectors and the reasons behind their potential. It is equally crucial to identify anchor investors and prominent domestic firms in these sectors and encourage them to develop expertise within Indonesia. Concurrently, it is imperative to foster an improved investment environment, with a dedicated focus on prioritized sectors. Only then can Indonesia fully realize the benefits of an unconventional growth trajectory.

As delineated in the methodology section, this analysis encompasses all tradable sectors, encompassing service sectors, at a higher level of aggregation. However, it's worth noting that when delving into a more detailed level of disaggregation, data limitations may constrain further examination within the Indonesian context. Indoensia's Statistics Office barely provides disaggregated data within its business/ manufacturing survey coverage.

The advice is to engage with the government to allow more disaggregated data for future industry analysis. Another limitation lies in the historical data instead of forward-looking indicators. A historical dataset may tell what had happened but the future may be not the same as some global trends, such as climate change, and digitalization, emerge⁵.

It is also possible to extend the scope of the exercise. One direction would be to conduct a "deep dive" analysis for priority sectors. The deep dive can cover various topics ranging from potential subsectors. value chain, to regulatory bottlenecks. For example, motor vehicle sector is one of the most high-impact sectors in Indonesia. However, one wants to analyze electric vehicle (EV) – as a subsector of motor vehicle – opportunities and challenges in Indonesia. Some sectoral case studies have been conducted in another country, as a case example studied by Hsu et al. (2021) for the Taiwanese automotive industry as a potential sector for targeting.

Finally, it is worth emphasizing the need for regular updates to this study, possibly on a biennial or triennial basis. The world undergoes changes, new datasets become accessible, and the government's development priorities evolve with

⁵ Forecasting method will suit for forward-looking indicators but this requires strong and precise assumption over the long-term trend.

different administrations. Revisiting and broadening the analysis can also serve as a valuable exercise in monitoring the short-term progress of high-priority sectors. Their impact may shift due to emerging global trends, or their existing capabilities may transform as a result of government initiatives aimed at their promotion.

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Appendix A. Overview of Datasets and Sources

Table A1. Indexes and Sources

Phase	Index	Sub-index	Variable	Source	Years Covered
Impact Criteria	Job Opportunity	Job creation	Jobs per value added (Indonesia)	Labor Force Surveys & BPS	2015 - 2019
			Jobs per value added (Malaysia)	CEIC	2015 - 2019
			Jobs per value added (USA)	CEIC & BEA	2015 - 2019
		Job quality	Average wage (Indonesia)	Labor Force Surveys	2015 - 2019
			Average wage (Malaysia)	CEIC	2015 - 2019
			Average wage (USA)	CEIC	2015 - 2019
		Job Inclusion	Female employment	Labor Force Surveys	2015 & 2018
			Employment Outside Java	Labor Force Surveys	2015 & 2018
	Market Size Opportunity	Domestic Market	Imports in Indonesia (current)	Trademap	2015 - 2019
			Imports in Indonesia (intensity)	Trademap	
			Imports in Indonesia (growth)	Trademap	
		World Market	Imports globally (current)	Trademap	2015 - 2019

	Investment Impact	Investment Intensity	Imports globally (growth)	Trademap	
			FDI per value added	BKPM	2015 - 2019
			DDI per value added		
			FDI per value added (OECD)	CEIC	2015 - 2019
		Investment Realization	Growth in FDI	BKPM	2015 - 2019
			Growth in DDI	BKPM	2015 - 2019
		Investment Sentiment	Business Tendency Index	CEIC	2018 - 2019
	Multiplier	Sophistication	Product Complexity	Atlas Harvard CID	2014 - 2018
		Linkages potential	Opportunity gain (New)	Atlas Harvard CID	2014 - 2018
			I-O table (Existing)	BPS	2016
Promotion strategy	Current Capacity	Labor	Employment (intensity)	ILO	2017
		Export Frontier	RCA	Trademap	2015 - 2019
			Product Distance Index	Atlas Harvard CID	2014 - 2018
	Input Intensity	Labour Quality	Managers	Labor Force Surveys & BLS	2015 & 2018
			Engineers & Scientists	Labor Force Surveys & BLS	2014 - 2015
		Electricity	Electricity use	BPS	2016
		Water	Water use	BPS	2016
		Transport	Land tpt use	BPS	2016
			Sea freight use	BPS	2016
			Air freight use	BPS	2016
			Logistic support	BPS	2016
		ICT	ICT use	BPS	2016
		Finance	Finance	BPS	2016
		Trade & Border	Export dependence	Trademap & BPS	2015 - 2019
		R&D	Spending on R&D, by industry	OECD	2014 - 2017

Appendix B. Comparison of Manufacturing and Development of Indonesia with other Asian countries and with World average.

Table B1. Real Value-Added of Manufacturing per capita, 1995-2019
(Dollars at 2017 constant prices and Purchasing Power Parities)

Country	1995	2000	2010	2015	2019
Indonesia	1413	1274	1810	2124	2336
World	1894	2004	2224	2474	2700
%	74.60	63.57	81.38	85.85	86.52

Source: Calculated from World Bank data of real GDP per capita at 2017 prices and Purchasing Power Parities) and percentage of Value-Added of Manufacturing on GDP:

Table B2. Real Gross Domestic Product per capita, 1995-2023

Country	1995	2000	2010	2015	2019	2023
Indonesia	5856	5621	8213	10122	11858	12410
World average	9969	11138	13899	15461	16877	17527
%	58.74	50.47	59.09	65.47	70.26	70.81

Source: % of Indonesia on World average calculated from World Bank data of real GDP per capita at 2017 prices and Purchasing Power Parities (PPPs).

Table B1 shows that the percentage of Indonesia on the World average of Manufacturing value-added per capita decreased for the period 1995-2000 and increased for the period 2000-2019, from 63.57% in the year 2000 to 86.52% in the year 2019.

Table B2 shows that the percentage of Indonesia on the World average of real GDP per capita, decreased for the period 1995-2000 and increased for the period 2000-2023, from 50.47% in the year 2000 to 59.09% in 2010, 65.47% in 2015, 70.26% in 2019 and 70.81% in 2023.

Table B3 presents a comparison of production per capita (in Manufacturing and Total) and several indicators of quality of life in the 8 most populated Asian countries in the year 2019. Population in million was as follows: China 1426, India 1429, Indonesia 278, Pakistan 240, Bangladesh 173, Japan 123, Philippines 117, Vietnam 99.

Columns 1st and 2nd: The first column indicates de value-added per capita in Manufacturing (qmh) in year 2019 and the second column the GDP per capita (ph) in the same year, both measured in Dollars at 2017 prices and Purchasing Power Parities (PPPs). The highest values of both variables, in Table B3, correspond to Japan, China, and Indonesia. Japan has values of both variables very high in comparison with the World average. China has a value of qmh higher than the World average and a value of ph very similar to the World average. Indonesia shows a value of qmh slightly below the World average and a value of ph higher than 10000 but below the World average.

Column 3rd: Tyr is the total years of average schooling of adult population (25+ years). In year 2019 presented a value equal to or higher than the World average for the following countries on the table: China, Indonesia, Japan, Philippines, and Vietnam. As seen in Guisan(2024) and other studies, the past and current values of this variable have shown a positive impact on investment per capita, industrial production, and real GDP per capita.

Indicators X2 to X6: In Table B3, the countries with the highest values of X2 (Voice of citizens) are Japan, China, India, and Indonesia. The highest values of X4 (Peace) correspond to Japan, Indonesia, and Vietnam. The highest values of X5 (Political stability) correspond to Japan, China, and Indonesia. The countries with the highest value of X6 (Economic Freedom in decimal scale) are Japan, Indonesia, and the Philippines.

Indicators X7 and X8: The lowest levels of X7 (Indicator of Air Pollution) correspond to Japan, Indonesia, and the Philippines. The lowest values of the rate of intended Homicides per 100 thousand people correspond to Japan, Indonesia, and China.

Indicator X1: The average value of X1 (Life Satisfaction) is usually positively related with development and several indicators of quality of life. In the countries of Table B3, the highest value in the year 2019 corresponds to Japan, the Philippines, and Vietnam.

Table B3. Manufacturing per capita and GDP per capita (Dollars at 2017 prices and PPPs), and Indicators of Education and Quality of Life, the year 2019.

Country	qmh	ph	tyr	X1	X2	X4	X5	X6	X7	X8
Bangladesh	1008	4754	6.2	5.03	3.42	4.83	3.1	5.3	60.9	2.50
China	4308	16092	8.1	5.34	6.30	4.72	4.5	4.8	52.7	0.62
India	904	6717	6.5	3.82	5.78	3.62	3.5	5.4	90.9	3.22
Indonesia	2327	11812	8.2	5.35	5.74	5.54	4.0	6.4	16.5	0.50
Japan	8387	41477	12.8	5.94	8.20	6.57	7.1	7.0	11.7	0.28
Pakistan	590	4690	5.2	4.93	3.90	2.83	0.5	4.9	58.3	4.41
Philippines	1651	8915	9.4	5.88	5.12	3.96	3.2	6.1	18.1	11.0
Vietnam	1913	8041	8.3	5.41	5.40	5.41	1.2	NA	29.6	1.52
World average	2586	16135	8.09	5.35	5.0	4.80	4.6	6.0	28.4	6.2

Source: First column elaborated from World Bank (2024), by multiplying the % of Value-Added on GDP, in year 2019 and the value of GDP per capita (ph) of the second column of the table. Data of Columns 2 to 10 from Guisan(2024) (elaborated from World Bank UN-WHR and other international statistics there cited. Tyr is the average years of schooling of population 25+, X1 to X6 are indicators of quality of life in decimal scale (0 minimum, 10 maximum): X1=Life Satisfaction, X2=Voice of Citizens, X4=Peace, X5=Political Stability, X6=Economic Freedom. Other indicators: X7=Air Pollution (microns of Particles PM2.5 per metric square of air), X8=Homicides rate per 100 thousand people.