Uncovering Suape's Potential

Strategic Pathways to Economic Complexity and Global Competitiveness

Technical cooperation outcome

UN trade & development

UNCTAD

Geneva, 2024

UNCTAD/TCS/DITC/INF/2024/10

Acknowledgements

This report on the strategic pathways to economic complexity and global competitiveness at the Port of Suape in Brazil was prepared by the Division on International Trade and Commodities of the United Nations Conference on Trade and Development (UNCTAD). The report is a result of a collaboration between UNCTAD and the National Service for Industrial Apprenticeship in Pernambuco (SENAI/PE). The UNCTAD report team comprised Clovis Freire Junior (lead) and Sofia Dominguez.

UNCTAD gratefully acknowledges the inputs of the SENAI/PE team, under the leadership of Ana Paula Macedo de Vasconcelos Cruz and including Thiago Caliari and Elton Freitas.

UNCTAD extends its appreciation to the participants in the "Training on Economic Complexity for Diversification", held on 21 March 2024 in Recife, Brazil, and the participants in the "Workshop on the Economic Complexity Study for the Suape Industrial Port Complex", held on 23–24 July 2024, also in Recife, for their essential contributions towards finalizing this report.

This report is part of the "Intelligence Package for Investment Attraction in the Port of Suape" project. The project was financed through the Port of Suape and jointly implemented by UNCTAD and SENAI/PE.

UNCTAD gratefully acknowledges the support of the Port of Suape, whose contributions were critical to the success of the project.

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Note

The report *Uncovering Suape's Potential: Strategic Pathways to Economic Complexity and Global Competitiveness* is part of the Intelligence Package for Investment Attraction in the Port of Suape project.[1] The objective of the project conducted by UNCTAD and SENAI/PE is to attract national and international investments to the Suape Industrial Port Complex by identifying opportunities to diversify economic activities beyond primary commodities and into more complex products.

The report was prepared jointly by UNCTAD and SENAI/PE and is the project's final output. This report draws on key project activities, notably:

- Two national workshops in Brazil.
- Primary data collection on companies operating within the Port Complex.
- An overview of the region's macroeconomic status and productive structure.
- Application of economic complexity and product space methodologies to identify product potential.
- Development of a preliminary and validated list of potential new products.

[1] The project website and project document can be accessed at: https://unctad.org/project/study-economic-complexity-suape-industrial-complex-pernambuco-brazil

Executive Summary

This report identifies potential new products that complement existing productive chains at the Suape Industrial Port Complex,[2] considering installed capacities and global trends to attract investments. It highlights opportunities for established companies to innovate and expand while guiding to attract new businesses that can enhance local production capabilities and align with sustainability indicators. The analysis combines quantitative methods using economic complexity and product space methodologies with qualitative input on the feasibility and product desirability from regional stakeholders. A key innovation in the methodology is the granular product analysis, disaggregated by unit price. This enhances traditional models by signalling distinct products within the same Harmonized System 6-digit codes through price variations, offering more precise insights for investment targeting.

The analysis identifies 141 products across six prioritized sectors – machinery and mechanical appliances, chemicals, iron and steel, plastics, electrical machinery and equipment, and vehicles. These products offer an export opportunity of US$ 141 billion,[3] and an investment requirement of US$ 2.24 billion. This investment has the potential to generate approximately 19,000 jobs,[4] with the machinery and chemicals sectors alone accounting for over 8,000 of these jobs. Examples of potential products by sector, along with their unit price ranges,[5] include:

- Machinery and Mechanical Appliances: Refrigerators and freezers (HS 841810, priced between US$ 566-922), catalytic converters (HS 842132, priced between US$ 444-493).
- Chemicals: Propene (propylene) (HS 290122, priced between US$ 6-11), silicon dioxide (HS 281122, priced between US$ 1-10).
- Iron and Steel: Stainless steel flat-rolled products (HS 721934, priced between US$ 3-5), steel alloy bars (HS 722790, priced between US$ 0-2).
- Plastics: Polycarbonates in primary forms (HS 390740, priced between US$ 3-6), polyesters saturated in primary forms (HS 390799, priced between US$ 3-8).
- Electrical Machinery and Equipment: Electric accumulators (HS 850790, priced between US$ 6-61), LED light sources (HS 853951, priced between US$ 5-89).
- Vehicles: Vehicles with diesel and electric propulsion (HS 870370, priced between US$ 24,092-47,449), vehicle airbags (HS 870895, priced between US$ 0-19).

The top export markets for the 141 products are led by Asia, with an export opportunity of US$ 47.2 billion, followed by Europe at US$ 41.3 billion. Key countries include China, India, and Japan in Asia, and Germany, Italy, and the Netherlands in Europe. Northern America, particularly the United States of America and Mexico, and broader Latin America (Argentina) and Africa (South Africa), also present important export potential.

[2] Combining the concept of industry and port, the Suape Industrial Port Complex arose as a public institution in 1978. Today, it is managed by the state enterprise SUAPE – Governor Eraldo Gueiros Industrial Port Complex, linked to the Bureau of Economic Development in Pernambuco, by authorisation of the Federal Government. (Available at https://www.suape.pe.gov.br/en/institutional/what-is-suape)

[3] Export opportunities are assessed through a monetized overlap index, which estimates the potential for new products to enter expanding import markets. This measure calculates the degree to which one country's potential new exports align with another country's growing import demand, based on the increase in the global share of imports in specific sectors.

[4] Measuring direct, indirect, and consumption-endogenized jobs.

[5] The unit of measurement varies by product, typically expressed as price per unit or price per kilogram.

Investment needs, job creation and environmental impacts vary by sector. Machinery and chemicals require the highest investments – US$ 522.8 million and US$ 508.2 million, respectively – while also offering significant job creation potential. However, the report also highlights the need to assess and mitigate environmental risks associated with each sector. For instance, the chemicals sector has one of the highest environmental risks, which requires integrating sustainable practices in investment and development strategies.

By leveraging products with higher economic complexity, Suape could significantly boost regional gross domestic product (GDP) and employment. The report estimates a potential 3.14 per cent increase in GDP, translating to an additional US$ 163.5 million. The report also estimates that increasing economic complexity could translate to 3,620 new formal direct jobs, representing a 4.54 per cent rise in formal employment.

The business dynamics analysis within the Suape Industrial Port Complex based on primary data reveals that 84 per cent of firms have implemented some form of innovation, with process innovations being more prevalent than product innovations. The data highlights a strong correlation between adopting advanced technologies – such as industrial robots, the Internet of Things (IoT), and Artificial Intelligence (AI) – and improved operational efficiency. However, several barriers, including reliance on traditional production practices, insufficient market demand, and limited access to financing, continue to hinder broader technology adoption. Additionally, infrastructure and logistics have been identified as key areas requiring improvement to enhance the overall business environment.

This report serves as a strategic tool for Suape's future, offering actionable insights and recommendations that will help the complex remain a competitive and dynamic force in both national and global markets. By leveraging the findings of this study, Suape is well-positioned to continue its trajectory of growth, creating a robust industrial ecosystem that reduces the Brazilian Northeast commodity dependence and benefits the entire region and country.


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1. Introduction

The economic complexity study, conducted in 2024 by the UNCTAD in partnership with the Port of Suape and SENAI/PE,[6] identifies 141 new products across six sectors that could diversify Suape's industrial base. These products present an export opportunity of US$141 billion, with an investment requirement of US$ 2.24 billion and the potential to create 19,000 jobs. The study highlights Suape's capacity to increase GDP by 3.14 per cent and promote sustainable growth through strategic investments in key sectors, such as machinery, chemicals, and electrical equipment.

The Industrial Complex at the Port of Suape serves as a vital commercial hub for Pernambuco, located in the municipalities of Cabo de Santo Agostinho and Ipojuca within the Metropolitan Region of Recife in Northeast Brazil. Home to over 80 operational companies across 12 development hubs, it generates more than 20,000 jobs.[7] Recognizing the region's significance, UNCTAD, in collaboration with the Port of Suape and SENAI/PE, launched an economic complexity study in March 2024, the first of its kind applied to a port industrial complex. The goal of this study is to attract major national and international investments, identifying opportunities to diversify economic activities beyond primary commodities and into more complex products.

The study identifies 141 new products across six key sectors that could enhance the diversification of Suape's industrial portfolio, with an estimated export opportunity of US$ 141 billion. The total investment required is estimated at US$ 2.24 billion, with the potential to generate 19,000 jobs. Machinery, mechanical appliances, and chemicals demand the largest investments — around US$ 500 million each — and are projected to create the most jobs, with a combined total of 8,192. While the electrical machinery and equipment sector received the highest overall score in the analysis, it offers comparatively fewer employment opportunities.

Increasing the region's economic complexity could also boost Suape's GDP by 3.14 per cent, adding approximately US$ 163.5 million. This economic transformation could generate an additional 3,620 formal jobs, representing a 4.54 per cent rise in direct employment. The findings highlight the importance of strategic investments in machinery, chemicals, and electrical equipment, which are expected to yield substantial economic returns. The total job creation, considering direct, indirect, and consumption-linked employment, could surpass 19,000 jobs, further demonstrating the region's potential for growth.

The study underscores Suape's capacity to diversify its industrial structure, aligning with global market trends and leveraging its existing industrial base. Prioritizing sectors and products that meet both global demand and local capabilities enhances Suape's competitive edge. Moreover, this approach

[6] SENAI Pernambuco (Serviço Nacional de Aprendizagem Industrial - Pernambuco) is a regional branch of Brazil's National Industrial Apprenticeship Service, a public-private entity that focuses on industrial development through technical education, professional training, and innovation.
[7] Port of Suape, 2024. Available at: https://www.suape.pe.gov.br/en/business/why-invest-on-suape

takes into account sustainability outcomes, local employment, and resource use, ensuring that diversification contributes to the region's sustainable development.

To unlock this potential, the report outlines key strategies, including infrastructure upgrades to improve logistics, connectivity, and operational efficiency. Governance efforts should focus on strengthening production chains and establishing targeted training programs in collaboration with science and technology institutions to foster innovation. It also recommends financial support mechanisms through development banks to ease the financial constraints that companies face, encouraging investment in advanced technologies.

The report provides a data-driven roadmap for the future of the Suape Industrial Port Complex. By implementing these recommendations, Suape can solidify its position as a key industrial hub in the Northeast and significantly contribute to the region's broader economic development. The strategic insights offered in this study pave the way for Suape to increase its economic complexity, foster sustainable growth, and attract both national and international investments.

The report is structured as follows: Section 2 outlines the current productive structure of Suape in terms of existing products and markets. Section 3 presents the data and methodologies used. Section 4 presents the key findings from the economic complexity and product space analysis. Section 5 presents questionnaire responses detailing firm profiles and technology and innovation trends. Section 6 outlines a macro-strategy for investment in the shortlisted high-leverage sectors. Finally, Section 7 concludes the report.

2. Diagnostic of the productive structure of Suape

This section provides an overview of the economic indicators and performance of Ipojuca and Cabo de Santo Agostinho, the municipalities where the Port of Suape is located. This information is essential for understanding the localized economic impact of the Suape Industrial Complex on both the region and the state of Pernambuco. By presenting detailed data on GDP growth, trade balance, employment, and industrial dynamics, this section underscores the significance of Suape's activities in driving regional economic growth, particularly when contrasted with the slower recovery seen in other parts of Pernambuco. These indicators offer crucial insights into the economic well-being of the municipalities and highlight the Port of Suape's strategic importance for attracting investment and fostering economic complexity.

The port of Suape is located in the municipalities of Cabo de Santo Agostinho and Ipojuca in the state of Pernambuco in Northeast Brazil. Pernambuco is organised into five mesoregions, which are further divided into 19 microregions and 185 municipalities. Among these, the Metropolitan Recife mesoregion includes four microregions: Fernando de Noronha, Itamaracá, Recife, and Suape, encompassing 15 municipalities (see Table 1).

Table 1
Territorial division of the Metropolitan Recife mesoregion

Microregion	Municipality
Fernando de Noronha	Fernando de Noronha
Itamaracá	Araçoiaba
	Igarassu
	Ilha de Itamaracá
	Itapissuma
Recife	Abreu e Lima
	Camaragibe
	Jaboatão dos Guararapes
	Moreno
	Olinda
	Paulista
	Recife
	São Lourenço da Mata
Suape	Cabo de Santo Agostinho
	Ipojuca

Source: Brazilian Institute of Geography and Statistics.

This section offers an overview of Suape's economy, highlighting its relationship to the broader economic context of the Northeast region and Brazil. The economic dynamics within these microregions and municipalities are crucial for understanding Pernambuco's overall GDP performance. The recession that began in the second quarter of 2014 in Brazil, coupled with a sluggish recovery starting in 2017, exacerbated by the COVID-19 pandemic, has led to a significant contraction in the GDP of the Recife microregion and stagnated growth across the state of Pernambuco.

In contrast, the municipalities of Ipojuca and Cabo de Santo Agostinho, which are significantly influenced by the economic activities of the Suape Industrial Complex, exhibited a compound annual growth rate (CAGR) exceeding the national average. The strong performance of these municipalities can be attributed to the strategic importance of the Suape Complex, which serves as a hub for logistics, energy, and heavy industries. As shown in Table 2, while Brazil's real GDP grew at an average annual rate of 2.32 per cent between 2016 and 2021, Pernambuco's GDP experienced modest growth of 0.58 per cent, and the Recife microregion faced an average annual contraction of 1.96 per cent. In comparison, the combined GDP of Ipojuca and Cabo de Santo Agostinho grew at an average rate of 2.58 per cent per year, driven predominantly by Cabo de Santo Agostinho's substantial growth rate of 4.32 per cent per year over the same period. The growth in Cabo de Santo Agostinho can be linked to the expansion of industrial activities and the influx of new businesses that have leveraged the logistical advantages provided by the proximity to the Suape Port.

These figures highlight the uneven impact of the recession and slow recovery on the service-oriented economy of the Recife microregion. Consequently, the relative share of the state's and capital's GDP in relation to the national GDP has declined. In contrast, the economic activities in Ipojuca and Cabo de Santo Agostinho, spurred by the influence of the Port of Suape, have increased their relative economic contribution.

Table 2
GDP evolution between 2011 and 2021

Territorial unit	GDP 2011 (in R$ bi)	National GDP share (per cent) 2011	GDP 2016 (in R$ bi)	National GDP share (per cent) 2016	GDP 2021 (in R$ bi)	National GDP share (per cent) 2021	CAGR (per cent) 2011-2016	CAGR (per cent) 2016-2021
Cabo de Santo Agostinho	9.9	0.13	11.1	0.14	13.7	0.15	2.26	4.32
Ipojuca	10.4	0.13	14.1	0.18	14.9	0.17	6.27	1.13
Suape	20.3	0.26	25.2	0.31	28.6	0.32	4.39	2.58
Recife (Microregion)	100.6	1.28	98.0	1.22	88.8	0.99	-0.52	-1.96
Pernambuco	198.1	2.52	214.5	2.67	220.8	2.45	1.60	0.58
Brazil	7 870.0	100.00	8 035.1	100.00	9 012.1	100.00	0.42	2.32

Source: Brazilian Institute of Geography and Statistics.

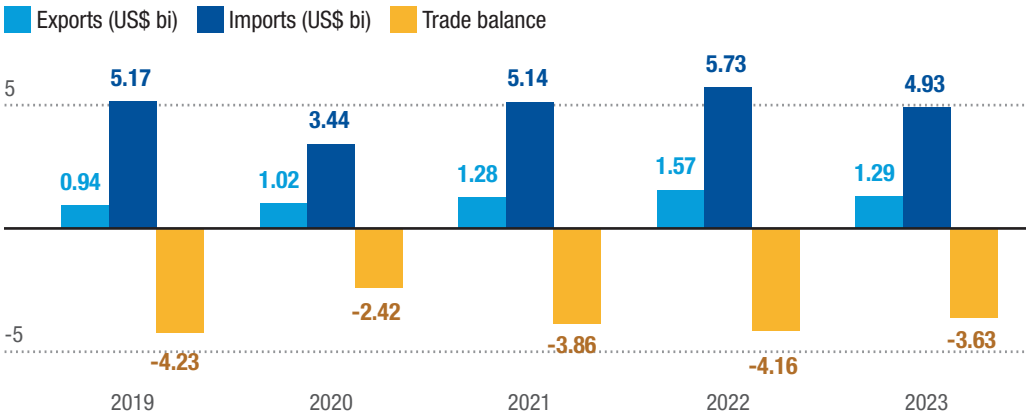
Note: GDP data are in 2021 prices; IPCA was used as the deflator.

The trade balance at Suape, irrespective of the production origin, has exhibited a stable trend in recent years, following closely the overall trade performance of Pernambuco, as illustrated in Figure 1. Since 2021, Suape has witnessed a gradual recovery in export activities, approaching pre-pandemic levels.

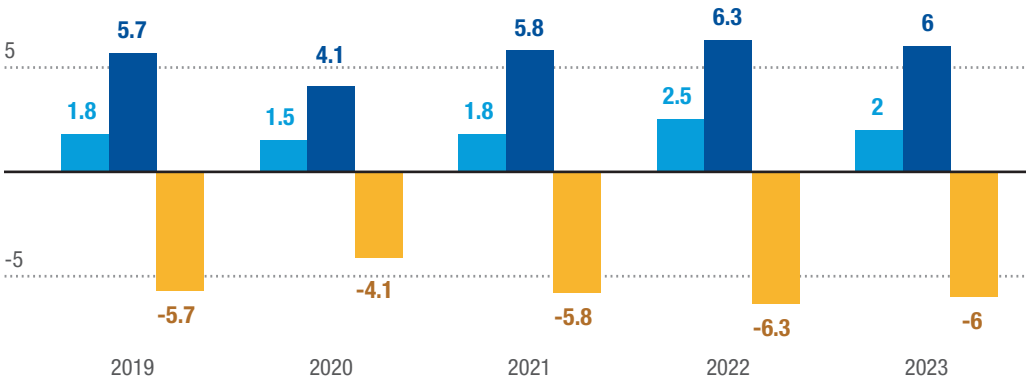
However, the decline in exports from Cabo de Santo Agostinho has been notably impacted by a significant reduction in the export of metal products. Specifically, exports in this sector decreased from US$ 79.9 million in 2019 to US$ 28.8 million in 2023.

Figure 1
Recent evolution of international trade

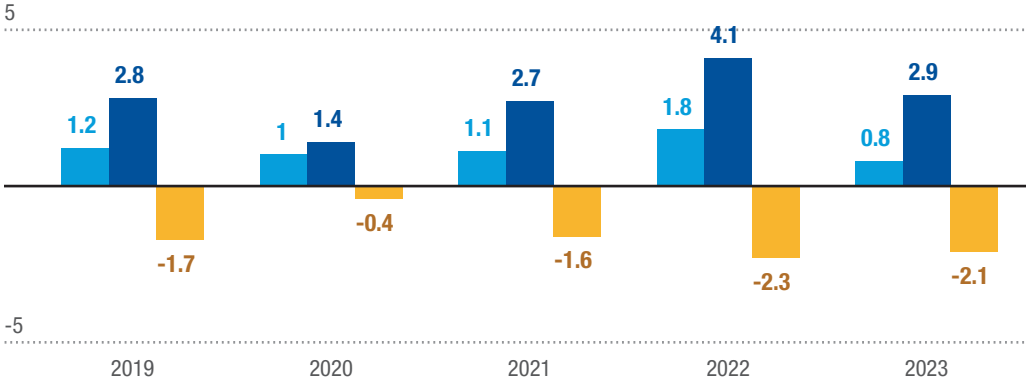
(A) Suape (only produced in Pernambuco)



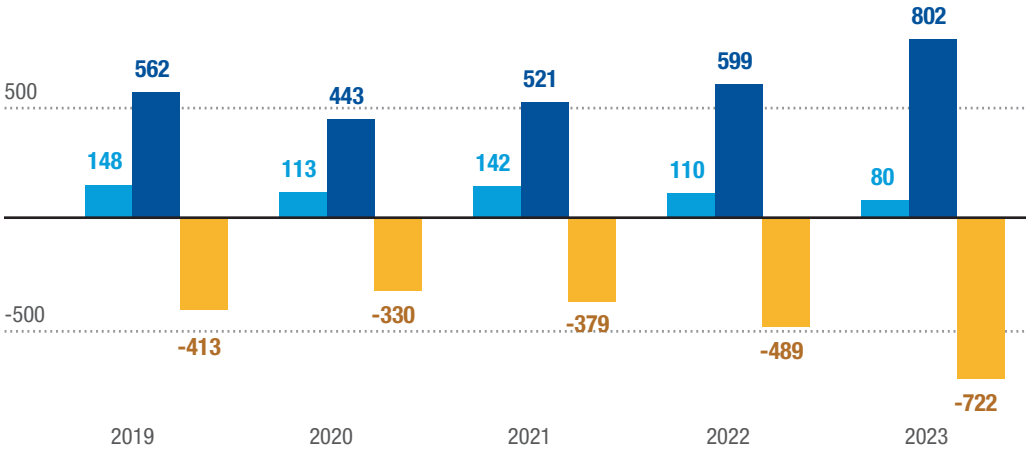
(B) Suape (regardless of the origin of production)



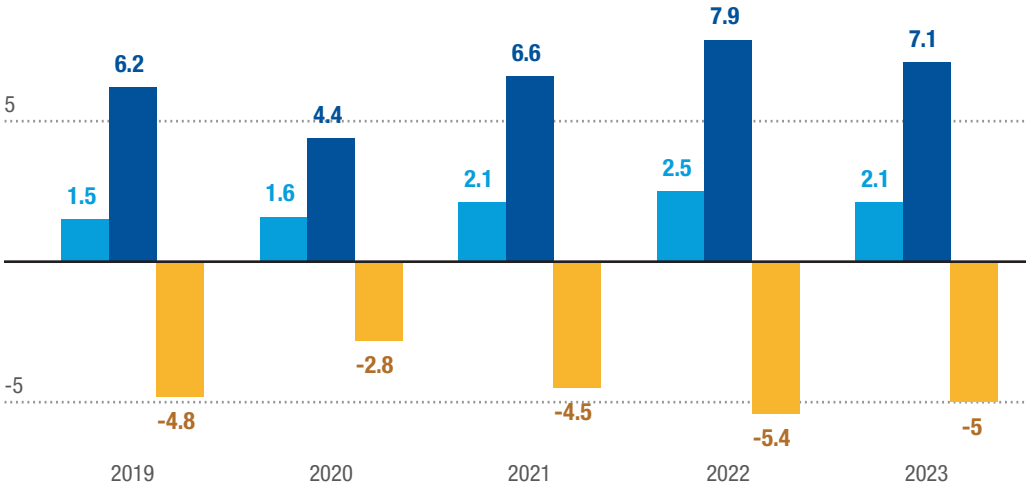
(C) Ipojuca



(D) Cabo de Santo Agostinho



(E) Pernambuco



Source: Ministry of Development, Industry, Trade and Services of Brazil (MDIC).

The data are presented in Free on Board (FOB) values for exports and Cost, Insurance and Freight (CIF) values for imports. FOB represents the value of goods at the point of departure, excluding shipping and insurance costs, while CIF includes the cost of goods along with insurance and freight charges incurred to bring the goods to the port of destination. (A) Suape data covers exports and imports carried out by the Port of Suape only of products produced in Pernambuco. (B) The Suape data encompass exports and imports conducted through the Port of Suape, regardless of the production's origin.

As illustrated in Figure 2, the recession and subsequent sluggish recovery have markedly impacted the industrial sector at both national and state levels, exhibiting distinct regional disparities. There is a discernible trend of a declining share of the industry in Gross Value Added (GVA),[8] concurrently with an increasing share of the services and public administration sectors.

An examination of Ipojuca and Cabo de Santo Agostinho reveals notable regional nuances. In Ipojuca, the industrial sector's share of GVA demonstrated resilience, experiencing a modest increase from 59.3 per cent in 2011 to 60.6 per cent in 2021. This suggests a relative robustness of the industrial sector in this municipality compared to other regions.

[8] Gross Value Added (GVA) is a productivity metric that measures the contribution of individual sectors and industries to an economy. It is calculated by subtracting the cost of inputs and raw materials from the total output.

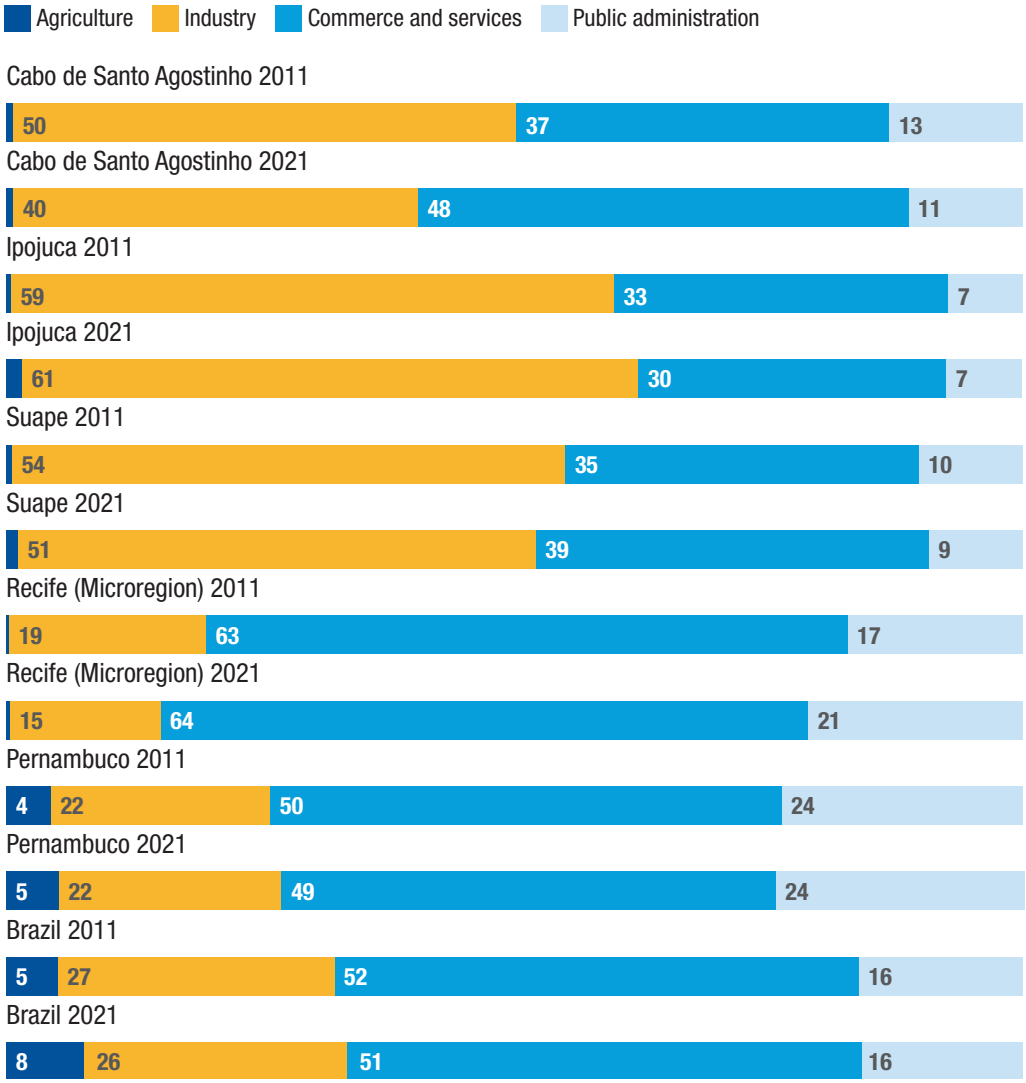
Conversely, Cabo de Santo Agostinho witnessed a significant contraction in the industrial share, decreasing from 49.5 per cent to 39.8 per cent, indicative of an industrial downturn. When analysing the combined data for both regions, there was an observable decline in the industrial share from 54.4 per cent to 50.9 per cent. At the same time, the trade and services sectors expanded their share, implying an economic transition and potential structural shift.

These findings underscore the need to consider regional specificities when evaluating the economic trajectory of the industrial sector. The persistence and growth of industrial activities in Ipojuca can be attributed to unique local conditions, such as its strategic location near the Suape Industrial Complex, which serves as a major logistics and production hub.

Figure 2

Evolution of the share of Gross Value Added (GVA) by sector between 2011 and 2021

(per cent)



Source: Brazilian Institute of Geography and Statistics.

The area benefits from specialized infrastructure, a skilled labour force, and a network of suppliers and support services that create a favourable environment for industrial operations. These characteristics enable Ipojuca to maintain robust levels of industrial activity, even as other regions experience a decline in the sector's relative economic contribution. Although Cabo de Santo Agostinho is also close to the Port, its industrial GVA breakdown indicates a greater emphasis on services compared to Ipojuca.

An analysis of employment data reveals trends different from previous economic indicators. Between 2017 and 2022, Ipojuca experienced a significant reduction in employment (Table 3), predominantly within the construction sector following the completion of projects at the Suape Port Complex and the closure of a sugarcane mill. In 2012, Ipojuca reported 75,100 jobs, accounting for 0.16 per cent of total national employment. By 2017, this figure had plummeted to 33,600 jobs (0.07 per cent of the national total), with the construction sector experiencing a pronounced decline from 29,600 jobs in 2012 to a mere 1,000 in 2017. This sharp contraction corresponds to a compound annual growth rate (CAGR) of -14.87 per cent between 2012 and 2017, indicating a period of severe economic downturn.

Since 2017, there has been a modest recovery, with employment in Ipojuca rising to 37,300 in 2022, maintaining a national employment share of 0.07 per cent. This recovery, reflected in a CAGR of 2.14 per cent from 2017 to 2022, suggests a gradual rebound following the earlier substantial decline. In contrast, Cabo de Santo Agostinho has exhibited a more stable employment trajectory, with a slight decrease from 39,900 jobs in 2012 to 37,500 in 2017, followed by growth to 42,400 in 2022, consistently representing 0.08 per cent of national employment.

A combined analysis of Ipojuca and Cabo de Santo Agostinho shows a significant reduction in employment from 115,000 jobs in 2012 to 71,100 in 2017, with a CAGR of -9.18 per cent during this period. However, from 2017 to 2022, employment recovered to 79,800 jobs, corresponding to an annual growth rate of 2.33 per cent.

Table 3
Evolution of formal employment between 2012 and 2022

Territorial unit	Employment 2012 (in thousand)	National employment share (per cent) 2012	Employment 2017 (in thousand)	National employment share (per cent) 2017	Employment 2022 (in thousand)	National employment share (per cent) 2022	CAGR (per cent) 2012-2017	CAGR (per cent) 2017-2022
Cabo de Santo Agostinho	39.9	0.08	37.5	0.08	42.4	0.08	-1.24	2.49
Ipojuca	75.1	0.16	33.6	0.07	37.3	0.07		2.14
Suape	115.0	0.24	71.1	0.15	79.8	0.15	-9.18	2.33
Recife (Microregion)	1,005.9	2.12	916.8	1.98	991.4	1.88	-1.84	1.58
Pernambuco	1 694.6	3.57	1 584.8	3.42	1 784.1	3.38	-1.33	2.40
Brazil	47 458.7	100.00	46 281.6	100.00	52 790.9	100.00	-0.50	2.67

Source: Annual Report of Social Information (RAIS).

In the Recife microregion and the broader state of Pernambuco, similar trends of recovery following a period of decline are evident. The Recife microregion recorded a decrease in employment from 1,005,900 in 2012 to 916,800 in 2017, followed by an increase to 991,400 in 2022. Nationally, Brazil experienced a slight reduction in employment numbers from 47,458,700 in 2012 to 46,281,600 in 2017, with a subsequent recovery to 52,790,900 thousand in 2022, reflecting a CAGR of 2.67 per cent in the most recent period.

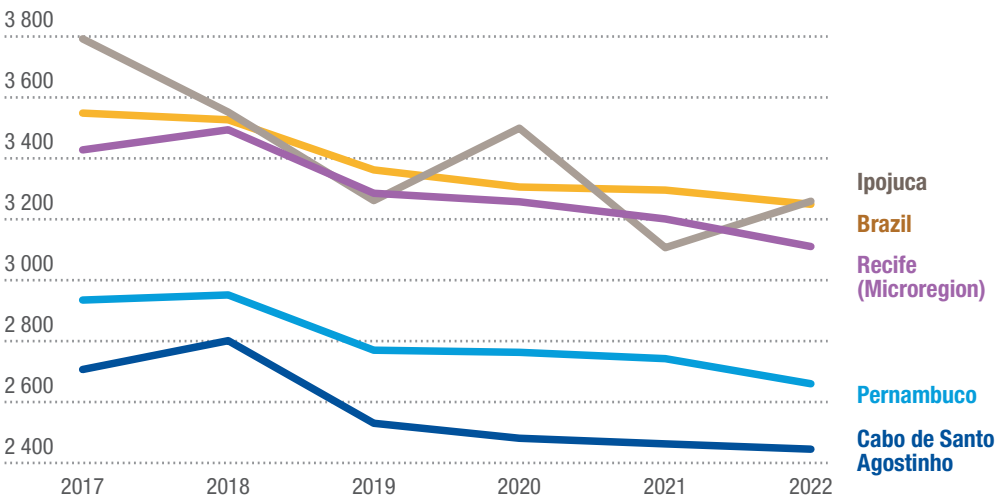
The data underscores that while Brazil and specific regions, such as Cabo de Santo Agostinho and the Recife microregion, displayed signs of employment recovery post-crisis, Ipojuca faced a more severe impact due to its high dependence on the construction sector. The downturn in this sector, which had been a significant driver of local employment, led to a sharp reduction in job opportunities. This vulnerability can be attributed to the concentration of large-scale infrastructure and industrial projects in the region, many of which were either halted or scaled back during the economic slowdown.

Figure 3 illustrates the trajectory of average real remuneration from 2017 to 2022, a period characterized by a consistent decline in average real income across Brazil and other regions. Notably, Ipojuca experienced a more pronounced reduction, with average real income decreasing by approximately 14 per cent, surpassing the national and regional rates. Specifically, the average remuneration of formal workers in the Recife microregion, Cabo de Santo Agostinho, and the state of Pernambuco collectively decreased by nearly 9 per cent in real terms over this period. In comparison, Brazil saw a decline of almost 8 per cent.

It is evident that the most severe repercussions of the 2020 recession, precipitated by the COVID-19 pandemic, are likely to exacerbate this downward trend. These effects are expected to vary across different sectors, with the service sector anticipated to be disproportionately affected.

Figure 4 displays the distribution of each product category in the export portfolio of Ipojuca and Cabo de Santo Agostinho between 2019 and 2023. The overall export structure remained relatively unchanged during this period.

Figure 3
Evolution of real average monthly wage between 2017 and 2022
(in R$)



Source: Annual Report of Social Information (RAIS).
Note: Average wage data are in 2021 prices; IPCA was used as adeflator.

However, notable shifts include the rise of petroleum coke in Ipojuca's export profile, now constituting 11.5 per cent of the municipality's exports. These can be attributed to increased refining capacity and investments in downstream activities by a firm operating within the Port of Suape, which have strengthened the municipality's position in oil-related exports.

Consequently, the share of oil-related exports increased to 87.8 per cent. In Cabo de Santo Agostinho, there was a substantial increase in the export share of plastics and rubber products, which grew from 35.8 per cent in 2019 to 54.5 per cent in 2023. Additionally, the proportion of raw plastic sheeting products in the municipality's exports notably increased, rising from 13.4 per cent to 26.3 per cent over the same period. This can be linked to establishing new production facilities and shifts in product category in the specialization, driven by changing market demands and the municipality's strategic focus on higher value-added segments within the plastics industry.

Figure 5 illustrates the composition of sales by product category in the municipalities of Ipojuca and Cabo de Santo Agostinho for 2019 and 2023. This data was derived from the Electronic Invoice system of the Pernambuco Finance Department.

In Ipojuca, the commercial structure remained relatively stable over this period. Conversely, Cabo de Santo Agostinho experienced a significant increase in the sales share of refined petroleum, which rose from a mere 0.39 per cent of total sales in 2019 to 25 per cent in 2023. Similarly to the case of exports, this rise can be attributed to the expansion of refining activities in the municipality, driven by investments in refining capacity and operational upgrades within local facilities at the Port of Suape. Additionally, the strategic proximity of Cabo de Santo Agostinho to the Port facilitated the distribution and export of refined petroleum products, enhancing the competitiveness of local producers and contributing to the substantial growth in sales.

However, the data from Electronic Invoices indicates a more diversified sales pattern compared to export data. Given that a substantial portion of the products manufactured and sold in these municipalities goes to domestic consumption, we observe a discrepancy that is not captured by export statistics. For instance, in Ipojuca in 2023, the contributions of the chemical products (5.5 per cent), metals (4.5 per cent), foodstuffs (4.2 per cent), and plastics and rubbers (3.7 per cent) sectors were notable. Similarly, in Cabo de Santo Agostinho in 2023, the sectors with significant participation in production and marketing included foodstuffs (18 per cent), machinery (14 per cent), transportation (10 per cent), metals (7 per cent), and plastics and rubbers (6.3 per cent).

The distribution of destinations and origins for exported and imported products (Figure 6) shows that in Ipojuca, 67.1 per cent of exported goods are destined for Singapore, followed by China at 10.8 per cent. The Netherlands (5.3 per cent), Argentina (4.4 per cent), and the United States of America (4.3 per cent) also feature prominently among the Ipojuca's top five export destinations. Regarding imports, the United States of America is the leading source, accounting for 22.3 per cent of the total, with the Netherlands (13.7 per cent) and India (11.1 per cent) also being significant suppliers. In Cabo de Santo Agostinho, Argentina (31.2 per cent) and the United States of America (31.1 per cent) are the primary export destinations. Conversely, the main origins of imports products are Argentina (47.7 per cent) and China (15.2 per cent).

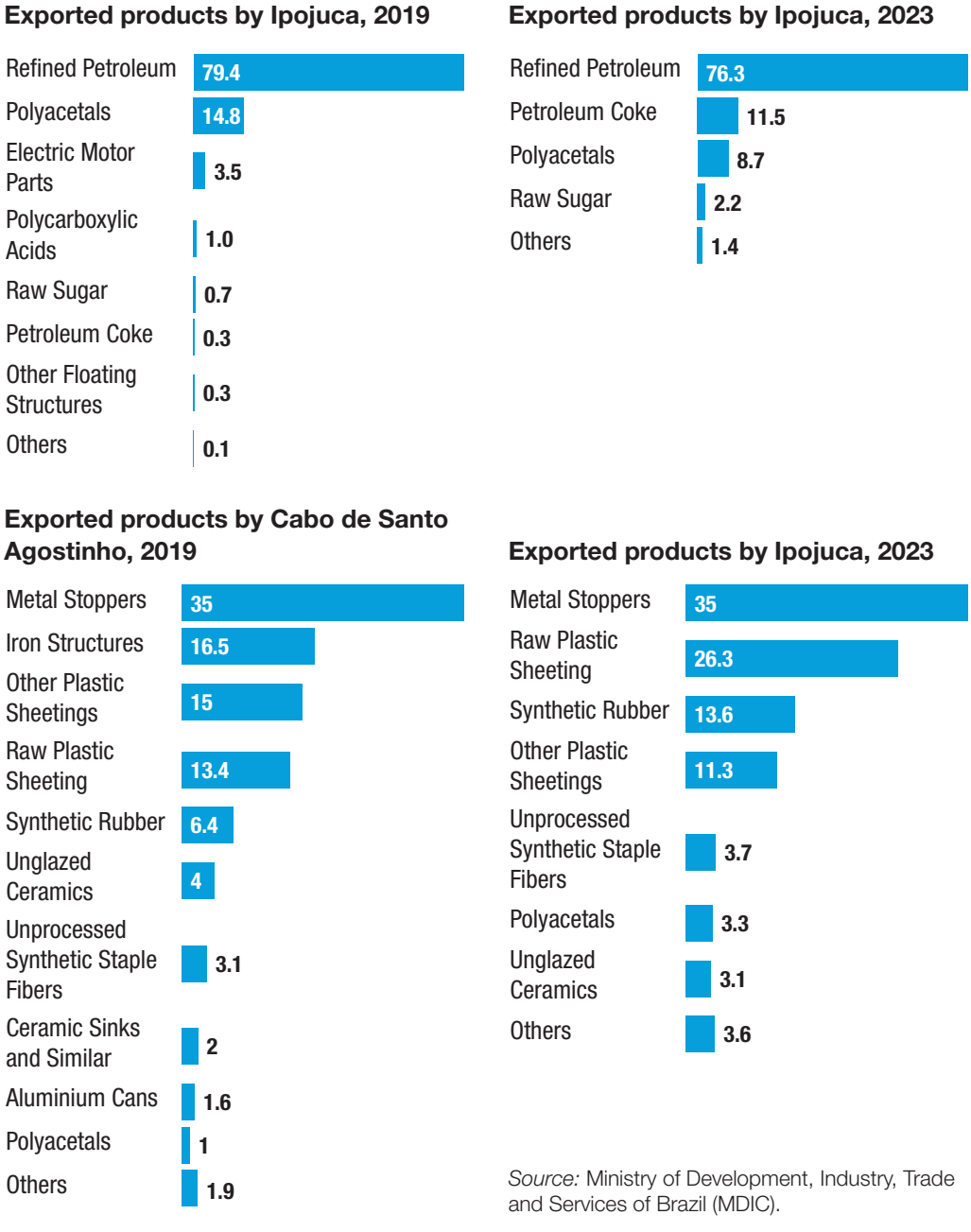
The production and export structures of Ipojuca and Cabo de Santo Agostinho highlight some trends in their economic profiles. The export data reveals a strong orientation toward specific industries, such as petroleum refining in Ipojuca and plastics and rubber in Cabo de Santo Agostinho. Similarly, for products sold domestically, petroleum refining is prominent in Ipojuca,

and to a lesser extent, in Cabo de Santo Agostinho. These observations set the stage for exploring potential product diversification and new export opportunities in the region.

Figure 4

Export portfolio of Ipojuca and Cabo de Santo Agostinho between 2019 and 2023

(per cent)

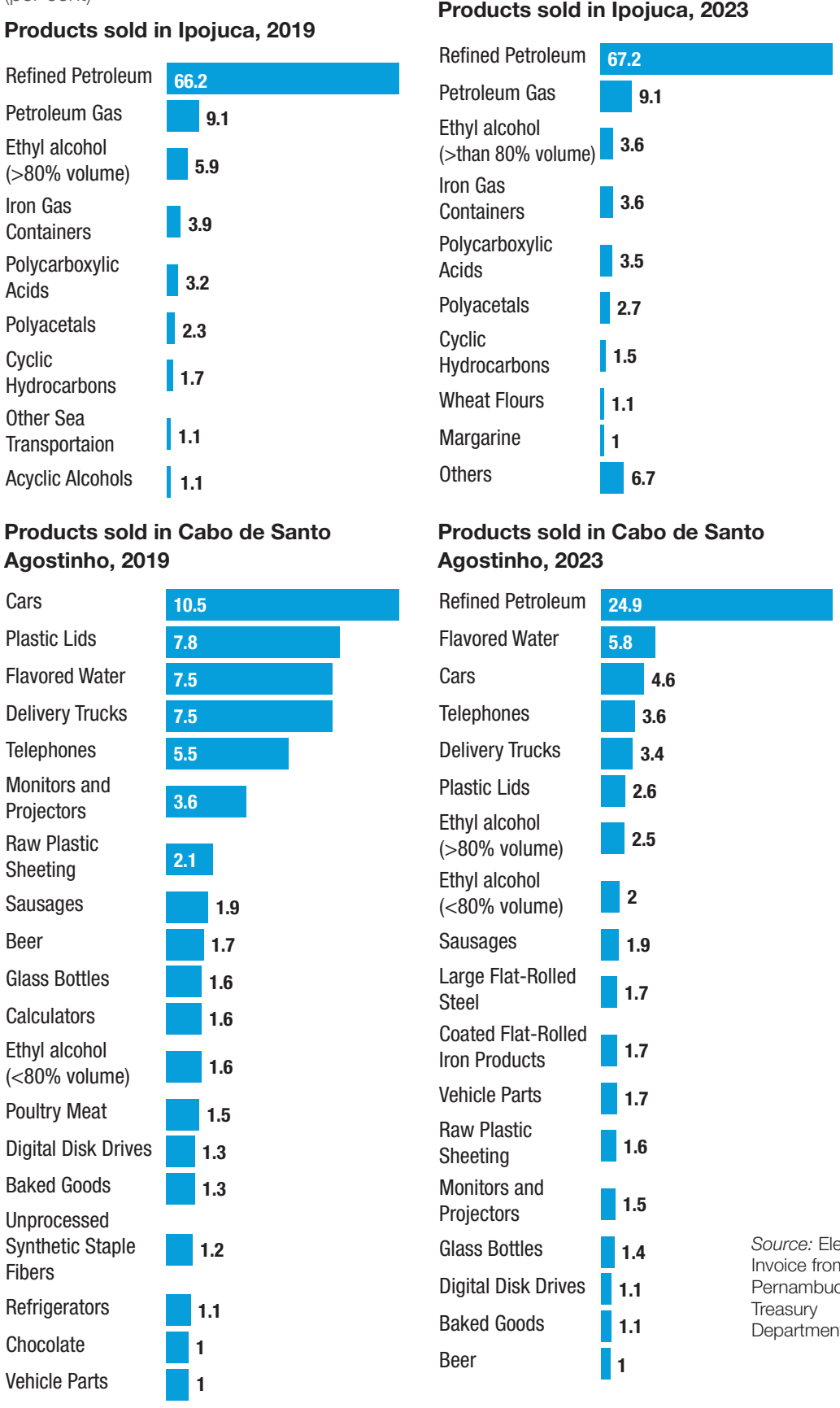


Source: Ministry of Development, Industry, Trade and Services of Brazil (MDIC).

Figure 5

Portfolio of products sold in Ipojuca and Cabo de Santo Agostinho in 2019 and 2023

(per cent)



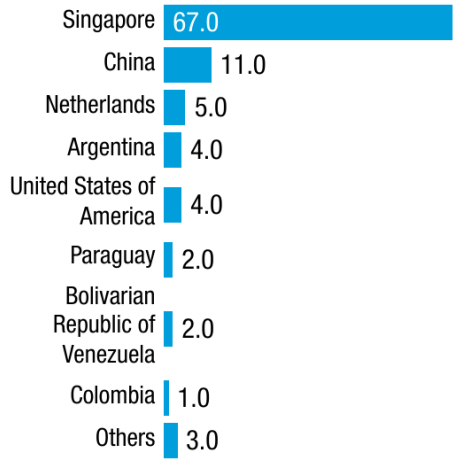
Source: Electronic Invoice from the Pernambuco Treasury Department.

Figure 6

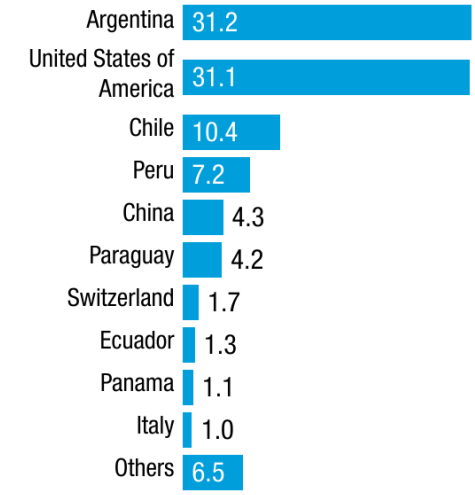
Basket of products imported and exported by Ipojua and Cabo de Santo Agostinho in 2023

(per cent)

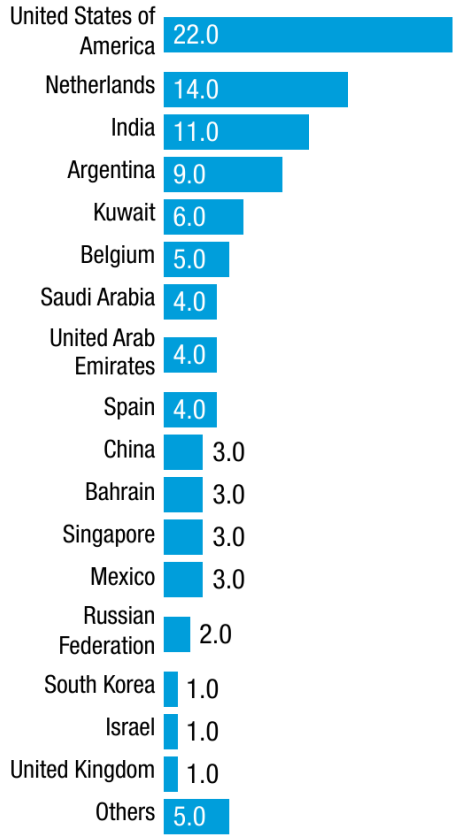
Destination of products from Ipojuca



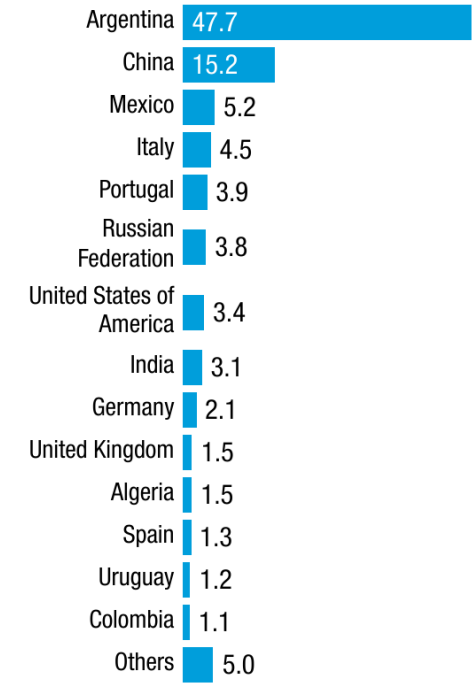
Destination of products from Cabo de Santo Agostinho



Origin of products from Ipojuca



Origin of products from Cabo de Santo Agostinho



Source: Ministry of Development, Industry, Trade and Services of Brazil (MDIC).

To analyze this further, we use the concept of product space, a tool to visualize how a country's or region's production structure relates to international competitiveness. The product space is built using export data and shows how closely different products are connected based on the likelihood that they will be co-exported by other countries. This framework, coupled with the Revealed Comparative Advantage (RCA)[9] indicator enables a comprehensive representation of the global production structure. It enables the mapping of products in which a country already has a comparative advantage, as well as those that are close to its current production capabilities.

By plotting the product space for the municipalities of Ipojuca and Cabo de Santo Agostinho, we can preliminarily identify products that are within reach for future expansion. This analysis, conducted with HS 6-digit level data, helps us observe products that could be potential targets for diversification or further growth.

Figure 7 provides a visual representation of the product space for 2023, highlighting the products where these municipalities have an RCA. This preliminary view lays the groundwork for a deeper analysis in subsequent sections, where we explore the full range of products with potential for exports beyond the current scope of the 6-digit HS code level.

Figure 7, together with Figure 8, which shows the absolute number of products exported, reveal key insights. First, the number of products that these municipalities produce competitively is relatively limited (see Figure 8B). In 2023, Cabo de Santo Agostinho's export basket of products with RCA consisted of approximately 67 products, while Ipojuca's basket included only 13 products. This reflects Brazil's broader trend of limited international integration, with much of its production geared toward the domestic market.

Second, the dispersion of these products across the product space suggests the presence of capabilities that could potentially enable: (i) an increase in the export volume of goods already exported but without RCA (see Figure 8A); and (ii) the development of new goods that could be introduced, creating new export opportunities.

The region's key exports are primarily those linked to the oil industry, such as refined oil, petroleum coke, and petroleum gas. Additionally, the competitive production of more complex goods is noteworthy, particularly those associated with the transportation industry, including vehicle parts, cars, and delivery trucks. To a lesser extent, the region also exports less complex goods, such as plastics and rubbers and foodstuffs, exemplified by raw plastic sheeting and other plastic sheeting, as well as flavored water and alcohol. Furthermore, the presence of more complex sectors, such as electronic products, adds to the diversity of the export structure.

An analysis of the Economic Complexity Index (ECI) reveals divergent trajectories for the regions from 2013 to 2023 (Figure 9). In Cabo de Santo Agostinho, the ECI exhibited a slight initial improvement, rising from 0.307 in 2013 to 0.421 in 2015, followed by a downward trend until 2017, reaching 0.287. A notable surge occurred in 2018, with the ECI peaking at 0.845 before declining in the subsequent years, reaching 0.178 in 2023.

In Ipojuca, the ECI displayed moderate growth from 2013 to 2015, increasing from 0.217 to 0.286. However, a decline was observed between 2016 and 2017, stabilising around 0.231. The index experienced a significant rise in 2018, peaking at 0.916, followed by a gradual decline, with the ECI fluctuating between 0.202 and 0.222 from 2021 to 2023.

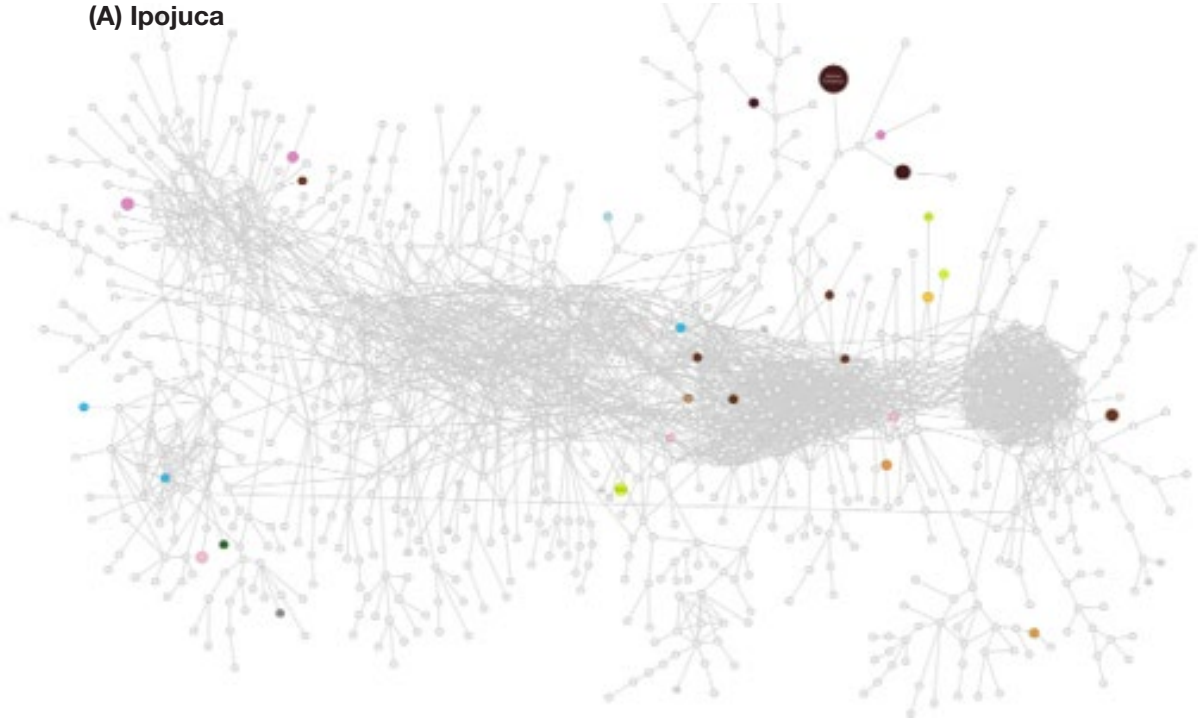
[9] Revealed Comparative Advantage (RCA) is a metric that determines a country's relative advantage in producing a particular good or service based on its export patterns. It is calculated as the ratio of a country's share of exports of a specific good to its total exports, relative to the world's share of that good to its total exports. An RCA value greater than one indicates a comparative advantage, while a value less than one indicates a comparative disadvantage.

The Recife microregion demonstrated relatively stable and high ECI performance over the years. The index began at 0.947 in 2013, peaked at 0.952 in 2015, experienced a slight decrease in 2018, and subsequently recovered, maintaining levels above 0.700 and registering 0.804 in 2023. The state of Pernambuco exhibited an initial growth trajectory, increasing from 0.436 in 2013 to 0.748 in 2017. However, there was a significant drop in 2018 to 0.038, followed by a gradual recovery in the ensuing years, reaching 0.384 in 2023.

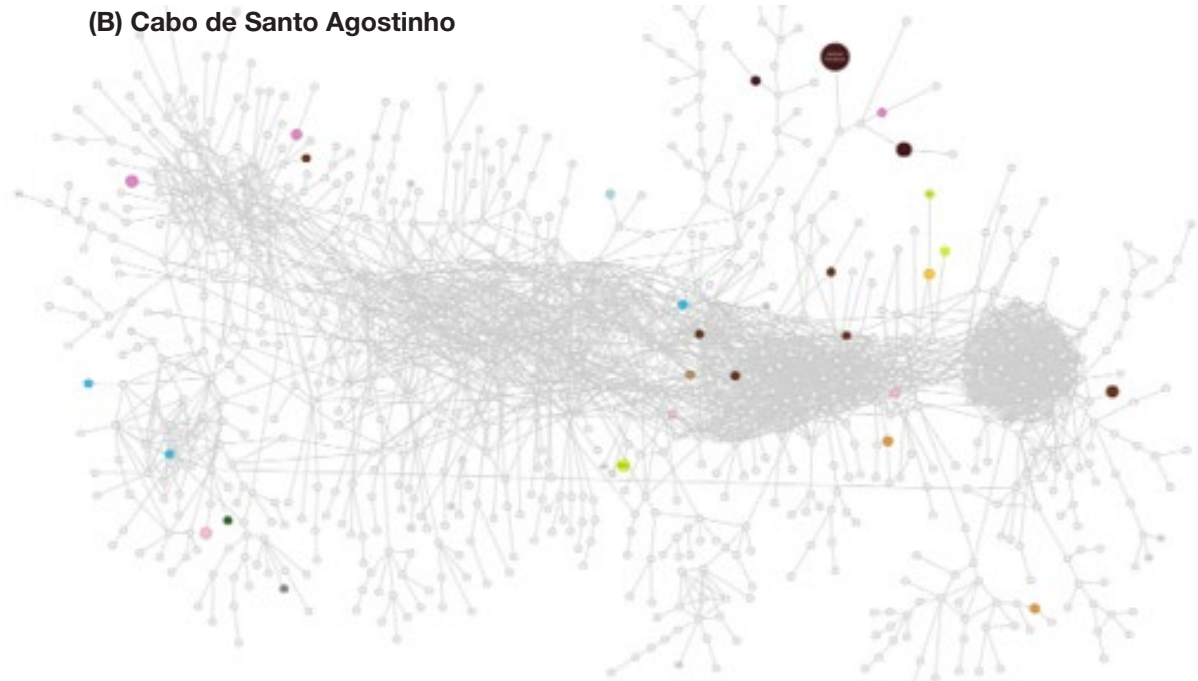
Finally, the Northeast region presented a negative ECI for most of the analysed period, indicating relatively low economic complexity. Starting at -09 in 2013, the index exhibited minor fluctuations until 2017, stabilising at -0.255. From 2019 onwards, a gradual improvement was observed, with the index turning positive, reaching 0.055 in 2023.

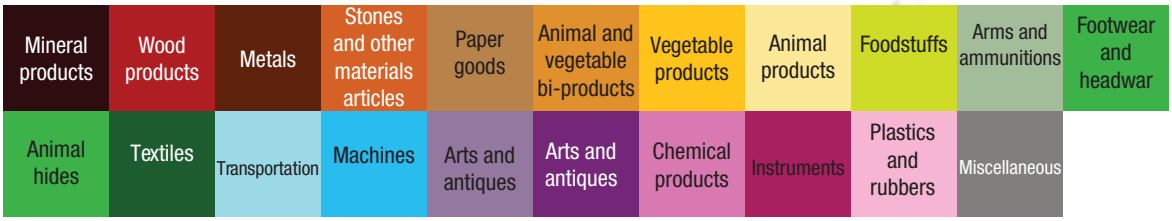
Figure 7
Product space from Ipojuca and Cabo de Santo Agostinho in 2023

(A) Ipojuca



(B) Cabo de Santo Agostinho

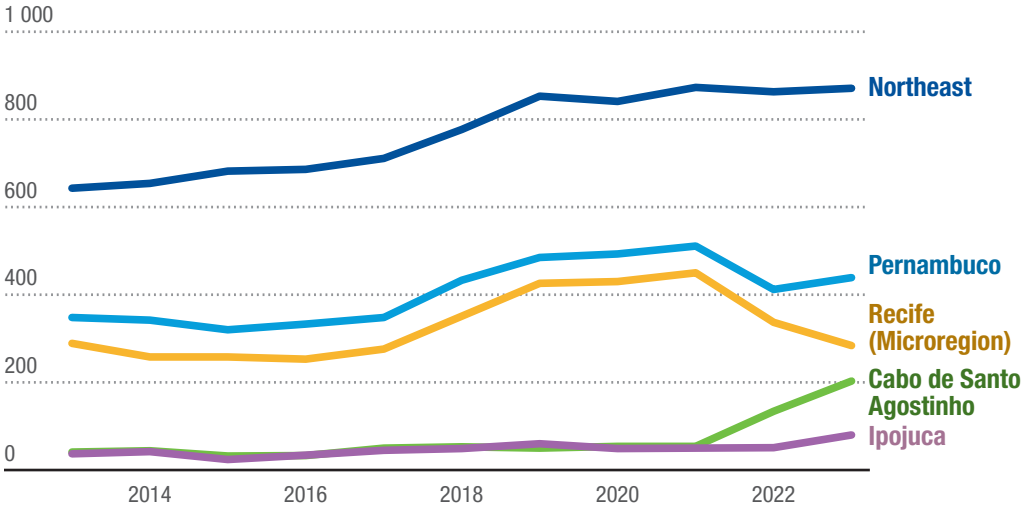




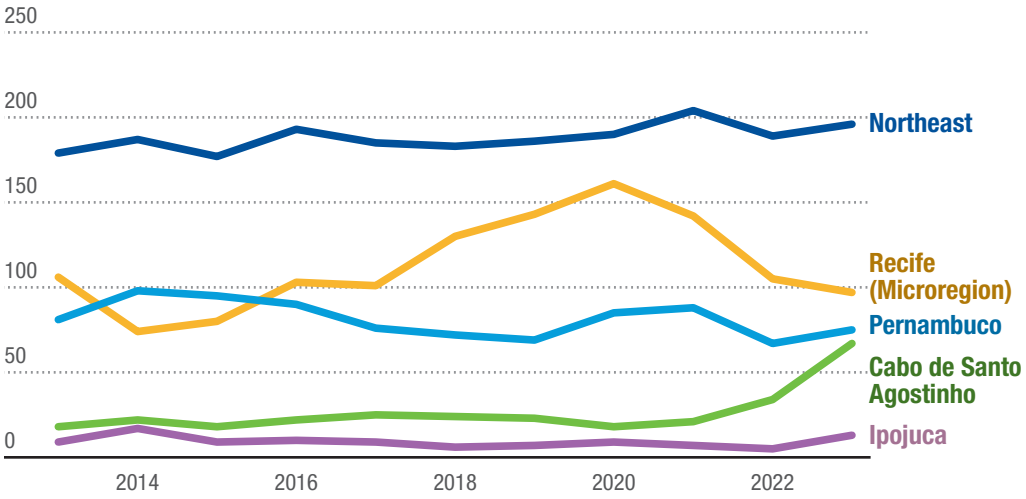
Source: Own elaboration with data from Electronic Invoice from the Pernambuco Treasury Department.

Figure 8
Diversity - number of products exported with and without RCA

(A) Number of products exported without RCA

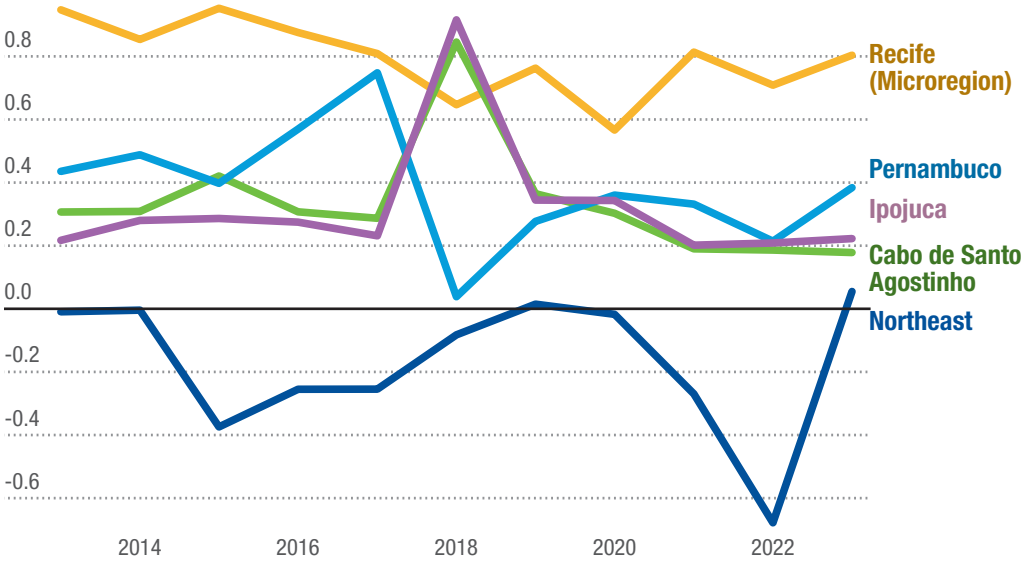


(B) Number of products exported with RCA



Source: Own elaboration with data from Ministry of Development, Industry, Trade and Services of Brazil (MDIC).

Figure 9
Evolution of economic complexity (ECI) between 2013 and 2023



Source: Own elaboration with data from Ministry of Development, Industry, Trade and Services of Brazil (MDIC).

Despite the modest share in international trade on a global scale, the region's engagement is relatively diverse and occupies significant (central) positions within the product space, being integral to key production chains. This observation raises three crucial questions for using this methodology to identify promising products and activities for the productive development of Suape:

- What products are currently exported and have the potential for export expansion?
- What products are not yet exported but whose network positioning suggests potential for export in the near future?
- Considering the intersection between the sectoral landscape, as indicated by exported and exportable goods, and the product space, which new products can be stimulated within the region's production structure?

There are various approaches to answering these questions. The traditional method involves detailed sectoral analysis of the production chains of national and multinational companies and their positioning within global value chains. This approach often requires case studies with a high level of specificity, which is feasible when the sectors and products are already identified.

Alternatively, this study proposes identifying the potential of activities and products using a broader dataset. This methodology will be elaborated on in subsequent sections.

3. Data and methodology

The analysis combines quantitative methods, using economic complexity and product space methodologies, with qualitative input from industry specialists and other stakeholders on products' feasibility and desirability. A key innovation is the granular product analysis, which disaggregates products by unit price within the same 6-digit HS codes. This approach refines traditional models by capturing price variations that signal distinct products, enabling more precise investment targeting. Including a validation workshop with industry experts translates the findings derived from the algorithm into a practical list of potential products for diversification to enhance the region's economic complexity.

3.1 Data collection

This study used firm- and municipality-level data to assess the existing productive capacities at the port of Suape. Firm information was gathered on production and exports, covering products exported, their corresponding "Nomenclatura Comum do Mercosul" (NCM) code at the 6-digit level, unit price, and whether the product was imported. The goal was to consider only locally produced products, assuming production occurred within the port.

This data collection exercise was piloted with four companies. Due to some firms' reluctance to disclose exact unit prices, unit price ranges were identified based on the NCM codes provided. This led to a follow-up stage where firms provided information on unit price ranges using an adjusted multiple-choice format.

Unit price ranges were determined using 2022 COMTRADE world export data, matching NCM to Harmonized System (HS) codes. As NCM codes comprise the initial six digits from the HS code classification, NCM and HS codes were used interchangeably in the process. Unit price values were constructed by dividing primary values by the quantity traded. Since these primary values are expressed in US$ in COMTRADE, they were multiplied by 1.1 to account for inflation in 2022 and 2023 and then multiplied by 5.12 to transform into Brazilian reais. They were also reduced by 10 per cent to account for potential differences between CIF and FOB prices.

A statistical method based on interquartile ranges and percentile values resulted in nine distinct price ranges per product. The use of interquartile ranges and multiple layers of outlier analysis ensured that the ranges were robust and accounted for extreme values, providing a clear structure for categorising unit values. This method facilitated firms in selecting an appropriate price range from nine options without disclosing exact unit prices. Despite this, the response rate was low, with only nine firms out of 43 providing the requested information. To ensure effective data collection, 15 individuals were trained to administer the questionnaire. This training was conducted with SENAI, consultants, and UNCTAD during a first mission to Recife. This data formed the basis for subsequent analyses, including the assessment of potential product diversification across different sectors for products with an above-average economic complexity value.

The study also comprised a second-round questionnaire to gather information on firm characteristics, including innovation and technology trends to better understand the business environment and inform the strategy guiding practical steps for attracting investments. This questionnaire[10] was sent to 36 companies operating in the manufacturing industry in Suape and comprised four sections:

Profile of the firm: This section included multiple-choice questions to determine whether the enterprise was a single independent establishment or part of a larger firm, details on capital ownership, and total employment figures.

Business dynamics: Respondents ranked the importance of nine different factors (services) that were believed to give their company a comparative advantage due to operating in the Port of Suape on a 1-5 scale.

Innovation: This section focused on process and product innovations within the firms, using multiple-choice questions.

New technology adoption: Questions about the adoption of new technologies within the firms were included in this multiple-choice section.

Determining average economic complexity and product complexity, as well as developing a measure of proximity between products involves constructing a bipartite network of countries and products to apply the method of reflections. This requires comprehensive trade data for all products across all countries. While a country's production data is ideal, systematically disaggregated production data is scarce, particularly for less industrialised developing and least developed countries. As a proxy, the study uses 2022 disaggregated trade data from COMTRADE under the HS 2002 classification at the 6-digit level. The data are further disaggregated by unit code of quantity and by unit price range using the methodology proposed in Freire (2017), each product represented by an 8-digit classification code in which the first six digits correspond to the 6-digit HS 2002 code, the seventh digit corresponds to the unit quantity code of the product and the eighth digit represents the unit value group that includes the unit value of the product. This allows the mapping of different products based on their closeness, which is needed to determine the potential for diversification of firms operating in the Port of Suape.

After identifying average global economic complexity, average product complexity and proximity between products, data on the municipalities located in Suape is needed to assess the port's current productive space and potential opportunities. At the municipality level, export data was collected using the Electronic Invoice system from the State's Revenue Office in Pernambuco (Receita Federal em Pernambuco).

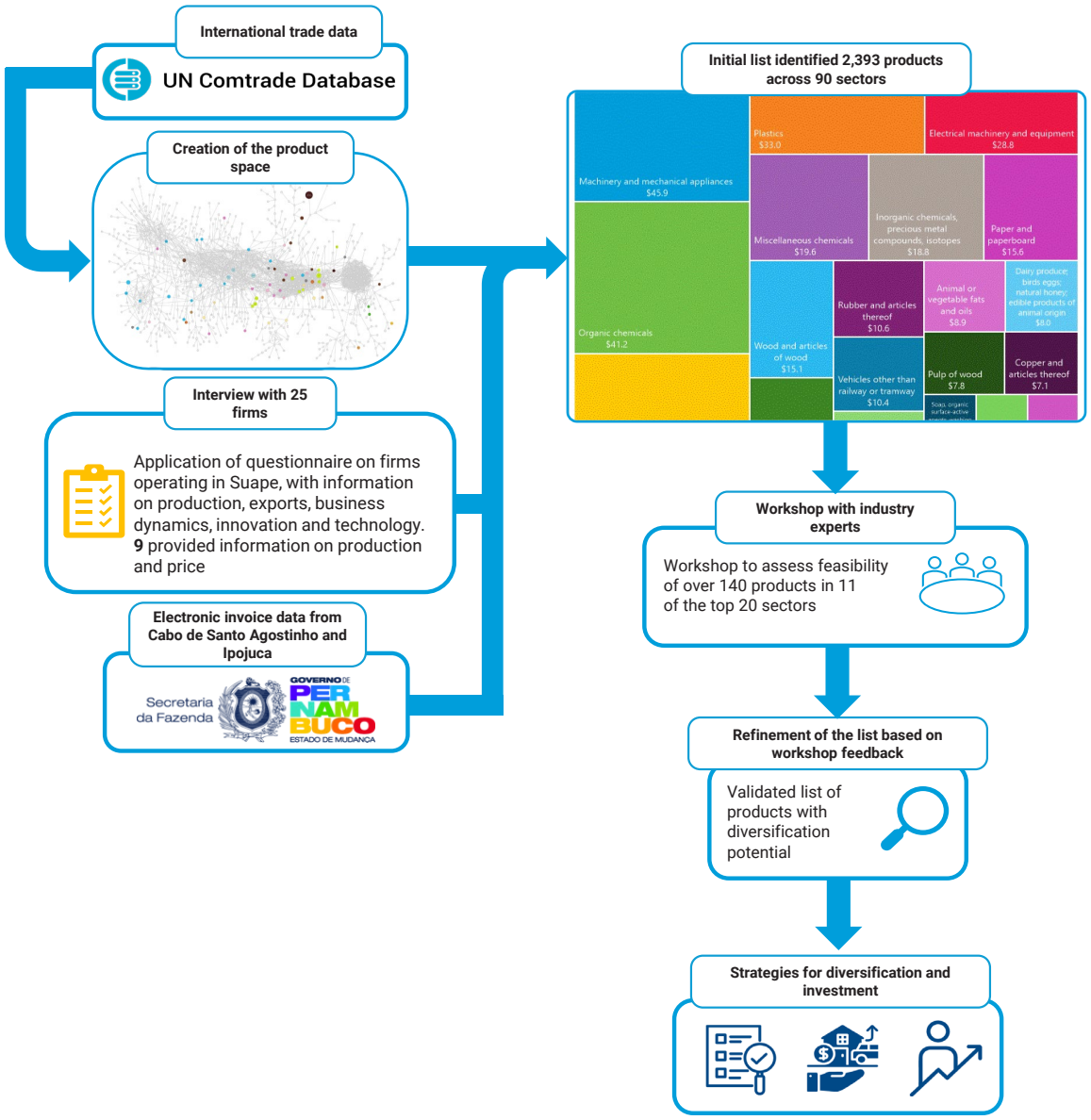
3.2 Methodology

The study uses qualitative and quantitative methods for data collection, processing, and analysis. Figure 10 illustrates the methodology. Initially, COMTRADE international trade data was used to create the product space. This data was matched with export data from the municipalities of Cabo de Santo Agostinho and Ipojuca, where the Port of Suape is located. This process generated an initial list of potential products closely related to those already exported through the port, ensuring the port's infrastructure and existing capacity can support expansion into these activities.

Municipality data was gathered using Electronic Invoice data, complemented by firm survey data. The resulting list of identified products was based on a quantitative analysis using the method of reflections developed by Hidalgo and Hausmann (2009), with modifications proposed by Freire (2017). This yielded a list of potential diversification products, restricted to those with above-average economic complexity and significant aggregate export opportunities9. Export

[10] Included in Appendix A.

Figure 10
Methodology



Source: Author's elaboration.

opportunities were assessed through a monetized overlap index, which estimates the potential for new products to enter expanding import markets.[11] This measure calculates the degree to which one country's potential new exports align with another country's growing import demand, based on the increase in the global share of imports in specific sectors.

This analysis restricted the initial list to the top twenty sectors. To advance economic development in the region, the feasibility of producing the identified products in Pernambuco was validated with the support of industry specialists. Subsequently, eleven sectors (further aggregated to six) were selected based on the availability of industry experts.

[11] The computation of measures used is included in Appendix B.

Table 4
Workshop participation

Industry	Sub-groups	No. of participants		
		SENAI	Company (no. companies)	Total
Chemistry	Organic chemistry Inorganic chemistry Mixed chemicals Soaps and lubricants Pharmaceuticals	3	9 (3)	12
Machinery and mechanical appliances		1	4 (3)	5
Vehicles		1	3 (2)	4
Iron and steel		3	3 (1)	6
Electronics		4	3 (1)	7
Plastics		2	2 (2)	4

To this end, a questionnaire was developed and distributed during a workshop to gather detailed information,[12] subject to criteria related to production processes, infrastructure needs, sustainability, innovation, and potential uses in other industries. Given the objective to expand the productive capacity of the Port of Suape, participants were asked to assess the availability of capital inputs and human resources in Pernambuco (or Brazil, and if not elsewhere in the world).

Table 4 summarises the industries, the number of products for which information was gathered, and the number of participants, including a breakdown of SENAI and external company representatives, totalling 39 participants. Some SENAI specialists participated in multiple sessions, lowering the number of unique participants to 33.

Responses were gathered for a total of 141 products, which form the basis of the final list of products for recommendation as part of the strategy for diversification and investment proposed in section 6.

With the defined products, the participants' responses were tabulated for the consideration of a ranking of production possibilities based on seven indices: inputs, machinery and equipment, human resources, employment, investment, utilities (water and energy), and sustainability. A rating scale was created for scoring each index, prioritizing products with easy access to local resources (including inputs, machinery and human resources), strong job creation potential (based on a comparative scale of job creation), greater women participation in production (based on a comparative scale of gender parity in the sector), lower investment needs (based on a comparative scale of investment requirements), lower usage of water and energy, and lower environmental impact (comparative scale of sustainability dimensions, including carbon emissions, deforestation, water and soil pollution, biodiversity loss, among others). The scoring was categorized between 5 (highest value) and 1 (lowest value). Information on job creation was estimated using Brazil's input-output matrix, while investment needs were based on respondents' answers and market information obtained through secondary research.[13]

[12] Included in Appendix C.
[13] Specialized sectoral websites, experts in projects involving university-industry interaction (mainly researchers from the Aeronautics Institute of Technology), and data from industrial associations such as ANFAVEA, ABIQUIM, ABINEE, ABM, ABIMAQ, ABRACICLO, and Sindipeças were consulted.

4. Results

The analysis identifies 141 high-potential products across six priority sectors: machinery and mechanical appliances, chemicals, iron and steel, plastics, electrical machinery and equipment, and vehicles. These products represent an export opportunity valued at US$ 141 billion and could generate significant employment, requiring an estimated investment of US$ 2.24 billion. An econometric exercise estimates that, by strategically targeting products with higher economic complexity, Suape has the potential to boost regional GDP by 3.14 per cent and formal employment by 4.54 per cent.

After applying the methodology defined in section 3.2, 2,393 products were identified at the HS 6-digit level, further disaggregated by quantity and unit price across 90 sectors. We focus on the top 20 sectors, which account for 82 per cent of the total export opportunity, corresponding to 1,382 products. These sectors, defined at the HS 2-digit level, along with their total export opportunity (expressed in US$), are summarised in Figure 11.

The measure of export opportunity is a monetized type of overlap index designed to measure the degree to which one country's potential new exports match another's expanding import markets. A higher degree of export opportunity for potential new products indicates more favourable prospects for commercial expansion for new products, given the past rate of growth of their importing markets.

Figure 11 reveals that the largest sector with export opportunity is machinery and mechanical appliances, which accounts for US$ 45.9 billion, equivalent to approximately 13 per cent of the opportunity for the top 20 sectors. This is followed by organic chemicals (US$ 41.2 billion, equivalent to 12 per cent), iron and steel (US$ 34.6 billion, 10 per cent), plastics (US$ 33 billion, 9 per cent), and electrical machinery and equipment (US$ 28.8 billion, 8 per cent).

The full list of sectors can be found in Table D.1. in Appendix D. When reconciling this analysis with Figure 7, which illustrates the existing product space of Ipojuca and Cabo de Santo Agostinho, it becomes evident that the sectors (and their associated products) represent an expansion of industries already operating in Suape, predominantly concentrated in Cabo de Santo Agostinho. This is reflected in the product space by the coloured points, highlighting areas of established activity.

Regarding potential destination markets (Figure 12 and Table 5), most export opportunities are in Europe, accounting for 34 per cent of the total, equivalent to US$ 73.8 billion. The largest shares within Europe are Italy (6 per cent), the Netherlands (4 per cent), and Germany (3 per cent). Asia represents the second-largest market, with a share of 31 per cent of the total export opportunities, led by China (10 per cent) and India (4 per cent). Northern America is the third-largest market, accounting for 23 per cent, with the United States of America being the largest potential export destination, capturing a significant 20 per cent share.

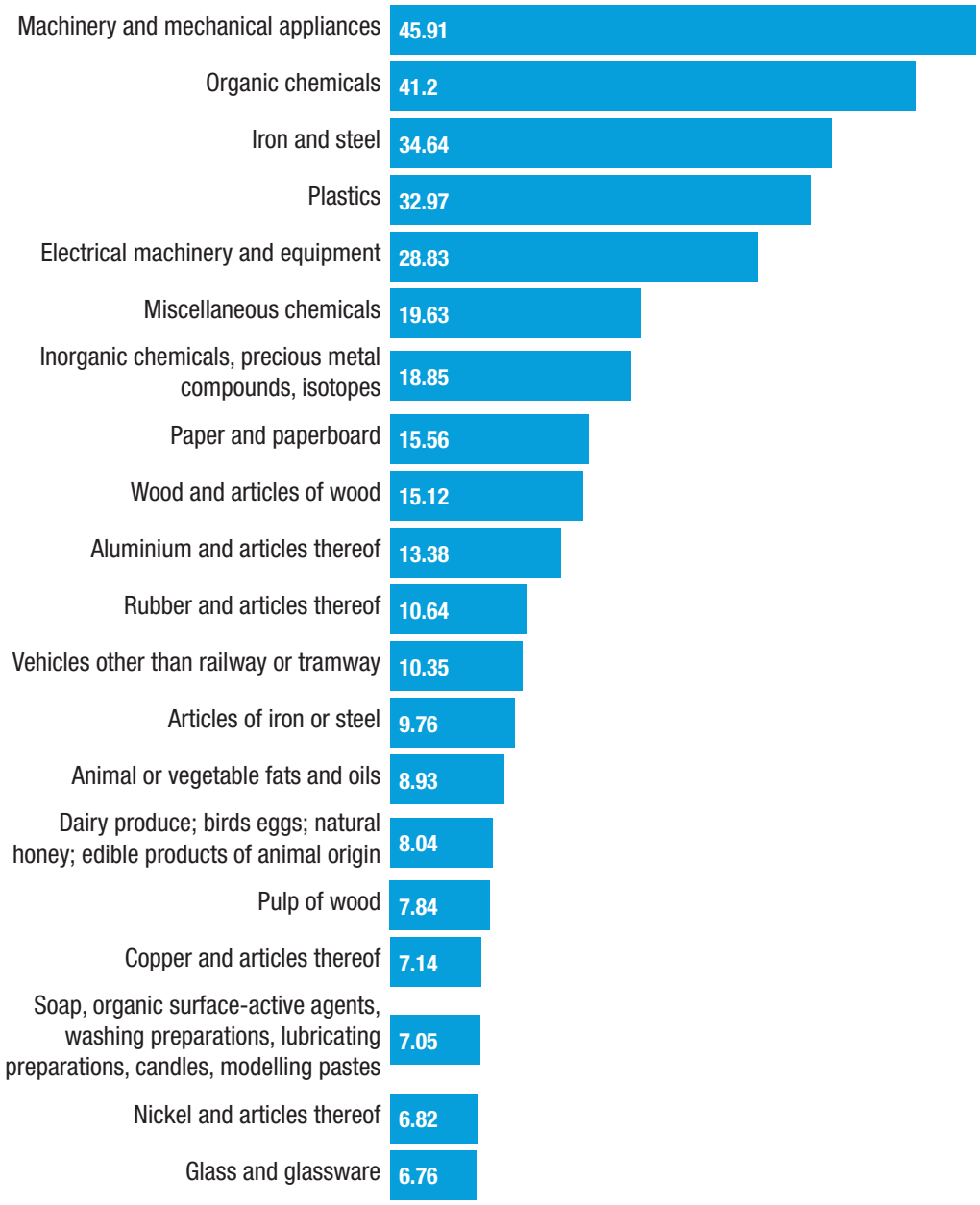
At the product level, we obtain detailed information on the export opportunity, including unit price ranges for the products' possible export and total export

opportunities, as well as a breakdown of opportunities by markets and their corresponding share. Information is generated for the top 10 markets for each product. For ease of reference, Table 6 provides an example, limiting the opportunities to the top 5 markets instead of 10.

Figure 11

Top 20 sectors with above-average economic complexity and large export opportunity

(US$ billion)



Note: This graph shows the top 20 sectors with the greatest total opportunity export potential, accounting for 82 per cent of the identified products.

Figure 12
Potential destination markets, by region

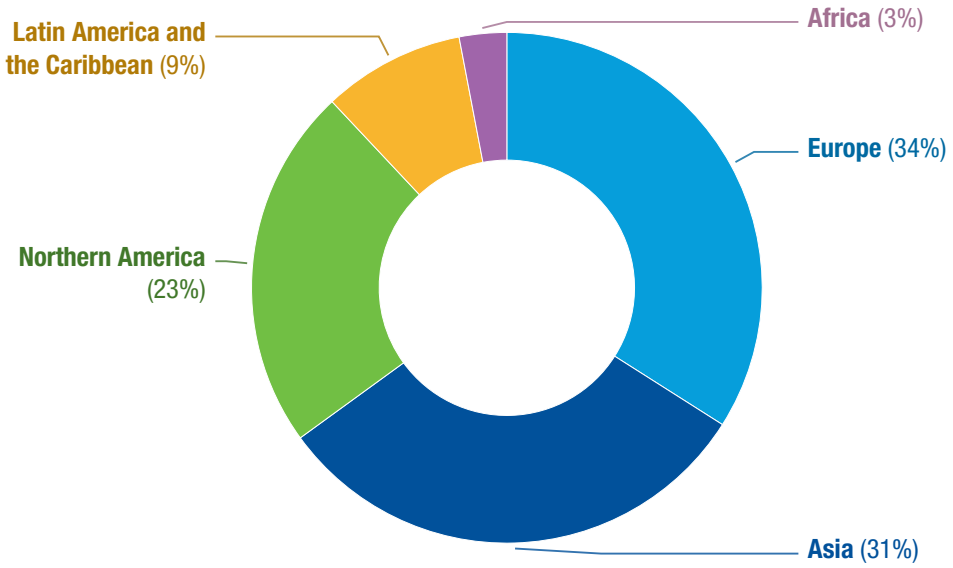


Table 5
Potential destination markets, by country

Potential market	Share of opportunity	Potential market	Share of opportunity
United States of America	20	Poland	3
China	10	Brazil	3
Italy	6	Austria	2
Netherlands	5	United Kingdom of Great Britain and Northern Ireland	2
India	4	Canada	2
Germany	3	Singapore	2
Mexico	3	Switzerland	1
Japan	3	Malaysia	1
Republic of Korea	3	Türkiye	1
Belgium	3	Others	19
France	3		

Table 6
Export destination markets and opportunities, by product

HS	Description	Unit price range (US$)	Total export opportunity (US$, million)	Opportunities in the top 5 markets (US$, million)									
				Market 1		Market 2		Market 3		Market 4		Market 5	
840734	Engines; reciprocating piston engines, of a kind used for the propulsion of vehicles of chapter 87, of a cylinder capacity exceeding 1000cc	$2 752-5 324	3 005	Germany	1 346	United States of America	1 140	Austria	145	Spain	106	Hungary	87
841199	Turbines; parts of gas turbines (excluding turbo-jets and turbo-propellers)	$571-1 350	2 009	Singapore	1 223	Mexico	117	Japan	117	Peru	113	United Arab Emirates	106
841861	Heat pumps; other than air conditioning machines of heading no. 8415	$1 824-2 564	1 767	France	551	Poland	340	Italy	291	United Kingdom of Great Britain and Northern Ireland	172	Spain	127
841810	Refrigerators and freezers; combined refrigerator-freezers, fitted with separate external doors, electric or other	$566-922	1 498	United States of America	1 008	Canada	312	India	98	Austria	13	Mexico	12

4.1 Validated results

The workshop with industry specialists yielded a refined list of products based on the six top industrial sectors identified on the methodology: chemicals (organic, inorganic, mixed chemicals, soap and lubricants and pharmaceuticals), machinery and mechanical appliances, iron and steel, plastics, electrical machinery and equipment, and vehicles. A total of 141 products were selected, considering their export capacity (products classified in the top 40 export percentage list). For sectors that did not have 10 products on this list, products from the overall list were added to meet a minimum of 10 products for analysis.

As outlined in the methodology, the products were evaluated based on a ranking of production possibilities across seven indices: inputs, machinery and equipment, human resources, employment, investment, utilities (water and energy), and sustainability. Scoring criteria varied across indices. For inputs, machinery and equipment, and human resources, priority was given to access within Pernambuco, followed by broader access within Brazil, and then imports. Employment generation and investment needs were scored using a comparative scale based on sectoral median values. Resource use and sustainability were similarly assessed using median sectoral benchmarks. The combined scores from these indices determined the overall ranking of each product, ranging from 0 (less prioritised) to 35 (most prioritised). The full list of the products and their corresponding scores can be found in the Appendix under Table D.2.

Considering the importance of strategies for productive densification based on sectoral similarities, the quantity and average score of the products are presented in Table 7, as well as the estimated investment required for production (based on respondents' answers and market information obtained through secondary research) and the estimated employment creation (direct, indirect, and through the endogenization of consumption) based on Brazil's input-output matrix.[14] In this case, the amounts obtained in Brazilian Real (R$) were converted to US$ at an exchange rate of R$ 5.50 / 1 US$.

Table 7
Investment, employment and products, by sector (prioritised products)

Sector	Investment (US$ million)	Employment	Products	Average score	Standard deviation (score)
Chemicals	508.23	3,529	61	23.9	2.37
Electrical machinery and equipment	368.06	2 294	19	26.3	2.23
Iron and steel	229	2 074	17	23.5	1.87
Machinery and mechanical appliances	522.82	4 663	14	23.6	3.65
Plastics	231.77	2 028	20	23.0	1.72
Vehicles	380.72	3 211	10	24.4	2.27
Total	2 240.60	19 171	141	24.1	

[14] Based on an update from Morceiro, P. C., Tessarin, M. S., & Guilhoto, J. J. M. (2022). *Produção e uso de tecnologia setorial no Brasil. Economia Aplicada, 26(4), 517-550. https://doi.org/10.11606/1980-5330/ea172515.*

The total investment across the 141 prioritised products is approximately US$ 2.24 billion, potentially generating around 19,000 jobs. Machinery and mechanical appliances and chemicals stand out as the sectors with the highest investment needs, at around US$ 500 million each. These sectors also rank high in job creation, generating around 4,663 and 3,529 jobs, respectively. Vehicles also rank high on employment creation (3,211 jobs) with an investment need of US$ 380 million. Although the electrical machinery and equipment sector has a substantial investment need of US$ 368 million, it shows lower employment generation (2,294 jobs) compared to sectors with similar levels of investment. In comparison, sectors with lower investment levels, such as iron and steel (US$ 229 million) and plastics (US$ 232 million), contribute over 2,000 jobs each, suggesting efficient job creation relative to investment.

The average score, representing product importance or prioritisation within each sector, is similar across sectors, hovering at around 24. However, the electrical machinery and equipment sector shows a slightly higher average score (26.3), indicating that products in this sector are given more priority despite the lower aggregate employment impact. The standard deviation of scores is relatively low across sectors (1.72-3.65), indicating consistency in how products are prioritised. However, the machinery and mechanical appliances sector has a higher standard deviation (3.65), suggesting greater variability in the importance of the products in this category. In contrast, sectors like plastics (1.72) and iron and steel (1.87) have tighter groupings of product scores, implying more uniform prioritisation.

Altogether, the chemicals sector leads in investment and job creation, which aligns with its broad product range (62 products). Although the electrical machinery and equipment sector has fewer products (20), its higher average score and lower score deviation suggest that the identified products within this sector are of strategic significance and consistently valued. The vehicles sector, despite focusing on only 10 products, attracts considerable investment (US$ 381 million), highlighting high capital intensity.

Table 8 summarises the market potential across different sectors and regions, aggregating a total export opportunity of $141 billion. Asia dominates with the highest market potential irrespective of the sector, totalling US$ 47.2 billion, making it a key region for companies seeking to expand or consolidate their global presence. Europe and North America also show substantial potential, with US$ 41.3 billion and US$ 31.6 billion, respectively, reflecting their position as mature and economically robust markets. In contrast, regions like Africa, Central America, and Oceania show smaller market potentials but could offer specific opportunities, especially in niche or emerging markets.

Among sectors, chemicals leads with a market opportunity of US$ 45.5 billion, with Asia (US$ 13.2 billion) and Europe (US$ 12.4 billion) as the main hubs with high demand driving global growth. Electrical machinery and equipment (US$ 29.1 billion) also show strong potential, especially in Asia (US$ 14.8 billion) and North America (US$ 9.3 billion). This sector benefits from technological advancement and demand for innovation, making these regions crucial for companies in this field.

The machinery and mechanical appliances (US$ 22.5 billion), plastics (US$ 19.4 billion) and iron and steel (16.4 billion) sectors also show significant potential, particularly in Europe and Asia. For example, the demand for machinery and mechanical appliances aligns with industrialisation and infrastructure development trends in these regions, while plastics may follow the growth of the packaging and manufacturing sectors. The vehicles sector has the smallest market potential (US$ 8.1), with key markets in Europe and North America.

Table 8
Distribution of opportunities across regions, by sector (in US$ million)

Sector	North America	Africa	Oceania	Asia	Europe	South America	Central America	Total
Chemicals	7 616.0	1 805.7	1 469.5	13 286.1	12 375.4	7 369.5	1 589.5	45 511.7
Electrical machinery and equipment	9 372.1	163.5	63.6	14 828.5	4 121.7	320.4	267.2	29 137.0
Iron and steel	2 666.0	768.3	94.0	6 203.8	4 556.1	1 264.7	810.9	16 363.8
Machinery and mechanical appliances	4 795.4	104.8	163.8	7 023.7	8 878.5	1 366.2	171.2	22 503.6
Plastics	4 039.6	728.2	0.0	5 108.1	7 483.0	1 036.2	975.4	19 370.5
Vehicles	3 114.7	22.5	36.8	843.2	3 890.0	67.9	141.9	8 117.0
Total	31 603.8	3 593.0	1 827.7	47 293.4	41 304.7	11 424.9	3 956.1	141 003.6

4.2 Potential impacts of smart diversification

The concept of smart diversification involves creating incentives to develop production chains with high technical and economic potential, leveraging each region's unique strengths and capabilities. This approach necessitates a thorough analysis of the potential for economic diversification, guided by insights into the production structure, including its comparative advantages and existing bottlenecks.

The preceding sections identified a set of strategic sectors for Suape, characterized by significant national and global dynamism. Despite their differing characteristics, these sectors should be considered central to Suape's economic strategy. This is due to their prominence in terms of local employment and exports, or because they present the greatest opportunities for regional economic advancement.

Table 9 presents the average Product Complexity Index (PCI) by strategic sectors for Suape. Notably, the sectors identified demonstrate a higher product complexity relative to those currently produced (where RCA >= 1). The potential benefits of enhancing these strategic sectors extend beyond mere diversification prospects; they occupy a more interconnected and dense area within the complexity map, indicating their pivotal role in fostering economic resilience and growth.

To evaluate the potential gains from implementing smart diversification strategies, as discussed in the previous sections, we conduct a hypothetical exercise to quantify the impact of acquiring RCA in the identified products on GDP and employment. This assessment offers complementary perspectives on how complexity influences economic output and employment levels.

To analyze the impact of the ECI on future economic growth, we estimate a series of regressions with GDP and formal employment as the dependent variables, covering the period from 2006 to 2021.

Table 9
Average PCI in identified sectors in Suape

Sectors	Average PCI
Products with RCA >= 1	-0.236
Chemicals	0.607
Electrical machinery and equipment	0.858
Iron and steel	0.512
Machinery and mechanical appliances	15
Plastics	0.985
Vehicles	0.803
All Sectors	0.722
All Products	0.364

Source: Own elaboration with data from Ministry of Development, Industry, Trade and Services of Brazil (MDIC).

The estimated equation for GDP follows the specification used by Hausmann et al. (2014), but in a panel data form:

$$\log(y)_{i,t}=\alpha+f_i+f_t+\beta_1\, ECI_{i,t}+\beta_2\, L.ECI_{i,t}*\log(y)_{i,t}+\beta_3\, \log(y)_{i,t-1}+\beta_i\, \log(p)_{i,t}+\varepsilon \quad (1)$$

where y is the GDP (gathered from the Brazilian Institute of Geography and Statistics – IBGE), f_i are fixed effects for individuals i (municipalities) and periods t (annual dummies), α is the constant, ε is the residuals. Among the explanatory variables are the initial GDP (log) and a multiplicative variable between ECI and GDP. The former seeks to capture the effect of the hypothesis of convergence or technological catch-up. The multiplicative term seeks to capture the non-linearity of the effect of ECI on GDP. Hypothetically, this effect is negative because the potential gains from increasing ECI diminish as both GDP and ECI rise over time. Finally, we use population (p) as a control variable in the regressions.

The explanatory variables are introduced with a lag to assess if they predict increases in GDP in the subsequent period. Although this does not solve potential simultaneity, it provides a stronger indication of the relevance of each variable.

The impact of ECI on the evolution of formal employment was evaluated estimating the following equation, analogous to equation (1):

$$\log(l)_{i,t}=\alpha+f_i+f_t+\beta_1\, ECI_{i,t}+\beta_2\, ECI_{i,t}*log(l)_{i,t}+\beta_3\, log(l)_{i,t-1}+\beta_i\, \log(p)_{i,t}+\varepsilon \quad (2)$$

where l is the formal employment in the economy. The interpretation of the variables is the same as in equation (2).

The estimation of equations (1) and (2) was conducted using traditional panel data methods. Across all models and specifications, both time and municipal fixed effects proved statistically significant, justifying their inclusion. Tests for the correlation between the endogenous variables and residuals further validated the choice of fixed-effects estimation. The detailed results are presented in Tables 10 and 11.

The models and their parameters exhibit a high degree of statistical significance, consistently supporting all the underlying hypotheses. Notably, the estimated coefficient for the ECI at the municipal level aligns closely with the findings of Hausmann et al. (2014) at the national level, based on export data, suggesting robustness across different spatial scales.

Table 10
Economic complexity and GDP

Variables	Coefficient
ECI	-0.1751*** (008)
Log of GDP (lag)	0.1212*** (040)
ECI * Log of GDP	090*** (000)
Log of Population	-0.0442*** (0.0114)
Constant	17.5782*** (0.1353)
Observations	12,377
Adjusted R2	0.9983
Average marginal effects (dy/dx – ECI)	063***

Note: The dependent variable is the Log of GDP. Robust standard errors in parenthesis. All models are estimated introducing region and year fixed effects. Significance: *=10 per cent; **=5 per cent; ***=1 per cent.

Source: Authors' elaboration.

Table 11
Economic complexity and employment

Variables	Coefficient
ECI	-0.0721*** (003)
Log of Employment (lag)	0.0744*** (034)
ECI * Log of Employment	095*** (000)
Log of Population	-0.0434*** (094)
Constant	7.4540*** (0.0958)
Observations	12,377
Adjusted R2	0.9989
Average marginal effects (dy/dx – ECI)	091***

Note: The dependent variable is the Log of Employment. Robust standard errors in parenthesis. All models are estimated introducing region and year fixed effects. Significance: *=10 per cent; **=5 per cent; ***=1 per cent.

Source: Authors' elaboration.

The explanatory power of the models is also noteworthy. Variations in both GDP and the formal employment ratio, across both temporal and cross-sectional dimensions, are largely accounted for by variations in the ECI. Even when the ECI is the sole explanatory variable, the model yields an R^2 of 0.99, indicating that approximately 99 per cent of the variance in GDP or formal employment can be attributed directly to differences in economic complexity.

Additionally, the elasticity of formal employment to changes in the ECI is found to be lower than that of GDP, indicating that while economic complexity has a significant impact on economic output, its influence on employment generation is relatively subdued. Moreover, lagged values of GDP and employment are positively correlated with their current values, reinforcing the persistence of economic growth and job creation over time.

Lastly, the impact of ECI on economic outcomes intensifies as the levels of output and formal employment increase within a municipality, suggesting that the potential gains from enhancing economic complexity are magnified in regions with higher initial levels of production or employment.

The average marginal effect of ECI represents the estimated change in the dependent variable, such as GDP or employment, associated with a one-unit increase in the ECI, holding all other factors constant. In practical terms, the marginal effect provides insight into how variations in economic complexity—defined as the diversity and sophistication of a region's or country's productive capabilities—translate into economic outcomes. For example, a positive marginal effect of the ECI on GDP indicates that regions or countries with more complex and diversified economies are likely to experience higher levels of economic growth. Similarly, if the marginal effect of the ECI on employment is positive, it suggests that an increase in economic complexity leads to higher employment levels. This effect is derived by calculating the partial derivative of the economic outcome variables (GDP and employment) with respect to the Economic Complexity Index (ECI). This derivative quantifies the sensitivity of GDP and employment to changes in economic complexity, capturing how marginal shifts in the ECI influence these key economic indicators while holding other factors constant.

The average marginal effect of the ECI on GDP is estimated at 063, indicating that a one-unit increase in ECI is associated with an approximate 0.63 per cent increase in GDP, holding other factors constant. This suggests a modest but statistically meaningful impact of economic complexity on regional economic output, reflecting the capacity of regions with more diverse and sophisticated production structures to achieve higher levels of GDP.

Similarly, the average marginal effect of ECI on formal employment is estimated at 091, implying that a one-unit increase in ECI corresponds to a 0.91 per cent rise in formal employment, ceteris paribus. This finding highlights the relatively greater sensitivity of employment levels to changes in economic complexity compared to GDP, suggesting that regions with higher economic complexity not only generate more output but also create a proportionally larger number of formal jobs.

These results underscore the importance of fostering economic complexity to achieve broader economic development objectives, including both output expansion and employment generation.

Table 12 presents the potential gains, expressed as the average marginal effect, for each of the strategies highlighted in the previous section. This simulation aggregates the average export data for the municipalities of Ipojuca and Cabo de Santo Agostinho. As a counterfactual scenario, we calculated the joint Economic Complexity Index (ECI) for Ipojuca and Cabo de Santo Agostinho over the period from 2019 to 2023. The indicator was normalized using the min-max scaling technique to ensure the ECI values ranged between 0 and 100.

Table 12
Projected gain in GDP and employment by acquiring RCA in the indicated promising sectors

Sectors	Projected ECI	ECI Gain (per cent)	GDP change (per cent)	Employment change (per cent)
Average between 2019-2023	86.94			
Chemicals	90.80	3.86	2.43	3.52
Electrical machinery and equipment	90.99	4.05	2.55	3.68
Iron and steel	91.13	4.19	2.64	3.81
Machinery and mechanical appliances	90.72	3.78	2.38	3.44
Plastics	90.88	3.94	2.48	3.59
Vehicles	90.74	3.80	2.39	3.46
All Sectors	91.93	4.99	3.14	4.54
All Products	90.80	3.86	2.43	3.52

Source: Authors' elaboration.

The baseline value obtained for 2019 and 2023 was 86.94.

We then simulated the change in the joint ECI for Ipojuca and Cabo de Santo Agostinho if the region were to acquire a comparative advantage in the products of each of the strategic sectors identified: Chemicals; Electrical machinery and equipment; Iron and steel; Machinery and mechanical appliances; Plastics; Vehicles. Additionally, we tested the scenario where the region acquires comparative advantage across all sectors simultaneously (141 products). Lastly, we analyzed the projected ECI if the region were to achieve comparative advantage in all initially identified products (2,184 products), irrespective of their selection in the workshop.

Table 12 also includes a column showing the increase in the ECI for each simulation relative to the baseline scenario.

Finally, we estimated the impact on GDP and total employment by multiplying the ECI growth by the average marginal effects of the ECI on GDP and employment, as previously identified.

The results presented in Table 12 demonstrate that the targeted strategy of acquiring RCA in specific sectors has varying impacts on economic growth and employment. Among the sectors analyzed, "Iron and Steel" and "Electrical Machinery and Equipment" stand out for their significant effects. The "Iron and Steel" sector shows the highest projected ECI gain of 4.19 per cent, resulting in a 2.64 per cent increase in GDP and a 3.81 per cent rise in employment. Similarly, the "Electrical Machinery and Equipment" sector achieves an ECI gain of 4.05 per cent, contributing to a GDP growth rate of 2.55 per cent and an employment growth rate of 3.68 per cent.

The "Plastics" and "Chemicals" sectors also exhibit substantial impacts, with ECI gains of 3.94 per cent and 3.86 per cent, respectively, translating into GDP growth rates of 2.48 per cent and 2.43 per cent, and employment growth rates of 3.59 per cent and 3.52 per cent. These results suggest that sectors with higher technological intensity and potential for value-added production tend to have a more pronounced effect on economic indicators.

The "Vehicles" and "Machinery and Mechanical Appliances" sectors, while showing slightly lower impacts, are still important drivers of growth. The "Vehicles" sector projects an ECI gain of 3.80 per cent, leading to a GDP growth rate of 2.39 per cent and an employment growth rate of 3.46 per cent. Meanwhile, the "Machinery and Mechanical Appliances" sector follows closely with an ECI gain of 3.78 per cent, GDP growth of 2.38 per cent, and an employment increase of 3.44 per cent. These sectors remain crucial to the overall strategy, reflecting their potential to enhance productive capabilities and foster job creation.

Comparing the strategies, the "All Sectors" approach, which focuses on gaining RCA in all identified strategic sectors, results in the most significant overall impact. This strategy yields an ECI gain of 4.99 per cent, alongside a GDP growth rate of 3.14 per cent and an employment growth rate of 4.54 per cent. In contrast, the "All Products" strategy, which includes acquiring RCA in all identified products without sectoral distinction, produces a smaller ECI gain of 3.86 per cent, with a GDP growth rate of 2.43 per cent and an employment growth rate of 3.52 per cent.

The comparison indicates that the "All Sectors" strategy is more effective than the "All Products" approach. This finding suggests that a targeted selection of sectors, rather than a broad-based strategy, has greater potential for generating significant economic growth and job creation. The results highlight the efficacy of the proposed methodology in identifying strategic sectors that maximize the impact on economic complexity, GDP, and employment, thereby providing a more focused path for regional economic development.

This analysis underscores the importance of prioritizing specific sectors that are aligned with the region's comparative advantages and growth potential, ultimately leading to more substantial economic outcomes.

5. Business dynamics, innovation and technology adoption

The business dynamics within the Suape Industrial Port Complex reveal that innovation is prevalent, with 84 per cent of firms reporting some form of innovation, particularly in production processes. Advanced technologies such as industrial robots, IoT, and AI are strongly correlated with increased operational efficiency. However, broader adoption of these technologies is hindered by reliance on traditional practices, limited market demand, and challenges in accessing financing. Infrastructure and logistics also remain critical areas for improvement, as emphasized by firms participating in the study.

Based on the questionnaire administered in the second round to companies within the Suape Industrial Port Complex, responses were collected concerning business dynamics, innovation practices, competitive profiles, and adoption of new technologies. The questionnaire was sent electronically to 36 companies engaged in the manufacturing industry and logistics sector, with responses received from 25 companies, a participation rate of nearly 70 per cent.

Table 13 provides an overview of the company profiles within the Industrial Port Complex that responded to the questionnaire. It includes details on their economic sector, size (number of employees), and capital structure. The respondents represent a broad distribution across economic activities, covering ten economic sectors. However, while the Suape Industrial Port Complex's website[15] identifies 12 sectors in total, no companies from the pharmaceutical and energy generation sectors participated. In terms of composition, there is more representation from the construction materials, plastic, food and beverages, wind energy, and petrochemical sectors.

Participating companies range in size, from small businesses with 1-49 employees to companies with over 1,000 employees. The sample predominantly comprises medium-sized companies (50 to 499 employees), making up 72 per cent of the respondents.

Regarding economic sectors, the data reveals a range of company sizes. The plastic sector shows consistency, with four companies having 50-249 employees. In the food and beverage sector, three companies have 50-499 employees, and one has over 1,000 employees. In the metalworking sector, two companies have 100-249 employees.

Over half (56 per cent) of the participating companies are part of a larger organisation with multiple establishments, showing significant participation from companies with more complex, multidivisional structures (Table 14). Additionally, capital origin varied across company types, with 44 per cent foreign capital companies, 28 per cent national capital companies, and 28 per cent mixed capital companies. Among the companies that specified the country of origin of their capital, there is representation from Austria, Spain, the Philippines, India, and Mexico.

[15] https://www.suape.pe.gov.br/en/business/complex-s-development-poles

Table 13
Companies' economic sectors and employees

			Employees					
Economic Sector	Companies	%	1-49	50-99	100-249	250-499	500-999	+1000
Construction Materials	5	20		1	1	1	1	1
Plastics	4	16		1	3			
Food and Beverages	4	16		1	1	1		1
Wind Energy	3	12		1	1		1	
Petrochemicals	3	12				2		1
Metalworking	2	8			2			
Liquid and Gas Bulk	1	4			1			
Naval and Offshore	1	4					1	
Service Center	1	4	1					
Logistics	1	4				1		
Total	25	100	1	4	9	5	3	3

Table 14
Type of companies, by capital structure and origin

Type	n	National capital	Foreign capital	Mixed capital	Countries of origin
One among several establishments belonging to a larger company or organisation	14	4	4	6	Austria, India and Mexico
A single establishment	11	7	3	1	Spain and the Philippines

Table 15
Factors affecting the competitiveness of firms

Topics	Very important	Important	Not very important	Indifferent	Do not apply
Infrastructure	19	6			
Logistics	23	2			
Custom processes	15	5	1	2	1
Regulations and compliance	15	9	1		
Taxation	19	4	1	1	
Technology Support	11	9	1	3	2
Training of human resources	14	10	1		
Networking support (events, meetings)	5	14	3	3	
Frequency (%)	61	30	4	5	2

Table 15 summarises responses regarding business dynamics, specifically on the factors of the Suape Industrial Port Complex's business environment that affect the competitive advantage of companies. Eight topics were proposed, allowing companies to rank them by importance and describe related issues in more detail.

Overall, respondents viewed nearly all topics as important for their competitive advantage, with 91 per cent of the responses rated as either 'very important' or 'important'. While topics such as "customs processes", "technology support", and "networking support" received lower-than-average importance ratings, the percentage high-importance ratings still reached at least 76 per cent for these topics.

Companies were also invited to elaborate on issues related to topics they deemed important. Based on their responses, a word cloud was generated (Figure 13), highlighting key concerns and suggestions for improvement identified by the respondents. The most frequently mentioned terms emphasize infrastructure and logistics, focusing on words such as "access", "cost", "infrastructure", "logistics", "competitiveness", and "transportation".

Despite responses in Table 15 highlighting the importance of most proposed topics for the companies' competitive advantage, the descriptive responses demonstrate that infrastructure and logistics are critical factors, indicating potential priority areas for the Port's improvements and investments.

Information was also gathered on the types of innovation, the degree of novelty, competitive strategies, and the adoption of emerging technologies among the companies within the Industrial Complex. Table 16 summarises the types of innovation implemented, along with their corresponding degree of novelty.

Most respondents (84 per cent) reported introducing innovations, either in products/services or production processes. Adopting new production processes (18 companies) was more common than introducing new products/services (10 companies). Only four companies reported no innovation.

The degree of novelty associated with these innovations offers additional insights. Innovations with higher degrees of novelty (at the national or global scale) were mainly related to new production processes, often involving new machinery. Companies that introduced only new products or services did so with products that were new to them but already existed in the market.

Figure 13
Word cloud highlighting areas for improvement to the business environment

An interesting pattern emerged among companies that reported introducing both product/service and process innovations. Five companies reported products that were new to Brazil, and two reported products that were new to the world. This suggests a potential association between the adoption of external technologies (new processes) and the ability to carry out product/service innovations with innovative impact for companies.

Table 16
Type and degree of innovation novelty

Type of innovation	Total	Degree of innovation		
		Company	Brazil	World
The company has implemented new production processes	11	7	7	1
The company has implemented new products/services	3	3		
The company has implemented both (processes and products/services)	7	7	6	3
None	4			

Note: While the questionnaire included a question regarding the reasons for not pursuing innovation, only one company provided a response. Consequently, this question has been excluded from the analysis.

Table 17
Companies' competitiveness strategies

Strategy	Priority order		
	First	Second	Third
Offer products or services of better quality than those offered by the competition	19	6	0
Regularly develop new products, services, or processes for the market	1	11	13
Offer products or services at lower prices than the competition	5	8	12

The main strategy of most companies focused on offering higher-quality products/services, while lower pricing and innovation held similar importance as secondary strategies (Table 17). This indicates that companies primarily focus on enhancing internal quality standards rather than seeking product innovation in the market, which is consistent with the responses in the previous table. Indeed, companies seem to be more focused on improving production processes rather than introducing new products to the market. This focus on product quality may have various determinants, such as market maturity and the level of competitiveness, among others, where differentiation by adding value is crucial for competitiveness since products are highly standardised.

The most prominent emerging technologies adopted among firms in the Industrial Complex are industrial robots, the Internet of Things (IoT), and Artificial Intelligence (AI) (Table 18). The origin of these technologies varies: industrial robots are typically purchased from foreign suppliers. In contrast, national suppliers, internal development and collaboration with domestic companies play a significant role in the adoption of IoT and AI technologies. This information seems to signal the need for firms in the complex to rely on foreign companies when it is necessary to internalise high-tech machinery in the productive process. In contrast, they have the possibility of resorting to internal and national knowledge when pursuing the implementation of services related to software and programming.

When asked about the main barriers limiting the adoption of new technologies, respondents highlighted the importance of traditional production practices and lack of or insufficient demand as the primary issues (12 responses each). The lack of financing and government support (10 responses each) were also significant, along with costly government regulations (9 responses).

This analysis highlights a characteristic business scenario within the Suape Industrial Port Complex. Respondent firms identified infrastructure and logistics as key priorities. Moreover, most of the participating firms' strategic approach focuses on enhancing product and service quality for competitiveness while engaging in intense internalisation of process and product innovations with varying degrees of novelty. Additionally, there is a notable trend towards adopting future-oriented technological innovations, primarily industrial robots, IoT and AI.

Table 18
New technology adoption

Technology	Total	Implementation or Purchase				
		National supplier	Foreign supplier in the country	Foreign supplier abroad	Developed internally	Collaboration with national company
AI	10	2		4	2	2
3D Printer	5	2	1	2		
IoT	12	6	1	1	1	3
Industrial Robots	14	1	4	9		
Collaborative Robots	5	1	3	1		
Virtual/Augmented Reality	2					2

6.
Macro-strategy for higher-level sectors

The report recommends implementing financial support mechanisms through development banks to alleviate companies' financial constraints and promote investment in innovation. It also suggests infrastructure upgrades to enhance connectivity, logistics, and overall operational efficiency within the complex. The report further recommends that the Suape Industrial Port Complex should lead governance efforts to foster strategies that strengthen the production chain. Establishing specific training programs tailored to company needs and enhancing relationships with science and technology institutions are key to support innovation and technological advancement.

Based on the analyses and results achieved, a macro-strategy is presented below (Table 19) to enhance the productive capacities of the Suape complex. The strategies are based on key sectors and are established around three main pillars: structural conditions, productive environment, and market. Detailed information on the topics of each pillar is available in the Appendix (Table E.1), and the recommendations proposed by the consultants for the active role of the Suape Complex administration are outlined below. They are based on S (current situation), O (objectives), and KR (key results).

Table 19
Macro-strategy for higher-level sectors

	Macro-strategy					
	Chemicals	Electrical machinery and equipment	Iron and steel	Machinery and mechanical appliances	Plastics	Vehicles
Structural conditions						
Political issues	The Suape Industrial Port Complex needs to lead the governance to foster strategies in order to strengthen the production chain					
Education	(S) Well-established human resources training in the region. (O) Create specific training programs tailored to the needs identified by companies. (KR) Periodic follow-up with Suape companies to identify bottlenecks and satisfaction with trainings					
Science & tech institutions (S&T)	(S) Well-established S&T environment with distinct and relevant expertise (O) To enhance relationships among Suape companies and S&T institutions (KR) Periodic follow-up with Suape companies to identify interactions and bottlenecks					
Environment	(S) High risk	(S) Low risk	(S) High risk	(S) High risk	(S) High risk	(S) High risk
	(O) To control and reduce impacts (KR) Establishment of environmental goals					
Financial constraints	(S) Low financial constraints	(S) Medium financial constraints	(S) Medium financial constraints	(S) High financial constraints	(S) Medium financial constraints	(S) High financial constraints
	(O) To support companies in reducing constraints through development banks (KR) Increase in the amount of investments through equity and loans					
Regulation / standards	(S) Suape companies have advanced production capacity. (O) To maintain and to enhance production capabilities while meeting the necessary regulatory standards. (KR) Periodic follow-up with SUAPE companies to identify bottlenecks / Encourage Suape companies and new companies to meet regulatory standards to access more profitable and demanding market					
Productive Environment						
Innovation	(S) Suape companies have different needs for the innovation process (O) Serve as the support point for Suape companies in their pursuit of product and process improvements (KR) Periodic follow-up with Suape companies to identify bottlenecks / Encourage Suape companies to engage with S&T institutions and industry trade fairs					
Infrastructure	(S) High costs associated with infrastructure and logistics. (O) To establish measures to improve the infrastructure. (KR) Periodic follow-up with Suape companies to assess satisfaction and bottlenecks					
Tax	Federal Tax Reform will universalize taxes through sectors, preventing tax policies					
Companies	(S) Suape companies have productive potential, but there is a need to attract new businesses. (O) To increase the production in the port complex, especially concerning products suggested in the report. (KR) To establish channels to contact potential new companies / to present potential new products for established companies.					
Institutions/ associations						

	Macro-strategy					
	Chemicals	Electrical machinery and equipment	Iron and steel	Machinery and mechanical appliances	Plastics	Vehicles
Market						
Companies (national/ international)						
International markets (in order of importance)	(S) Established companies have productive potential, but there is need to attract new businesses. (O) To increase the national and international market penetration of Suape companies. (KR) Explore international regions and establish contact with highlighted companies / Leverage networks through business associations.					
International institutions/ associations						

7. Conclusion

The study highlights Suape's significant potential for diversifying its productive structure by leveraging its existing industrial base and aligning with global market trends. Based on a mixed methodology, the analysis identifies key products for diversification, along with their estimated export opportunity, investment requirement and employment gain. The report emphasizes the importance of prioritizing products that align with global demand and local capabilities to improve Suape's competitive edge while considering sustainability and local employment. Additionally, it outlines potential barriers to sector expansion and offers a macro-level investment strategy to address these challenges, providing a comprehensive roadmap for Suape's future growth as a vital industrial hub in the Northeast region.

Suape has significant potential to diversify its productive structure, building upon its existing industrial base and capitalising on global market trends. By conducting a thorough assessment of the capacities in the Port area using the economic complexity methodology, this study has identified key potential sectors and products that complement existing operations and offer substantial opportunities for growth and expansion.

The findings underscore the critical role of strategic investments in sectors such as machinery and mechanical appliances, chemicals, and electrical equipment, which are anticipated to yield the highest returns in terms of economic output and job creation. The report projects that an investment of approximately US$ 2.24 billion in these sectors could enhance the region's economic complexity, potentially leading to a GDP increase of approximately 3.14 per cent, equivalent to an additional US$ 163.5 million in GDP. Moreover, this boost in economic complexity is expected to create approximately 3,620 new formal direct jobs, reflecting a 4.54 per cent increase in formal direct employment. Considering direct, indirect, and consumption-endogenized jobs, the total could reach up to above 19,000 jobs. These results emphasize the substantial economic benefits that targeted investments in these high-potential sectors can bring to the regional economy, offering a significant opportunity for growth and development.

The method of prioritisation of products and sectors that align with global demand and local capabilities positions the Port of Suape to enhance its competitive edge. Simultaneously, this prioritisation, which also considers local employment gains, sustainability outcomes and resource use, ensure that diversification efforts contribute to sustainable development in the region.

Moreover, the report presents a sectoral analysis that identifies potential barriers to expansion within the identified sectors and offers a macro-level investment strategy to address these challenges. This is particularly valuable for the Port of Suape, as it seeks to target investments across sectors effectively. Key recommendations include the Suape Complex administration's governance to coordinate improvements in structural conditions, the productive environment, and support for companies in opening new markets.

In conclusion, the strategic insights and data-driven recommendations presented in this report provide a roadmap for the future investment and growth of the Suape Industrial Port Complex. By leveraging these opportunities, Suape can strengthen its position as a key industrial hub in the Northeast and contribute to the broader economic landscape of the region.

Appendices

Appendix A. Questionnaire for interviews

Respondent profile:

Preferred: in-depth knowledge of the company's products/services and also someone who knows about the revenue of these products (In larger companies, these capabilities may not be just in one person).

Product Manager / Commercial Manager / Financial Manager / Trade-Marketing-Market Intelligence Manager.

Part 1. Company Profile

A. Company Name: .....

Q1. This company is:

	Answer
A single establishment	
One among several establishments owned by a larger company or organisation	

Q2. How would you describe the ownership of the equity in this company?

	Answer
National ownership	
Mixed: domestic and foreign ownership	
Foreign ownership (specify)	
State ownership	
Other (please specify)	

Q3. How many employees work in this company? [Regardless of contract type]

	1-49	**50-99**	**100-249**	**250-499**	**500-999**	**+1000**
Total employees						

Part 2. Business Dynamics

B. Business Environment

Q4a. Considering the items below, what is the degree of importance on a scale of 1 to 5 (1 being not at all important and 5 most important) of these items for the competitive advantage of your company?

1 It doesn't matter **2** Not very important **3** Indifferent **4** Important **5** Very important

Item	**1**	**2**	**3**	**4**	**5**
Infrastructure					
Logistics					
Customs processes					
Regulations and compliance					
Taxation					
Technology support					
Training of human resources					
Networking support (events, meetings, etc.)					
Other: Which one?					

Q4b. If the item is valued at 4 or 5, open the question:

In view of the important and very important items for the company's competitive advantage, what improvement measures adopted in the business environment of the Port of Suape (if any) do you believe are essential to expand such advantage?

.....

C. Innovation

Q5a. In the last three years, has your establishment developed in any kind of innovation? [Multiple Answer]

	Answer
Introduced new products	
Implemented new processes	
None	

Q5b.1 If none, what were the reasons for not innovating?

	Answer
I don't know how to innovate	
Traditional ways of doing things work for us	
New things take time to find the market	
Innovation is costly	
Other (please specify)	

Q6. What degree of innovations (goods, services, or processes) have you introduced in the last three years? (check as appropriate) [Multiple Answer]

	Product innovation	**Process innovation**
Just new to your business unit [Help: Your business introduced a new good, service, or process that was already available from your competitors in your market]		
New to your home market [Help: Your business introduced a good, service, or process to your market before your competitors (may already be available in other markets)]		
New to the world		

Q7. In the business view of your establishment, what is the order of importance of the factors below for the competitive success of the company?

	1st Place	**2nd Place**	**3rd Place**
Offer products or services at lower prices than the competition			
Offer products or services that are of better quality than those offered by the competition			
Regularly develop new products, services or processes for the market			

D. Adoption of new technologies

Q8. In general, what are the top three barriers that limit the adoption of new technologies in your establishment? (Mark the three main barriers)

	Answer
Linked to existing practices and traditional ways of doing things	
Deficient technology infrastructure (electricity, internet...)	
Lack of capabilities to absorb/use new technologies	
Lack of funding	
Lack/insufficient demand or uncertainty	
Costly government regulations	
Insufficient government support (e.g., grants, grants) for technology adoption	
Other (please specify)	

Q9. Is this company currently using the following technologies?

	Yes	**No**
Artificial intelligence		
3D Printing		
Internet of Things		
Industrial Robots		
Collaborative Robots		
Virtual / Augmented Reality		

Note: In the previous question for each item that answered yes, open question Q10.

Q10. How did the establishment acquire/develop this technology?

	Answer	**Technology**
The technology was acquired/purchased from a national supplier		
The technology was acquired/purchased from a foreign vendor or a foreign vendor located in this country		
The technology was acquired/purchased from a foreign supplier located outside the country		
The technology was developed and implemented in-house by this company		
The technology was developed and implemented in collaboration with a national company		
The technology was developed and implemented in collaboration with a foreign company or a foreign company located in this country		
The technology was acquired/purchased from a national state program or international donors		
Other		

Appendix B. Computation of measures for the method of reflections and product space

Proximity measure

The analysis identifies products that require a similar set of capabilities to those required to produce the current product mix in the municipalities of Cabo de Santo Agostinho and Ipojuca to identify opportunities for new investments in new sectors. These products are located in the product space close to the existing product mix.

The measure of proximity between products A and B (ΦAB) in the product space is calculated using a method proposed by Freire (2017) similar to that proposed by Hidalgo et al (2007), as the minimum value between the conditional probability $P(A|B)$ of a country producing A, given that it produces B and the conditional probability $P(A|B)$ from a country producing B, since it produces A:

$$\Phi_{A,B} = \Phi_{B,A} = \min\left(P(A|B), P(B|A)\right) \quad (1)$$

The proximity between two products, therefore, varies from 0 per cent, in the case where no country produces both products, to 100 per cent, in the case where all countries that produce one good also produce the other.

To identify products located in the vicinity of each country's product space, a value for the threshold of proximity between products that correspond to a "usual" distance travelled during the diversification process is chosen. In this report, this value is 80 per cent, which means that eight out of ten countries that export one of the products also export the other.

Economic and product complexity measures

The report then identifies potential new products that are close in the product space and are also more complex. To measure the complexity of the product, this report uses the method of reflections proposed by Hidalgo and Hausmann (2009). The method builds a bipartite network of countries and the products they produce and iteratively calculates a generalised measure of diversification and ubiquity as follows:

$$k_{c,N} = \frac{1}{k_{c,0}} \sum_p M_{cp} \cdot k_{p,N-1} \text{ (Generalised measure of diversification)} \quad (2)$$

$$k_{p,N} = \frac{1}{k_{p,0}} \sum_c M_{cp} \cdot k_{c,N-1} \text{ (Generalised measure of ubiquity)} \quad (3)$$

Where M_{cp} is 1 if country c produces the product p and 0 otherwise, $k_{c,0}$ is the number of products produced by country c and $k_{p,0}$ is the number of countries that produce the product p.

The product complexity index (PCI) is taken as the normalised value of k_p:

$$\overrightarrow{PCI} = \frac{\overrightarrow{k_p} - \langle \overrightarrow{k_p} \rangle}{stdev(\overrightarrow{k_p})} \quad (4)$$

Where $\langle \overrightarrow{k_p} \rangle$ is the mean and $stdev(\overrightarrow{k_p})$ is the standard deviation of the k_p distribution.

The analysis considers the price incentives that entrepreneurs face when choosing between different potential new economic activities, estimating export opportunities and import substitution. The assumption is that entrepreneurs face price incentives when choosing between different potential new economic activities. New products with higher demand potential are more likely to be selected, other things being equal.

Export potential

To estimate the export potential, the report uses a measure of the export opportunity of potential new products (Freire, 2017). This measure is a monetised type of overlap index designed to measure the degree to which one country's potential new exports match another's expanding import markets. A higher degree of export opportunity for potential new products indicates more favourable prospects for commercial expansion for new products, given the past rate of growth of their importing markets.

The indicator (XOP) is defined as the sum of the differences in the shares of the importing country's sectoral imports in the total world imports between two periods. Formally:

$$XOP = \sum_i G_{isd}^{t0,t1} \times M^{2022} \quad (5)$$

Where M^{2022} is the total imports by all countries in all products in the year 2022, and it is the growth of the global share of imports $G_{isd}^{t0,t1}m$ of industry i in country D in the period between $t0$ (2021) and $t1$ (2022). For any pair of countries, only those sectors that meet the following criteria are included: 1) the share of sectoral imports in total world imports increased between the two periods, and 2) this sector represents a potential new product for the exporting country. Formally:

$$G_{i,s,d}^{t0,t1} = \frac{m_{i,c}^{t1}}{M^{t1}} - \frac{m_{i,c}^{t0}}{M^{t0}} \quad (6)$$

Where s is the country of origin, d is the country of destination.

The value will be 1 if $\Phi_{i,j} > 85\%$ for some product j in the existing product mix in the country and $\frac{m_{i,c}^{t1}}{M^{t1}} > \frac{m_{i,c}^{t0}}{M^{t0}}$ and zero otherwise.

Appendix C. Questionnaire for the workshop with industry specialists

Macro group	Capacities	Question	Product 1	Product ...	Product n
Production	Core inputs for production	What are the main inputs for production in terms of materials?			
		What is the origin of the main required inputs?			
		Pernambuco			
		Brazil			
		World (specify)			
	Machinery	What are the critical machinery for production?			
		What is the origin of the main required machines?			
		Pernambuco			
		Brazil			
		World (specify)			
	Technologies	What are the future-oriented technologies that can be used in production?			
		Artificial Intelligence / Machine Learning			
		3D Printing			
		Internet of Things			
		Industrial Robots			
		Collaborative Robots			
		Virtual / Augmented Reality			
		Others			
	Productive scale	What scale is required to make production economically viable?			
	Human resources (formation)	What is the required education level for production?			
		Higher education			
		Location			
		Technical / Technologist level			
		Location			
	Human resources (scale)	How many employees are needed for production?			
	Human resources (gender)	What is the usual gender composition in production?			
		Female			
		Male			

Infrastructure		What is the most important logistical infrastructure for the outflow of production?			
		Port of airport			
		Compared to other industries, how important are these resources for production? Rate as 1 (below), 2 (average), and 3 (above)			
		Water supply			
		Energy			
Sustainability		What are the environmental concerns involved in production?			
		Carbon emissions			
		Water pollution			
		Soil pollution			
		Deforestation			
		Biodiversity			
		Others			
Utility		Which industries/sectors use this product as an input?			
		Can you name industries/companies that use this input/product in Pernambuco?			
		Can you name companies that produce this input/product?			

Appendix D. List of identified sectors and products

Table D.1
Initial list of identified sectors, by total export opportunity

HS code (2 digit)	Description	Total opportunity export potential (in US$ million)	Percentage of total opportunities (%)
84	Machinery & mechanical appliances, etc.	45 912	10.77
29	Organic chemicals	41 199	9.67
72	Iron and steel	34 642	8.13
39	Plastics and articles thereof	32 966	7.73
85	Electrical machinery and equipment and parts thereof	28 825	6.76
38	Miscellaneous chemical products	19 632	4.61
28	Inorganic chemicals, precious metal compounds, isotopes	18 846	4.42
48	Paper and paperboard; articles of paper pulp, of paper, or of paperboard	15 556	3.65
44	Wood and articles of wood, wood charcoal	15 120	3.55
76	Aluminium and articles thereof	13 380	3.14
40	Rubber and articles thereof	10 640	2.50
87	Vehicles other than railway or tramway rolling stock, and parts and accessories thereof	10 350	2.43
73	Articles of iron or steel	9 761	2.29
15	Animal or vegetable fats and oils and their cleavage products; prepared edible fats; animal or vegetable waxes	8 931	2.10
4	Dairy produce; birds eggs; natural honey; edible products of animal origin, not elsewhere specified or included	8 035	1.89
47	Pulp of wood, fibrous cellulosic material, waste, etc.	7 842	1.84
74	Copper and articles thereof	7 143	1.68
34	Soap, organic surface-active agents, washing preparations, lubricating preparations, candles, modelling pastes	7 045	1.65
75	Nickel and articles thereof	6 821	1.60
70	Glass and glassware	6 761	1.59
68	Articles of stone, plaster, cement, asbestos, mica, or similar materials	6 420	1.51
30	Pharmaceutical products	6 300	1.48
27	Mineral fuels, mineral oils and products of their distillation; bituminous substances; mineral waxes	5 958	1.40
32	Tanning or dyeing extracts; tannins and their derivatives; dyes, pigments, and other colouring matter	3 563	0.84
35	Albuminoidal substances; modified starches; glues; enzymes	3 520	0.83
81	Other base metals, cermets, and articles thereof	3 425	0.80
71	Natural or cultured pearls, precious or semi-precious stones, precious metals, metals clad with precious metal	2 722	0.64
57	Carpets and other textile floor coverings	2 693	0.63
56	Wadding, felt and nonwovens; special yarns; twine, cordage, ropes and cables and articles thereof	2 547	0.60

HS code (2 digit)	Description	Total opportunity export potential (in US$ million)	Percentage of total opportunities (%)
20	Preparations of vegetables, fruit, nuts or other parts of plants	2 090	0.49
82	Tools, implements, cutlery, spoons and forks, of base metal; parts thereof of base metal	2 082	0.49
54	Man-made filaments	2 027	0.48
55	Man-made staple fibres	2 012	0.47
94	Furniture; bedding, mattresses, mattress supports, cushions and similar stuffed furnishings; lamps and lighting fittings, not elsewhere specified or included; illuminated signs, illuminated name-plates and the like; prefabricated buildings	1 987	0.47
31	Fertilizers	1 963	0.46
37	Photographic or cinematographic goods	1 904	0.45
12	Oil seeds and oleaginous fruits; miscellaneous grains, seeds and fruit; industrial or medicinal plants	1 731	0.41
79	Zinc and articles thereof	1 543	0.36
25	Salt; sulphur; earths and stone; plastering materials, lime and cement	1 496	0.35
2	Meat and edible meat offal	1 387	0.33
59	Impregnated, coated, covered or laminated textile fabrics; textile articles of a kind suitable for industrial use	1 365	0.32
86	Railway or tramway locomotives, rolling-stock and parts thereof; track fixtures and fittings; mechanical	1 298	0.30
11	Products of the milling industry; malt; starches; inulin; wheat gluten	1 194	0.28
16	Preparations of meat, of fish or of crustaceans, molluscs or other aquatic invertebrates	1 066	0.25
69	Ceramic products	1 020	0.24
60	Knitted or crocheted fabrics	1 008	0.24
41	Raw hides and skins (other than furskins) and leather	925	0.22
17	Sugars and sugar confectionery	888	0.21
33	Essential oils and resinoids; perfumery, cosmetic or toilet preparations	774	0.18
8	Edible fruit and nuts; peel of citrus fruit or melons	756	0.18
83	Miscellaneous articles of base metal	716	0.17
26	Ores, slag and ash	693	0.16
23	Residues and waste from the food industries; prepared animal fodder	653	0.15
63	Other made-up textile articles; sets; worn clothing and worn textile articles; rags	636	0.15
90	Optical, photographic, cinematographic, measuring, checking, precision, medical or surgical instruments and apparatus	555	0.13
7	Edible vegetables and certain roots and tubers	554	0.13
52	Cotton	504	0.12
58	Special woven fabrics; tufted textile fabrics; lace; tapestries; trimmings; embroidery	457	0.11
3	Fish and crustaceans, molluscs and other aquatic invertebrates	442	0.10
19	Preparations of cereals, flour, starch or milk; pastrycooks' products	394	0.09
64	Footwear, gaiters and the like; parts of such articles	308	0.07

HS code (2 digit)	Description	Total opportunity export potential (in US$ million)	Percentage of total opportunities (%)
51	Wool, fine or coarse animal hair, horsehair yarn and woven fabric	291	0.07
53	Other vegetable textile fibres; paper yarn and woven fabrics of paper yarn	285	0.07
96	Miscellaneous manufactured articles	256	0.06
21	Miscellaneous edible preparations	250	0.06
66	Umbrellas, sun umbrellas, walking-sticks, seat-sticks, whips, riding-crops and parts thereof	239	0.06
61	Articles of apparel and clothing accessories, knitted or crocheted	238	0.06
62	Articles of apparel and clothing accessories, knitted or crocheted	229	0.05
13	Lac; gums, resins and other vegetable saps and extracts	192	0.05
50	Silk	170	0.04
80	Tin and articles thereof	158	0.04
36	Explosives; pyrotechnic products; matches; pyrophoric alloys; certain combustible preparations	147	0.03
78	Lead and articles thereof	142	0.03
24	Tobacco and manufactured tobacco substitutes	119	0.03
91	Clocks and watches and parts thereof	101	0.02
49	Printed books, newspapers, pictures and other products of the printing industry; manuscripts, typescripts and plans	49	0.01
89	Ships, boats and floating structures	47	0.01
65	Headgear and parts thereof	44	0.01
88	Aircraft, spacecraft, and parts thereof	44	0.01
22	Beverages, spirits and vinegar	39	0.01
45	Cork and articles of cork	38	0.01
9	Coffee, tea, maté and spices.	33	0.01
97	Works of art, collectors' pieces and antiques	29	07
10	Cereals	20	05
43	Furskins and artificial fur; manufactures thereof	20	05
46	Manufactures of straw, esparto or other plaiting materials; basketware and wickerwork	17	04
95	Toys, games and sports requisites; parts and accessories thereof	9	02
93	Arms and ammunition; parts and accessories thereof	5	01
67	Prepared feathers and down and articles made of feathers or of down; artificial flowers; articles of human hair	3	01
92	Musical instruments; parts and accessories of such articles	1	00

Table D.2.
List of identified products, by score

Sector	HS	Description	Price Range (US dollars)	Score	Total Opportunity (EO) (in US$ million)	Market 1		Market 2		Market 3		Market 4		Market 5	
						Market	EO (US$ million)	Market	EO (US$ million)	Market	EO (US$ million)	Market	EO (US$ million)	Market	EO (US$ million)
Electrical machinery and equipment	850180	Electric generators; (excluding generating sets), photovoltaic AC generators (alternators)	$168-1889	37	399	United States	311	France	29.5	Canada	25.3	United Kingdom	9.7	Italy	6.5
Electrical machinery and equipment	850140	Electric motors; AC motors, single-phase	$0-52	34	639	United States	240.5	Mexico	124.2	Italy	63.6	Austria	55.4	India	50
Vehicles	870821	Vehicles; parts of bodies, safety seat belts	$14-64	34	221	Canada	85.1	Japan	32.9	India	19	Republic of Korea	16.3	Mexico	15.6
Machinery and mechanical appliances	843680	Machinery; for agricultural, horticultural or forestry use and n.e.c. in heading no. 8436	$0-483	33	533	United States	424.3	Canada	56.3	United Kingdom	35.4	New Zealand	9.9	Philippines	2.1
Electrical machinery and equipment	851890	Microphones, headphones, earphones, amplifier equipment; parts of the equipment of heading no. 8518	$152-345	33	430	China	389.6	Malaysia	19	Singapore	7	Republic of Korea	3.9	Greece	2.6
Electrical machinery and equipment	852491	Media, recorded; n.e.s. in heading no. 8524, for reproducing phenomena other than sound or image, (excluding products of chapter 37)	$55-379	33	3375	China	1546	Slovakia	524.6	Türkiye	428.8	United States	362	Brazil	173
Electrical machinery and equipment	852499	Media, recorded; n.e.s. in heading no. 8524, for reproducing sound or image, (excluding products of chapter 37)	$65-896	33	92	South Africa	59.9	India	19.8	Colombia	2.8	Cambodia	2.1	Finland	1.5
Electrical machinery and equipment	851431	Furnaces and ovens; electric, for industrial or laboratory use, other than those functioning by induction, dielectric loss or resistance heated, electron beam furnaces	$0-260	32	5	United States	3.5	France	1.1	Netherlands	0.1	Italy	0.1	Canada	0.1
Vehicles	870895	Vehicle parts; safety airbags with inflater system; parts thereof	$0-19	32	374	Poland	92.3	China	55.9	Hungary	51.7	United Kingdom	47.6	Republic of Korea	27.9
Chemistry	291590	Acids; saturated acyclic monocarboxylic acids; anhydrides, halides, peroxides, peroxyacids and halogenated, sulphonated, nitrated or nitrosated derivatives, n.e.c. in heading no. 2915	$3-17	31	948	Belgium	233.7	India	160.9	United States	71.2	United Kingdom	59.8	Spain	59.6
Iron and steel	721934	Steel, stainless; flat-rolled, width 600mm or more, cold-rolled, of a thickness of 0.5mm or more but not exceeding 1mm	$3-5	31	1015	Italy	582.9	Poland	113.4	United States	87.8	Republic of Korea	45.1	Switzerland	23
Iron and steel	722020	Steel, stainless; flat-rolled, width less than 600mm, cold-rolled	$4-12	31	598	United States	145.2	Italy	83	France	82.7	Mexico	62.3	India	39.4
Iron and steel	722530	Steel, alloy; flat-rolled, width 600mm or more, hot-rolled, in coils	$0-1	31	833	United States	430.8	Mexico	220.7	Kenya	33.7	Switzerland	27.9	Netherlands	27
Iron and steel	722550	Steel, alloy; flat-rolled, width 600mm or more, cold-rolled	$1-2	31	460	China	113.9	Mexico	98.7	France	67.2	India	49.9	Brazil	32.3

Sector	HS	Description	Price Range (US dollars)	Score	Total Opportunity (EO) (in US$ million)	Market 1		Market 2		Market 3		Market 4		Market 5	
						Market	EO (US$ million)	Market	EO (US$ million)	Market	EO (US$ million)	Market	EO (US$ million)	Market	EO (US$ million)
Iron and steel	722592	Steel, alloy; flat-rolled, width 600mm or more, n.e.c. in heading no. 7225, plated or coated with zinc (other than electrolytically)	$1-1	31	783	United States	154.7	Mexico	134.8	Thailand	109.9	Italy	76.6	Germany	58.8
Machinery and mechanical appliances	843991	Machinery; parts of machinery for making pulp of fibrous cellulosic material	$22-73	31	96	Malaysia	33	United States	16.9	Brazil	7.6	Singapore	4.5	Indonesia	4.2
Electrical machinery and equipment	850153	Electric motors; AC motors, multi-phase, of an output exceeding 75kW	$1841-16420	31	719	United States	344.9	Austria	99.3	China	82.6	Italy	56.2	Mexico	44.4
Electrical machinery and equipment	852411	Flat panel display modules, whether or not incorporating touch-sensitive screens; of liquid crystals, without drivers or control circuits	$0-35	31	5030	China	4756	United States	97.2	Brazil	42.6	India	28.8	Singapore	20.8
Electrical machinery and equipment	852411	Flat panel display modules, whether or not incorporating touch-sensitive screens; of liquid crystals, without drivers or control circuits	$35-435	31	367	Slovakia	198	United States	50	South Africa	44	Slovenia	41	Estonia	5
Chemistry	284170	Salts; molybdates	$18-81	30	48	Denmark	15.7	China	6.2	Netherlands	5.5	Republic of Korea	4.3	United States	4.2
Chemistry	290919	Ethers; acyclic, and their halogenated, sulphonated, nitrated or nitrosated derivatives, other than diethyl ether	$0-2	30	4707	Singapore	1273	Japan	918.8	Mexico	587.6	Malaysia	483.1	Netherlands	478
Chemistry	290960	Alcohol peroxides, ether peroxides, ketone peroxides and their halogenated, sulphonated, nitrated or nitrosated derivatives	$4-10	30	112	United States	18.9	India	16.8	Netherlands	16.1	Italy	13.8	Türkiye	8.1
Chemistry	291212	Aldehydes; acyclic, without other oxygen function, ethanal (acetaldehyde)	$13-72	30	2	Switzerland	0.8	Indonesia	0.3	Singapore	0.2	South Africa	0.2	Philippines	0.1
Chemistry	340231	Anionic organic surface-active agents (other than soap); linear alkylbenzene sulphonic acids and their salts, whether or not put up for retail sale	$2-6	30	407	United States	70.5	France	53.1	Zambia	35.5	Canada	28.7	Spain	21.1
Chemistry	340239	Anionic organic surface-active agents (other than soap); other than linear alkylbenzene sulphonic acids and their salts, whether or not put up for retail sale	$0-2	30	847	Netherlands	57.7	Germany	54.9	Türkiye	49.9	France	48.3	China	46.6
Chemistry	340242	Organic surface-active agents; non-ionic (other than soap), whether or not put up for retail sale	$0-2	30	1739	Italy	217	Germany	197	China	183	Türkiye	135	Netherlands	134
Chemistry	340242	Organic surface-active agents; non-ionic (other than soap), whether or not put up for retail sale	$2-6	30	3096	France	308.8	China	231.5	Brazil	227	Germany	221.3	Canada	172

Sector	HS	Description	Price Range (US dollars)	Score	Total Opportunity (EO) (in US$ million)	Market 1		Market 2		Market 3		Market 4		Market 5	
						Market	EO (US$ million)	Market	EO (US$ million)	Market	EO (US$ million)	Market	EO (US$ million)	Market	EO (US$ million)
Chemistry	340311	Lubricating preparations; for the treatment of textile and similar materials (leather, furskins etc), containing less than 70% (by weight) of petroleum oils or oils obtained from bituminous minerals	$2-14	30	66	China	35.8	Italy	4	India	3.1	Netherlands	2.7	Malaysia	2.5
Chemistry	340391	Lubricating preparations; for the treatment of textile and similar materials (leather, furskins etc), (not containing petroleum oils or oils obtained from bituminous minerals)	$2-12	30	56	China	17.9	United States	8	Mexico	7.9	India	3.8	Netherlands	3
Plastics	390799	Polyesters; n.e.s. in heading no. 3907, saturated, in primary forms	$3-8	30	1473	China	368.5	Belgium	186.3	United States	125.1	Italy	124.8	Japan	93.5
Plastics	391190	Polysulphides, polysulphones and similar products of chemical synthesis n.e.c. in chapter 39; in primary forms	$3-11	30	956	United States	153.3	Canada	101.2	India	88.1	China	87.2	Italy	75.1
Machinery and mechanical appliances	843999	Machinery; parts of machinery for making or finishing paper or paperboard	$0-14	30	265	Indonesia	204.6	Malaysia	22.1	Sweden	11.4	India	8.4	Argentina	2.9
Electrical machinery and equipment	850220	Electric generating sets; with spark-ignition internal combustion piston engines	$0-441	30	1151	United States	513.3	Ukraine	153.9	Canada	108.3	Poland	88.1	Germany	74.3
Electrical machinery and equipment	851419	Furnaces and ovens; electric, for industrial or laboratory use, resistance heated; other than hot isostatic presses, for the manufacture of semiconductor devices on semiconductor wafers	$1189-8103	30	339	United States	63.9	France	36.8	China	28.7	Türkiye	27.3	Italy	20.5
Electrical machinery and equipment	852721	Radio-broadcast receivers not capable of operating without an external source of power, of a kind used in motor vehicles; combined with sound recording or reproducing apparatus	$266-537	30	591	United States	434.4	Mexico	52.9	Brazil	44.3	Finland	26.7	Sweden	20.3
Chemistry	281122	Silicon dioxide	$1-10	29	726	United States	195.9	Mexico	133.5	Belgium	41.2	Germany	36.5	Poland	29.5
Chemistry	281410	Ammonia; anhydrous	$1-3	29	4681	Morocco	1725	Belgium	545	Brazil	469.3	Germany	247	Chile	234
Chemistry	282760	Iodides and iodide oxides	$39-114	29	99	China	43.1	India	9.8	Netherlands	8.3	Belgium	7.2	Republic of Korea	5.9
Chemistry	283329	Sulphates; n.e.c. in item no. 2833.2	$0-0	29	169	Australia	32.1	United States	18.6	Peru	17.4	South Africa	12.8	Türkiye	11.8
Chemistry	290723	Polyphenols; 4,4'-isopropylidenediphenol (bisphenol A, diphenylolpropane) and its salts	$2-7	29	101	Netherlands	55.7	United States	20	Italy	9	United Kingdom	5.3	Spain	3.6
Chemistry	300610	Pharmaceutical goods; sterile surgical catgut, suture materials, tissue adhesives, laminaria, laminaria tents, absorbable surgical or dental haemostatics, and surgical or dental adhesion barriers	$417-895	29	412	Japan	64	United States	61.7	Switzerland	52.2	United Kingdom	36.1	Netherlands	33.2

Sector	HS	Description	Price Range (US dollars)	Score	Total Opportunity (EO) (in US$ million)	Market 1		Market 2		Market 3		Market 4		Market 5	
						Market	EO (US$ million)	Market	EO (US$ million)	Market	EO (US$ million)	Market	EO (US$ million)	Market	EO (US$ million)
Chemistry	300693	Pharmaceutical goods; placebos and blinded (or double-blinded) clinical trial kits for a recognised clinical trial, put up in measured doses	$0-33	29	551	United States	281.7	Malaysia	223.9	Canada	23.7	Denmark	6.2	France	6
Chemistry	340490	Waxes; artificial and prepared, other than of polyethylene glycol	$0-3	29	252	Italy	87.8	Poland	40.5	China	39.7	Republic of Korea	10.8	Japan	10.7
Chemistry	340520	Polishes, creams and similar preparations; for the maintenance of wooden furniture, floors or other woodwork, excluding waxes of heading no. 3404	$2-10	29	19	France	6.7	United States	1.7	Chile	0.9	Philippines	0.8	Lesotho	0.8
Plastics	390530	Poly(vinyl alcohol); whether or not containing unhydrolysed acetate groups	$3-8	29	554	India	125.3	Italy	62	Brazil	57.2	Malaysia	38.4	Türkiye	36.5
Plastics	390761	Poly(ethylene terephthalate); in primary forms, having a viscosity of 78ml/g or higher	$1-2	29	2957	United States	774	Italy	617.6	Poland	133.3	Nigeria	130.9	Peru	118
Plastics	390791	Polyesters; n.e.c. in heading no. 3907, unsaturated, in primary forms	$2-7	29	577	Canada	172.7	Mexico	128.5	United States	79	Italy	25.1	Portugal	21.7
Plastics	390931	Amino-resins; n.e.c. in heading no. 3909, in primary forms, poly(methylene phenyl isocyanate) (Crude MDI, polymeric MDI)	$2-4	29	980	United States	451.6	Canada	210.2	Brazil	81.7	Egypt	66.9	Colombia	34.1
Machinery and mechanical appliances	841780	Furnaces and ovens; including incinerators, non-electric, for industrial or laboratory use, n.e.c. in heading no. 8417	$1339-28768	29	130	Mexico	33	United States	24.6	Spain	11.2	India	10.1	Ukraine	9.3
Machinery and mechanical appliances	842951	Front-end shovel loaders	$71112-123983	29	856	United States	412.8	Italy	129.3	Peru	60.4	South Africa	39.1	New Zealand	36.8
Electrical machinery and equipment	850750	Electric accumulators; nickel-metal hydride, including separators, whether or not rectangular (including square)	$5-89	29	352	China	226.3	Canada	45.9	France	30	India	15.8	United Kingdom	15.6
Electrical machinery and equipment	852583	Television cameras, digital cameras and video camera recorders; night vision goods as specified in subheading note 3 to this chapter	$95-958	29	442	Netherlands	180.8	United States	71.9	United Kingdom	60.3	France	42.8	Türkiye	28
Vehicles	871160	Motorcycles (including mopeds) and cycles; fitted with auxiliary motor, with electric motor for propulsion, with or without side-cars; side-cars	$1812-3673	29	363	France	136.8	Austria	80.3	Switzerland	48.2	United Kingdom	47.7	Australia	9.4
Chemistry	281512	Sodium hydroxide (caustic soda); in aqueous solution (soda lye or liquid soda)	$0-4	28	2613	Australia	1215	France	174.4	Belgium	154.4	Austria	110.5	Netherlands	92.4
Chemistry	300212	Blood, human or animal, antisera, other blood fractions and immunological products; antisera and other blood fractions	$732-1695	28	1858	United States	1241	Austria	212.7	Republic of Korea	70.4	Japan	68.1	Netherlands	52.9

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Chemistry	300510	Dressings, adhesive; and other articles having an adhesive layer, packed for retail sale for medical, surgical, dental or veterinary purposes	$57-119	28	117	Spain	29.2	Japan	16.8	Malaysia	12	Singapore	8.7	Austria	6.9
Chemistry	381210	Rubber accelerators; prepared	$4-10	28	98	India	19.5	United States	15.4	Poland	8.5	Hungary	7	Slovakia	6.3
Chemistry	381220	Plasticisers, compound; for rubber or plastics	$2-7	28	105	United States	35.8	Mexico	8.8	Italy	8.8	Japan	8.2	Poland	4.7
Chemistry	381700	Mixed alkylbenzenes and mixed alkylnaphthalenes, other than those of heading no. 2707 or 2902	$2-5	28	579	United States	119.4	Germany	101.2	United Kingdom	78.3	Mexico	56.4	Poland	42.1
Plastics	391239	Cellulose ethers; (other than carboxymethylcellulose and its salts), in primary forms	$5-17	28	549	India	108.2	United States	105.6	Italy	61.3	China	49.3	Mexico	42
Machinery and mechanical appliances	841810	Refrigerators and freezers; combined refrigerator-freezers, fitted with separate external doors, electric or other	$566-922	28	1498	United States	1008	Canada	312.2	India	97.7	Austria	12.7	Mexico	12.4
Vehicles	870310	Vehicles; specially designed for travelling on snow, golf cars and similar vehicles	$2824-9475	28	690	United States	531	Thailand	23.5	United Arab Emirates	12.8	Australia	12.6	Ethiopia	12.2
Vehicles	870822	Vehicles; parts and accessories, front windscreens (windshields), rear windows and other windows specified in subheading note 1 to this chapter	$0-10	28	840	Germany	259.1	Czechia	70.8	France	69.1	Spain	61.5	United Kingdom	59
Chemistry	290711	Monophenols; phenol (hydroxybenzene) and its salts	$0-1	27	194	India	66.5	Japan	34.8	China	24.9	Chile	15.4	Netherlands	12.6
Chemistry	290719	Monophenols; n.e.c. in item no. 2907.1	$4-21	27	102	Switzerland	19.6	United States	18.5	Brazil	10.5	Republic of Korea	9.8	Belgium	7.5
Chemistry	291511	Acids; saturated acyclic monocarboxylic acids; formic acid	$1-6	27	79	Brazil	24.1	Türkiye	23.1	India	3.2	Mexico	3.2	Philippines	2.9
Chemistry	300213	Blood, human or animal, antisera, other blood fractions and immunological products; immunological products, unmixed, not put up in measured doses or in forms or packings for retail sale	$100-5701	27	719	France	537	United States	113.8	Philippines	15.1	Slovenia	13.6	Republic of Korea	9.4
Chemistry	300449	Medicaments; containing alkaloids or their derivatives; other than ephedrine, pseudoephedrine (INN) or norephedrine or their salts; for therapeutic or prophylactic uses, packaged for retail sale	$303-698	27	149	United States	54.7	Romania	21.2	Hungary	17.3	France	14.9	Spain	10.1
Chemistry	300670	Pharmaceutical goods; Gel preparations designed to be used in human or veterinary medicine as a lubricant for parts of the body for surgical operations or physical examinations or as a coupling agent between the body and medical instruments	$8-81	27	36	United States	12.5	Costa Rica	4.9	Mexico	2.8	Singapore	1.6	Denmark	1.2

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Chemistry	340530	Polishes, creams and similar preparations; for coachwork, other than metal polishes, excluding waxes of heading no. 3404	$0-4	27	24	Mexico	8.5	Italy	2.4	Belgium	2.2	Poland	1.3	Norway	1.1
Chemistry	340530	Polishes, creams and similar preparations; for coachwork, other than metal polishes, excluding waxes of heading no. 3404	$0-4	27	24	Mexico	8.5	Italy	2.4	Belgium	2.2	Poland	1.3	Norway	1.1
Chemistry	340540	Scouring pastes and powders and other scouring preparations; (whether or not in the form of paper, wadding, felt, nonwovens, cellular plastics, cellular rubber, impregnated, coated or covered)	$1-12	27	40	Republic of Korea	11.8	Panama	6.8	Costa Rica	5.2	Japan	4.4	Spain	2
Chemistry	380190	Graphite or other carbon based preparations; in the form of pastes, blocks, plates or other semi-manufactures	$4-54	27	78	Hungary	31.1	China	13.9	Canada	8.2	Malaysia	8	Republic of Korea	3.7
Plastics	390469	Halogenated olefin polymers; fluoro-polymers (other than polytetrafluoroethylene), in primary forms	$19-48	27	1050	United States	256.1	Republic of Korea	209.4	Japan	101.4	China	97.4	Italy	88.3
Machinery and mechanical appliances	840410	Boilers; auxiliary plant, for use with boilers of heading no. 8402 or 8403 (e.g. economisers, super-heaters, soot removers, gas recoverers)	$10-46	27	118	Philippines	23.8	Egypt	19.5	Netherlands	9.1	Poland	8.5	Japan	7.1
Electrical machinery and equipment	850790	Electric accumulators; parts n.e.c. in heading no. 8507	$6-61	27	4702	United States	3185	Germany	624.9	India	233.2	Hungary	207.6	Japan	114
Electrical machinery and equipment	853951	Lamps; light-emitting diode (LED) light sources, light-emitting diode (LED) modules	$5-89	27	311	Netherlands	52.1	France	49.7	United States	49.3	Austria	26.2	Sweden	19.6
Vehicles	870370	Vehicles; with both compression-ignition internal combustion piston engine (diesel or semi-diesel) and electric motor for propulsion, capable of being charged by plugging to external source of electric power	$24092-47449	27	503	Belgium	236.4	United States	121	Austria	74.8	France	27.5	Poland	18.4
Vehicles	870422	Vehicles; compression-ignition internal combustion piston engine (diesel or semi-diesel), for transport of goods, (of a g.v.w. exceeding 5 tonnes but not exceeding 20 tonnes), nes in item no 8704.1	$49471-87227	27	2779	Canada	1544	United States	549.1	Italy	166.1	Austria	102.8	Romania	61.1
Vehicles	871631	Tanker trailers and tanker semi-trailers	$45048-83852	27	169	United States	87.1	Ukraine	34.8	United Kingdom	10.5	Argentina	5.6	Hungary	5.4
Chemistry	290122	Acyclic hydrocarbons; unsaturated, propene (propylene)	$1-8	26	892	Germany	460.4	Poland	152.8	Belgium	113.7	France	71.6	Sweden	30.9

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						Market	EO (US$ million)	Market	EO (US$ million)	Market	EO (US$ million)	Market	EO (US$ million)	Market	EO (US$ million)
Chemistry	292029	Esters; phosphite esters and their salts; their halogenated, sulphonated, nitrated or nitrosated derivatives, n.e.c. in heading no. 2920	$5-9	26	81	France	18.9	Netherlands	17.5	Brazil	17	China	10.8	Austria	2.1
Chemistry	292090	Esters; other than thiophosphoric esters (phosphorothioates) and phosphite esters and their salts, their halogenated, sulphonated, nitrated or nitrosated derivatives, n.e.c. in heading no. 2920	$3-46	26	211	India	59.8	United States	43.6	Bahrain	22.2	Japan	13.9	China	9.5
Chemistry	293339	Heterocyclic compounds; containing an unfused pyridine ring (whether or not hydrogenated) in the structure, n.e.c. in 2933.3	$0-30	26	1291	Brazil	407.7	United States	395.5	India	158.9	Australia	86.2	Indonesia	64.5
Chemistry	381121	Lubricating oil additives; containing petroleum oils or oils obtained from bituminous minerals	$3-8	26	1929	Singapore	288.8	United Arab Emirates	155.5	Belgium	151	Brazil	150.5	United States	123
Chemistry	382312	Industrial monocarboxylic fatty acids, acid oils from refining; oleic acid	$0-2	26	207	China	42	United States	34.9	Netherlands	33.7	India	18	Republic of Korea	17.8
Plastics	390110	Ethylene polymers; in primary forms, polyethylene having a specific gravity of less than 0.94	$2-3	26	679	China	252.1	Luxembourg	44.2	Brazil	33.1	Republic of Korea	31.4	Serbia	31
Plastics	390130	Ethylene polymers; in primary forms, ethylene-vinyl acetate copolymers	$2-4	26	1202	China	783.6	Italy	137.7	Mexico	53.8	India	35.5	Indonesia	34.1
Plastics	390140	Ethylene polymers; in primary forms, ethylene-alpha-olefin copolymers, having a specific gravity of less than 0.94	$1-2	26	1687	China	368	Japan	232.7	Brazil	168	Indonesia	107.9	Italy	91.8
Plastics	390190	Ethylene polymers; in primary forms, n.e.c. in heading no. 3901	$1-4	26	906	Netherlands	144.2	United States	130.7	India	96.9	China	78.5	Brazil	54.7
Plastics	390311	Styrene polymers; expansible polystyrene, in primary forms	$2-3	26	820	United States	185	Italy	137.9	Poland	122.3	Netherlands	60.2	Germany	49.3
Plastics	390319	Styrene polymers; (other than expansible polystyrene), in primary forms	$1-3	26	537	Italy	160.6	United States	56.7	Mexico	45.4	Poland	39.9	Bulgaria	23.5
Plastics	390330	Styrene polymers; acrylonitrile-butadiene-styrene (ABS) copolymers, in primary forms	$2-4	26	757	United States	187.2	India	141.1	Mexico	100.5	Canada	76.2	Poland	55.4
Plastics	390810	Polyamides; polyamide-6, -11, -12, -6,6, -6,9, -6,10 or -6,12, in primary forms	$0-3	26	673	Republic of Korea	228	Thailand	130	Italy	104	India	62	China	28
Plastics	390810	Polyamides; polyamide-6, -11, -12, -6,6, -6,9, -6,10 or -6,12, in primary forms	$3-7	26	1852	United States	323.5	Netherlands	205.8	Mexico	196.1	Poland	184.5	Belgium	147
Iron and steel	721399	Iron or non-alloy steel; bars and rods, hot-rolled, in irregularly wound coils, n.e.s. in heading no. 7213, of circular cross-section measuring 14mm or more in diameter	$0-2	26	164	Italy	47.7	Republic of Korea	22.4	United States	21.3	Poland	13	Indonesia	11.9
Iron and steel	721710	Iron or non-alloy steel; wire, (not plated or coated), whether or not polished	$1-3	26	564	United States	228.4	Germany	89.4	Poland	37.6	Denmark	21.1	Morocco	20.5

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Iron and steel	722790	Steel, alloy; bars and rods, hot-rolled, in irregularly wound coils, n.e.c. in heading no. 7227	$0-2	26	478	United States	165.1	Italy	109.1	Republic of Korea	27.2	Brazil	27.1	China	25.9
Machinery and mechanical appliances	841199	Turbines; parts of gas turbines (excluding turbo-jets and turbo-propellers)	$571-1350	26	2009	Singapore	1223	Mexico	117.2	Japan	117	Peru	112.8	United Arab Emirates	106
Machinery and mechanical appliances	842132	Machinery; catalytic converters or particulate filters, whether or not combined, for purifying or filtering exhaust gases from internal combustion engines	$444-493	26	4881	Germany	1980	Türkiye	672.1	Czechia	541.7	Spain	273.7	Sweden	266
Electrical machinery and equipment	854159	Electrical apparatus; photosensitive semiconductor devices n.e.c. in heading no. 8541	$1-108	26	308	United States	177	China	106.9	Japan	9.1	India	7.3	New Zealand	2.2
Electrical machinery and equipment	854190	Electrical apparatus; parts for diodes, transistors and similar semiconductor devices and photosensitive semiconductor devices	$20-341	26	541	Singapore	210.2	India	117.9	Cambodia	65.8	Malaysia	52.1	China	28.7
Electrical machinery and equipment	854929	Waste and scrap; of a kind used principally for the recovery of precious metal n.e.c. in item no 8549.21	$2-16	26	668	Japan	538.9	Germany	50.1	Canada	46.8	Netherlands	14.5	Republic of Korea	8.4
Chemistry	282200	Cobalt oxides and hydroxides; commercial cobalt oxides	$31-68	25	177	Republic of Korea	39.9	Belgium	31.9	Germany	27.1	United States	24.1	Japan	15.5
Chemistry	290121	Acyclic hydrocarbons; unsaturated, ethylene	$1-5	25	1397	Belgium	1107	Netherlands	72.5	Sweden	70.7	Argentina	48.7	Republic of Korea	35.9
Chemistry	290250	Cyclic hydrocarbons; styrene	$0-1	25	1632	Netherlands	460.3	India	310.1	France	274.9	Republic of Korea	169.7	United States	105
Chemistry	290542	Alcohols; polyhydric, pentaerythritol	$2-3	25	49	United States	22.2	Italy	13.6	Tunisia	2.8	Poland	2.2	Chile	1.5
Chemistry	291829	Acids; carboxylic acids, (with phenol function but without other oxygen function), their anhydrides, halides, peroxides, peroxyacids and their derivatives, n.e.c. in item no. 2918.2	$5-25	25	91	Italy	12.8	Canada	11.4	United States	10.2	Netherlands	8.9	Israel	7.3
Chemistry	292419	Acyclic amides (including acyclic carbamates) and their derivatives; salts thereof, other than meprobamate (INN), fluoroacetamide (ISO), monocrotophos (ISO) or phosphamidon (ISO)	$4-27	25	523	United States	232.2	Brazil	73.8	Netherlands	39.6	China	36.4	Mexico	27.6
Chemistry	292529	Imines and their derivatives; salts thereof; other than chlordimeform (ISO)	$0-9	25	277	United States	113.3	Poland	25.5	Switzerland	18.5	Belgium	14.6	Australia	13.7
Chemistry	292690	Nitrile-function compounds; n.e.s. in heading no. 2926	$0-8	25	631	China	397.7	Brazil	89.1	India	35.1	France	32.6	Switzerland	22
Chemistry	293371	Heterocyclic compounds; lactams; 6-hexanelactam (epsilon-caprolactam)	$2-3	25	183	Switzerland	86.9	Poland	29.5	Italy	29	Colombia	19.8	United Kingdom	8.7

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Plastics	390410	Vinyl chloride, other halogenated olefin polymers; poly(vinyl chloride), not mixed with any other substances, in primary forms	$1-2	25	2376	Italy	595.2	Germany	365.5	Belgium	291.6	United Kingdom	249.8	Netherlands	187
Plastics	390729	Polyethers other than polyacetals, and bis(polyoxyethylene) methylphosphonate; in primary forms	$6-11	25	579	Germany	184.6	United States	84.7	Belgium	57.9	Republic of Korea	55.3	Türkiye	44.7
Plastics	390740	Polycarbonates; in primary forms	$3-6	25	1010	Italy	234.7	India	193	United States	163.6	Mexico	104.8	Singapore	44.2
Machinery and mechanical appliances	840734	Engines; reciprocating piston engines, of a kind used for the propulsion of vehicles of chapter 87, of a cylinder capacity exceeding 1000cc	$2752-5324	25	3005	Germany	1346	United States	1140	Austria	144.9	Spain	105.8	Hungary	86.6
Machinery and mechanical appliances	840790	Engines; rotary internal combustion piston engines, for other than aircraft or marine propulsion	$155-1514	25	636	United States	528.6	China	39.4	Netherlands	19.9	Austria	13.3	Australia	8.1
Vehicles	870350	Vehicles; with both compression-ignition internal combustion piston engine (diesel or semi-diesel) and electric motor for propulsion, incapable of being charged by plugging to external source of electric power	$28117-50950	25	2338	Italy	812.1	Republic of Korea	413.4	Switzerland	334.4	Poland	224.7	Denmark	73.7
Vehicles	871120	Motorcycles (including mopeds) and cycles; fitted with an auxiliary motor, reciprocating internal combustion piston engine, of cylinder capacity exceeding 50cc but not exceeding 250cc, with or without side-cars; side-cars	$2925-5161	25	444	United States	193.6	Dominican Republic	118.7	Austria	85	Australia	11.7	China	8.3
Chemistry	291899	Acids; carboxylic acids, with additional oxygen function (not alcohol, phenol, aldehyde or ketone) and their anhydrides, halides, peroxides and peroxyacids; their halogenated, sulphonated, nitrated or nitrosated derivatives; other than 2,4,5-T (ISO)	$8-67	24	376	United States	185.1	Italy	32.5	Switzerland	17	Japan	15.6	Australia	15.2
Chemistry	293149	Non-halogenated organo-phosphorous derivatives; other non-halogenated organo-phosphorous derivatives, n.e.c. in item no. 2931.4	$3-20	24	4258	United States	1522	Brazil	1455	Indonesia	178.1	Canada	120.1	Ireland	107
Chemistry	381800	Chemical elements; doped for use in electronics, in the form of discs, wafers or similar forms; chemical compounds doped for use in electronics	$43-898	24	4900	Malaysia	1604	Thailand	1097	China	544.6	Republic of Korea	490	United States	483

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Chemistry	382763	Mixtures containing halogenated derivatives of methane, ethane or propane; containing other hydrofluorocarbons (HFCs) but not containing chlorofluorocarbons (CFCs) or hydrochlorofluorocarbons (HCFCs); other mixtures not included in the subheadings above,	$5-17	24	118	United States	25.1	Japan	20.1	Canada	13.1	France	10.2	Italy	8.3
Iron and steel	720827	Iron or non-alloy steel; in coils, without patterns in relief, flat-rolled, of a width 600mm or more, hot-rolled, pickled, of a thickness of less than 3mm	$0-1	24	1021	Thailand	332.7	Indonesia	162.5	Belgium	104.9	Canada	93.4	Poland	75.9
Iron and steel	720837	Iron or non-alloy steel; in coils, without patterns in relief, flat-rolled, of a width 600mm or more, hot-rolled, of a thickness of 4.75mm or more but not exceeding 10mm	$0-1	24	1177	Italy	431.9	Egypt	181.1	Netherlands	100.8	Greece	93.7	India	86.2
Iron and steel	720851	Iron or non-alloy steel; (not in coils), flat-rolled, of a width 600mm or more, hot-rolled, without patterns in relief, of a thickness exceeding 10mm	$0-1	24	2768	Republic of Korea	1315	United Arab Emirates	207.5	Indonesia	191.1	China	129.6	Singapore	122
Iron and steel	720851	Iron or non-alloy steel; (not in coils), flat-rolled, of a width 600mm or more, hot-rolled, without patterns in relief, of a thickness exceeding 10mm	$1-1	24	2437	Poland	475	Netherlands	207	Spain	199	United States	174	Argentina	155
Iron and steel	721012	Iron or non-alloy steel; flat-rolled, width 600mm or more, plated or coated with tin, thickness of less than 0.5mm	$1-1	24	2320	Italy	552.7	United States	323.3	Mexico	248.2	Philippines	136.8	Poland	116
Iron and steel	721049	Iron or non-alloy steel; flat-rolled, width 600mm or more, (not corrugated), plated or coated with zinc (not electrolytically)	$1-1	24	3535	United States	899.2	Brazil	464.1	Italy	302.1	Morocco	223.2	Thailand	212
Iron and steel	721123	Iron or non-alloy steel; flat-rolled, cold-rolled, of a width less than 600mm, containing by weight less than 0.25% of carbon	$1-3	24	73	Mexico	20.2	Netherlands	9.6	Switzerland	8.9	United States	8.5	Poland	5.3
Iron and steel	721250	Iron or non-alloy steel; flat-rolled, width less than 600mm, plated or coated, (excluding tin, zinc or plastic)	$1-8	24	120	China	51.1	Italy	21.1	India	16.3	United States	8.1	Poland	4.1
Machinery and mechanical appliances	846223	Machine-tools; bending, folding, straightening or flattening machines (including presses), for working metal, numerically controlled press brakes	$40235-82622	24	233	Germany	57.8	Republic of Korea	25.8	Italy	19.2	United Kingdom	16.6	Canada	15
Chemistry	284390	Inorganic or organic compounds; of precious metals (excluding gold and silver), whether or not chemically defined, amalgams of precious metals	$793-26133	23	742	India	311.3	Malaysia	80.3	United Kingdom	72.4	Thailand	55.3	Switzerland	52.9

Sector	HS	Description	Price Range (US dollars)	Score	Total Opportunity (EO) (in US$ million)	Market 1		Market 2		Market 3		Market 4		Market 5	
						Market	EO (US$ million)	Market	EO (US$ million)	Market	EO (US$ million)	Market	EO (US$ million)	Market	EO (US$ million)
Chemistry	293319	Heterocyclic compounds; with nitrogen hetero-atom(s) only, containing an unfused pyrazole ring (whether or not hydrogenated) in the structure, other than henazone (antipyrin) and its derivatives	$39-431	23	739	Brazil	300.3	United States	232.2	Switzerland	55.1	Japan	41.5	China	30.8
Chemistry	293410	Heterocyclic compounds; containing an unfused thiazole ring (whether or not hydrogenated) in the structure	$50-709	23	481	Brazil	343.7	United States	49.7	Japan	27.6	Italy	12.2	Belgium	9.5
Chemistry	380859	Insecticides, rodenticides, fungicides, disinfectants, herbicides and the like; containing goods specified in Subheading Note 1 to this Chapter; not DDT (ISO) (clofenotane (INN)), put up in forms or packings for retail sale or as preparations or articles	$4-24	23	192	Myanmar	91.7	Canada	41.9	Colombia	20.6	Guatemala	11.7	Thailand	6.5
Iron and steel	720711	Iron or non-alloy steel; semi-finished products of iron or non-alloy steel; containing by weight less than 0.25% of carbon, of rectangular (including square) cross-section, width less than twice thickness	$0-4	23	606	Kenya	174.9	Canada	56.4	Bulgaria	53.8	Italy	50.7	Egypt	49.8
Machinery and mechanical appliances	841861	Heat pumps; other than air conditioning machines of heading no. 8415	$1824-2564	23	1767	France	550.8	Poland	340.1	Italy	291.2	United Kingdom	172.2	Spain	127
Chemistry	284430	Uranium; depleted in U235, thorium, their compounds, alloys, dispersions (including cermets), ceramic products and mixtures containing uranium depleted in U235, thorium; compounds of these products	$7-254	21	19	Netherlands	11.3	France	3.8	United States	1.9	Spain	0.8	Belgium	0.3
Chemistry	380893	Herbicides, anti-sprouting products and plant-growth regulators; other than containing goods of Subheading Note 1 to this Chapter; put up in forms or packings for retail sale or as preparations or articles	$6-20	20	4445	Brazil	2178	United States	412.7	India	203.9	Poland	184.1	Uruguay	178
Machinery and mechanical appliances	841112	Turbo-jets; of a thrust exceeding 25kN	$1284979-6746350	20	7769	United Arab Emirates	1736	Singapore	1116	Brazil	1080	Japan	1027	Spain	954

Appendix E. Macro-strategy

Table E.1.
Auxiliary Table for Macro-strategy

	SECTORAL ISSUES					
Themes	**Chemicals**	**Electrical machinery and equipment**	**Iron and steel**	**Machinery and mechanical appliances**	**Plastics**	**Vehicles**
Conditions						
Political issues	No political issues, but Suape need to govern activities					
Education	Local course offerings are sufficient / SENAI is crucial for specialized training.					
Science & tech institutions	https://ecossistema.pe / CESAR / CETENE / FIOCRUZ PE / FITEC / FUNDAÇÃO JOAQUIM NABUCO / IFPE / PARQTEL / PORTO DIGITAL / SENAI / UFPE / UPE / UCP					
Environment	Carbon emission / water pollution / soil pollution	Water pollution	Carbon emission / water pollution / soil pollution / biodiversity	Carbon emission / water pollution / soil pollution / biodiversity	Carbon emission / water pollution	Carbon emission / water pollution / soil pollution
Financial constraints	Low (US$ 8.5 millions average)	Medium (US$ 18.5 millions average)	Medium (US$ 13.5 millions average)	High (US$ 37.3 millions average)	Medium (US$ 11.5 millions average)	High (US$ 38 millions average)
	BNDES / BNB					
Regulation / standards	Suape companies have advanced production capabilities, but coordination and interaction are needed to address potential regulatory bottlenecks, especially regarding more demanding markets.					
Productive environment						
Innovation	Product and processes innovations based mainly on science and users	Product and processes innovations based mainly on science and users	Processes innovations highly focused on cost and based on suppliers and users	Product and processes innovations based mainly on suppliers and users	Processes innovations highly focused on cost and based on suppliers and users	Product and processes innovations based mainly on suppliers and users
Infrastructure	Port	Port / Airport	Port	Port / Airport	Port	Port
	Logistic and infrastructure improvement are crucial					
Tax	PRODEPE, but Federal Tax Reform will universalize taxes through sectos, preventing tax policies					

	SECTORAL ISSUES					
Themes	**Chemicals**	**Electrical machinery and equipment**	**Iron and steel**	**Machinery and mechanical appliances**	**Plastics**	**Vehicles**
Companies	Abbott Agrocera, BASF, Bayer, Blau farma, BrasChemical, Braskem, Butantan, Chevron, Clarit, Corteva Agriscience, Cristalmaster, Delquímica, Detem, DSM, Estepham, ExxonMobil, Fertibeira, Fresenius, Fundação Prosangue, GrafTech, Hemobrás, Higix, Honeywell, Ibex, Imerys, Incasa, Kalykim, Klabin, LG Chem, Merck, Molnlycke, Nutriplat, Oxiteno, P&G, PlantaAgro, Sasol, SGL, Sigma, Sigma, Sinete Cirúrgica, Sumitomo, Sunquimica, Syngenta, Takeda, Thermo Scientific, Toray, Total Energies, Unilever, Usiquímica	AldoSolar, Arno, Blussun Solar, Broadcom, Electrolux, Flir, Harris Broadcast, Hikvision, Linear equipamentos, Mondial, Moura, Narada, Neosolar, Night Optics, NXP, Pulsar, Rayovac, Romi, Tectoy, Texas Instrument, Vale, Ventisol, Voges, WEG	Amperam, Arcelor Mittal, CSN, Gerdau, Usiminas	Avac, Caterpillar, GE, Grupo Dedini, John Deere, Máquinas Piratininga, Pratt-Whitney, Softbrasil Catalisadores, Stell, Thamil, Tramontina, Whirlpool	Alpek, Ashland Global Holdings, BASF, Braskem, Chemours Company, Covestro, Daikin, Dow Brasil, Ensinger, Gellner, Indorama, Kemox Celulose, Luccplasticos, Mitsubishi, Petrobras, SABIC, Sogun, Unigel, Unipar, Victrex PLC	Aprila, Autoliv, Catterpilar, Ducatti, Facchini, Honda, Iveco, John Deere, Mercedes Benz, Morumbi, MWM, Penha, Royal, Scania, Shineray, Suzuki, SWM, Valtra, Vivix, Volvo, Wuyang, Yamaha, Younglee

	SECTORAL ISSUES					
Themes	**Chemicals**	**Electrical machinery and equipment**	**Iron and steel**	**Machinery and mechanical appliances**	**Plastics**	**Vehicles**
Institutions/ associations	ABIQUIM	ABINEE	Abal / Abcem / Abifa / Abifer / Abinox / ABM / Alacero / IABr / ICZ / Inda / Sindisider / Abimetal	ABIMAQ / ABIMEI / ABINFER / Abipeças	ABIPLAST / ABIEF	ANFAVEA / ABRACICLO / FENABRAVE / Sindipeças / Abipeças
	SUDENE / CNI / SDE-PE					
Market						
Companies (national/ international)	Ache, Agrovale, Alpek, Ambev, Asa, BASF, Braskem, Brilux, Chemical Agroindustrial, Coral, Coremal, Dafonte Renovadora, Electrolux, Exatacor, Frevo, Heineken, Hidrotintas, Hospitals, Ipê, Iquine, Jonhson, Levorin, Lonza, Metalúrgica Barra, Moura baterias, Neoclor, Ondunorte, Pamesa, Petrobras, Petropolis, Pirelli, Poliinova, Rayovac, Recketti, Rendplast, Roca, Starlux, Tcall, Unilever, Usina São José, Vertellus, Vitopel	Arno, Cone Multimodal, Gerdau, Hospitals, Laboratories, Liserve, Lonax, Moura, Tron, Ventisol	Arclima, Atlântico Sul, Betler, Bombril, CBA, Fricon, Gerdau, Indústrias Reunidas Renda, Itaesbra, Moura, Musashi, Promar, Stellantis	AluminioPlan, Grupo Janga, Iberdrola, Itaesbra, Moura, Nacional Têxtil, Ondunorte, Pamesa, Porto Rico, Poty, Raimundo da Fonte, Recife Têxtil, Refinaria Abreu e Lima, Shineray, Stellantis, Termopernambuco, Tramontina	Alpargatas, Amanco, Amcor, Arpoador Espumas, ASA, Bombril, Coca-Cola, Espumas Mor, Frescolat, Hering, Interlândia, IPREP, Kenner, Moura, MRV, Pernambuco Construtora, Raimundo da Fonte, Stellantis, Tigre, Tron, Ypê	BR Distribuidora, Compesa, Stellantis, Yazaki
International markets (in order of importance)	Asia / Europe / North America / South America	Asia / North America / Europe	Asia / Europe / North America	Europe / Asia / North America	Europe / Asia / North America	Europe / North America / Asia
International institutions/ associations	ICCA	AEMT / NEMA / EGSA / EASA / IPC / BEAMA	World Steel Association	AEM	Plastics Industry Association	ACEA / OICA