MEXICO SOUTHERN STATES STUDY

SECTOR ASSESSMENT: AGRO-INDUSTRY

WORLD BANK GROUP
THE WORLD BANK IBRD • IDA
IFC International Finance Corporation

Mexico Southern States Study

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A forthcoming Country Private Sector Diagnostic (CPSD) will provide a broader view on the main challenges and opportunities for private sector development in Mexico, complementing the findings of these Deep Dives at the regional level. The CPSD and the Deep Dives will be mutually reinforcing, as the national coverage of the former will offer a more comprehensive view of the economic structure, constraints and opportunities for private sector investment in the country while the latter offers more granular analytics on the state of the economy and the private sector in Mexico's poorest region.

Abbreviations

AFF	agriculture, forestry, and fishing
Bancomext	*Banco Nacional de Comercio Exterior* (National Exterior Commerce Bank)
Banobras	*Banco Nacional de Obras y Servicios Públicos*
Banxico	*Banco de México* (Bank of Mexico)
CIIT	*Corredor Interoceánico del Istmo de Tehuantepec* (Interoceanic Corridor of the Isthmus of Tehuantepec)
CENAPRED	*Centro Nacional de Prevención de Desastres*
CNBV	*Comisión Nacional Bancaria y de Valores*
EBIT	earnings before interest and taxes
EDUTIH	*Encuesta Nacional sobre Disponibilidad y Uso de Tecnologías de la Información en los Hogares*
ENOE	*Encuesta Nacional de Ocupación y Empleo* (National Survey of Occupation and Employment)
ENCRIGE	*Encuesta Nacional de Calidad Regulatoria e Impacto Gubernamental en Empresas* (National Survey of Regulatory Quality and Government Impact on Enterprises)
FBT	food, beverages, and tobacco
FDI	foreign direct investment
GDP	gross domestic product
IMT	*Instituto Mexicano del Transporte*
km	kilometer
kV	kilovolt
m	meter
Nafin	*Nacional Financiera*
NAICS	North American Industry Classification System
R&D	research and development
SEMARNAT	*Secretaría de Medio Ambiente y Recursos Naturales* (Secretariat of Environment and Natural Resources)
SCT	*Secretaría de Comunicaciones y Transportes* (Secretariat of Infrastructure, Communications and Transportation)
SHCP	*Secretaría de Hacienda y Crédito Público* (Secretariat of the Treasury and Public Credit)
SENER	*Secretaría de Energía* (Secretariat of Energy)
SIACON	*Sistema de Información Agroalimentaria de Consulta*
SIE	*Sistema de Información Energética* (Energy Information System)
Sistrangas	*Sistema de Transporte y Almacenamiento Nacional Integrado de Gas Natural* (National Interconnected System of Natural Gas)
SMEs	small and medium enterprises
SNIARN	*Sistema Nacional de Información Ambiental y de Recursos Naturales*
TIF	*Tipo Inspección Federal* (Federal Inspection Type)
TSS	*Tipo Inspección de la Secretaría de Salud*

Overview

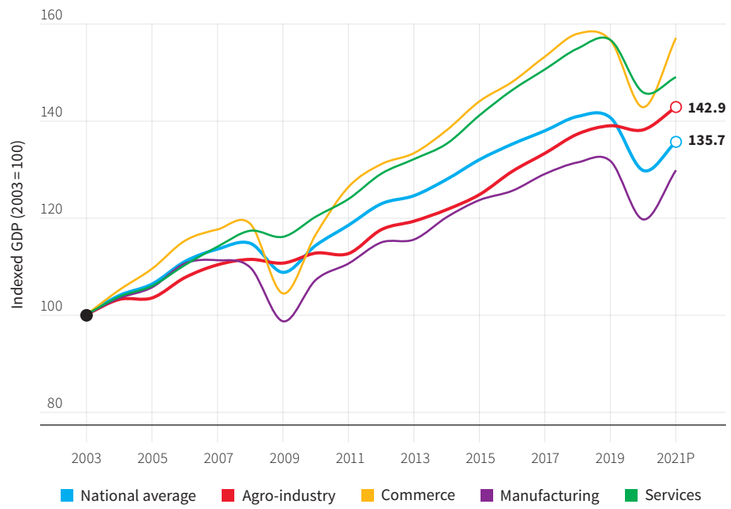
Mexico enjoys a significant standing in the global agrifood market, ranking among leading exporters of various key products. It holds the first position for avocados, tomatoes, mangoes, and cookies, the second for berries and lemons, the third for candies and orange juice, the ninth for beef, and the tenth for pork meat. Regionally, it is the third-largest agro-industry exporter in Latin America, trailing only Argentina and Brazil. However, despite this relative success, the story does not resonate uniformly across the country. The southern states of Mexico, for instance, are largely unable to access global agro-industry value chains. In these states, agriculture is dominated by small-scale, traditional, self-subsistence farming, and has struggled to enhance its competitiveness and strengthen its international linkages. Despite these hurdles, these states are important players in the domestic agrifood arena. Among selected states, Chiapas excels as a top producer of coffee beans and cocoa; Guerrero and Oaxaca are known for coconuts, lemons, and mangoes; Oaxaca is a leading producer of papayas, and Yucatán is prominent for its cucumbers, among other agricultural products.[1] These states are also recognized for beef production, with Chiapas ranking as the seventh-largest beef producer in Mexico in 2021. Furthermore, in terms of seafood, Chiapas holds the top position in the country for mojarra production and the third-largest for tuna production. Yucatán, on the other hand, is the largest producer of octopus, second-largest producer of lobster, and fourth-largest producer of carcass pork meat.

MARKET ANALYSIS

Mexico's agro-industry—including agriculture, food, beverage, and tobacco manufacturing—which accounts for 8 percent of total gross domestic product (GDP) and 16.6 percent of total employment in established firms, grew more than the country's GDP and increased its presence in external markets.[2] Between 2003 and 2021, the growth in the agro-industry's value added rose by 42.9 percent, above the overall GDP growth rate (figure O.1). Since 2003, the agro-industry has received 10.5 percent of Mexico's total foreign direct investment (FDI) inflows. Furthermore, it plays a critical role in the country's export landscape, with agricultural products representing 8.9 percent of Mexico's total exports. Between 1995 and 2021, agricultural exports grew at an average rate of 7.8 percent per year, raising Mexico's share in global agricultural exports from 1.4 percent (US$6.3 billion) to 2.4 percent (US$43.9 billion). At the forefront of this progress are the central and northern states of Chihuahua, Guanajuato, Jalisco, Michoacán, Nuevo León, Sinaloa, and Sonora, producing more than half of the country's agro-industry exports.

The domestic market for agricultural and food products is growing. Mexico's agro-industry imports have risen substantially in recent decades. Between 1995 and 2021, agro-industry imports rose from 6.7 percent to 7.1 percent of Mexico's total imports, while Mexican agro-industry imports rose from 1.1 percent to 1.9 percent of global agro-industry imports. This pattern underscores the rapid expansion of Mexico's domestic market and highlights the opportunity to boost domestic output of agrifood goods that are not yet produced com-

FIGURE O.1
The Mexican Agro-Industry Sector's Output Performance



Source: Based on data from INEGI's National Accounts (various years).
Note: GDP = gross domestic product. P = preliminary. Agro-industry includes activities in the primary sector (excluding forestry) and the food, beverages, and tobacco industry.

petitively within the country. An analysis of imports in the selected states and their neighbors reveals four products with high import values and substantial growth potential: corn (maize), oilcake and other solid residues, crustaceans, and coffee. In addition, agro-industry's contribution to other economic activities represents 6 percent of the total value added in the Mexican economy. The subsectors that contribute most to other economic activities are oilseed and grain farming (20.3 percent), cattle ranching and farming (12.6 percent), and grain and oilseed milling (10.7 percent).

Agro-industry is a key sector in Mexico's southern states. As of 2021, agro-industry represented 12 percent of the selected states' GDP. Moreover, the food, beverages, and tobacco (FBT) industries jointly account for over 65.3 percent of their manufacturing activities, up from 39 percent in 2003. In 2018, agro-industry firms represented 8.1 percent of all firms in the selected states, and agro-industry contributed 9.4 percent to their overall gross value added, well above the national average of 7.4 percent. Between 2003 and 2021, agro-industry accounted for 25.5 percent of the region's total FDI inflows, driven by food and beverage manufacturing. In 2021, agro-industry provided jobs for 32.3 percent of the employed formal and informal workforce in the selected states.[3]

The selected states are well positioned to exploit the growing international and domestic agrifood markets. These states are home to 7.6 percent of the country's export-oriented agro-industry plants and produce a combined 9.1 percent of Mexico's agro-industry exports. Out of 69 agro-industry activities, Chiapas has a comparative advantage[4] in value added terms in 17, while Yucatán and Oaxaca in 14 each and Guerrero in nine. In terms of exports, out of 201 products, Chiapas has a comparative advantage in 26, while Oaxaca and Yucatán in 20 each, and Guerrero in 18.

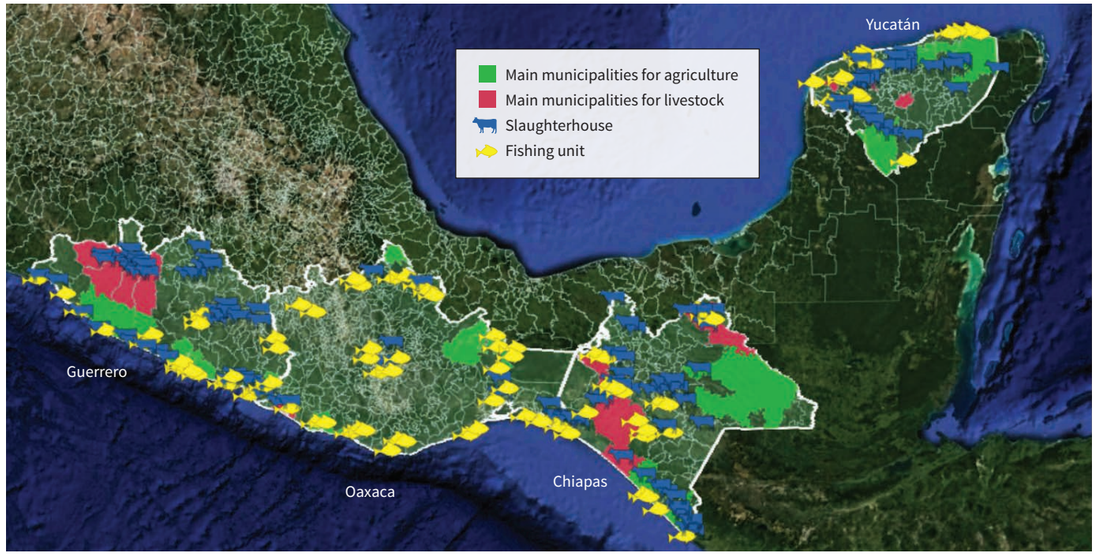
Map O.1 and O.2 show that the selected states have the potential to host major agro-industry production sites. Based on the location of primary activities and availability of required infrastructure, the following areas are suitable for agro-industry investment: in Chiapas, the coastal areas, the central region extending from Arriaga to Tuxtla Gutiérrez and further to Comitán de Dominguez, and the northern region around Palenque; in Guerrero, the southeast region, the area around Acapulco, and the west coast; in Oaxaca, the Valles Centrales and Istmo regions, the north region centered around Tuxtepec, and the southern region around Villa de Tututepec; and in Yucatán, the central and northern regions, including the Mérida-Progreso-Tizimín triangle.

ECONOMIC POTENTIAL

Agro-industry can help the selected states leverage their natural resources to diversify their economies and access higher-value-added segments of the value chain. In all the states, productivity of the FBT subsector is higher than the primary sector, which is expected. However, the subsector also has higher productivity than the average of the manufacturing sector. Indeed, in Chiapas and Yucatán, productivity of the FBT is higher than the average productivity of the overall economy. Production in the FBT subsector is an important engine of job creation. In the selected states, the average agro-industry firm employs 6.8

MAP O.1

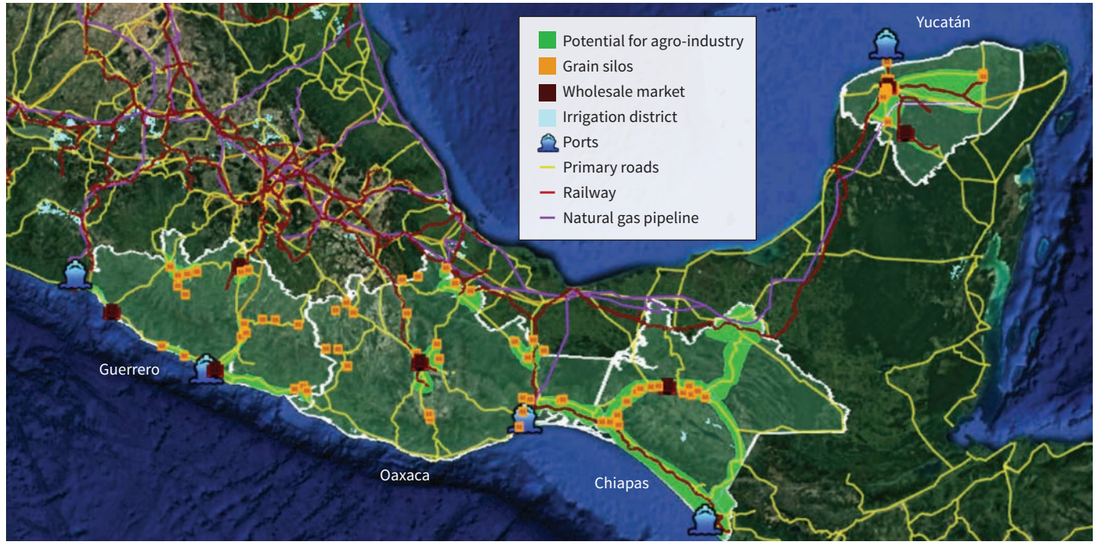
Primary Agricultural Production Areas in the Selected States



Source: Elaborated using Google Earth with information from SIAP 2019a, 2019b, 2019c, 2019d, and 2019e.
Note: The symbols are only indicative and are not meant to reflect exact locations.

MAP O.2

Priority Areas for Agro-Industrial Development in the Selected States



Source: Elaborated using Google Earth with information from SIAP 2019a, 2019b, 2019c, 2019d, 2019e, SCT 2019, SENER 2018, and CONABIO 2015.
Note: The symbols are only indicative and are not meant to reflect exact locations. A qualitative analysis was made for potential agro-industry locations, but additional studies are required to determine definitive areas with potential.

workers, versus an average of just 2.8 in the manufacturing sector. In Chiapas and Yucatán, agriculture, forestry, fishing, and hunting are more labor intensive than the primary sector at the national level.

Moreover, in the selected states, the number of workers per Mex$1 million of value added is 5.8, which is more than twice the national average of 2.3. Given the forward and backward links in FBT activities, the subsector has one of the economy's highest employment multipliers, which makes investment in agro-industry an effective way to alleviate poverty and generate inclusive growth. The value of agro-industry purchases represents about 18.7 percent of economy-wide purchases, while the value of agro-industry sales represents 8 percent of total sales.[5] Agro-industry has a strong potential of generating sizeable backward links, which could benefit suppliers of inputs in the selected states and the broader South-Southeast region.

BINDING CONSTRAINTS FACED BY THE SECTOR[6]

Infrastructure gaps inhibit the development of the agro-industry sector in the selected states, particularly in Guerrero. Weak logistics systems and poor transportation infrastructure are a major obstacle to the growth of agro-industry in southern Mexico, largely because of the lack of paved roads in remote production regions. Water access and irrigation infrastructure are also a major constraint on agro-industry in some parts of Guerrero, where water costs are high and quality of service provision is low; in Oaxaca, given its higher production costs and cost-fare ratio; and in Yucatán, where there is only one irrigation district for agricultural production (while the rest of selected states have two or more). The lack of sector-specific infrastructure such as grain-storage facilities, farms, and slaughterhouses, also constrain the agro-industry in these states. For example, in Oaxaca, there are no *Tipo Inspección Federal* (TIF) slaughterhouses in operation.[7] Furthermore, although there is no shortage of fuel availability, the lack of connections to Mexico's natural gas system in the selected states could limit the future growth of agro-industrial development.

High levels of market concentration, communal land tenure, and distortive government interventions also undermine the sector's development. The concentration of market power, particularly in markets for seed, fertilizer, and other inputs, as well as in the retail sector, distorts prices, which has a disproportionately negative effect on asset-poor farmers and smaller agritrade entrepreneurs. Restrictions on private land ownership, a high degree of land fragmentation, and an unclear definition of property rights for communal land[8] deter investment, limit access to finance, and slow the development of economies of scale in the selected states.

Limited access to finance is another constraint for the development of agriculture in the selected states. Firms in the selected states are unlikely to seek external financing to purchase inputs, which either indicates that there is excessive leverage from local suppliers or constraints on the scale of production to what the cyclical budget of producers allows, limiting their capacity to access more competitive inputs. In contrast, the heavy reliance on external financing to purchase equipment or expand business operations, combined with low levels of financial penetration, may explain the slow pace of technical upgrading across the primary sector in the region. Access to finance is notably a binding constraint on the development of the FBT subsector in Oaxaca.

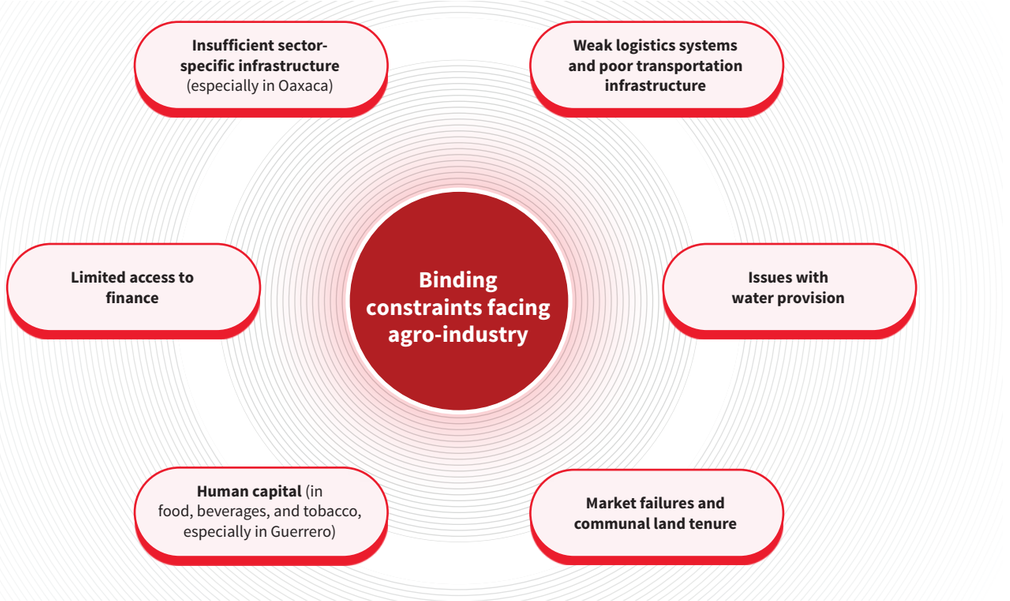
Although human capital seems sufficient for primary agricultural products, it may become a barrier in the more advanced stages of the value chain. The size and quality of the labor force in the selected states can be considered as broadly adequate for the development of primary agricultural activities. But human capital is a constraint at the advanced stages of the agro-industry value chain in Guerrero and, to a lesser extent, in Oaxaca. In Yucatán, human capital is not a binding constraint on the development of more advanced segments of the agro-industry sector, and in Chiapas it does not seem to be the main constraint.

Figure O.2 summarizes the binding constraints for developing the agro-industry sector in the selected states.

OPPORTUNITIES FOR GROWTH: WHAT WOULD IT TAKE TO DEVELOP THE SECTOR?

Greater investment in infrastructure would help connect farmers, industries, and final consumer markets. Upgrading major roads and logistics nodes will be necessary to reduce transportation costs and delays. In addition, ensuring a reliable and continuous energy supply, expanding irrigation systems, building

FIGURE O.2
High-Level Overview of Binding Constraints Facing Agro-Industry in the Selected States



new storage facilities, phytosanitary centers, and certified slaughterhouses (in Oaxaca) would greatly increase opportunities for value addition.

Establishing or fostering existing agro-industry clusters could further reduce transaction costs and address information asymmetries, leverage economies of scale, increase specialization, and facilitate innovation and knowledge dissemination. More support is required to consolidate ongoing public-private initiatives like the agro-industry parks identified in Chiapas, Guerrero, and Oaxaca. For large private facilities with significant economic and social benefits, granting land contingent on last-mile infrastructure, investment, or job-creation goals could help overcome restrictions on private-land ownership. The state and federal governments could also consider using nondistortionary incentives to attract and retain anchor firms, promote links with local small and medium enterprises (SMEs), facilitate technology transfer, encourage onsite industrialization, and promote environmentally sustainable practices. Supporting small-scale producers to establish cooperatives could enhance horizontal integration, facilitate the growth of economies of scale, improve production systems, foster the development of management and marketing skills, expand access to finance, and enhance bargaining power.

Improving occupational skills and labor competencies along the agro-industry value chain would help ease human capital constraints in advanced stages in the agro-industry value chain. These efforts should focus on (1) bolstering the capacity of farmers to scale-up production and comply with export standards and certification requirements, (2) increasing the supply of skilled workers for FBT and supporting industries, and (3) developing human capital of SMEs supplying intermediary goods and services along the value chain. Generating and adapting research and development and agro-industrial extension centers in partnership with the private sector and academia could improve the quality of agricultural inputs, raw production, and industrialization stages, with a specialization on the agriproducts to be developed in each state.

Addressing market power issues and improving government programs would enhance the efficiency of agro-industry production. Actively enforcing the *Ley Federal de Competencia Económica* (Federal Law on Economic Competition), supporting the entry of new firms into the input and intermediary markets, and improving the design, targeting, and transparency of government programs and subsidies would help level the playing field. Government interventions should address gaps around resources, infrastructure, skills, and technology faced by small-scale agricultural producers, and the government should incentivize the production of agricultural products with the greatest market potential and social benefits. Establishing an interstate collaboration program among the governments of the selected states could help disseminate best practices for attracting investment related to the main agriproducts they share and developing strong value chains.

Broadening access to financial services by providing affordable products tailored to the needs of primary producers would help overcome constraints on investment and working capital. Financial assistance programs should focus on the procurement of inputs, equipment, and machinery. The private sector will require support to establish guarantee funds and specialized agricultural insurance. The priority should be on financial products that facilitate technology

adoption, especially those targeting the production of primary inputs. In addition, evaluation and, if necessary, modification of existing financing instruments offered by development banks is required to ensure their alignment with the requirements.

Consolidating an agro-industry knowledge and information system would support the dissemination of practical knowledge along sectoral value chains, with especially significant benefits for small farmers and SMEs providing manufacturing and support services. An upgraded and more comprehensive *Servicio de Información Agroalimentaria y Pesquera* (Agrifood and Fishing Information Service) platform could provide a starting point for a more robust knowledge-management system, which could also provide information on market trends and prospects, as well as weather reports, soil analyses, estimated training needs, and advisory services on regulations, standards and certification requirements, export potential, and expansion into more sophisticated value chains. Facilitating the adoption of information and communications technology for controlling and monitoring production would help ensure safer growing conditions and foster more efficient agro-industry production methods with less environmental impact.

Table O.1. summarizes the main policy recommendations for developing the agro-industry sector in the selected states.

TABLE O.1

Matrix of Policy Recommendations

	Infrastructure
	➜ Develop and implement an infrastructure plan, featuring prioritized projects (and potential sources of public and private financing sources) aimed at improving critical transportation infrastructure that would connect the main productive regions with logistics nodes and target markets. ➜ Explore potential synergies with key federal government projects, such as the Interoceanic Corridor of the Isthmus of Tehuantepec by developing a coastal road corridor that connects Salina Cruz, Oaxaca to Chiapas and Guerrero. ➜ Consolidate the *Sistemas Intermodales Portuarios Costeros* (Intermodal Port and Coasts Systems) in the main ports of the selected states, including the development of logistics platforms systems in the *Sureste* (Chiapas, Oaxaca, Tabasco, and Veracruz), *Central* (Colima, Guerrero, Mexico City, Michoacán, Morelos, and the State of México), and *Peninsular* (Quintana Roo and Yucatán) regions. ➜ Ensure reliable energy supply for manufacturing activities. In the medium-term, develop infrastructure to access natural gas in Guerrero (potential connection at the coastal region from the pipeline in Michoacán), and Chiapas (potential connection from the pipeline in the Isthmus of Tehuantepec in Oaxaca to Tapachula, and potentially to Central America). ➜ Improve the provision of agro-industry sector-specific infrastructure, including: 1. Development of facilities for phytosanitary services. 2. Expansion of coverage of irrigation districts. 3. Improvement and development of grain and cold storage facilities, especially in Chiapas and Oaxaca. 4. Construction of at least one *Tipo Inspección Federal* (Federal Inspection Type) slaughterhouse in Oaxaca, and increase the capacity of *Tipo Inspección de la Secretaría de Salud* (municipal) slaughterhouses in Yucatán. 5. Development of logistics facilities to expand storage capacities in ports. 6. Supply of support and last-mile infrastructure for the development of agro-industry clusters.
	Support to producers
	➜ Foster the establishment of agro-industry clusters and support existing private initiatives such as the agro-industrial park projects identified in Chiapas, Guerrero, and Oaxaca, to increase (1) the capacity of farmers to scale-up production and meet standards and certification requirements, (2) the capacity of smaller- and medium-firms to provide intermediate goods and services along the value chain, and (3) the workforce's skills demanded by food and beverage manufacturers. ➜ Create supplier-development programs in coordination with large firms and potential investors. ➜ Provide support for small-scale producers to establish cooperatives and link them with large agro-industrial firms or final markets. ➜ Establish or adapt research and development and agro-industrial extension centers in partnership with the private sector and academia, to improve agricultural inputs (including seeds, fertilizers, and pesticides), raw production, and industrialization stages, with a specialization on the agriproducts developed in each state. ➜ Invest in digital infrastructure in productive (rural) areas that are underserved or lack coverage, and promote information and communication technologies to optimize and monitor production processes. ➜ Strengthen existing efforts to consolidate an agro-industry knowledge and information system, capable of generating, integrating, disseminating, and supporting the application of practical knowledge along the sector's value chains, particularly for small farmers and small and medium enterprises providing manufacturing and support services. ➜ Create an interstate program for collaborative participation among governments of southern states to attract investments of anchor industries and firms for processing common agriproducts where a robust business case can be made.

(Table continues next page)

TABLE O.1

Matrix of Policy Recommendations *(continued)*

	Investment climate, competition, and government interventions
	➜ Make requirements and tax administration procedures less complex to encourage firms to formalize and/or grow their businesses. ➜ Actively enforce the *Ley Federal de Competencia Económica* (Federal Law on Economic Competition) and support the entry of new firms into the input and intermediary markets to address issues related to competition and market power issues. ➜ Improve the design, targeting, and transparency of subsidies given to some inputs, such as seeds and fertilizers, as well as government-guaranteed prices, to incentivize the production of agricultural products with the greatest market potential and social benefits. ➜ Explore options for adopting an incentive system to attract private investment, with the aim of accelerating the consolidation of agro-industry clusters. These incentives could focus on new investments (including expansions and reinvestments), projects to increase storage and processing capacities, as well as the adoption of sustainable practices. The system could target anchor firms willing to establish links with local producers and share their knowledge. The incentives should be gradually reduced over a defined timeline and phased out when external agglomeration benefits have been achieved.
	Access to finance
	➜ Strengthen access to financial services with products tailored to the needs of small and medium primary producers, particularly for securing necessary inputs, equipment, machinery, and fulfilling certification requirements to reach high-end and export markets. ➜ Assess the impact of existing financing programs (direct and through intermediaries) provided by development banks and other specialized-financial institutions, such as FIRA and FOCIR. ➜ Promote microfinance, nonbanking financial initiatives, and public and private investment funds as instruments to access finance from multilateral agencies (harder to reach small and disperse pools of primary producers).

Note: FIRA = *Fideicomisos Instituidos en Relación con la Agricultura* (Trust Funds for Rural Development); FOCIR = *Fondo de Capitalización e Inversión del Sector Rural* (Capitalization and Investment Fund for the Rural Sector).

1

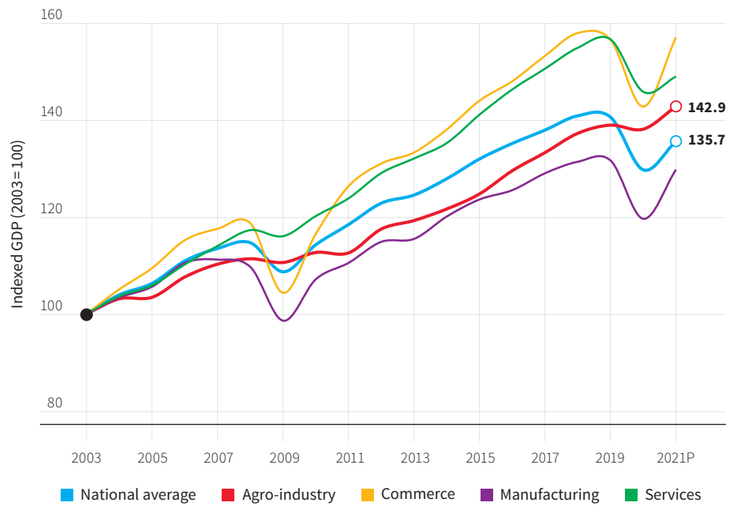
Agro-Industry in Mexico and in the Selected States

The agro-industry sector is a key component of the Mexican economy. The sector represents 8 percent of the country's gross domestic product (GDP), accounts for 5.3 percent of firms, and generates 16.6 percent of total (formal and informal) employment.[9] Between 2003 and 2021, the value added of agro-industry to Mexico's GDP increased by 42.9 percent, performing better than the country's overall GDP growth rate (figure 1.1). During the same period, agro-industry received 10.5 percent of total foreign direct investment (FDI) inflows to the country. Most of this inflow (70.7 percent) was concentrated in the beverages and tobacco products manufacturing.[10] Yet the share of agro-industry activities on gross capital formation fell from 5.3 percent in 2014 to 4.7 percent in 2018. Most of this capital was captured by food manufacturing activities (69.3 percent).[11]

Throughout this assessment, agro-industry includes the following subsectors: crop production; animal production and aquaculture; fishing, hunting, and trapping; support activities for crop production; support activities for animal production; food manufacturing; and beverage and tobacco product manufacturing.

FIGURE 1.1

The Mexican Agro-Industry Sector's Output Performance



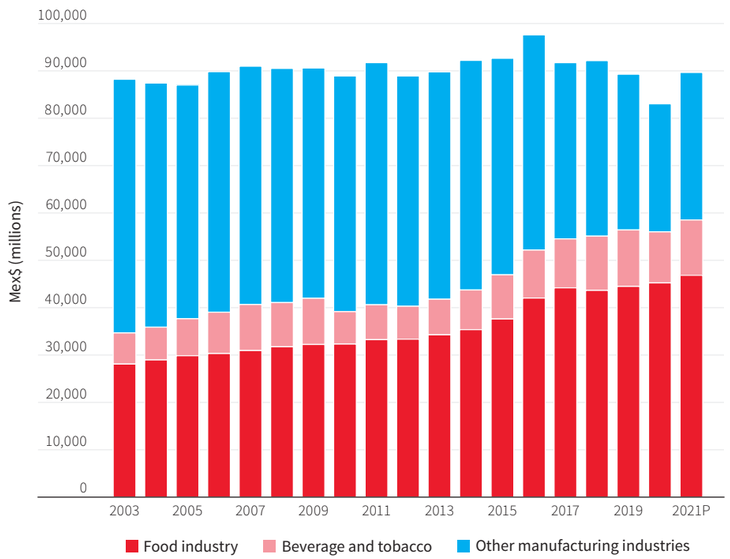
Source: Based on data from INEGI's National Accounts (various years).
Note: GDP = gross domestic product. P = preliminary. Agro-industry includes activities in the primary sector (excluding forestry) and the food, beverages, and tobacco industry.

Agro-industry plays an important role in Chiapas, Guerrero, Oaxaca, and Yucatán. The sector contributed 12 percent to the aggregate GDP of the selected states and represented 65.3 percent of the value added by the manufacturing sector[12] in 2021, compared to 10.9 and 39.3 percent, respectively, in 2003 (figure 1.2). According to INEGI's *Encuesta Nacional de Ocupación y Empleo* (National Survey of Occupation and Employment), agro-industry accounted for a substantial 32.3 percent of total employment in the selected states in 2021, with rates ranging from 41.8 percent in Chiapas to 14.2 percent in Yucatán. Although the selected states received only 3.2 percent of total FDI flows to Mexico between 2003 and 2021, they received 7.7 percent of the total FDI in agro-industry. Indeed, the sector accounted for 25.5 percent of the total FDI in the selected states. At an average of 19.5 percent, food and beverage manufacturing accounted for the largest share of FDI received by the selected states over the period (figure 1.3).

Development of the agro-industry sector in the selected states is key for promoting inclusive growth, poverty reduction, and food security. In the southern states, agro-industry is a key source of employment, and, with several competitive agro-industry products, the states may attract foreign and domestic investments. The sector has strong backward links: for every monetary unit of value generated by the agro-industry sector, 2.3 monetary units are spent purchasing inputs from other sectors.[13] Moreover, in the selected states, agriculture and food, beverage, and tobacco account for a third of total (formal and informal) employment, twice the national average. The employment-to-output ratio of the sector in these states is also twice the national average, underscoring the sec-

FIGURE 1.2

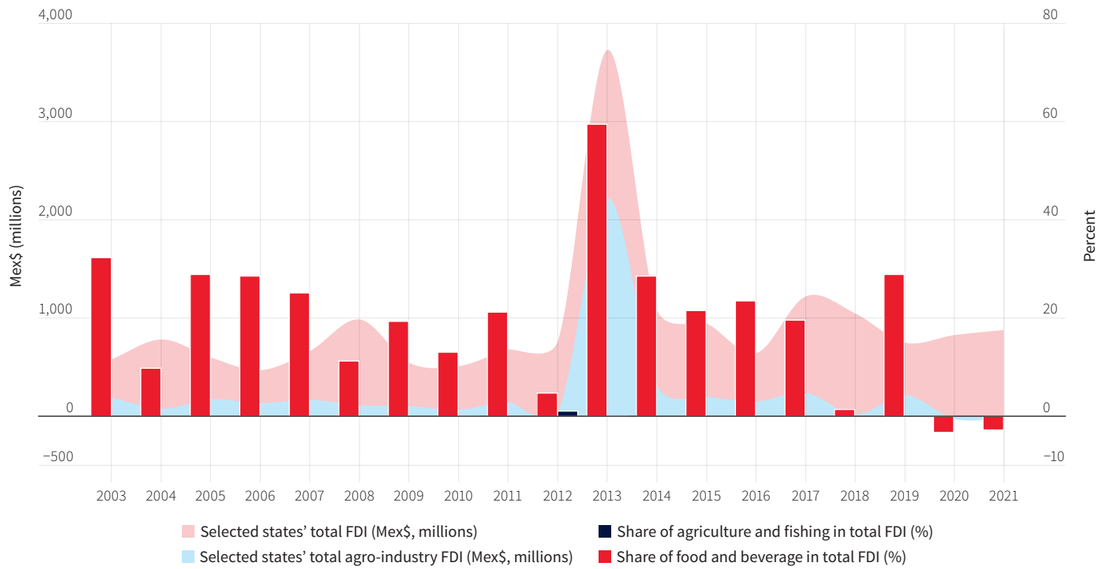
Agro-Industry's Share in Manufacturing Output, Selected States



Source: Based on data from INEGI's National Accounts (various years).
Note: P = preliminary.

FIGURE 1.3

FDI in Agro-Industry, Selected States, 2003–21



Source: Based on data from the *Secretaría de Economía* (Secretariat of Economy).
Note: FDI = foreign direct investment.

tor's potential for job creation. By spurring the development of the agro-industry sector, not only will these direct jobs increase, but additional jobs associated with input production (such as seeds, fertilizers, and pesticides) and support services (such as packing, transportation and logistics, marketing, and distribution) will also be generate throughout the sector's value chain.

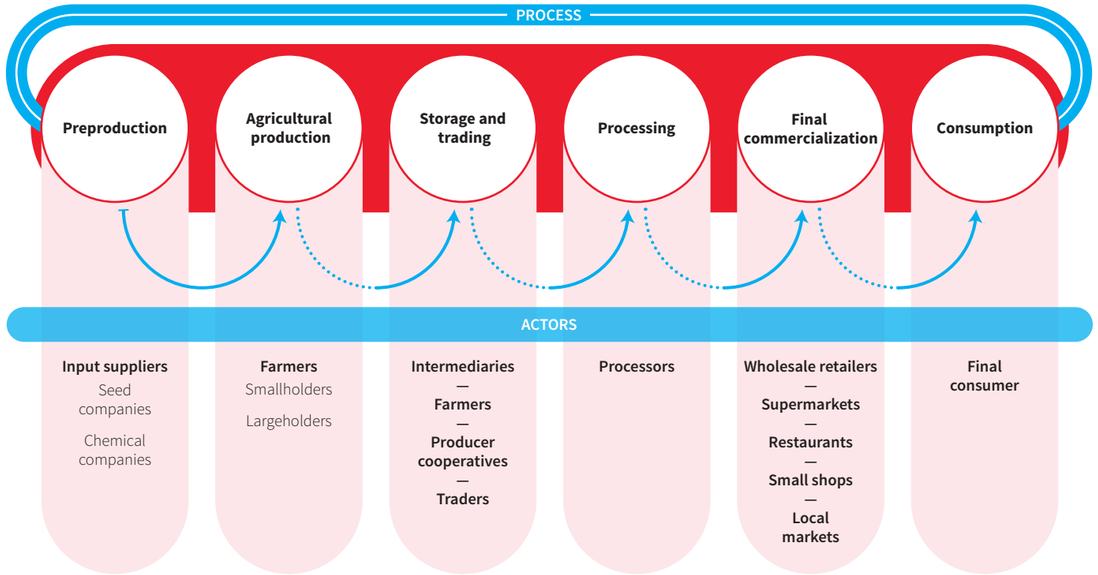
Promoting high-productivity agriculture connected to final markets or more advanced stages of the value chain could help increase the living standard of agricultural producers. The benefits will be greater in rural areas where subsistence farming prevails, by helping prevent migration and preserving the roots and cultural identity of communities. Similarly, developing industrialization capacities for adding value to agricultural products will grant access to more sophisticated markets where local producers could benefit from higher prices and profits, and simultaneously encourage an escalation and quality enhancement of primary production, generating a virtuous circle.[14]

THE AGRO-INDUSTRIAL VALUE CHAIN

Key stages of the agro-industry value chain include preproduction, production, storage, processing, transportation, and retail sale (figure 1.4). Globally, approximately 70 percent of the value added in agro-industrial exports comes from domestic input suppliers.[15] These inputs include goods such as seed and fertilizer (23 percent) and services such as transportation and storage (38 percent). Given the perishable nature of many agricultural products, agro-indus-

FIGURE 1.4

The Agro-Industry Value Chain



Source: Based on UNCTAD 2014; Humphrey and Memedovic 2006; KPMG 2013.

trial value chains require especially strong logistics services. In Mexico, over 80 percent of the value added in agro-industrial exports is generated domestically, while approximately 10 percent comes from the United States and the remainder from other trade partners. In addition, the contribution of agro-industry as output in other economic activities corresponds to 6 percent of the national value added.[16] The agro-industry subsectors with the largest participation in these activities include oilseed and grain farming, cattle ranching and farming, and grain and oilseed milling.

Mexico's success in agro-industry exports highlights the opportunity for the selected states to expand their integration in global value chains. As of 2021, Mexico ranked among the world's leading exporters of agrifood products such as avocado, berries, lemon and lime, mango, orange juice, cookies, sugar and candy, and beef and pork meat.[17] The country has developed, modern, and tightly integrated value chains, with efficient input systems, audited packhouses, refrigerated transportation, advanced processing plants, robust quality controls, and access to a wide range of domestic and international markets. However, the development of agro-industrial capabilities and support services has not been evenly distributed: the selected states still rely heavily on subsistence farming, low-yield inputs, rudimentary logistics networks, and limited public and private infrastructure.

REGULATORY FRAMEWORK

Several domestic regulations and international trade agreements impact agribusiness activities in the country. Mexico's food-safety laws are primarily governed by the Plant Production Law and the Federal General Health Act. The Plant Production Law authorizes the Secretariat of Agriculture and Rural Development to regulate plant health, implement systems to reduce risk contamination, and define good agriculture practices. On the other hand, the Federal General Health Act gives the Secretariat of Health the mandate to monitor food-safety issues.

The United States is the most important trade partner of Mexico, receiving over 70 percent of its agricultural exports. The United States–Mexico–Canada Agreement, formerly the North American Free Trade Agreement, has allowed for free trade of all agricultural products since 2008. Nonetheless, the agreement does not restrict agricultural support policies,[18] and strong U.S. government support for key agricultural products limits Mexico's agrifood exports. Mexico has numerous trade agreements, yet agricultural trade with its non-U.S. partners is modest, because, in part, to the exclusion of "sensitive" agriculture products from many of those agreements. For instance, only two of Mexico's ten most important export products receive full preferential treatment in its trade agreement with the European Union.[19] Among Mexico's relevant trade agreements with Central and South American countries, only those with Chile, Colombia, and Nicaragua have agro-industry liberalization rates above 90 percent.[20]

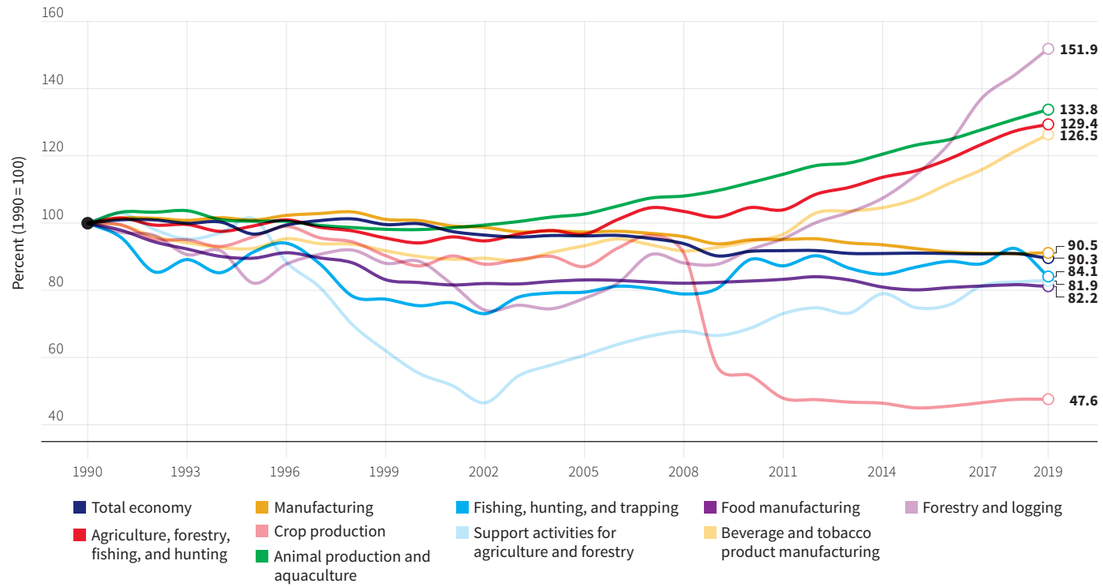
Technical regulations and food safety and quality standards are the main nontariff barriers to trade for agro-industry products.[21] In some years, Mexican goods have accounted for almost a quarter of all fruits and vegetables that

were denied entry at the U.S. border. Inadequate adherence to sanitary standards and labelling regulations were the main reasons for rejection, followed by pesticide residues, unauthorized food additives, and microbiological contaminants.[22] The use of private certification standards is increasing, as firms strive to differentiate their products and signal superior quality to consumers. The high costs of regulatory compliance, proliferation of public and private standards, increasing number of audits and assessment systems, and growing importance of third-party validation programs squeeze profit margins for Mexican farmers and negatively impact their benefits from trade.[23] More recently, there has been a transition from product controls to process controls, for example, the adoption of the Hazard Analysis Critical Control Point by the U.S. Food and Drug Administration in food processing.

PRODUCTIVITY, LABOR AND CAPITAL INTENSIVENESS, AND WAGES

The productivity of agro-industry subsectors in Mexico has been mixed. As figure 1.5 shows, despite an economywide decline in total factor productivity (TFP), the TFP of agriculture, forestry, fishing, and hunting (North American Industry Classification System [NAICS] code 11) grew at an annual rate of 0.92 percent between 1990 and 2019, leading to a cumulative growth of 29.4 percent. This positive trend was driven by the 1.02 percent average growth rate

FIGURE 1.5
Total Factor Productivity in the Selected Sectors



Source: INEGI.

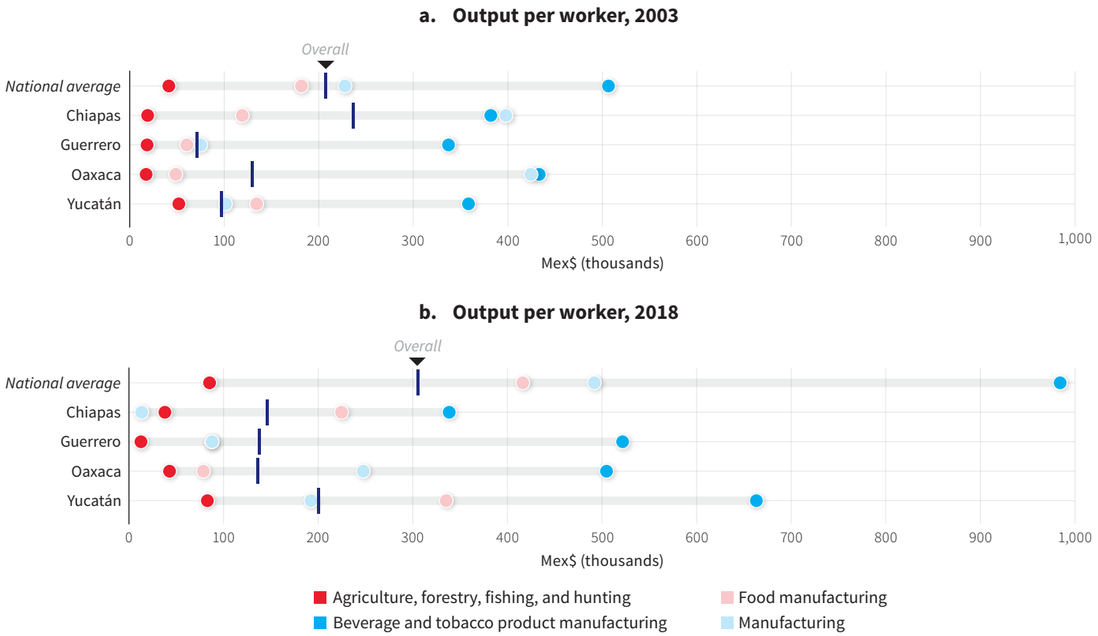
of animal production and aquaculture (NAICS 112) and 1.60 percent growth rate of forestry and logging (NAICS 113). The TFP of beverage and tobacco product manufacturing (NAICS 312) also increased at an annual average rate of 0.84 percent. However, during the period, the annual TFP growth rate of other subsectors contracted: crop production (NAICS 111) by –2.17 percent, fishing, hunting, and trapping (NAICS 114) by –0.46 percent, support activities for agriculture and forestry (NAICS 115) by –0.42 percent, and food manufacturing (NAICS 311) by –0.67 percent.

Labor productivity in the selected states is below the national average across all agro-industrial subsectors. This pattern is broadly consistent with the low overall productivity of the selected states. However, their productivity levels are higher for activities related to food, beverage, and tobacco manufacturing compared to the primary and manufacturing sectors, as well as for their overall economies (except for food manufacturing in Guerrero and Oaxaca). These higher productivity levels underscore the potential of the less developed agro-industrial subsectors in the selected states (figure 1.6).

Analysis of 69 agro-industry activities reveals that Chiapas has seven activities with productivity levels above the national average, Yucatán has five and Guerrero has three, while Oaxaca has none.[24] An analysis of those activities with a comparative advantage[25] based on value added reveals that Chiapas has the most with 17 products, followed by Oaxaca and Yucatán (14 each), and Guerrero (9). As table 1.1 shows, for products with above-average labor productivity and comparative advantage, Chiapas has the most again (6 products), followed by Yucatán (4) and Guerrero (1), while Oaxaca has none.

FIGURE 1.6

Agro-Industrial Labor Productivity by Subsector, Selected States



Source: INEGI 2004; 2019.

TABLE 1.1

Agro-Industry Activities with Labor Productivity Levels Above the National Average and a Comparative Advantage, Selected States, 2018

NAICS code	Description	Chiapas		Guerrero		Oaxaca		Yucatán	
		Labor productivity	RCA	Labor productivity	RCA	Labor productivity	RCA	Labor productivity	RCA
112512	Shellfish farming	167.9	30.6	...	...	...	...	...	...
114119	Fishing and catching fish, crustaceans, molluscs, and other species	...	...	...	...	...	...	85.3	19.2
311110	Animal feed manufacturing	1,472.4	2.0	...	...	...	...	1,555.6	4.2
311213	Corn flour manufacturing	1,278.9	6.7	...	...	...	...	...	...
311611	Slaughter of livestock, poultry, and other edible animals	...	...	...	...	...	...	574.3	12.5
311612	Cut and pack meat from livestock, poultry, and other edible animals	2,027.7	4.4	...	...	...	...	...	...
311710	Preparation and packaging of fish and seafood	...	...	...	...	...	...	901.9	6.6
311813	Frozen cakes, pies, and other pastries manufacturing	91.9	1.6	...	...	...	...	...	...
312111	Soft drink manufacturing	1,374.9	2.1	2,580.5	3.1	...	...	...	...

Source: Based on data from INEGI (2019).
Note: Labor productivity is measured as thousands of Mexican pesos per worker per year. RCA = revealed comparative advantage.

The manufacturing of beverage and tobacco products typically exhibit larger capital stock per firm and higher capital-stock-to-worker ratio compared to other agro-industry subsectors. Table 1.2 shows that most agro-industry subsectors are highly labor intensive in the selected states. The selected states have an average of 6.8 workers per agro-industrial firm. This exceeds the national overall average of 5.7 and the average of 2.8 for manufacturing firms in the selected states. However, while agro-industrial labor intensity in the selected states is higher than the national average, wage rates are lower, and the wage gap between formal and informal workers is especially large.[26]

The high labor intensity of the agro-industry in the selected states is associated with lower salaries compared to the national level. Prior to the COVID-19 pandemic, average hourly wages for the formal and informal sectors in agriculture, forestry, fishing, hunting, and support activities were 19.4 and 30.9 percent lower than the national averages, respectively. These disparities were even larger in the selected states, particularly in the formal sector where the wage gap was –56 percent on average. In the food industry, the wage gap was –30.8 percent for the formal sector and –10.2 percent for the informal sector at the national level. This gap was even deeper in the selected states, particularly in the formal sector, with an average of –44.3 percent) (with Chiapas and Oaxaca reaching a gap of –53.4 and –51.1 percent, respectively). In the beverage and tobacco industry, the wage gap was –15.5 percent for the formal and –28.9 percent for the

TABLE 1.2

The Use of Capital and Labor in Agro-Industry, Selected States, 2018

	Agriculture, forestry, fishing, and hunting	Manufacturing	Food manufacturing	Beverage and tobacco product manufacturing	Overall
			Capital per firm (Mex$, thousands)		
National average	1,091.1	5,116.1	1,769.6	5,522.0	2,413.3
Chiapas	824.5	933.1	1,079.7	1,046.3	1,017.8
Guerrero	186.8	90.7	136.4	593.4	392.1
Oaxaca	123.5	489.2	133.0	5,666.9	491.5
Yucatán	900.1	860.5	2,239.4	10,901.1	884.8
			Capital per worker (Mex$, thousands)		
National average	113.9	456.9	331.3	738.6	426.9
Chiapas	40.0	310.1	310.9	231.1	343.2
Guerrero	19.7	42.6	57.9	127.5	134.4
Oaxaca	41.0	254.7	72.5	974.7	195.5
Yucatán	87.3	207.5	351.5	1,182.1	192.6
			No. of workers per firm		
National average	9.6	11.2	5.3	7.5	5.7
Chiapas	20.6	3.0	3.5	4.5	3.0
Guerrero	9.5	2.1	2.4	4.7	2.9
Oaxaca	3.0	1.9	1.8	5.8	2.5
Yucatán	10.3	4.1	6.4	9.2	4.6

Source: Calculations based on data from INEGI (2019).
Note: The subsectors are classified by a Harmonized System (HS): HS 11 (agriculture, forestry, fishing, and hunting), HS 31–33 (manufacturing), HS 311 (food manufacturing), HS 312 (beverage and tobacco product manufacturing). Outlined cells with red dashed lines indicate higher than the national level values.

informal sector, which was again larger in the selected states (on average, –38.7 and –37.6 percent, respectively). The average years of education of those employed in these sectors is lower than the national and state averages (table 1.3).

TYPICAL COST STRUCTURE AND PROFITABILITY

A study of 100 jurisdictions in ten countries found that Mexico has a cost advantage of 11.1 percent in agro-industrial production (figure 1.7).[27] Chiapas has the third lowest cost index among other locations assessed in Mexico, 0.9 percent lower than the baseline (Mexico City), while Oaxaca has the highest cost index at 1.8 percent above the baseline. Chiapas also has the lowest labor and facilities costs, while Oaxaca has the lowest tax costs (figure 1.8).[28] However, both states have the highest transportation costs. The cost structure for agro-industry differs from those of other manufacturing subsectors. A case study of operating plants in Chiapas and Oaxaca shows that materials and other expenses represent the highest cost (65 percent), followed by transportation (20.7 percent), labor (4 percent), utilities (3.7 percent), taxes (2.4 percent), and capital costs (0.7 percent) (figure 1.9).

In Mexico's agro-industry sector, profitability tends to be concentrated in the upstream segments of the value chain. For instance, input companies demon-

TABLE 1.3

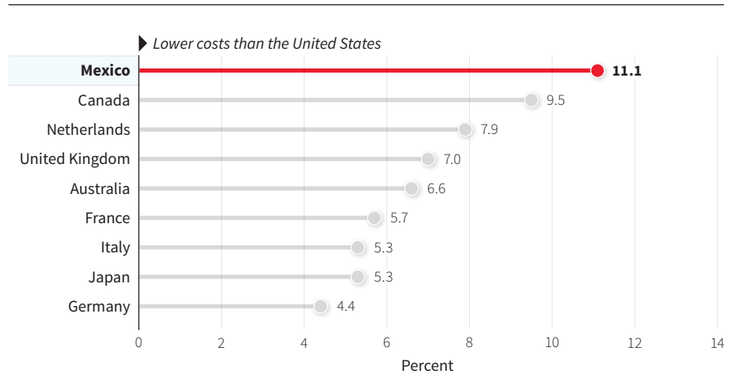
Salaries and Education Level's Among Formal and Informal Agro-Industry Workers, Selected States, 2019

	National average		Chiapas		Guerrero		Oaxaca		Yucatán	
	Formal	Informal	Formal	Informal	Formal	Informal	Formal	Informal	Formal	Informal
					Overall					
Average income per hour worked (Mex$)	47.3	33.4	38.3	20.2	41.1	27.1	48.3	25.2	47.9	31.3
Average years of education	12.0	8.5	11.2	7.3	12.5	7.6	12.7	7.2	12.1	8.1
					Agriculture, forestry, fishing, hunting, and support activities					
Average income per hour worked (Mex$)	38.2	23.1	18.9	7.8	17.7	17.1	17.2	12.3	23.4	13.9
Average years of education	7.8	6.3	6.9	5.8	5.8	6.0	6.0	5.6	7.8	5.7
					Food industry					
Average income per hour worked (Mex$)	32.7	30.0	17.8	16.5	28.9	22.8	23.6	19.4	27.3	19.9
Average years of education	10.0	8.1	5.3	7.2	9.2	7.6	9.9	6.1	10.4	8.1
					Beverage and tobacco industry					
Average income per hour worked (Mex$)	40.0	23.8	23.8	13.4	28.6	16.6	28.7	19.5	26.4	15.3
Average years of education	11.7	9.5	11.7	8.0	11.0	9.2	10.6	8.5	11.8	9.5

Source: Based on data from INEGI's ENOE database.

FIGURE 1.7

Business Cost Index for Agro-Industry, Mexico and Comparators, 2016



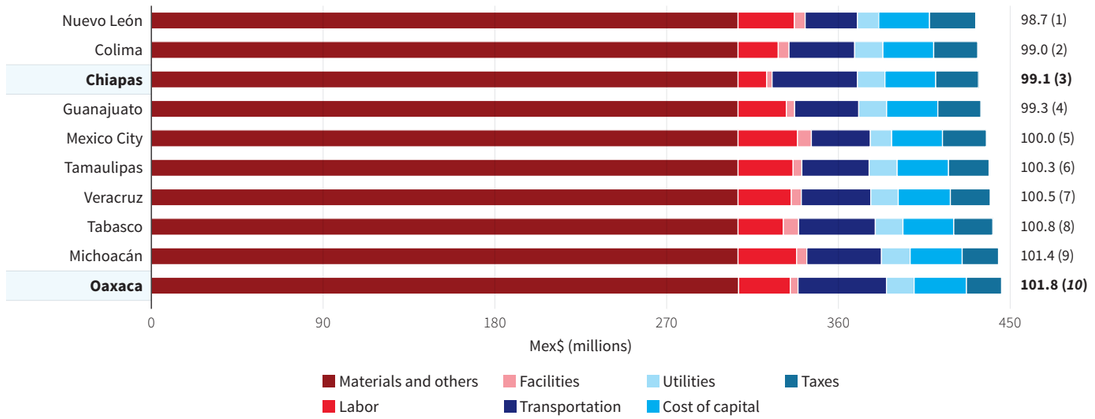
Source: KMPG 2016.
Note: Business costs scores above zero indicate lower costs than the United States (baseline).

strate the highest earnings before interest and taxes (EBIT), averaging 15 percent. Food companies follow closely behind with EBIT percentages ranging from 10 to 20 percent. Down the value chain, however, profitability declines. Intermediate traders and retailers have much lower EBIT percentages ranging from 2 to 5 and 5 percent, respectively. Farmers have a more complex situation. Their EBIT percentages are highly variable, fluctuating based on the type of crops they produce.[29]

Agro-industrial value chains in Mexico tend to be dominated by a few medium- and large-scale private oligopolies. The concentration of market power, particularly in input segments such as seeds and fertilizers, negatively impacts price-taking,

FIGURE 1.8

Business Cost Index and Cost Structure, Select States, 2016

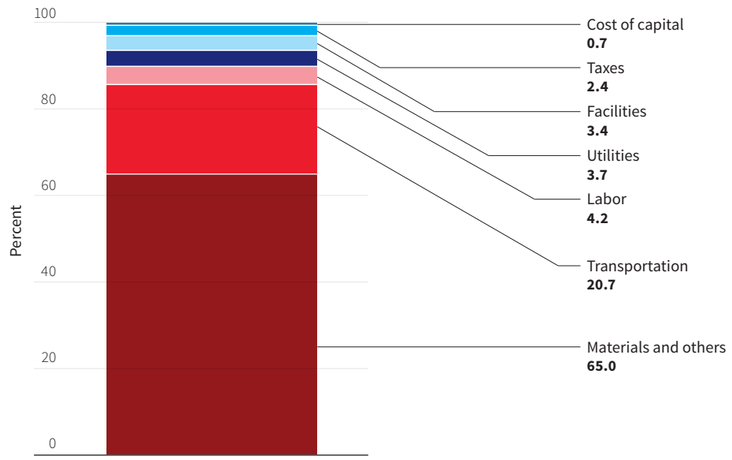


Source: World Bank and MMK Consulting 2016.
Note: Index scores below 100 represent a lower cost of business than Mexico City (baseline). Representative cities were considered for each state.

asset-poor farmers and small and medium commercial traders.[30] In the seed production industry, foreign firms, which only represent an estimated 12 percent of all seed producers in Mexico, control an astounding 90 percent of the domestic market. Monsanto, for instance, held an estimated market share of 30 percent in 2015. Similarly, in the fertilizer production industry, the four largest fertilizer companies astonishingly account for 90 percent of total production.[31]

FIGURE 1.9

Agro-Industry Cost Structure in Chiapas and Oxaca, 2016



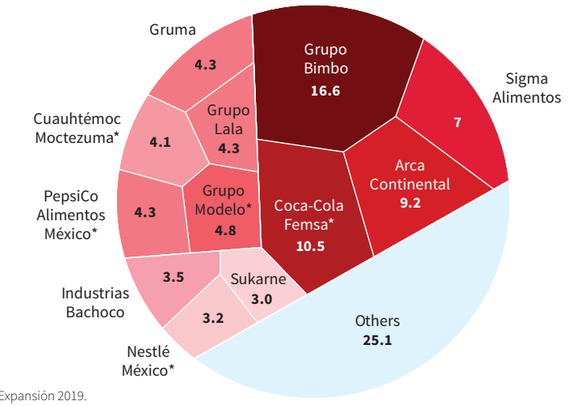
Source: Based on data from World Bank and MMK Consulting 2016.
Note: The case study considered a food processing plant with specific parameters. For Yucatán and Guerrero, the cost structure is likely to be similar, except for utilities and transportations costs, because these states (particularly Guerrero) have serious infrastructure gaps that prevent the efficient supply of energy, combustibles, and connections to main markets.

INDUSTRY LEADERS

Nationally, the top players are in upstream segments of processing and retail in the agro-industry value chain. Grupo Bimbo, the largest processing company, accounts for about 17 percent of total sales, followed by Coca-Cola Femsa at 11 percent, Arca Continental at 7 percent, and Grupo Modelo at 5 percent, with the remaining market shares split among 38 other companies (figure 1.10). In the retail segment, Walmart de México accounted for 43 percent of total sales, followed by Femsa Comercio at 12 percent, Organización Soriana at 11 percent, Sam's Club at 9 percent, Grupo Comercial Chedraui at 8 percent, and the remainder is distributed among 13 other companies (figure 1.11).[32]

FIGURE 1.10

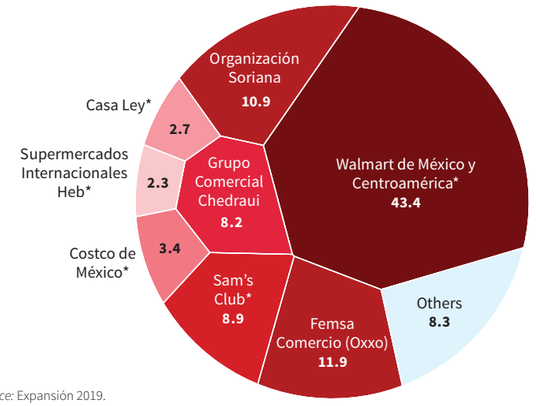
Market Shares of Top Processing Companies in Agro-Industry, 2018



Source: Expansión 2019.
*Multinational company.

FIGURE 1.11

Market Shares of Top Retail Companies in Agro-Industry, 2018



Source: Expansión 2019.
*Multinational company.

2
Market Potential

EXPORTS

In 2021, the total value of global agricultural products exports amounted to US$1.9 trillion, representing 8.6 percent of all merchandise exports, which totaled US$21.5 trillion. However, these shares have decreased over the last decades (down from 9.6 percent in 1995). By 2021, nearly two-thirds of the global agro-industry market was concentrated in Europe and Asia, with Europe accounting for 43.8 percent (US$812 billion) and Asia accounting for 20.7 percent (US$384 billion). Conversely, North America accounts for 15.5 percent (US$287 billion) of the sector's global market, led by the United States with 9.5 percent, followed by Canada 3.6 percent and Mexico with 2.4 percent. Notably, Brazil and Argentina in Latin America also have high shares of 5.4 and 2.4 percent, respectively.

Agricultural exports represent 8.9 percent of Mexico's total exports and have been growing at an average rate of 7.8 percent per year. Consequently, Mexico's share in global agricultural exports expanded from 1.4 percent in 1995 to 2.4 percent in 2021. Particularly robust growth has been observed in five subsectors: beverages with a 7.2 percent market share and an annual growth rate of 11.9 percent; fruits and nuts with 6.1 percent share and 10.4 percent growth; sugar and candy with 4.0 percent share and 8.4 percent growth; preparations of cereals, flour, starch, or milk with 3.1 percent share and 12.5 percent growth; and meat with 2.1 percent share and 16.4 percent growth (tables 2.1 and 2.2).

During 2007–21, Mexico's total food exports amounted to US$116.5 billion, with only 3.1 percent originating from the selected states.[33] Moreover, the compound annual growth rate of those agro-industrial exports in Chiapas (6.2 percent), Oaxaca (4.4 percent), and Yucatán (–0.6 percent) lagged behind the growth rate at the country level (8.7 percent). Half of Mexico's food exports come from just five states: Veracruz (11.4 percent), State of México (11.2 percent), Nuevo León (10.9 percent), Guanajuato (9.0 percent), and Jalisco (6.6 percent). According to the latest data available from the Mexican Atlas of Economic Complexity, in 2014, the selected states account for just 9.1 percent of Mexico's agro-industry exports and 7.6 percent of the total exporting plants (figure 2.1). In contrast, more than 50 percent of the country's agro-industry exports are concentrated in seven states from the North and Bajío regions: Sinaloa (9.6 percent), Michoacán (8.8 percent), Jalisco (8.7 percent), Sonora (7.1 percent), Nuevo León (6.1 percent), Guanajuato (6.1 percent), and Chihuahua (5.3 percent).

Despite their low export performance, the selected states are competitive in several products of the value chain. As table 2.3 show, Chiapas has the most products (26) with a comparative advantage in terms of exports, followed by Oaxaca and Yucatán (20 products each) and Guerrero (18 products). These products have especially strong potential to drive the growth of agro-industry in the selected states.

TABLE 2.1

Mexico's Top Agro-Industry Exports, 2021

Rank	Description	Global product exports value (US$, billions)	Mexico's share (%)
1	Vegetables	79.6	10.8
2	Beverages	140.0	7.2
3	Fruits and nuts	135.9	6.1
4	Other vegetable materials	1.4	5.9
5	Sugar and candy	46.8	4.0
6	Live animals	23.0	3.1
7	Preparations of cereals, flour, starch, or milk	85.6	3.1
8	Preparations of vegetables, fruit, or nuts	68.7	2.7
9	Meat	155.7	2.1
10	Lac and other vegetable extracts	9.2	1.6
11	Cocoa	44.7	1.5
12	Miscellaneous edible preparations	94.2	1.4
13	Flours, starches, and malts	21.4	1.2
14	Coffee, tea, and spices	56.9	1.0
15	Fish	126.9	0.8
16	Tobacco	42.9	0.6
17	Animal products	11.5	0.6
18	Plants	27.6	0.5
19	Food residues and animal feed	95.6	0.4
20	Animal or vegetable fats, oils, or waxes	143.5	0.4
21	Preparations of meat or fish	57.6	0.4
22	Dairy products	109.9	0.3
23	Cereals	149.1	0.3
24	Oil seeds and oleaginous fruits	128.0	0.2
Total		1,855.5	2.4

Source: Based on data from UN Comtrade database.

TABLE 2.2

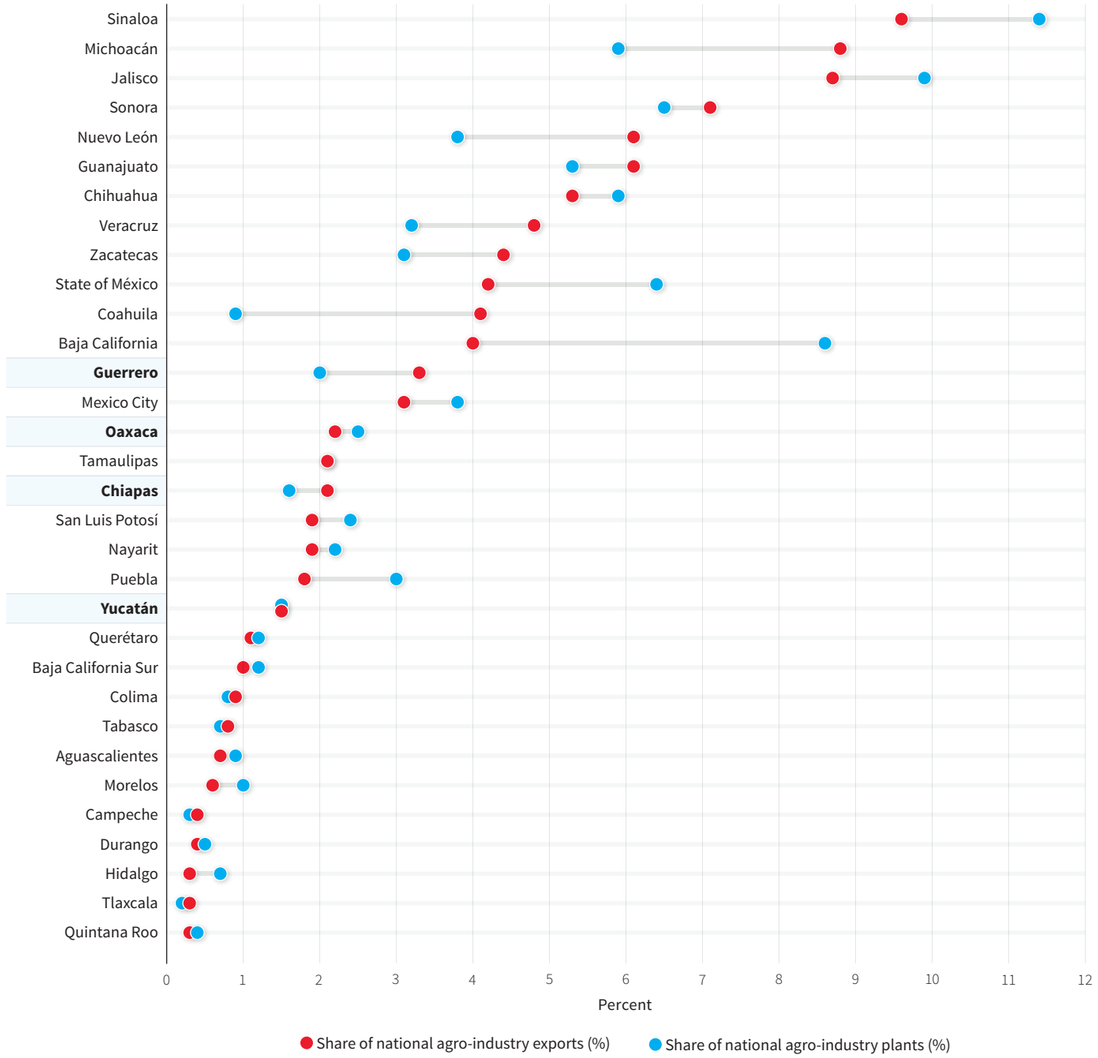
Growth of Agro-Industry Exports in Mexico

Rank	Description	Product exports value, 2021 (US$, billion)	CAGR, 1995–2021 (%)
1	Meat	3.2	16.4
2	Food residues and animal feed	0.4	14.2
3	Preparations of cereals, flour, starch, or milk	2.7	12.5
4	Beverages	10.0	11.9
5	Cocoa	0.7	11.0
6	Fruits and nuts	8.3	10.4
7	Flours, starches, and malts	0.2	10.2
8	Miscellaneous edible preparations	1.3	9.0
9	Animal or vegetable fats, oils, or waxes	0.6	8.6
10	Dairy products	0.3	8.5
11	Sugar and candy	1.9	8.4
12	Preparations of vegetables, fruit, or nuts	1.9	7.6
13	Lac and other vegetable extracts	0.1	7.2
14	Oil seeds and oleaginous fruits	0.2	6.5
15	Animal products	0.1	6.3
16	Vegetables	8.6	6.3
17	Cereals	0.4	6.2
18	Tobacco	0.3	5.7
19	Plants	0.1	5.2
20	Preparations of meat or fish	0.2	4.5
21	Other vegetable materials	0.1	4.1
22	Fish	1.0	1.9
23	Live animals	0.7	1.1
24	Coffee, tea, and spices	0.6	−1.1
Total		43.9	7.8

Source: Based on data from UN Comtrade database.
Note: CAGR = compound annual growth rate.

FIGURE 2.1

Share of Agro-Industry Exports and Export Plants, 2014



Source: Based on data from the Mexico Atlas of Economic Complexity.

TABLE 2.3

Competitive Export Strengths in the Selected States, 2014

HS code	Description	Products with an RCA greater than one			
		Chiapas	Guerrero	Oaxaca	Yucatán
0302	Fish, fresh or chilled, excluding fish fillets and other fish meat (whether or not minced), fresh, chilled, or frozen	✓			✓
0303	Fish, frozen, excluding fish fillets and other fish meat (whether or not minced), fresh, chilled, or frozen				✓
0304	Fish fillets and other fish meat (whether or not minced), fresh, chilled, or frozen	✓			✓
0307	Molluscs, whether in shell or not, live, fresh, chilled, frozen, dried, salted, or in brine; aquatic invertebrates other than crustaceans and molluscs, live, fresh, chilled, frozen, dried, salted, or in brine; flours, meals, and pellets of aquatic invertebrates				✓
0409	Natural honey	✓			✓
0702	Tomatoes, fresh or chilled	✓	✓	✓	✓
0703	Onions, shallots, garlic, leeks, and other alliaceous vegetables, fresh or chilled	✓			
0707	Cucumbers, including gherkins, fresh or chilled		✓		✓
0708	Leguminous vegetables, shelled or unshelled, fresh or chilled				✓
0709	Other vegetables, fresh or chilled	✓	✓	✓	✓
0713	Dried leguminous vegetables, shelled, whether or not skinned or split	✓	✓	✓	
0803	Bananas and plantains, fresh or dried	✓	✓	✓	
0804	Dates, figs, pineapples, avocados, guavas, mangoes, and mangosteens, fresh or dried	✓	✓	✓	✓
0805	Citrus fruit, fresh or dried	✓	✓	✓	✓
0807	Melons (including watermelons) and papayas (papaws), fresh	✓	✓	✓	✓
0810	Other fresh fruit			✓	
0901	Coffee, whether or not roasted or decaffeinated; coffee husks and skins; coffee substitutes containing coffee in any proportion	✓	✓	✓	
1102	Cereal flours other than of wheat or meslin	✓			
1202	Peanuts (groundnuts), not roasted or otherwise cooked, whether or not shelled or broken	✓	✓	✓	
1203	Copra		✓		
1209	Seeds, fruits, and spores for sowing	✓			✓
1212	Locust beans, seaweeds and other algae, sugar beet and sugar cane, fresh, chilled, frozen, or dried, whether or not ground; fruit stones and kernels and other vegetable products (including unroasted chicory roots of the variety Cichorium intybus sativum)	✓		✓	
1213	Cereal straw and husks, unprepared, whether or not chopped, ground, pressed, or in the form of pellets	✓	✓		

(Table continues next page)

TABLE 2.3

Competitive export strengths in the selected states, 2014 *(continued)*

HS code	Description	Products with an RCA greater than one			
		Chiapas	Guerrero	Oaxaca	Yucatán
1214	Rutabagas (swedes), mangolds, fodder roots, hay, alfalfa (lucerne), clover, sainfoin, forage kale, lupines, vetches, and similar forage products, whether or not in the form of pellets			✓	
1302	Vegetable saps and extracts; pectic substances, pectinates, and pectates; agar-agar and other mucilages and thickeners, whether or not modified, derived from vegetable products	✓	✓	✓	✓
1516	Animal or vegetable fats and oils and their fractions, partly or wholly hydrogenated, interesterified, reesterified or elaidinized, whether or not refined, but not further prepared				✓
1601	Sausages and similar products of meat, meat offal, or blood; food preparations based on these products	✓	✓		
1603	Extracts and juices of meat, fish or crustaceans, molluscs, or other aquatic invertebrates			✓	
1604	Caviar and caviar substitutes prepared from fish eggs	✓			
1605	Crustaceans, molluscs, and other aquatic invertebrates, prepared or preserved				✓
1701	Cane or beet sugar and chemically pure sucrose in solid form	✓		✓	
1703	Molasses resulting from the extraction or refining of sugar	✓		✓	
1806	Chocolate and other food preparations containing cocoa			✓	
1901	Flour, groats, meal, starch, or malt extract preparations, not containing cocoa or containing less than 40% by weight of cocoa calculated on a totally defatted basis, nes	✓			
1905	Bread, pastry, cakes, biscuits, and other bakers' wares, whether or not containing cocoa; communion wafers, empty capsules of a kind suitable for pharmaceutical use, sealing wafers, rice paper, and similar products	✓	✓	✓	✓
2101	Extracts, essences, and concentrates of coffee, tea, or mate and preparations with a basis of these products or with a basis of coffee, tea, or mate; roasted chicory and other roasted coffee substitutes, and extracts, essences, and concentrates	✓			✓
2103	Sauces and preparations therefor; mixed condiments and mixed seasonings; mustard flour and meal and prepared mustard		✓		✓
2105	Ice cream and other edible ice, whether or not containing cocoa	✓			
2202	Waters, including mineral waters and aerated waters, containing added sugar or other sweetening matter or flavored, and other nonalcoholic beverages, not including unfermented fruit or vegetable juices not containing added spirit		✓		
2203	Beer in containers each holding over 4 liters			✓	
2208	Undenatured ethyl alcohol of an alcoholic strength by volume of less than 80% vol.; spirits, liqueurs, and other spirituous beverages		✓	✓	
2309	Animal feed				✓

Source: Mexico Atlas of Economic Complexity.
Note: HS = Harmonized System; RCA = revealed comparative advantage.

IMPORT-SUBSTITUTION ANALYSIS

As of 2021, the United States is the leading source of Mexico's agro-industry imports, accounting for 79 percent of them, followed by Canada (6.2 percent), Brazil (2.3 percent), China (2.1 percent), Chile (1.6 percent), Spain (1.6 percent), and Guatemala (0.8 percent). Cereals, seeds, dairy, and protein animals' products are the country's largest agro-industry import categories (table 2.4). As of 2014, latest year for which state-level imports data are available, the selected states accounted for 2.7 percent of Mexico's total agro-industrial imports, down from 3.4 percent in 2004, and agro-industry imports represented 28.2 percent of their combined total imports, up from 22.8 percent in 2004. The most relevant agro-industry imports of the selected states are soybeans (35.4 percent of total imports), corn (maize) (15.1 percent), crustaceans (8.5 percent), and coffee (5.9 percent) (table 2.5). An analysis of these imports together with the imports of the neighboring states[34] reveals that the products with the greatest potential for import substitution are corn (maize) (HS code 1005), oilcake and other solid residues (HS code 2304), crustaceans (HS code 0306), and coffee (HS code 0901) (for more details, see appendix H).

TABLE 2.4

Most Important Agricultural Imports of Mexico, 2021

Rank	HS code	Product	Value (US$ million)	Share in Mexico's total agro-industry imports (%)	CAGR, 2003–21 (%)
1	100590	Maize (corn), other than seed	4,285.8	17.6	10.6
2	20312	Meat of swine, hams, shoulders, and cuts thereof, with bone in, fresh or chilled	1,331.9	5.5	11.8
3	230400	Oilcake and other solid residues whether or not ground or in the form of pellets, resulting from the extraction of soya-bean oil	759.9	3.1	9.2
4	20130	Meat of bovine animals, boneless cuts, fresh or chilled	716.3	2.9	−0.3
5	20713	Meat and edible offal; of fowls of the species Gallus domesticus, cuts and offal, fresh or chilled	642.7	2.6	14.7
6	120510	Low erucic acid rape or colza seeds oil, whether or not broken	616.3	2.5	15.1
7	210690	Food preparations nes	581.9	2.4	4.9
8	40210	Milk and cream, concentrated or containing added sugar or other sweetening matter, in powder, granules, or other solid forms, of a fat content not exceeding 1.5% (by weight)	477.4	2.0	4.4
9	120991	Vegetable seeds for sowing	289.2	1.2	5.9
10	20726	Meat and edible offal of turkeys, cuts, and offal, fresh or chilled	277.0	1.1	6.0
11	100610	Rice in the husk (paddy or rough)	275.5	1.1	4.7
12	110710	Malt, not roasted	273.2	1.1	11.3
13	210390	Sauces and preparations therefor; mixed condiments and mixed seasonings	268.9	1.1	6.9
14	170260	Fructose, other than chemically pure fructose, and fructose syrup (containing in the dry state more than 50% by weight of fructose), excluding invert sugar	260.4	1.1	32.2
15	40690	Cheese (not grated, powdered, or processed), nes	243.7	1.0	3.1

Source: UN Comtrade.
Note: These products represent at least 1 percent of Mexico's agro-industry imports. HS = Harmonized System; nes = not elsewhere specified.

TABLE 2.5

Most Important Agricultural Imports of the Selected States, 2014

Rank	HS code	Product	Value (US$ thousand)	Share in the selected states' total agro-industry imports (%)	CAGR, 2004–14 (%)
1	1201	Soya beans	233,113.0	35.4	0.4
2	1005	Corn (maize)	99,333.8	15.1	26.2
3	0306	Crustaceans, whether in shell or not, live, fresh, chilled, frozen, dried, salted, or in brine; crustaceans, in shell, cooked by steaming or by boiling in water, whether or not chilled, frozen, dried, salted, or in brine; flours, meals, and pellets of crustaceans	56,185.3	8.5	86.6
4	0901	Coffee, whether or not roasted or decaffeinated; coffee husks and skins; coffee substitutes containing coffee in any proportion	39,177.6	5.9	73.7
5	1205	Rape or colza seeds, whether or not broken	35,781.7	5.4	3.0
6	1001	Wheat and meslin	22,165.3	3.4	3.9
7	1107	Malt, whether or not roasted	19,227.8	2.9	12.6
8	2208	Undenatured ethyl alcohol of an alcoholic strength by volume of less than 80% vol.; spirits, liqueurs, and other spirituous beverages	19,004.9	2.9	8.2
9	0406	Cheese and curd	14,545.2	2.2	7.9
10	1902	Pasta, whether or not cooked or stuffed (with meat or other substances) or otherwise prepared, such as spaghetti, macaroni, noodles, lasagna, gnocchi, ravioli, cannelloni; couscous, whether or not prepared	10,929.4	1.7	35.4
11	1502	Bovine, sheep, and goat fats, raw or rendered	9,700.5	1.5	1.9
12	0402	Milk and cream, concentrated or containing added sugar or other sweetening matter	9,660.7	1.5	−4.8
13	2304	Oilcake and other solid residues, whether or not ground or in the form of pellets, resulting from the extraction of soybean oil	7,441.2	1.1	22.0
14	0203	Meat of swine, fresh, chilled, or frozen	7,261.9	1.1	7.5
15	2106	Food preparations nes	7,155.9	1.1	11.9
16	1901	Flour, groats, meal, starch or malt extract preparations, not containing cocoa or containing less than 40% by weight of cocoa calculated on a totally defatted basis, nes	6,924.4	1.1	9.8
17	2103	Sauces and preparations therefor; mixed condiments and mixed seasonings; mustard flour and meal and prepared mustard	6,579.7	1.0	16.4

Source: Mexico Atlas of Economic Complexity.
Note: These products represent at least 1 percent of the selected states' total agro-industry imports. HS = Harmonized System; nes = not elsewhere specified.

To assess the feasibility for substituting imports demanded in the rest of the country by agro-industry products from the selected states, distance and estimated time for transporting products by truck from the selected states to the main domestic markets are calculated, taking each state's capital city as the starting points (tables 2.6, 2.7, 2.8, 2.9, 2.10, and 2.11).[35] Guerrero and Oaxaca seem to be relatively well located to supply the Bajío region and Mexico City (a logistics hub for the distribution of agricultural products), while Chiapas is further away from these target markets and Yucatán has the longest route. Yet, Yucatán has the best location to supply Quintana Roo, an important touristic destination of southeastern Mexico with an income per capita above the national average. On the other hand, it would take at least one full day and up to around 3.5 days to reach the states in the North region by truck, which makes the use of maritime transportation more efficient.

TABLE 2.6

Distances to Cities in the Bajío Region (Km)

	Aguascalientes, Aguascalientes	Guanajuato, Guanajuato	Guadalajara, Jalisco	Querétaro, Querétaro	San Luis Potosí, San Luis Potosí
Tuxtla Gutierrez, Chiapas	1,318.5	1,182.0	1,373.8	1,040.6	1,240.3
Chilpancingo, Guerrero	764.1	627.6	797.3	486.3	685.9
Oaxaca City, Oaxaca	938.7	802.1	994.0	660.8	860.4
Mérida, Yucatán	1,795.4	1,658.9	1,850.8	1,517.5	1,717.2

Source: Estimations based on Google Maps.
Note: km = kilometer.

TABLE 2.7

Distances to Northern Frontier Cities, U.S. Border States (Km)

	Mexicali, Baja California	Hermosillo, Sonora	Chihuahua, Chihuahua	Saltillo, Coahuila	Monterrey, Nuevo León	Ciudad Victoria, Tamaulipas
Tuxtla Gutierrez, Chiapas	3,426.7	2,727.5	2,249.9	1,665.6	1,521.5	1,251.1
Chilpancingo, Guerrero	2,850.2	2,151.0	1,695.6	1,111.3	1,178.7	997.7
Oaxaca City, Oaxaca	3,046.9	2,347.7	1,870.1	1,285.8	1,353.2	1,027.4
Mérida, Yucatán	3,903.6	3,204.5	2,726.9	2,142.6	1,998.4	1,728.1

Source: Estimations based on Google Maps.
Note: km = kilometer.

TABLE 2.8

Distances to Other Relevant Cities (Km)

	Mexico City	La Paz, Baja California Sur*	Chetumal, Quintana Roo	Colima, Colima
Tuxtla Gutierrez, Chiapas	841.7	2,504.0	905.5	1,563.7
Chilpancingo, Guerrero	247.7	1,927.1	1,568.4	987.1
Oaxaca City, Oaxaca	461.8	2,123.8	1,456.4	1,183.8
Mérida, Yucatán	1,318.6	2,980.5	382.7	2,040.6

Source: Estimations based on Google Maps.
Note: Other relevant cities are in states with gross domestic product per capita above the national average, which include Aguascalientes, Baja California, Chihuahua, Coahuila, Jalisco, Nuevo León, Querétaro, and Sonora. km = kilometer.
*Includes travelling by ferry from Topolobampo, Sinaloa to La Paz, Baja California Sur.

TABLE 2.9

Estimated Times for Transportation by Truck to Cities in the Bajío Region (Hours)

	Aguascalientes, Aguascalientes	Guanajuato, Guanajuato	Guadalajara, Jalisco	Querétaro, Querétaro	San Luis Potosí, San Luis Potosí
Tuxtla Gutierrez, Chiapas	26.9	24.1	28.0	21.2	25.3
Chilpancingo, Guerrero	15.6	12.8	16.3	9.9	14.0
Oaxaca City, Oaxaca	19.2	16.4	20.3	13.5	17.6
Mérida, Yucatán	36.6	33.9	37.8	31.0	35.0

Source: Estimations based on Google Maps.

TABLE 2.10

Estimated Times for Transportation by Truck to Northern Frontier Cities, U.S. Bordering States (Hours)

	Mexicali, Baja California	Hermosillo, Sonora	Chihuahua, Chihuahua	Saltillo, Coahuila	Monterrey, Nuevo León	Ciudad Victoria, Tamaulipas
Tuxtla Gutierrez, Chiapas	69.9	55.7	45.9	34.0	31.1	25.5
Chilpancingo, Guerrero	58.2	43.9	34.6	22.7	24.1	20.4
Oaxaca City, Oaxaca	62.2	47.9	38.2	26.2	27.6	21.0
Mérida, Yucatán	79.7	65.4	55.7	43.7	40.8	35.3

Source: Estimations based on Google Maps.

TABLE 2.11

Estimated Times for Transportation by Truck to Other Relevant Cities (Hours)

	Mexico City	La Paz, Baja California Sur*	Chetumal, Quintana Roo	Colima, Colima
Tuxtla Gutierrez, Chiapas	17.2	51.1	18.5	31.9
Chilpancingo, Guerrero	5.1	39.3	32.0	20.1
Oaxaca City, Oaxaca	9.4	43.3	29.7	24.2
Mérida, Yucatán	26.9	60.8	7.8	41.6

Source: Estimations based on Google Maps.
Note: Other relevant cities are in states with gross domestic product per capita above the national average, which include Aguascalientes, Baja California, Chihuahua, Coahuila, Jalisco, Nuevo León, Querétaro, and Sonora. The travel time estimates consider the 70 kilometers per hour maximum velocity allowed for a trailer in Mexico, with an average speed of 49 kilometers per hour.
*Includes travelling by ferry from Topolobampo, Sinaloa to La Paz, Baja California Sur.

3

Main Products and Potential Locations

There are numerous agro-industry products that carry relatively high market values, and several of these stand out as the selected states ranked among Mexico's top 10 producers in 2021. Notably, these include banana and coffee (first); cocoa (second), papaya (third), mango (fourth), sugar cane, pear, and sesame (fifth), peach, beans, and soy (sixth), apple (seventh), pineapple, watermelon, corn, and avocado (eighth) for Chiapas; coconut (first), mango, melon, and sesame (second), cocoa (third), coffee and watermelon (fifth), guava, papaya, and avocado (sixth), chickpea, corn, and banana (seventh), lemon and peach (ninth), and pineapple and palay rice (10th) for Guerrero; papaya (first), pineapple (second), lemon (third), coffee, sugarcane, and sesame (fourth), mango and amaranth (fifth), coconut (sixth), watermelon (seventh), melon, banana, and chickpea (eighth), avocado and pear (ninth), and apple and nut (10th) for Oaxaca; and grapefruit and soy (fourth), eggplant (fifth), orange (sixth), lemon and cucumber (seventh), coconut (eighth), zucchini (ninth), and avocado (10th) for Yucatán. Although all the states produce carcass bovine meat, only Chiapas is an important producer at the national level (seventh largest). Yucatán is also notable as a producer of pork meat and carcass poultry meat, ranking fourth and ninth, respectively, while Guerrero is the fifth-largest producer of goat meat, and Oaxaca the sixth. Chiapas is a significant shrimp producer, ranking 10th nationally, and the largest producer of mojarra and third largest of tuna. Oaxaca is a significant producer of red snapper. Yucatán is a substantial producer of octopus and lobster, ranking first and second, respectively. Table 3.1 summarizes the agricultural products that concentrated the greatest volume and value in the selected states.

TABLE 3.1

Main Agricultural Products in the Selected States, 2019

Rank		Chiapas	Guerrero	Oaxaca	Yucatán
		Agriculture			
1	**Product**	**Corn kernel**	**Corn kernel**	**Pastures**	**Pastures**
	Share in the state's total agricultural production* (%)	24.8	33.5	25	25
	Total value (Mex$, millions)	4,511	5,313	4,709	2,243
	Total volume (tons)	1,147,899	1,271,851	13,014,518	5,018,566
	Value per volume (Mex$, thousands)	3.9	4.2	0.4	0.4
2	**Product**	**Sugar cane**	**Mango**	**Sugar cane**	**Corn kernel**
	Share in the state's total agricultural production* (%)	13	13.7	16.2	14.6
	Total value (Mex$, millions)	2,360	2,167	3,060	522
	Total volume (tons)	3,007,870	385,125	3,817,417	124,858
	Value per volume (Mex$, thousands)	0.8	5.6	0.8	4.2
3	**Product**	**Coffee cherry**	**Pastures**	**Corn kernel**	**Orange**
	Share in the state's total agricultural production* (%)	10	13.4	14.6	8
	Total value (Mex$, millions)	1,812	2,125	2,747	371
	Total volume (tons)	354,944	2,950,380	704,261	148,345
	Value per volume (Mex$, thousands)	5.1	0.7	3.9	2.5
4	**Product**	**Banana**	**Copra**	**Papaya**	**Cucumber**
	Share in the state's total agricultural production* (%)	9.1	10.8	10.6	7.3
	Total value (Mex$, millions)	1,659	1,707	1,999	341
	Total volume (tons)	697,932	190,149	314,713	36,251
	Value per volume (Mex$, thousands)	2.4	9	6.4	9.4
5	**Product**	**Mango**	**Melon**	**Lemon**	**Lemon**
	Share in the state's total agricultural production* (%)	8	3.8	7	5.5
	Total value (Mex$, millions)	1,452	603	1,312	254
	Total volume (tons)	279,281	98,381	280,170	64,698
	Value per volume (Mex$, thousands)	5.2	6.1	4.7	3.9
		Livestock			
1	**Product**	**Carcass poultry meat**	**Carcass bovine meat**	**Carcass bovine meat**	**Carcass porcine meat**
	Share in the state's total agricultural production* (%)	38.7	49.9	55.5	39.8
	Total value (Mex$, millions)	5,960	2,716	4,254	6,772
	Total volume (tons)	186,151	41,841	60,411	144,235
	Value per volume (Mex$, thousands)	32	64.9	70.4	47
2	**Product**	**Carcass bovine meat**	**Carcass porcine meat**	**Carcass porcine meat**	**Carcass poultry meat**
	Share in the state's total agricultural production* (%)	34.5	16.5	16.3	29.7
	Total value (Mex$, millions)	5,321	898	1,246	5,059
	Total volume (tons)	105,521	21,666	28,117	141,640
	Value per volume (Mex$, thousands)	50.4	41.4	44.3	35.7
3	**Product**	**Bovine milk**	**Bovine milk**	**Bovine milk**	**Carcass bovine meat**
	Share in the state's total agricultural production* (%)	14.6	12.6	11.9	13.8
	Total value (Mex$, millions)	2,257	683	914	2,351

(Table continues next page)

TABLE 3.1

Main agricultural products in the selected states, 2019 *(continued)*

Rank		Chiapas	Guerrero	Oaxaca	Yucatán
	Total volume (tons)	433,738	86,853	147,501	32,036
	Value per volume (Mex$, thousands)	5.2	7.9	6.2	73.4
4	**Product**	**Carcass porcine meat**	**Carcass poultry meat**	**Carcass poultry meat**	**Chicken eggs**
	Share in the state's total agricultural production* (%)	8.7	7.9	5.8	12.1
	Total value (Mex$, millions)	1,339	430	444	2,065
	Total volume (tons)	28,913	11,599	12,367	89,080
	Value per volume (Mex$, thousands)	46.3	37.1	35.9	23.2
5	**Product**	**Honey**	**Chicken eggs**	**Carcass goat meat**	**Honey**
	Share in the state's total agricultural production* (%)	1.5	4.5	2.9	2.6
	Total value (Mex$, millions)	233	245	226	444
	Total volume (tons)	5,474	9,110	3,630	11,589
	Value per volume (Mex$, thousands)	42.6	26.9	62.3	38.3
			Fishery		
1	**Product**	**Bream-Mojarra**	**Bream-Mojarra**	**Shrimp**	**Octopus**
	Share in the state's total agricultural production* (%)	41.5	23.9	14.3	71.6
	Total value (Mex$, millions)	552	154	70.7	1,719
	Total volume (tons)	28,230	5,674	1,765	36,965
	Value per volume (Mex$, thousands)	19.6	27.1	40.1	46.5
2	**Product**	**Tuna**	**Red snapper**	**Red snapper**	**Grouper fish**
	Share in the state's total agricultural production* (%)	35	12.6	13.1	8.9
	Total value (Mex$, millions)	465	80.8	65	214
	Total volume (tons)	17,664	1,595	1,439	5,715
	Value per volume (Mex$, thousands)	26.3	50.7	45.2	37.4
3	**Product**	**Shark**	**Snapper**	**Dogfish**	**Lobster**
	Share in the state's total agricultural production* (%)	7.7	7.2	9.4	5
	Total value (Mex$, millions)	102	46.5	46.4	121
	Total volume (tons)	6,840	932	1,548	598
	Value per volume (Mex$, thousands)	14.9	49.9	30	202.3
4	**Product**	**Shrimp**	**Lisa fish**	**Tuna**	**Snapper** *(Villajaiba)*
	Share in the state's total agricultural production* (%)	7.1	6.7	8.8	3.1
	Total value (Mex$, millions)	94.2	43.2	43.7	73.9
	Total volume (tons)	1,093	4,340	1,354	2,877
	Value per volume (Mex$, thousands)	86.2	10	32.3	25.7
5	**Product**	**Sea bass**	**Shrimp**	**Bream-Mojarra**	**Sea cucumber**
	Share in the state's total agricultural production* (%)	1.1	5.9	8.1	2
	Total value (Mex$, millions)	14.3	37.8	39.9	47.9
	Total volume (tons)	394	421	1,093	1,197
	Value per volume (Mex$, thousands)	36.3	89.8	36.5	40

Source: Based on data from SIAP 2019a, 2019b, 2019c, and 2019d.
*Includes agriculture, livestock, and fisheries.

CHIAPAS

Chiapas is Mexico's leader in cherry coffee production, which has a relatively high market value. An agricultural disease and other challenges sharply reduced Mexico's coffee production between 2010 and 2019. In 2021, the country's coffee exports were less than half their value in 1995. Mexico's share of global coffee exports fell from 6.4 to 1.1 percent over the period. However, production has rebounded in the last years, and coffee exports have been gradually recovering since 2016. Chiapas accounted for 40.6 percent of the country's cherry coffee production in 2021, and along with Veracruz accounted for almost two-thirds of it.[36] The state could feasibly develop higher value-added products such as roasted , ground , or instant coffee, leveraging strong demand for one of its top-performing products to upgrade its productive structure.[37] The United States and Canada, Mexico's largest trading partners, account for almost one fourth of global coffee imports, and even within Mexico there is unfulfilled domestic demand for coffee (annual imports averaged US$88 million between 2010–21).[38]

Cocoa and by-products also present an opportunity for Chiapas. Mexico was the world's 14th-largest cocoa producer in 2021, while Chiapas was the second-largest cocoa producer in the country (37 percent of total production).[39] Between 1995 and 2021, Mexico's cocoa and cocoa preparations exports grew at an average rate of 11 percent per year, and its share of global exports rose from 0.4 to 1.5 percent. However, despite chocolate being one of Mexico's main agrifood exports, it is estimated that 80 percent of Mexican chocolate is produced from imported cacao. Chiapas has a clear opportunity to expand its domestic market share in the upstream segments of the value chain, which could increase profits for producers by up to five or six times, likely spurring further investments in production.[40] Given proper infrastructure and logistical support, Mexico could expand its chocolate confectionery exports to the United States, the world's top importer of chocolates in 2021 (10.3 percent of global import share).

Agro-industry parks in Chiapas can play a key role in realizing the potential of coffee, cocoa, and other agricultural products manufacturing. In Tapachula, an operational but underutilized industrial park of approximately 94 hectares is close to Chiapas's Soconusco agricultural region and has access to key transportation infrastructure, including its only port. Public-private coordination is required to attract manufacturers of agricultural products to this park; organize local producers and link them with processing firms; and ensure access to high-quality inputs and workers with the necessary skills. Agromod, a business registered in the Registro Nacional de Instituciones y Empresas Científicas y Tecnológicas (National Registry of Institutions and Businesses in Science and Technology) that develops improved seeds, is located in Tapachula, providing immediate access to this input. The biotech firm is already working with an association of banana producers in the Soconusco region (which concentrates around a fifth of domestic production) who owns a section of the park and has investment plans for it to add value to their primary production.

Chiapas also has scope to increase its production and processing of beef. Mexico was the world's sixth-largest producer of carcass bovine meat in 2021 and has been a net exporter since 2015. Within Mexico, Chiapas is the seventh-largest producer of carcass bovine meat, accounting for 5.1 percent of the

total domestic production.[41] More than 85 percent of Mexican beef exports go to the United States (second-largest importer of beef after China). Although these exports originate mostly from the North region, a substantial share of it is from southern states such as Veracruz and Chiapas. Livestock in this region tends to be fed until they reach the appropriate weight to be processed and exported.[42] With effective support policies, Chiapas could boost cattle production in Ocozocoautla de Espinosa, which is close to consumer markets, labor force, and the *Tipo Inspección Federal* (Federal Inspection Type) facilities in Tuxtla Gutiérrez.[43] Public-private coordination is necessary to organize producers at the primary level and train local workers in the activities required to participate in more advanced segments of the value chain, as well to guarantee compliance with national and international standards.

Fishing and aquaculture are other subsectors with significant growth potential. Chiapas was the largest producer of mojarra and third-largest producer of tuna in 2021, accounting for 31.3 and 10.8 percent of Mexico's production, respectively. Although fish production in Mexico has increased rapidly in recent years, the country is still a net importer of mojarra.[44] In contrast, Mexico is a net exporter of tuna, which primarily goes to Japan, Spain, and the United States.[45] Aquaculture offers the most promising opportunity to increase fish production, as wild catch of several species is already subject to overfishing and concerns around environmental sustainability.[46]

Aquaculture output in Chiapas grew at an annual rate of 11.9 percent during 2000–19 (12.3 percent in the case of Mojarra), positioning the state as one the country's main aquaculture producers. To realize its higher market opportunity, the state must expand, modernize, and maintain the infrastructure necessary for aquaculture. This could be done leveraging on the National Fishing and Aquaculture Program for 2020–24, which aims to increase fish production by 20 percent by expanding access to equipment, infrastructure, technical assistance, and genetically-improved fish species.

Public-private coordinated efforts could focus on developing the biotechnology required to ensure that tuna aquaculture is sustainable.[47] Because all tuna in Chiapas are wild-caught, the state must develop its capacity for aquaculture.[48] Policy makers could explore collaboration with firms located in Baja California, which became Mexico's leading producer of aquaculture bluefin tuna, concentrating most of its annual production which averaged 5,200 tons between 2005 and 2021.[49]

Efforts to build a stable and growing primary production base should be complemented by a strategy to attract anchor firms that could aggregate and process future output. Chiapas has 21 firms in the seafood product preparation and packaging subsector, but only three firms have over 250 workers (out of the 13 firms existing in the country of this size). Of those firms, two were tuna processors located in Tapachula. One of them, Herdez, recently closed its operations and sold its plant to the other firm, Procesa (Procesamiento Especializado de Alimentos), which recently combined its fish processing capacity and other animal components manufacturing to diversify to the wet-pet food production (mainly focused on the U.S. market).

The risk of further bans on Mexican shrimp exports to the United States does not apply to shrimp produced through aquaculture. Chiapas, the 10th-largest producer of shrimp in Mexico in 2021 and home to an aquaculture center focused on shrimp production, has potential to further increase production and exports. Public-private efforts are required in obtaining necessary certifications and enhancing the size of shrimp produced from aquaculture. The relatively smaller size of the

shrimp reduces its appeal and price compared to premium large shrimp and larger shrimp produced through aquaculture in Asian countries such as Thailand.[50]

In Chiapas, potential locations for agro-industry development should take advantage of the existing roads and railway connecting to Central America and the Isthmus of Tehuantepec. In 2021, the city of Tapachula was responsible for 6.7 percent of the state's agricultural output and 4.4 percent of its cultivated area.[51] This city also encompasses Puerto Chiapas, the state's only port,[52] and has access to coastal and interregional transportation rail and road routes, including the infrastructure of the *Corredor Interoceánico del Istmo de Tehuantepec* (Interoceanic Corridor of the Isthmus of Tehuantepec; CIIT).[53] Firms that invest in areas along the southern border with Guatemala are eligible for income and value-added tax breaks from January 2021 through December 2024. These areas include 17 municipalities in the state of Chiapas.[54] There is also potential for agro-industry in the region served by the Federal Highway (Fed.) 190D, which links Arriaga to Tuxtla Gutiérrez and Ocozocoautla de Espinosa, where many grain silos are located. There is also potential in the area between Tuxtla Gutiérrez and Comitán, which has irrigation districts and are connected by two primary roads (Fed. 226 and 190). Finally, the northern municipality of Palenque is close to producers and has access to railways and primary roads that connect to Tabasco, the Mayan Peninsula—where the railway is being modernized as part of the Mayan Train, another flagship project of the Mexican government[55]—and Coatzacoalcos in Veracruz (maps 3.1 and 3.2).

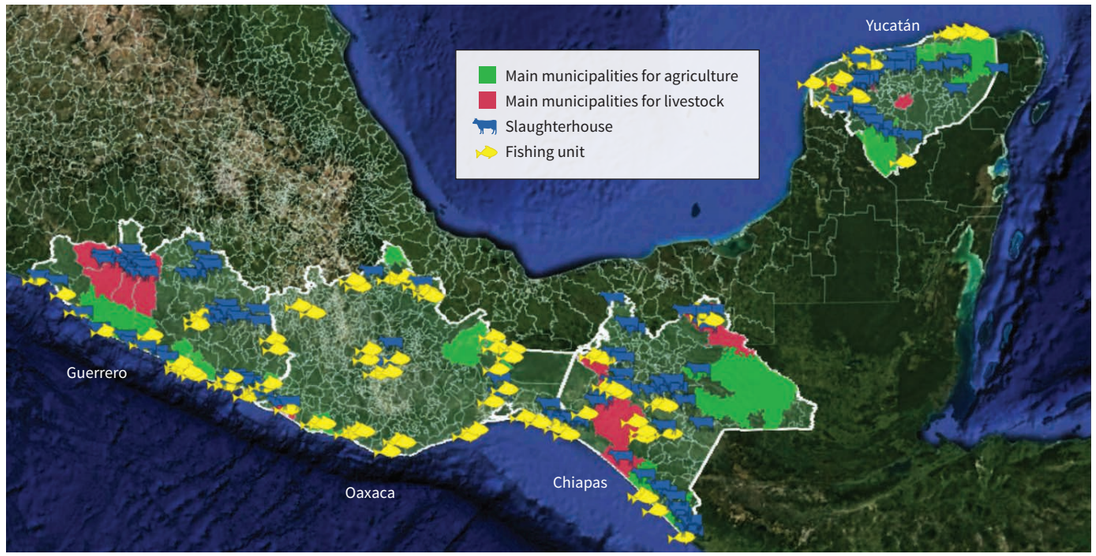
GUERRERO

Coconut, along with its derived products including copra, nut, fiber, and water, offer enormous opportunities for Guerrero. Mexico was the eighth-largest producer of coconut and copra worldwide in 2021. Domestic production of coconut and copra grew at an annual rate of 3.8 percent during 2010–21, with Guerrero as the main producer, accounting for 41.4 percent. In 2019, the Canadian and U.S. markets received around 14 percent of global raw coconut imports, and an important import share of processed products like coconut oil. However, despite the growing external demand, Mexico's supply of coconut products falls short. In 2019, its share in supplying coconut imports to the United States and Canada was just 12.7 and 1.5 percent, respectively. In contrast, the Philippines supplied 46.9 and 35.4 percent, respectively.[56]

To capitalize on this market opportunity, Guerrero needs to increase the area under cultivation, establish efficient aggregation centers, and develop industrial processing capabilities. The consolidation of an ongoing private initiative to operate an agro-industry park in Zihuatanejo, adjacent to the international airport and around an hour by road from the port of Lázaro Cárdenas in Michoacán (one of Mexico's biggest and more dynamic ports), would be an important step. The creation of an industrial complex to fully take advantage of all components of the coconut and its palm tree, targeting the United States as the main destination of the by-products, would benefit more than 5,000 coconut producers in the region by establishing aggregation centers and implementing agricultural renewal and extension programs. An agro-industry park is being developed on a 240-hectare site secured by private investors, with additional last-mile infrastructure to be installed. This agro-industry park is expected to have the capacity to process other primary products such as mango and lemon.

MAP 3.1

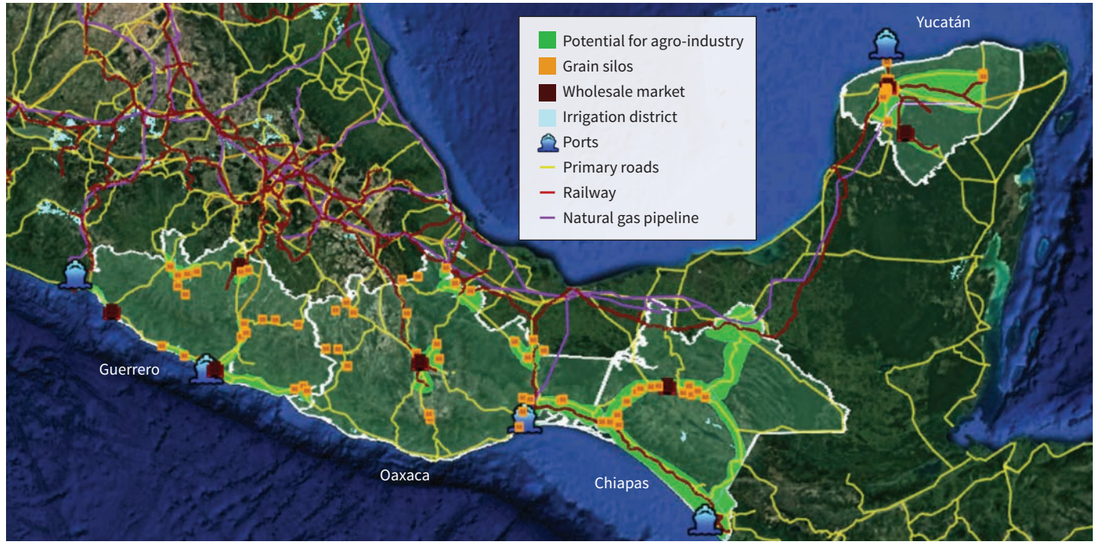
Primary Agricultural Production Areas in the Selected States



Source: Elaborated using Google Earth with information from SIAP 2019a, 2019b, 2019c, 2019d, and 2019e.
Note: The symbols are only indicative and are not meant to reflect exact locations.

MAP 3.2

Priority Areas for Agro-Industrial Development in the Selected States



Source: Elaborated using Google Earth with information from SIAP 2019a, 2019b, 2019c, 2019d, 2019e, SCT 2019, SENER 2018, and CONABIO 2015.
Note: The symbols are only indicative and are not meant to reflect exact locations. A qualitative analysis was made for potential agro-industry locations, but additional studies are required to determine definitive areas with potential.

Guerrero is Mexico's second-largest producer of mangoes, representing approximately one-fifth of the domestic production.[57] In 2021, Mexico was the world's third-largest mango producer and a leading exporter, with the majority of exports going to Canada and the United States. Between 2012 and 2021, the number of destination countries for mango exports grew from 19 to 55, indicating a growing global demand. Yet, some significant importers with tariff-free access to Mexican mangoes, like France, Germany, the Netherlands, and the United Kingdom, remain underserved.[58]

Guerrero can increase its mango production and export capacities by investing in better sowing, care, and harvesting systems; improved plant varieties; more intensive cultivation methods; and advanced processing and logistics capabilities. Moreover, it is strategic to also develop the industrialization capacity to create by-products (pulp, juice and other beverages, nectar, jam, sauces, dried fruit, ice cream, among others) with higher value added and know-how embedded in them. According to the Mexican Mango Exports Association, Mexico's mango exports are primarily in the form of unprocessed fruit and only 2 percent by pulp or juice. Building the industrial capacity to produce juices and other by-products could greatly increase value added. A dedicated agro-industry park could provide the required conditions to harness this market opportunity.

Guerrero has the potential to develop agro-industry along its coasts. The municipalities near Acapulco in the southeast region of Costa Chica, which is linked by the Fed. 200, generated 4.7 percent of the state's agricultural output in 2021 and encompassed 4 percent of its cultivated area. [59] Other priority areas include the west coast between the municipalities of Zihuatanejo and La Unión, which encompasses one of the three state wholesale markets and the regions of Tierra Caliente and Zona Norte (maps 3.1 and 3.2).

OAXACA

In Oaxaca, papaya is a key primary product with untapped processing potential. In 2021, Mexico was the world's fourth-largest producer of papaya and Oaxaca is its largest producer. The most important destination market of papayas was the United States, but Europe offers opportunities to diversify papaya exports into markets supplied primarily by Brazil and where Mexico faces no tariff barriers.

Oaxaca's share in Mexico's total papaya production rose from 17.2 percent in 2012 to 31.2 percent in 2021.[60] To further increase production, Oaxaca must improve its irrigation systems and phytosanitary measures, automate some stages of production, improve plant quality, and increase the area under cultivation in the Costa and Istmo regions. Joint commercialization and branding strategies by small producers, the use of harvest contracts, and improvements in logistics and conservation processes are necessary to expand production and exports. Creating an agro-industry park and research and development (R&D) center for papaya and other regional products could facilitate the development of industrial processing and enable diversification and increase value addition.

Other key agro-industry products in Oaxaca include coconut, mango, and lemon. Although coconut production in the state has recently fallen because of inadequate irrigation systems, aging plantations, crop disease, and outdated cul-

tivation processes, Oaxaca is the sixth-largest producer in Mexico, contributing 6.4 percent to domestic production in 2021. Oaxaca is also the fifth-largest producer of mangoes, representing 9.9 percent of domestic production.[61] Some private initiatives have already been established to take advantage of these market opportunities, with projects such as La Costa Agro-Industrial Park in Santiago Jamiltepec,[62] which is expected to have the capacity to buy and process all the coconut produced in the Costa region. Projects like this could benefit from a joint strategy with Guerrero to develop an interstate cluster of products with aggregation centers, industrial parks, and R&D facilities along the coast and close to state borders. In the case of mango, firms such as Magmar,[63] located in the municipality of Chahuites within the Istmo region, already produces and aggregates close to 8,000 tons of Ataúlfo and Tommy Atkins mangoes annually, placing around 70 percent of its production "in fresh" mainly to U.S. premium markets (given its quality and good practices certifications) and the remaining 30 percent in domestic markets (mainly used for manufactured by-products). Finally, Mexico was the world's second-largest producer of lemons in 2021. Between 2011 and 2021, Mexican exports of lemons tripled their value (from US$220 million to US$664 million), and 67.5 percent of lemons imported by the United States come from Mexico. In 2021, Oaxaca was the third-largest producer in the country, accounting for 10.4 percent of domestic production.[64] Recognizing the opportunities of lemon and mango products, two packing facilities started operations close to the port of Salina Cruz and adjacent to the land reserved for one of the industrial parks planned under the CIIT project (known as "Polígono 14").

Oaxaca's high-potential agro-industry areas are in the Valles Centrales region, which includes the state's capital, and in the Istmo region, which is connected to Arriaga in Chiapas by rail and by the Fed. 200. Within the Istmo region, Tehuantepec has grain silos and irrigation districts, as well as access to the interoceanic road and railway enhanced under the CIIT, which connects the port of Salina Cruz in Oaxaca to the port of Coatzacoalcos in Veracruz. Potential locations can also be found along the Fed. 185 and 190, which provide connections to the CIIT railway. Other municipalities with agro-industry potential include Tuxtepec on the northern border close to the state of Veracruz and Villa de Tututepec in the south, which accounted for 9.4 and 6.2 percent of the state's agricultural production in 2021, respectively (maps 3.1 and 3.2). [65]

YUCATÁN

In Yucatán, attractive market opportunities have been identified for cucumber production. Mexico was the world's fifth-largest cucumber producer in 2021, with 18,100 hectares sown and harvested across the country. The country's annual production increased from 477,000 tons in 2010 to 1.04 million tons in 2021, and exports grew at an annual average rate of 8.2 percent. Most of Mexico's cucumber exports are destined for the United States and Canada. Yucatán is the country's seventh-largest producer, representing 3.8 percent of total production in 2021. It is already a relevant exporter and has a refrigerated warehouse in Puerto Progreso. From 2008 to 2021, the state increased the area under cucumber cultivation by 32.9 percent.[66] Further efforts to develop the cucumber

value chain could focus on Buctzotz and Dzilam González, which are close to the state's main logistical nodes in Mérida and Progreso. Public-private coordination is required to develop irrigation infrastructure in the state and to link local producers with other segments of the value chain. As in other states, establishing an agro-industry park or agricultural cluster could help facilitate private-public coordination.

Yucatán's fishing sector produces lobster and octopus, two products with substantial market potential. In 2021, Mexico was the world's 14th-largest producer of lobster and the value of its lobster exports rose from an annual average of US$25.7 million in 2010–14 to US$92.2 million in 2015–21. Unlike many of Mexico's agro-industry products, the main destination for its lobsters is China (including Hong Kong SAR, China) rather than the United States, even though the latter is a top global importer of lobster and Mexico's main commercial partner. Yucatán is Mexico's second-largest lobster producer, accounting for one-fifth of national production in 2021.[67] In addition, Mexico was the world's fourth-largest producer of octopus in 2021. Most of the country's octopus exports are destined for Italy, Spain, and the United States. Yucatán is Mexico's main producer of octopus, representing 63.2 percent of national production in 2021.[68]

Yucatán has above-average labor productivity levels and a comparative advantage in key segments related to the lobster and octopus value chains. These include shellfish farming, fishing, and catching crustaceans, and the preparation and packaging of fish and seafood. Because fishing activities are concentrated in Yucatán's northern coast, a first step is to keep improving the processing facilities and port infrastructure in Progreso, a key logistics hub. This would strengthen the link between primary production and processing while improving access to target markets. Finally, aquaculture could be another activity to spur Yucatán's potential in this subsector, while diversifying its products and preventing overexploitation.

Yucatán also has potential to increase pork production and processing for national and international markets. In 2021, Mexico was the world's 12th-largest producer of carcass pork meat, yet it is still a net importer. The country's exports of pork valued at US$899 million was less than half the value of its imports (US$2.07 billion), which came mostly from Canada and the United States. Yucatán is the country's fourth-largest producer, accounting for 9.2 percent of national production. Kekén in Yucatán, a subsidiary of Grupo Kuo, is Mexico's main producer and exporter of pork products, whose highest levels of technical efficiency and quality certifications grant it access to the Asian market (main global importer), notably to Japan, the destination of more than 60 percent of Mexican pork exports.[69]

In Yucatán, agro-industry potential is concentrated in the central region along the Fed. 180. This road connects the city of Campeche in Campeche with Cancun in Quintana Roo and passes through Yucatán's main cities. This region has a railway right-of-way that connects with the city of Coatzacoalcos (currently not operating) that will connect to the Mayan Train. In northern Yucatán, the Mérida-Progreso-Tizimín triangle has access to primary roads and international port. In 2019, Tizimín had 28.1 percent of the state's cultivated area and was responsible for 14 percent of agricultural production. Mérida, the capital

of Yucatán, concentrates more than 40 percent of the state's population. The Mérida-Valladolid corridor, with existing railways and primary roads, also has potential (maps 3.1 and 3.2).

Across the selected states, strategies to develop agro-industry must consider not only access to raw materials and products, but also availability of storage and transportation infrastructure, as well as supply of water and electricity. Primary production is located in different regions within the selected states and not all have equal access to infrastructure and markets.

4
Challenges and Sectoral Binding Constraints

To identify the main constraints for the development of the agro-industry sector in the selected states, this chapter draws on the growth diagnostics decision tree developed by Hausmann, Klinger, and Wagner (2008) at the sectoral level.[70] Based on this framework, the main constraints to the sector's development in these states include human capital, infrastructure, access to finance, land tenure security, and supply of public extension services.

HUMAN CAPITAL[71]

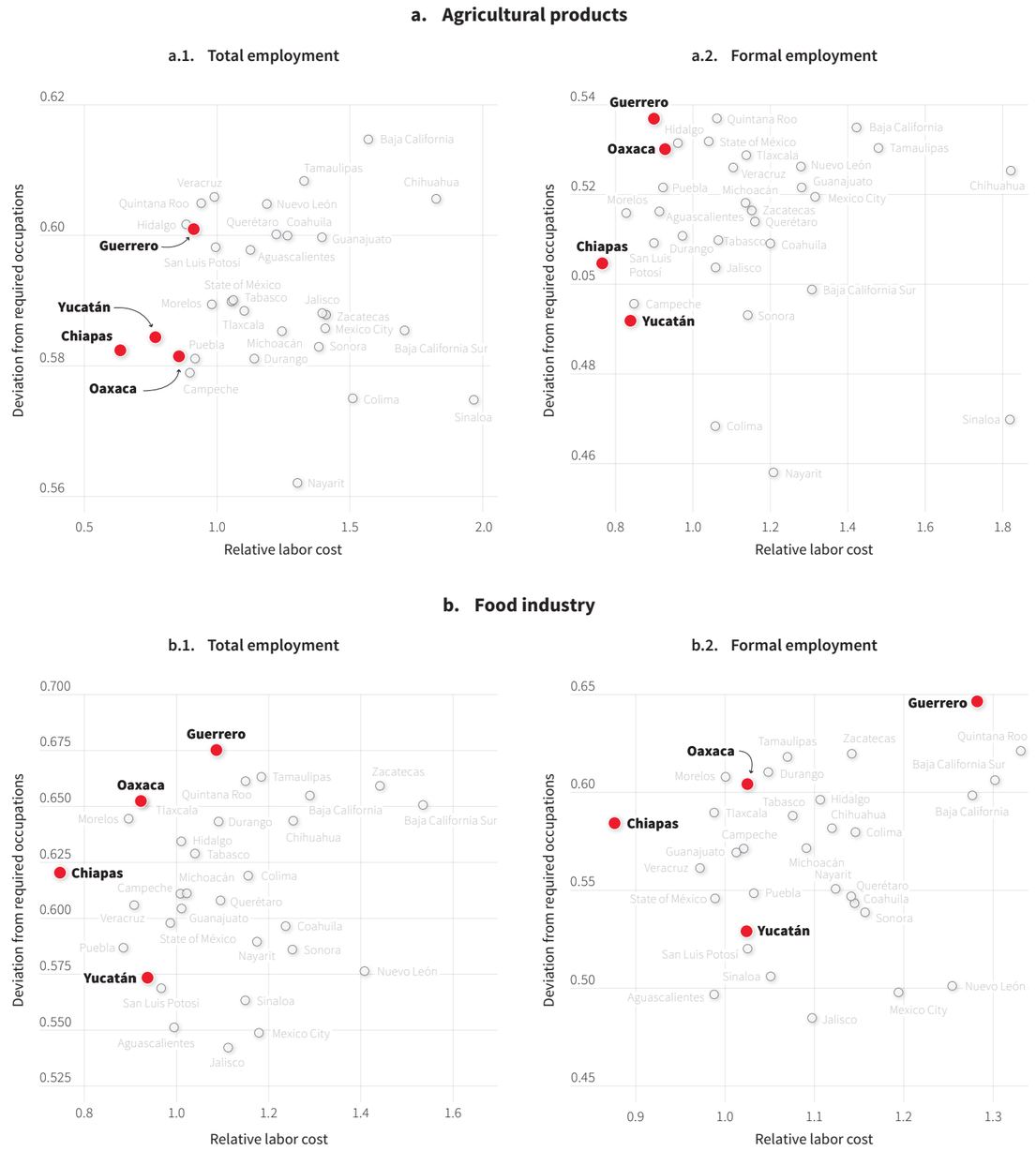
Although there is no clear statistical evidence that human capital is a binding constraint to the growth of primary agricultural production, lack of qualified workers may inhibit the sector's expansion toward more advanced stages of the agro-industrial value chain. Figure 4.1, panel a.1, shows that the human capital stock is sufficient for agricultural production when total employment is considered, except for Guerrero. When only formal jobs are analyzed (figure 4.1, panel a.2), Guerrero and Oaxaca have the second- and seventh-highest deviations from required occupations among Mexico's 32 states, suggesting that their labor supply is adequate mainly for subsistence primary agriculture, but not for more sophisticated forms of agro-industry in the formal sector. Despite this shortage, relative salaries in both states rank in the lower half, indicating that the labor market is not offering a premium for qualified workers given their abundance in the informal sector. Guerrero notably lacks sufficient workforce skills for the food industry, with the highest deviations from required occupations considering total employment and only formal jobs and the third-highest labor cost in the formal sector (figure 4.1, panels b.1 and b.2). Oaxaca has the seventh- and ninth-highest skills gaps for the food industry in the total and formal labor markets, respectively, but ranks in the bottom half in terms of relative salary in both markets. For the beverage and tobacco industries, Guerrero and Oaxaca rank in the upper half on skills gaps when considering total and formal sector labor force (figure 4.1, panels c.1 and c.2). Yet only Guerrero has a high relative salary in the formal sector (seventh highest), which confirms a scarcity of qualified labor force for these industries. By contrast, in Chiapas and Yucatán human capital do not seem to be a binding constraint for the growth of agribusiness.

INFRASTRUCTURE AND FACTOR INTENSITY[72 AND 73]

Transportation infrastructure is a constraint for most agro-industry activities undertaken in the selected states, mainly because of the lack of adequate roads connecting primary production regions and, in the case of Guerrero, because of the deficient port and railway infrastructure as well. This constraint is reflected in firm's low satisfaction with the road network, which is below average except in Yucatán. Low levels of transportation infrastructure may undermine the ability of the selected states to attract agro-industrial activities that use freight intensively. The low rates of paved roads in the selected states increases operational costs and reduces total factor productivity. Because of their rugged topographies, this constraint is especially significant for Chiapas, Guerrero, and Oaxaca. It not only increases the costs of providing basic services but also makes it more challenging to connect rural areas, where agricultural production is concentrated, with urban areas, which are the main domestic markets, and export points. Railway freight volumes are highest in Yucatán, while Guerrero has no connection to Mexico's railway system. All selected states, except Guerrero, have an international port, with port satisfaction highest in Oaxaca (98 percent) and lowest in Guerrero (12 percent). Guerrero's very low satisfac-

FIGURE 4.1

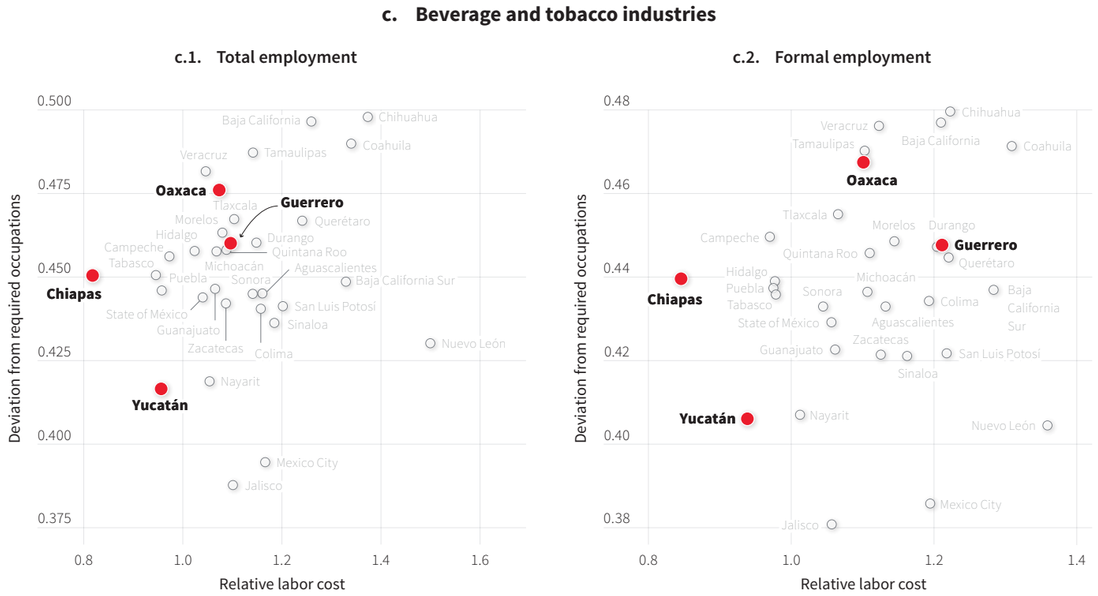
Skill Deviations and Labor Costs in the Main Agribusiness Subsectors



(Figure continues next page)

FIGURE 4.1

Skill deviations and labor costs in the main agribusiness subsectors *(continued)*



Source: Calculations based on the methodology implemented by Barrios and others (2018a; 2018b) using data from INEGI's ENOE database.
Note: In both panels, the x-axis is the ratio of the average hourly wage ratios at national and state levels, and y-axis is the deviation in occupation shares between national and state levels (measured using the symmetric mean absolute percentage error), in the first quarter of 2019.

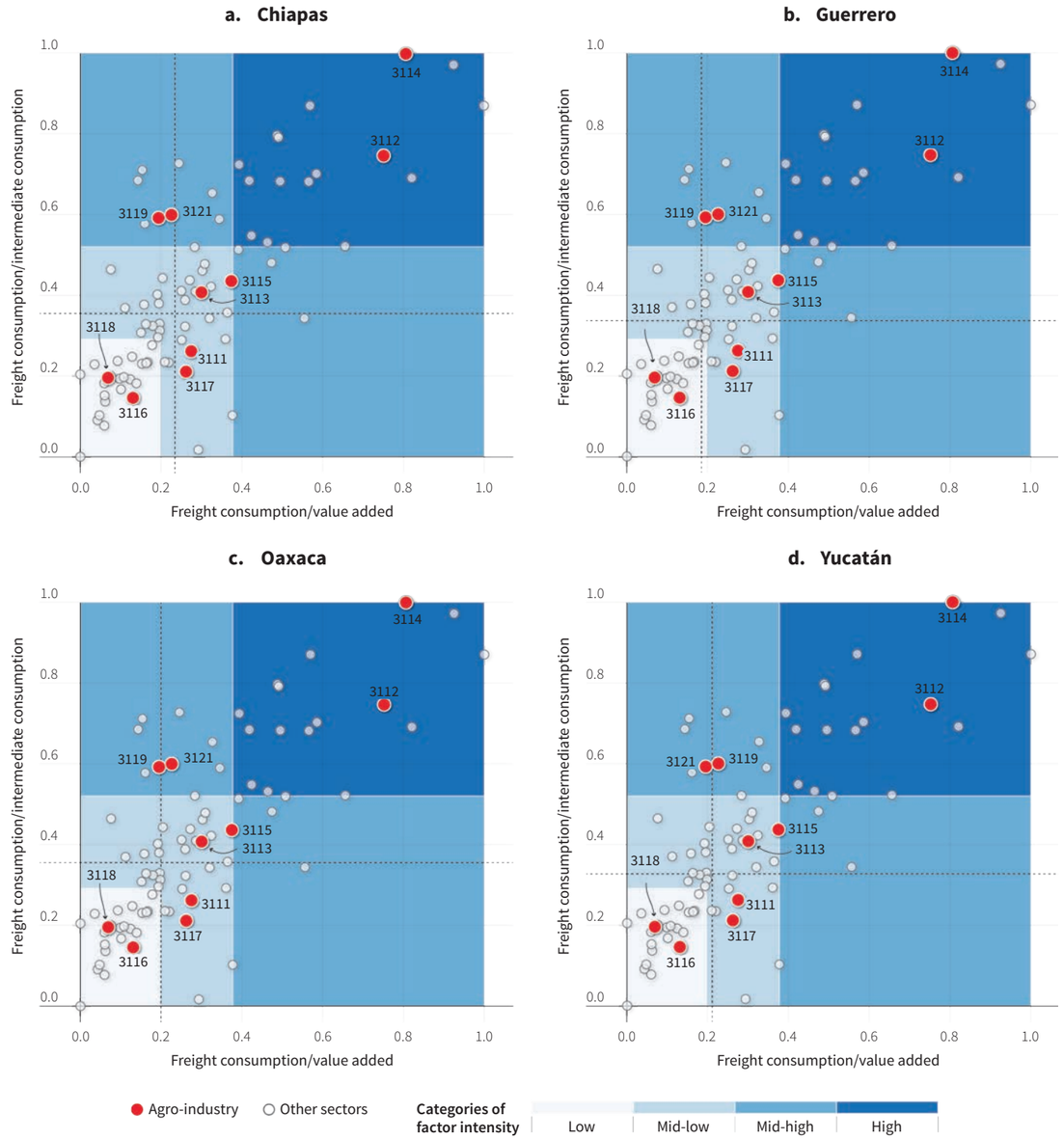
tion level indicates that port infrastructure is a binding constraint of agro-industrial development, especially to reach overseas markets (figure 4.2).

Water provision is a significant constraint in parts of Guerrero, Oaxaca, and Yucatán, and so is access to the natural gas system in Chiapas and Guerrero. In some regions of Guerrero, water costs are high and satisfaction of firms is low. In Oaxaca, production costs and cost-fare ratio are high. In Yucatán, there is only one irrigation district for agriculture. Although lack of electricity is discarded as a binding constraint given the relative low use intensity of agro-industry activities, access to combustibles is an important requirement. Chiapas and Guerrero, however, are not connected to Sistrangas (*Sistema de Transporte y Almacenamiento Nacional Integrado de Gas Natural*) or the National Interconnected System of Natural Gas, which could be an important constraint in these two states.

Logistics, storage, and processing infrastructure for agricultural products is highly insufficient in some of the selected states. Oaxaca has grains storage capacity for less than 1 percent of its production, while Chiapas has a storage capacity of less than 50 percent of its production. Only Yucatán has more storage capacity than its production, with some grain silos being underused. Guerrero, Oaxaca, and Yucatán produce more livestock than their slaughterhouses can handle—especially Oaxaca, where there are no *Tipo Inspección Federal* (TIF) slaughterhouses.[74]

FIGURE 4.2

Intensity of Freight Use by Sectors, 2014 and 2019



Source: Calculations based on data from INEGI 2014; 2019.
Note: Data present averages. Sectors are classified using the North American Industry Classification System (NAICS) four-digit code. Dashed lines represent the average normalized value of sectors in each state with a revealed comparative advantage greater than one. Red points represent groups of agro-industry sectors classified under NAICS, with the exception of groups for which information is confidential. The sectors indicated by the NAICS codes are those where each state have a comparative advantage. For Chiapas, those sectors were 3111, 3112, 3113, 3115, 3116, 3117, 3118, 3119, 3121, 3149, 3219, 3231, 3323, 3328, and 3371; for Guerrero, those sectors were 3115, 3118, 3121, 3131, 3141, 3149, 3152, 3159, 3169, 3219, 3259, 3262, 3273, 3279, 3323, 3371, and 3399; for Oaxaca, those sectors were 3113, 3118, 3121, 3131, 3141, 3149, 3211, 3219, 3241, 3273, and 3323; and for Yucatán, those sectors were 3111, 3112, 3116, 3117, 3118, 3121, 3131, 3141, 3149, 3151, 3152, 3159, 3169, 3219, 3261, 3273, 3279, 3323, 3332, 3333, 3353, 3366, 3371, and 3399.

Although coverage of telecommunication services is low across the region, telecommunications services are not a significant constraint. Despite low levels of telecommunications coverage in Chiapas, Guerrero, and Oaxaca and rural areas of Yucatán, all agro-industry activities have a low and mid-low intensity use of this factor which is reflected in telecommunications spending representing a small share of consumption for firms in the sector.

MARKET AND GOVERNANCE

Market concentration in input segments of the value chain is a barrier to agro-industrial development. Market concentration leads to uncompetitive prices and prevents small farmers from accessing key inputs such as fertilizers and improved seeds. Land tenure is often cited as a key obstacle to agricultural development in southern Mexico.[75] Communal land covers around 81 percent of Oaxaca, 78 percent of Guerrero, 59 percent of Chiapas, and 55 percent of Yucatán. Restrictions to private ownership and an unclear definition of property rights for communal land deter investment and financing in agriculture as producers cannot use communal land as loan collateral. Evidence from Latin America suggests that providing freehold titles to smallholders can significantly increase investment, agricultural productivity, and income.[76] Land fragmentation is another challenge as the average size of agricultural land holdings in Mexico is just 8 hectares and only 6 percent of all farms exceed 20 hectares.[77] Moreover, the few large farms are concentrated in northern Mexico, while most smallholders are in the southern part of the country.

ACCESS TO FINANCE[78]

The limited penetration of financial services in the selected states may restrict the development of agro-industry in the region, especially in Chiapas, Oaxaca, and Guerrero. As of 2021, Oaxaca has the lowest share of municipalities with financial access points, only 39.6 percent.[79] In Yucatán, about 74.5 percent of municipalities had financial access points and, in Chiapas and Guerrero, the share was 80.6 and 91.4 percent, respectively. When looking at the number of financial access points per 10,000 inhabitants, Chiapas and Oaxaca are at the bottom with 7.6 and 8.5 access points, respectively, while Guerrero is slightly higher with 9.2 access points and Yucatán has 13.1 access points. As of 2019, total portfolio balance of commercial and development banks as a percentage of nonoil GDP for Guerrero, Oaxaca, and Chiapas represented 2.8, 6.1, and 6.6 percent, respectively. On the other hand, Yucatán is among the 10 states with the highest ratio at 10.3 percent.[80]

Although interest rates are low, access to finance is a constraint for the development of agro-industry, especially in Guerrero and Oaxaca. The interest rates charged to agro-industrial producers are relatively low because of the strong role of government development financial institutions. However, access to finance is significantly constrained for agriculture activities in the selected states, particularly in Oaxaca and Guerrero, and processing subsectors, particularly in Oaxaca. In primary production, low demand for credit suggests either a leverage on local suppliers (which prevents farmers from obtaining better

inputs) or limitation of scale of production to what the cyclical budget of producers allows. Government programs and subsidies are other financing sources that limit the demand for credit by firms in the sector, but large producers from more developed states (especially in the North region) use to concentrate most of these supports. Firms in the agro-industry in the selected states are also less likely to seek external financing.

OTHER RISKS AND CHALLENGES

Agricultural production in the selected states often falls short of the scale and quality requirements for industrialization and export markets. Agro-industrial value chains rely on specific quality standards and volume levels to sustain profitability. Exports to Europe, North America, and other high-end markets are subject to especially strict regulations and certifications, and compliance may not be affordable for small and medium producers.

Profit margins for farmers are very narrow. A lack of storage options or onsite processing capacity compels primary producers to sell raw products as quickly as possible. This increases the leverage of traders while limiting the scope for value addition by farmers. Unreliable access to quality inputs, support services, and logistical networks further limits profit margins among farmers in the selected states.

Across Mexico, income shocks have led to the expansion of intensive cultivation of hybrid maize varieties instead of the traditional milpa system, in which maize, beans, squash, and other crops are grown together. Monoculture systems tend to be heavily reliant on agro-chemicals, which pollute the environment and contribute to the loss of biodiversity.[81] However, the relative novelty of monoculture in the selected states could enable farmers to implement more environmentally friendly methods as they expand production.

5
Comparative Advantages to Develop

This chapter draws on Michael Porter's (2008) diamond framework for analyzing the competitive advantage of the selected states for agro-industry. The framework has four elements (figure 5.1).

1 **Factor conditions.** The selected states, rich in natural resources, are key producers of agricultural products. Their geographical proximity to Central America positions them as key players in this underserved market for Mexican exports. Yucatán, in particular, hosts an important agricultural biotechnology research facility, the *Centro de Investigación Científica de Yucatán* (Yucatán Scientific Research Center). However, greater links need to be established between producers and the research and development being produced. Moreover, land fragmentation and unclear property rights have primarily led to small-scale farming that relies on low-productivity methods. There is a shortage of qualified workers in more advanced segments of the value chain, and deficiencies in transportation and logistics infrastructure negatively impact output and narrow the scope for diversification. Lastly, government programs largely fail to reach smallholders that prevail in these states, while bolsterings larger producers in the northern states.

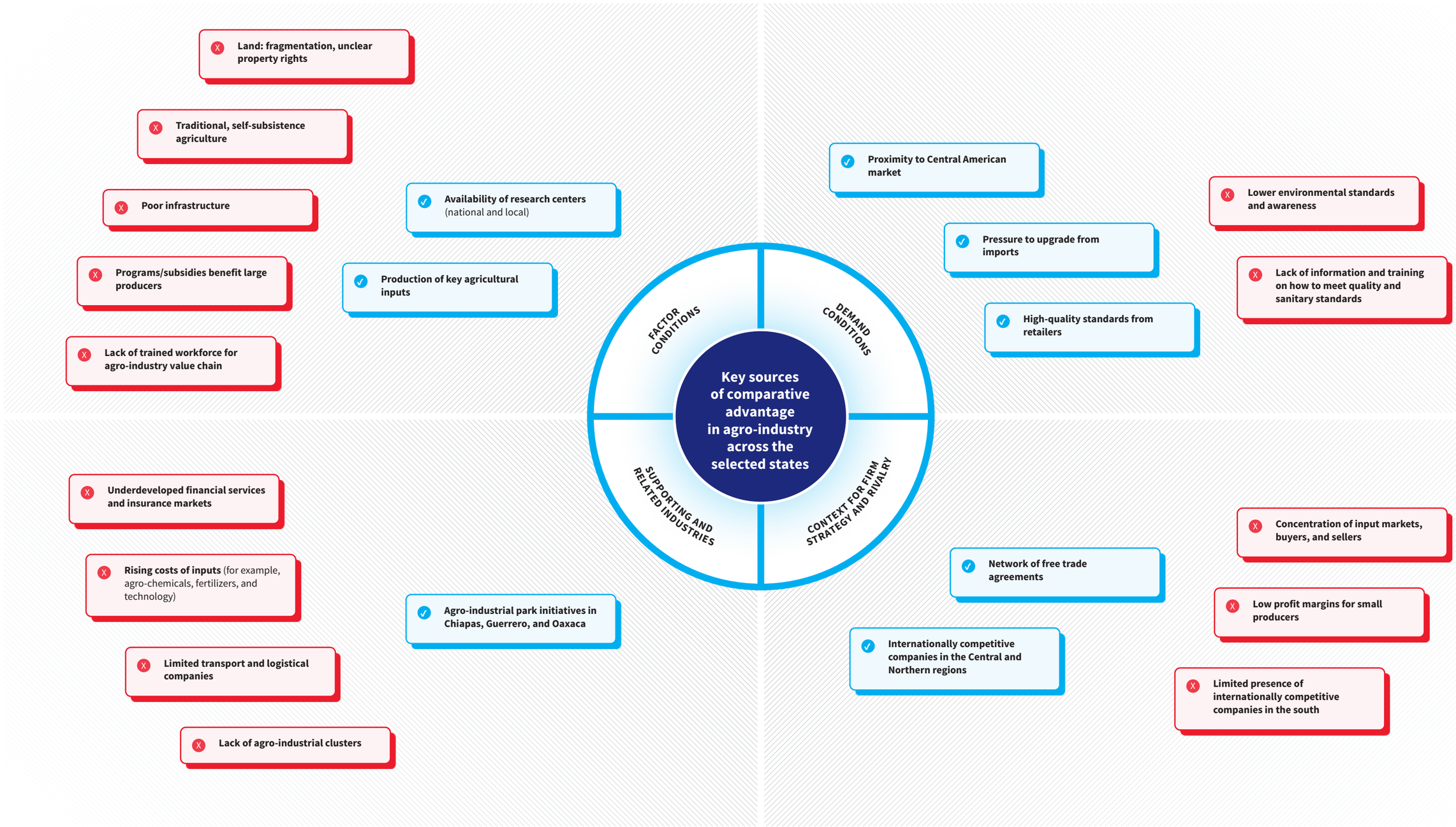
2 **Demand conditions.** Following trade liberalization, Mexican producers increasingly compete with international retailers who maintain high quality standards for agricultural and food products. The growing presence of imports has also intensified competition and raised the quality bar for local products. However, a lack of information among producers in southern states about these quality benchmarks and how to meet them has resulted in a loss of competitiveness for the region. In particular, a lack of adherence to strict environmental standards could hinder the growth of exports to the European Union, United States, and other markets with higher consumer awareness.

3 **Supporting activities and related industries.** Key related industries are missing in the selected states, especially input suppliers, specialized financial institutions, and transportation and logistics providers. The high costs of inputs, limited credit access, and lack of insurance are constraints on agricultural productivity, and inadequate transportation and logistics services limit the ability of producers to participate in agro-industry value chains. Establishing and strengthening agro-industrial clusters in the selected states, such as the agro-industrial park in Chiapas and ongoing projects in Guerrero and Oaxaca, could help address some of these challenges.

4 **Context for strategy and rivalry.** Mexico has positioned itself as a major player on the global stage, ranking as one of the top exporters of agricultural products including avocados, lemons and limes, mangoes, orange juice, cookies, sugar and candy, beef and pork, and other agricultural products. The country has leveraged a wide network of free trade agreements, giving competitive companies access to key international markets. However, medium- and large-scale firms in the agro-industry value chain are concentrated in central and northern Mexico. Rather than stimulating competition, these firms function more like oligopolies, setting prices and reducing profit margins for smaller producers.

FIGURE 5.1

Key Sources of Comparative Advantage in Agro-Industry Across the Selected States



Source: Adapted from Porter 2008.

6
Policy Recommendations

This chapter provides a summary of policy recommendations designed to accelerate the growth of agro-industry in the selected states. The proposed policy recommendations are organized in measures aimed at creating or strengthening public goods and others at correcting market failures through market interventions.

PUBLIC GOODS

1. **Invest in public infrastructure** to connect farmers, industries, and final markets, with particular attention to main road systems[82] and logistics nodes. Ensure a reliable and continuous energy supply, as well as adequate sector-specific infrastructure such as irrigation systems, grain and cold storage facilities, phytosanitary centers, and TIF (*Tipo Inspección Federal*)–certified slaughterhouses, particularly in Oaxaca.[83]

2. **Establish and/or strengthen agro-industry clusters** to reduce transaction costs and information asymmetries, attract more customers, increase specialization and productivity, and facilitate innovation and knowledge dissemination. More public support is required to consolidate some ongoing private initiatives like the agro-industry parks identified in Chiapas, Guerrero, and Oaxaca and other demand-driven projects, particularly in the provision of last-mile infrastructure.

3. **Provide support for small-scale producers to establish cooperatives** that will enhance horizontal integration; allow producers to scale up operations; encourage the dissemination of production, management, and marketing skills; expand access to finance; and strengthen bargaining power. Public support to facilitate productive partnerships between them with agribusiness firms are recommended.

4. **Improve technical skills and labor competencies along the agro-industry value chain,** focusing on: (a) the capacity of farmers to escalate production and comply with standards and certification requirements to reach final consumption and export markets, (b) the capacity of small and medium firms to provide intermediate goods and services along the value chain, and (c) the development of workforce skills demanded by processors and supporting industries.

5. **Create supplier-development programs** in coordination with large firms (not necessarily located in the selected states) and potential investors. Complement these efforts by creating a matchmaking platform for existing agricultural producers and enterprises.

6. **Partner with the private sector and academia to create and/or adapt research and development and agro-industrial extension centers** for improving the quality of agricultural inputs (seeds, fertilizers, and pesticides) and raw production and encouraging industrialization stages. These efforts should target priority agro-industrial products specific to each selected state in coordination with relevant state and federal agencies.

7. **Establish a consolidated agro-industry knowledge and information system** capable of generating, integrating, disseminating, and supporting the application of practical knowledge along the sector's value chain, particularly among small farmers and small and medium firms providing manufacturing and support services.[84] The government could partner with private manufacturers to make key information easily available to agricultural producers by using information and communications technologies or "train-the-trainer" schemes, ensuring greater reach, particularly in areas with low connectivity.

8 **Facilitate the access and adoption of information technology** to better control and monitor production, improve growing conditions, and create more efficient practices that limit input use and mitigate the sector's environmental impact.[85]

9 **Establish coordination mechanisms among the governments of southern states** to attract investments by anchor firms, especially in processing and exporting. Organizing roadshows and international missions could help promote regional products in countries with which Mexico has free trade agreements, in addition to Canada and the United States.

10 **Expand the provision of equipment, infrastructure, technical assistance, and genetically improved species** to enhance aquaculture productivity. In Chiapas, expand the scope of the State Aquaculture Center beyond shrimp production to include mojarra and explore business partnerships with tuna aquaculture firms in Baja California. Strengthen wastewater treatment for fish processors to reduce their negative environmental impact.

11 **Promote ancillary activities for rural areas with off-farm activities including agro- and ecotourism and platforms for direct selling and positioning to final consumers,** enabling them to capitalize on organic processes, geographical origin, and cultural heritage.

12 **Promote sustainable and environmentally friendly agricultural production systems that also enhance market position,** such as organic and fair-trade certifications and product traceability ("farm to fork") standards. This includes:

- **Design environmental impact guidelines based on international best practices** for firms throughout the agro-industry value chain.
- **Promote regenerative farming practices**, transitioning away from conventional practices that rely on increasingly expensive synthetic fertilizers and pesticides.
- **Introduce a circular-economy approach to the agro-industry value chain** by linking its activities with waste treatment and recycling companies, as well as other sectors (such as textiles and chemicals) in which the organic and inorganic waste produced by agro-industry can be reused.

MARKET INTERVENTIONS

1 **Address the excessive market power existent at multiple levels of the value chain** by actively enforcing the Competition Law and supporting the entry of new firms into the input and intermediary markets.

2 **Improve the design, targeting, and transparency of public agricultural assistance programs, subsidies, and price supports,** as well as the coordination between national and subnational agencies, focusing on: (a) closing the gaps around infrastructure, equipment, skills, and technology faced by small producers and (b) shifting the allocation of resources to firms and sectors with the greatest market potential and social benefits.[86]

3 **Facilitate the acquisition of land for anchor firms and agro-industry parks,** including through conditional land grants for large private investments that can generate substantial economic and social benefits. The land originally secured for the since-cancelled special economic zones could be used for this purpose.

4 **Strengthen the rural financial sector with products tailored to the needs of primary producers,** including specialized financing for inputs and equipment purchases and certification requirements, as well as guarantee funds and specialized agricultural insurance. This includes:

- **Reassess the existing instruments offered by development banks** and ensure that they complement, but do not compete with, private financing.
- **Promote microfinance, nonbank financial institutions, and public and private investment trusts** that can increase access to finance from development financial institutions.

5 **Explore the adoption of incentives provided by the local, state, and federal governments to accelerate the development of agro-industry clusters.** These incentives should (a) apply only to new investments, (b) focus on attracting anchor firms, (c) incentivize commercial links and technology transfer between anchor and local firms, (d) encourage investment for on-site storage and processing capacity to ease logistical challenges (for example, on-site industrialization), and (e) promote sustainable practices.[87]

Appendixes

APPENDIX A

Detailed Policy Recommendations

This appendix presents a set of public policy recommendations organized in measures aimed at creating or strengthening public goods and correcting market failures through market interventions. The policies are not exhaustive and should be complemented, deepened, and adapted to the particularities of each state, target market, products to be developed, and specific investments aimed to be attracted, retained, or expanded. A comprehensive and continuous public-private interaction should be carried out to complement the diagnostic and calibrate the proposals. This coordination should not only be among local actors, but also among leading firms, potential investors, academic institutions, and even other governments that have been successful in similar productive strategies. The focus should not only to increase the competitiveness environment for developing the sector, but also to maximize the benefits and spillover effects and minimize any potential negative externality.

PUBLIC GOODS

1 Prioritize the improvement of logistics and transportation–related infrastructure to improve connections between farmers, retailers, and industries, as well as links between industries and their final markets.

- Consider expanding the coverage of the "Caminos Rurales" program that paves rural roads in regions with high potential for primary activities.
- Focus on enhancing the main roads that connect primary production areas to regions with higher potential for industrial production and improve the

connectivity between these industrial regions and key domestic markets, export points, or logistics nodes.

- Explore potential synergies with key federal projects, such as the Interoceanic Corridor of the Isthmus of Tehuantepec. One strategy could involve consolidating a coastal road corridor that connects Salina Cruz, Oaxaca to Chiapas and Guerrero.
- Given the substantial resources required and the budget constraints of national and subnational governments, it is crucial to define strategic priorities based on the products, regions, and markets to be developed. Sequencing infrastructure deployment and increasing private participation are also necessary because of these budgetary limitations.

2 Consolidate the *Sistemas Intermodales Portuarios Costeros* (Intermodal Port and Coasts Systems)[88] across major ports in the selected states. This includes developing the logistics platforms in three regions: Sureste (Chiapas, Oaxaca, Tabasco, and Veracruz), Central (Colima, Guerrero, Mexico City, Michoacán, Morelos, and State of México), and Peninsular (Quintana Roo and Yucatán).

- Promote short-sea shipping between the ports of the selected states and main ports of Mexico, as well as ports of neighboring countries (like the recently launched route between the ports of Chiapas and Quetzal) as a mechanism to boost economic activity and expand the reach of these ports while their infrastructure limitations are being addressed.
- Enhance the storage and logistics capabilities of ports in the selected states. Foster the use of public-private partnerships (PPPs) and similar instruments to facilitate private investment in port facilities, complementing public resources for infrastructure projects.

3 Improve the provision of basic infrastructure to boost agro-industrial production:

- Expand facilities that provide phytosanitary services to prevent crop pests and animal diseases, overcoming barriers to exports.
- Modernize irrigation districts and expand their coverage.
- Improve grains and cold storage facilities and establish more, mainly in the states of Chiapas and Oaxaca, where there is a greater gap. Encourage private investment and operation in these facilities.
- Establish the first TIF (*Tipo Inspección Federal*; Federal Inspection Type) slaughterhouse in Oaxaca,[89] and increase the capacity of TSS (*Tipo Inspección de la Secretaría de Salud*) slaughterhouses in Yucatán to meet the needs of local producers.
- Ensure a reliable and continuous power supply for manufacturing activities.

4 Increase access to natural gas in the selected states, mainly in the coastal regions of Guerrero (connecting from the pipeline in Michoacán) and Chiapas (connecting from the pipeline in the Isthmus of Tehuantepec in Oaxaca), with potential to extend natural gas provision to Central America.

5 Invest in digital infrastructure in productive (rural) areas that are underserved or lack coverage, and promote the use of information and communication technologies (ICTs) to control and monitor production processes. This could guarantee safer growing conditions and streamline processes along the agro-industry value chain, thereby reducing environmental impact. Partnerships with key ICT firms that provide specialized solutions to the primary activities should also be established.[90]

6 Increase public support to consolidate agro-industry clusters (including the provision of last-mile infrastructure) to foster economies of scale and scope, reduce transaction costs and information asymmetries, attract more customers, increase specialization and productivity, and facilitate innovation and knowledge dissemination. The location and specialization of these clusters should be driven by demand. Public efforts focused on consolidating ongoing private initiatives, such as the agro-industrial parks identified in Chiapas, Guerrero, and Oaxaca, could yield high social returns.

7 Expedite land titling and consolidation programs to convert communal land to freehold titles, particularly in areas targeted for agro-industry development. Land ownership not only increases access to finance by serving as collateral, but also improves property rights for investment projects.

8 Facilitate and provide support for small-scale producers to form cooperatives. This collaborative approach will allow them to have better coordination, both horizontally and vertically, and leverage economies of scale. It could also potentially improve their production systems, management, and marketing skills, as well as their access to finance and bargaining power.

9 Implement on-the-job training programs, potentially extending to academic ones, aimed at creating and improving occupational skills and labor competencies. These initiatives could (a) increase the capacity of farmers to escalate and stabilize their production and reach industrial, final consumption, or export standards and certification requirements; (b) create a pool of locally skilled workers for the food, beverage, and tobacco industry, as well as support industries; and (c) elevate the human capital of small and medium enterprises (SMEs) to provide intermediate goods and services along the agro-industry value chain.

- Establish coordination mechanisms with large firms (initially including those not located within the selected states) and potential investors. Particularly, there should be a focus on large-scale investors and the addition of a supplier development strategy to ensure productive collaboration between large enterprises and small suppliers.
- Develop a match-making platform or directory to facilitate connections between agricultural producers and local enterprises.

10 Establish or adapt research and development and agro-industrial extension centers in partnership with the private sector and academic institutions. These centers would be responsible for improving agricultural inputs (including seeds, fertilizers, and pesticides), raw production, and industrialization stages. Each center should specialize in the agriproducts that are produced in each state.

11 Promote the adoption of sustainable and environmentally friendly agricultural production systems that leverage circular economy practices. These practices could potentially result in price markups for certified organic farming. Designing guidelines based on international best practices for firms to follow and implement throughout the agro-industry value chain and support the certification process of farmers are strongly recommended.

12 Strengthen efforts to consolidate an agro-industry knowledge and information system, capable of generating, integrating, disseminating, and supporting the application of practical knowledge along the sector's value chains, particularly for small farmers and SMEs providing manufacturing and support services. An upgraded and more comprehensive *Servicio de Información Agroalimentaria y Pesquera* (Agrifood and Fishing Information Service) platform could be a good starting point. The system must be able to provide more detailed information about market trends and prospects, such as input-output prices, business intelligence reports, new technologies, weather reports, soil quality and potential analysis by region, and training needs. It should also be able to provide advisory services on regulatory standards, certification requirements for final consumption, export, and high-end markets, among others. Partnering with private manufacturers to ensure crucial information is easily available to agricultural producers is key. Using ICTs or "train the trainer" schemes are advisable for a greater reach, particularly in areas with low connectivity.

13 Advocate for a complementary program for rural economies that involves off-farm activities such as agro and ecotourism. This includes direct selling and product positioning for the final consumers, adding value and branding to products given their organic processes, geographical origin, and cultural heritage.

14 Formulate a state-level strategy to foster agri-PPPs.[91] This aims to establish strategic partnerships between the public and private sectors, mainly focusing on four different approaches that have seen success in other countries: (a) development of agricultural value chains; (b) creation of research, innovation, and technology transfer; (c) provision of business development services for SMEs in the sector; and (d) construction and improvement of required infrastructure.

15 Create an interstate program for collaborative participation among governments of southern states to attract investments of anchor industries and firms to process common agriproducts where a robust business case can be made. Organizing promotional roadshows and international missions, specifically targeting countries where Mexico has free trade agreements, other than the United States, is strongly recommended.

16 In the fishing sector, increase the provision of equipment, infrastructure, technical assistance, and genetically improved species to enhance the productivity of aquaculture in Chiapas.

- Expand the scope of the *Centro Estatal de Acuacultura Chiapas* (State Aquaculture Center) to not only enhancing shrimp production, but also improving the yield of mojarra. Additionally, explore business partnerships with firms in Baja California to promote tuna aquaculture aimed at premium markets.
- Establish wastewater treatment plants close to fish processing firms to minimize their environmental footprint, particularly in Tapachula, where concerns about this issue are rising.

MARKET INTERVENTIONS

1 Actively enforce the *Ley Federal de Competencia Económica* (Federal Law on Economic Competition) to address potential competition and market power issues, notably in highly concentrated stages of the value chain such as input markets and intermediary firms. Support the entry of new firms into both segments.

2 Improve the precision, transparency, and coordination across government programs to comprehensively address the gaps concerning resources, infrastructure, skills, training, and technology faced by small and medium agricultural producers.

- Reevaluate the existing subsidies given to certain inputs, such as seeds and fertilizers, as well as government-guaranteed prices, to incentivize the production of agricultural products with the greatest market potential and social benefits, avoiding the canalization of government support only to organizations with larger lobbying capacities.

3 Facilitate the acquisition of land for the establishment of anchor firms or the development of agro-industrial parks. For major private investments that offer greater economic and social benefits, the selected states could consider providing the land (conditioned to last-mile infrastructure development or certain investment and job generation goals). The land originally secured for the now-cancelled special economic zone project, which is close to the main ports of the selected states, could be used as land banks for this purpose.

4 Strengthen access to financial services with products tailored to the needs of primary producers, particularly for securing inputs, equipment, and machinery, as well as guarantee funds and specialized agricultural insurance. Assess the impact of existing financing programs (direct and through intermediaries) provided by development banks and other specialized-financial institutions (including FIRA [*Fideicomisos Instituidos en Relación con la Agricultura*; Trust Funds for Rural Development] and FOCIR [*Fondo de Capitalización e Inversión del Sector Rural*; Capitalization and Investment Fund for the Rural Sector]) that specifically target agro-industry-related activities. Based on the assessment, determine which programs should remain unchanged, be replaced, redesigned, or combined.

5. Encourage the use of microfinance, nonbanking financial initiatives, and public-private investment funds as instruments to access financing from multilateral agencies, particularly for smaller and more dispersed groups of primary producers.

6. Explore options for adopting an incentive system to attract private investment, with the aim of accelerating the consolidation of agro-industry clusters. These incentives could focus on new investments that not only increase primary production, but also storage and processing capacities, while promoting the adoption of sustainable practices. The system could target anchor firms willing to establish links with local producers and share their knowledge. The incentives should be decreasing and time-bound and phased out when external agglomeration benefits have been achieved.

APPENDIX B

Assessment of Human Capital Constraints

Although human capital is often identified as an important barrier for private sector development in the selected states, it is important to assess the extent of this constraint in shaping the development of different segments within the agro-industry sector. For this purpose, an analysis of the availability and cost of labor force for the sector is carried out, following a methodology developed by Barrios and others (2018a; 2018b), using labor market data from the *Encuesta Nacional de Ocupación y Empleo* (National Survey of Occupation and Employment) of the *Instituto Nacional de Estadística y Geografía* (INEGI) and classification of occupations from INEGI's (2011) *Sistema Nacional de Clasificación de Ocupaciones* (National Classification System for Occupations). Three subsectors within the agro-industry are assessed: (1) agricultural products, which include crop production, animal production, aquaculture, fishing and hunting, and support activities for agriculture and forestry, (2) food industry, and (3) beverage and tobacco product manufacturing. The analysis calculates the deviation between the share of occupations at the national and state levels for each subsector. The symmetric mean absolute percentage error is used to measure the availability of workers in the required occupations. In addition, the relative labor cost in each subsector is calculated for each state and compared to the national level. This allows for an assessment of the relative availability or shortage of skilled human capital.[92] Given the high prevalence of informality in the selected states and the salary gap between formal and informal jobs, the analysis encompasses total employment (formal and informal), as well as focusing only on the formal sector.

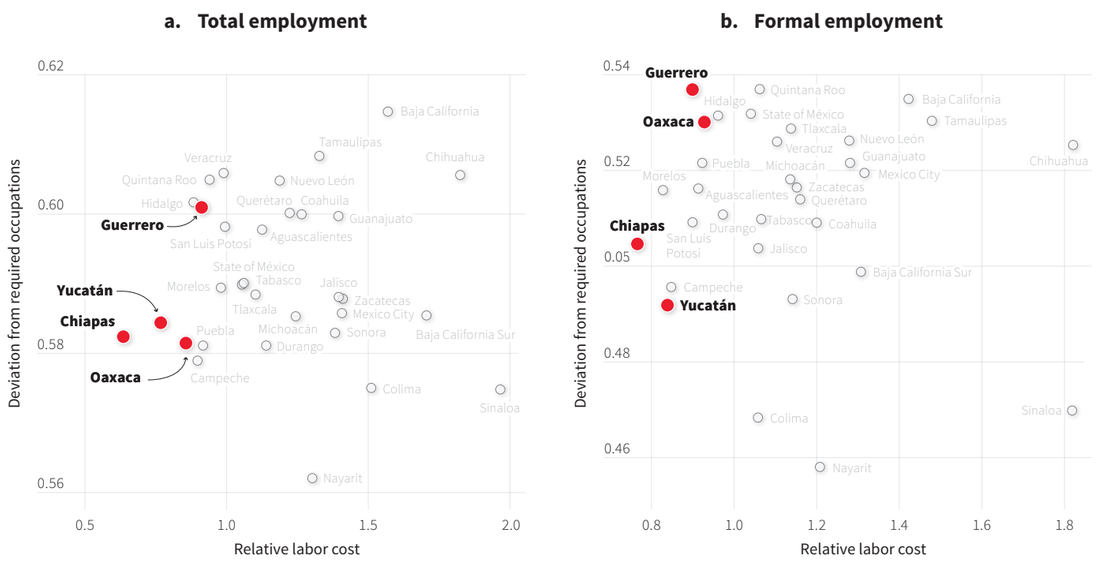
Figure B.1 shows that the stock of human capital of the selected states is sufficient for agricultural production when total employment is considered, except in Guerrero. Among Mexico's 32 states, Chiapas, Oaxaca, and Yucatán rank in the lower half in terms of deviation from the required occupations and have lower labor costs in total employment, while Guerrero and Oaxaca have the second and seventh highest, respectively, considering only formal jobs. This suggests that the available labor force in these states is only sufficient for self-subsistence primary agriculture, but not for producing more sophisticated agro-industry goods. However, in terms of relative salaries, Guerrero and Oaxaca ranked in the lower half, which suggests that there is no premium to get qualified workers, given their abundance in the informal sector. Chiapas and Yucatán seem different, given that for the two formal sector indicators they ranked in the bottom half, which suggests that low human capital is not a binding constraint for agriculture and agro-industry activities in these two states.

For the food industry, figure B.2 shows that Guerrero's performance lags behind that of Chiapas and Oaxaca, while Yucatán performs well in the overall and formal labor market. Guerrero has the highest deviation from the required occupations, considering all workers and only formal jobs. In addition, although the state ranked in the middle in terms of relative salary considering the entire labor force, it has the third-highest labor cost for the formal sector. On the other hand, Oaxaca has the seventh- and ninth-highest discrepancies from the necessary occupations in the total and formal labor market, respectively. However, the state falls into the bottom half in terms of relative salary for both employment scenarios. Chiapas, although ranking in the middle in terms of deviation from the required occupations, has the lowest relative salary in total and formal labor markets. Finally, Yucatán is ranked in the lower half for both indicators and scenarios, indicating a more favorable labor market situation for the food industry.

Regarding the beverage and tobacco industry, the findings are mixed. As figure B.3 shows, Guerrero and Oaxaca rank in the upper half for deviations from required occupations, considering entire labor force and only formal sector, while Chiapas is positioned around the middle. However, only Guerrero presents a higher relative salary in the formal sector, where it holds the seventh-highest value. This reveals a scarcity of qualified labor force that could be incorporated into more developed and sophisticated formal firms. Chiapas and Yucatán are ranked in the lower half in terms of labor costs, suggesting that qualified labor force is available in these states.

FIGURE B.1

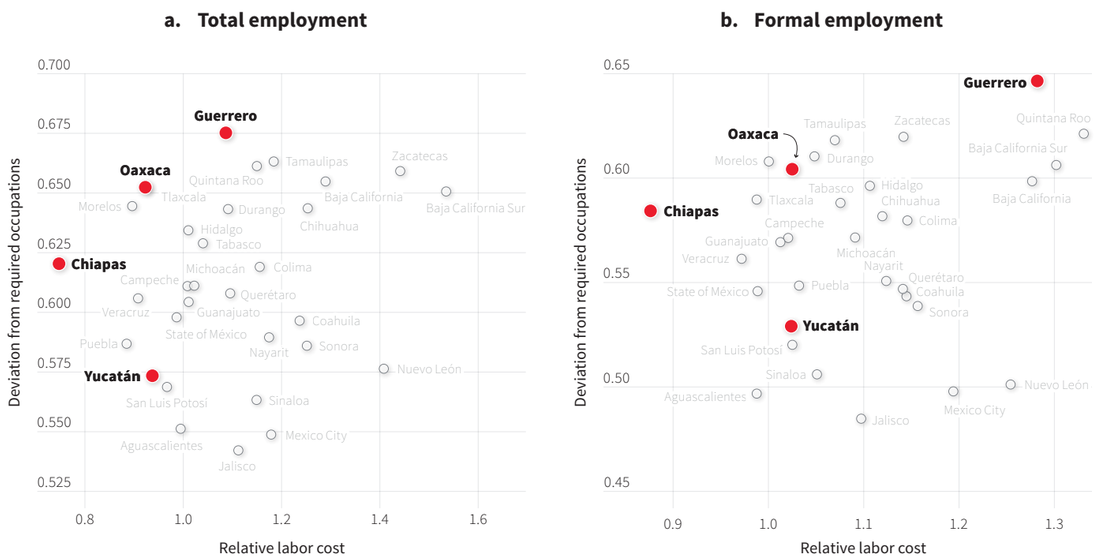
Skill Deviations and Relative Labor Cost in Agricultural Production



Source: Calculations based on the methodology implemented by Barrios and others (2018a; 2018b) using data from INEGI's ENOE database.
Note: In both panels, the x-axis is the ratio of the average hourly wage ratios at national and state levels, and y-axis is the deviation in occupation shares between national and state levels (measured using the symmetric mean absolute percentage error), in the first quarter of 2019.

FIGURE B.2

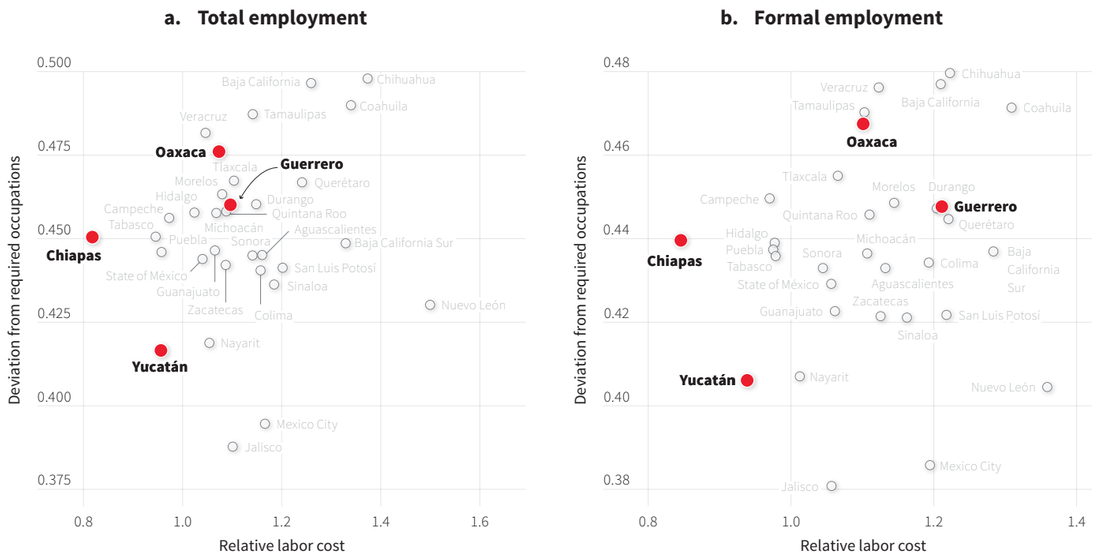
Skill Deviations and Relative Labor Cost in the Food Industry



Source: Calculations based on the methodology implemented by Barrios and others (2018a; 2018b) using data from INEGI's ENOE database.
Note: In both panels, the x-axis is the ratio of the average hourly wage ratios at national and state levels, and y-axis is the deviation in occupation shares between national and state levels (measured using the symmetric mean absolute percentage error), in the first quarter of 2019.

FIGURE B.3

Skill Deviations and Relative Labor Cost in the Beverage and Tobacco Industry



Source: Calculations based on the methodology implemented by Barrios and others (2018a; 2018b) using data from INEGI's ENOE database.
Note: In both panels, the x-axis is the ratio of the average hourly wage ratios at national and state levels, and y-axis is the deviation in occupation shares between national and state levels (measured using the symmetric mean absolute percentage error), in the first quarter of 2019.

APPENDIX C
Infrastructure and Geographic Conditions

INFRASTRUCTURE

As a first step to identify potential infrastructure-related constraints that could hinder the development of the agro-industry sector in Chiapas, Guerrero, Oaxaca, and Yucatán, in this appendix, key inputs for the production processes namely electricity, water, combustibles, transportation, telecommunications, and other sector-specific infrastructure are assessed. The findings in this appendix are combined with the analysis of use intensity of each input by the agro-industry subsectors presented in appendix D to determine whether potential mismatches between supply and demand could be a binding constraint for the sector.[93]

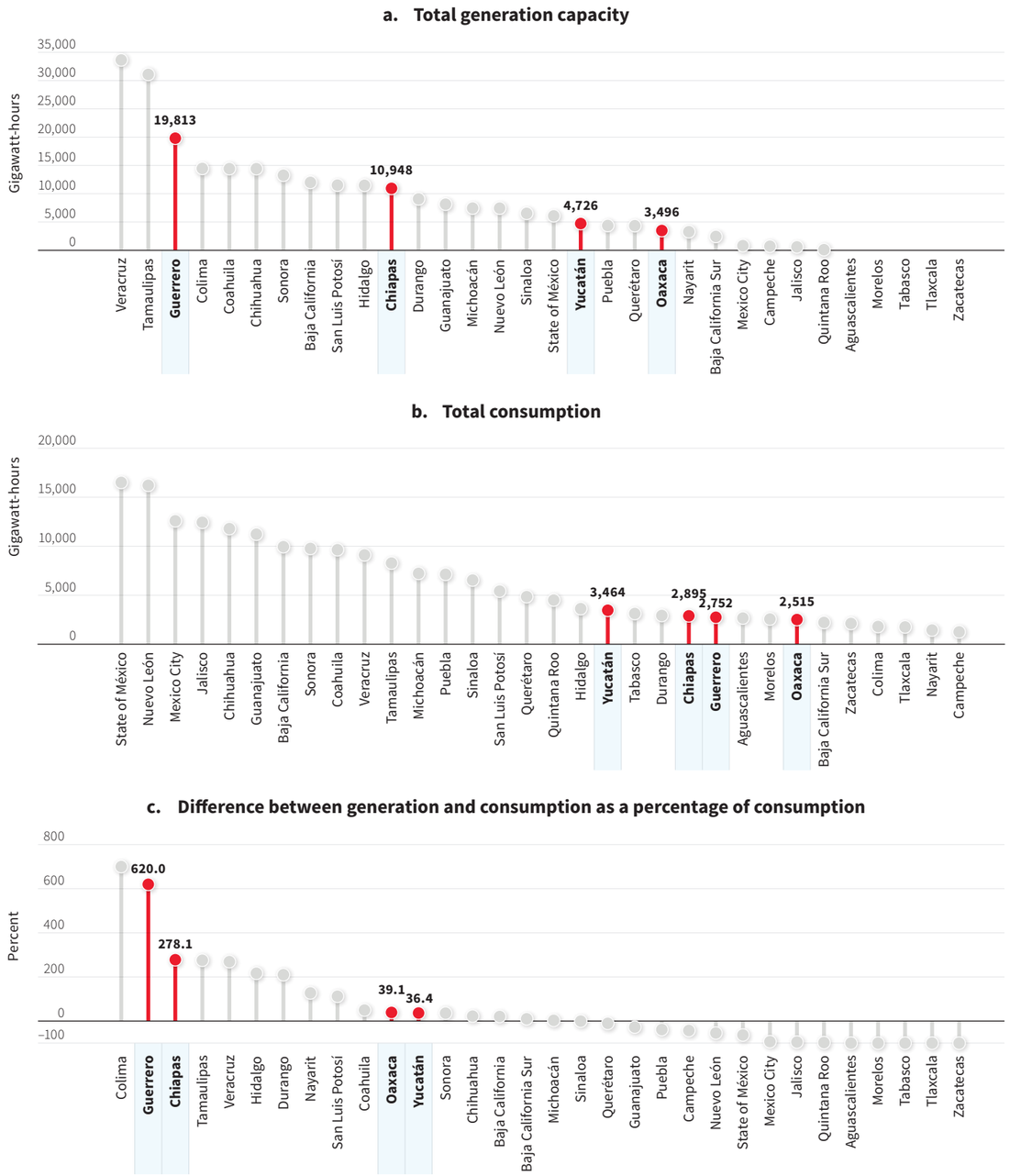
ELECTRICITY

Assessing the conditions of electricity infrastructure entails comparing electricity generation, consumption, and balance, as well as access and coverage of the electricity network and quality of services across states.

In terms of generation capacity and consumption, figure C.1 shows that the selected states generate more than what they consume. In Guerrero, the difference between generation and consumption is 620 percent of the state's consumption, in Chiapas it is 278 percent, and in Oaxaca and Yucatán it is 39 and 36 percent, respectively. As generation capacity is higher than consumption, electricity does not seem to be a concern for the development of economic activities in the four states.

FIGURE C.1

Electricity Generation and Consumption, by State, 2017



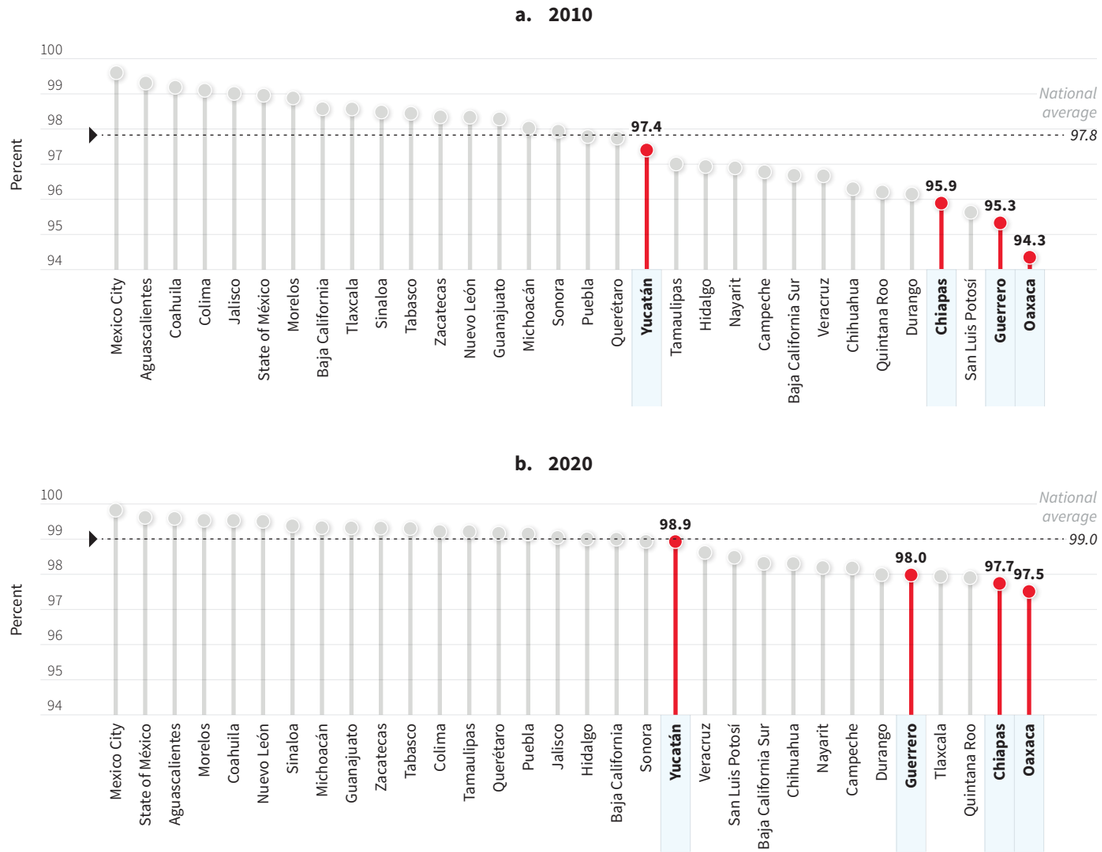
Source: Calculations based on data from SENER's SIE database.
Note: The most recent available electricity generation and consumption data is for 2017.

In terms of households with access to electricity, figure C.2 shows that only Yucatán, with 98.9 percent, has coverage levels close to national averages. Despite coverage levels having improved in Chiapas, Guerrero, and Oaxaca, they still have coverage levels that are among the lowest in the country.

Regarding satisfaction with overall electricity services, figure C.3 suggests that firms in Chiapas, Guerrero, and Oaxaca are generally dissatisfied. In Oaxaca, only 33.6 percent of firms reported satisfaction, just below Guerrero and Chiapas at 34.8 and 35 percent, respectively. Meanwhile, 52 percent of firms in Yucatán were satisfied with electricity-related services, the only selected state with a proportion above the national average (46.2 percent). However, in most Mexican states, dissatisfaction seems prevalent among firms, suggesting that the quality of electricity services is not particularly lower when compared to national averages.

FIGURE C.2

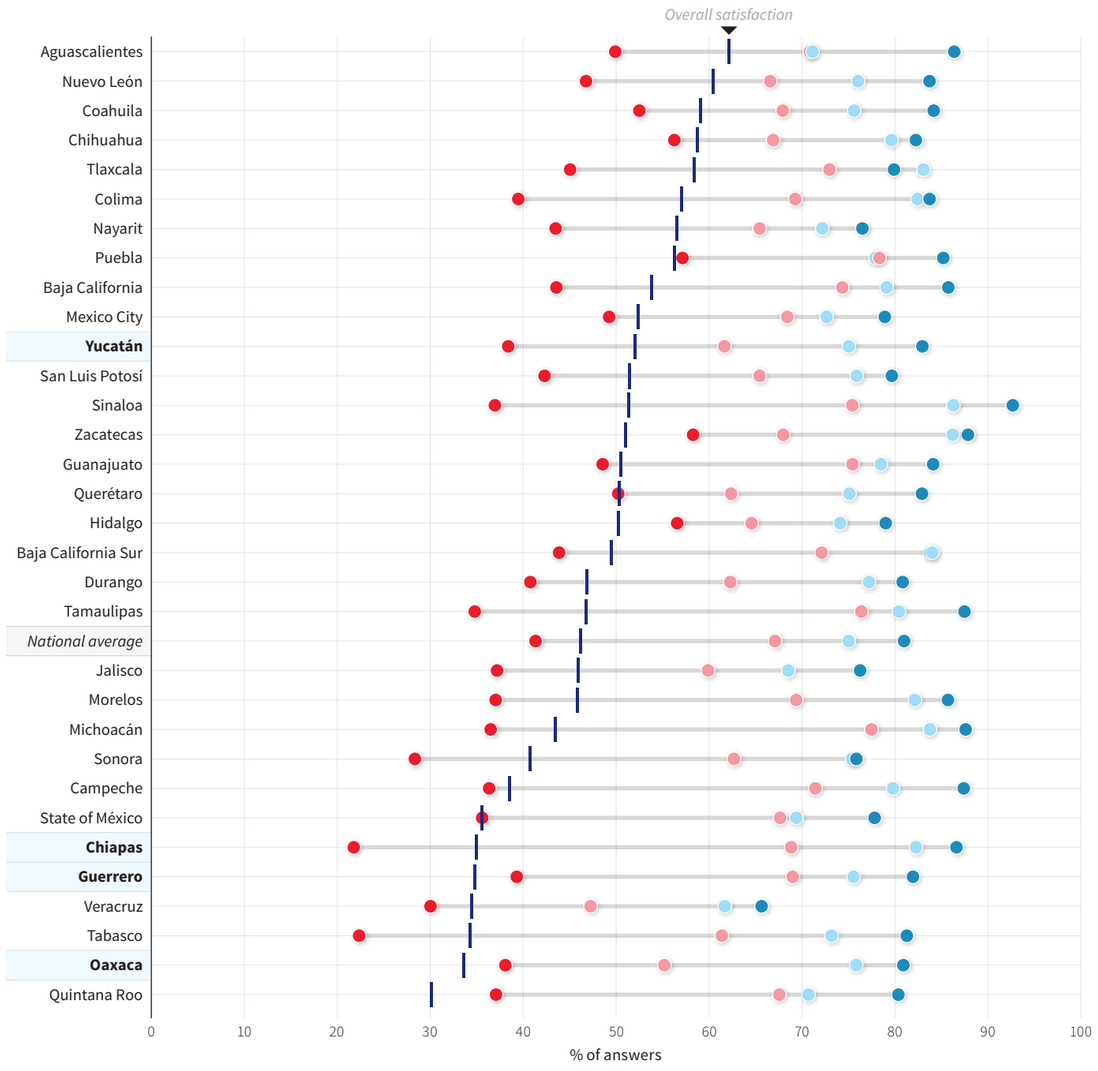
Households with Access to Electricity, by State



Source: Based on data from INEGI 2010; 2020.

FIGURE C.3

Firms' Satisfaction with Electricity Services, by State, 2016

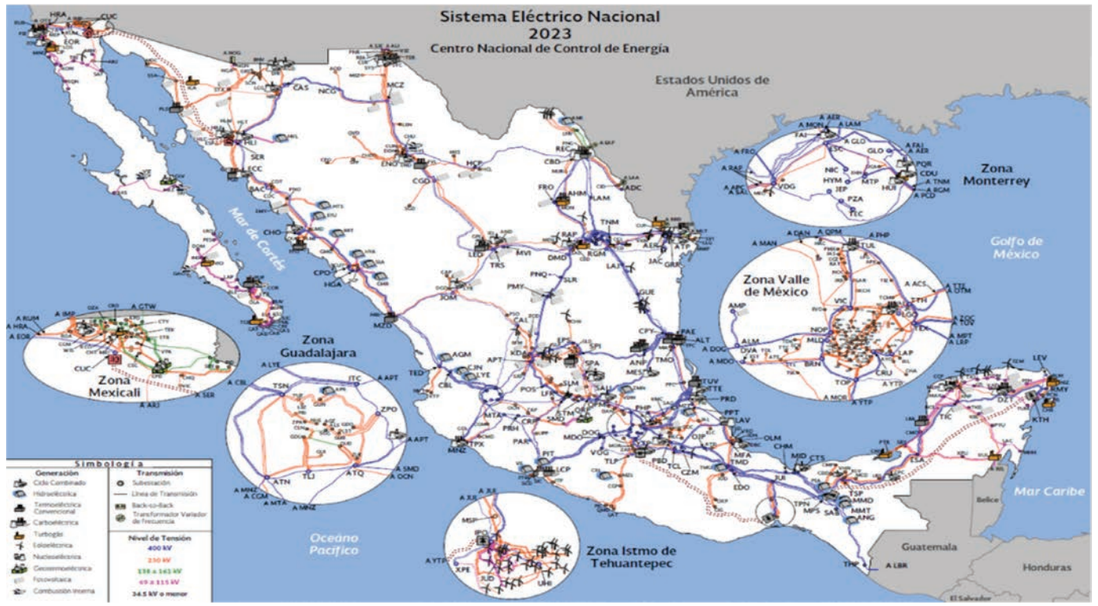


Source: Based on data from INEGI 2016.
Note: The last period an assessment of energy services was included in the survey was in 2016.

An important consideration for understanding the availability of electricity services in the selected states is the infrastructure of the national electricity system illustrated in map C.1. Chiapas has many hydroelectric power plants, mainly at the center and north of the state. It also has a main transmission line (400 kilovolts [kV]) that goes from Tapachula to Tuxtla Gutiérrez and intersects through the state of Tabasco. However, the rest of the state lacks transmission lines of 400 or 230 kV. Guerrero only has few hydroelectric power plants in its central region and transmission lines of 230 kV that go from the city of Acapulco, around its coast, to Michoacán and from Acapulco to the state of Morelos, crossing its capital city of Chilpancingo. Oaxaca has a high wind power potential in the region of La Ventosa, at the Isthmus of Tehuantepec. From that region some transmission lines (400 kV and 230 kV) are integrated with those in the state of Veracruz. Another transmission line comes from the north of Oaxaca and goes to the region of Valles Centrales to the capital city of Oaxaca. While the rest of Oaxaca lacks transmission line connections. Yucatán mainly has wind and coal power production around the main cities of the state. In the state as well, crosses a few transmission lines with low tension (69 to 115 kV) and one transmission line of 400 kV. From this perspective, the selected states do not have enough transmission infrastructure to cover all their regions, which could make the distribution of high energy volumes difficult for industries that use this input intensively.

MAP C.1

Mexico's National Electric System, 2018



Source: CENACE 2018.
Note: kV = kilovolts.

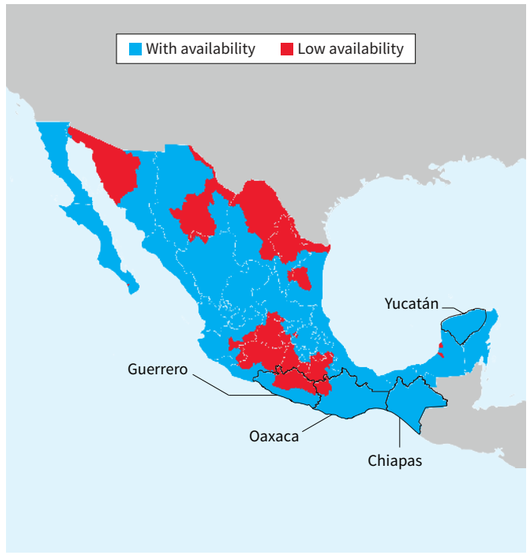
WATER

To assess whether the provision of water is a binding constraint to the expansion of agro-industry activities in the selected states, a series of measures are employed to determine the availability and utilization of this basic input in production processes.

First, the analysis begins by evaluating the availability of water resources in the selected states. As maps C.2 and C.3 show, there is adequate superficial water available in all selected states, except for the northwest region of Guerrero, where availability is limited. In addition, there is adequate availability of underground water in these states. Therefore, water is not a constraint for productive activities requiring this input.

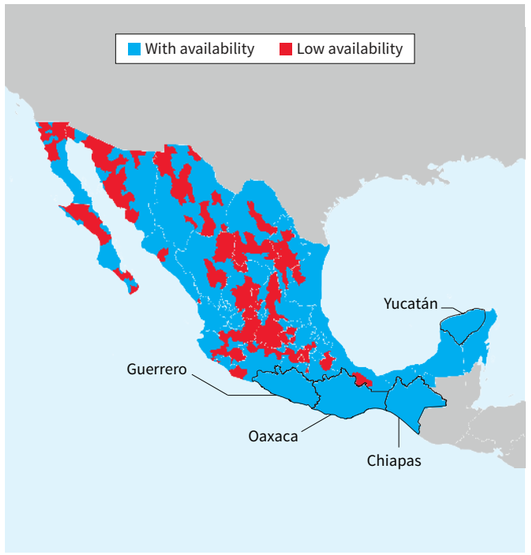
The second indicator evaluates the satisfaction level of firms with water services. Figure C.4 shows that, in 2016, Guerrero, Chiapas, and Oaxaca had some of the lowest levels of satisfaction with potable water services, with rates of 29.0, 29.6, and 34.2 percent, respectively. Meanwhile, Yucatán had the second-highest levels of satisfied firms in the country, with 73.2 percent. However, by 2020 that fell to 38.8 percent, the third lowest among Mexico's 32 states. In Chiapas, the share of satisfied firms dropped as well by half to 15.1 percent. In contrast, the levels of satisfaction in Oaxaca and Guerrero increased to 55.5 and 43.0 percent, respectively. Although these shifts in firms' perception could be related to the impact of the pandemic on supply and demand, the quality of water services should be continually monitored to guarantee adequate provision for productive use.

MAP C.2
Superficial Water Availability in Mexico, 2016



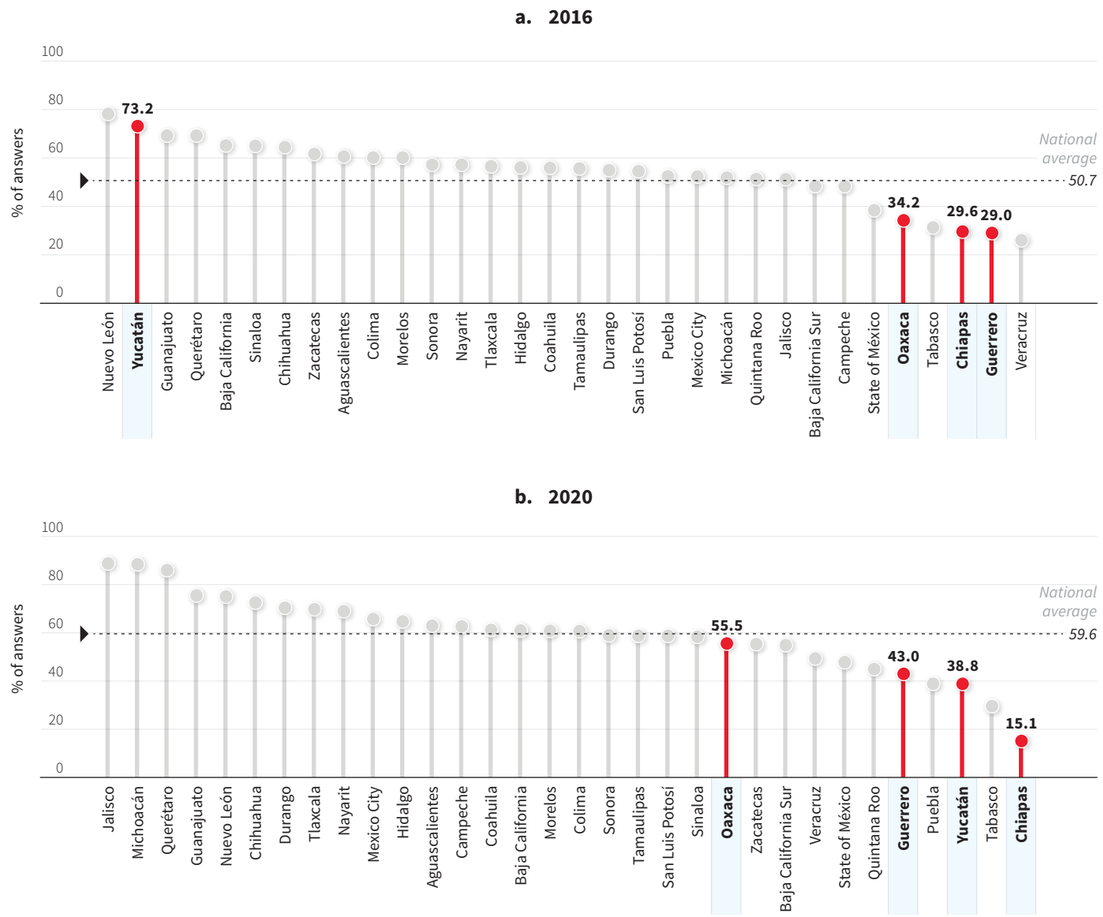
Source: CENACE 2018.

MAP C.3
Underground Water Availability in Mexico, 2016



Source: CENACE 2018.

FIGURE C.4
Firms' Satisfaction with Water Services, by State



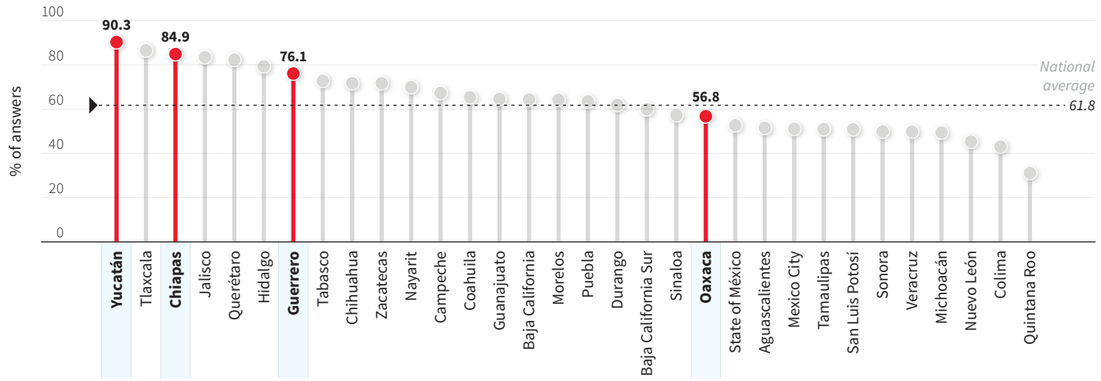
Source: Based on data from INEGI's ENCRIGE database.

To identify the specific causes of the low satisfaction levels in water services provision, figure C.5 presents accessibility and quality of service rates in four aspects: reliability of water provision, level of pressure, level of potability, and level of clarity and purity. On average, more than 75 percent of firms agree that the rate they pay is affordable in the selected states, ranging from 56.8 percent in Oaxaca to 90.3 percent in Yucatán. However, the reliability of water services provision in Chiapas, Guerrero, and Oaxaca is lower than the national average. All the selected states are also lower than the national average in terms of pressure, purity, clarity, and potability of water. On the other hand, in Chiapas and Yucatán, more than 80 percent of firms agree that there is no water wasted because of leaks, and, although this share is above 50 percent for Guerrero and Oaxaca, they are still below the national average.

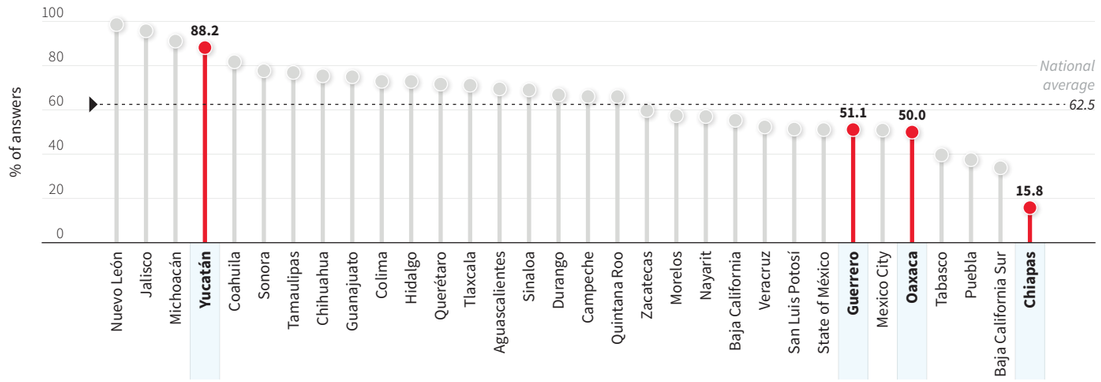
FIGURE C.5

Indicators of Firms' Satisfaction with Water Services, by State, 2020

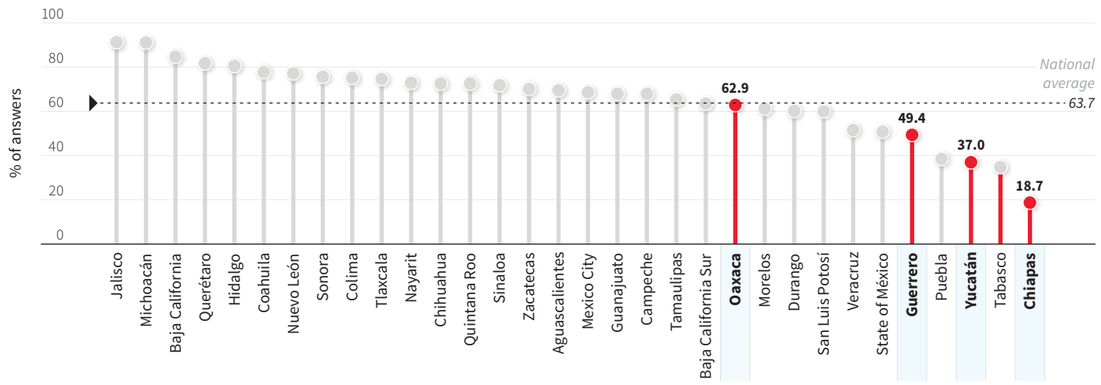
a. Affordability



b. Reliable supply



c. Enough pressure

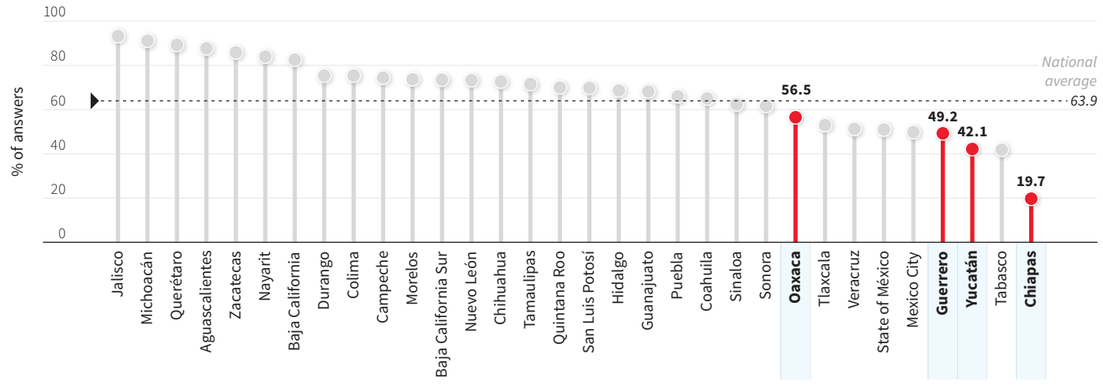


(Figure continues next page)

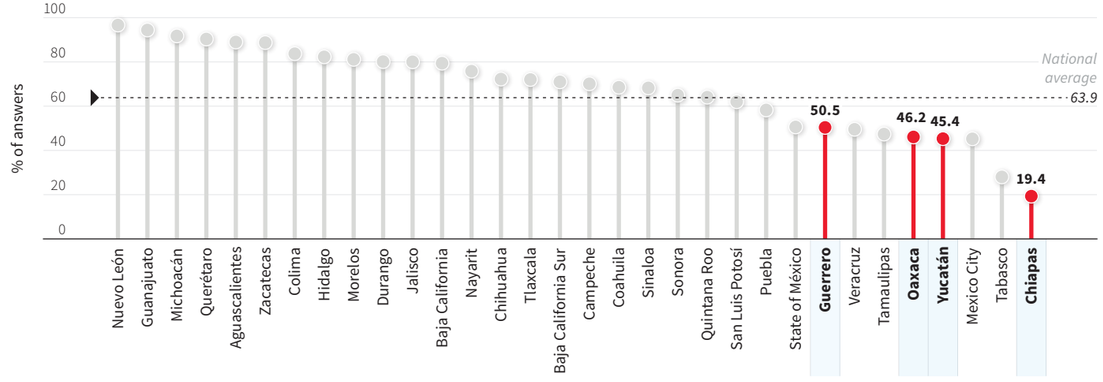
FIGURE C.5

Indicators of firms' satisfaction with water services, by state, 2020 *(continued)*

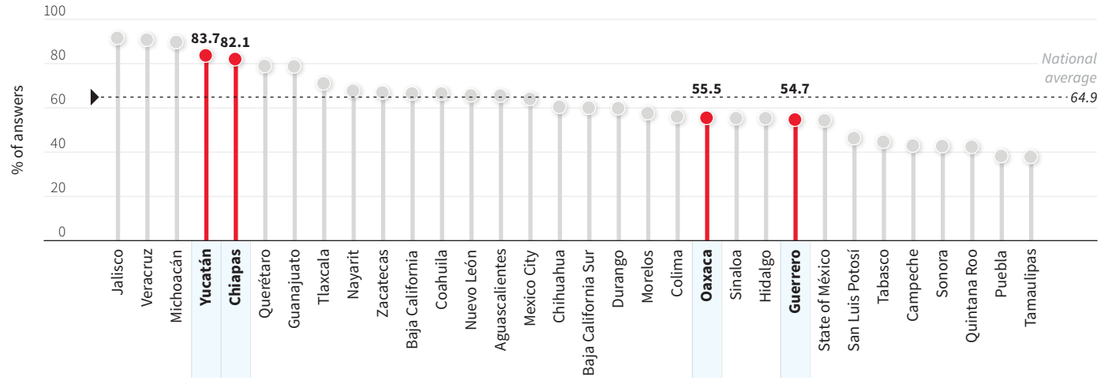
d. Level of potability



e. Level of clarity and purity



f. No waste because of leaks

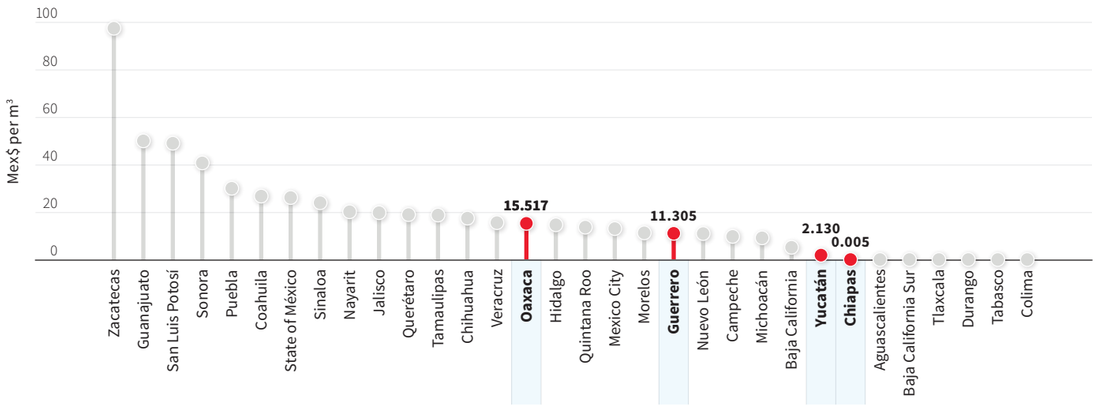


Source: Based on data from INEGI's ENCRIGE database.

Figures C.6, C.7, and C.8 provide detailed analysis of the cost of water supply fares and the efficiency of local water agencies at the state level. The fares for water are among the lowest in the country for Yucatán and Chiapas, with a relationship in cost fare of 0.003 and 0.005, respectively. In Guerrero and Oaxaca, this ratio is higher, with 11.5 and 18.1, respectively, placing these states in the middle of the ranking. The cost per volume produced is also low in Chiapas and Yucatán, whereas for Guerrero and Oaxaca, it increases heavily. However, state agencies have very low overall efficiency, except for Oaxaca which has one of the top three, with 47.9 percent.

FIGURE C.6

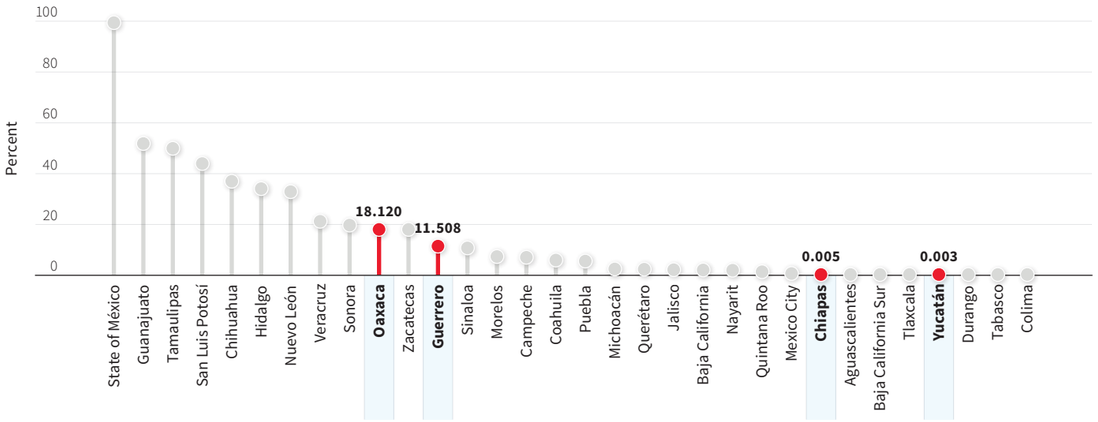
Water Cost per Volume Produced, by State, 2017



Source: Based on data from CONAGUA and IMTA 2017.
Note: m^3 = cubic meter.

FIGURE C.7

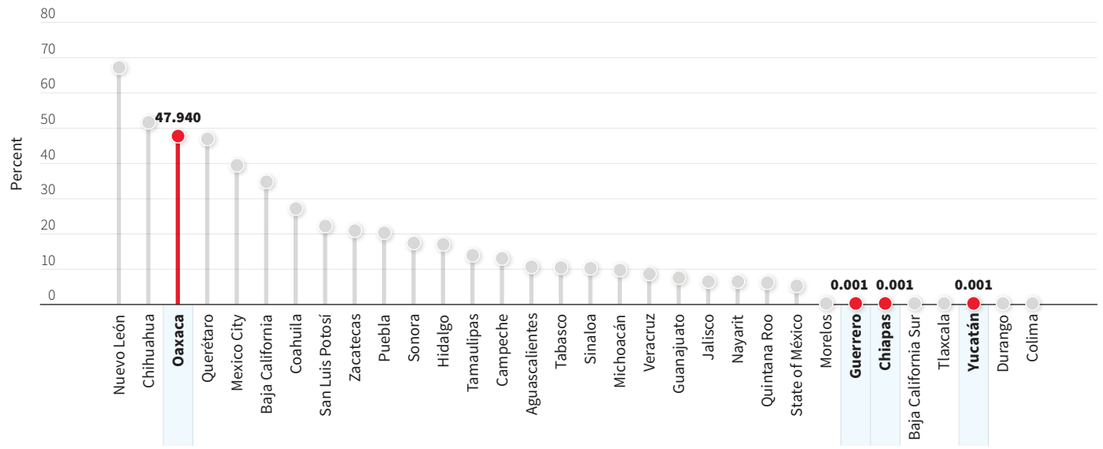
Water Cost-Fare Relation, by State, 2017



Source: Based on data from CONAGUA and IMTA 2017.

FIGURE C.8

Average Overall Efficiency of Water System, by State, 2017

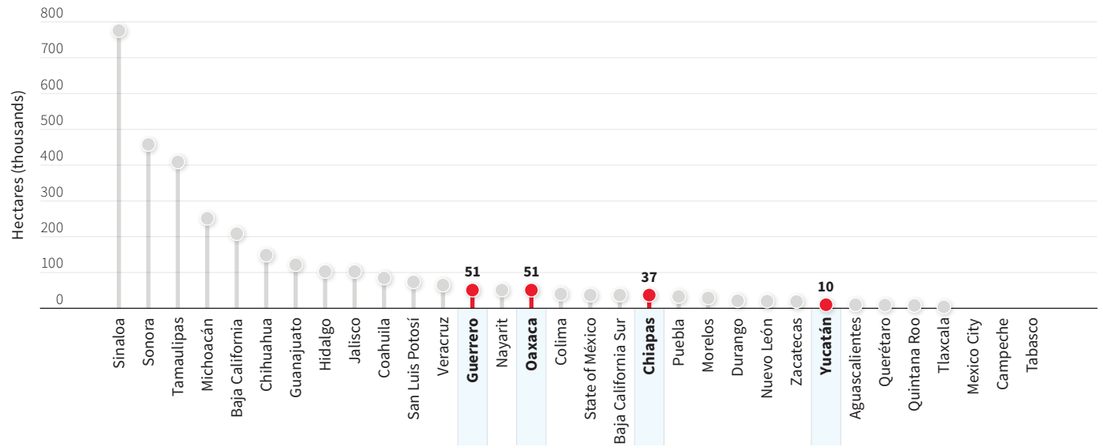


Source: Based on data from CONAGUA and IMTA 2017.
Note: Figure shows the volume of water collected by volume produced.

In addition, the coverage of irrigation districts was analyzed, as it serves as an indicator of the availability of water for agriculture. As figure C.9 shows, the selected states have a relatively low coverage of irrigation districts. Yucatán has the lowest level of coverage, with only 10,000 hectares (ha) in a single irrigation district, followed by Chiapas (37,000 ha), Guerrero (51,000 ha), and Oaxaca (51,000 ha).

FIGURE C.9

Areas Covered by Irrigation Districts, by State, 2019



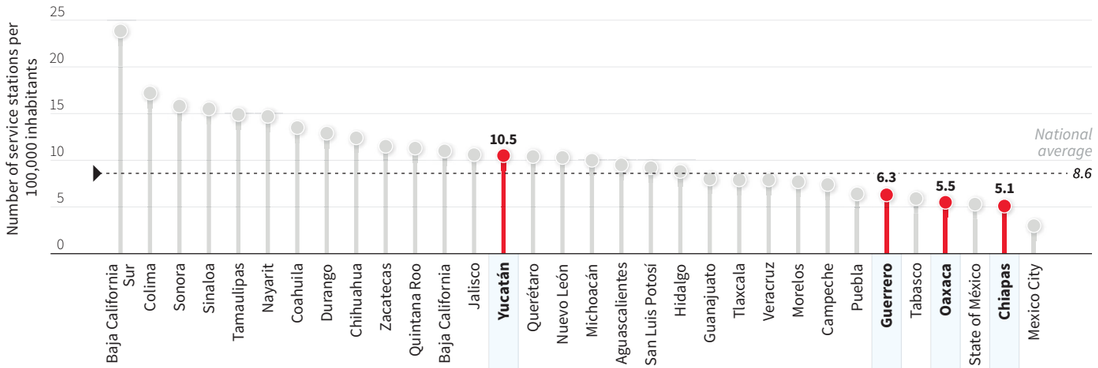
Source: Based on data from SEMARNAT's *Consulta Temática* database.

COMBUSTIBLES

To determine whether access to combustibles is a constraint for the development of the agro-industry sector in the selected states, an analysis of the physical infrastructure, consumption, and satisfaction levels in the provision of combustibles is conducted. Figure C.10 shows that the number of service stations per 100,000 inhabitants in Chiapas, Oaxaca, and Guerrero are below the 8.6 national average (5.1, 5.3, and 6.3, respectively). Yucatán is the only state that is marginally above that national average. Regarding consumption of natural gas, figure C.11 shows that Guerrero is the only selected state with no consumption in 2019, whereas Oaxaca, Chiapas, and Yucatán had consumptions of 31.1, 43.5, and 104.5 million cubic feet per day, respectively.

FIGURE C.10

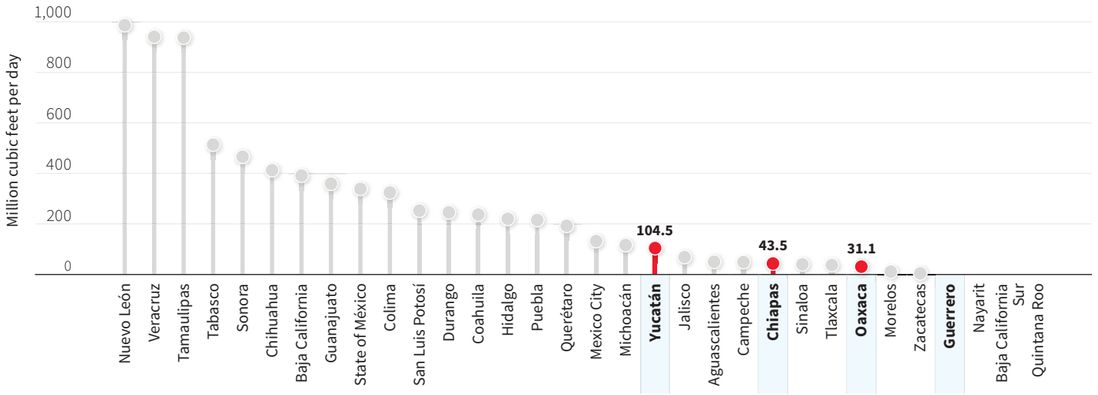
Number of Service Stations per 100,000 Inhabitants, by State, 2017



Source: Based on Pemex 2019.
Note: Service stations are those that supply gasoline and diesel.

FIGURE C.11

Consumption of Natural Gas, by State, 2019



Source: Based on data from SENER's SIE database.

One key aspect about the null consumption of natural gas in Guerrero is that it is the only selected state that does not have connection to the Sistema de Transporte y Almacenamiento Nacional Integrado de Gas Natural (National Interconnected System of Natural Gas; Sistrangas) (see map C.4). Guerrero needs a connection to Sistrangas to offer competitive delivery of combustibles such as natural gas to industries. However, low demand makes a pipeline project unfeasible for the state, which is a barrier for natural gas–intensive manufacturing activities, including some agro-industry subsectors.

Despite the low availability of physical infrastructure in the selected states, firms' satisfaction in the delivery of combustibles is high, except for Oaxaca (figure C.12). Chiapas and Yucatán are in the top positions, with 57 percent satisfaction. Guerrero has 48 percent satisfaction and Oaxaca has 34 percent, which is the only one below the national rate of 37 percent.

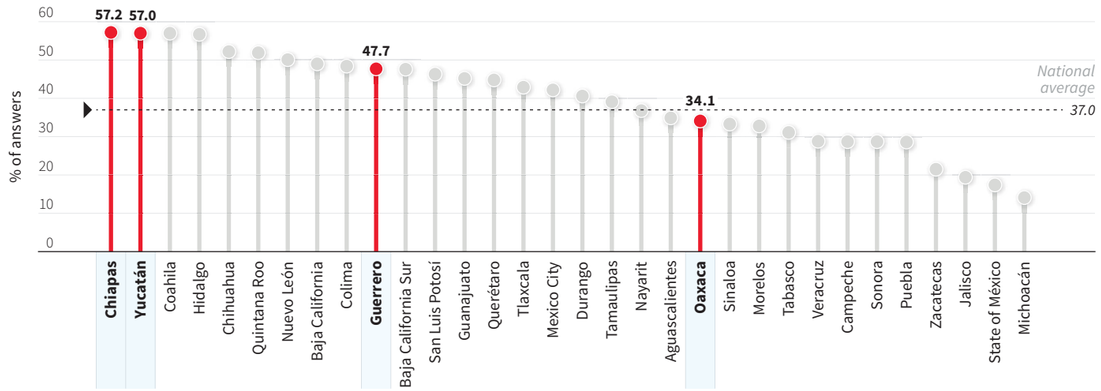
MAP C.4

Mexico's Interconnected System of Natural Gas (Sistrangas), 2019

Source: Based on information from the *Secretaría de Energía*.

FIGURE C.12

Firms' Satisfaction with Combustibles-Related Services, by State, 2016



Source: Based on data from INEGI's ENCRIGE database.
Note: The last period an assessment of combustible-related services was included in the survey was in 2016.

TRANSPORTATION

To evaluate whether transportation infrastructure conditions are a binding constraint for the agro-industry sector in the selected states, three primary modes of transportation intensively used by agro-industry activities are assessed: roads, ports, and railways. Figure C.13 shows the physical condition of roads. Chiapas, Guerrero, and Oaxaca have lower shares of paved roads than the national average (43.4 percent), whereas Yucatán is above this average. A similar pattern is observed for availability of roads with four or more lanes, only 4 percent of the roads in Yucatán have four or more lanes, whereas for the rest of selected states this share is less than half the national average.

Figures C.14 and C.15 show road network densities by inhabitants (per 10,000) and area (per 100 square kilometers [km]). Yucatán has high rates of paved roads in relation to its inhabitants and area. Guerrero is the second of the selected states, with 19.5 km of paved roads per 10,000 inhabitants and 10.43 km of paved roads per 100 square km. Both states are above the national average. Oaxaca has a higher density of paved roads per 10,000 inhabitants than Chiapas, but this trend is switched for paved roads per 100 square km.

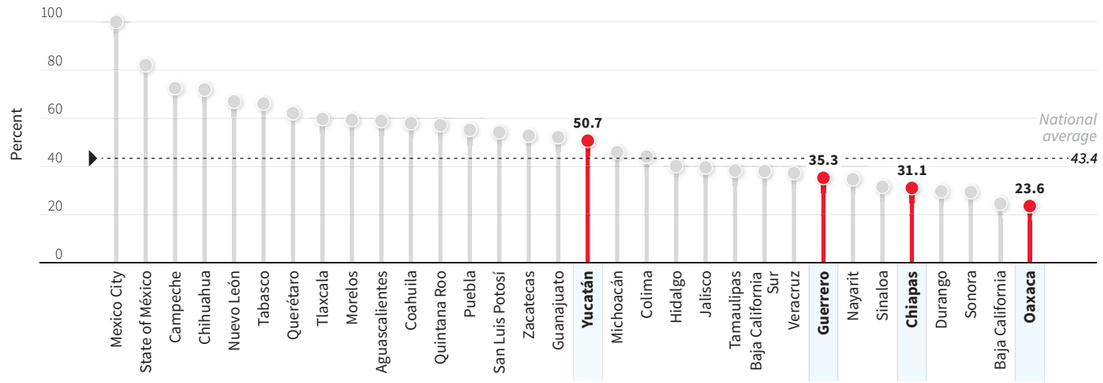
Paved roads are mostly administrated and maintained by the local, state, and federal governments, but there are also toll roads, which are usually given to private entities or to publicly owned agencies for managing. Federal highways (Fed.) are the main interconnections between the regions of the states to other places of the country. These roads tend to have free access and some of them have traffic congestion, especially in urban areas, resulting in lower average speed and longer travel times. There are also toll roads controlled by private operators. These roads are frequently more efficient, reducing time travelled by allowing a higher average speed, being more competitive and attractive for logistic purposes for firms, if the toll fares do not represent a burden.

In the selected states, federal highways connect the main cities and take part of the road corridors of the country. However, these states have few toll roads.

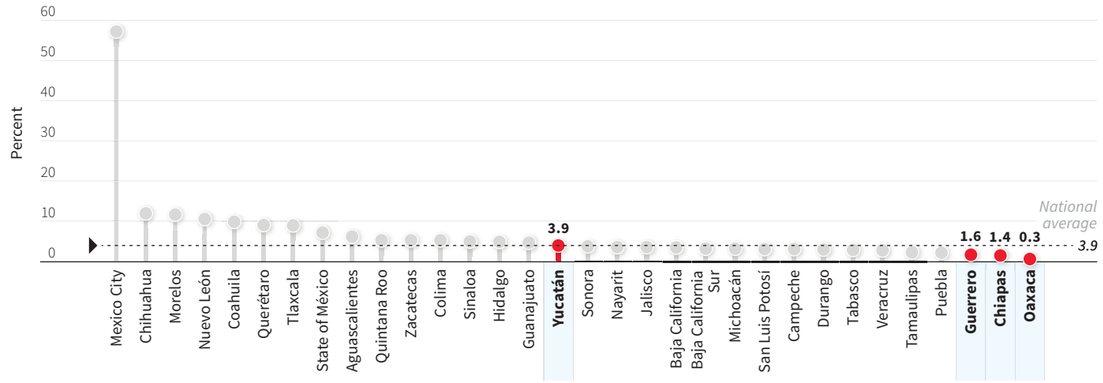
FIGURE C.13

Road Conditions, by State, 2018

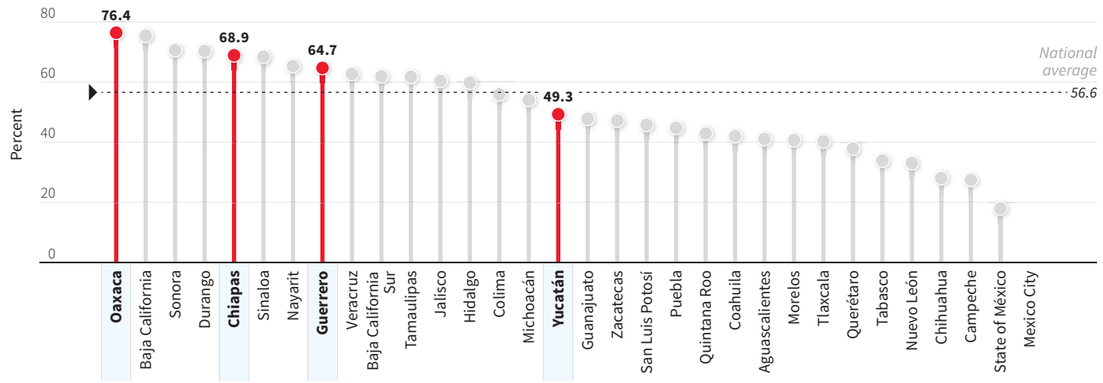
a. Share of paved roads



b. Share of roads with four or more lanes



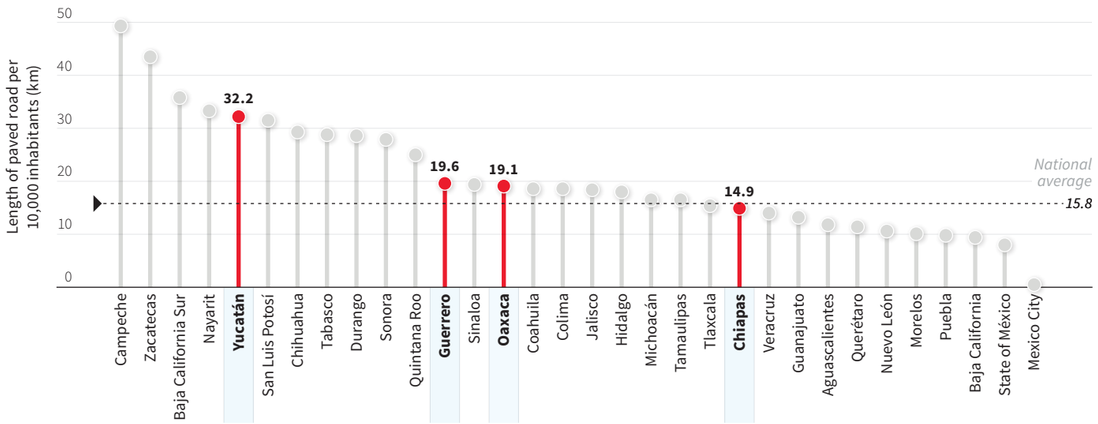
c. Share of unpaved roads



Source: SCT 2020.

FIGURE C.14

Length of Paved Roads per Number of Inhabitants, by State, 2018



Source: Calculations are based on data from SCT 2018.
Note: km = kilometer.

FIGURE C.15

Length of Paved Roads per Land Area, by State, 2018

Source: Calculations are based on data from SCT 2018.
Note: km = kilometer.

Map C.5 shows the location of the three toll roads in Chiapas: from Tuxtla Gutiérrez to San Cristóbal de las Casas (Fed. 190D), from Tuxtla Gutiérrez to Arriaga (Fed. 190D), and from Ocozocoautla to Coatzacoalcos (Fed. 145D). Guerrero has only one toll road, known as Autopista del Sol (Fed. 95D), which connects Acapulco to Chilpancingo, Cuernavaca (Morelos) and Mexico City. Oaxaca has three toll roads: one from Oaxaca City to Puebla and Mexico City, another from Mitla to Santo Domingo Tepuxtepec (an incomplete road that will eventually connect to Tehuantepec), and the last one from Salina Cruz to Tehuantepec. Yucatán only has one toll road from Progreso to Cancún, in Quintana Roo.

MAP C.5

Federal and Toll Roads in the Selected States, 2019

Source: Adapted from SCT-IMT's *Red Nacional de Caminos*.

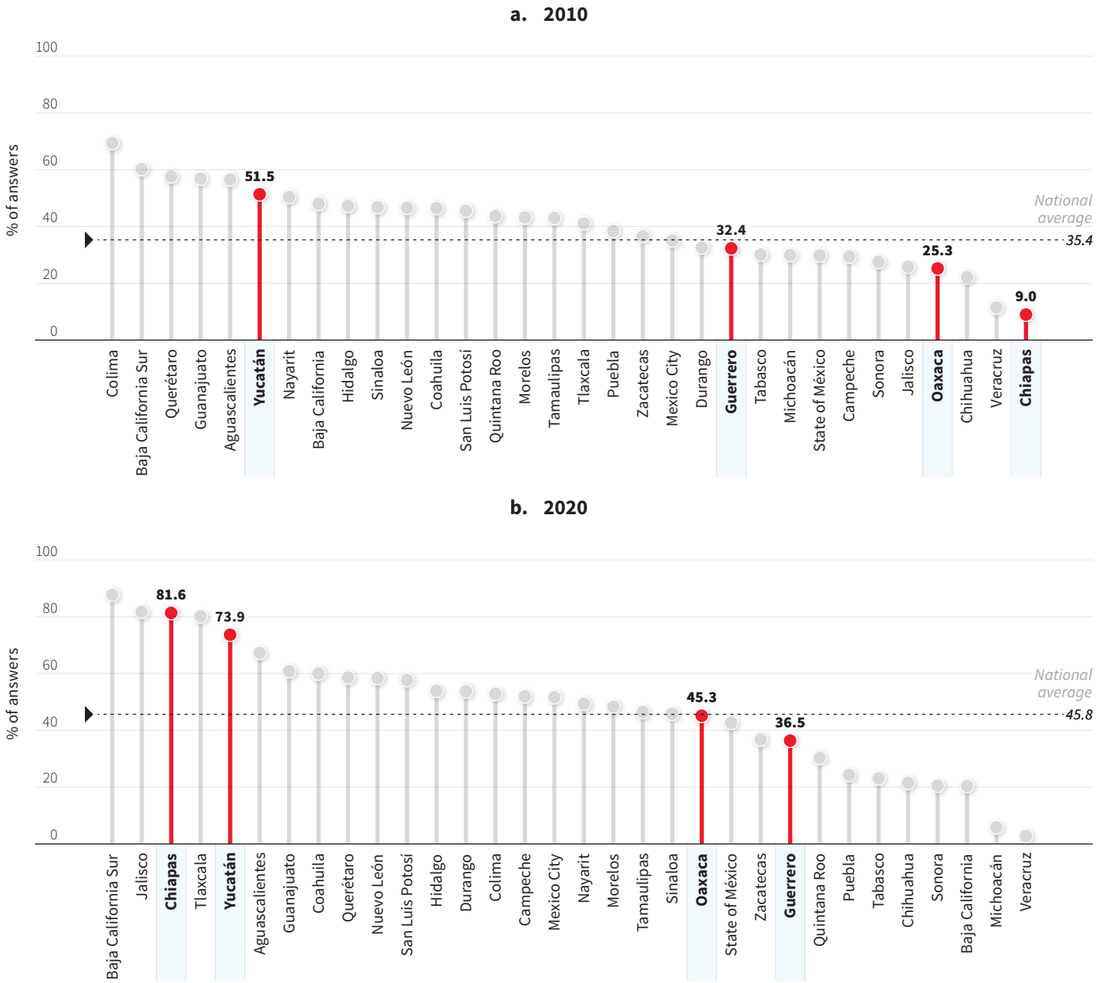
Figure C.16 shows the levels of satisfaction among firms with roads across states. In the selected states, satisfaction levels are generally lower than the national average, except for Yucatán. In 2016, the levels of firms' satisfaction with roads in Chiapas, Oaxaca, and Guerrero were 9, 25, and 33 percent, respectively (versus the national average of 36 percent). Meanwhile, Yucatán had the sixth highest satisfied firms in the country, with a rate above 50 percent. In 2020, this metric dramatically improved for Chiapas, which surged to 81.6 percent (the third-highest proportion nationally. Yucatán also saw a significant improvement, with a satisfaction rate of 73.9 percent. However, Guerrero and Oaxaca, remained below the national average. Yet, the last metrics are probably distorted by the pandemic crisis. Given these findings, and those of the previous analysis, it is implied that road infrastructure deficiencies could be a constraint to attract new industries into the selected states.

Regarding port infrastructure and operation in the selected states, except for Guerrero, all states have ports with capacity for international trade. These ports include Puerto Chiapas, in Chiapas; Puerto de Salina Cruz, in Oaxaca; and Puerto de Progreso, in Yucatán. Guerrero only has a port in Acapulco, which attends mainly to coastal and touristic trade. Between 1996 and mid-2021, this port was operated by a private concessionaire, but in June 2021 it was handed back to the federal government through the Ministry of the Navy.

First, to assess the feasibility of reaching selected ports from the main economic regions in the respective states, three indicators are compared: time, cost,

FIGURE C.16

Firms' Satisfaction with Roads, by State

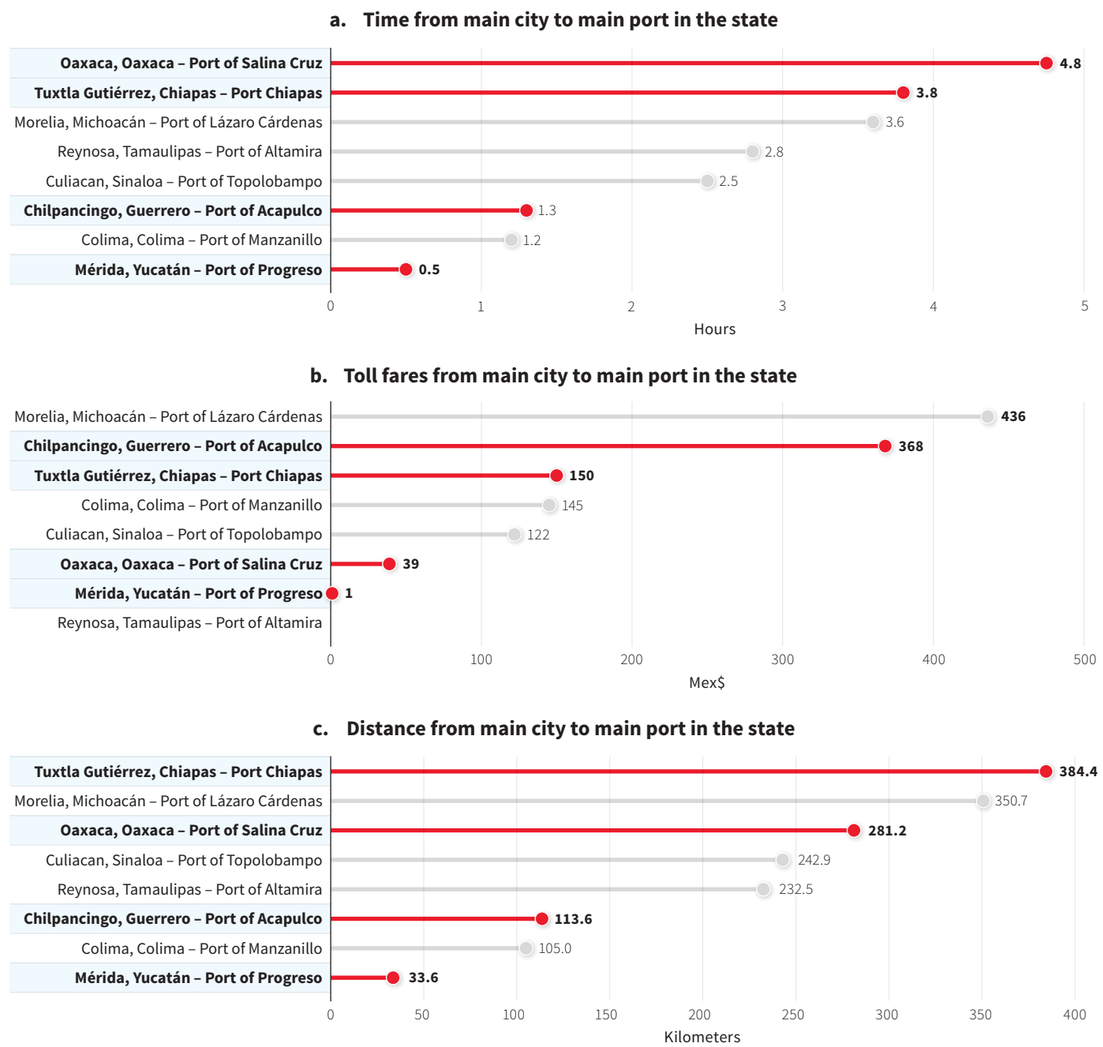


Source: ENCRIGE 2016 and 2020.
Note: Toll roads are excluded from the figure.

and distance (figure C.17). Yucatán has the lowest levels across all metrics, with a time to transport from Mérida (main city) to Progreso (port city) of less than one hour, no toll fares are needed, and distance below 50 km. In Guerrero, the route from Chilpancingo (main city) to the port of Acapulco is competitive in distance and time, but not in toll fares, which are the second highest among the selected states. Oaxaca is only competitive in the toll fares needed to pay to transport from Oaxaca (main city) to Puerto de Salina Cruz of less than Mex$100, while time and distance results were not competitive. Finally, Chiapas has a low performance in time and distance from Tuxtla Gutiérrez (main city) to Puerto Chiapas, although toll fares account for less than Mex$150.

FIGURE C.17

Port Availability to Main Cities, Selected States, 2020

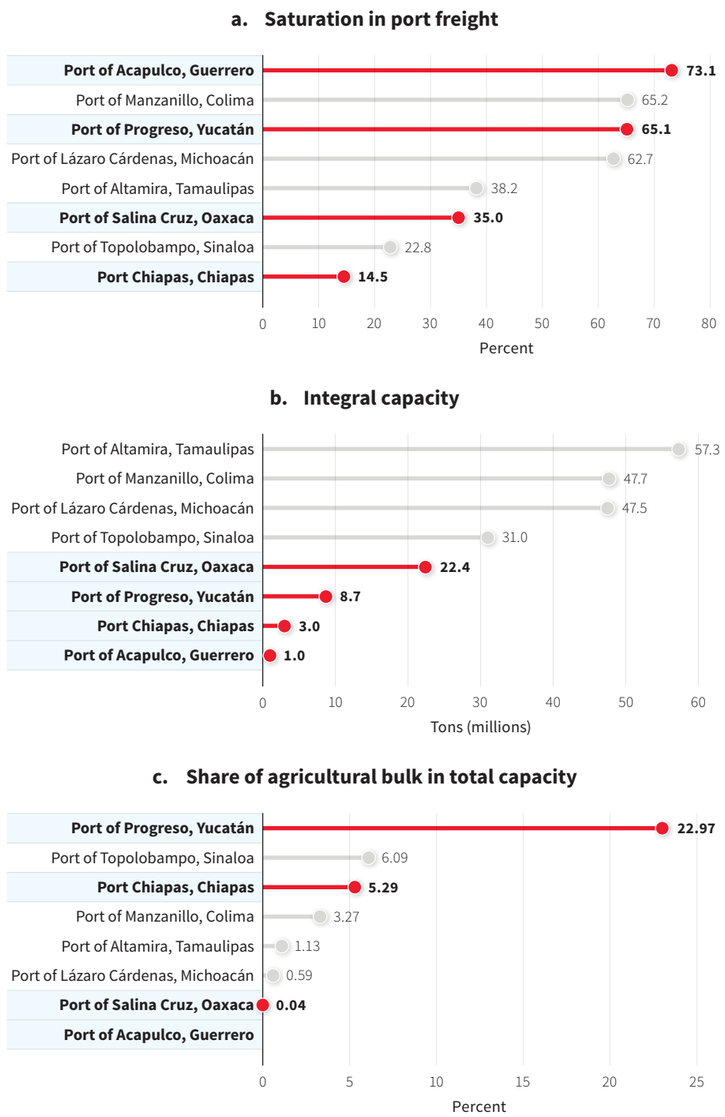


Source: Based on data from SCT's MAPPIR application.
Note: For panel b, toll fares were estimated for an automobile.

Second, in the analysis of port saturation levels for the selected states, the existing infrastructures is examined to identify potential utilization by incoming firms into the region (figure C.18). Among the selected states, Puerto de Acapulco in Guerrero exhibits the highest level of saturation at 73 percent, as well as the port with the lowest integral capacity, handling less than 1 million tons. In contrast, Puerto Chiapas demonstrates the least saturation rate among ports in the selected states at 14 percent. However, its absolute capacity of only 3 million tons is low. Puerto

FIGURE C.18

Level of Port Saturation and Absolute Integral Capacity, Selected Ports, 2017



Source: Calculations based on data from SCT 2020; Idom Consulting 2017.

de Salina Cruz in Oaxaca also presents a relatively low saturation rate at only 35 percent and has the highest integral capacity, with 22.4 million tons. Puerto de Progreso in Yucatán, on the other hand, has a saturation rate of 65 percent, and its integral capacity is only one-third of that of Puerto de Salina Cruz. Only Puerto

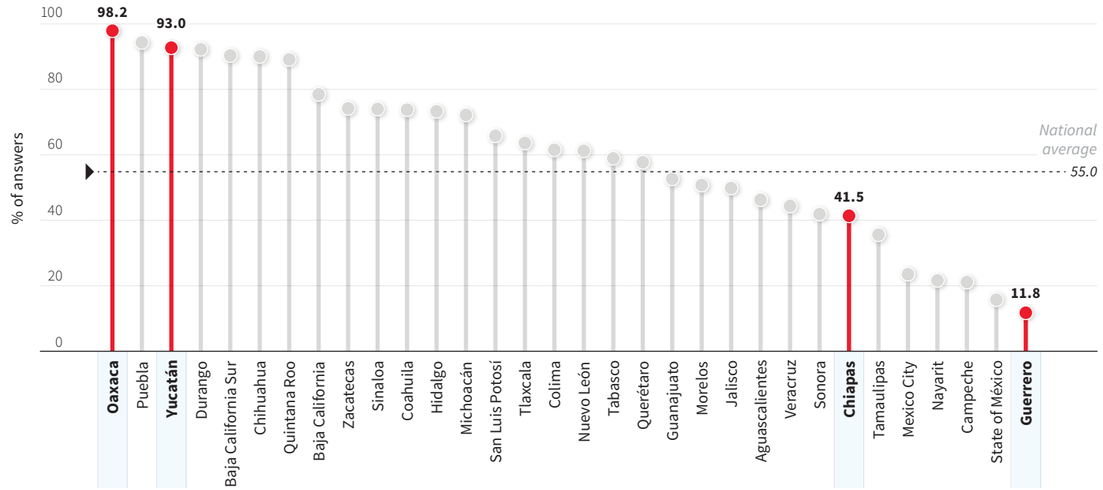
de Progreso and Puerto Chiapas are able to mobilize agricultural bulk, whereas Puerto de Salina Cruz registers a very low rate and Port of Acapulco has none.

Third, comparing the level of satisfaction among firms using port infrastructures, figure C.19, provides valuable insights. Oaxaca stands out as having the highest level of satisfaction in Mexico, with a rate of 98 percent, although the main user of this port is the state-owned enterprise Pemex. This is followed by Yucatán in third, with a level of satisfaction at 93 percent. On the other hand, Chiapas and Guerrero are below the national average of 55 percent, with satisfaction rates of 42 and 12 percent, respectively. Guerrero's performance is concerning, as it fares the worst among all states in the country. From this analysis and the previous one, it becomes apparent that port infrastructure is a constraint for Guerrero, resulting in expensive transport from its main city to the city of Acapulco, the port offers neither agriculture bulk freight nor international trade, and has the most saturated ports among the selected states. Therefore, improvements in port infrastructure are needed to offer an advantage to potential industries requiring this infrastructure that desire to install in the state.

In addition to the service and capacity of the ports in the selected states, it is worth noting that all of them count with heterogeneous infrastructure facilities. In Chiapas, Puerto Chiapas has terminals for containers, agriculture bulks and for cruises, as well as a custom facility (recinto fiscalizado). However, the port has a maximum draft of only 10.5 meters (m), which restricts the size of vessels that can be attended there. Additionally, since it is not located in a natural port, it requires to do dredging every year, to keep the draft of the port with the same dept. The port of Acapulco in Guerrero only has a draft of 9 m and counts with a small terminal for cruises, a terminal for vehicles and another one for soil bulks. The port of Salina Cruz in Oaxaca has a draft of 12 m and ter-

FIGURE C.19

Firms' Satisfaction with Port Infrastructure, by State, 2016



Source: Based on INEGI's ENCRIGE database.
Note: The last period an assessment of this service was included in the survey was in 2016.

minals for general purposes, oil products, for containers and a fiscal pier. The port of Progreso in Yucatán has terminals for containers, agriculture and mineral bulks, and a place for ship reparations. It has a draft of 10.4 m.

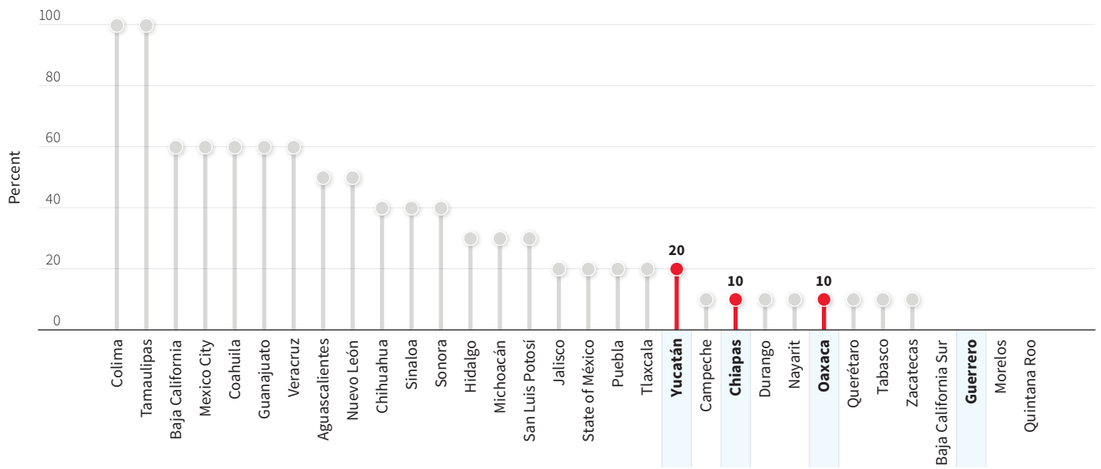
The railway infrastructure completes the assessment of transportation infrastructure. The selected states have a poor performance in the use of railway to transport products. Figure C.20 shows that Chiapas and Oaxaca have an index of density of freight moved by railways of 10 percent, while Yucatán has one of 20 percent. Guerrero is the only of the selected states with a null density of freight.

The low density of freight transported by railways is related to the coverage of Mexico's railway system. Map C.6 shows that Chiapas shares the same line as Oaxaca and Yucatán, the Chiapas-Mayab Line and the Isthmus of Tehuantepec Railway. Both belong to a state-owned company. Guerrero is the only selected state with no rail infrastructure within its territory. It only has an old right-of-way from the state of Morelos that is not used anymore. Because of this lack of railway connection to the rest of Mexico's railway system, any manufacturing industry is constrained, especially the agro-industry sector, which is intensive in the use of railways for transporting agriculture bulk.

Regarding the airport infrastructure, Mexico's system had 77 airports in 2021, 64 of them with international routes, and 1,492 aerodromes (map C.7). Together, the selected states have 11 airports and 60 aerodromes. Figures C.21 shows that Oaxaca has the most airports among the selected states, with four in the cities of Oaxaca, Huatulco, Puerto Escondido, and Ixtepec. Chiapas has three airports in the cities of Tuxtla Gutiérrez, Tapachula, and Palenque (with no operations). Guerrero and Yucatán have two airports each, Zihuatanejo and Acapulco in Guerrero, and Mérida and Kaua in Yucatán.[94] Figure C.22 shows

FIGURE C.20

Rail Freight Density Index, by State, 2018



Source: ARTF 2018.
Note: Normalized values are based on total products transported using the available rails within each state. A value of 100 percent represents a high density, 10 percent represents a low density, and 0 percent represents either no movement of products or no railways available for freight.

MAP C.6

Mexico's Railway System, 2021

Source: ARTF 2022.

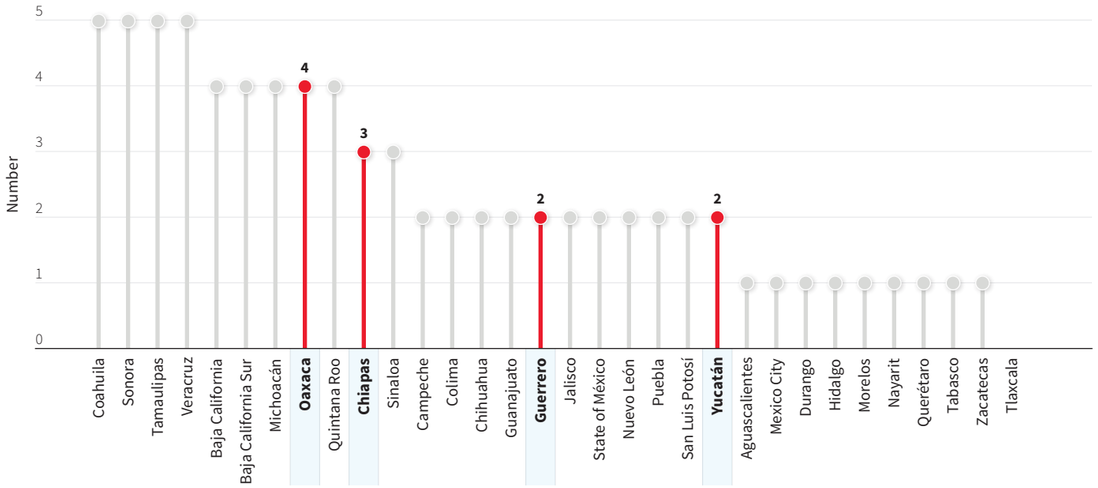
MAP C.7

Main Airports in Mexico, 2021

Source: SCT 2022.

FIGURE C.21

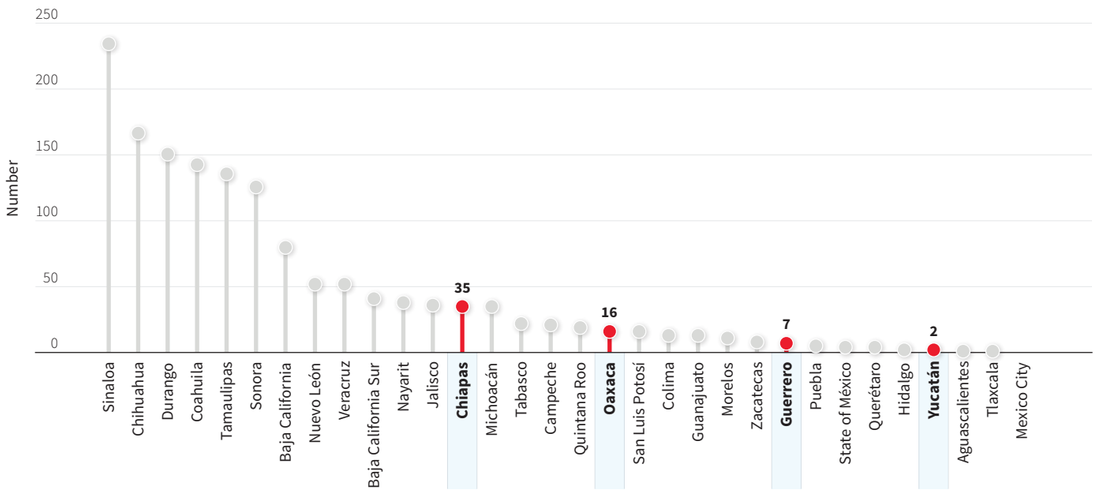
Number of Airports, by State, 2021



Source: SCT 2022.

FIGURE C.22

Number of Aerodromes, by State, 2021



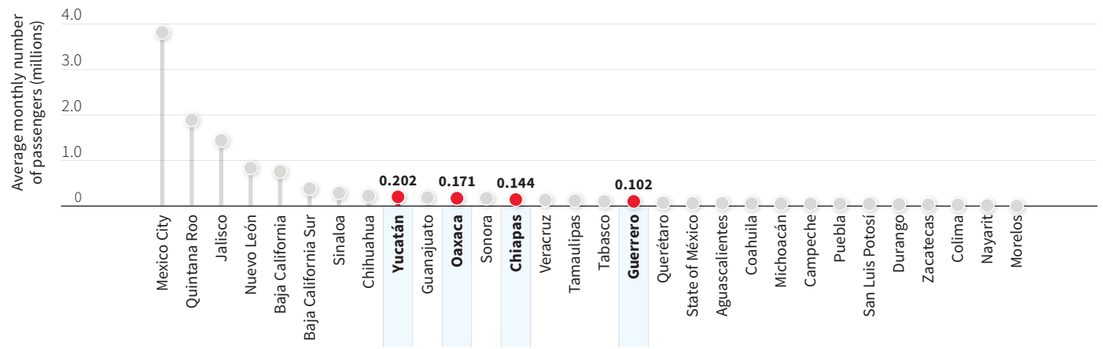
Source: SCT 2022.

that Chiapas has the highest number of aerodromes among the selected states, with 35, while Oaxaca, Guerrero, and Yucatán have 16, 7, and 2, respectively.

Regarding operations, figure C.23 and C.24 show that Yucatán has the highest number of passengers and freight mobilized by air among the selected states; Oaxaca and Chiapas were in the middle of the distribution among the 32 states,

FIGURE C.23

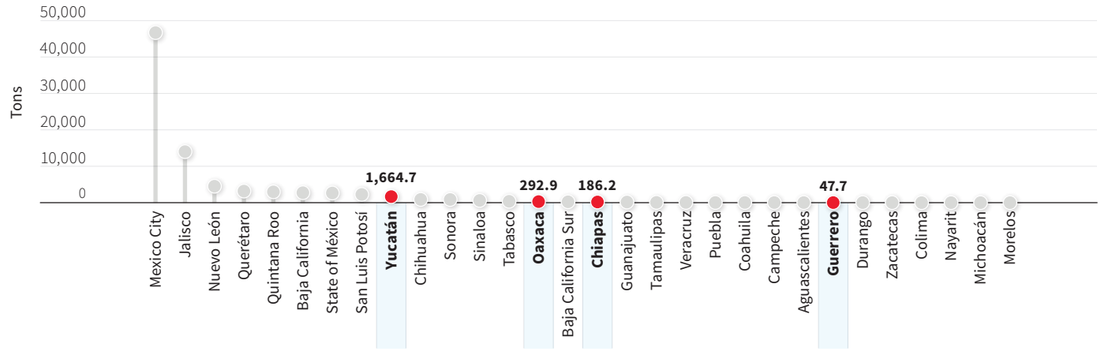
Monthly Average Air Passenger Volume, by State, 2015–19



Source: Calculations based on data from SCT's *Estadística Operativa de Aeropuertos, Dirección General de Aeronáutica Civil.*
Note: The figure corresponds to the months of November from the years considered.

FIGURE C.24

Monthly Average of Air Freight Transport, by State, 2015–19



Source: Calculations based on data from SCT's *Estadística Operativa de Aeropuertos, Dirección General de Aeronáutica Civil.*
Note: The figure corresponds to the months of November from the years considered.

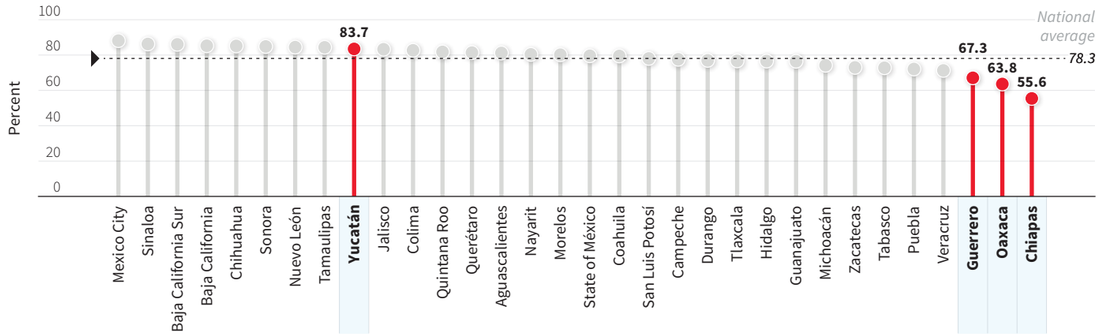
but very far from the top performers, and Guerrero had one of the lowest numbers of passengers and freight mobilized.

TELECOMMUNICATIONS

Figures C.25, C.26, and C.27 show that Chiapas, Guerrero, and Oaxaca have the lowest positions in terms of the share of population using mobile telephony and internet across the country. The only state among the selected states with above average rates for both metrics is Yucatán, with 83.7 and 79.9 percent, versus the national averages of 78.3 and 75.6 percent, respectively. For households with internet connection, Oaxaca and Chiapas are among the states with the very lowest shares among (39.0 and 30.8 percent, respectively), while Guerrero also have below average rates (66.4 percent). Yucatán reached the same proportion as the national level, but it is almost 20 percentage points below the

FIGURE C.25

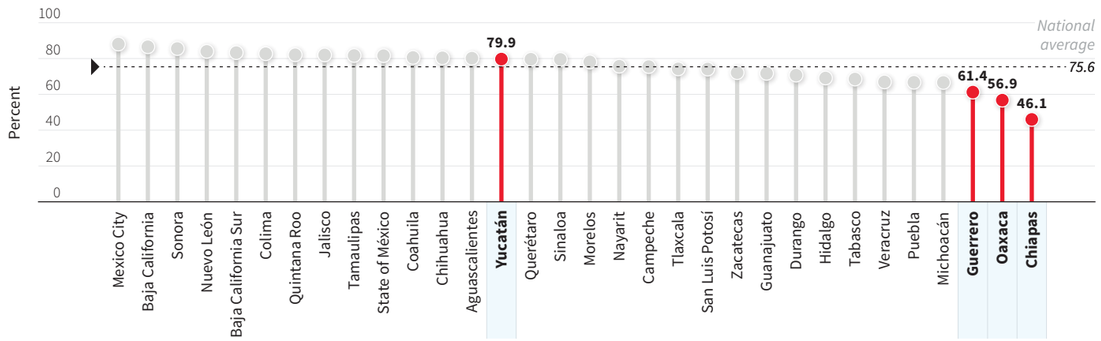
Percentage of Mobile Telephony Users, by State, 2021



Source: Based on data from INEGI's EDUTIH database.

FIGURE C.26

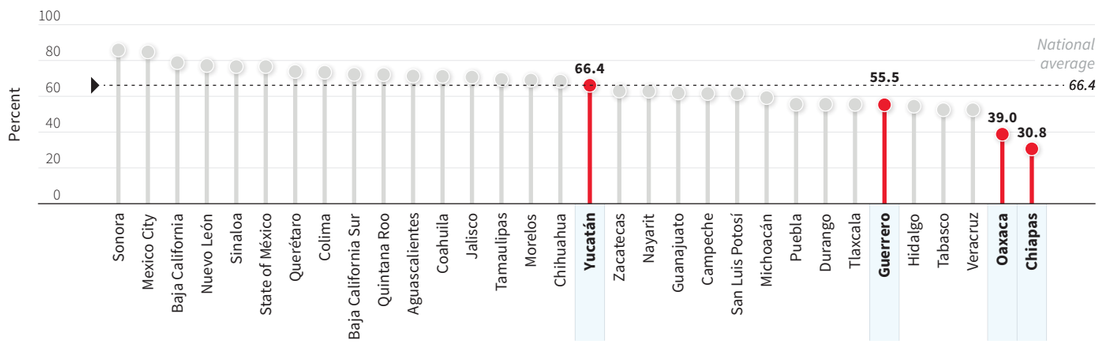
Percentage of Internet Users, by State, 2021



Source: Based on data from INEGI's EDUTIH database.

FIGURE C.27

Percentage of Households with Internet Connection, by State, 2021



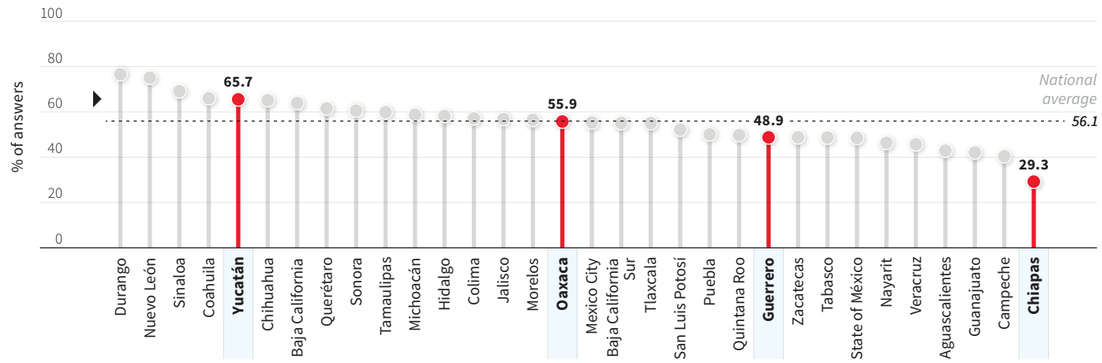
Source: Based on data from INEGI's EDUTIH database.

most connected state. This implies that although there is an increasing number of users for telecommunications technologies, internet connection does not cover all places within the selected states.

Despite these poor levels of coverage, figures C.28 and C.29 show that the firms' level of satisfaction is relatively high in the selected states. For internet service, all selected states but Oaxaca are above the national average (58 percent), with Yucatán at 70 percent, Guerrero at 65 percent and Chiapas at 62 percent. In terms of mobile telephony service, only Yucatán is above the national average (56 percent). Oaxaca is tied with the national average, Guerrero at 49 percent and Chiapas is at the bottom with a rate of 29 percent.

FIGURE C.28

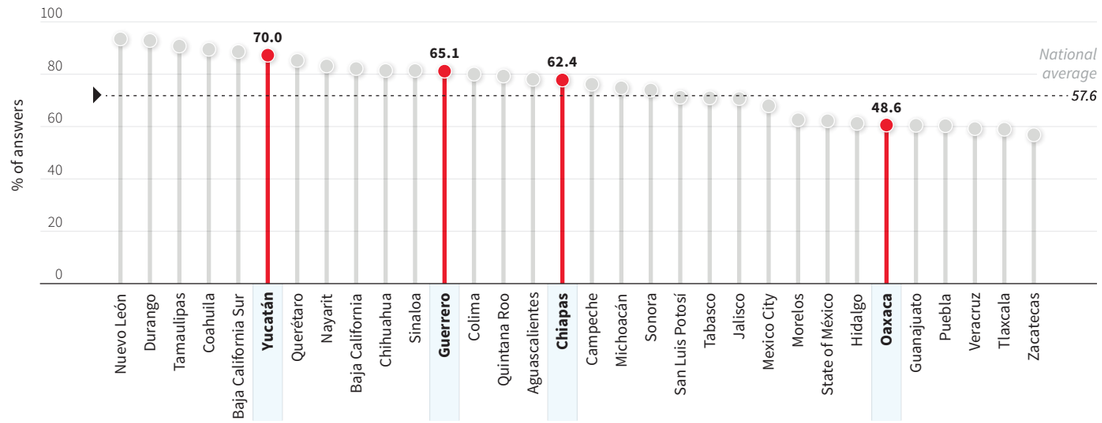
Firms' Satisfaction with Mobile Telephony Service, by State, 2016



Source: Based on INEGI's ENCRIGE database.
Note: The last period an assessment of mobile telephony services was included in the survey was in 2016.

FIGURE C.29

Firms' Satisfaction with Internet Service, by State, 2016



Source: Based on INEGI's ENCRIGE database.
Note: The last period an assessment of internet services was included in the survey was in 2016.

INFRASTRUCTURE FOR AGRO-INDUSTRY

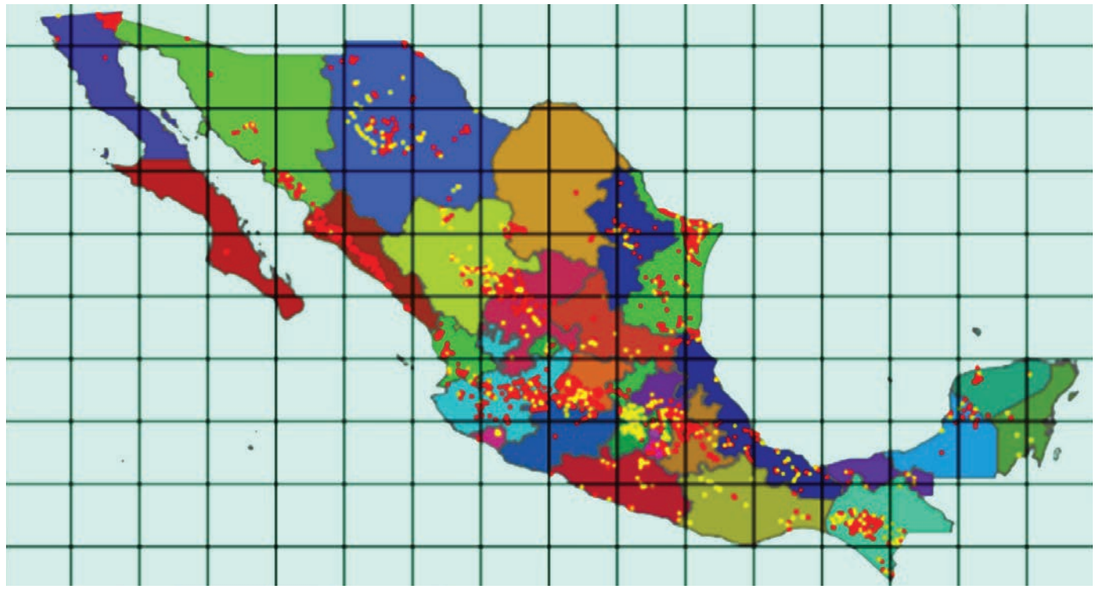
In addition to the basic infrastructure services used by all sectors, agro-industry activities use specialized infrastructure for their operation. This section provides an evaluation of the existing infrastructure for both activities at a national and state level.

For agricultural activities, the main infrastructure asset required is a grain storage facility. Map C.8 shows that there are up to 2,555 grain storage facilities in Mexico, mainly located in the states of the North and Bajío regions, as well as in the Valley of Mexico, which covers Mexico City. From this total, up to 462 are inactive, which means that only 2,093 operate at national level. Baja California Sur, Coahuila, and Querétaro are the only states with no inactive facilities.

Figures C.30 and C.31 show that Chiapas has the highest number of active and inactive facilities of the selected states, with 101 active and 38 inactive. Guerrero has almost the same number of active as inactive facilities, with 27 and 22, respectively. Yucatán has 24 active facilities and only 2 inactive. Oaxaca, on the other hand, has more inactive facilities than active ones, with 14 inactive and only 7 actives.

MAP C.8

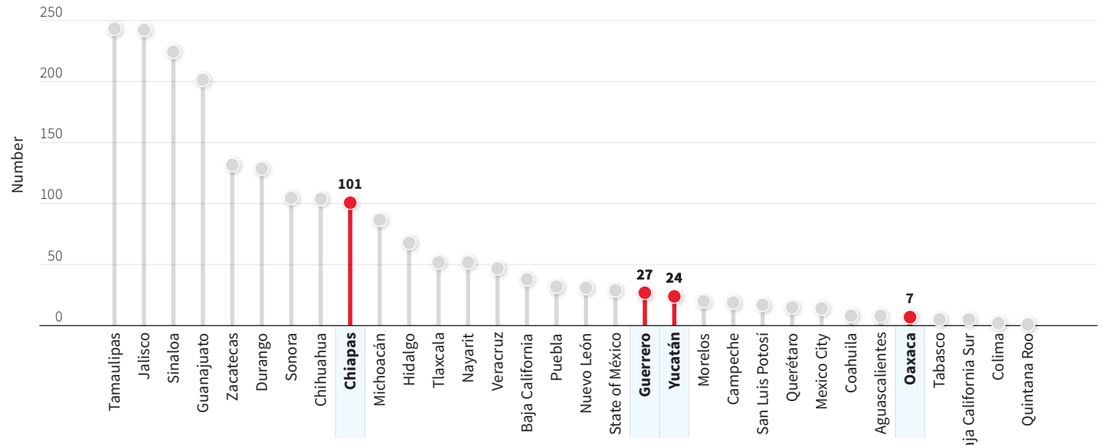
Location of Grain Storage Facilities in Mexico, 2018



Source: WBG, IDB, FAO, and ASERCA 2018.

FIGURE C.30

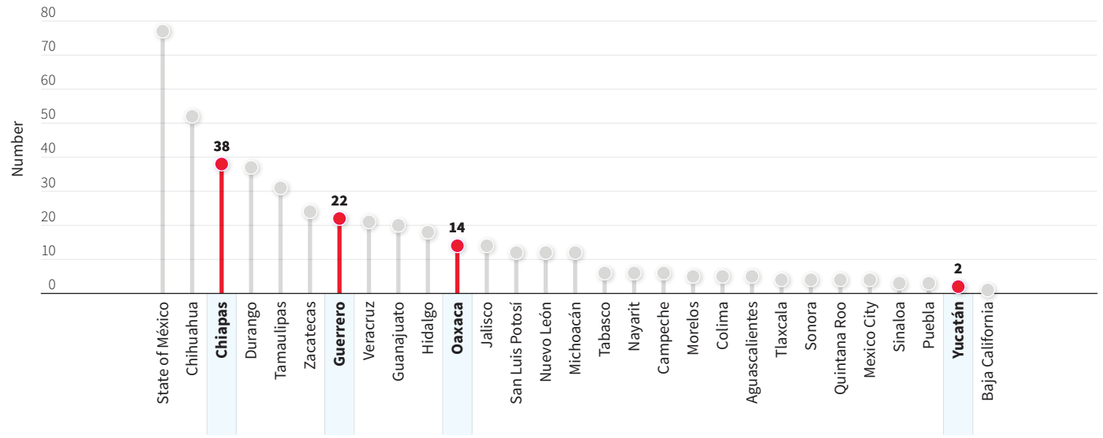
Number of Active Grain Storage Facilities, by State, 2018



Source: WBG, IDB, FAO, and ASERCA 2018.

FIGURE C.31

Number of Inactive Grain Storage Facilities, by State, 2018



Source: WBG, IDB, FAO, and ASERCA 2018.

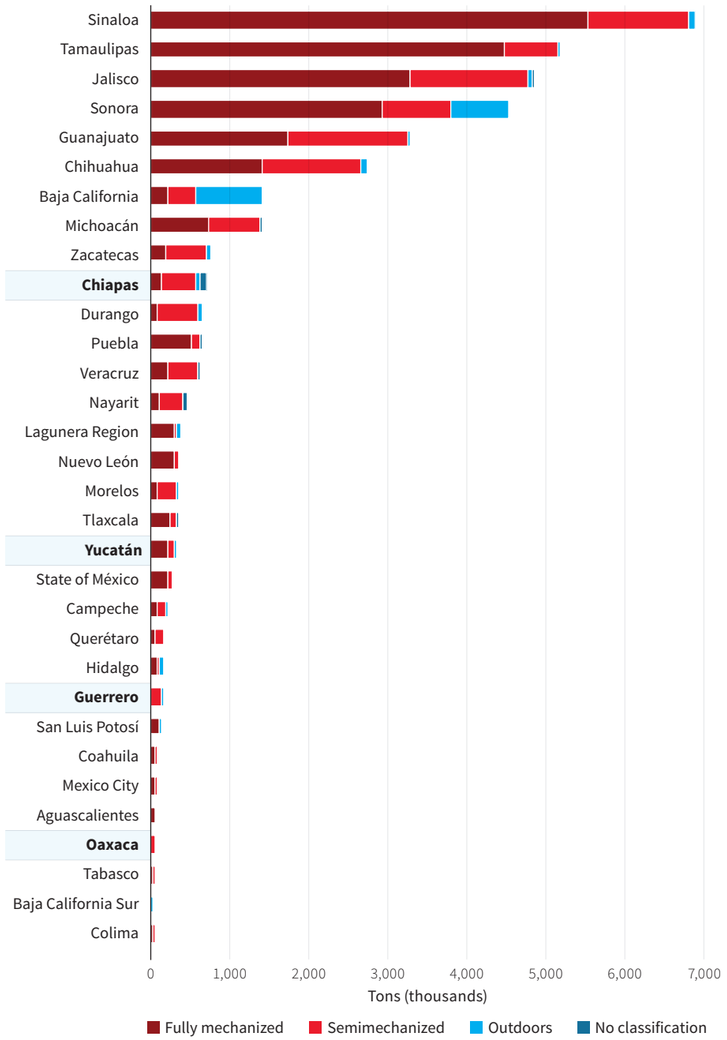
At the national level, grain storage facilities have a total capacity of 39.8 million tons. Fully mechanized facilities represent 62 percent of total capacity (24.7 million tons), semimechanized account for 32 percent (12.7 million tons), and outdoors facilities make up 5 percent (2 million tons).[95] Figure C.32 shows that Oaxaca has a storage capacity of about 47,000 tons, but only semimechanized grain storage facilities. Guerrero has a storage capacity of around 137,000 tons, mostly semimechanized and outdoors facilities. Yucatán has a storage capacity close to 313,000 tons, with fully and semimechanized grain storage facilities.

Chiapas has the highest capacity of the selected states, with around 722,000 tons for all types of storage.

In comparison to their grains production volume, the grain storage capacity is highly insufficient in three of the selected states. Figure C.33 shows that Oaxaca has the highest difference, with less than 1 percent of storage capacity compared to its grains production. Guerrero has a storage capacity of less than 10 percent and Chiapas has less than 50 percent. Only Yucatán has a storage capacity that fulfills its grains production, but the grain silos are underused. A lack of appropriate conditions in grain storage facilities to guarantee its operation could represent a constraint for developing efficiently the sector in the selected states. Additionally, according to an impact evaluation by the World Bank (2018), many of the inactive facilities belong to ejidos (or communal land) and individuals, which have little incentive to maintain them in operating conditions.

FIGURE C.32

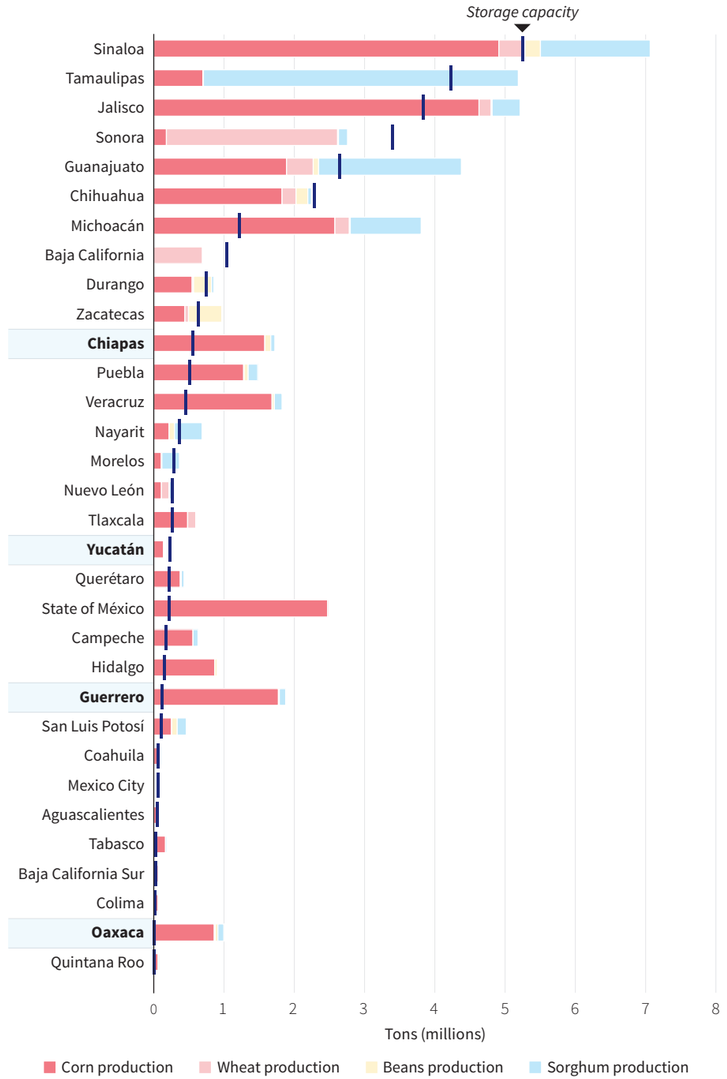
Storage Capacity of Grain Silos, by State, 2018



Source: WBG. IDB. FAO. and ASERCA.

FIGURE C.33

Grains Production Volume and Grain Silos Storage Capacity, by State, 2018



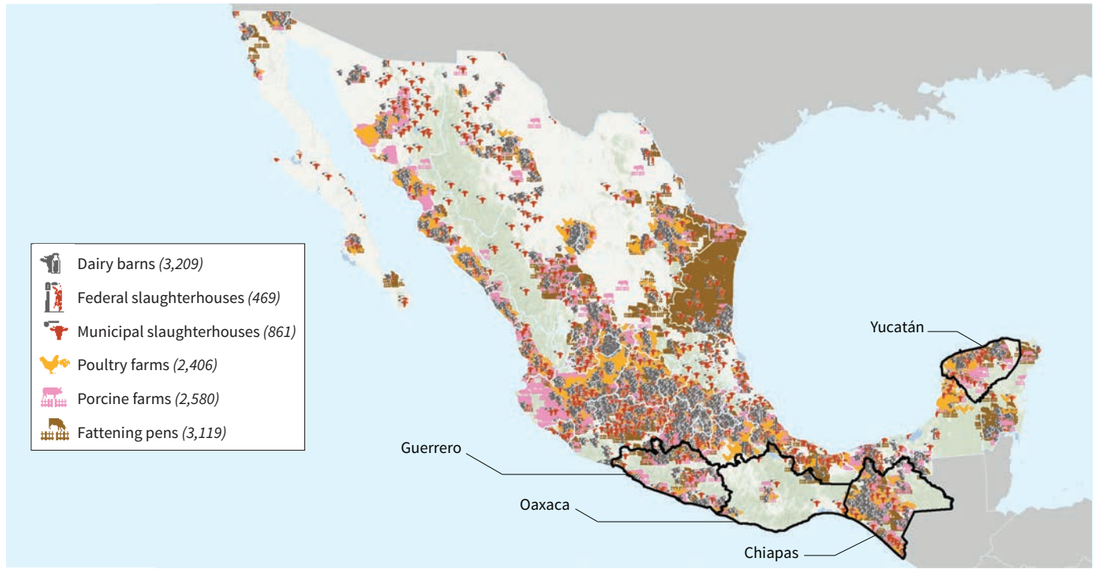
Source: WBG. IDB. FAO. and ASERCA 2018.

For livestock activities, various infrastructures are considered, such as dairy barns, federal and municipal slaughterhouses, poultry and porcine farms, and fattening pens. Map C.9 shows that for dairy barns, Oaxaca is the selected state with the least, less than 10; Guerrero and Yucatán have between 10 and 20. That similar distribution occurs with fattening pens. Regarding poultry farms, Chiapas and Yucatán have more than 20; Guerrero has less than 10, and Oaxaca has none.

Regarding slaughterhouses, there are up to 1,330 at the national level, in which 469 (35 percent) are *Tipo Inspección Federal* (Federal Inspection Type; TIF) facilities. A TIF certification ensures that the facility where the livestock product was slaughtered, stored, or processed undergoes permanent sanitary inspections to fulfill all requirements from the *Secretaría de Salud* (Secretariat of Health) and the *Secretaría de Agricultura y Desarrollo Rural* (Secretariat of Agriculture and Rural Development), achieving the highest quality standard for trading livestock products domestically and internationally. The other 861 (65 percent) slaughterhouses are known as rastros municipales (*Tipo Inspección de la Secretaría de Salud*; TSS), which mainly focus on the domestic trade of livestock products, with inspections only from the health authorities.

MAP C.9

Location of Livestock Infrastructures, 2019

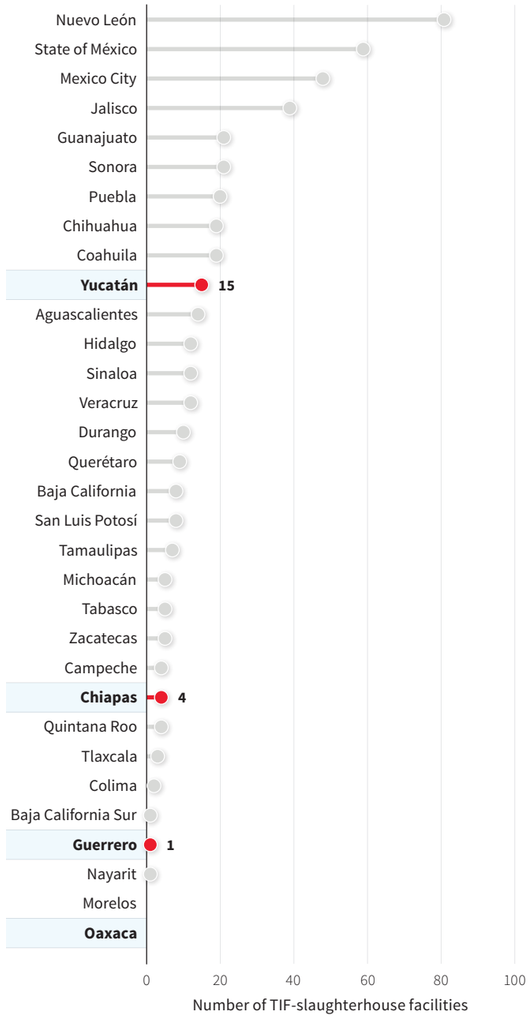


Source: SIAP 2019.

Among the selected states, Yucatán has the highest number of TIF slaughterhouses, with 14, followed by Chiapas (4), and Guerrero (1). Oaxaca is the only one with no TIF slaughterhouses (figure C.34). On the side of TSS slaughterhouses, Guerrero has 47 facilities, while Chiapas has 41, Yucatán has 21 and Oaxaca only has 11 (figure C.35). Figure C.36 shows that the slaughterhouses of the selected states represent only 10.2 percent of the total capacity for slaughtering livestock at national level.

FIGURE C.34

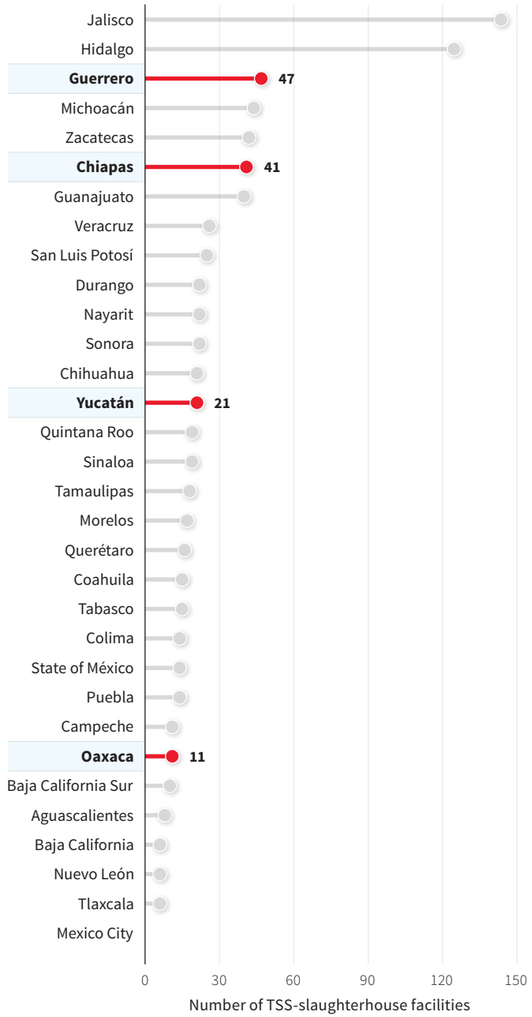
Number of TIF Slaughterhouses Facilities, by State, 2018



Source: SENASICA-SADER 2020.
Note: TIF = *Tipo Inspección Federal* (Federal Inspection Type).

FIGURE C.35

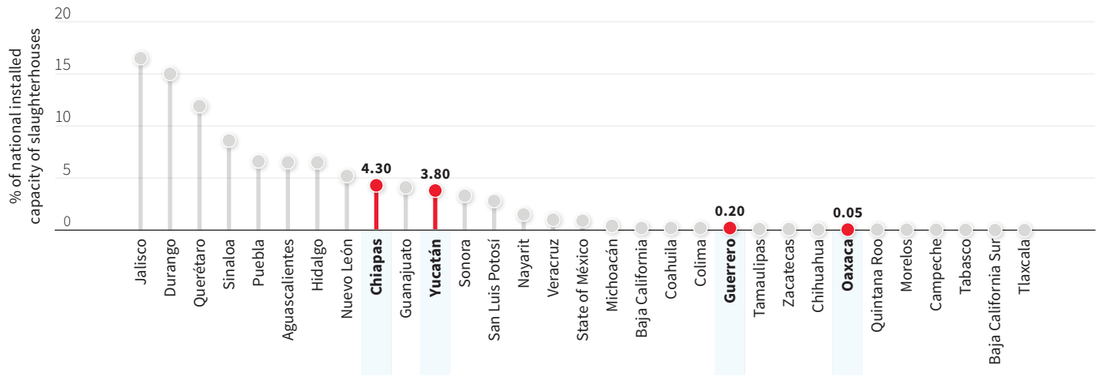
Number of TSS Slaughterhouses Facilities by State, 2018



Source: SENASICA-SADER 2020.
Note: TSS = *Tipo Inspección de la Secretaría de Salud*.

FIGURE C.36

Percentage of National Installed Capacity of Slaughterhouses, by State, 2019

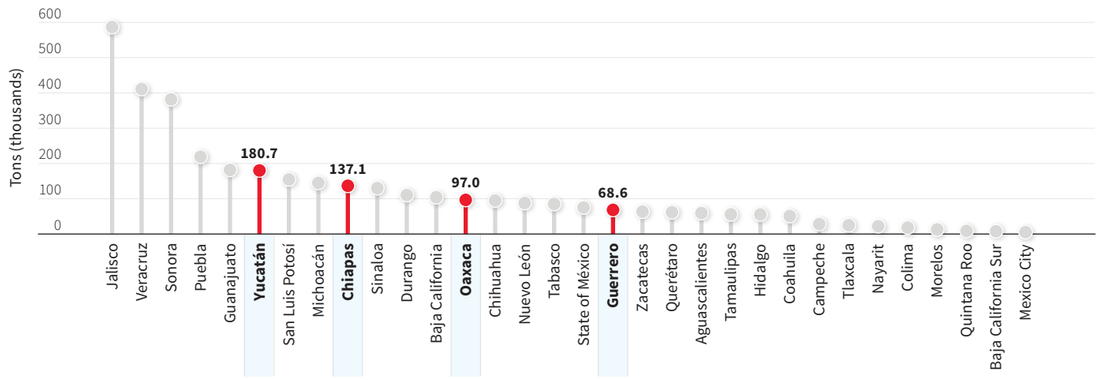


Source: SIAP 2019f.
Note: The calculation excludes Mexico City.

Figure C.37 shows that Yucatán and Chiapas are among the top 10 meat producers in Mexico. Additionally, figure C.38 reveals that Chiapas, Oaxaca, and Yucatán are among the top 10 in terms of livestock processing, measured by the number of slaughtered heads. Furthermore, figure C.39 shows that, among the selected states, Yucatán contributes the highest percentage of the total number of livestock (ovine, porcine, goat, bovine) slaughtered at the national level, at 5.8 percent, followed by Oaxaca at 3.4 percent, and Chiapas and Guerrero at 2.8 and 2.3 percent, respectively. This suggests that these states require a higher number of these facilities, especially Oaxaca whose difference between shares of production and installed capacity is 67 times, and notably has no TIF slaughterhouses.

FIGURE C.37

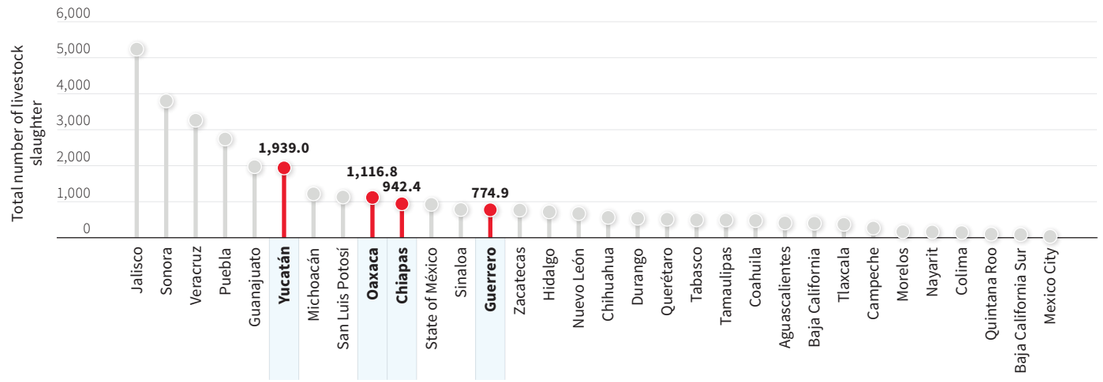
Meat Production Volume, by State, 2019



Source: SIAP 2019g.
Note: Meat includes ovine, porcine, goat, and bovine.

FIGURE C.38

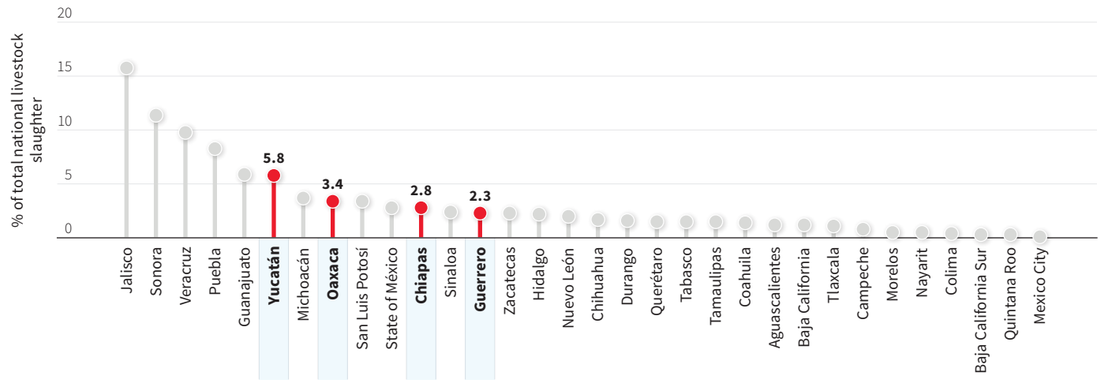
Number of Livestock Slaughtered, by State, 2019



Source: SIAP 2019g.
Note: Livestock includes ovine, porcine, goat, and bovine.

FIGURE C.39

Percentage of National Total Livestock Slaughtered, by State, 2019



Source: Calculations based on data from SIAP 2019g.
Note: Livestock includes ovine, porcine, goat, and bovine.

GEOGRAPHIC CONDITIONS

This section presents a qualitative analysis of the natural conditions and potential risks that could threaten the development of the agro-industry sector in the selected states. The natural conditions include topography, climate, and soil predominance, as well as ecological and environmental management plans. For potential risks include seismicity, risks of hurricanes, fires, floods, and droughts.

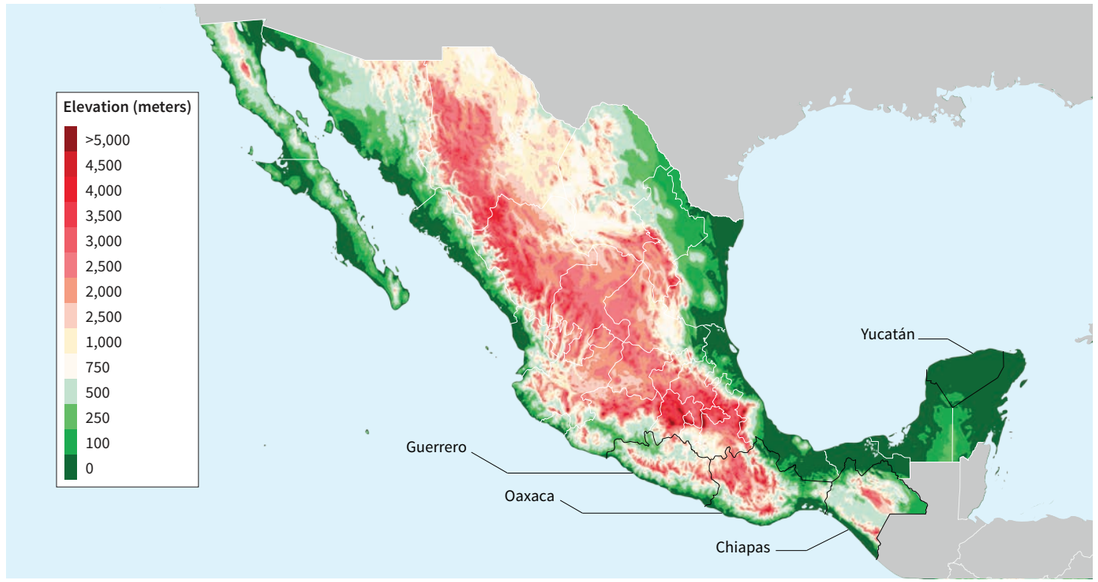
NATURAL CONDITIONS

The topography of the selected states is quite diverse. In Guerrero and Oaxaca, there is a highly rugged area, with high mountains part of the Sierra Madre del Sur. The mountain system extends from the western region of Guerrero to eastern Oaxaca. It divides the coastal regions of both states with the regions near the Valley of Mexico. Oaxaca also has a flat region in the Isthmus of Tehuantepec, which connects Oaxaca to Veracruz on the east, as well as the shortest distance of the country between its western and eastern coasts. Chiapas also has a mountain system, the Sierra Madre de Chiapas. Yucatán, on the other hand, is mostly flat, with no significant changes in its topography within all its territory (map C.10).

Regarding climate conditions, Yucatán and the coastal regions of Chiapas and Oaxaca, as well as most of Guerrero's territory have subtropical weather conditions. Chiapas has a tropical region in the north and a region with mild weather in San Cristóbal de las Casas. Mild weather also exists in the north of Oaxaca, while the central part has predominantly dry weather (map C.11).

MAP C.10

Mexico's Topography, 2015



Source: Based on SEMARNAT's *Atlas Digital Geográfico.*

Weather conditions do not represent a particular constraint for the development of agro-industry in the selected states. However, the ripped topography could be a constraint for developing infrastructure in the mountainous parts of these states.

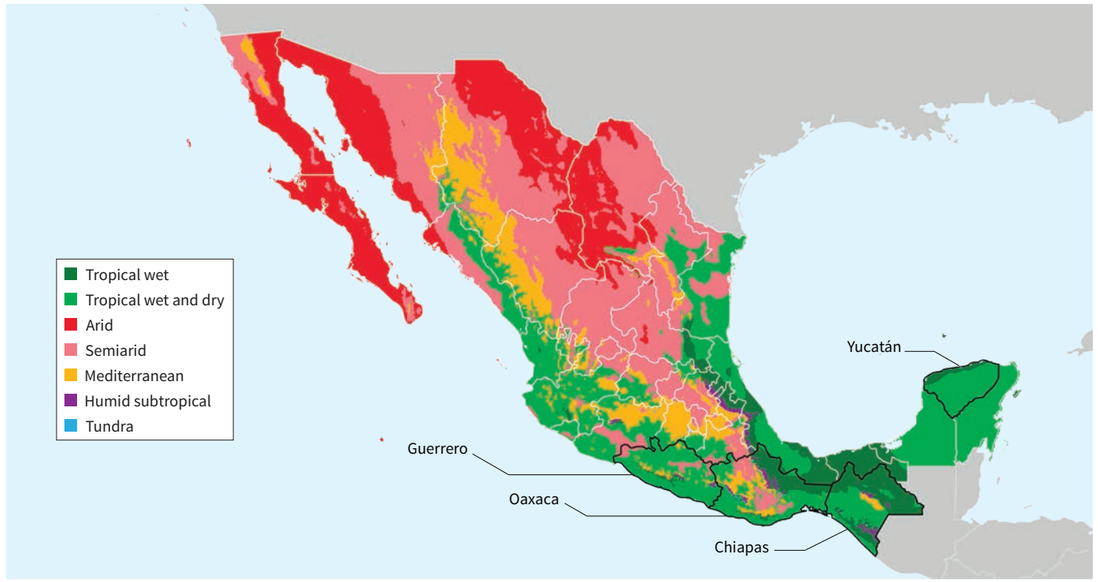
Map C.12 shows that most of the selected states' territories have clayish and silty soils, which are optimal for the development of agriculture activities. The coastal regions of Oaxaca and Guerrero have sands that could reduce the productivity of agriculture. On another note, Chiapas, Oaxaca, and Yucatán have ecological management plans (see map C.13) for regulating the use of land to avoid any environmental impact to the regions. This could result in a longer period for getting permits to start projects, which could be a potential constraint for any industry to install.

Map C.14 shows that agricultural systems in the selected states are focused on just a few regions. The coastal and northern regions of Chiapas, some coastal regions of Guerrero and Oaxaca, and the northern region of Yucatán are dedicated to pasture cultivations, while seasonal agriculture is spread around all the states. Map C.15 shows that Yucatán has a considerable level of soil degradation, mainly for agriculture activities. Chiapas has a noticeable level of deforestation, mainly in the central-northern region. Nonetheless, soil degradation does not seem to be a particular constraint for agro-industry development in the selected states.

Map C.16 presents land uses and vegetation in the selected states. Guerrero has mainly forest vegetation in the mountain regions of the state, and few trop-

MAP C.11

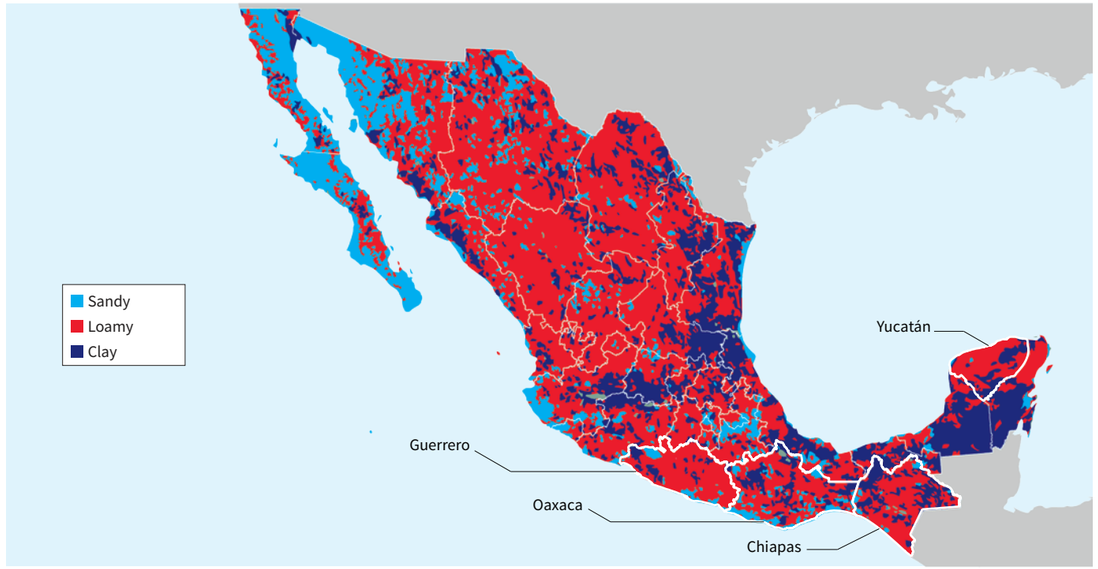
Mexico's Climate, 2015



Source: Based on SEMARNAT's *Atlas Digital Geográfico.*

MAP C.12

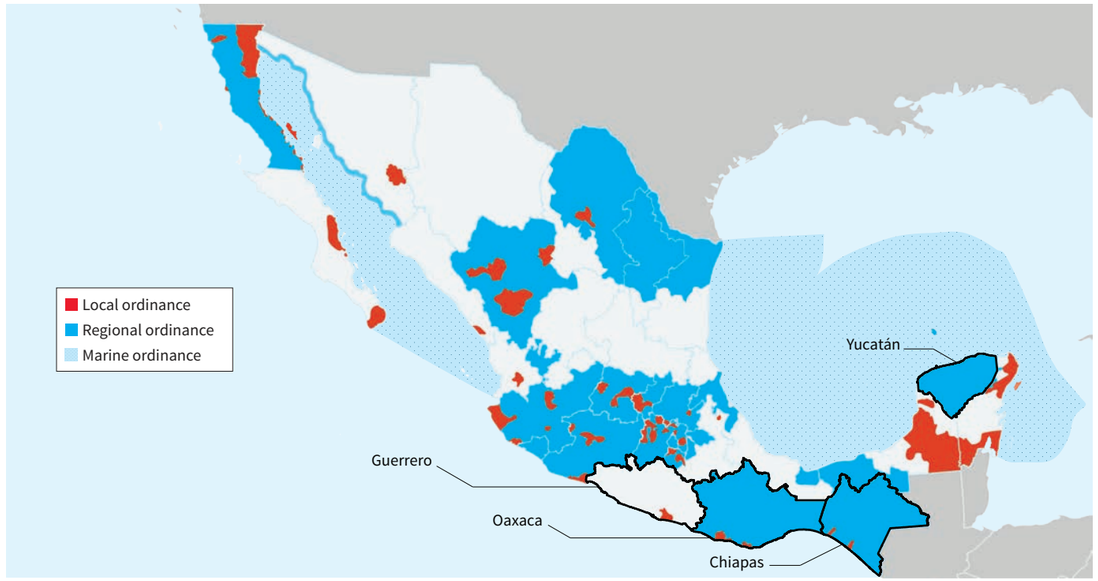
Soil Predominance in Mexico, 2015



Source: CONAFOR 2020a.

MAP C.13

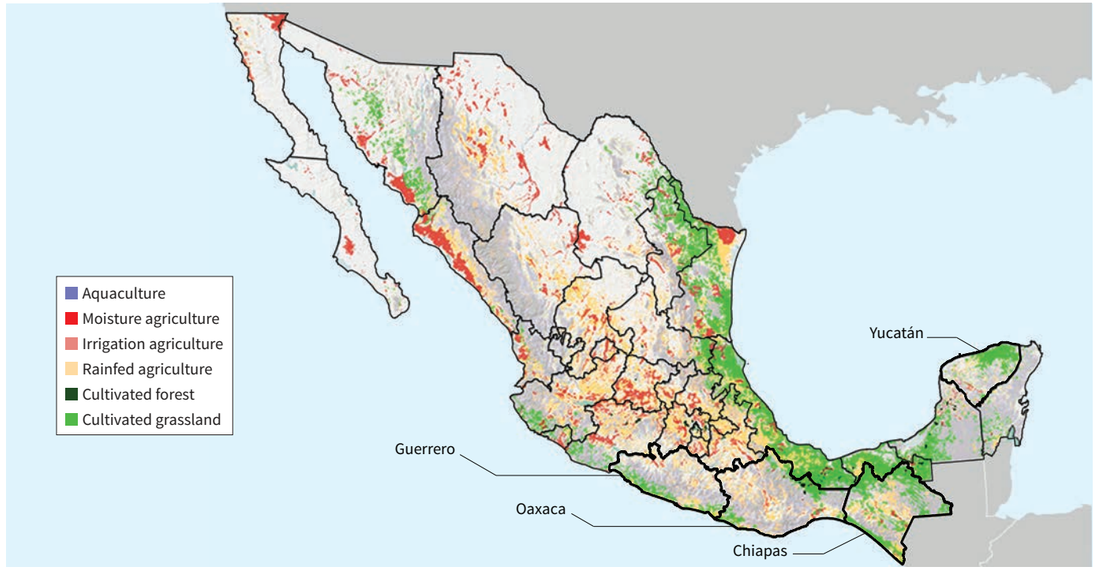
Areas with Ecological and Environmental Management Plans in Mexico, 2015



Source: SEMARNAT 2015.

MAP C.14

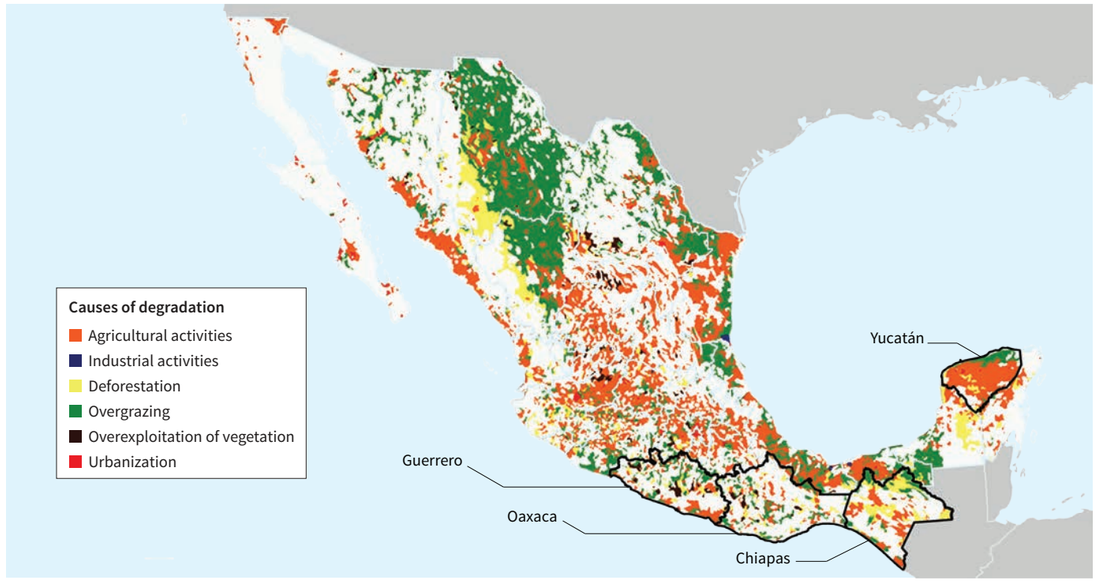
Agricultural Systems in Mexico, 2015



Source: SEMARNAT 2015.

MAP C.15

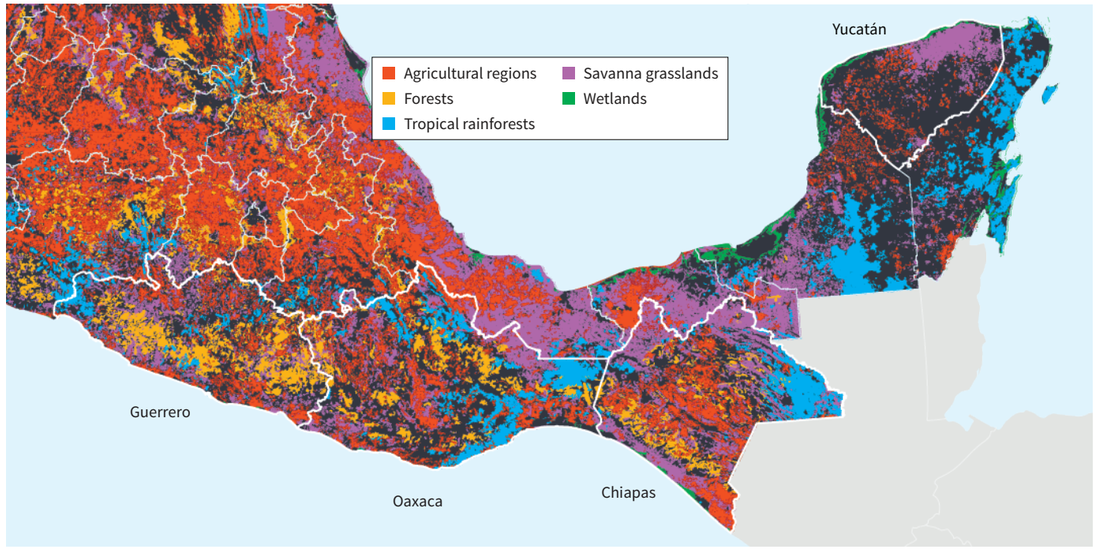
Areas Affected by Soil Degradation in Mexico, 2015



Source: SEMARNAT 2015.

MAP C.16

Land Uses in Selected States, 2015



Source: Based on data from INEGI 2017.
Note: The map is a simplified version.

ical rainforests in the north and west region of it. Chiapas has a forest region, mainly in the Frailesca region, tropical rainforest region in the east (Selva Lacandona), and savanna and grassland in the coastal and top north regions. Oaxaca has mainly tropical rainforest vegetation in the east and southeast regions of the state and low forest vegetation in the mountain regions. Yucatán stands out for mainly having savanna grassland, especially in the northeast region of the state. The selected states have several protected areas.[96] As map C.17 shows, Chiapas has the largest number of protected areas, mainly in the Frailesca and Selva Lacandona regions. Oaxaca has a protected area in the Mixteca region, north part of the state. Guerrero and Yucatán only have some protected regions in coastal and mountain parts. Protected areas allow some economic activities within them. However, they are restricted to only preservation and conservation activities with proven sustainable practices.

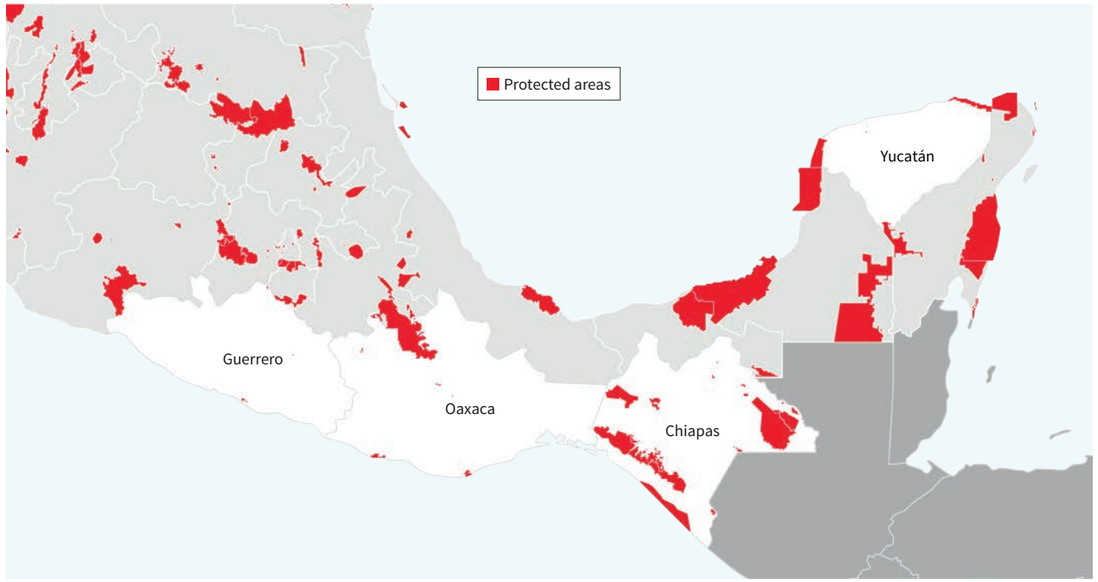
RISKS BY REGION

Map C.18 shows that Chiapas, Guerrero, and Oaxaca have the most seismic regions in the country, since the northern border of the Cocos Plate extends through the coastal line of these states. The seismic risk is very high in the coastal regions of these states (zone D) and high in the rest of the states' territory (zone C). Only Yucatán has a low risk of earthquake of the selected states.

In addition to the risk of earthquake for the selected states, intensity is a relevant aspect to consider. As map C.19 shows, intensity is high in the coastal regions of Chiapas, Guerrero, and Oaxaca (ranging from VIII to XI on a scale of

MAP C.17

Protected Areas in Selected States, 2019



Source: CONANP 2019.

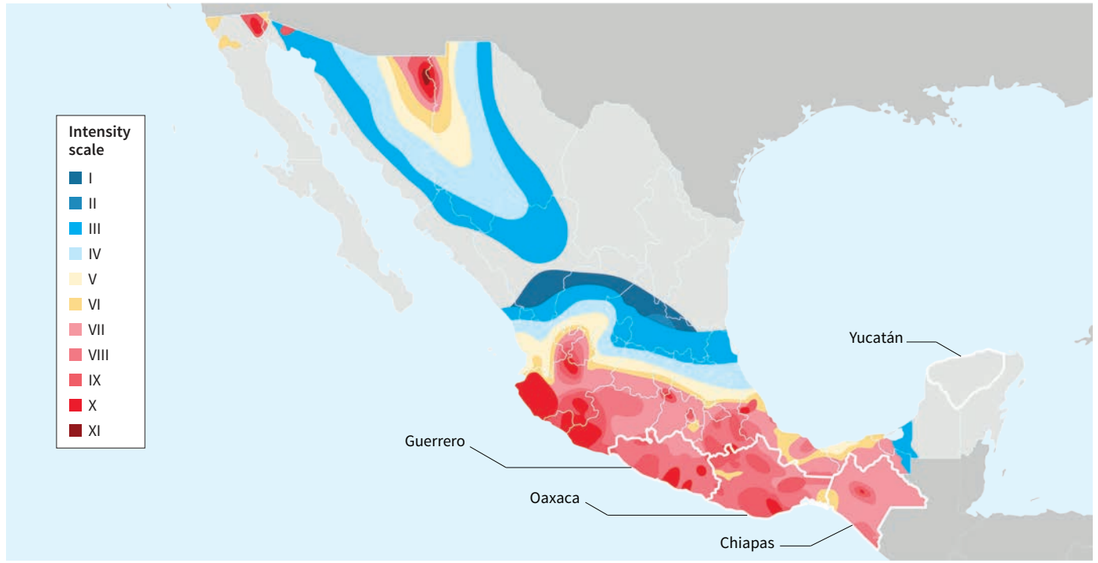
MAP C.18

Seismic Regionalization in Mexico, 2015

Source: Based on CENAPRED's *Sistema de Información Sobre Riesgos*, http://www.atlasnacionalderiesgos.gob.mx/archivo/visor-capas.html.

MAP C.19

Intensity of Earthquakes in Mexico, 2017



Source: Based on CENAPRED's *Sistema de Información Sobre Riesgos.*
Note: Intensity levels range from I (lowest) to XI (highest).

I–XI). Yucatán has no intensity. Construction projects in high intensity areas require a higher investment for design that comply with code requirements to minimize the impact of earthquakes on any structure.

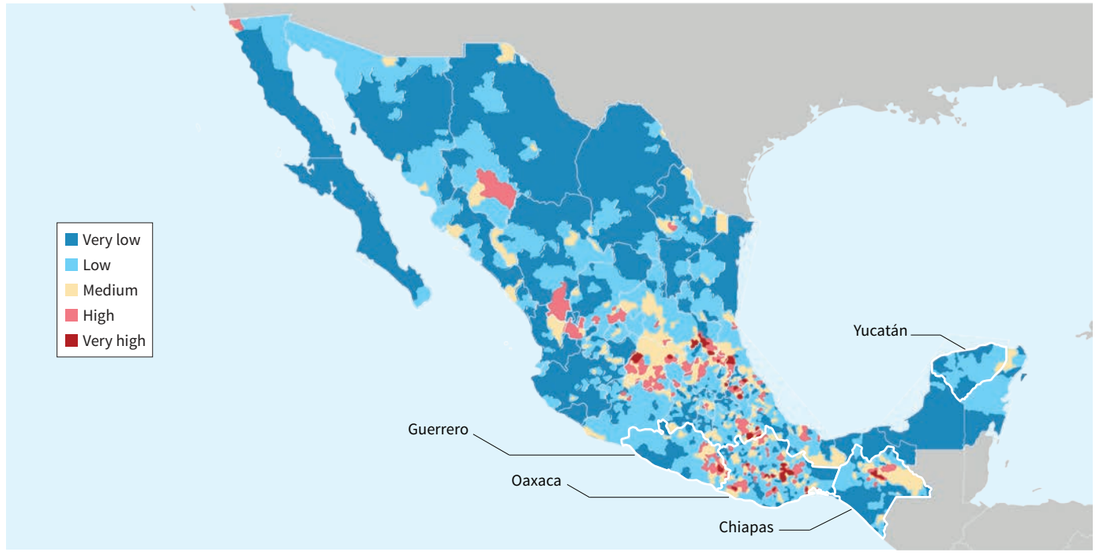
Another risk to consider for agriculture activities is the risk of drought and flood. As shown in map C.20, risks of droughts are low in all the selected states, with only a small region with high risk in the north of Chiapas.

The risk of floods is potentially higher than that of droughts, especially in Yucatán (since it is a flat region). Map C.21 shows that floods are mildly riskier in the coastal regions of Chiapas, Guerrero, and Oaxaca. However, it would not constrain the economic development in the selected states, especially if adaptation measures are implemented.

Regarding the potential risks for storms and hurricanes, map C.22 indicates that all the selected states face the risk of being impacted by a tropical storm impact. The southern coast of Chiapas and the region of Huatulco in Oaxaca are particularly susceptible, with a probability ranging between 0.66 and 1.00. The remaining coasts in the selected states have a probability below 0.6. When considering category 1 and 2 hurricanes, the coasts of the selected states have a probability between 0 and 0.167 of being impacted. However, there is a slightly higher risk in Chiapas and the Istmo region of Oaxaca, where the probability ranges from 0.168 to 0.5. For category 3, 4, and 5 hurricanes, the probability reduces significantly, falling below 0.077 for all states. Therefore, the potential risk from hurricanes does not represent a particular constraint for economic development in the selected states.

MAP C.20

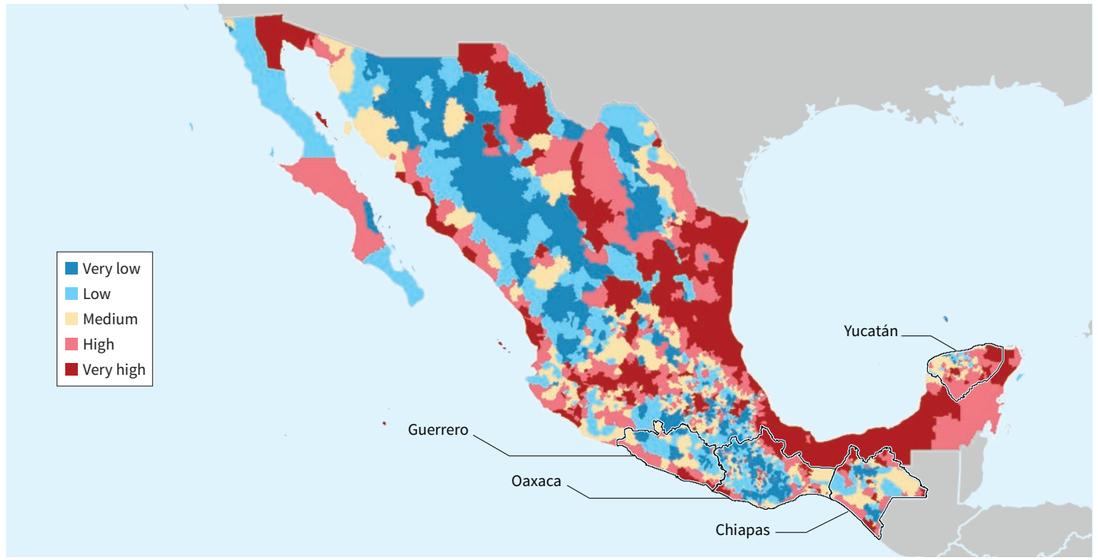
Risk of Drought in Mexico, 2017



Source: Based on CENAPRED's *Sistema de Información Sobre Riesgos.*
Note: The map presents qualitative data.

MAP C.21

Risk of Floods in Mexico, 2017



Source: Adapted from CENAPRED's *Sistema Nacional de Información Sobre Riesgos.*
Note: The map presents qualitative data.

MAP C.22

Risk for Storms and Hurricanes in the Selected States, 2017

a. Tropical storm

b. Category 1 hurricane

c. Category 2 hurricane

d. Category 3 hurricane

e. Category 4 hurricane

f. Category 5 hurricane

Source: Adapted from CENAPRED's *Sistema Nacional de Información Sobre Riesgos*.
Note: Hurricane wind speeds are classified into five categories according to the Saffir-Simpson Hurricane Wind Scale. A category 1 hurricane has wind speeds ranging from 119 to 153 kilometers per hour (km/h), often causing minimal damage. Category 2 hurricanes exhibit wind speeds from 154 to 177 km/h, resulting in moderate damage. The wind speeds of a category 3 hurricane, which is considered to cause extensive damage, range from 178 to 208 km/h. Category 4 hurricanes have wind speeds between 209 and 251 km/h and can cause severe damage. Finally, a category 5 hurricane, which can cause catastrophic damage, has wind speeds of 252 km/h or higher.

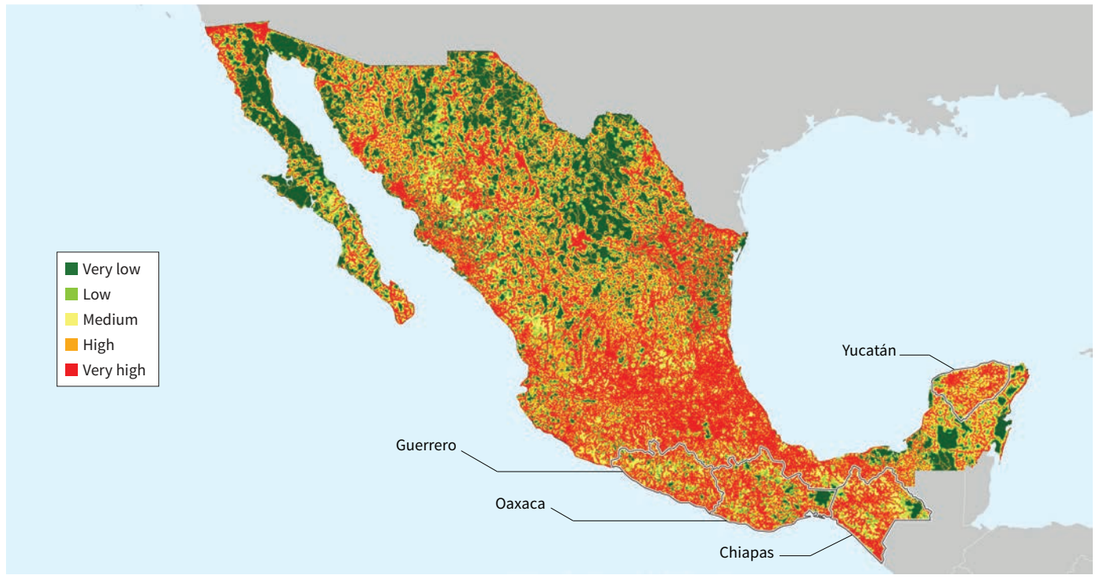
The risk of forest fires caused by human activities increases in the regions with higher population density. In the selected states, map C.23 shows that the risk of occurrence is high to very high mainly in Guerrero. In Oaxaca and Chiapas, the risk is similar, only with two regions with very low risk (Chimalapas in both states and Selva Lacandona in Chiapas). For Yucatán, the risk of fires is also high to very high across the state.

Among the selected states, figure C.40 shows that there is a higher probability of a forest fire occurring in Chiapas, Guerrero, and Oaxaca. On average, Chiapas had the highest number of forest fires registered each year between 2010 and 2021 (333), followed by Oaxaca (249) and Guerrero (192). In contrast, Yucatán registered only 47 fires on average during the same period.

Map C.24 presents the geographical distribution of risks of plague of parasite insects and plants. In this regard, all selected states but Yucatán present a high to very high risk of these plagues in their regions. According to CONAFOR (2020), the states that present a higher surface with high and very high risk for plagues are Chiapas, Chihuahua, Durango, Guerrero, Jalisco, Michoacán, and Oaxaca. Having no control of these plagues could represent a constraint for efficiently developing agricultural and forestry activities.

MAP C.23

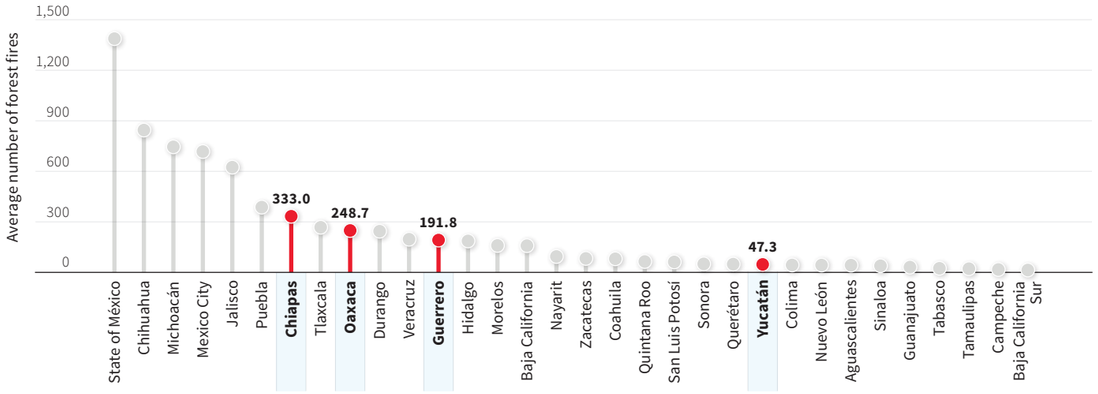
Risk of Human-Caused Forest Fire Occurrence in Mexico, 2020



Source: Based on CENAPRED's *Sistema de Información Sobre Riesgos*.

FIGURE C.40

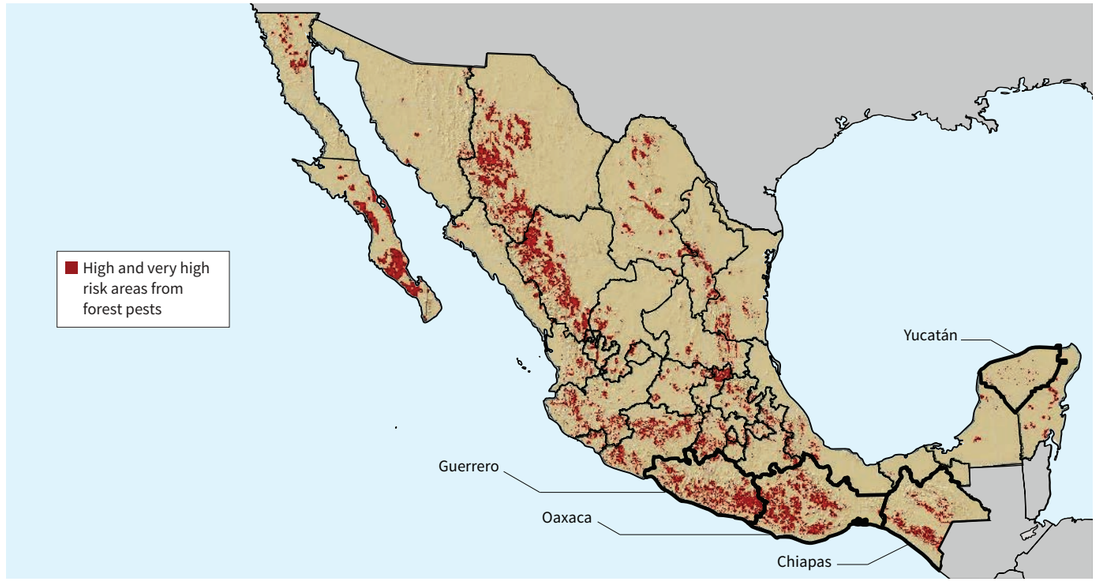
Average Number of Forest Fires Occurred Every Year, by State, 2010–21



Source: Based on data from SEMARNAT's SNIARN database.

MAP C.24

High Risk Regions for Outbreaks of Forest Pests and Parasitic Plants in Mexico, 2020



Source: CONAFOR 2020a.

APPENDIX D

Factor Intensity in the Agro-Industry Sector

To identify infrastructure-related constraints hindering the development of agro-industry in the selected states, an analysis of key input utilization in the production process is conducted. The analysis encompasses the use of energy (electricity), water, combustibles, logistics (freight), and telecommunications, and contrast the results with the availability of each input (see appendix C).[97]

Using firm level data, the analysis measures the performances of various manufacturing activities at the national level on two metrics of factor usage intensity: (1) consumption or expenditure of a factor as a percentage of intermediate consumption and (2) consumption or expenditure of a factor as a percentage of value added. If a sector requires one of the factors in which the state has deficiencies, this could be a binding constraint.

Two benchmarks to reflect the intensity of factor usage were considered. The first is the national average for all existing manufacturing activities. The second is the average of manufacturing activities in which a selected state has a revealed comparative advantage greater than one (a competitive sector in that state). Following the methodology by Barrios and others (2018a; 2018b), the classification of factor intensity has defined four categories: (1) high intensity, for industry groups with a dependence of the factor higher than the sum of the national average and half a standard deviation for both metrics (dark blue quadrant); (2) mid-high intensity, for industry groups with a dependence of the factor higher than the sum of the national average and half a standard deviation in one of the metrics (medium-dark blue quadrant); (3) mid-low intensity, for those groups with a dependence of the factor below half standard deviation of national average in both or one of the metrics, but with the other metric below

the sum of the national average half a standard deviation (medium-light blue quadrant); (4) low intensity, for those industry groups with a factor below the difference of the national average and half a standard deviation in both metrics (light blue quadrant).

As figure D.1 shows, all agro-industry activities fall in the low and mid-low quadrants when it comes to energy intensity. Animal food manufacturing (North American Industry Classification System [NAICS] four-digit product code 3111), sugar and confectionery product manufacturing (3113), animal slaughtering (3116), other food manufacturing (3119), and beverage manufacturing (3121) fall in the low intensity quadrant. The remaining activities, grain and oilseed milling (3112), fruit and vegetable preserving and specialty food manufacturing (3114), dairy product manufacturing (3115), seafood product preparation and packaging (3117), and bakeries and tortilla manufacturing (3118) fall in the mid-low intensity quadrant, with similar values in both metrics.

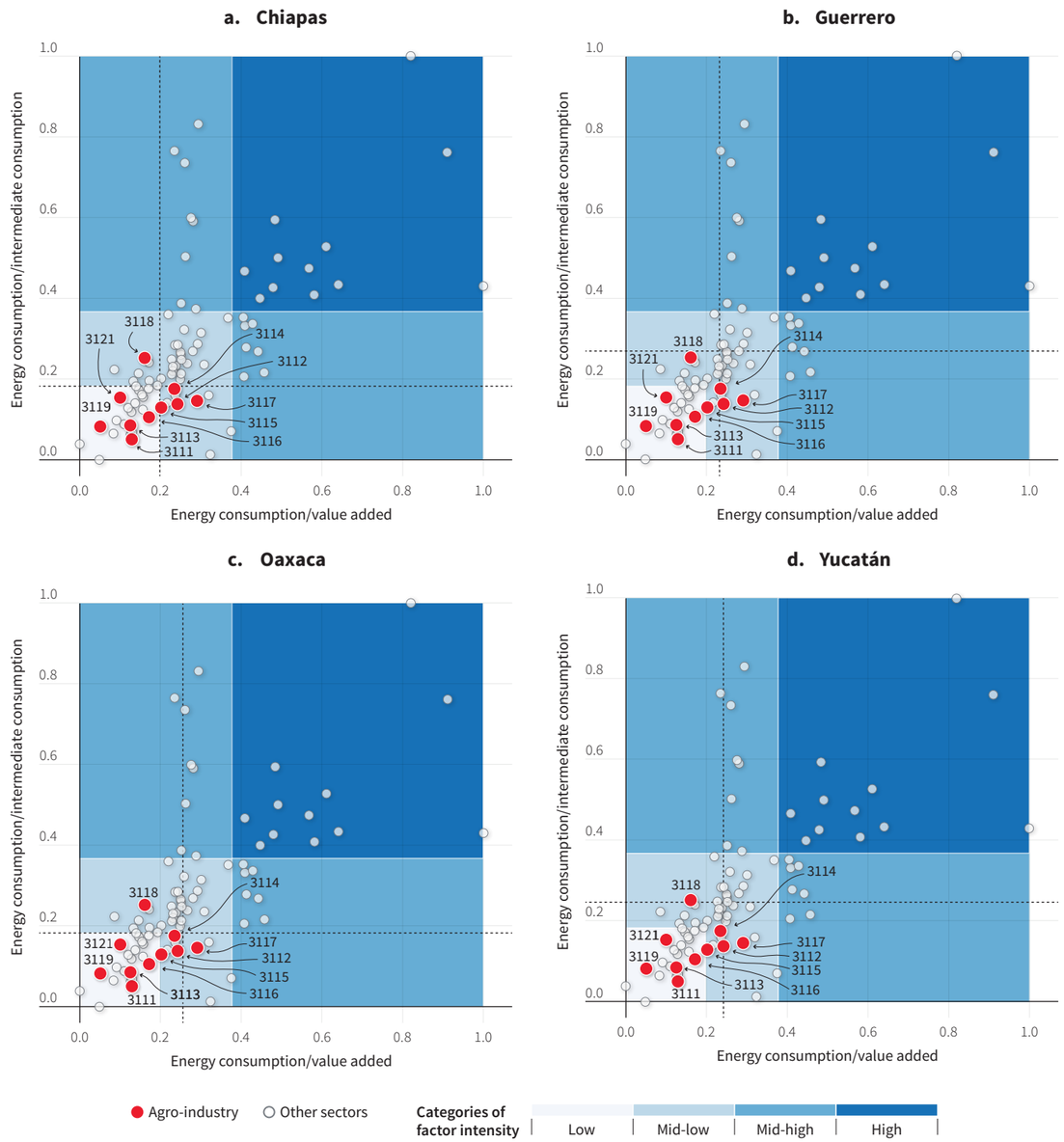
This analysis indicates that almost all agro-industry activities are lower or very similar to other industries in which the selected states have a comparative advantage. The exceptions are activities 3117 and 3118, which show higher energy intensity in at least one metric across these states. In terms of energy consumption as a percentage of intermediate consumption, Guerrero and Yucatán seem to have higher metrics. Despite the slight variances in energy consumption, all activities with a comparative advantage fall in the mid-low intensity quadrants. Thus, given that these activities have low energy consumption requirements, energy infrastructure is discarded as a binding constraint.

Figure D.2 shows that the water intensity of agro-industry activities is heterogeneous. Activities such animal food manufacturing (3111) and animal slaughtering (3116) have low intensity, while others like seafood product preparation and packaging (3117) and beverage manufacturing (3121) show high intensity. The majority of the activities, including rain and oilseed milling (3112), sugar and confectionery product manufacturing (3113), fruit and vegetable preserving and specialty as manufacturing (3114), dairy product manufacturing (3115), bakeries and tortilla manufacturing (3118), and other food manufacturing (3119) fall in the mid-low intensity quadrant. As described in appendix C, the selected states have sufficient water available (superficial and groundwater), except for some regions in northern Guerrero, which also has higher cost of water per volume produced and a low firms' satisfaction for water services. Oaxaca may also have a constraint regarding water as an input, because it has the highest cost per volume produced and the highest cost-fare relation of the four selected states. In terms of infrastructure for irrigation, among the selected states, Yucatán only has one irrigation district, which could be a constraint to expand agro-industry activities using this input.

For intensity of freight use, figure D.3 shows that only animal slaughtering (3116) and bakeries and tortilla manufacturing (3118) fall into the low intensity quadrant. Others like animal food manufacturing (3111), sugar and confectionery product manufacturing (3113), dairy product manufacturing (3115), and seafood product preparation and packaging (3117) fall into the mid-low intensity quadrant. Certain sectors, such as other food manufacturing (3119) and beverage manufacturing (3121) fall into the mid-high intensity quadrant, indicating a higher levels of freight expenditure as a percentage of intermediate

FIGURE D.1

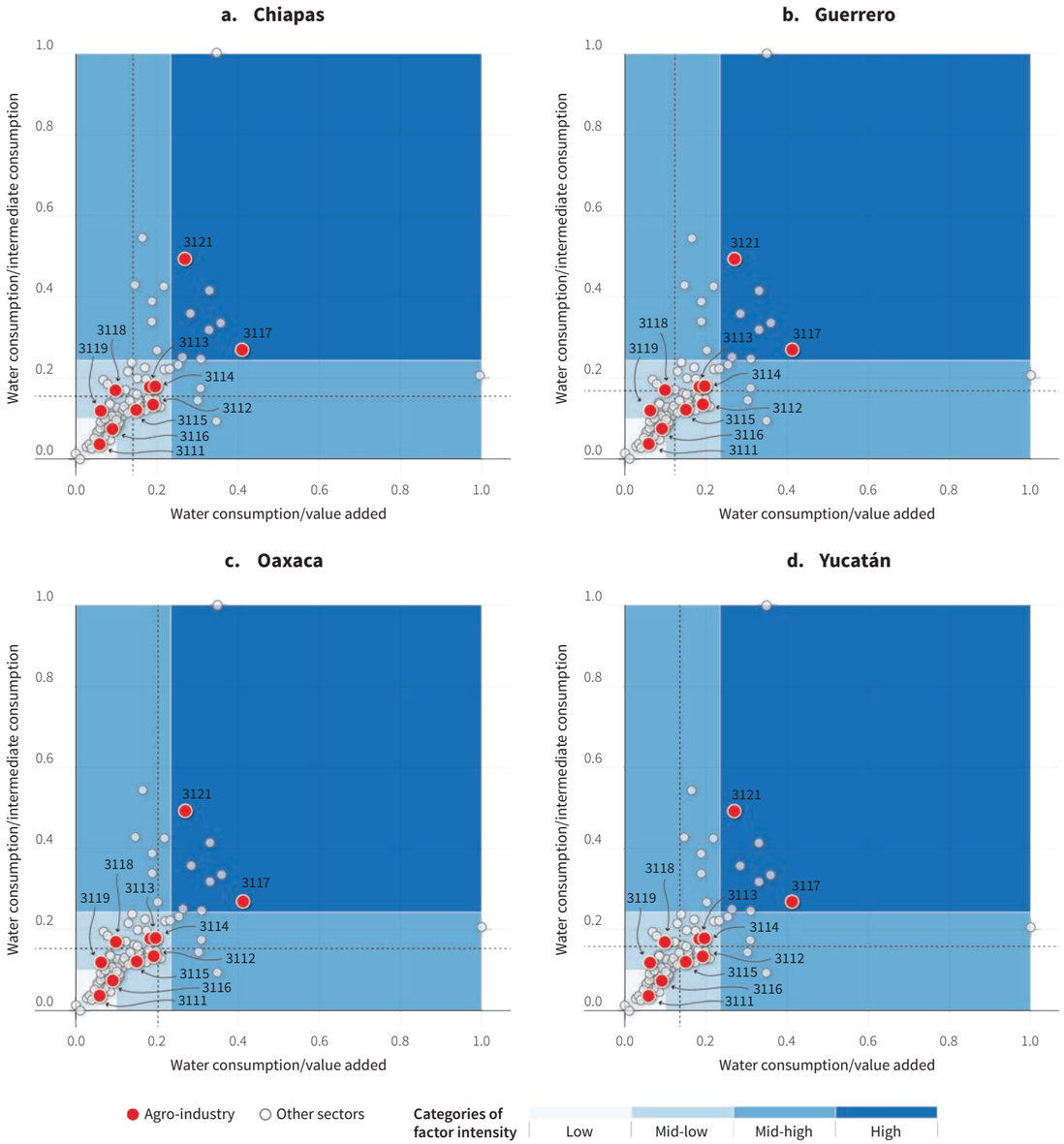
Intensity of Energy Use by Sectors, 2014 and 2019



Source: Calculations based on data from INEGI 2014; 2019.
Note: Data present averages. Sectors are classified using the North American Industry Classification System (NAICS) four-digit code. Dashed lines represent the average normalized value of sectors in each state with a revealed comparative advantage greater than one. Red points represent groups of agro-industry sectors classified under NAICS, with the exception of groups for which information is confidential. The sectors indicated by the NAICS codes where each state have a comparative advantage include: for Chiapas, those sectors were 3111, 3112, 3113, 3115, 3116, 3117, 3118, 3119, 3121, 3149, 3219, 3231, 3323, 3328, and 3371; for Guerrero, those sectors were 3115, 3118, 3121, 3131, 3141, 3149, 3152, 3159, 3169, 3219, 3259, 3262, 3273, 3279, 3323, 3371, and 3399; for Oaxaca, those sectors were 3113, 3118, 3121, 3131, 3141, 3149, 3211, 3219, 3241, 3273, and 3323; and for Yucatán, those sectors were 3111, 3112, 3116, 3117, 3118, 3121, 3131, 3141, 3149, 3151, 3152, 3159, 3169, 3219, 3261, 3273, 3279, 3323, 3332, 3333, 3353, 3366, 3371, and 3399.

FIGURE D.2

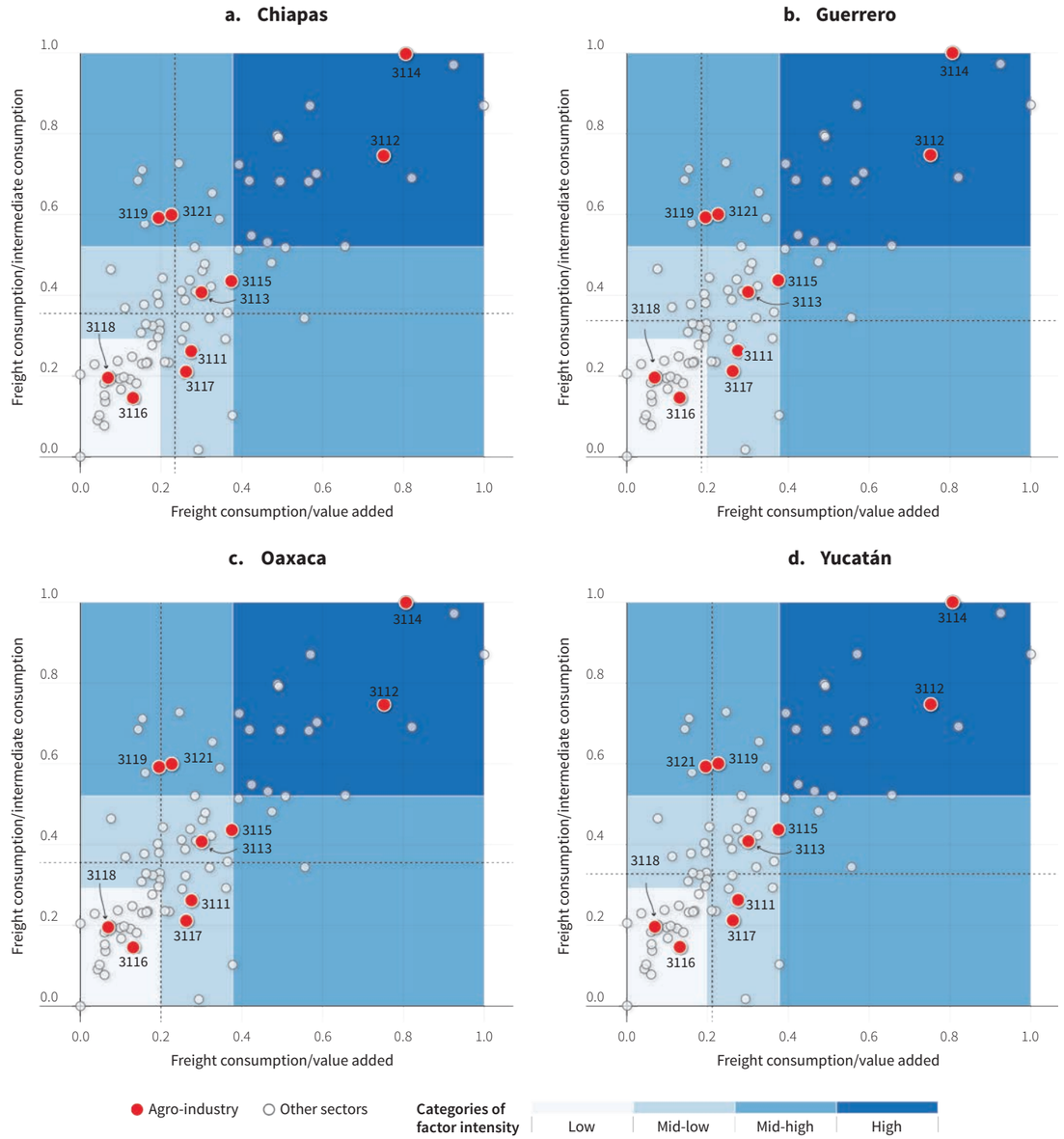
Intensity of Water Use by Sectors, 2014 and 2019



Source: Calculations based on data from INEGI 2014; 2019.
Note: Data present averages. Sectors are classified using the North American Industry Classification System (NAICS) four-digit code. Dashed lines represent the average normalized value of sectors in each state with a revealed comparative advantage greater than one. Red points represent groups of agro-industry sectors classified under NAICS, with the exception of groups for which information is confidential. The sectors indicated by the NAICS codes are those where each state have a comparative advantage. For Chiapas, those sectors were 3111, 3112, 3113, 3115, 3116, 3117, 3118, 3119, 3121, 3149, 3219, 3231, 3323, 3328, and 3371; for Guerrero, those sectors were 3115, 3118, 3121, 3131, 3141, 3149, 3152, 3159, 3169, 3219, 3259, 3262, 3273, 3279, 3323, 3371, and 3399; for Oaxaca, those sectors were 3113, 3118, 3121, 3131, 3141, 3149, 3211, 3219, 3241, 3273, and 3323; and for Yucatán, those sectors were 3111, 3112, 3116, 3117, 3118, 3121, 3131, 3141, 3149, 3151, 3152, 3159, 3169, 3219, 3261, 3273, 3279, 3323, 3332, 3333, 3353, 3366, 3371, and 3399.

FIGURE D.3

Intensity of Freight Use by Sectors, 2014 and 2019



Source: Calculations based on data from INEGI 2014; 2019.
Note: Data present averages. Sectors are classified using the North American Industry Classification System (NAICS) four-digit code. Dashed lines represent the average normalized value of sectors in each state with a revealed comparative advantage greater than one. Red points represent groups of agro-industry sectors classified under NAICS, with the exception of groups for which information is confidential. The sectors indicated by the NAICS codes are those where each state have a comparative advantage. For Chiapas, those sectors were 3111, 3112, 3113, 3115, 3116, 3117, 3118, 3119, 3121, 3149, 3219, 3231, 3323, 3328, and 3371; for Guerrero, those sectors were 3115, 3118, 3121, 3131, 3141, 3149, 3152, 3159, 3169, 3219, 3259, 3262, 3273, 3279, 3323, 3371, and 3399; for Oaxaca, those sectors were 3113, 3118, 3121, 3131, 3141, 3149, 3211, 3219, 3241, 3273, and 3323; and for Yucatán, those sectors were 3111, 3112, 3116, 3117, 3118, 3121, 3131, 3141, 3149, 3151, 3152, 3159, 3169, 3219, 3261, 3273, 3279, 3323, 3332, 3333, 3353, 3366, 3371, and 3399.

consumption. Finally, grain and oilseed milling (3112) and fruit and vegetable preserving and specialty food manufacturing (3114) fall into the high intensity quadrant. In the selected states, activities with a comparative advantage fall into the mid-low intensity quadrant, suggesting that they are not heavily reliant on transportation infrastructure within those states. However, for certain agro-industry activities, the lack of adequate and efficient freight infrastructure could be a binding constraint on their development.

The low rate of paved roads, especially in areas with difficult terrain such as Chiapas, Guerrero, and Oaxaca, is a binding constraint. It increases operational costs, reduce total factor productivity, and lowers the satisfaction levels of users. Furthermore, it not only makes the provision of basic services cost more, but also makes it more difficult to connect rural regions (where the production of agricultural products is concentrated) and urban areas.

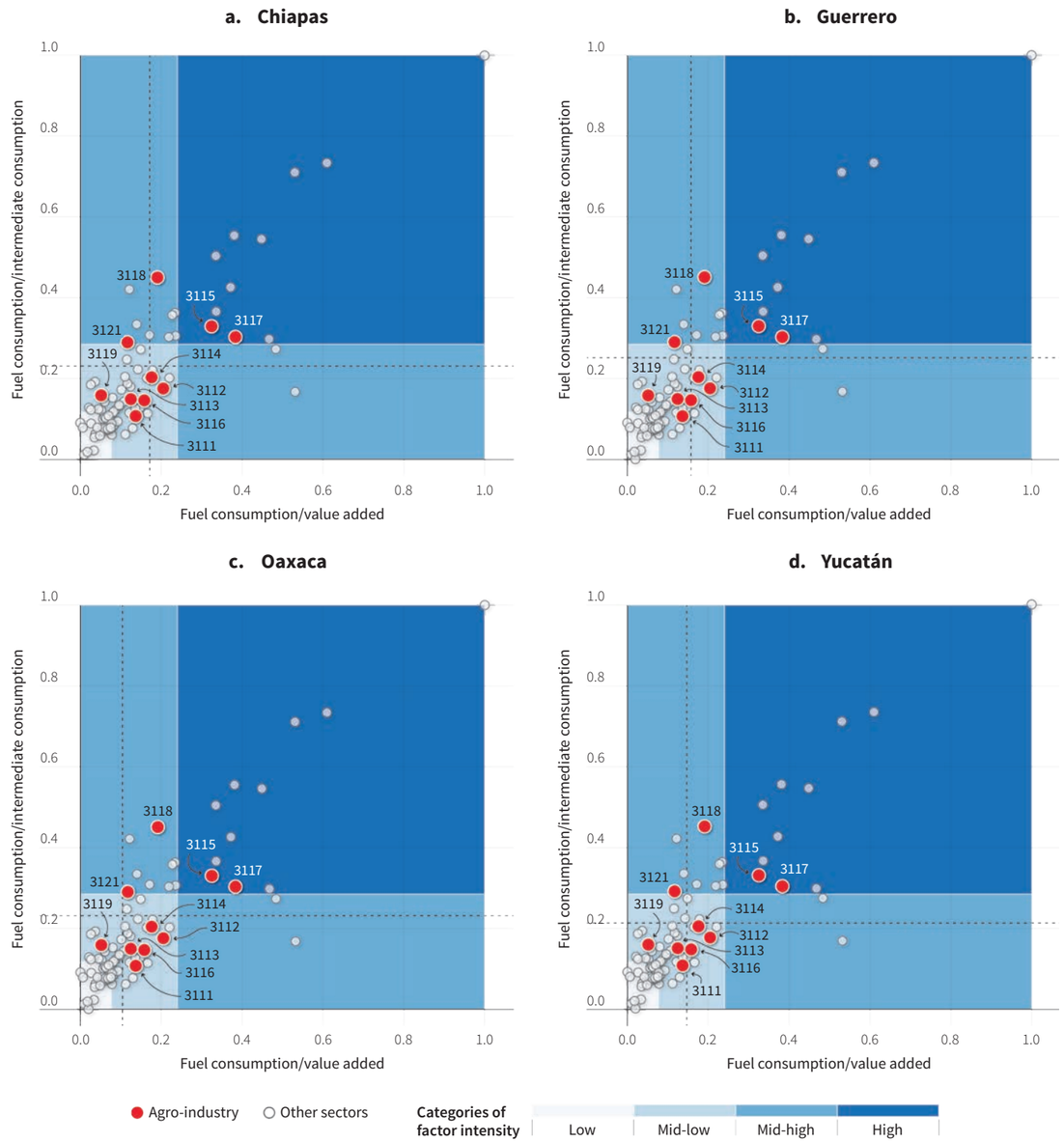
Guerrero faces even greater constraints in terms of transportation infrastructure. Specifically, the high cost of transporting merchandise from Chilpancingo—the state's capital and main city excluding tourism activities—to the city of Acapulco, where the biggest port of the state is located. Furthermore, the port of Acapulco does not offer agriculture bulk freight nor international trade, and it is the most congested among the ports analyzed. Another relevant infrastructure constraint for Guerrero is the lack of a railway connection to Mexico's railway system, which could hinder the development of agro-industry in the state.

The analysis of combustibles in figure D.4 reveals that agro-industry activities are reliant on these resources. Animal food manufacturing (3111), grain and oilseed milling (3112), sugar and confectionery product manufacturing (3113), fruit and vegetable preserving and specialty food manufacturing (3114), animal slaughtering (3116), and other food manufacturing (3119) are within the mid-low intensity quadrant. Bakeries and tortilla manufacturing (3118) and beverage manufacturing (3121) fall in the mid-high intensity quadrant, with a higher intensity in the metric of combustible consumption as a percentage of intermediate consumption. Dairy product manufacturing (3115) and seafood product preparation and packaging (3117) fall in the high intensity quadrant. These last four activities, namely 3115, 3117, 3118, and 3121, have a relatively high intensity use of combustibles. Thus, access to combustibles may be analyzed carefully for firms that require mainly natural gas as an input, especially if they plan to establish them in Chiapas and Guerrero, where there is no access to the national natural gas system (see appendix C for further explanation). In this regard, access to combustible is a constraint to further develop select agro-industry activities in Chiapas and Guerrero.

The results presented in figure D.5 reveals that telecommunication services are not heavily relied upon by most agro-industry activities. Animal food manufacturing (3111), grain and oilseed milling (3112), sugar and confectionery product manufacturing (3113), fruit and vegetable preserving and specialty food manufacturing (3114), seafood product preparation and packaging (3117), and other food manufacturing (3119) are in the low intensity quadrant. Dairy product manufacturing (3115), animal slaughtering (3116), bakeries and tortilla manufacturing (3118), and beverage manufacturing (3121) are within the mid-low intensity quadrants. Activities in which the selected states have a comparative advantage are close to the low intensity quadrant for Chiapas and Oaxaca, while in the

FIGURE D.4

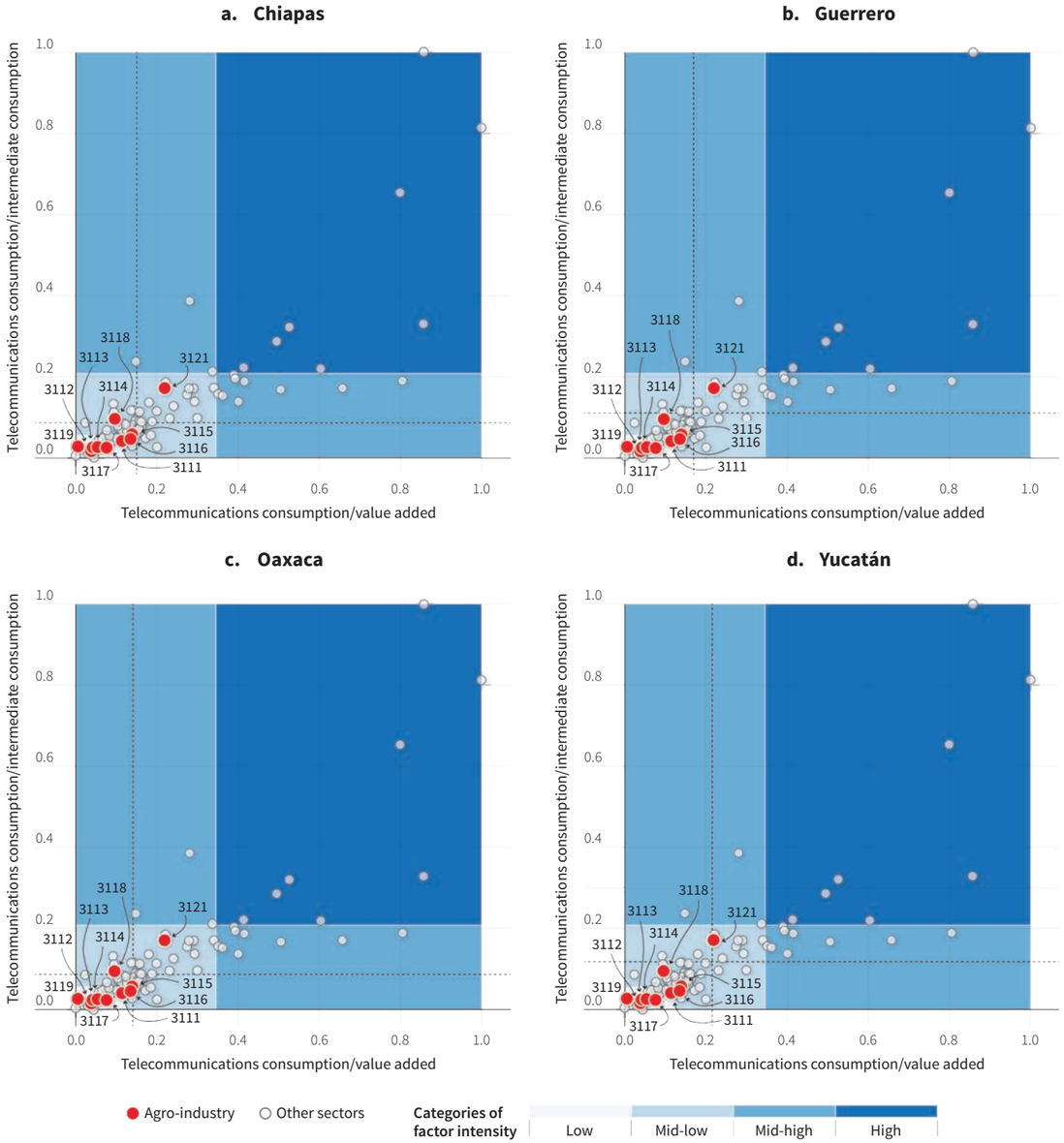
Intensity of Fuel Use by Sectors, 2014 and 2019



Source: Calculations based on data from INEGI 2014; 2019.
Note: Data present averages. Sectors are classified using the North American Industry Classification System (NAICS) four-digit code. Dashed lines represent the average normalized value of sectors in each state with a revealed comparative advantage greater than one. Red points represent groups of agro-industry sectors classified under NAICS, with the exception of groups for which information is confidential. The sectors indicated by the NAICS codes are those where each state have a comparative advantage. For Chiapas, those sectors were 3111, 3112, 3113, 3115, 3116, 3117, 3118, 3119, 3121, 3149, 3219, 3231, 3323, 3328, and 3371; for Guerrero, those sectors were 3115, 3118, 3121, 3131, 3141, 3149, 3152, 3159, 3169, 3219, 3259, 3262, 3273, 3279, 3323, 3371, and 3399; for Oaxaca, those sectors were 3113, 3118, 3121, 3131, 3141, 3149, 3211, 3219, 3241, 3273, and 3323; and for Yucatán, those sectors were 3111, 3112, 3116, 3117, 3118, 3121, 3131, 3141, 3149, 3151, 3152, 3159, 3169, 3219, 3261, 3273, 3279, 3323, 3332, 3333, 3353, 3366, 3371, and 3399.

FIGURE D.5

Intensity of Telecommunications Use by Sectors, 2014 and 2019



Source: Calculations based on data from INEGI 2014; 2019.
Note: Data present averages. Sectors are classified using the North American Industry Classification System (NAICS) four-digit code. Dashed lines represent the average normalized value of sectors in each state with a revealed comparative advantage greater than one. Red points represent groups of agro-industry sectors classified under NAICS, with the exception of groups for which information is confidential. The sectors indicated by the NAICS codes where each state have a comparative advantage include: for Chiapas, those sectors were 3111, 3112, 3113, 3115, 3116, 3117, 3118, 3119, 3121, 3149, 3219, 3231, 3323, 3328, and 3371; for Guerrero, those sectors were 3115, 3118, 3121, 3131, 3141, 3149, 3152, 3159, 3169, 3219, 3259, 3262, 3273, 3279, 3323, 3371, and 3399; for Oaxaca, those sectors were 3113, 3118, 3121, 3131, 3141, 3149, 3211, 3219, 3241, 3273, and 3323; and for Yucatán, those sectors were 3111, 3112, 3116, 3117, 3118, 3121, 3131, 3141, 3149, 3151, 3152, 3159, 3169, 3219, 3261, 3273, 3279, 3323, 3332, 3333, 3353, 3366, 3371, and 3399.

mid-low intensity quadrant for Guerrero and Yucatán. Hence, despite Chiapas, Guerrero, and Oaxaca have low coverage in internet and telephony services (see appendix C), telecommunications infrastructure seems to not be a constraint for developing agro-industry in the selected states.

Regarding specific infrastructure for agro-industry beyond irrigation systems, the analysis focuses on grain storage facilities, farms, and slaughterhouses. As described in appendix C, the grain storage capacities in Guerrero, Oaxaca, and Yucatán fall below their grain production levels, with a particular emphasis on Oaxaca, which has more inactive grain storage facilities (14) than active ones (7). This situation limits their ability to maintain high-quality grains and compete effectively in existing markets.[98] Regarding farms, Oaxaca seems to be the least advantageous among the selected states. It has a limited number of dairy barns and fattening pens (less than 10 of each) compared to the other selected states, which have more than 20 of each. In addition, Oaxaca lack poultry farms altogether. With regard to slaughterhouses, Yucatán and Oaxaca have higher livestock slaughter numbers than their installed capacity. However, Oaxaca does not have any *Tipo Inspección Federal* (TIF)–certified slaughterhouses and only 11 rastros municipales or municipal slaughterhouses (*Tipo Inspección de la Secretaría de Salud*), unlike Yucatán, which has 14 and 21, respectively. This lack of TIF facilities in Oaxaca is an important constraint when it comes to reaching markets for beef outside the state. Despite a project aimed at building a TIF slaughterhouse, no progress has been reported thus far.[99]

In summary, the analysis of input utilization suggests that provision of water seems to be a sizeable constraint for developing agro-industry in certain regions. In Guerrero, the provision of water is a barrier because of high costs and low satisfaction among firms. In Oaxaca, the higher production costs and cost-fare ratio contribute to water being a constraint. Similarly, Yucatán faces challenges as it only has one irrigation district for agriculture. Transportation infrastructure is a constraint across all the selected states, mainly because of the limited paved roads in remote production regions. In Guerrero, deficient port infrastructure further exacerbates this issue. The availability of combustibles is a constraint for specific agro-industry activities (NAICS 3115, 3117, 3118, and 3121). The lack of access to the national natural gas system in Chiapas and Guerrero intensifies this constraint. However, energy and telecommunications infrastructure are not limiting factors in any of the selected states. Finally, inadequate grain storage facilities and slaughterhouses are a constraint, mainly in Oaxaca. It is essential to develop a strategy for building more grain storage facilities and at least one TIF-type slaughterhouse in the state. These deficiencies must be considered when selecting the location for establishing industrial facilities.

APPENDIX E

Access to Finance in the Agro-Industry Sector

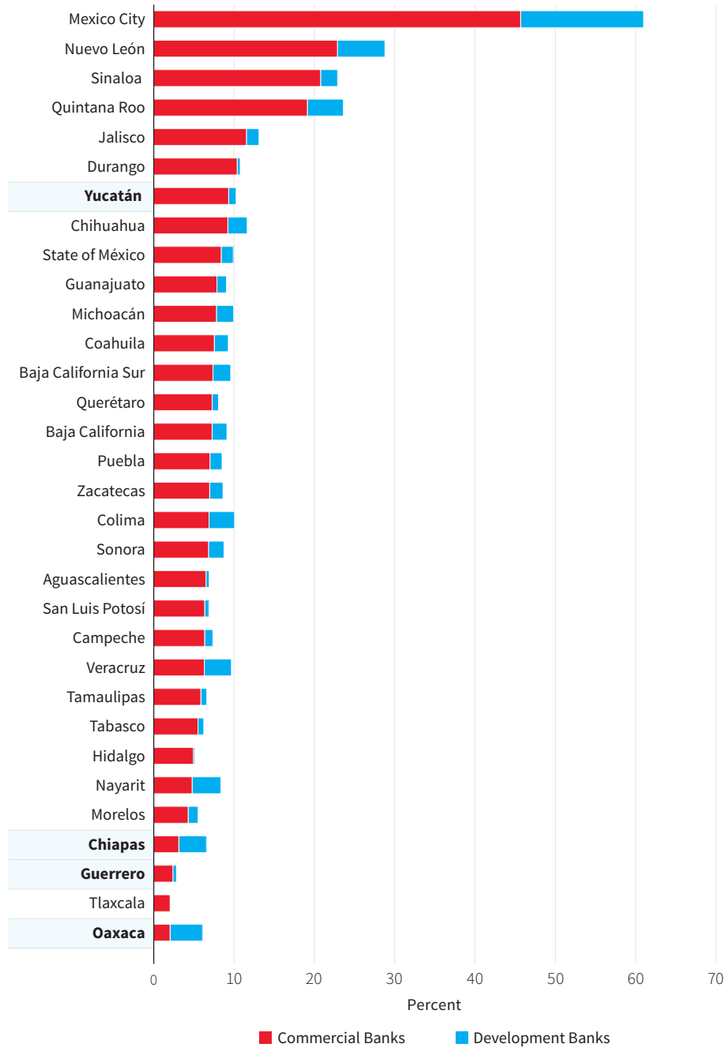
The agro-industry sector received 11.6 percent of total foreign direct investment inflows in Mexico and 28.4 percent of total inflows in Chiapas, Guerrero, Oaxaca, and Yucatán. Agro-industry activities have attracted international financing for many years. Indeed, international actors already have a large and growing stake in Mexico's agro-industry. International actors have fostered the development of agriculture through financial and insurance services and solutions. Although different in nature (debt, equity, venture capital), some examples include international financial institutions, such as the International Finance Corporation, the United Nations International Fund for Agricultural Development, the Corporación Interamericana de Inversiones (Inter-American Investment Corporation) (with programs like the Fondo para los Pequeños Productores Rurales en América Latina [Fund for Small Producers in Latin America]), United Nations Industrial Development Organization Food and Agribusiness Equity fund, Alterfin, and Root Capital. With this evidence, lack of international sources of finance can be discarded as a constraint to develop agro-industry in the selected states. The challenge is to link grassroots actors with these international actors.

The geographical distribution of access to financial services in the selected states is uneven. As of 2021, Oaxaca had the lowest share of municipalities with financial access points, with only 39.6 percent.[100] In Yucatán, about 74.5 percent of municipalities had financial access points, and in Chiapas and Guerrero the share was 80.6 and 91.4 percent, respectively. Looking at the number of financial access points per 10,000 inhabitants, Chiapas and Oaxaca are at the bottom, with 7.6 and 8.5, respectively, and Guerrero is slightly higher with 9.2, Yucatán, on the other hand, has 13.1 access points.[101]

On the demand side, figure E.1 shows that total portfolio balance of commercial and development banks as a percentage of nonoil GDP for Guerrero, Oaxaca, Chiapas, and Yucatán represented 2.8, 6.1, 6.6, and 10.3 percent, respectively. Chiapas has the seventh-lowest percentage, Oaxaca the fifth lowest, and Guerrero the second lowest. Yucatán, however, is among the 10 best states. Further evidence on how low penetration and take up of financial services can affect agro-industry projects in the selected states is examined in this appendix.

FIGURE E.1

Total Portfolio Balance as a Percentage of Nonoil GDP, 2019



Source: Based on data from Banxico and INEGI's National Accounts.
Note: Figure refers to the credit portfolio for all sectors, as state-level data is not disaggregated by public and private sectors. Bars are ordered by the size of commercial bank's credit portfolio as percentage of nonoil GDP. GDP = gross domestic product.

Figure E.2 presents information on interest rates. Data at the national level suggests that interest rates charged by commercial banks to enterprises in the subsectors of agriculture, forestry, and fishing (AFF) and food, beverages, and tobacco (FBT), are 13.6 and 14 percent, respectively, similar to the ones charged for other sectors. However, interest rates charged by development banks are at the lower end (10.3 and 10.1 percent, respectively), and the differential between both types of financial institutions is among the highest in these two sectors (3.3 and 3.9 percent, respectively). In this regard, interest rates charged to the agro-industry sector do not pose a cause for concern.

In the absence of publicly available data on interest rates at the regional or local level, an analysis of interest rates paid by firms according to their size and sector at a national level provides insights. Figure E.3 shows that for AFF and FBT sectors, out of all sizes, micro-enterprises pay the highest interest rates (15.4 and 15.1 percent, respectively) and large-sized ones pay the lowest interest rates (11.5 and 11.4 percent, respectively). However, it is worth noting that across all sizes, agro-industry seems to be in the lower end of the interest rates range, suggesting that interest rates faced by enterprises in AFF and FBT are among the lowest. Hence the interest rates charged by firms in the sector do not pose a cause for concern.

Figure E.4 presents access to external sources of finance. As the benchmark, five states with the highest contribution of agro-industry value added (AFF and FBT) to nonoil GDP are highlighted.[102] Given the differences between primary activities and manufacturing activities, firms in primary agriculture (North American Industry Classification System [NAICS] 112, 114, and 115) and FBT industry (NAICS 311 and 312) are analyzed separately.

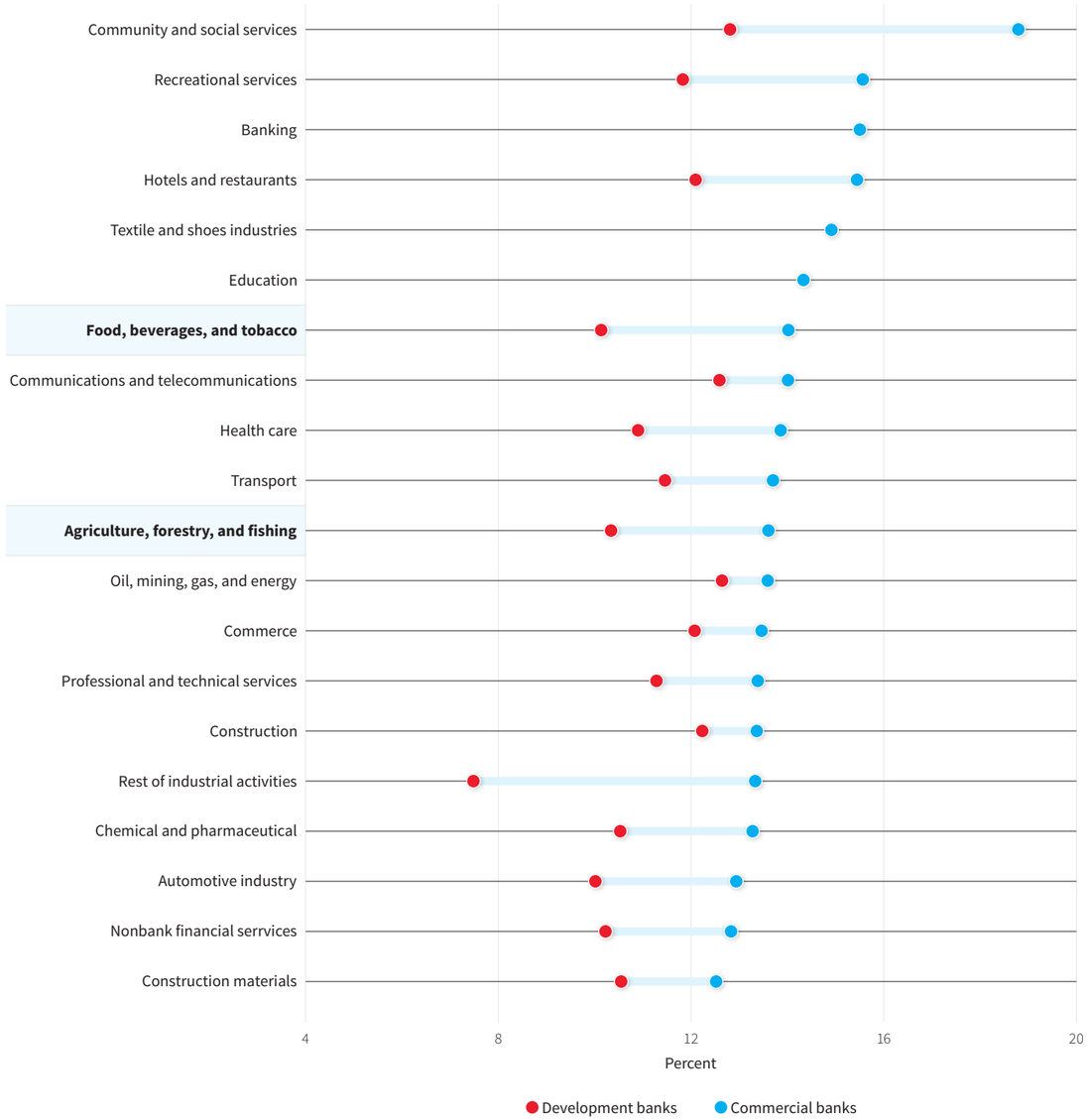
As of 2018, firms in the top five and selected states seem to behave similarly when looking at all sources of external financing for all economic activities. Yet, firms in the agriculture sector, on average, in the selected states are less likely to seek and borrow from an external source when compared to their peers in the champion states. Moreover, borrowing from banks is low, largely because firms in this sector have access to a wider pool of resources[103] such as suppliers, government programs, savings banks ("cajas de ahorro"), and private lenders. Lastly, the difference in the percentage of firms in agriculture that seek external sources of financing in the selected states when compared to the top-five states suggests that finance can be a potential constraint to further develop agriculture activities in the former, especially in Guerrero and Oaxaca.

For firms in the FBT industry, a similar trend can be observed; firms in the selected states are less likely to seek external sources of financing. The difference, however, is less stark than the analysis for agriculture, although Oaxaca stands out for having the smallest percentage of firms seeking finance (in general and from banks). Finance from banks is low mostly because FBT firms have access to a wider pool of resources, including friends and family, as well as suppliers. In line with the agriculture analysis, access to finance can be a potential constraint to further develop the FBT industry, especially in Oaxaca.

To complement that analysis, figure E.5 looks at the use of external financial resources by agriculture firms in the selected and top-five states. A key difference between agriculture firms of both groups is that those in the former are more likely to purchase inputs domestically. This suggests that firms

FIGURE E.2

Weighted Average Interest Rates Paid by Firms in Various Industries, 2022



Source: Based on data from CNBV's *Portafolio de Información* (Information Portfolio) for December 2016 and October 2022; Banxico.
Note: The figure only considers credits in local currency. The CNBV's latest Information Portfolio does not provide interest rate data at the sector level. To estimate the interest rates charged to firms by sector, the spread between (1) the monetary policy rate from December 2016 and (2) the weighted average interest rate charged by commercial and development banks by sector in December 2016 (the latest year for which the CNBV's previous information portfolio offers data), was calculated. By maintaining the spread constant for each sector, the interest rates for October 2022 were estimated using the monetary policy rate from October 2022 (the latest month for which the CNBV's latest portfolio provides data). Development banking institutions, which include Nafin, Bancomext, and Banobras, had no reported interest rates for the sectors of education, textiles, footwear, and banking services. CNBV = *Comisión Nacional Bancaria y de Valores*.

FIGURE E.3

Interest Rates Paid by Enterprises in Various Industries by Size, 2022

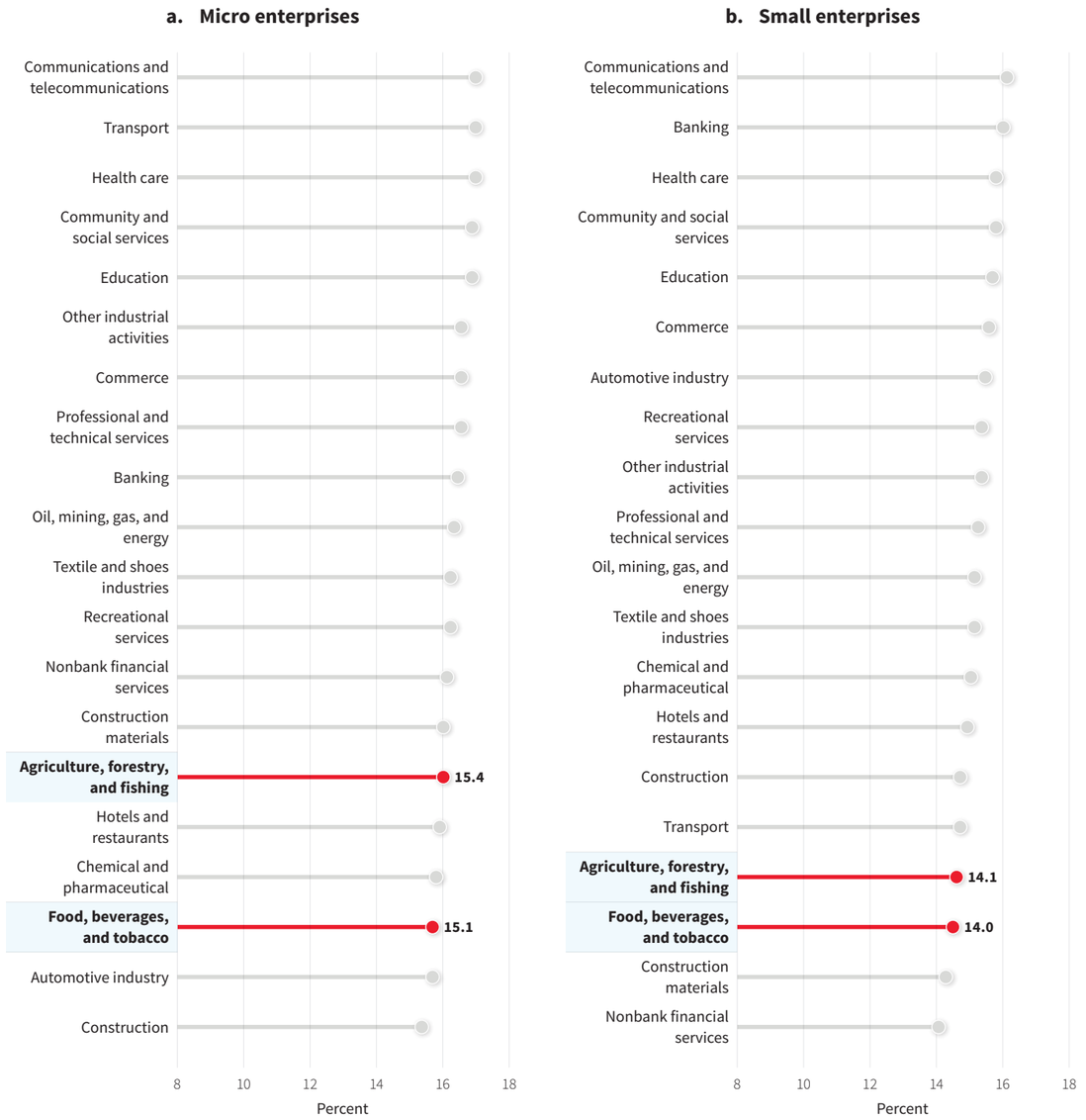


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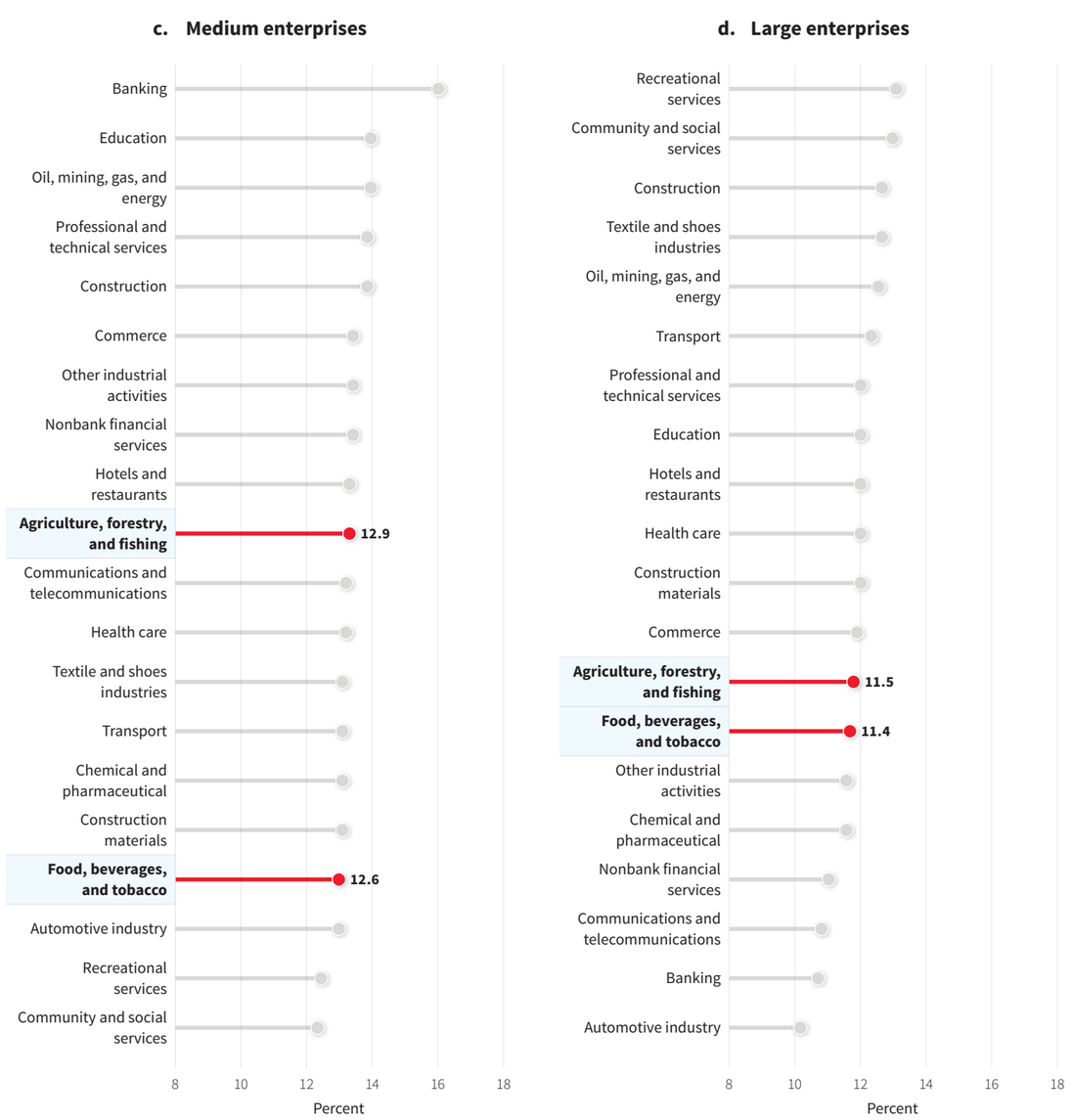
FIGURE E.3

Interest rates paid by enterprises in various industries by size, 2022 *(continued)*



Source: Based on data from CNBV's *Portafolio de Información* (Information Portfolio) for December 2016 and October 2022; Banxico.
Note: The figure only considers credits in local currency. The CNBV's latest Information Portfolio does not provide interest rate data at the sector level. To estimate the interest rates charged to firms by sector, the spread between (1) the monetary policy rate from December 2016 and (2) the weighted average interest rate charged by commercial and development banks by sector in December 2016 (the latest year for which the CNBV's previous information portfolio offers data), was calculated. By maintaining the spread constant for each sector, the interest rates for October 2022 were estimated using the monetary policy rate from October 2022 (the latest month for which the CNBV's latest portfolio provides data). Development banking institutions, which include Nafin, Bancomext, and Banobras, had no reported interest rates for the sectors of education, textiles, footwear, and banking services. CNBV = *Comisión Nacional Bancaria y de Valores*.

FIGURE E.4

Firms' Access to External Financing, by State, 2018

a. All economic activities

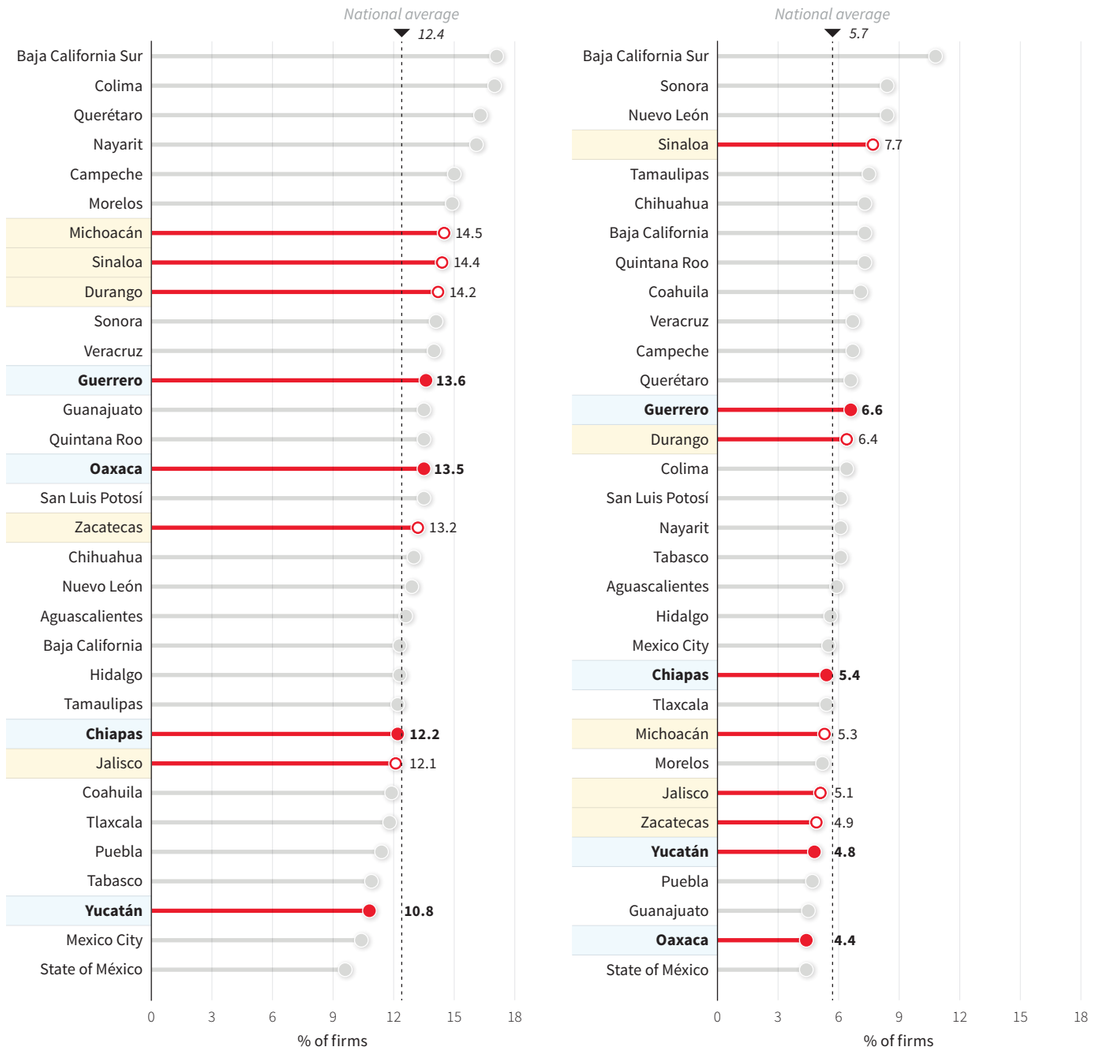


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FIGURE E.4

Firms' access to external financing, by state, 2018 *(continued)*

b. Agriculture

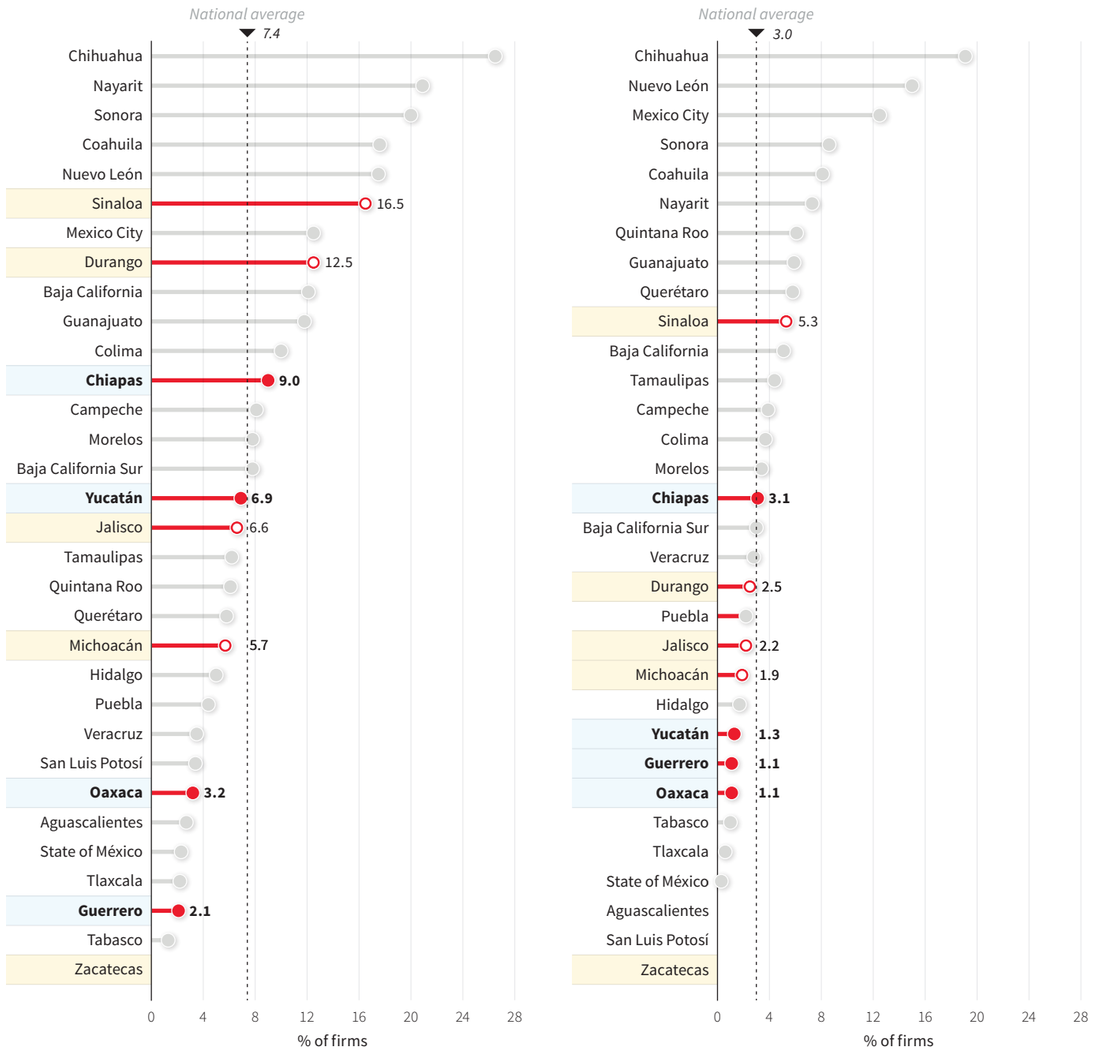

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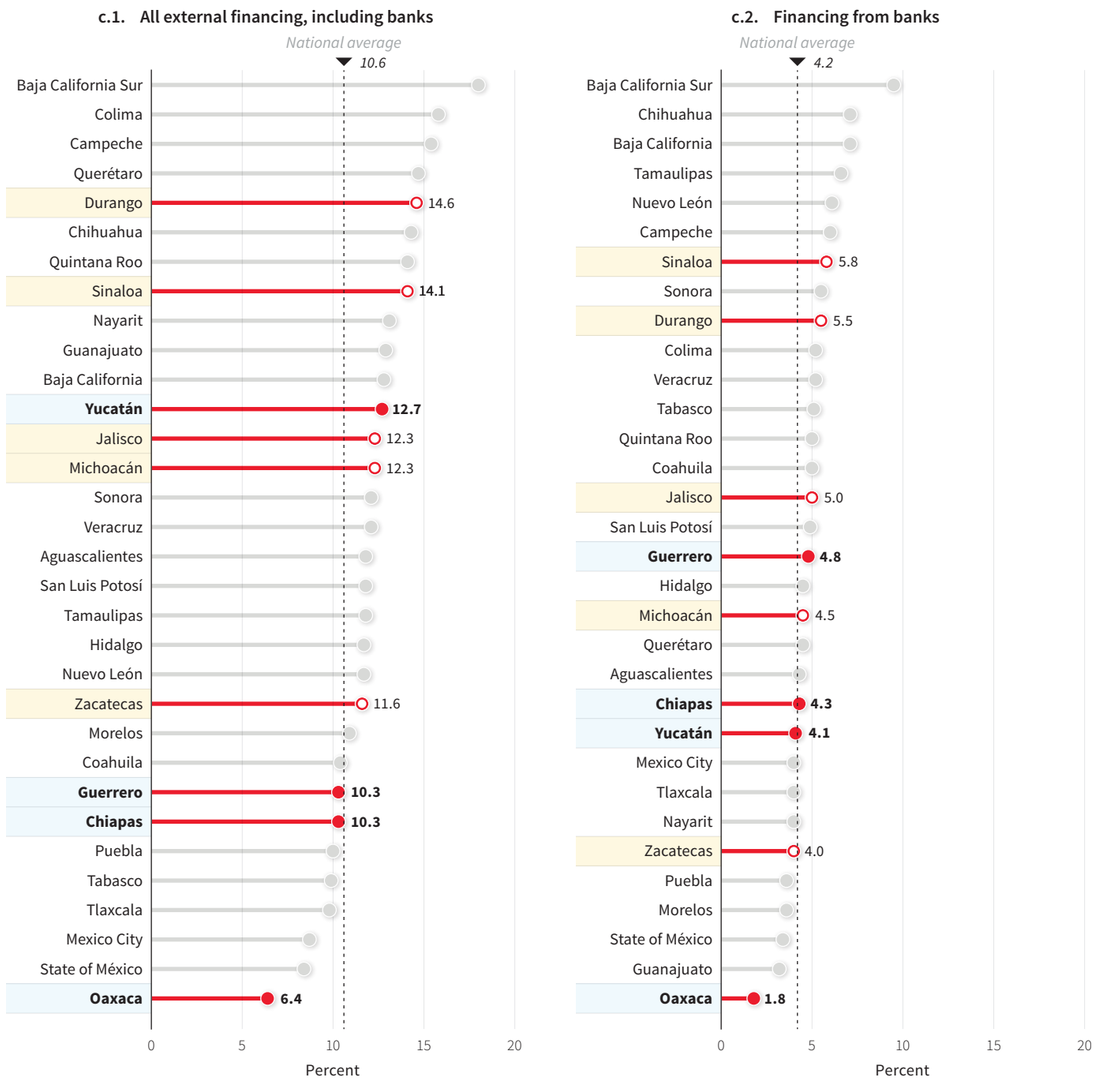
FIGURE E.4

Firms' access to external financing, by state, 2018 *(continued)*

c. Food, beverage, and tobacco



Source: INEGI 2019; INEGI's National Account.
Note: The yellow backgrounds highlight the states with the highest contribution of agro-industry (agriculture, forestry, and fishing and food, beverages, and tobacco) to nonoil gross domestic product: Sinaloa (17.8 percent), Durango (17.4 percent), Zacatecas (15.9 percent), Michoacán (15.6 percent), and Jalisco (14.6 percent). External financing refers to the percentage of firms (economic units) who used external sources of financing. Financing from banks refers to the percentage of firms who only used financing from banks. Both are percentages of total firms in each sector.

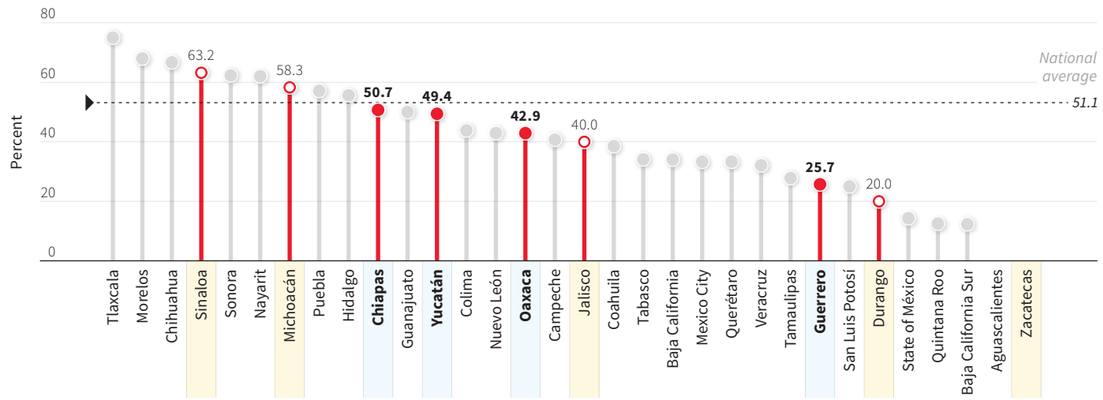
in the selected states may have limited access to higher-quality or to more competitive inputs. Another difference is on investing in business development category, in which the selected states exhibit higher proportions of firms than the leading states (excluding Jalisco). This difference suggests that there is a high reliance on external finance to purchase equipment or expand operations, which, coupled with the low access to finance in the region, could explain the low technification of the primary sector. Regarding the rest of the categories, there are no significant differences between the groups.[104]

Figure E.6 presents the use of external financial resources by FBT firms. Few differences were identified in the way firms use the resources they receive from external sources. On average, firms in the selected states are more likely to use resources to purchase inputs domestically but are less likely to invest in busi-

FIGURE E.5

Agriculture Firms' Use of Financial Resources, by State, 2018

a. Purchased inputs domestically



b. Purchased inputs abroad

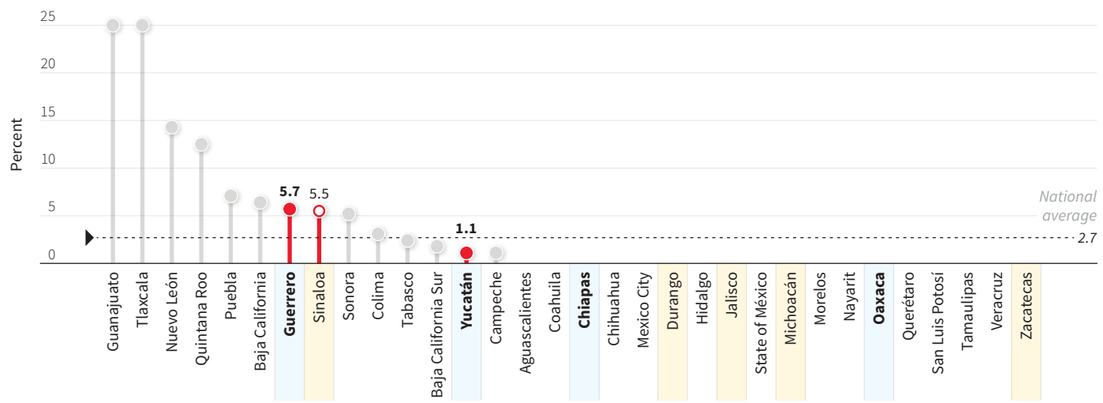


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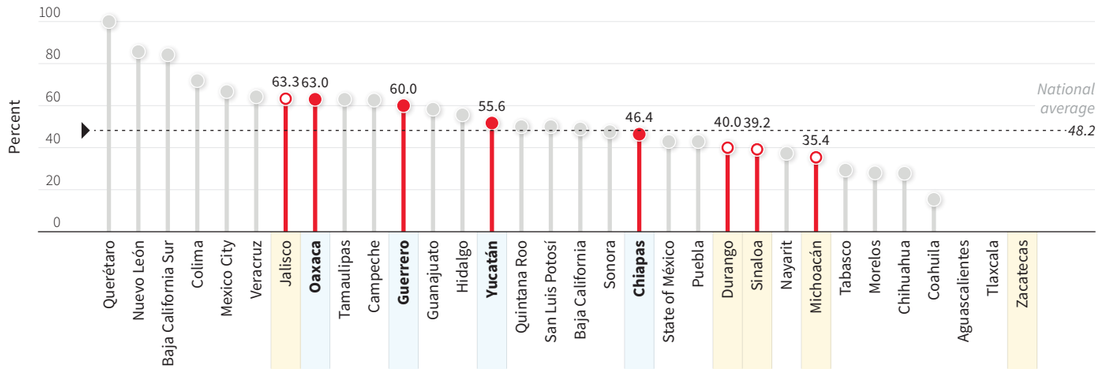
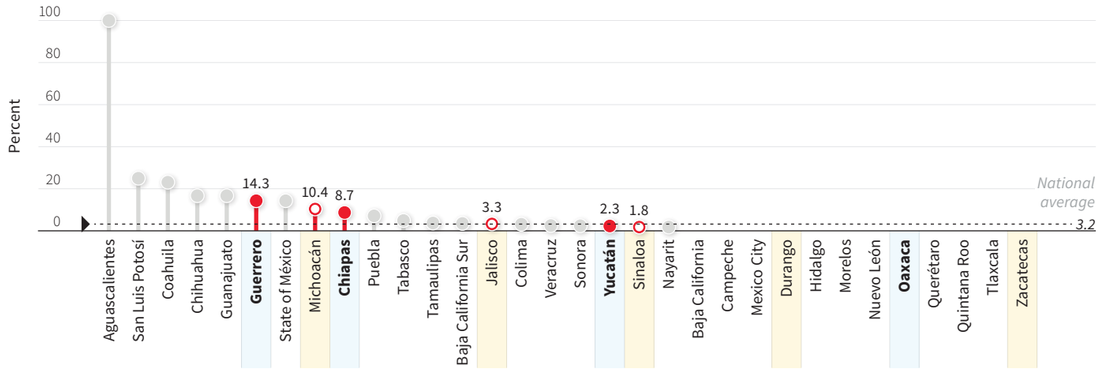
FIGURE E.5

Agriculture firms' use of financial resources, by state, 2018 *(continued)*

c. Invested in business development*



d. Started a business



e. Paid down debt

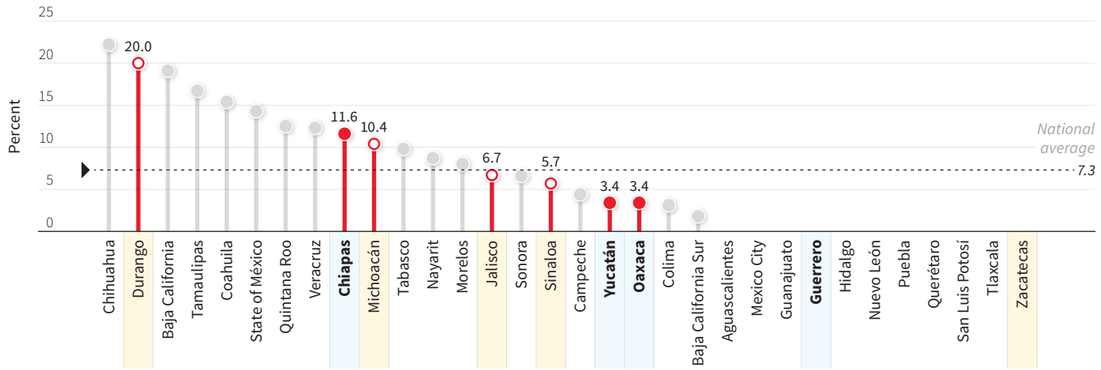


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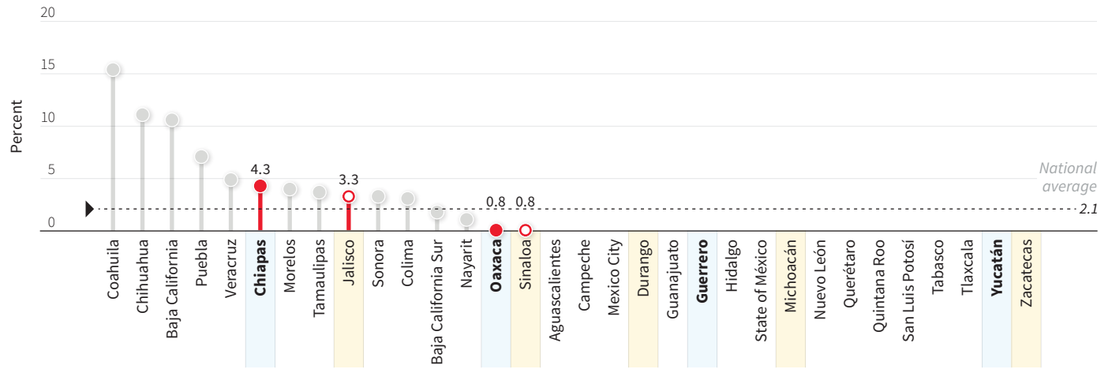
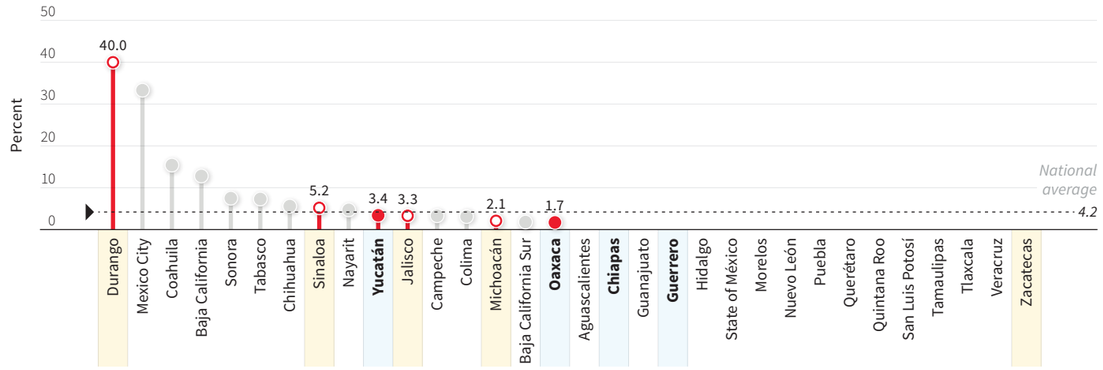
FIGURE E.5

Agriculture firms' use of financial resources, by state, 2018 *(continued)*

f. Purchased retail space or a vehicle



g. Paid wages



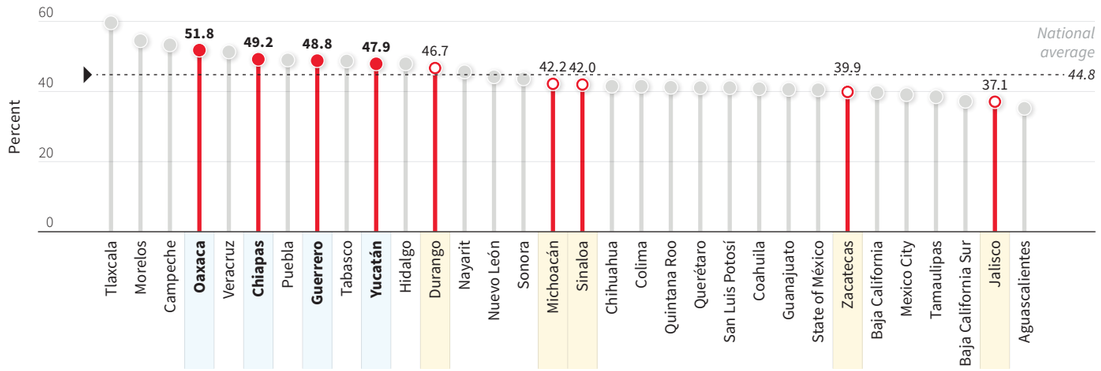
Source: INEGI 2019.
Note: The figures show percentages of the firms that accessed external financing. The yellow backgrounds highlight the states with the highest contribution of agro-industry (agriculture, forestry, and fishing and food, beverages, and tobacco) to nonoil gross domestic product: Sinaloa (17.8 percent), Durango (17.4 percent), Zacatecas (15.9 percent), Michoacán (15.6 percent), and Jalisco (14.6 percent). For categories with states without bars, this indicate that no firms used external financing for that particular category in that state.
*Refers to purchase of equipment or expansion of business.

ness development (purchase equipment or expand operations). The differences are the opposite for agriculture firms. Firms in the top states are more likely to use external financing to support their operations than those in the selected states, that is, to pay debt, purchase assets, and pay wages. Although the magnitude of these proportions is not large[105] and thus does not represent a source of concern, this behavior calls for a more in-depth analysis about the way firms in the FBT industry in the selected states use the resources they borrow from external sources.

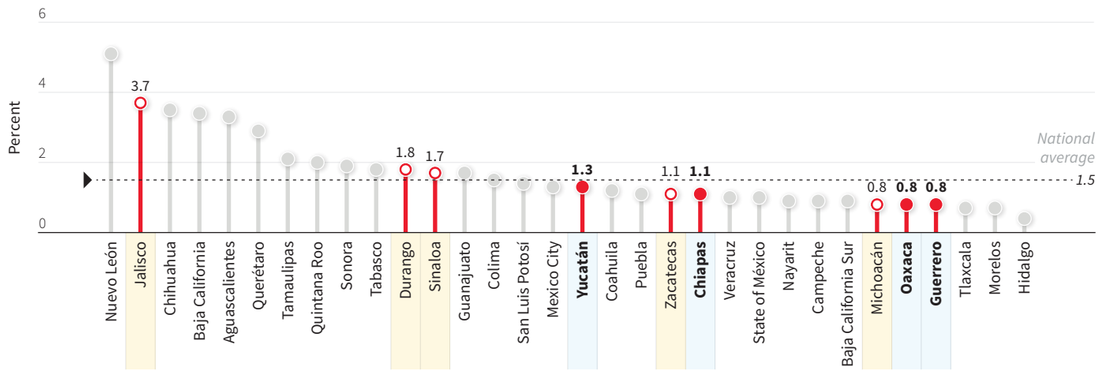
FIGURE E.6

FBT Firms' Use of Financial Resources, by State, 2018

a. Purchased inputs domestically



b. Purchased inputs abroad



c. Invested in business development*

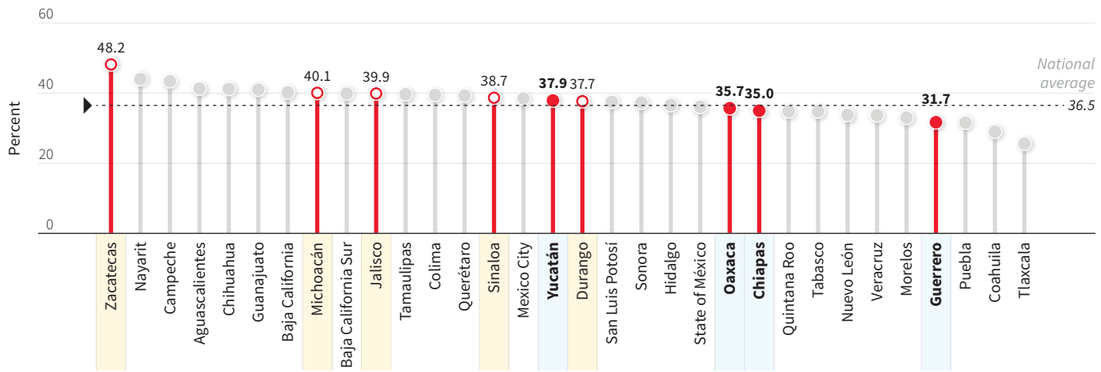


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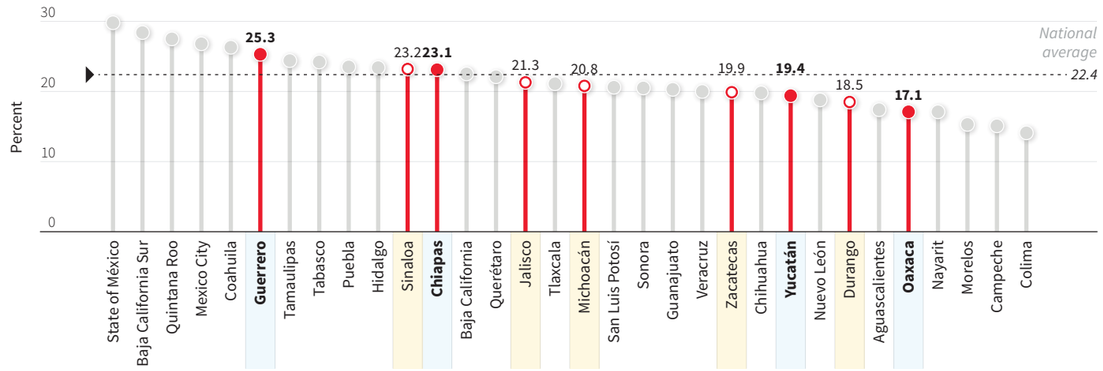
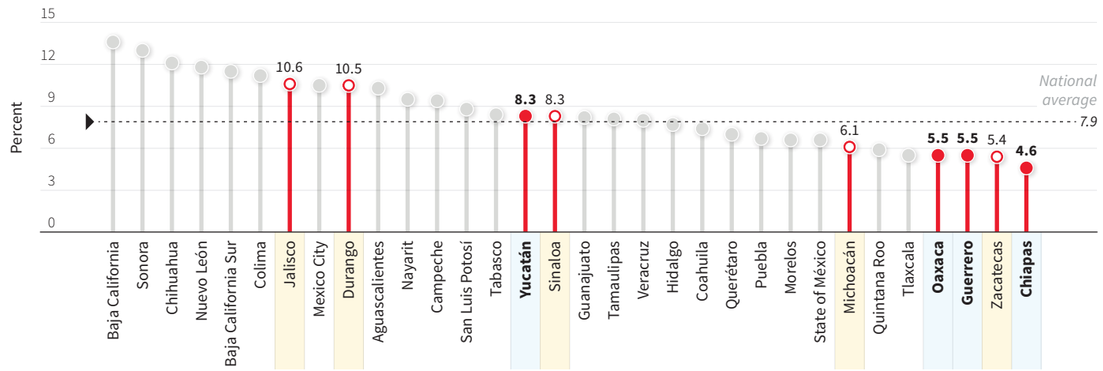
FIGURE E.6

FBT firms' use of financial resources, by state, 2018 *(continued)*

d. Started a business



e. Paid down debt



f. Purchased retail space or a vehicle

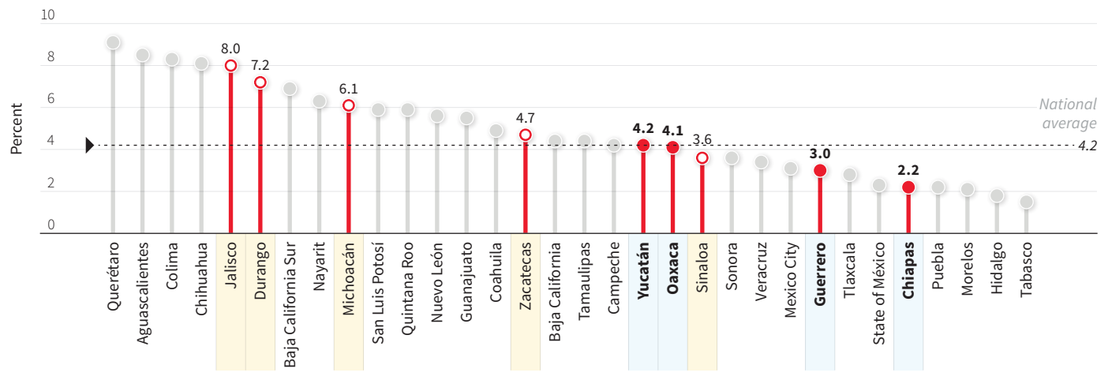


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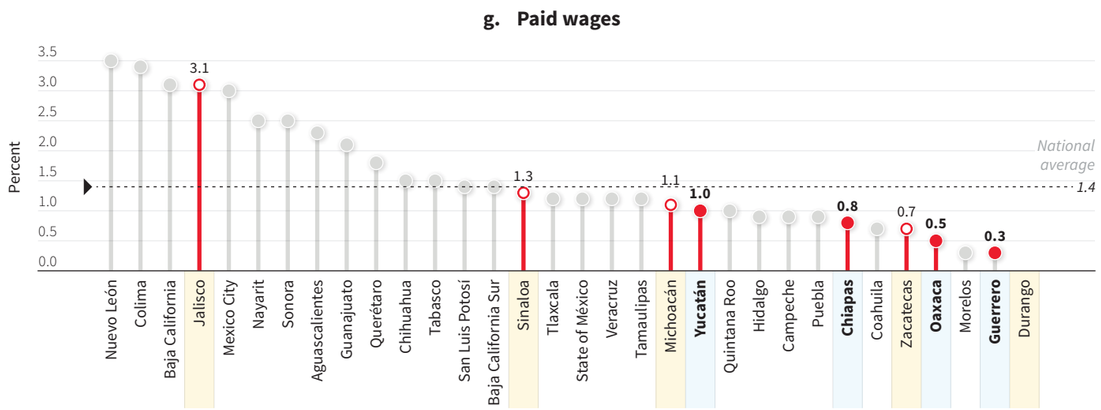
FIGURE E.6

FBT firms' use of financial resources, by state, 2018 *(continued)*



Source: INEGI 2019.
Note: FBT = food, beverages, and tobacco. The figure show percentages of firms that accessed external financing. Highlighted with yellow background show the states with the highest contribution of agro-industry (agriculture, forestry, and fishing and food, beverages, and tobacco) to nonoil GDP: Sinaloa (17.8 percent), Durango (17.4 percent), Zacatecas (15.9 percent), Michoacán (15.6 percent), and Jalisco (14.6 percent). For categories with states without bars, this indicate that no firms used external financing for that particular category in that state.
*Refers to purchase equipment or expansion of business.

APPENDIX F

Government and International Financial Institutions Programs Supporting the Agro-Industry Sector

Several government trust-funds (fideicomisos) and different ministries at federal and state level offer various programs and financial products such as credits, guarantees, grants, and technical support aimed at enhancing the development of the agro-industry sector (table F.1). Nonetheless, small farmers have, in general, not used state support to diversify into other activities or crops (UNCTAD 2014). At the federal level, there are several programs and products from funds and entities, including the Secretariat of Agriculture and Rural Sector, Secretariat of Welfare, and Secretariat of Economy, as well as the National Water Commission. At the state level, there are also programs and products implemented by the respective state secretaries of the sector.

International institutions also have implemented programs in the selected states to support the development of activities along the agro-industry value chain. Many of these programs aim to improve the sector's competitiveness, while generating income opportunities for rural farmers. A nonexhaustive list of international programs is presented in table F.2.

TABLE F.1

Government Support Programs

Institution	Name of program	Name of program in Spanish	Description
Federal level			
Bienestar	Planting Life Program	*Programa Sembrando Vida*	Encourages rural landowners to establish forestry productive systems through the production of timber and fruit trees. The program has coverage in all selected states. Includes support in-kind, financial, and technical support.
FIRA	FIRA Credit	*Crédito FIRA*	Financial assistance to financial intermediaries registered with FIRA to spread resources to agro-industry companies.
	FIRA Guarantee	*Garantía FIRA*	Guarantee to financial intermediaries registered with FIRA to spread resources to agro-industry companies and recover one part of credits they give.
	Program to Support of Development	*Programa de Soporte al Desarrollo*	Supports the inclusion of small producers of agro-industry sector to financial services and products.
FOCIR	Reimbursable Support	*Apoyos Reembolsables*	Financial support to cover all initial activities to start a business.
	Risk Capital Support	*Capital de Riesgo*	Provides direct equity investment to companies, holding shares of them.
SADER	Production for Wellbeing	*Producción para el Bienestar*	Financial support to give liquidity and capitalization to agriculture and livestock producers of specific products.
	Program of Price Guarantees for Basic Food Products	*Precios de Garantía a Productos Alimentarios Básicos a cargo de Segalmex 2020*	Guarantees the purchase of specific products to small producers with a fixed price.
	Program of Fertilizers for Wellbeing	*Programa Fertilizantes para el Bienestar*	Provides supply of fertilizers in specific regions and products to small producers.
	Program of Promotion of Agro-industry Sector	*Programa de Fomento a la Agricultura, Ganadería, Pesca y Acuicultura*	Promotes fishery and aquaculture sectors with in-kind and financial support.
	Livestock Credit Program	*Crédito Ganadero a la Palabra*	Provides in-kind support and financial support to farmers. It has priority for states of Campeche, Chiapas, Guerrero, Jalisco, Nayarit, Michoacán, Oaxaca, Quintana Roo, Tabasco, Tamaulipas, Veracruz, Yucatán, and Zacatecas. Repayment is done in-kind.
	Program Participation with Other States	*Programa Concurrencia con las Entidades Federativas*	Assits to increase production capabilities of companies in agro-industry sector.
FIRA and SADER	National Fund for Guarantees in Agriculture, Forestry, Fishery, Farming and Rural Sectors	*Fondo Nacional de Garantías de los Sectores Agropecuario, Forestal, Pesquero y Rural*	Provides complimentary guarantees to facilitate access to other credits.
	Special Program to Support Consolidated Purchasing of Fertilizers	*Programa Especial de Apoyo a la Compra Consolidada de Fertilizantes*	Provides complimentary credit guarantees to acquire fertilizers loans with other financial institutions.

(Table continues next page)

TABLE F.1

Government Support Programs *(continued)*

Institution	Name of program	Name of program in Spanish	Description
FIRA and CONAGUA	Guarantee Fund for Efficient Uses of Water	*Fondo de Garantías para el Uso Eficiente del Agua*	Financial support to infrastructure irrigation projects.
UDP and FOCIR	Emergent Program for Economic Reactivation UDP-FOCIR	*Progama Emergente de Reactivación Económica y el Fondo de Capitalización e Inversión del Sector Rural UDP-FOCIR*	Mex$300 million to mitigate impact of COVID-19 in small companies for agro-industry sector. It is a financial support with concessional terms.
State level			
Secretariat of Agriculture, Livestock, and Fishery of the State of Chiapas	Program Technical Productive and Organizational Capabilities	*Capacidades Técnico Productivas y Organizacionales*	Supports building of facilities for technology transfer and educational training.
	Program Technological Packages for Agro-Industry Sector	*Paquetes Tecnológicos Agrícolas, Pecuarios, de Pesca y Acuícolas*	Provides monetary support to agro-industry producers.
	Enhancement to Fishery and Aquaculture Sectors Productive Chain	*Fortalecimiento de la Cadena Productiva Pesquera y Acuícola*	Provides technical support and training education to improve performance in fishery and aquaculture organizations.
	Charitable Support to Fishery Trade	*Apoyo Solidario a la Comercialización Pesquera*	Provides annual support to fishery organizations to improve their commercial processes.
	Technical Studies to Improve Fishery and Aquiculture Productivity	*Estudios para el Mejoramiento de la Productividad Pesquera y Acuícola*	Support for the elaboration of different technical studies for construction projects for facilities related with the sector.
	Program to Promote Fishery and Aquaculture Productivity	*Programa Fomento a la Productividad Pesquera y Acuícola*	Provides supply of equipment for fishery activities (boat motors).
Secretariat of Agriculture, Livestock, Fishery, and Rural Development of the State of Guerrero	Support to Agricultural Production	*Apoyos a la Producción Agropecuaria*	Provides monetary support to rural production units to cover equipment, supply, and infrastructure expenses.
	Program to Support Fishermen Through Fishing Gear and Equipment Acquisitions	*Programa de Apoyo a Pescadores Mediante la Adquisición de Artes y Equipos de Pesca Rivereña*	Assists to improve the efficiency in the operation of boats for fishery activities.
Secretariat of Rural Development of the State of Yucatán	Program for Genetic Improvement and Livestock Repopulation	*Programa para el Mejoramiento Genético y Repoblamiento Ganadero*	Assists in acquiring different animal species and genetic material for efficient production of livestock.
	Program of Rural Development	*Programa de Desarrollo Rural*	Provides technical support for small producers to increase their production.
	Program “Peso a Peso”	*Programa Peso a Peso*	Provides grants for economic support for equipment acquisition by 50% of their cost.
Secretariat of Agriculture, Fishery, and Aquaculture of the State of Oaxaca	Program for Fishery and Aquaculture Sectors	*Programa de Desarrollo Pesquero y Acuícola*	Provides financial support to activities in both sectors.
	Program for Agriculture Development	*Programa de Desarrollo Agrícola*	Provides financial and technical support for agriculture activities.
	Program for Livestock Development	*Programa de Desarrollo Pecuario*	Provides financial and technical support for livestock activities.

Sources: Consejería Jurídica del Poder Ejecutivo del Estado de Guerrero 2019; Finanzas 2018; FIRA 2022; FOCIR n.d.; Gobierno del Estado de Guerrero 2019; SADER n.d.; SEDER n.d.; Subsecretaría de Agricultura y Ganadería del Estado de Chiapas n.d.; Secretaría de Agricultura de Pesca y Acuacultura del Estado de Chiapas n.d.
Note: Bienestar = Secretaría de Bienestar (Secretariat of Welfare); CONAGUA = Comisión Nacional del Agua (National Water Commission); FIRA = Fideicomisos Instituidos en Relación con la Agricultura (Trust Funds for Rural Development); FOCIR = Fondo de Capitalización e Inversión del Sector Rural (Capitalization and Investment Fund for the Rural Sector); SADER = Secretaría de Agricultura y Desarrollo Rural (Secretariat of Agriculture and Rural Sector; SADER); UDP = Secretaría de Economía a través de la Unidad de Desarrollo Productivo. This list includes the main federal and state programs existing as of 2020.

TABLE F.2

International Financial Institutions Support Programs

Institution	Project or program	Description
Food and Agriculture Organization of the United Nations	Ensuring the future of world agriculture in the face of climate change by conserving the genetic biodiversity of the Traditional Agroecosystems of Mexico	Supports the conservation, sustainable use, and resilience of agro-biodiversity in Mexico.
	Fishing, From Hook to Plate: Strengthening sustainable fishing to safeguard marine biodiversity	Supports the conservation of marine ecosystems and biodiversity and the sustainable livelihoods of fishing communities.
Inter-American Development Bank	Animal Health Improvement	Strengthen the efficiency and capacity of animal health services by revamping disease diagnostic services. By doing so, expected results are increases in livestock productivity and access to national and international markets. This project has been ongoing since 2016/17.
	Scaling Climate Smart Transformation of Coffee Landscapes in Mexico	Improves the competitiveness of small coffee producers in Southern Mexico by facilitating access to technology and to improved coffee production techniques. The project also aims to bridge these producers with strategic markets. The project focuses on Chiapas and Oaxaca and is currently being implemented.
International Fund for Agricultural Development	Social Economy: Territory and Inclusion Project	Helps rural farmers participate in the government of Mexico's Social Economy Development Program and assists farmers raise their productivity and income. Ongoing since 2017, focusing on Chiapas, Guerrero, Oaxaca, and Puebla, and intends to go until 2023.
	Sustainable Development Project for Communities in Semiarid Areas	Helps increase the income and employment of indigenous and rural poor households in various states, including Guerrero and Oaxaca, by supporting sustainable agricultural production and developing entrepreneurial links and rural microenterprises.
World Bank	Sustainable Productive Landscapes Project	Strengthens sustainable management of productive landscapes and increase economic opportunities for rural producers in priority areas of Mexico. It also supports investments with a sustainable and climate-smart approach to productive activities in the agriculture sector in various regions including Chiapas, Oaxaca, and Yucatán. This is an ongoing project that started in 2018 and is intended to end in 2023.
	Food Systems, Land Use and Restoration	Targets large production of beef, cocoa, corn, coffee, palm oil, rice, soy, and wheat. It aims to transform the global food and land use systems so that production areas are better integrated for producing ecosystem services and maintaining natural capital.

Source: Information from the various institutions' websites.
Note: Information about the Food and Agriculture Organization of the United Nations projects were limited.

APPENDIX G
Potential Investors

Table G.1 presents a list of potential leading firms operating in Mexico that could be interested in developing agro-industry activities or activities along its value chain in the selected states, all of which have operations in the country and, in some cases, already present in the selected states (for example, Sigma Alimentos in Yucatán).

TABLE G.1

Key Players in Agro-Industry

Company	Description
Sukarne*	Meat processing and distribution. Presence in the north and Guadalajara
PepsiCo Alimentos México*	Fresh and processed agriculture production and distribution. Presence in Mexico and Central America and access to international markets.
Sigma Alimentos*	Meat processing and distribution. Presence in Mexico City's Valley and north of Mexico
Walmart de México y Centroamérica*	Top retailer in Mexico. Little logistics distribution in the selected states. Needs distribution center in the Peninsula region.
Tyson Foods	Meat processing and distribution. Presence in Mexico City and northern Mexico.
Archer Daniels Midland Company	Fresh and processed agriculture production and distribution. Presence mainly in Asia and North America. Access to international markets.
Mondelez International	Food processing. Presence in 29 countries around the world and access to main international markets.
Olam International	Food processing. Presence in Chiapas and Puebla, mainly in coffee production. Access to main international markets.

Source: Based on information from Scully 2019; Expansión 2019.
Note: The list is only indicative, not exhaustive.
*Top domestic industry.

There are also relevant firms operating in the sector in the four selected states (table G.2) These firms have been identified as important actors at the local level due to the number of jobs they create, with each recording at least 251 employees. The relevance of these firms could be leveraged at an initial phase to further develop the agro-industry, and at later phases to create supplier development strategies with local actors.

TABLE G.2

Key Local Players in Agro-Industry (251 Workers or More)

NAICS six-digit code	Sector	Enterprise	Municipality
		Chiapas	
114111	Finfish fishing	Sociedad Cooperativa de Produccion Pesquera de Bienes y Servicios 20 de Noviembre	Tonalá
		Sociedad Cooperativa de Produccion Pesquera Archipielago de Bienes y Servicios	Pijijiapan
		Sociedad Cooperativa de Produccion Pesquera Obreros del Mar de Bienes y Servicios	Pijijiapan
		Sociedad Cooperativa de Producción Pesquera de Bienes y Servicios Union y Trabajo	Pijijiapan
311213	Maize flour production	Molinos Azteca de Chiapas (Maseca)	Ocozocoautla de Espinosa
311311	Cane sugar manufacturing (sugarcane mills)	Cía. Azucarera La Fe	Venustiano Carranza
		Ingenio de Huixtla	Huixtla
311421	Fruit and vegetable canning	Mazazul Internacional	Arriaga
			Tapachula
311612	Meat processed from carcasses	Buenaventura Grupo Pecuario	Villaflores
311710	Seafood product preparation and packaging	Herdez, Chiapas plant (recently aquired by Procesa)	Tapachula
		Regal Springs Mexico (Acuagranjas Dos Lagos)	Ostuacán
		Procesamiento Especializado de Alimentos (Procesa)	Tapachula
311922	Roasted and milled coffee manufacturing	Finca Triunfo Verde	Angel Albino Corzo
312111	Soft drink manufacturing	Embotelladora y Distribuidora Gepp	Chiapa de Corzo
		Guerrero	
311511	Fluid milk manufacturing	Leche La Imperial	Teloloapan
312111	Soft drink manufacturing	Propimex-Cayaco	Acapulco de Juárez
		Oaxaca	
114111	Finfish fishing	Sociedad Cooperativa de Produccion Pesquera Jaltepec de la Mar	San Francisco del Mar
311311	Cane sugar manufacturing (sugarcane mills)	Ingenio Adolfo López Mateos	San Juan Bautista Tuxtepec
		Ingenio el Refugio	Cosolapa
		Ingenio la Margarita	Acatlán de Pérez Figueroa
312120	Breweries	Compañia Cervecera del Trópico	San Juan Bautista Tuxtepec
		Yucatán	
114119	Other marine fishing (except finfish and shellfish)	Congeladora Carlos Zacarias Dib	Progreso
		Hul Kin	Celestún
		Rivereños de Sisal	Hunucmá

(Table continues next page)

TABLE G.2

Key local players in agro-industry (251 workers or more)

NAICS six-digit code	Sector	Enterprise	Municipality
311213	Malt manufacturing	Harinera de Yucatán	Mérida
311222	Soybean processing	Hidrogenadora Yucateca	Mérida
		Proteinas y Oleicos	Mérida
311513	Cheese and cheese substitutes manufacturing	Sigma Alimentos	Mérida
311611	Animal (except poultry) slaughtering	Comercializadora Porcicola Mexicana	Kanasín (processing facility)
			Umán (slaughterhouse)
		Bachoco-Planta Procesadora de Aves Division Peninsula	Umán
		Pollo Industrializado de Mexico	Kanasín
311613	Rendering and meat byproduct processing	Bachoco-Empacadora Dorantes	Mérida
		Industrias Alimentarias del Sureste (Iassa)	Mérida
311811	Retail bakeries	Bimbo-Planta Mérida	Mérida
311820	Cookie, cracker, and pasta manufacturing	Productos de Harina (Donde)	Mérida
		Productos Alimenticios Donde	Umán
311940	Seasoning and dressing manufacturing	Industria Salinera de Yucatán-Planta las Coloradas	Río Lagartos
312111	Soft drink manufacturing	Bepensa Bebidas Oriente	Mérida
312120	Breweries	Cervecería Yucateca	Hunucmá

Source: Based on data from INEGI's Directorio Estadístico Nacional de Unidades Económicas database.
Note: NAICS = North American Industry Classification System.

It is worth noting that in Chiapas (13), Oaxaca (7) and Yucatán (15) there are other relevant food manufacturing firms with 101–250 workers. These include Cafés de Especialidad de Chiapas (Cafesca), which operates the only freeze-dried coffee factory in Mexico and Central America, located in Tapachula (currently analyzing to industrialize other regional products such as mangoes and banana).[106] Nestlé, who recently announced a US$12 million investment to expand its "Coffee Mate" plant in Chiapa de Corzo. This facility currently supplies domestic markets, as well as the Caribbean, Central America, and South America. Café Blasón in Oaxaca, a coffee plant of Grupo Herdez, which is the leader in the processed foods segments in Mexico and a major player in the Mexican food category in the United States. Furthermore, Campi Alimentos in Yucatán, an animal feed manufacturing subsidiary of Bachoco, Mexico's leading producer and processor of poultry and one of the 10 largest poultry producers worldwide. Additionally, there are some recent sector-related initiatives, like the one by Grupo Ideal in Chiapas. This Guatemalan firm built an industrial complex spanning approximately 40 hectares in Tapachula. The US$100 million investment has generated more than 2,000 direct and indirect jobs. A central market project to supply the Central America region, promoted by businessmen from Chiapas and Nuevo León, also deserves mention. It has a projected investment of Mex$1.2 billion over the next three years.

Lastly, the International Finance Corporation's team in Mexico identified additional potential investors that could be relevant for the development of agro-industry in the selected states (table G.3).

TABLE G.3

Potential Investors

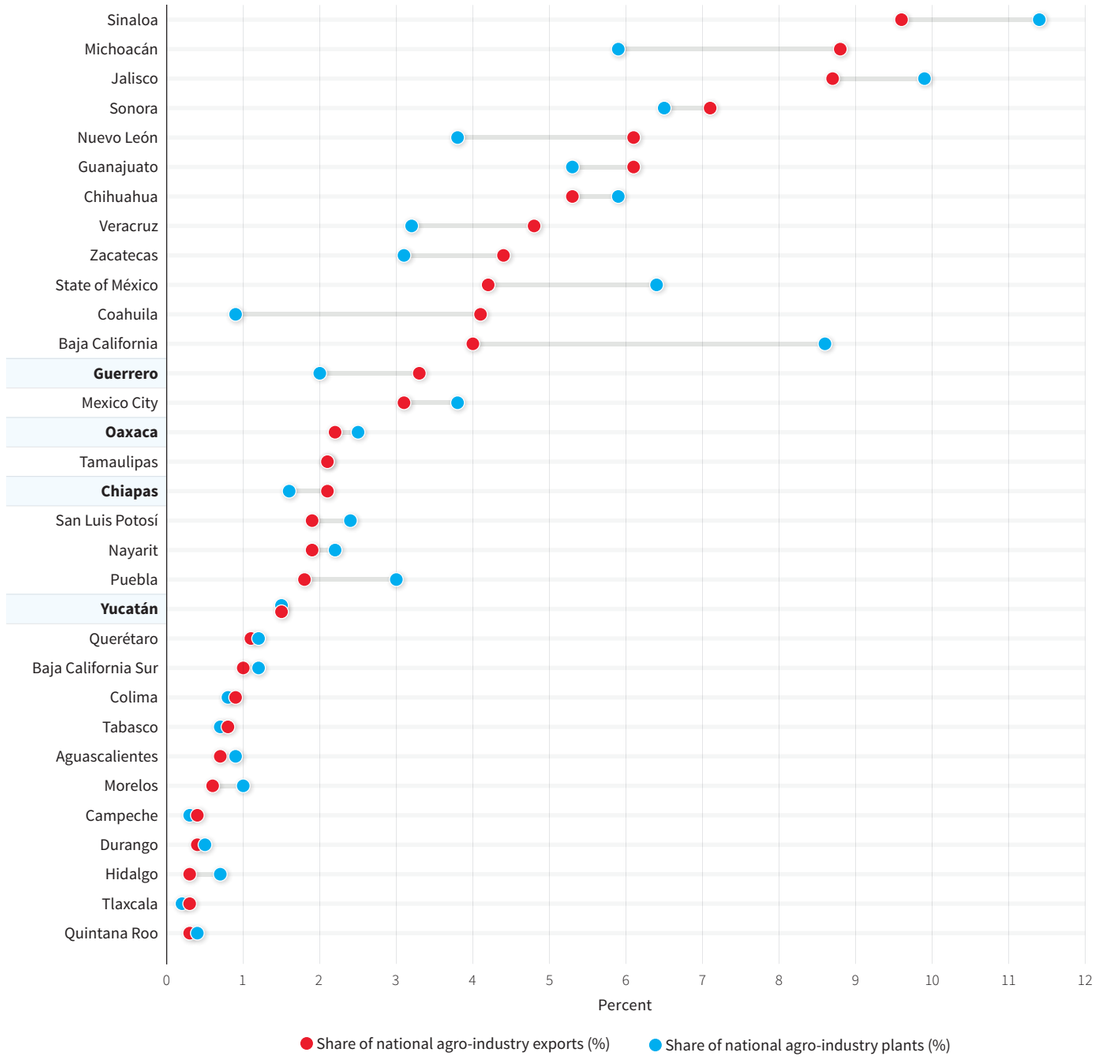
Sector	Company	Location
Vegetables and fruits	Lomas del Coyote	Chiapas
	Calavo de México	Michoacán
	Mission Produce	Uruapan, Michoacán
	Frutas Finas de Tancítaro	Tancítaro, Michoacán
	Empacadora Agroexport	Michoacán
	Global Frut	Uruapan, Michoacán
	Grupo Aguacatero Mexicano	Uruapan, Michoacán
	Domadi	Mexico City
	Bananera La Concordia	Tapachula, Chiapas
	Bananera San Carlos	Tabasco
Sugar (some have plantations in Oaxaca)	Grupo Beta San Miguel	Multiple states
	Zucarmex	Cualiacán, Sinaloa
	Piasa	San Luis Potosí
	Grupo Azucarero México	Mexico City
	Azúcar Grupo Sáenz	Mexico City
	Ingenios Santos	Veracruz
	Azúcar Grupo Porres	Tapachula, Chiapas
	Grupo Azucarero del Trópico (La Gloria)	Multiple states
	Agroindustrial del Valle del Fuerte	Multiple states
Palm oil (plantations in Campeche and Oaxaca)	Grupo Agroforestal Uumbal	Mexico City
	Grupo Oleomex (Oleosfinos)	Guadalajara, Jalisco
	Palma Tica (Agricultural Services and Development Costa Rica)	Costa Rica
	Oleosur (Propalma)	Mexico City
	Agroindustrias Palmeras de la Candelaria	Mexico City
Coffee	Agroindustrias Unidas de México (Ecom Trading)	Mexico City
	Agroindustrias Monte Grande	Mexico City
	Café Combate	Chihuahua, Chihuahua
	Café Internacional de Cordoba	Guadalajara, Jalisco
	Café Tasa de Oro	Jalisco
	Grupo San Roke (Catoex, Los Portales de Cordoba)	Mexico City
Grains	Enerall	Yucatán
Poultry	Crio	Mérida, Yucatán
Pork	Grupo Porcicola Mexicano (Keken)	Mérida, Yucatán

Source: Based on information from IFC agriculture sector team.

APPENDIX H
Additional Statistics and Information

FIGURE H.1

Share of Agro-Industry Exports and Export Plants, 2014



Source: Based on data from the Mexico Atlas of Economic Complexity.

TABLE H.1

Mexico's Top Agricultural Products Exports, 2021

Rank	Description	Global exports value (US$, billions)	Mexico's share in global exports (%)
1	Vegetables	79.6	10.8
2	Beverages	140.0	7.2
3	Fruits and nuts	135.9	6.1
4	Other vegetable materials	1.4	5.9
5	Sugar and candy	46.8	4.0
6	Live animals	23.0	3.1
7	Preparations of cereals, flour, starch, or milk	85.6	3.1
8	Preparations of vegetables, fruit, or nuts	68.7	2.7
9	Meat	155.7	2.1
10	Lac and other vegetable extracts	9.2	1.6
11	Cocoa	44.7	1.5
12	Miscellaneous edible preparations	94.2	1.4
13	Flours, starches, and malts	21.4	1.2
14	Coffee, tea, and spices	56.9	1.0
15	Fish	126.9	0.8
16	Tobacco	42.9	0.6
17	Animal products	11.5	0.6
18	Plants	27.6	0.5
19	Food residues and animal feed	95.6	0.4
20	Animal or vegetable fats, oils, or waxes	143.5	0.4
21	Preparations of meat or fish	57.6	0.4
22	Dairy products	109.9	0.3
23	Cereals	149.1	0.3
24	Oil seeds and oleaginous fruits	128.0	0.2
	Total	1,855.5	2.4

Source: Based on data from UN Comtrade database.
Note: Table corresponds to commodities with Harmonized System (HS) codes 1–24.

TABLE H.2

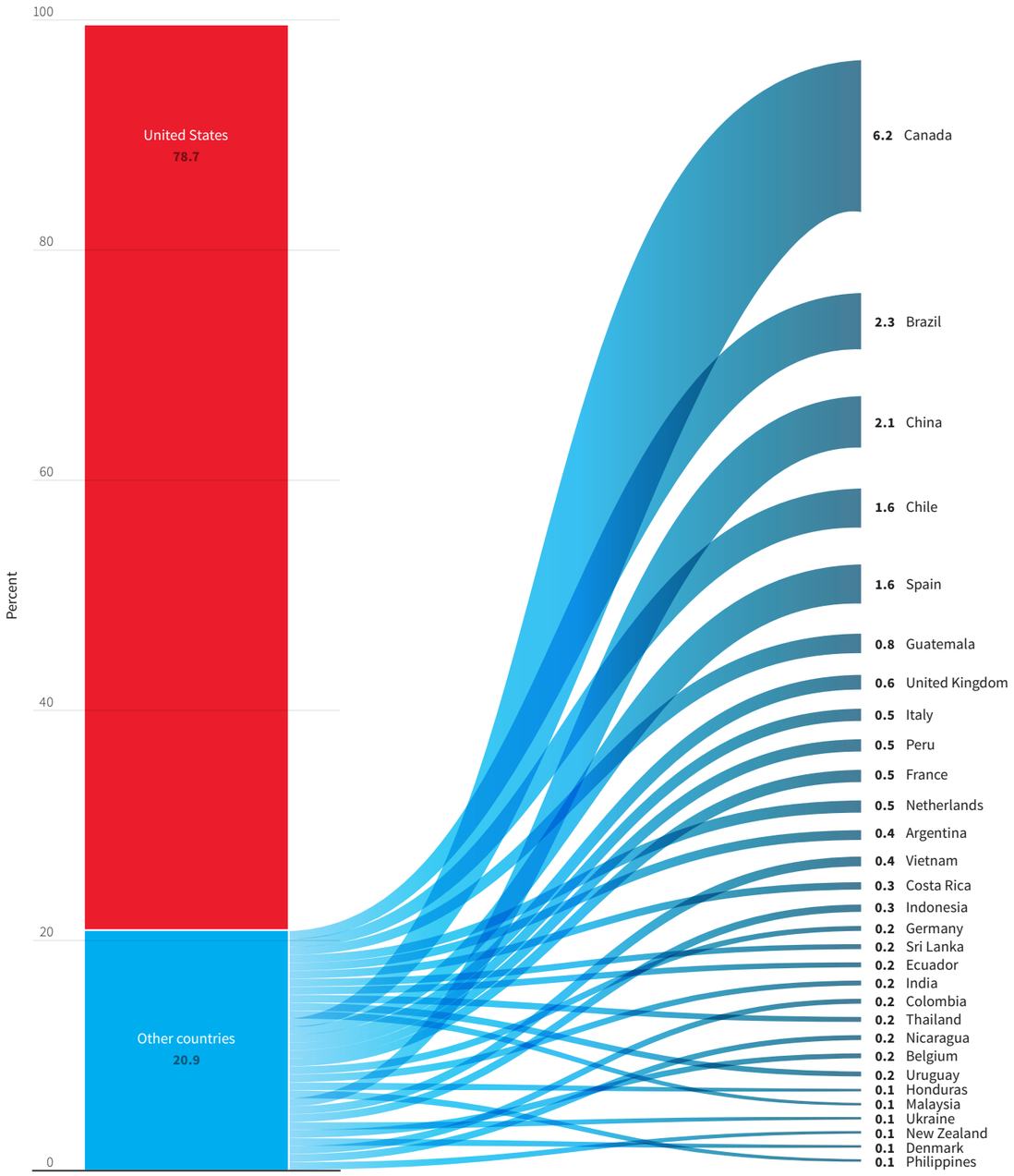
Growth of Mexico's Agricultural Products Exports

Rank	Description	Exports value, 2021 (US$, billions)	CAGR, 1995–2021 (%)
1	Meat	3.2	16.4
2	Food residues and animal feed	0.4	14.2
3	Preparations of cereals, flour, starch, or milk	2.7	12.5
4	Beverages	10.0	11.9
5	Cocoa	0.7	11.0
6	Fruits and nuts	8.3	10.4
7	Flours, starches, and malts	0.2	10.2
8	Miscellaneous edible preparations	1.3	9.0
9	Animal or vegetable fats, oils, or waxes	0.6	8.6
10	Dairy products	0.3	8.5
11	Sugar and candy	1.9	8.4
12	Preparations of vegetables, fruit, or nuts	1.9	7.6
13	Lac and other vegetable extracts	0.1	7.2
14	Oil seeds and oleaginous fruits	0.2	6.5
15	Animal products	0.1	6.3
16	Vegetables	8.6	6.3
17	Cereals	0.4	6.2
18	Tobacco	0.3	5.7
19	Plants	0.1	5.2
20	Preparations of meat or fish	0.2	4.5
21	Other vegetable materials	0.1	4.1
22	Fish	1.0	1.9
23	Live animals	0.7	1.1
24	Coffee, tea, and spices	0.6	−1.1
	Total	43.9	7.8

Source: Based on data from UN Comtrade database.
Note: CAGR = compound annual growth rate. Table corresponds to commodities with Harmonized System (HS) codes 1–24.

FIGURE H.2

Mexico's Main Agro-Industry Import Partners, 2021



Source: Based on data from UN Comtrade.
Note: The figure corresponds to commodities with Harmonized System (HS) codes 1–24.

TABLE H.3

Mexico's Leading Agro-Industry Imports, 2021

Rank	HS code	Product	Imports value, 2021 (US$, millions)	Share in total agro-industry imports, 2021 (%)	CAGR, 2003–21 (%)
1	100590	Maize (corn), other than seed	4,285.8	17.6	10.6
2	20312	Meat of swine, hams, shoulders, and cuts thereof, with bone in, fresh or chilled	1,331.9	5.5	11.8
3	230400	Oilcake and other solid residues, whether or not ground or in the form of pellets, resulting from the extraction of soya-bean oil	759.9	3.1	9.2
4	20130	Meat of bovine animals, boneless cuts, fresh or chilled	716.3	2.9	−0.3
5	20713	Meat and edible offal of fowls of the species Gallus domesticus, cuts and offal, fresh or chilled	642.7	2.6	14.7
6	120510	Low erucic acid rape or colza seeds oil, whether or not broken	616.3	2.5	15.1
7	210690	Food preparations nes	581.9	2.4	4.9
8	40210	Milk and cream, concentrated or containing added sugar or other sweetening matter, in powder, granules or other solid forms, of a fat content not exceeding 1.5% (by weight)	477.4	2.0	4.4
9	120991	Vegetable seeds used for sowing	289.2	1.2	5.9
10	20726	Meat and edible offal of turkeys, cuts and offal, fresh or chilled	277.0	1.1	6.0
11	100610	Rice in the husk (paddy or rough)	275.5	1.1	4.7
12	110710	Malt, not roasted	273.2	1.1	11.3
13	210390	Sauces and preparations therefor; mixed condiments and mixed seasonings	268.9	1.1	6.9
14	170260	Fructose, other than chemically pure fructose, and fructose syrup (containing in the dry state more than 50% by weight of fructose), excluding invert sugar	260.4	1.1	32.2
15	40690	Cheese (not grated, powdered or processed), nes	243.7	1.0	3.1

Source: Based on data from UN Comtrade database.
Note: CAGR = compound annual growth rate; HS = Harmonized System; nes = not elsewhere specified. These products represent 1 percent and higher of the country's agro-industry imports. Percentages are the share of the product in Mexico's total agro-industry imports.

TABLE H.4

Growth of Mexico's Leading Agro-Industry Imports

Rank	HS code	Description	Imports value, 2021 (US$, millions)	Share in total agro-industry imports, 2021 (%)	CAGR, 2003–21 (%)
1	70420	Brussels sprouts, fresh or chilled	6.5	0.0	40.1
2	151419	Low erucic acid rape or colza oil and its fractions, other than crude, but not chemically modified	145.6	0.6	38.9
3	170260	Fructose, other than chemically pure fructose, and fructose syrup (containing in the dry state more than 50% by weight of fructose), excluding invert sugar	260.4	1.1	32.2
4	151219	Sunflower seed or safflower oil and their fractions, other than crude, whether or not refined, but not chemically modified	9.9	0.0	28.9
5	200880	Strawberries, prepared or preserved in ways nes, whether or not containing added sugar, other sweetening matter or spirit	4.8	0.0	23.2
6	151319	Coconut (copra) oil and its fractions, other than crude, whether or not refined, but not chemically modified	2.4	0.0	23.0
7	170240	Glucose and glucose syrup, containing in the dry state at least 20% but less than 50% by weight of fructose, excluding invert sugar, the syrup not containing added flavoring or coloring matter	19.1	0.1	20.6
8	110620	Flour, meal, and powder of sago, manioc, arrowroot, salep, Jerusalem artichokes, sweet potatoes and similar roots and tubers with high starch or inulin content	0.3	0.0	19.8
9	180400	Cocoa butter, fat, and oil	13.0	0.1	19.5
10	70810	Peas (pisum sativum), shelled or unshelled, fresh or chilled	1.1	0.0	19.5
11	80111	Coconuts, desiccated	0.5	0.0	19.2
12	151000	Vegetable oils and their fractions nes, obtained solely from olives, whether or not refined, but not chemically modified	4.8	0.0	18.9
13	140490	Vegetable products nes	11.5	0.0	18.6
14	110610	Flour, meal and powder of the dried leguminous vegetables, shelled, whether or not skinned or split	0.6	0.0	18.6
15	91030	Turmeric (curcuma)	1.0	0.0	18.0

Source: Based on data from UN Comtrade database.
Note: CAGR = compound annual growth rate; HS = Harmonized System; nes = not elsewhere specified. Percentages are the share of the product in Mexico's total agro-industry imports.

TABLE H.5

Leading Agro-Industry Imports in the Selected States

Rank	HS four-digit code	Description	Imports value, 2014 (US$, thousands)	CAGR, 2004–14 (%)	Share in the selected states' agro-industry imports, 2014 (%)
1	1201	Soya beans	233,113.0	0.4	35.4
2	1005	Corn (maize)	99,333.8	26.2	15.1
3	0306	Crustaceans, whether in shell or not, live, fresh, chilled, frozen, dried, salted or in brine; crustaceans, in shell, cooked by steaming or by boiling in water, whether or not chilled, frozen, dried, salted or in brine; flours, meals and pellets of crustaceans	56,185.3	86.6	8.5
4	0901	Coffee, whether or not roasted or decaffeinated; coffee husks and skins; coffee substitutes containing coffee in any proportion	39,177.6	73.7	5.9
5	1205	Rape or colza seeds, whether or not broken	35,781.7	3.0	5.4
6	1001	Wheat and meslin	22,165.3	3.9	3.4
7	1107	Malt, whether or not roasted	19,227.8	12.6	2.9
8	2208	Undenatured ethyl alcohol of an alcoholic strength by volume of less than 80% vol.; spirits, liqueurs, and other spirituous beverages	19,004.9	8.2	2.9
9	0406	Cheese and curd	14,545.2	7.9	2.2
10	1902	Pasta, whether or not cooked or stuffed (with meat or other substances) or otherwise prepared, such as spaghetti, macaroni, noodles, lasagna, gnocchi, ravioli, cannelloni; couscous, whether or not prepared	10,929.4	35.4	1.7
11	1502	Bovine, sheep, and goat fats, raw or rendered	9,700.5	1.9	1.5
12	0402	Milk and cream, concentrated or containing added sugar or other sweetening matter	9,660.7	−4.8	1.5
13	2304	Oilcake and other solid residues, whether or not ground or in the form of pellets, resulting from the extraction of soybean oil	7,441.2	22.0	1.1
14	0203	Meat of swine, fresh, chilled, or frozen	7,261.9	7.5	1.1
15	2106	Food preparations nes or included	7,155.9	11.9	1.1
16	1901	Flour, groats, meal, starch or malt extract preparations, not containing cocoa or containing less than 40% by weight of cocoa calculated on a totally defatted basis, nes	6,924.4	9.8	1.1
17	2103	Sauces and preparations therefor; mixed condiments and mixed seasonings; mustard flour and meal and prepared mustard	6,579.7	16.4	1.0

Source: Based on data from the Mexico Atlas of Economic Complexity; SHCP.
Note: CAGR = compound annual growth rate; HS = Harmonized System; nes = not elsewhere specified. These products represent 1 percent or higher of the selected states' total agro-industry imports. Percentages are the share of the product in the selected states' total agro-industry imports.

TABLE H.6

Growth of Leading Agro-Industry Imports in the Selected States

Rank	HS four-digit code	Description	Import value, 2014 (US$, thousands)	Share in the selected states' agro-industry imports, 2014 (%)	CAGR, 2004–14 (%)
1	0306	Crustaceans, whether in shell or not, live, fresh, chilled, frozen, dried, salted or in brine; crustaceans, in shell, cooked by steaming or by boiling in water, whether or not chilled, frozen, dried, salted or in brine; flours, meals and pellets of crustaceans	56,185.3	8.53	86.6
2	0901	Coffee, whether or not roasted or decaffeinated; coffee husks and skins; coffee substitutes containing coffee in any proportion	39,177.6	5.95	73.7
3	2306	Oilcake and other solid residues, whether or not ground or in the form of pellets, resulting from the extraction of vegetable fats or oils, nes	437.4	0.07	46.8
4	0802	Other nuts, fresh or dried, whether or not shelled or peeled	66.1	0.01	44.5
5	0210	Meat and edible meat offal, salted, in brine, dried or smoked; edible flours and meals of meat or meat offal	333.0	0.05	41.6
6	2009	Fruit juices (including grape must) and vegetable juices, not fortified with vitamins or minerals, unfermented and not containing added spirit, whether or not containing added sugar or other sweetening matter	99.3	0.02	35.9
7	1902	Pasta, whether or not cooked or stuffed (with meat or other substances) or otherwise prepared, such as spaghetti, macaroni, noodles, lasagna, gnocchi, ravioli, cannelloni; couscous, whether or not prepared	10,929.4	1.66	35.4
8	1517	Margarine; edible mixtures or preparations of animal or vegetable fats or oils or of fractions of different fats or oils of this chapter, other than edible fats or oils or their fractions nes	510.8	0.08	32.6
9	0504	Guts, bladders, and stomachs of animals except fish	134.5	0.02	27.9
10	0713	Dried leguminous vegetables, shelled, whether or not skinned or split	305.5	0.05	26.9
11	1521	Vegetable waxes (other than triglycerides), beeswax, other insect waxes and spermaceti, whether or not refined or colored	196.4	0.03	26.5
12	1005	Corn (maize)	99,333.8	15.08	26.2
13	0204	Meat of sheep or goats, fresh, chilled, or frozen	38.4	0.01	24.7
14	2001	Vegetables, fruit, nuts, and other edible parts of plants, prepared or preserved by vinegar or acetic acid	65.6	0.01	22.6
15	1207	Other oil seeds and oleaginous fruits, whether or not broken	1,122.9	0.17	22.4
16	2304	Oilcake and other solid residues, whether or not ground or in the form of pellets, resulting from the extraction of soybean oil	7,441.2	1.13	22.0
17	1206	Sunflower seeds	75.4	0.01	19.8

Source: Based on data from the Mexico Atlas of Economic Complexity; SHCP.
Note: CAGR = compound annual growth rate; HS = Harmonized System; nes = not elsewhere specified. Percentages are the share of the product in the selected states' total agro-industry imports.

TABLE H.7

Leading Agro-Industry Imports in Neighboring States by Contribution to the Nine States' Agro-Industry Imports

Rank	HS code	Product	Imports value, 2014 (US$, millions)	CAGR, 2004–14 (%)	Share in the nine states' agro-industry imports, 2014 (%)
1	1005	Corn (maize)	1,147.4	26.2	10.6
2	1001	Wheat and meslin	1,021.7	8.3	9.4
3	1201	Soya beans	654.8	5.4	6.0
4	0203	Meat of swine, fresh, chilled, or frozen	399.3	10.4	3.7
5	0201	Meat of bovine animals, fresh or chilled	395.5	7.7	3.7
6	0402	Milk and cream, concentrated or containing added sugar or other sweetening matter	395.3	6.1	3.7
7	2106	Food preparations nes	293.4	2.6	2.7
8	1205	Rape or colza seeds, whether or not broken	286.1	6.5	2.6
9	1511	Palm oil and its fractions, whether or not refined, but not chemically modified	236.8	20.2	2.2
10	2208	Undenatured ethyl alcohol of an alcoholic strength by volume of less than 80% vol.; spirits, liqueurs, and other spirituous beverages	224.7	3.8	2.1
11	0406	Cheese and curd	217.9	5.0	2.0
12	1006	Rice	217.3	6.7	2.0
13	2104	Soups and broths and preparations therefor; homogenized composite food preparations	181.2	3.0	1.7
14	1901	Flour, groats, meal, starch or malt extract preparations, not containing cocoa or containing less than 40% by weight of cocoa calculated on a totally defatted basis, nes	177.8	4.3	1.6
15	0207	Meat and edible offal, of the poultry of fowls of the species gallus domesticus, ducks, geese, turkeys and guinea fowls, fresh, chilled, or frozen	170.6	7.5	1.6
16	2204	Wine of fresh grapes, including fortified wines; grape nes	170.2	2.5	1.6
17	2008	Fruit, nuts, and other edible parts of plants, otherwise prepared or preserved, whether or not containing added sugar or other sweetening matter or spirit, nes	162.1	7.5	1.5
18	2103	Sauces and preparations therefor; mixed condiments and mixed seasonings; mustard flour and meal and prepared mustard	160.5	12.9	1.5
19	2304	Oilcake and other solid residues, whether or not ground or in the form of pellets, resulting from the extraction of soybean oil	157.3	24.6	1.5
20	1502	Bovine, sheep, and goat fats, raw or rendered	151.2	2.7	1.4

Source: Based on data from the Mexico Atlas of Economic Complexity; SHCP.
Note: CAGR = compound annual growth rate; HS = Harmonized System; nes = not elsewhere specified. The nine states include: Campeche, Mexico City, Michoacán, Morelos, Puebla, Quintana Roo, State of México, Tabasco, and Veracruz. These products represent 1 percent or higher of the neighbor states' total agro-industry imports. Percentages are the share of the product in the neighbor states' total agro-industry imports.

TABLE H.8

Leading Agro-Industry Imports in Neighboring States by CAGR

Rank	HS code	Description	Imports value, 2014 (US$, millions)	Share in the nine states' imports, 2014 (%)	CAGR, 2004–14
1	2401	Unmanufactured tobacco (whether or not threshed or similarly processed); tobacco refuse	14.6	0.1	43.4
2	0407	Birds' eggs, in shell, fresh, preserved or cooked	20.7	0.2	42.6
3	0803	Bananas and plantains, fresh or dried	0.3	0.0	39.6
4	0101	Live horses, asses, mules, or hinnies	24.6	0.2	34.1
5	2403	Other manufactured tobacco and manufactured tobacco substitutes; homogenized or reconstituted tobacco; tobacco extracts and essences	1.4	0.0	32.7
6	1517	Margarine; edible mixtures or preparations of animal or vegetable fats or oils or of fractions of different fats or oils of this chapter, nes	35.4	0.3	31.2
7	1801	Cocoa beans, whole or broken, raw or roasted	78.4	0.7	28.2
8	0907	Cloves (whole fruit, cloves, and stems)	3.1	0.0	28.1
9	2201	Waters, including natural or artificial mineral waters and aerated waters, not containing added sugar or other sweetening matter nor flavored; ice and snow	25.6	0.2	27.2
10	1005	Corn (maize)	1,147.4	10.6	26.2
11	1603	Extracts and juices of meat, fish or crustaceans, molluscs, or other aquatic invertebrates	0.3	0.0	24.7
12	2304	Oilcake and other solid residues, whether or not ground or in the form of pellets, resulting from the extraction of soybean oil	157.3	1.5	24.6
13	0306	Crustaceans, whether in shell or not, live, fresh, chilled, frozen, dried, salted or in brine; crustaceans, in shell, cooked by steaming or by boiling in water, whether or not chilled, frozen, dried, salted or in brine; flours, meals and pellets of crustaceans	95.5	0.9	24.5
14	0901	Coffee, whether or not roasted or decaffeinated; coffee husks and skins; coffee substitutes containing coffee in any proportion	69.1	0.6	24.4
15	1102	Cereal flours other than of wheat or meslin	13.7	0.1	24.1
16	1702	Other sugars, including chemically pure lactose, maltose, glucose, and fructose, in solid form; sugar syrups not containing added flavoring or coloring matter; artificial honey, whether or not mixed with natural honey; caramel	112.2	1.0	23.9
17	2303	Residues of starch manufacture and similar residues, beet-pulp, bagasse, and other waste of sugar manufacture, brewing or distilling dregs and waste, whether or not in the form of pellets	117.4	1.1	23.3
18	0701	Potatoes, fresh or chilled	0.8	0.0	23.3
19	0408	Birds' eggs, not in shell, and egg yolks, fresh, dried, cooked by steaming or by boiling in water, molded, frozen or otherwise preserved, whether or not containing added sugar or other sweetening matter	12.8	0.1	22.6
20	1511	Palm oil and its fractions, whether or not refined, but not chemically modified	236.8	2.2	20.2

Source: Based on data from the Mexico Atlas of Economic Complexity; SHCP.
Note: CAGR = compound annual growth rate; HS = Harmonized System; nes = not elsewhere specified. The nine states include: Campeche, Mexico City, Michoacán, Morelos, Puebla, Quintana Roo, State of México, Tabasco, and Veracruz. Percentages are the share of the product in the neighbor states' total agro-industry imports.

TABLE H.9

Key Agricultural Products of Chiapas

Product	Average year-on-year growth, 2010–18 (%)
Raw cane sugar (*piloncillo*)	151.1
Green tomato	131.4
Avocado	109.5
Rambutan	82.4
Tobacco	38.6
Hevea rubber	36.4
Lemon (*limón*)	35.0
Melon fruit	31.9
Peanuts	15.9
Papaya	13.8
	Share in national product value, 2018 (%)
Mangosteen	100.0
Rambutan	94.5
African or oil palm	57.0
Soy seeds	40.1
Coffee cherry	36.3
Cocoa	31.6
Hevea rubber	22.5
Banana	20.8
Mango	17.2
Peanuts	15.1
	Share in overall value of agricultural production of Chiapas, 2018 (%)
Corn grain (*maíz grano*)	24.8
Sugar cane	13.0
Coffee cherry	10.0
Banana	9.1
Mango	8.0
Meadows and pastures	5.5
African or oil palm	4.7
Beans (*frijoles*)	4.6
Papaya	4.3
Red tomato	2.9

Source: Based on data from SIAP 2019a.
Note: Outlined cells with blue dashed lines indicate a repetition in two categories.

TABLE H.10

Key Agricultural Products of Guerrero

Product	Average year-on-year growth, 2010–18 (%)
Cassava	153.7
Agave	146.1
Chickpea	54.9
Pumpkin seeds or chihua	37.3
Zempoalxochitl	34.4
Melon fruit	34.3
Avocado	24.8
Onion	24.4
Hibiscus (*jamaica*)	23.4
Nopalitos	22.7
	Share in national product value, 2018 (%)
Anthuriums (thick)	100.0
Copra	82.8
Common daisy	80.8
Scourer	75.5
Porophyllum ruderale (*pápalo*)	64.1
Morinda citrifolia	57.6
Hibiscus (*jamaica*)	53.6
Nanche	45.8
Mango	25.6
Sesame seed	25.4
	Share in overall value of agricultural production of Guerrero, 2018 (%)
Corn grain (*maíz grano*)	33.5
Mango	13.7
Meadows and pastures	13.4
Copra	10.8
Melon fruit	3.8
Lemon (*limón*)	2.3
Banana	2.3
Coffee cherry	1.9
Papaya	1.8
Sesame seed	1.7

Source: Based on data from SIAP 2019b.
Note: Outlined cells with blue dashed lines indicate a repetition in two categories.

TABLE H.11

Key Agricultural Products of Oaxaca

Product	
	Average year-on-year growth, 2010–18 (%)
Pepper	93.9
Sesame seed	72.2
Avocado	39.8
Cactus fruit (tuna)	32.9
Papaya	31.7
Sorghum grain	28.0
Pea (*arvejón*)	25.1
Oregano	23.0
Coriander	21.6
Sugar cane seed	19.6
	Share in national product value (%)
Birdseed (*alpiste*)	100.0
Ginger	38.6
Dragon fruit (*pitaya*)	33.2
Papaya	32.3
Pomegranate	22.4
Meadows and pastures	20.1
Raw cane sugar (*piloncillo*)	18.9
Oregano	17.6
Hibiscus	15.1
Lychee	13.9
	Share in overall value of agricultural production of Oaxaca, 2018 (%)
Meadows and pastures	25.0
Sugar cane	16.0
Corn grain (*maíz grano*)	14.6
Papaya	10.6
Lemon (*limón*)	7.0
Red tomato	4.0
Mango	3.6
Pineapple	2.6
Coffee cherry	1.8
Beans (*frijoles*)	1.5

Source: Based on data from SIAP 2019c.
Note: Outlined cells with blue dashed lines indicate a repetition in two categories. Outlined cells with red dashed lines indicate a repetition in three categories.

TABLE H.12

Key Agricultural Products of Yucatán

Product	
	Average year-on-year growth, 2010–18 (%)
Guava	888.2
Soybean	274.8
Lime (*lima*)	131.8
Peanuts	116.7
Cucumber	53.1
Green bean	50.5
Dragon fruit (*pitaya*)	39.4
Eggplant	35.5
Cassava	24.1
Orange	21.8
	Share in national product value (%)
Sugar apple (*saramuyo*)	100.0
X'pelon beans	96.9
Henequen	91.9
Caimito	73.8
Dragon fruit (*pitaya*)	57.4
Mammee (*mamey*)	52.7
Annatto	35.6
Sapote (zapote)	15.1
Sugar cane (*forrajera*)	11.1
Coriander seeds	10.7
	Share in overall value of agricultural production of Yucatán, 2018 (%)
Meadows and pastures	48.4
Corn grain (*maíz grano*)	11.3
Orange	8.0
Cucumber	7.3
Lemon (*limón*)	5.5
Soybean	3.0
Green chili	2.3
Papaya	2.2
Zucchini	2.1
Avocado	1.7

Source: Based on data from SIAP 2019d.
Note: Outlined cells with blue dashed lines indicate a repetition in two categories.

Notes

1. The South-Southeast region of Mexico covers nine states: Campeche, Chiapas, Guerrero, Oaxaca, Puebla, Quintana Roo, Tabasco, Veracruz, and Yucatán. Given the differences in economic structure, social development, and institutional capacities of each state, and potential flaws of having a "one-size-fits-all" approach, this Deep Dive by the International Finance Corporation focused on the three poorest states in Mexico: Chiapas, Guerrero, and Oaxaca—all located in the southern part of the country, and Yucatan, one of the more dynamic and developed states in the southeast.

2. GDP data is from INEGI's National Accounts; firm data is from INEGI's 2019 Economic Census.

3. Employment data is from INEGI's National Employment Survey for the first quarter of 2021. There are differences in the employment registered in the INEGI's Economic Census and this survey, notably in the agricultural sector, given that the former is an exhaustive census but only applied to established economic units (firms), whereas the latter is based on a survey applied to a representative sample of households considering three domains: 39 "self-represented" cities (according to political, economic development, average annual growth rate, urban development and classification on the national urban system), a high-density urban complement, and a rural domain. Hence, the employment survey includes concepts of people that are not considered in the census, such as the population employed in the agricultural field.

4. A product is said to have a comparative advantage if its revealed comparative advantage (RCA) is greater than one. The RCA is determined by calculating the ratio of the value added or export of an industry or product to the total value added or export in a state, over the average contribution of that industry or product in Mexico's total value added or exports. This indicator of a location's competitive strengths is based on Ricardian trade theory, which claims that patterns of production or trade among regions are defined by their relative differences in productivity.

5. INEGI's Input-Output Matrix, https://en.www.inegi.org.mx/programas/mip/2013/.

6. This section draws from the growth diagnostics decision tree developed by Hausmann, Klinger, and Wagner (2008) to a sectoral level.

7. A *Tipo Inspección Federal* (Federal Inspection Type; TIF) certification ensures that the facility where the livestock product was slaughtered, stored, or processed undergoes permanent sanitary inspections to fulfill all requirements from the *Secretaría de Salud* (Secretariat of Health) and the *Secretaría de Agricultura y Desarrollo Rural* (Secretariat of Agriculture and Rural Development), achieving the highest quality standard for trading livestock products domestically and internationally.

8. In Oaxaca and Guerrero, communal land represents 81 and 78 percent of all land, respectively, while in Chiapas and Yucatán, 59 and 55 percent of land is communal, respectively.

9. GDP data is from INEGI's National Accounts; firm data is from INEGI's 2019 Economic Census; employment data is from INEGI's National Employment Survey for the first quarter of 2021.

10. Data from Mexico's Secretariat of Economy.

11. INEGI (2019). For national levels, oil-related activities are excluded.

12. The comparison with the manufacturing sector was done considering the food, beverage, and tobacco industries, that is, excluding the nonmanufacturing components of agro-industry.

13. INEGI's Input-Output Matrix, https://en.www.inegi.org.mx/programas/mip/2013/.

14. Most agro-industrial projects used to be accompanied by strategies or programs to secure the supply of the primary products to be processed in proper quality and quantity.

15. WTO (2017).

16. INEGI's Input-Output Matrix, https://en.www.inegi.org.mx/programas/mip/2013/.

17. SIAP (2022).

18. According to Organisation for Economic Co-operation and Development estimates, producer support in the United States totaled US$26 billion in 2010 (7 percent of the total value of production). Mexico's support to producer during the same time period was US$6.2 billion (12 percent of the value of agricultural production) (UNCTAD 2014).

19. UNCTAD (2014).

20. Michalczewsky (2017).

21. UNCTAD (2014).

22. UNCTAD (2014).

23. UNCTAD (2014).

24. These products correspond to the NAICS six-digit codes for sectors 112, 114, 115, 311, and 312.

25. A product is said to have a comparative advantage if its revealed comparative advantage (RCA) is greater than one. The RCA is determined by calculating the ratio of the value added or export of an industry or product to the total value added or export in a state, over the average contribution of that industry or product in Mexico's total value added or exports. This indicator of a location's competitive strengths is based on Ricardian trade theory, which claims that patterns of production and trade among regions are defined by their relative differences in productivity.

26. Based on INEGI's ENOE database.

27. KPMG (2016). The study analyzed 100 cities in Mexico, Australia, Canada, France, Germany, Japan, Italy, the Netherlands, the United Kingdom, and the United States with sectors modeled on a 10-year horizon.

28. World Bank and MMK Consulting (2016).

29. KPMG International (2013).

30. UNCTAD (2014).

31. COFECE (2015).

32. Expansión (2019). The values are only for the top 500 companies in Mexico. For a longer list, see appendix G.

33. Refers to the food industry, a subsector that presents fewer years for which information is classified at the state level.

34. The neighboring states are Campeche, Morelos, Puebla, Quintana Roo, Tabasco, Veracruz, Michoacán, and the State of México; Mexico City is also included as a key domestic market.

35. To define relevant markets in Mexico, two criteria are considered: states in regions that represent a strategic location because of their connectivity to international markets (that is, the North and Bajío regions) and states that have a nonoil GDP per capita larger than the country average. Distances and estimated times displayed correspond

to nonlineal distances, according to the most efficient "ground" route.

36. Puebla, Oaxaca, and Guerrero were the third-, fourth-, and fifth-largest producers, respectively. Including Chiapas and Veracruz, these five states accounted for 94 percent of coffee production in 2021.

37. Hausmann, Cheston, Santos (2015).

38. Based on SADER's SIACON and UN Comtrade databases.

39. Guerrero is the third-largest producer with a share of 1 percent.

40. Báez (2018).

41. SADER (2022); SIACON database; Mexico Atlas of Economic Complexity.

42. Flores (2021).

43. Chiapas has four TIF slaughterhouses, 42 *rastros municipales* (TSS), and two private facilities, contributing 4.5 percent to the national infrastructure for meat production.

44. Mojarra is one of the most consumed fish products in Mexico given its tasteful flavor and low price.

45. SADER (2022); SIACON database.

46. For example, bluefin tuna is classified as an overexploited species, with catch amounts controlled by annual quotas, and, in 2021 and in previous years, exports of Mexican wild-caught shrimp to United States have been banned because of inadequate protections for sea turtles or similar environmental claims.

47. The *Centro Estatal de Acuacultura Chiapas* (State Aquaculture Center) could play a key role for this purpose. It could broaden its focus (currently only shrimp) to include other species, increase its budget, and seek out research partners according to this new scope.

48. Unlike mojarra production, which are easier to breed in confined spaces, tuna production is mostly obtained through high-seas catch, with less than 5 percent through aquaculture. Tuna's technical-biological limitations make them difficult to breed and produce in captivity. Tuna aquaculture depends on capturing juvenile fish from the wild that are fed in "farms" until they reach the adequate size for market (SAGARPA 2015; SEMARNAT 2015).

49. SEMARNAT (2015).

50. Sackton (2020).

51. SIAP (2021).

52. Port Chiapas has certain limitations when compared to larger Mexican ports, including high maintenance cost because of its dredging needs. Its level of commercial operations is significantly lower compared to those of the Port of Quetzal in Guatemala, which is 110 nautical miles away with an annual freight that was more than 30 times of Chiapas port over the last years, despite having relatively similar capacities. This suggests that the port will benefit from the development of new industries and stronger effort to promote new routes and trade products. In 2021, the Short-Sea Shipping Project was implemented with the Port of Quetzal to promote the Port of Chiapas as a logistics node for commercial exchange from and to Central America.

53. A priority project of the current federal administration aims to enhance the economic and social infrastructure around the corridor that represents the shortest distance between the Pacific and Atlantic Oceans in Mexico (approximately 300 kilometers, from the Port of Salina Cruz in Oaxaca to the Port of Coatzacoalcos in Veracruz) and consolidate up to 10 industrial parks (special economic zones) along it. The project could benefit 79 municipalities from Oaxaca (46) and Veracruz (33) and their populations of 2.4 million.

54. These municipalities include: (a) Amatenango de la Frontera, Benemérito de las Américas, Cacahoatán, Frontera, Frontera Comalapa, Hidalgo, La Trinitaria, Las Margaritas, Maravilla Tenejapa, Marqués de Comillas, Mazapa de Madero, Metapa, Motozintla, Ocosingo, Palenque, Suchiate, Tapachula, Tuxtla Chico, and Unión Juárez in Chiapas; (b) Calakmul and Candelaria in Campeche; (c) Balancán and Tenosique in Tabasco, and (d) Othón P. Blanco in Quintana Roo (for further details, see *Decreto de Estímulos Fiscales Región Fronteriza Sur*, https://dof.gob.mx/nota_detalle.php?codigo=5609182&fecha=30/12/2020).

55. The project plans to develop approximately 1,500 kilometers of railway, including approximately 1,000 kilometers of new tracks, that would connect 190 sites across the Mayan Peninsula mainly. Its primary focus is to not only incentivize tourism in the southern states of Campeche, Chiapas, Tabasco, Quintana Roo, and Yucatán, but also potentially facilitate the transportation of freight.

56. SIAP (2022); Mexico Atlas of Economic Complexity.

57. In 2021, mango production of 76.5 percent was concentrated in five champion states: Sinaloa (19.6 percent), Guerrero (18.8 percent), Nayarit (15.5 percent), Chiapas (12.6 percent), and Oaxaca (9.9 percent).

58. SADER (2017, 2022); SIACON. After the United Kingdom's exit from the Europe Union, benefits from the Free Trade Agreement with the region is in a transitory period. Mexico and the United Kingdom are exploring a bilateral agreement.

59. SIAP (2021a).

60. SIAP (2022); SIACON.

61. SIAP (2022).

62. Based on interviews with private sector stakeholders in 2021.

63. See https://www.magmar.com.mx/.

64. SIAP (2022).

65. SIAP (2021b).

66. SIAP (2022); SIAP; UN Comtrade.

67. Baja California Sur (45.0 percent), Yucatán (20.2 percent) and Baja California (18.6 percent) concentrated more than 80 percent of lobster production in 2021.

68. SIAP (2022); SIAP; UN Comtrade.

69. SADER (2022); SIACON; Mexico Atlas of Economic Complexity; https://www.kuo.com.mx/ .

70. That is, instead of focusing on country- or state-level economic growth, the analysis focuses on investment and growth for the specific industry in each state.

71. Appendix B presents a detailed analysis of the availability and cost of labor force for the sector which follows the methodology implemented by Barrios and others (2018a; 2018b) using data from INEGI's ENOE database and the *Sistema Nacional de Clasificación de Ocupaciones* (INEGI 2011). Three subsectors were assessed: agricultural products, the food industry, and beverage and tobacco product manufacturing. In each case, it was calculated the deviation between the share of occupations existing at the national and state levels, using the symmetric mean absolute percentage error as a measure of availability of workers performing the occupations required. In addition, the labor cost in each subsector for each state is calculated and compared to the national level, as a measure of relative availability or scarcity of qualified human capital, using a weighted average of the hourly wage. The ratio uses both in the numerator and denominator the ponderations of occupations at national level. In case a state has no workers in some occupation, the highest salary among the states for that occupation is assigned (reflecting the scarcity of workers in that activity). Because of the high prevalence of informality in the selected states and the salary gap between formal and informal jobs, the analysis is made for the total employment (formal and informal) and employment in the formal sector.

72. To identify infrastructure-related constraints hindering the development of the sector, the assessment of coverage and quality of infrastructure services are combined with measures of usage intensity of key inputs. A detailed analysis of coverage and quality of infrastructure services and their usage intensity is presented in appendices C and D.

73. This section draws on the analysis by Barrios and others (2018a; 2018b) and includes all industry groups under NAICS sector codes 31–33 (manufacturing) at the four-digit level, except classified ones, according to INEGI's Economic Census for 2014 and 2019.

74. A TIF certification ensures that the facility where the livestock product was slaughtered, stored, or processed undergoes permanent sanitary inspections to fulfill all requirements from the *Secretaría de Salud* (Secretariat of Health) and the *Secretaría de Agricultura y Desarrollo Rural* (Secretariat of Agriculture and Rural Development), achieving the highest quality standard for trading livestock products domestically and internationally.

75. UNCTAD (2014).

76. Waddington and others (2014).

77. UNCTAD (2014).

78. Appendix E provides detailed information on financial sector services coverage in the selected states.

79. Financial access points refer to banks, *sociedades cooperativas de ahorro y crédito popular* (savings and credit cooperative societies) and *sociedades financieras populares* (popular financial companies) branches, as well as bank agents, and automated teller machines.

80. Data from CNBV's *Bases de Datos de Inclusión Financiera* (Financial Inclusion Dataset) for December 2021.

81. For more details, see appendix A.

82. In this regard, completing and increasing the coverage of the program *Caminos Rurales* for paving rural roads in regions with high potential for primary activities that enable their integration to logistics corridors is key.

83. Given the large number of resources required and budget constraints faced by governments, the definition of strategic priorities (depending on the products and targeted markets) and sequence of infrastructure deployment, along with a higher private participation are needed.

84. An upgraded and more comprehensive *Servicio de Información Agroalimentaria y Pesquera* (Agrifood and Fishing Information Service) platform could be a good starting point. The system should also provide information on market trends and prospects; weather reports and analysis of quality and soil potential by region; training and advisory services on regulations, standards, and certification requirements for final consumption and export and high-end markets; among others.

85. These technologies include sensors for weather, moisture, and temperature control of crops; machines for spreading fertilizers and seeds remotely as well as for capturing aerial images to control plantations growth; and global positioning system.

86. Instead of those producers or organizations with larger lobbying capacities.

87. Once the agents benefit from the agglomeration externalities, the incentives can be phased out.

88. The intermodal system is an initiative of the *Coordinación General de Puertos y Marina Mercante* (General Coordination for Ports and Merchant Marine) for the period 2019–24 that aims to increase logistics routes through the use of the ports by offering coastal routes, better infrastructure for telecommunications and transportation in port facilities, attraction of industries near ports, and creation of social infrastructure for cities and towns near ports.

89. Reassess initiatives proposed by livestock producers in the Istmo region for export markets harnessing the CIIT project and explore the feasibility of a facility close to the metropolitan area of Oaxaca City (the main local target market).

90. Some of these technologies could be sensors for weather, moisture, and temperature control in crops. Machines for spreading remotely fertilizers and seeds, aerial images to control growth of plantations and global positioning satellite technology (for more on agricultural technologies, see https://nifa.usda.gov/topic/agriculture-technology.

91. Santacoloma and others (2016) defines agri-PPPs as formalized partnerships between public institutions and private partners designed to address sustainable agricultural development objectives, where the public benefits anticipated from the partnership are clearly defined, investment contributions and risk are shared, and active roles exist for all partners at various stages throughout the PPP project lifecycle.

92. A weighted average of the hourly wage is used for the national and state level. The ratio uses the ponderations of occupations at the national level as the numerator and denominator. In case a state has no workers in some occupation, the highest salary among the states for that occupation is assigned (reflecting the scarcity of workers in that activity).

93. The approach and assumptions are similar to that used by Barrios and others (2018a; 2018b).

94. Yucatán has another airport in Tizimín, but currently it has no operations.

95. World Bank (2018).

96. Includes natural protected and voluntary protected areas.

97. The analysis approach and assumptions are similar to that used by Barrios and others (2018a; 2018b).

98. World Bank (2018).

99. In 2017, the state government of Oaxaca compromised to develop a TIF slaughterhouse in the municipality of Juchitán de Zaragoza. However, the project did not go forward. For more details, see https://compromisoporoaxaca.com/?cat=40.

100. Financial access points refer to bank, *sociedades cooperativas de ahorro y crédito popular* (savings and credit cooperative societies) and *sociedades financieras populares* (popular financial companies) branches, as well as bank agents, and automated teller machines.

101. Data from CNBV's *Bases de Datos de Inclusión Financiera* (Financial Inclusion Dataset) for December 2021.

102. Average for the time period 2014–18; the states are Sinaloa (17.8 percent), Durango (17.4 percent), Zacatecas (15.9 percent), Michoacán (15.6 percent), and Jalisco (14.6 percent).

103. This can be observed from taking the difference between all external financing and financing from banks.

104. Regarding pay debt and pay wages, by excluding Durango, an upper-end outlier, the comparison reveals a balance between firms in the selected states and in champion states.

105. At most 10.6, 8.0, and 3.1 percent, respectively.

106. A remarkable fact is that, despite Chiapas being the largest coffee producer among the 32 Mexican states, Cafesca imports, mainly from Vietnam, the Robusta coffee beans it uses for its products. Robusta is cheaper, stronger, with more caffeine content and even more resilient than Arabica which the state, like the national and global, production is concentrated. In addition, the imported coffee does not arrive to Port Chiapas but to the Port of Veracruz and brought to Chiapas by road, which significantly increases logistics costs for the firm.

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