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MEXICO'S AGRICULTURE DEVELOPMENT:
Perspectives and outlook

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ABBREVIATIONS AND ACCRONYMS

AFA	Agro-Food Armour
AMIS	Agricultural Market Information System
APEAM	Avocado Producers and Exporting Packers Association of Michoacán
APEC	Asia-Pacific Economic Cooperation
APHIS	Animal and Plant Health Inspection Service
ASA	Aeropuertos y Servicios Auxiliares
ASERCA	Apoyos y Servicios a la Comercialización Agropecuaria
AVE	Ad Valorem Equivalents
BPA	Buenas Prácticas Agrícolas
BPM	Programa de Buenas Prácticas de Manufactura de Alimentos
CANIMOLT	Cámara Nacional de la Industria Molinera de Trigo
CDC	Centers for Disease Control
CDM	Clean Development Mechanism
CFC	Mexican Federal Competition Commission
CIDRS,	Commission for Sustainable Rural Development
COFEPRIS	Comisión Federal para la Protección Contra Riesgos Sanitarios
CONAGUA	Comision Nacional del Agua
CONASUPO	Compañía Nacional de Subsistencias Populares
ENERGEX	ENERGEX Biocombustibles Internacionales, S.A. de C.V.
EU	European Union
FAEE	Fatty acid ethyl esters
FAME	Fatty acid methyl ester
FAO	Food and Agricultural Organization of the United Nations
FDA	Food and Drug Administration
FIRA	Fideicomisos Insituidos en Relacion a la Agricultura
FIRCO	Fideicomiso de Riesgo Compartido
FOCIR	Fondo de Capitalizacion e Inversion del Sector Rural
FSMA	Food Safety Modernization Act
FTA	Free Trade Agreement
GATT	General Agreement on Tariffs and Trade
GDP	Gross Domestic Product
GIMSA	GIMSA, Sociedad Anonima Bursatil de Capital Variable
GMO	Genetically Modified Organism
GPEC	Epecial Concernet Program for Rural Development
GSTP	Global System of Trade Preferences among Developing Countries
Ha	Hectare
HACCP	Hazard analysis and critical control points
HVA	High-Value Agriculture
IADB	Inter-American Development Bank
ICO	International Coffee Organization

ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IEA	International Energy Agency
IMF	International Monetary Fund
Kgs	Kilograms
LAERFTE	Ley para el Aprovechamiento de las Energias Renovables y Financiamento para la Transición Energetica
LDRS	Ley de Desarrollo Rural Sustentable
LFC	Ley Federal de Competencia Económica
MCS	México Calidad Suprema
MFN	Most favoured nation
Minsa	Grupo Minsa, Sociedad Anonima Bursatil de Capital Variable
MMT	Million Metric Tonnes
MTBE	Methyl Tertiary Butyl Ether
Mw	Megawatt
MXN	Mexican Peso
NAC	National Accord for the Countryside
NAFTA	North Atlantic Free Trade Agreement
NGO	Non-Governmental Organization
NTBs	Non-tariff barriers
NTMs	Non-Tariff Measures
OECD	Organization for Economic Co-operation and Development
OTDS	Overall Trade Distorting Support
PAPIR	Programa de Apoyo a los Proyectos de Inversion Rural
PDR	Rural Develpment Program
PEC	Programa Especial Concurrente para el Desarrollo Rural Sustentable
PECC	Programa Especial de Cambio Climático
PEMEX	Petróleos Mejicanos
PROCAMPO	Programa de Apoyo Directo al Campo
PRODESCA	Programa de Desarrollo de Capacidades en el Medio Rural
PROFEMOR	Programa para el Fortalecimiento de Empresas y Organización Rural
PROGRESA	Programa de Educación, Salud y Alimentación
PRONASE	Productora Nacional de Semillas
PTN	Protocolo in Trade Negotiations
REMBIO	Red Mexicana de Bioenergia
RME	Rapeseed methyl ester
RTAs	Regional Trade Agreements
SAGARPA	Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación de México
SAGARPA-CONACYT	Fondo Sectorial SAGARPA - Consejo Nacional de Ciencia y Tecnologia
SCT	Secretaria de Comunicaciones y Transporte
SE	Secretaria de Economia
SECTUR	Secretaria de Turismo

SENER	Secretaría de Energía
SHCP	Secretaria de Hacienda y Credito Publico
SIAP	Statistical Institute for Asia and the Pacific
SME	Soy methyl ester
SNAP	Supplemental Nutrition Assistance Program
SPS	Sanitary and Phytosanitary Measures
SPS Systems	Single Payment Scheme Systems
STPS	Secretaria del Trabajo y Prevision Social
TBT	Technical Barriers to Trade
TNCs	Transnational Corporations
TPP	Trans-Pacific Partnership
TPR	Trade Policy Review
UMFFAAC	Unión Mexicana de Fabricantes y Formuladores de Agroquímicos
UN	United Nations
UNCTAD	United Nations Conference on Trade and Development
UNEP	United Nations Environment Programme
UNICA	União da Indústria da Cana-de-Açúcar
UNIDO	United Nations Industrial Development Organizations
UNFCC	United Nations Framework Convention on Climate Change
U.S.	United States of America
USDA	United States Department of Agriculture
USTR	Office of the United States Trade Representative
WTO	World Trade Organization

EXECUTIVE SUMMARY

This work (Outlook) is the response by UNCTAD to a request made by SAGARPA to address the issue of Mexican Agricultural Development and Policy with an integrated, holistic approach. The Outlook addresses key issues affecting agricultural production and trade of those commodities identified by the Mexican authorities as being of strategic importance for the country. It encompasses both macro- and micro-economic issues with links to commodities, trade policy and trade agreements, competition and competitiveness, and food and energy security. It also identifies complementary measures and enabling policies, such as infrastructural investment, research and development, and trade facilitation. Furthermore, the Outlook demonstrates a close integration with the national development outlook of Mexico, which ensures an ongoing consistency with overall national development priorities, including enhancing food security, and reducing poverty, consistent with the UN Millennium Development Goal 1.

Extensive primary research has been carried out to facilitate this diagnosis, including data collection, numerous videoconferences, and interviews with many stakeholders within Mexico's agricultural sector including various Mexican government agencies. This component was coordinated by the SAGARPA, and the Permanent Mission of Mexico in Geneva.

Agriculture remains a very important sector for Mexico. Despite the declining contribution of the sector to GDP, and the shrinking of agricultural labour force, about half of the rural population was employed in the sector in 2011. Poverty in rural areas in Mexico is high and has been increasing. In 2008, 61 per cent of the rural population (with an average annual income of 3,800 pesos) was classified as poor, as compared to a national rate of 45 per cent. In 2007, small farms represented approximately 73 per cent of total production units. Indeed, small and medium producers employ a majority of rural population but their potential to provide a decent livelihood for themselves and to constitute a viable base for expanding economic activity in rural areas is curtailed by a variety of constraints. These include rising costs of factor inputs, land possession issues, adverse climatic conditions, increasing competition from below-cost imports, structural rigidities and some public policies, which although designed to benefit small and medium holders have not had the intended impact.

There is the need for public policy and private action (possibly Public-Private-Partnerships) to address the root causes of the continued economic marginalization of small holders, and of agriculture generally, in order to enhance the sector's resilience and ensure food security.

It is in this context that this diagnosis was undertaken not only to provide extensive analysis and a comprehensive discussion of the agricultural sector in Mexico but also to identify realistic policy recommendations that provide workable solutions to enhancing the development impact of the agricultural sector. It is important, however, that agricultural development is regarded as an opportunity within the Mexican economy to be exploited to create jobs, reduce poverty and enhance food security, rather than a problem; and that SAGARPA can, and indeed must, be an integral part of the rejuvenation and the sustainable development process of Mexican agriculture.

Agricultural development, food security and poverty reduction

Mexico is the home of avocado and corn (or maize), with both having long histories which are deeply engrained in Mexican culture and lifestyle. Agriculture remains the livelihood for an estimated eight million rural farmers (about 7 per cent of total population), who produce much of Mexico's agricultural and food produce (agrifoods) for export and domestic markets, on landholdings no bigger than five hectares. Mexico is among the world's leading agrifoods producer: ranked first in avocado, lemon and limes, third and fourth respectively for grapefruit and corn, fifth for beans, coconut oil, oranges and poultry and sixth for sugar. However, owing to various factors, both national and international, including trade and related policy reforms, Mexican agricultural production has suffered. According to OECD data between 1993 and 2010, total agricultural employment in Mexico declined by 28 per cent; agricultural wages have also declined during the last decades up to 2007, while wages in other sectors have generally increased. Domestic agricultural production also appeared to have suffered during the period. In a single year, the production of Mexican corn and other basic grains fell by half due, inter alia, to competition

from imports, and millions of peasant farmers lost their income and livelihoods. The recalibration of government agricultural support in response to trade liberalization from the price-based CONASUPO programmes to the direct transfer-based PROCAMPO programme, has had a limited impact on transforming Mexican agriculture. As PROCAMPO payments were not targeted to where it was most needed, a significant portion of the fiscal support went to large farm holdings, which oft-shielded them from external competition.

The opening up of the Mexican market following the complete removal of tariff and quota restrictions in 2008 owing to trade reforms under NAFTA and other trade agreements, was followed by an increase in Mexico's non-oil exports fourfold and expanded foreign direct investment by 14 times. However, the terms of trade for its farmers, had declined. The influx of below-cost consumer goods and imports of key agrifoods – for which Mexico has comparative advantage in producing them - either squeezed farmers out of production and into poverty, or excluded them from high value markets. Rural poverty is a leading 'push factor' that is driving asset-poor rural farmers to sell off their lands and migrate north of the border to U.S. in search of work and better lives.

The changing policy environment and agricultural markets may have also had a negative impact on the environment, threatening the traditional agricultural ecosystem and biodiversity. In order to cope with reduced incomes, both commercial and subsistence producers shifted into intensive agricultural farming systems including the cultivation of high-yielding varieties of food crops. In the process, farmers abandoned the traditional milpa system which included intercropping of food crops. Monoculture cultivation systems based on intensive use of agro-chemical inputs gradually replaced low-input traditional systems that promoted agro-diversity and sustainable agricultural production, which preserved Mexico's rich germaplasm resources.

To reinforce the sustainability of small and medium-scale producers and to increase their competitiveness, the introduction of irrigation and improved farm management practices, including the use of high quality seeds, fertilizer and new technology, are necessary. However, programmes to deliver these services must be properly targeted in order to get optimum results - higher yields and sustainable incomes for producers. Technological improvements have qualitative benefits on products, including better output quality, homogeneity and predictability, which also reduce the risks to output volatility. These characteristics not only increase the competitiveness of the commodity sector and open market niches; they also facilitate to access working capital and agricultural credit for new investments. Of key importance is the recognition of the fundamental dependence of profits on irrigation, as negative margins are widely correlated with an absence of irrigation. With the exception of sugarcane, a lack of irrigation negatively affects almost all crops, and reduces the competitiveness of broad sections of small and medium-scale farmers, who depend on rain-fed agriculture. Negative margins are not only an indicator of the low level of economic efficiency in the agricultural sector, but also of low annual family incomes for small farmers.

Lack of access to working capital through credit is a key constraint on improving agricultural productivity and intensification of activities. Apart from a small number of small farmers that used private (Alianza) funds, many have been unable to access state support to diversify into other profitable activities such as value addition.

While targeted investment in small-scale farmers is generally considered as the most cost-efficient instrument for reducing poverty, in reality, both public policies and private actions have not fully exploited this potential. There is the need for a public policy and private action to help improve infrastructure, access to credit and technologies, business skills, supply-side capacities (e.g. food safety standards), and design and implement, where appropriate and feasible, market-based innovative schemes (e.g. crop and weather insurance schemes) for farmers. Without these transformations, the rural economy cannot generate sufficient income opportunities to reduce poverty among vulnerable groups.

Government agricultural programmes have largely had a limited impact in promoting capacity building investments or diversification out of agriculture and into other productive sectors of the economy. The corn subsidy programme, for example, should be reviewed with the objective of enhancing targeting, with clearly defined and closely monitored eligibility criteria, as well as time-bound exit strategies. Programmes should also assist smallholder producer organisations have access to storage and warehousing systems, processing facilities, contracting transport services, and inputs procurement. Improving research and extension services (e.g., 'train-the-trainer' schemes) would help smallholder producers increase productive capacities, facilitate access

to knowledge and high-yielding seed varieties, and increase efficient use of resources (e.g. water harvesting techniques). Underinvestment in rural infrastructure (e.g., poor infrastructure and border facilities) contributes, in part, to the weak international competitiveness of Mexican agriculture. Overall, logistical costs are twice as high as they are in the U.S. and other OECD countries. The government should therefore increase public investment in basic rural infrastructure.

Poor cash flows limit the small farmers' investment, production, harvesting and marketing decisions. There is a need to increase financial services and access to affordable credit to these farmers through public and private credit schemes. Further develop the role of non-bank and semi-formal financial institutions, financing models that focus on supply chain finance, and encourage the development of micro-finance institutions. Addressing property rights (land tenure and access to water right) is key to helping small and medium producers to use their land as collateral.

The WTO Agreements on Technical Barriers to Trade (TBT), and Sanitary and Phytosanitary (SPS), notwithstanding, the SPS requirements embodied in regional trading agreements, set out the basic rules and guidelines for Mexico to implement so that its exports meet the quality and technical regulations. Over the past 30 years, there has been a proliferation of non-tariff measures (NTMs), particularly stringent food safety and quality standards, both public (mandatory) and private (voluntary) standards, technical regulations and food laws applied in major markets of export interest to Mexico. These NTMs, can, and have restricted trade, and increased the cost structure of Mexico's agrifood industry.

Mexico's long history with trade-related phytosanitary problems dates back to 1914 when the U.S. imposed quarantine restrictions on Hass avocados entering its markets. While Mexico has made considerable strides in enacting food safety laws: Plant Production Law (revised 2008), and the federal General Health Act, to meet export standards and quality requirements, considerable challenges remain. Over the past several years, food safety-related trade problems, particularly border rejections as well as food- and water–borne illnesses in the global food chain have increased. This reveals both sector and product, and systemic weaknesses in the compliance capacities of Mexico.

The Government of Mexico, through SAGARPA and Health Ministry, had reformed and modernized its national food safety laws and regulations to fully establish new public oversight of its agrifood supply chains. Given that U.S. is its major trading partner in agrifoods, Mexico should periodically review and maintain its Agreement on Food Safety Rules with the U.S., particularly the FDA.

Trade, an important determinant for the agricultural sector

For Mexico, both agricultural exports and imports have increased significantly in recent years and are highly concentrated towards the US, accounting for some three-quarters of its agricultural trade. The share of agricultural trade with the US has not significantly increased since the early 1990s, although the composition of trade has changed, as more staple crops and meats flow south and more beverages, seasonal fruits and vegetables flow north. This development coincides with a change of the trade policy that has led to much more open markets, especially within the NAFTA region. The European Union is the third largest market for imports and the second largest market for exports from Mexico, followed by Canada and Japan. These four destinations account for about 90 per cent of Mexico's agricultural exports.

Despite the fact that Mexican agricultural exports to the world and the US grew 170 per cent, Mexico has been a net-food and animal product importer since the 1980s as the rise of agricultural imports in recent years is significant (200 per cent since 1995) and in the upper range of other countries' average import growth. The increase of imports of some particularly sensitive products such as corn, rice, beef, pork, poultry and beans are high. For instance, imports of maize are 670 per cent higher in 2008-2010 than they were in 1991-1993, and imports of beans have increased by 853 per cent. The main agricultural exports of Mexico are horticulture products, such as tomatoes and fruits, whilst beer exports have also increased significantly. Mexico has a significant market share in US agricultural imports of about 17 per cent. The importance of live cattle has decreased, though it remains important.

Due to this increasing specialization the self-sufficiency ratio declined considerably for some essential food products such as beans, maize, rice and wheat. The self-sufficiency ratio has increased significantly for most vegetables such as tomatoes and many fruits, mostly citrus fruits. NAFTA has contributed to this increased specialization.

Mexico has undertaken significant agricultural market reforms which includes a decrease of its trade barriers since the early 1990s. Mexico is a founding member of the WTO. Mexico's commitments under the WTO are unlikely to have contributed to the increase in agricultural trade and in trade specialization.

Mexico's external agricultural trade relations are dominated by bilateral agreements, which provide both opportunities and challenges. Mexico is member of several RTAs with countries in the region and South America as well as with several developed countries. Trade in agricultural products is, however, relatively small with many of these partners. NAFTA that came into force in 1994 has eliminated all tariffs on agricultural products between Mexico and the US. Other RTAs such as the one with the EU exclude sensitive products including often those that are of export interest to Mexico. Tariff commitments have increased Mexican farmers' exposure to agricultural policies of its main trading partners. Thus, for example, any changes in US agricultural policy, such as new US farm bills, have a direct impact on Mexican farmers. High subsidies in the US on products such as maize, rice, sugar, sorghum and wheat during the late 1990s and early 2000s have led to significant losses for Mexican farmers producing such commodities. It is likely that this contributed to low investments which in turn are a major course for the low productivity in Mexico. However, consumers and exporters of fruits and vegetables and certain processed products have benefited from the market opening. The government needs to review the level of exposure to external shocks, to try and identify measures to limit the impact of such shocks and to ensure fair market conditions as well as coherence between trade and development policies.

Globally there is a tendency to move away from border measures towards behind the border measures, including allowing subsidies such as decoupled domestic support. The WTO agreement on agriculture provides flexibility for support which could include income loss insurance, investment subsidies and other measures. There are no commitments on domestic support in the important RTAs. Domestic support in agriculture would have a positive impact on production and employment in agriculture but would impose a cost on other sectors.

With regard to offensive interests in free trade agreements including in those with trading partners that have interesting and highly protected agricultural markets such as the EU and Japan it appears that Mexico's agricultural sector has not increased its exports to these partners at a higher pace than other countries and remains to have a small market share (except within the US). Mexico also has signed RTAs with developing countries and in few cases has been able to disproportionately increase its exports. However, exports to its developing country trading partners and dynamic developing country markets remain very low. Despite many difficulties including exclusion of sensitive products or competition from highly productive countries Mexico has proven to be very competitive with certain products and should explore increasing exports to the markets with which it has trade agreements markets.

Participation in new free trade agreements, Trans-Pacific Partnership, is currently being discussed. Although Mexico has agreements with various TPP countries such as Chile, Peru and the US, it would be a far reaching agreement and as such, Mexico should assess in detail its implications.

Due to the elimination of agricultural tariffs between the US and Mexico, NAFTA has contributed significantly to market integration. However, in terms of standards and other measures regulating cross border trade the markets are not fully integrated and do not have a common agricultural policy. Having preferential tariffs with its major trading partners non-tariff measures become more relevant instruments determining market entry conditions, such as the requirement to meet standards in export market. The standards that seem to be most problematic to exporting firms and producers are labeling requirements, SPS measures and security/customs procedures.

Problems relate to difficulties to meet high official and private standards in developed country markets and grey areas in trade rules disciplining them. Since Mexico's main trading partners are all developed countries NTMs are of particular interest to Mexico. Standards in export markets have to be met and Mexican producers could be supported through appropriate agricultural extension services.

Mutual recognition and equivalence seem to have not worked well to overcome barriers identified. Working with key trading partners towards harmonization of measures and regulation could be an interesting path to explore, particularly for food packaging and nutrition labeling regulations which is very controversial in the current context of trade with the US. This path could also be explored in the case of food safety, risk assessment and risk reduction. Standardized and mutually facilitated customs procedures with its main trading partner are important.

From the import perspective, the issue of standards seems to be related to the weak domestic capacity to enforce and verify quality regulations, which in turn can lead to a non-uniform application of requirements at border ports of entry. From the point of view of producers, this situation is perceived as contributing to (1) unfair competition with low quality and cheap imports of agricultural products, which affect the price and quality of inputs along the value chain and (2) lack of consumer protection. To overcome these challenges, Mexico should examine the need to strengthen quality control measures and enforcement in the domestic market to improve consumer protection. Furthermore, a strong monitoring of import prices could detect potential "dumping". One particular concern is the increase of imports of animal parts, for example chicken parts in particular thighs and legs, not meeting the taste of exporting countries' consumers at low prices.

The competitive environment of the agricultural sector

A detailed assessment of competition issues in corn production and commercialization in Mexico, has helped to identify impediments to agricultural development and policy options to address these. The possible existence of particular restrictions to competition in the Mexican agricultural has been highlighted, namely the presence of large suppliers of agricultural inputs (fertilizer, seeds, etc.) and buyers (such as processors and retail chains) that might abuse their market power to the detriment of farmers and consumers. Starkly differing degrees of concentration exist at different levels of the agricultural value chain as while both production and consumption are highly atomised, agricultural commodities typically pass through a number of highly concentrated functional markets between growers and consumers. The market value chains in Mexico are concentrated in the hands of few medium- to large-scale private sector oligopolies, who also claim much of the benefits from domestic farm support (subsidy) programs instituted by the Mexican government.

While overall there are 2 million producers of corn in Mexico, they can be divided into two categories: commercial and traditional. It is estimated that the minimum surface for commercial corn production is around 30 hectares per farmer, which means that only large and medium sized farms are actually in a position to participate in commercial production. However, less than 6 per cent of all farmers in Mexico benefit from land possession of more than 20 hectares and most of the larger farms are located in the Northern regions. The large majority of small holders engaging in traditional farming are located in the Southern region where they either produce solely for self-consumption or sell corn to persons living near their farms. The productivity of traditional farmers is reported to be 15 to 20 per cent of the level of productivity of commercial farmers.

As local corn production freely competes with corn production in the US, it is reported that prices for corn produced in Mexico are based on the corn future prices at the Chicago Mercantile Exchange plus international and national transport costs that would occur when importing corn from the US minus cost for local transportation from the production to the consumption point, which would not occur in the case of imports. This formula clearly reflects the interchangeability of US and Mexican price from a demand side perspective. A recent study on this issue concludes that these fears were well founded and that until the price peaks of agricultural products during the recent food crisis, subsidised corn from the US eliminated for the lowest productivity smallholder in Mexico any positive income from the sales of corn in the market place and forced them to retreat into subsistence.

There is an increasing use and dependency of commercial farmers on hybrid corn seeds and the market remains highly concentrated to date with Monsanto holding a dominant position. This position was strengthened by the liquidation of PRONASE in early 2000s as, according to a recent study, 95 per cent of the hybrid seeds planted in 2009 were produced solely by Monsanto and Pioneer. In contrast to the large number of corn producers in Mexico, corn processors GIMSA, S.A.B. de C.V (GIMSA) and Grupo Minsa SAB de CV (Minsa) have an estimated market share of around 97 per cent. In such concentrated market, corn processors could take advantage of their superior market power to pay less than international prices to local corn producers while charging international

prices to local customers pressurize small domestic corn producers without storage or alternative buyers or only honour favourable contractual obligations. Even in the absence of abusive practices by a dominant company, which would be prohibited by competition law, highly concentrated markets are characterised by less competition compared to less concentrated markets and can have a negative impact on prices and product innovation. Continuing to actively enforce the Ley Federal de Competencia Económica in the agricultural sector would help to address certain of the possible competition issues affecting corn production and processing. In particular, continuing to vigorously assessing mergers that affect those agricultural markets that are already highly concentrated will prevent further concentration through external growth.

Conversely, the Mexican market for agrochemicals is composed of more than 50 players and has been described as highly competitive. However, as regards the key ingredients for potassium fertilizer, recent research suggests the existence of a worldwide operating potash cartel which, although operating outside of Mexico, would have a clear impact on the prices of potassium fertilizers in Mexico. With respect to the producers of agrochemicals that are active in the production of active substances, (ii) the manufacture of the formulation from active substances and inert ingredients, and (iii) the packaging of such formulations, a study from 2005 finds that at the time 75 to 80 per cent of the overall market were controlled by only six companies: Syngenta, Bayer, Monsanto, BASF, Dow and DuPont. This relatively high level of concentration on the international level suggests that it may be worth assessing the Mexican market for agrochemicals in more detail.

Concentration of market power, in both buyer and seller, given oligopolistic behaviour in Mexico's agrifoods sector, distorts markets and prices, which impacts negatively on the millions of 'price-taking' asset-poor farmers and small- to medium-scale agritrade entrepreneurs. It is therefore imperative for the development of 'new' approaches to national competition policy that addresses the inconsistencies and the negative impacts of market power concentration on both producer and consumer welfare. Enforcement of transparency and accountability is central to this process. In this connection, apportioning of benefits and costs between the participants along the different agrifoods value chains, and procedures and policies in that trading relationship. Further, in order to restore some balance in the value chain the establishment and strengthening of producer organisations such as cooperatives or farmers associations through information, incentives, and appropriate regulation should be encouraged; easy and affordable access to market intelligence and price information, through market information system that is accessible to smallholder, should be set up; and local rural and urban markets need to be better integrated. Smallholder associations/cooperatives could also invest in storage facilities, which would allow for certain flexibility when selling their harvest. Further, advocacy measures targeted at smallholders could increase their capacity to denounce of anti-competitive conduct from which they suffer and to provide the CFC with the required information to start an investigation.

The potential of bioenergy

The promotion of biofuels in conjunction with the agricultural sector in Mexico can help enhance income opportunities and improve access to energy services. Mexico's policies supporting sustainable development open significant business and job opportunities for biofuels and bioenergy. In particular, residue streams from agriculture can enhance value chains of agricultural products. This could considerably help rural areas improve economic diversification while supporting a national transition to a low-carbon economy.

The use of residual by-products of agriculture to produce biofuels can add value to the lifecycles of agricultural goods whilst addressing energy needs in rural areas. The large availability of agricultural residues in Mexico improves prospects for the production of biofuels using low-cost, non-edible feedstocks. Other co-benefits can also be tapped, such as employment creation, income generation and alternative energy solutions, while safeguarding food security in Mexico. Potentials are estimated for the production of bioelectricity, biogas and second-generation liquid biofuels using residue streams from the industrial processing of 13 agricultural products in Mexico (corn, sugarcane, beans, wheat, rice, sorghum, coffee, egg, milk, beef, pork, poultry and fish). The use of harvest residues as a feedstock was not considered due to their role in protecting soils against erosion and their use as a natural fertilizer.

Energy potentials considering residues from the 13 selected products only show a large under-utilized and untapped potential: bioelectricity could produce 10.5 per cent of the yearly national electricity consumption in Mexico; 2nd generation bioethanol could replace 6.3 per cent of gasoline used (in energy terms); biodiesel produced via biomass-to-liquid technologies could replace 23.2 per cent of diesel demand; and biomethane could meet up to 14 per cent of natural gas demand in the country.

By integrating energy and agricultural production, estimates suggest significantly increased income-generation in rural areas. By considering residues from the 13 agricultural products analyzed, the production of bioelectricity, bioethanol and biodiesel could generate between USD 2.2 and 4.1 billion in additional revenue for Mexican agriculture. Biogas potentials could add another USD 234 million to revenue earnings.

The production of biofuels from agricultural residues could also provide important net employment opportunities in Mexico, including from the development of bioelectricity (direct and indirect), bioethanol, biodiesel and biogas. These jobs would provide better worker wages and offer higher-skilled employment opportunities than the current average in Mexican agriculture. While the average revenue per job created in the entire Mexican agricultural sector is USD 9.020 per employee, the equivalent in bioenergy has been estimated to average USD 57.400 per employee. Since many of the products analyzed are also cultivated in smallholder systems with low remuneration, income diversification arising from the additional bioenergy revenue streams could help to reduce rural poverty, seasonal fluctuations in agricultural employment and income, and rural emigration.

However, before these potentials can be realized, many regulatory and technological hurdles need to be overcome. The legal framework for biofuels in Mexico has advanced since the publication of the National Biofuels Law in 2008. While it has prompted an interest in first-generation biofuel production, little attention has been paid to the use of agricultural residues to produce biofuels or to foster technological options for 2nd generation biofuels. Demand-pull instruments have been based on public procurement mechanisms that focus primarily on first generation anhydrous ethanol, without including provisions to encourage second generation biofuel development and production. The new strategy for anhydrous ethanol blending in the country calls for the company Petróleos Mexicanos (PEMEX) to procure indicative amounts of ethanol to be blended into gasoline starting in 2012. However, there are currently no foreseen minimum purchase requirements on biofuels produced from residues.

Moving beyond the current focus on first generation biofuels is very important. In order to tap the wealth of resources existing in agricultural residues, the country may need a comprehensive framework to accelerate technology development and demand for biofuels produced from residues. Since second generation biofuels are not yet produced at commercial scales, the Mexican government has made efforts to support research, as well as development and transfer of technologies in the sector. A number of programs are in place to support rural investments and R&D efforts in biofuels activities, notably in biogas projects from anaerobic digestion. Even as the government has sought to facilitate communication about existing instruments supporting production, storage, transport and retail of biofuels, it remains unclear for producers which programs are best suited to support development of biofuels made from agricultural residues. That, coupled with the lack of foreseeable market opportunities for advanced biofuels in the country, leads to market uncertainty and discourages private investments in research and development.

Clear strategies to bring down costs and investment risks, as well as to promote research and deployment of second generation biofuel technologies, both indigenously and in cooperation with other countries, will be critical for the realization of the potential economic gains identified in this Outlook. In addition, international cooperation will be important to meet initial R&D costs, as well as to generate markets of sufficient size to exploit available economies of scale. For that, Mexico can benefit from its ongoing biofuel partnerships in the Mesoamerican region, and from cooperation with countries and regions engaged in advanced biofuels research and deployment, such as the United States, Brazil and the European Union.

The institutional dimension also deserves attention. The rural policy approach in Mexico has sought to promote dialogue and cooperation between different government ministries. An inter-ministerial working group composed of Ministries of Energy, Agriculture, Economics, Finance and Environment has been established to define public policies for biofuels. While a similar inter-ministerial structure has been set up to cater for rural policy matters, the

role of the energy ministry in the later has been unclear. For the realization of an integrative approach between agriculture and biofuel production from residues, coordinated policies and common funding schemes will be important, especially SAGARPA and the Ministry of Energy (SENER).

Mexico's territorial heterogeneities call for solutions which are flexible enough to accommodate different residue streams and produce different outputs to meet local energy demand, be it for transport, cooking or electrification needs. In addition to the 13 agricultural products analyzed, policies and incentives should thus support production from a wider spectrum of residues, including forestry and municipal waste.

If agricultural policy objectives including reform of existing rural investment programs, investment in research and development, expansion of rural infrastructure; diversification of rural incomes, collectivization of atomized smallholders, are met, then a second generation biofuels industry is not only attainable but represents a "low-hanging fruit" that can quickly result in significant development gains.

Conclusions

In conclusion, it is evident that the agriculture sector in Mexico can play an even greater role with respect to food and energy security, trade growth, poverty alleviation and employment creation. The appropriate policy measures to strengthen the agricultural sector depend on the specific objectives identified by policy-makers. Policies to reduce poverty and migration from rural to urban areas may differ from those that increase export revenue or maximize agricultural output. A stated objective is to use the existing policy space with a view to enhancing Mexico's benefits from its agricultural sector including in increasing the number of jobs in the sector, reduce dependency on imports and promoting exports in agriculture. Priorities should be determined and an integrative approach to agriculture-trade-energy policies is highly recommended with a view to achieving social, economic, trade and energy goals. It is fundamental to recognize that that any given set of agricultural policies can address issues across the range of topics discussed in this Outlook. It is important that Mexico should be cognizant of and harness the potential of agriculture and its contribution to development, and in particular as a source of employment and income creation in rural areas.

It is important to note the need for further research and analysis to complement this Outlook. Whilst many stakeholders were consulted in order to facilitate the completion of this work, it is acknowledged that this preliminary analytical effort should be followed by a more in-depth research with national institutions in order to generate specific policy recommendations For instance, it should be recognized that the diagnosis needs to be augmented with further work carried out in the field and that widespread stakeholder engagement needs to take place before policy recommendations can be drawn. Moreover, there are obvious extensions to aspects of this Outlook that would contribute to a wider agricultural policy reform such as on the competitive conditions in sectors other than corn, or a more comprehensive energy policy. Furthermore, as the findings of the Outlook are preliminary in nature, it would certainly benefit from a wider validation process among relevant stakeholders in Mexico.

In going forward, UNCTAD can provide support to Mexico in terms further deepening of the diagnosis, technical assistance and capacity building, as well as support the implementation and strengthening of certain measures linked to agriculture development, and trade and related areas. UNCTAD could also help facilitate an exchange of views among national stakeholders, as well as foster discussion of potential measures for implementation that enhance agriculture development in Mexico.

INTRODUCTION TO THE OUTLOOK

This work on Mexico's agriculture development perspectives and outlook (Outlook) is the result of an overall institutional response by UNCTAD to a request made by SAGARPA (Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación, or Ministry of Agriculture, Livestock, Rural Development, Fisheries and Food) to address the issue of Mexican agricultural development in the medium to long term with an integrated, holistic approach. It represents collaboration between UNCTAD's Division on International Trade in Goods and Services, and Commodities, and the Special Unit on Commodities, and the Government of Mexico.

The Outlook addresses different sectors affecting key agriculture outputs that are of strategic importance for Mexico, as well as encompassing both macroeconomic and microeconomic issues with links to trade policy and trade agreements, agriculture commodities, competition and competitiveness in agriculture, including food security, and agriculture and energy security. The Outlook also identifies complementary measures and enabling policies, such as infrastructural investment, research activities and trade facilitation. Furthermore, the Outlook demonstrates a close integration with the national development outlook of Mexico, which ensures an ongoing consistency with overall national development priorities, including poverty reduction, which is a major concern particularly in the rural areas. It will endeavor to contribute to improving the Mexican economy and development perspectives from the perspective of the agriculture sector.

Extensive primary research has been carried out to facilitate this diagnosis, including data collection, numerous videoconferences with key stakeholders, interviews with many stakeholders within the Mexican agricultural sector and various Mexican government agencies coordinated by the SAGARPA, all with the valuable support of the Mexican authorities and the Permanent Mission of Mexico to the United Nations in Geneva.

In 2011, more than a fifth of Mexico's population lived in small, rural localities and despite a downward trend at a national level, more than half of the rural population is employed in the agricultural sector. In these localities, average income is 3,800 pesos compared with 10,200 pesos in large communities and 61 per cent of the rural population was classified as poor, in comparison to 45 per cent at the national level. Although fundamental to rural employment, agriculture, forestry, fishing and agribusiness activities account for less than four per cent of Mexican GDP. It is in this context that the diagnosis was undertaken and it is these statistics, in part, that this Outlook aims to address. The aim of this Outlook is not only to provide extensive analysis and a comprehensive discussion of the agricultural sector in Mexico but also to provide realistic policy recommendations that provide workable solutions to outstanding issues within the agricultural sector. It is important however that agricultural development is regarded as an opportunity within the Mexican economy and that SAGARPA can, and indeed must, be an integral part of the reformation process and the continual evolution of Mexican agriculture.

The Outlook is organized in the following manner:

The first chapter of the Outlook discusses trade and trade policy issues. Recent developments in the trade of agricultural products are examined. A disaggregated analysis elucidates on the structure of trade, highlighting changes in the composition and direction of trade flows, and contributory factors are identified. It also explores the link between changes in trade to Mexico's food self-sufficiency and employment changes in the agricultural sector. Further, this chapter examines Mexico's agricultural trade policy, recognizing the importance of Mexico's participation in the NAFTA agreement, and the influence on recent trade developments. It also deals with the potential effects of standards and measures, specifically SPS and TBT, on Mexico's agricultural sector, the link between trade policies and developments in the agricultural sector and a general equilibrium analysis of potential policies to strengthen the agricultural sector. Lastly, the chapter concludes with suggested policy options and recommendations in order to enhance Mexico's benefits from its agricultural sector.

The second chapter of the Outlook provides an agricultural commodity policy review for Mexico, identifying strategies for enhancing agricultural commodity production, competitiveness and trade, such that these commodities act as drivers for growth and stimulate inclusive development (including linkages, poverty reduction and food security). The Outlook notes that the agricultural sector's multi-functionality and its intricate linkages with other productive sectors of the economy offers solid prospects for sustainable livelihoods and poverty reduction

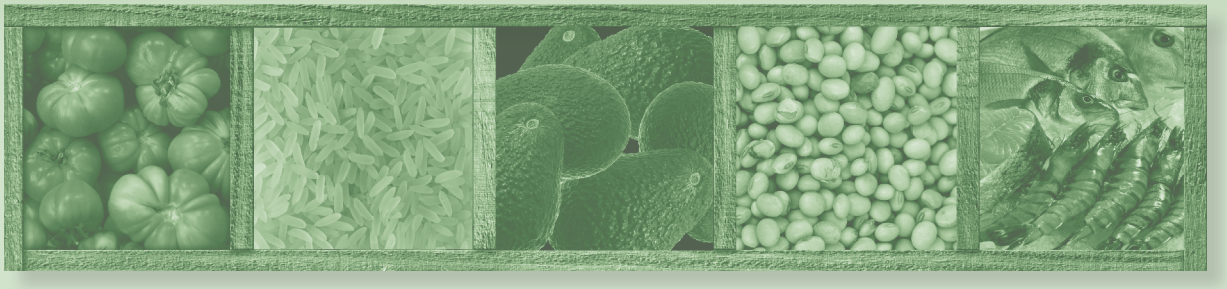
for Mexican farm families. Further the sector is the principal depository for Mexico's rich and diverse cultures, history, landscapes and natural capital. However, agriculture's declining importance, both in terms of GDP and merchandise exports, pose profound impact on the prospects of Mexico's broad-based economic growth and sustainable development. It is prudent, therefore, to 'get it right' with both public and private policy reforms and actions so that the sectors' longstanding problems – e.g. poor infrastructure, lack of support services (e.g. access to finance and credit), economies of scale, declining terms of trade, rising input costs (e.g. fertilizers), low and declining public investment, economic marginalization of the sector, etc. – are addressed comprehensively, so that agriculture regains its rightful place in Mexico's economic and development agenda now and into the 21st Century.

The third chapter of the Outlook focuses on competition issues relating to the Mexican agriculture sector. It is noted that that in many developing countries the issues of food security and large scale employment in the agricultural sector present significant challenges to enacting and enforcing competition policy. Although a number of agricultural products are identified as having a significant economic contribution this chapter restricts itself to the in-depth analysis of the production and commercialization of corn. Within in this context, the benefits of competition are outlined as well as considerable public and private restrictions. Particular focus is paid to the differing degrees of concentration at different levels of the agricultural value chain. Further, the chapter discusses the manner in which issues can be addressed through the existing competition law and policy system, whilst highlighting experiences from other countries in order to explore additional measures.

The fourth chapter offers a complementary approach on the role of biofuels for the Mexican agricultural sector. Current Mexican agricultural policies regarding sustainable development present a considerable economic opportunity for biofuels and bioenergy that employ residue streams from agriculture. Not only would these industries deepen value chains of agricultural products, expand opportunities for rural job creation and enhance income opportunities for people in rural areas but access to energy services would be greatly improved, often in areas where it is lacking. This chapter analysze the application of technologies that would make a considerable contribution to increased economic diversification in rural areas while promoting and supporting the move to a national low-carbon economy.

The final section of this outlook offers a condensed summary of the conclusions arising from the analyses presented in the four chapters of the Outlook. It serves to highlight that agricultural development in Mexico is a complex of interactions that requires a holistic policy response, insofar as policy will have both direct and indirect effects to many parts of the agricultural economy and the population that are dependent on the sector.

CHAPTER I



AGRICULTURE TRADE POLICY ISSUES FOR MEXICO

A. INTRODUCTION

Mexico has a large rural territory and population[1] - the largest population living in predominantly rural areas in the OECD[2]. Farm employment, however, has dropped dramatically in recent decades. Agriculture accounts for about 14 per cent of employment in Mexico,[3] down from more than 25 per cent in the early 1990s. Furthermore, agriculture contributes only about 4 per cent to its GDP which is half the level it contributed two decades ago. Rural poverty is high with 61 per cent of the people in rural areas living below the national rural poverty line, compared to 46 per cent in urban areas.[4]

This development coincides with a trade policy that has led to much more open markets, especially within the NAFTA region, and significantly increased trade in agricultural products. Although a shrinking agricultural sector is not uncommon during the course of development, the situation of the agricultural sector in Mexico has been found unsatisfactory in terms of employment and it has been argued that Mexico's external trade relations have an adverse impact on the agricultural sector in Mexico, especially on the production of basic food products. Particular concerns of producers in Mexico are subsidies in some of its major trading partners and technical standards. The latter is a barrier on their exports while a weak capacity to enforce and verify application of quality regulations on imports is perceived to create unfair competition with low quality and cheap imports as well as lack of consumer protection.

Due to the heterogeneity of the agricultural sector in Mexico, the impact of trade policy changes varies for different groups of farmers and consumers. In some areas, predominantly in north-western parts of the country, larger commercialized farms operate. In central and southern states farms are often smaller and often produce for subsistence. The relative importance of products for big and small farms varies as well. According to Prina (2010), for smaller farms fruits and vegetables are relatively more important than for larger farms for which maize is more important. Chapter I provides a comprehensive discussion of the agricultural sector in Mexico.

This Chapter examines trade and trade policy issues. Section B describes the recent development of agricultural trade. Both exports and imports have increased significantly in recent years. A disaggregated analysis reveals that the composition of trade has changed as well. Trade with its largest trading partner, the US, has increased and more staple crops and meats flow south and more beverages, seasonal fruits and vegetables flow north. It is likely that NAFTA has contributed to this development. Due to this increasing specialization has the self-sufficiency ratio declined for some essential products. If this is a concern for the Mexican government, potential measures could be discussed at the political and technical level. The section attempts to link the changes in trade to Mexico's food self-sufficiency and employment changes in the agricultural sector.

Section C examines Mexico's agricultural trade policy. Although this report is not focusing on NAFTA, due to the weight and likely impact of trade with the US this agreement plays an important role in the section on trade policy as well as in the section describing recent trade developments. The potential effect of standards, specifically SPS and TBT, as well as other measures of Mexico and its major trading partners, including NTMs and subsidies, on Mexico's agricultural sector is the focus of Section D. The link between trade policies and developments in the agricultural sector is analyzed in Section E. Section F concludes and attempts to develop policy options and recommendations with a view to enhance Mexico's benefits from its agricultural sector including in increasing the number of jobs in the sector and promoting trade in agriculture.

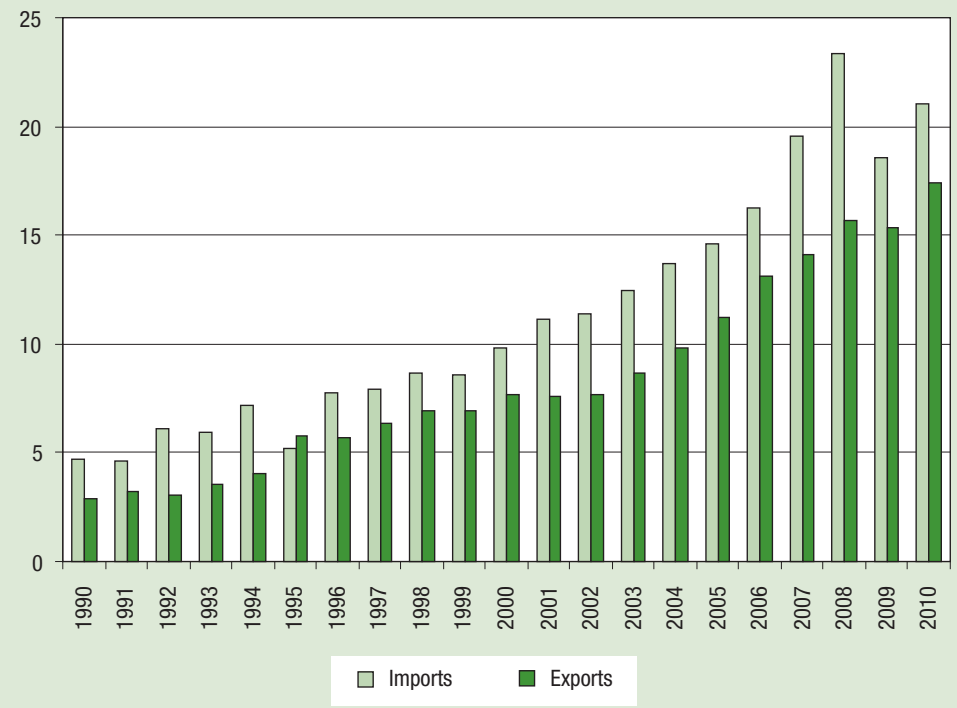
B. AGRICULTURAL TRADE

1. Aggregate agricultural trade

Total merchandise exports were about US$ 298 bill. and imports US$ 301 bill. in 2010. The United States is by far the main trading partner. More than 80 per cent are exported to the US. Import sources are more diversified with the US accounting for about one half of all merchandise imports.

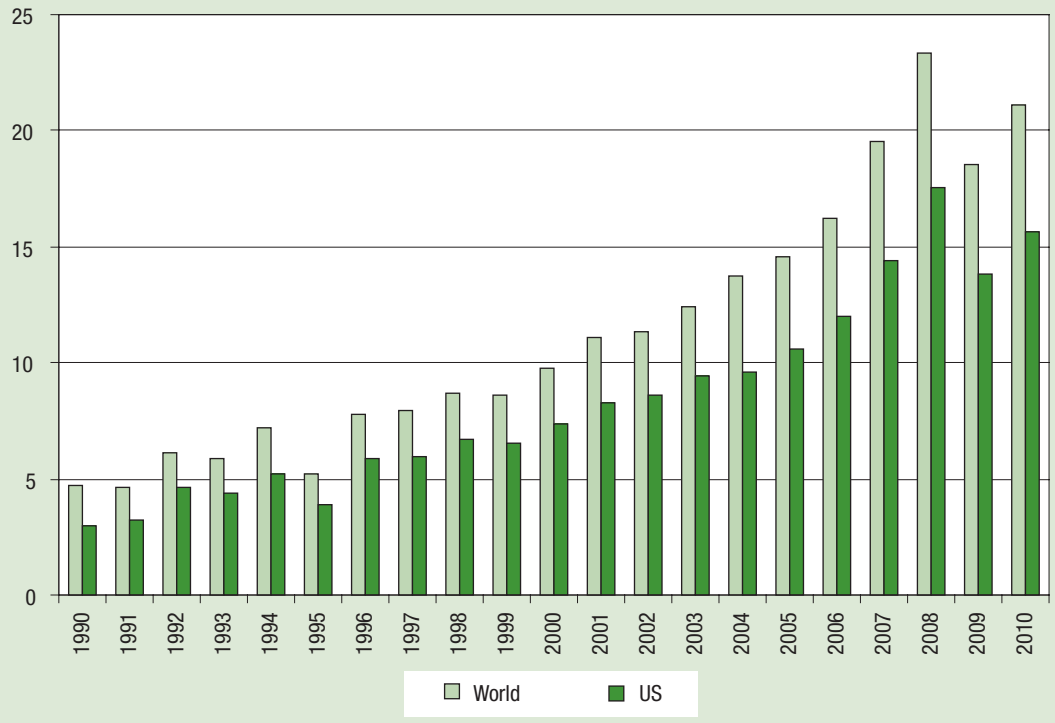
Agriculture[5] makes up about 6 per cent of Mexico's merchandise exports (about US$ 17 bill.) and less than 7 per cent of its imports (US$ 21 bill.) in 2010 (Figure I.1). Agricultural exports and imports are highly concentrated towards the US, accounting for 78 per cent and 74 per cent of its total merchandise exports and imports, respectively, in 2010. The share of agricultural imports sourced from the United States increased before 1993 to a level of around three-quarters (74 per cent in 1993) and fluctuates since then around that level (Figure I.2). The share of

Figure I.1: Mexican agricultural imports and exports, in US$ bill



Source: UN Comtrade

Figure I.2: Agricultural imports from the world and the US, in US$ bill

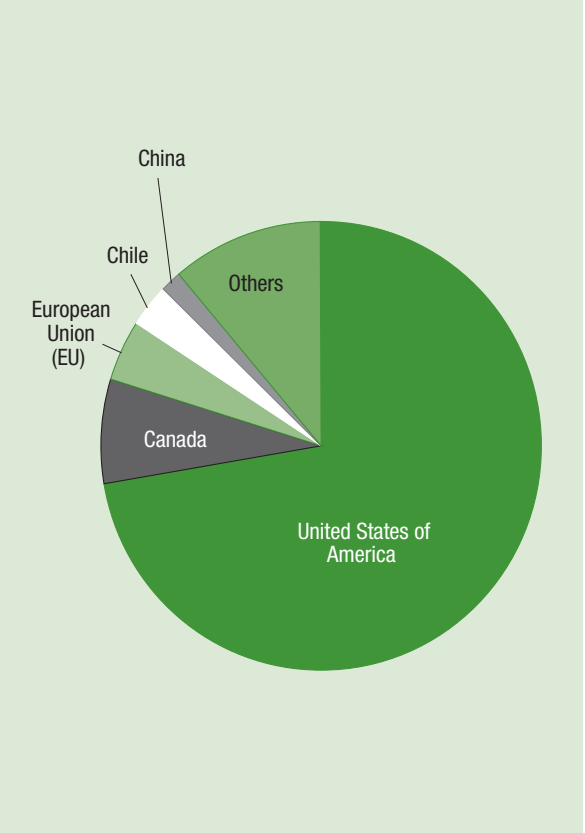


Source: UN Comtrade

exports to the United States decreased from values between 83 per cent and 89 per cent between 1991 and 1995 to the current level of 78 per cent. Thus, the share of agricultural trade with the US has not significantly increased since the early 1990s, though, the composition of trade has changed and for certain staple food and meat products the share of US imports has increased significantly.

Trade with Canada has been growing disproportionately but remains at a low level. The share of imports from Canada in total Mexican agricultural imports grew from 3 per cent to 6 per cent between 1991 and 1995 to 8 per cent in 2010. The share of exports to Canada increased from 1 per cent to 3 per cent. Due to the increasing share of imports from Canada has the share of total agricultural imports from NAFTA markets increased slightly from 79 per cent to 82 per cent since the implementation of NAFTA began in 1994 (Figure I.3). The total share of exports to NAFTA markets decreased from 90 per cent to 81 per cent. The European Union is the third largest market for imports and the second largest market for exports from Mexico, followed by Canada and Japan. These four destinations account for about 90 per cent of Mexico's agricultural exports (Table I.1).

Figure I.3: Imports of agricultural products in 2010



Source: UNCTADStat

Table I.1: Export concentration of Mexico's food exports and Mexico's import share in total imports, 2010

Partner country	Export share (%)	Share of Imports from Mexico in total imports in partner country (%)
United States of America	77.8	15.4
European Union	4.6	0.2
Canada	3.4	4.2
Japan	3.1	1.1
Venezuela	1.3	1.6
Guatemala	1.2	11.0
China, Hong Kong	0.6	0.3
Australia	0.6	1.2
El Salvador	0.6	6.8
Colombia	0.5	2.5
Costa Rica	0.5	8.1
Honduras	0.4	5.2
Panama	0.4	5.1
Chile	0.3	1.6
Cuba	0.3	3.3

Source: UNCTADStat.

The United States is by far the most important market for Mexico's agricultural exports and Mexico has a significant market share in US' imports of 15 to 17 per cent. In all other markets Mexico has a very low market share in its partner countries' imports except perhaps in Guatemala where Mexico accounts for 11 per cent of its total imports.

Mexico became a net-food and animal product importer during the 1980s. It had been a net exporter before. The rise of Mexico's agricultural imports in recent years is significant and in the upper range of other countries' average import growth, though, not extreme among developing countries. Since 1995 to 1997, Mexico's imports increased by 201 per cent until 2008 to 2010 and world imports of agricultural goods increased by 130 per cent in US$ nominal value terms.6 During the same period imports into e.g. Brazil increased by 26 per cent, Chile, 207 per cent, Colombia 124 per cent, Guatemala 278 per cent, Peru 146 per cent and Turkey 147 per cent. The total low and middle income countries import value increased by 238 per cent between 1995-1997 and 2008-2010.7 As seen from the discussion of the share of agricultural imports from the US, Mexican growth rates of imports from the world and from the US are very similar for agricultural products in Mexico (201 per cent and 199 per cent, respectively).

Aggregate agricultural exports to both the world and the US have also been dynamic. For the period 1995-97 to 2008-10 exports to the world grew 171 per cent and to the US 170 per cent – thus less than imports. The relation between import and export growth during the recent two decades in Mexico depends on the exact reference periods that are taken from the early 1990s until the late 2010s. Due to the overvaluation of the Peso in the early 1990s the results may be biased and the import growth underestimated if a starting period before 1995 is taken.[8] Taking the period 1991 to 1993 as the base period reveals that import growth was lower than export growth (Table I.2).

Regional trade agreements (RTAs) usually lead to trade creation and diversion effects, resulting in a higher share of intra-RTA trade. Mexico's imports from Canada and the US have increased slightly from 79 per cent to 82 per cent (Table I.3). United States imports from Mexico have increased from an import market share of 11 per cent to 17 per cent between 1993 and 2010 and Canada's share of imports from Mexico from 2 per cent to 4 per cent. This confirms the trade creation effect. The decreasing share of Mexico's exports to the NAFTA markets is explained by the lower import growth rates in Canada and the US and does not reflect loosing market shares. However, the Mexican market share in Canada is still very low.[9]

Reading example: 5 per cent of Mexico's total imports are from Canada; 8 per cent of US' total exports are exported to Mexico (US reporter, Mexico partner, column exports).

To summarize, both aggregate agricultural imports and exports have increased significantly in Mexico with a slightly higher increase of imports if the base period starts after the Peso crisis. Trade with the US is dominating accounting for some three-quarters of its agricultural trade. Mexican agricultural imports were always higher than its exports since 1993 with both the world and the US (except in 1995). Trade with NAFTA partners was slightly more dynamic indicating a small trade creation and trade diversion effect.

Table I.2: Agricultural exports and imports of Mexico for different periods and different data sources/definitions (in US$ 1'000)

		1995-97 US$ 1'000	2008-10 US$ 1'000	growth %
UNCTADStat (SITC All food items)	Exports	6'339'952	16'506'172	160
	Imports	6'062'387	19'558'910	223
UN Comtrade (Def. WTO agriculture)	Exports	5'947'594	16'141'772	171
	Imports	6'971'344	20'988'250	201
1991-93 / 2008-10				
UN Comtrade (Def. WTO agriculture)	Exports	3'274'966	16'141'772	393
	Imports	5'547'508	20'988'250	278

Source: UN Comtrade and UNCTADStat

Table I.3: Market shares of agricultural exports and imports in NAFTA

Reporter	Partner	Imports		Exports	
		1993 %	2010 %	1993 %	2010 %
Mexico	United States	74	74	89	78
	Canada	5	8	1	3
	NAFTA	79	82	90	81
United States	Mexico	11	17	8	12
Canada	Mexico	2	4	2	4

Source: UN Comtrade

2. Product specific trade

Liberalization of agricultural trade within the NAFTA implementation period coincides with a changing composition of traded agricultural goods with more staple crops and meats flowing south and more beverages, seasonal fruits and vegetables flowing north. In that sense, NAFTA's liberalization of agricultural trade appears to have produced the "expected" results (Wise, 2009). The major imports from the US are cereals and soybeans meal for feed and meat and byproducts for human consumption. Table I.4 reflects the increase of imports of cereals and meat from an already high share of those products in total imports from the US in 1993.[10]

Notwithstanding the growth of aggregate imports which is basically in line with many developing countries' growth of agricultural imports, imports of some particularly sensitive products such as corn, rice, beef, pork, poultry and beans are partly very high. For all these products the US market share is very high and for many of these products has it been increasing since 1993. Imports of maize are 670 per cent higher in 2008-2010 than they were in 1991-1993. Almost all of the maize is imported from the US (Table I.5). Similarly, beans imports have increased by 853 per cent. Imports of wheat from the world have increased by less, 192 per cent, but the share of imports from the US increased from 58.9 to 76.1 per cent, showing that imports from the US have increased disproportionately. Pork and poultry meat import growth was also high at 664 per cent and 390 per cent, respectively.[11]

A concern that has been raised is the increase of imports of animal parts, for example chicken parts in particular thighs and legs, not meeting the taste of exporting countries' consumers at low prices. This is a serious problem that many developing country producer face. In Mexico, a concern regarding sanitary issues has not been raised. Chicken is an example but the same practice holds for other animal products such as pork where bacon is kept in the exporting country and other parts are exported.

Mexico's agricultural exports to the US are estimated at $13.6 bill., accounting for about 17 per cent of the total value of US imports. The major exports are shown in Table I.6. Horticulture products such as tomatoes and fruits are the main exports. Beer exports have increased significantly while the importance of live cattle has decreased, though it remains important. Shrimps and prawns are also major exports.

Mexico's exports of organic products are about 3 per cent of its total exports (in 2007), predominantly exported to the US. The most significant organic export crop is coffee, followed by vegetables and fruits as well as cocoa. Organic livestock production in Mexico is still in the early stages of development.[12]

To summarize, the changing composition of agricultural trade reveals a higher trade specialization with more staple crops and meat flowing south and more seasonal fruits and vegetables flowing north. This is confirmed by a trade specialization index calculated by Dimaranan, Hertel and Keeney (2003) cited in Stiglitz and Carlton (2005, p. 221). Mexico has actually become more dependent on imports in program crops and meat/livestock between 1996-75 and 1986-98.

Table I.4: Top ten Mexican agricultural imports from USA, share in total agriculture imports from US

HS 2 digit	Product	1993 %	2010 %
10	Cereals	15.4	19.0
02	Meat and edible meat offal	13.5	17.7
12	Oil seed, oleagi fruits; miscell grain	14.4	12.8
52	Cotton.	8.0	6.8
23	Residues & waste from the food industry; feed	4.9	6.0
15	Animal/veg fats & oils	7.3	5.4
04	Dairy prod; birds' eggs; natural honey	5.8	5.4
21	Miscellaneous edible preparations.	4.2	4.8
17	Sugars and sugar confectionery.	1.9	4.7
08	Edible fruit and nuts; peel of citron	3.5	3.5
	Total agriculture (US$ bill.)	4.3	15.6
08	Edible fruit and nuts; peel of citron	3.5	3.5
	Total agriculture (US$ bill.)	4.3	15.6

Source: UN Comtrade.

Table I.5: Imports of selected agricultural products

	Imports from the world				Share US imports of total imports	
	Volume	Change	Value	Change	Value	Value
	Average 2008-10	1991-93 to 2008-10	Average 2008-10	1991-93 to 2008-10	1991-93	2008-10
	1'000 tonne	%	US$ mill	%	%	%
Barley	104.4	-1.1	43.3	214.7	68.9	57.8
Beans	129.1	852.6	126.1	1330.0	92.4	90.8
Beef	318.9	70.2	1152.7	198.6	81.1	84.6
Coffee	8.0	218.8	54.8	912.3	45.2	54.6
Eggs	9.9	-10.6	33.2	159.8	82.0	99.9
Maize	8179.6	670.3	1854.6	947.7	99.0	99.3
Milk	309.5	22.4	654.4	91.8	34.9	75.5
Pork	478.4	664.1	843.3	791.5	78.3	90.5
Poultry	642.6	390.2	757.9	506.4	98.5	90.7
Rice	820.7	173.7	345.5	390.8	72.3	99.5
Shrimp	6.1	39.6	33.0	62.2	98.9	3.4
Sorghum	2101.0	-44.4	411.3	-3.9	99.4	100.0
Sugar c.	2.1	-98.3	0.6	-98.1	25.2	84.6
Sugar	4556.5	1031.5	649.7	413.1	43.5	73.9
Tuna	33.9	1121.5	71.2	1451.3	81.1	4.6
Wheat	3323.2	191.7	1006.8	484.0	58.9	76.1

Source: UN Comtrade, SITC classification of products see Annex.

Table I.6: Top ten Mexican agricultural exports to USA, share in total agriculture exports to US

HS 2 digit	Product	1993 %	2010 %
07	Edible vegetables and certain roots	38.1	30.3
22	Beverages, spirits and vinegar.	7.8	17.0
08	Edible fruit and nuts; peel of citr	12.3	14.9
17	Sugars and sugar confectionery.	1.3	8.7
19	Prep.of cereal, flour, starch/milk;	1.9	5.3
20	Prep of vegetable, fruit, nuts or o	5.0	5.2
01	Live animals	14.3	4.0
21	Miscellaneous edible preparations.	2.3	3.7
18	Cocoa and cocoa preparations.	0.7	3.4
03	Fish & crustacean, mollusc & other	11.2	2.8
	Total (US$ bill.)	3.2	13.6

Source: UN Comtrade.

3. Self sufficiency

Food trade coupled with a country's production and consumption determines the dependence on food imports. The recent food price crisis has raised concerns over the dependency on food imports. Furthermore, one notion to decrease exposure to food insecurity is to increase the self-sufficiency ratio. Mexico is a net food importer with total food imports being about 10 per cent higher than corresponding exports. Exports of fruits and vegetables as well as beverages are high while on the other hand imports of cereals, meat and oil seeds are high. The self-sufficiency ratio varies from product to product and has changed over time. Calculating self-sufficiency ratios at the product level is problematic for several reasons, including due to a lack of consistent and coherent production and consumption data.[13] According to the FAO who provides data for 102 products is Mexico self-sufficient for 29 of these products (average 2005-07). These products are mainly vegetables and fruits as well as some beverages.

For the products of particular interest, the self-sufficiency ratio is mainly below one and has decreased from 1991-93 to 2005-07 (Table I.7). A sharp decrease has been experienced for beans where Mexico used to be self-sufficient in 1991-93 and where domestic production now accounts for 84 per cent of domestic consumption. For maize, rice and wheat the self-sufficiency has also dropped significantly. About 28 per cent of the rice production is grown domestically, a drop from 54 per cent. Among the meat products where self-sufficiency has declined for all three meat products, pig meat has experienced the highest drop. Therefore, the self-sufficiency has declined considerably for some essential products.

The self-sufficiency ratio confirms the tendency that production and exports become more specialized on certain products. The self-sufficiency ratio has increased significantly for most vegetables such as tomatoes and many fruits, mostly citrus fruits. The aggregate ratios for vegetables and fruits have increased to reach 1.49 and 1.11, respectively, in 2005-07.

Wise (2009) confirms this and shows that between 1990-92 and 2006-08 the import dependency of Mexico for corn, soybeans, wheat, cotton, rice, beef, pork and poultry has increased.

Table I.7: Self domestic production to domestic consumption ratio

	1991-93	2005-07
Barley	0.86	0.67
Beans	0.99	0.84
Bovine Meat	0.90	0.84
Coffee	2.32	2.33
Eggs, total	0.99	0.99
Fish, Seafood, total	0.92	0.90
Maize	0.91	0.77
Milk – excl. butter, total	0.75	0.78
Pigmeat	0.90	0.78
Poultry Meat	0.87	0.81
Rice (Milled Equivalent)	0.54	0.28
Sorghum	0.51	0.70
Wheat	0.78	0.54

Source: FAO Statistics, balance sheets.

4. Employment

Agriculture accounts for about 14 per cent of employment in Mexico[14] contributing about 4 per cent to its GDP. In the early 1990s more than 25 per cent of employment was in agriculture and the contribution to GDP was almost twice as high as it is nowadays. In some areas, predominantly in north-western parts of the country, larger commercialized farms operate. In central and southern states farms are often smaller and often produce for subsistence. Employment in agriculture is very significant in the poorer southern states: 40 per cent in Chiapas, and close to 30 per cent in Oaxaca and Guerrero (Scott, 2010). Furthermore, agriculture does not only account for direct employment in the primary sector but agricultural production is also linked to employment in other sectors such as those producing inputs (upstream, e.g. fertilizer) and those in downstream sectors (e.g. transport and other services sectors).

Between 1993 and 2010 total agricultural employment in Mexico declined 28 per cent according to OECD data.[15] In 1993 about 8 million people were employed in agriculture in Mexico and in 2010 5.8 million (Figure I.4). These data are unfortunately not disaggregated by agricultural sectors. Between 1991 and 2007 the number of small producers has slightly increased while the number of middle size and large producers declined by almost 30 per cent. A large majority of employment in agriculture are seasonal and non-remunerated (family) workers. In 2007, only 421 thousand workers were permanently employed in agriculture, similar to 1991. A significant change from 1991 to 2007 is that non remunerated family workers in agriculture (minus 58 per cent) have been replaced by remunerated seasonal workers (plus 151 per cent) (Scott, 2010). A hypotheses discussed by Scott (2010) is that family members have taken jobs outside of agriculture in rural areas or migrated.

Wages in agriculture in Mexico have declined during the last decades, except since 2007, while wages in other sectors increased. Wages in the primary sector are about one fifth to one quarter of wages in other sectors (Scott, 2010; table 2). Income disparity and poverty remain a challenge in Mexico. Most people living below the poverty line live in rural areas.[16] The percentage of the rural population living below the national rural poverty line is 61 per cent.[17] This reflects the low labour productivity in agriculture in Mexico which is the result of lack of investment and low

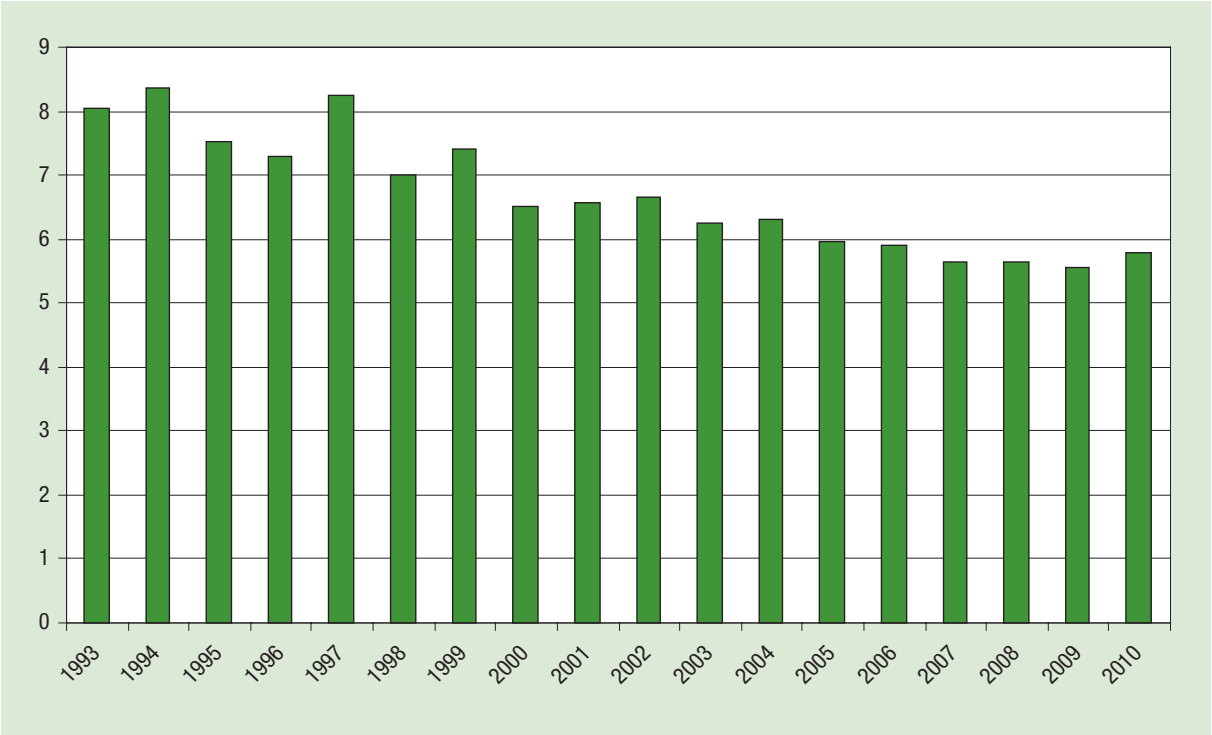
capital intensity of production. See Chapter II of this publication for a discussion of and ways to improve productivity.

The relative importance of agriculture to Mexico has declined as in other OECD and developing countries (Figure I.5). During the development process, productivity is increasing and more labour shifts to the manufacturing or the services sector. In poor countries agriculture often accounts for 50 per cent of GDP, in wealthy countries this share is mostly below 10 per cent. However, the relationship between income growth and agricultural employment is extremely diverse. Asia's development path is mostly characterized by fast growth with relatively slow agricultural exits, a "labour-intensive green revolution" (Headey, 2010). The decline of employment in Mexico appears higher than in many other countries. According to World Bank data the share declined between 1990-95 to 2005-10 by 45 per cent; more than in e.g. Brazil, Chile, Malaysia or Turkey (Table I.8). In the World Bank classification Mexico is in the upper middle income group where on average the share of employment in agriculture to total employment declined by 29 per cent. Furthermore, the absolute share in Mexico is, with 14 per cent, at the lower end compared to many other developing countries in this group.

The structural adjustment of the rural economy with a declining contribution of agriculture and an increasing share of non-farm activities has increased significantly the number of unemployed people in both rural dispersed and rural semi-urban areas. Furthermore, significant migration from rural areas to urban areas or the US indicates a lack of employment opportunities.

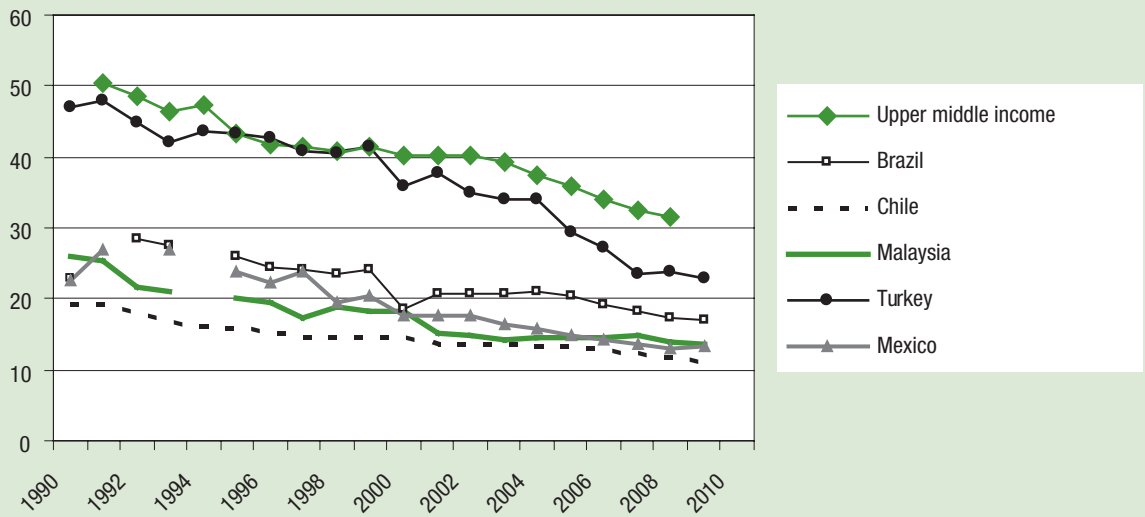
It is difficult to identify causality between the loss of jobs in the agricultural sector and trade and trade policy changes. Several studies have accused NAFTA for having had a negative impact on employment in the agriculture sector in Mexico. Others, however, point to the increased exports of fruits and vegetables. Prina (2012) assesses in an econometric study the impact of NAFTA-induced border price changes of crops on agricultural employment in Mexico.[18] She finds that increases in the real price of vegetables are associated with an increase in employment in the cultivation of vegetables, whereas the drop in the real price of corn reduces employment in the corn

Figure I.4: Employment in agriculture in Mexico, in million



Source: OECD Labour force statistics
Note: Break in 2004

Figure I.5: Employment share in workforce, 1990 to 2010



Source: WDI 2011

Table I.8: Employment share in workforce 1990 to 2010

Country	Average 1990-95	Average 2005-10	Change
Upper middle income	47	33	-29
Brazil	26	19	-29
Chile	17	12	-30
Malaysia	23	14	-37
Turkey	45	25	-43
Mexico	25	14	-45

Source: WDI 2011.

sector. Thus, the sharp increase of imports in cereals and meat products has had a negative impact on employment while the increase of exports of fruits and vegetables as well as certain processed products has had a positive impact on employment. Linking the labour intensity with the change in exports and imports indicates a mixed picture. Exports of fruits and vegetables, a labour intensive sector, are high and have increased significantly. About 41 per cent of the total costs of production are labour costs (Table I.9). Relatively less labour intensive products such as cereals are major imports of Mexico. This could indicate that employment losses due to increased imports that have potentially replaced domestic production may have been compensated partly by increased employment resulting from higher exports of other products. On the other hand, other labour intensive products such as oil seeds are also among major import.

The relative importance of products for big and small farms varies. According to Prina (2010), for smaller farms fruits and vegetables are relatively more important than for larger farms for which maize is more important. Organic products are predominantly produced by small-scale farmers with an average of 3 hectares land.

Table I.9: Labour output ratio in Mexico

	Share of labour in total costs
Paddy rice	0.37
Wheat	0.24
Cereal grains nec	0.35
Vegetables, fruit, nuts	0.41
Oil seeds	0.43
Sugar cane, sugar beet	0.38
Plant-based fibers	0.21
Crops nec	0.42
Cattle,sheep,goats,horses	0.21
Animal products nec	0.18
Raw milk	0.19
Fishing	0.09
Meat: cattle,sheep,goats,horse	0.07
Meat products nec	0.05
Vegetable oils and fats	0.04
Dairy products	0.06
Processed rice	0.05
Sugar	0.08
Food products nec	0.10
Beverages and tobacco products	0.12

Source: GTAP 8, "nec": not elsewhere classified

C. TRADE POLICY

Mexico has undertaken significant agricultural market reforms. Since the early 1990s Mexico has decreased its trade barriers, shifted away from commodity support to more decoupled forms of support and encouraged market liberalization (OECD, 2006).

1. Multilateral trade agreement

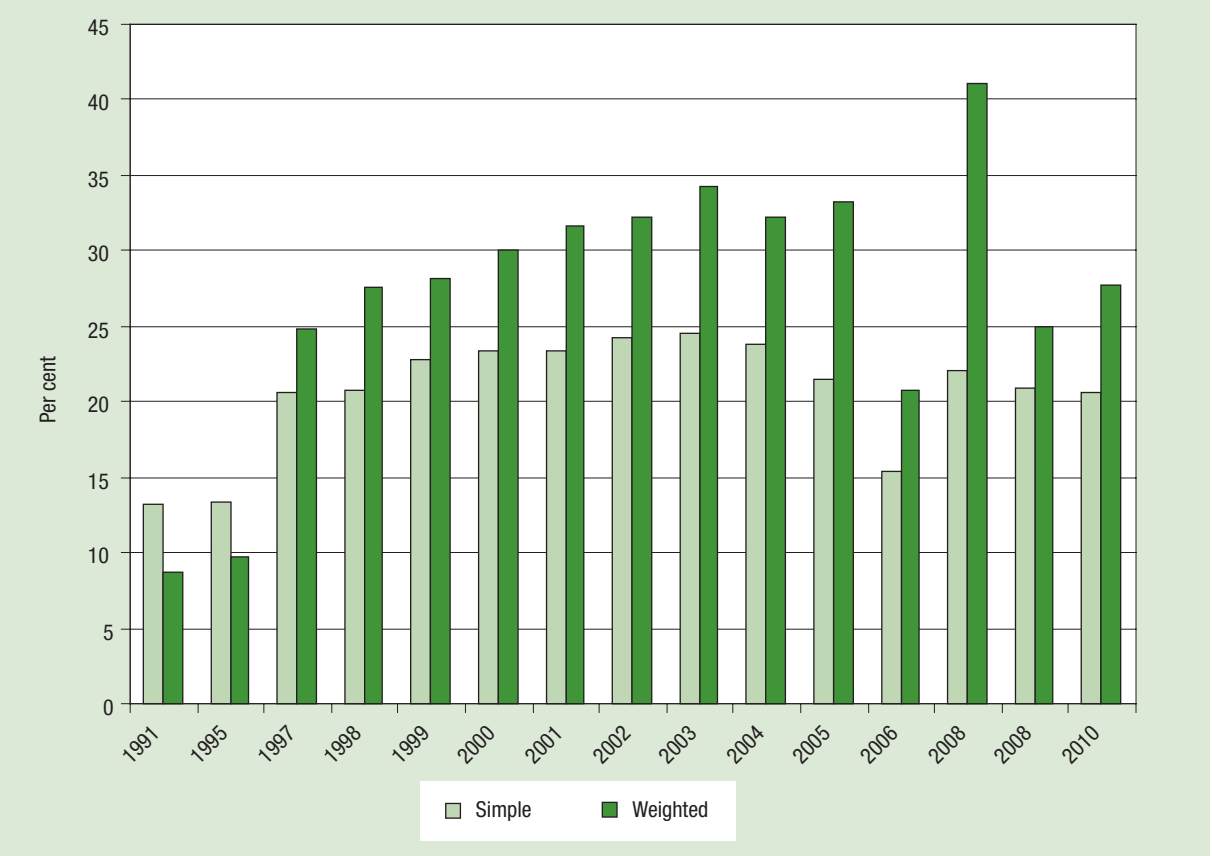
Mexico is a founding member of WTO and became part of the General Agreement on Tariffs and Trade in 1986. Mexico has an average bound rate of 44 per cent and in 2010 an average applied rate of 21 per cent (simple averages for agricultural products). This compares to an average applied rate of e.g. 13 per cent in low and middle income countries, 15 per cent in OECD countries, and 5 per cent and 11 per cent in the US and Canada for agricultural products, respectively. Many other countries, however, still have considerably higher MFN agricultural tariffs. Turkey has 43 per cent, for example, and India has 32 per cent. Thus, Mexico has relatively but not extremely high MFN applied agricultural tariffs. It has not reduced those MFN applied tariffs during the last two decades (Figure I.6).

Sugars and confectionary, animal and dairy products and coffee and tea attract the highest tariffs (Table I.10). Applied rates are, for all product groups, below their average bound levels.

The more disaggregated HS 6-digit level confirms that for most products the applied rates are well below the bound rates providing Mexico with some policy space. Mexico has some tariff peaks in agriculture with a maximum applied tariff of 254 per cent in the sectors animal products and oilseeds, fats and oils.

For few products applied rates are up against the bound rates so that Mexico has no possibility to increase tariffs on those products. This includes some cereals. The average bound rate of cereals and

Figure I.6: Average MFN applied tariff in Mexico



Source: UNCTAD Trains

Table I.10: Mexico tariffs by product group

	Bound	Applied 2010
Animal products	64	41
Dairy products	63	35
Fruit, vegetables, plants	37	18
Coffee, tea	64	37
Cereals and preparations	45	20
Oilseeds, fats and oils	44	17
Sugars and confectionary	119	66
Beverages and tobacco	44	28
Cotton	39	5
Other agricultural products	28	7
All agriculture	44	21
Fish and fish products	35	17

Source: WTO, ITC, UNCTAD World Tariff Profiles 2010

preparations is 45.1 per cent and the average applied rate in that sector is 19.5 per cent.

Since most imports are under preferential agreements and MFN tariffs have not been decreased and are not particularly low in Mexico the significant increase in imports of cereals and meat products has, in general, not been caused due to Mexico's WTO tariff commitments.

2. Regional Trade Agreements

Mexico is one of the world leaders in signing RTAs and is now member of several RTAs with countries in the region and South America, as well as with several developed countries. Thirteen RTAs have been notified to the WTO; and Mexico is signatory to the Global System of Trade Preferences among Developing Countries (GSTP).

Regional trade agreements have been notified for Chile, Colombia, Costa Rica, EFTA, EU, GSTP, Israel, Japan, Latin American Integration Association (LAIA), Northern Triangle (El Salvador, Guatemala, Honduras), Nicaragua, North American Free Trade Agreement (NAFTA), Peru, and Protocol on Trade Negotiations (PTN).

Trade in agricultural products is, however, relatively small with many of these partners (see section above). The RTA with Japan signed in 2004 includes agricultural products, though sensitive products are excluded, and Mexico exports food products such as tomatoes, garlic, onions, lemons and avocados. Since 2004 and 2010, Mexico could increase its share in Japan's imports only slightly from 1.0 to 1.1 per cent. The RTA with the EU came into force in 2000 and includes also agriculture. Mexico was, however, not able to increase its share of EU's food imports which remains stable since 2000 at a low level of about 0.2 per cent. Sensitive agricultural products excluded from the trade agreement with the EU are one reason for the poor performance. From Mexico's 10 most important export products (at the HS 6-digit level; edible vegetables such as tomatoes, fruits such as avocados, sugar products and beverages) only 2 products benefit from full preferential treatment, i.e. zero tariffs (Table I.11).

The free trade agreement with Costa Rica, that includes agriculture as well, entered into force in 1995. The share in Costa Rica's food imports coming from Mexico has increased from 1995 to 2000 from 4.0 to 8.5 per cent and has since then fallen slightly to 8.1 per cent.

Mexico, along with Canada and Japan, expressed interest in joining the Trans-Pacific Partnership (TPP) Agreement in November 2011 at the annual Asia-Pacific Economic Cooperation (APEC) Leaders' Meeting but have not yet joined the negotiations.[19]

The North-American Free Trade Agreement (NAFTA) between Mexico, the United-States and Canada came into force in 1994. Many tariffs were immediately eliminated including a broad range of agricultural products. More than half the value of agricultural trade became duty free when the agreement went into effect.[20] Because of the sensitivity of agriculture, the agreement featured an extended implementation period for sensitive products where tariffs were phased out over transition periods of 5, 10, or 15

Table I.11: EU preferential treatment of Mexico's 10 most important export products to the world

HS code	Preferential treatment in EU
220300	No
070200	Yes, but not duty free
220890	No
070960	Yes
080440	Yes
010290	No
170199	No
070990	Yes; many tariffs zero but not all duty free
170490	Yes, but not duty free
090111	MFN duty free

Source: UN Comtrade and UNCTAD Trains, 2010.

years. Sensitive products of US exports to Mexico included maize, dry edible beans, nonfat dry milk and high fructose corn syrup. Sensitive products of Mexican exports to the US included sugar and certain horticulture products. For maize in Mexico the NAFTA agreement had a 15 year phase-in period of tariff reductions to protect the Mexican market from imports of US maize. Import-sensitive sectors were protected with longer transition periods, tariff-rate quotas, and, for certain products, special safeguard provisions. The phase-in was completed in 2008 and free trade prevails for all agricultural products.[21]

In NAFTA agriculture has not been negotiated trilaterally. While the US – Canada agreement allows for exceptions and quotas on sensitive products such as sugar, diary and poultry has the US – Mexico agreed on a comprehensive liberalization schedule.

It is likely that the comprehensive liberalization schedule with the US has had an impact on the increase of imports from the US. The free market access to the US has most likely also helped Mexican exporters but the US has in general not very high tariffs on agricultural goods. The average US applied MFN tariff is 4.9 per cent compared to 21 per cent in Mexico. On fruits and vegetables, the major export product to the US, the average applied MFN rate is low at 4.9 per cent. In many sectors where the US has high tariffs, such as in dairy (16.2 per cent) Mexico is not a major exporter. The preference margin for US exports to Mexico is 31.1 per cent while the preference margin for exports from Mexico to the US is with 5.4 per cent considerably lower (Table I.12). Thus, the tariff preferences through NAFTA had, compared to the relative value for US farmers, a relatively lower value for Mexico's agricultural producers.

The following table presents the average applied tariffs on agricultural products in NAFTA.

Similarly, the preference margin for trade with Canada is higher for exports from Canada to Mexico (16.7 per cent) then for exports from Mexico to Canada (5.8 per cent). The average applied tariffs on agricultural trade between NAFTA members is not strongly preferential for Mexico. The difference between the applied rates within the NAFTA region and with the non-NAFTA members varies little for Mexican exports. There are exceptions. US imports of processed tobacco and processed ground-nuts were protected by tariffs of 77 and 164 per cent of the product price respectively. Mexico benefits from preferences for those agricultural products to access the US market related to the rest of the world. On tobacco and tobacco products, however, Mexico exported in 2010 only US$ 12 mill., down from US$ 27 mill. in 1995, while total imports of tobacco products increased from US$ 1 mill. to US$ 58 mill. For processed ground-nuts, the preferential rates for Mexico exports are around 50 per cent of the MFN rate.

The NAFTA agreement includes also provisions in other areas than tariffs. Some of these provisions are discussed in the section on non-tariff measures. Although tariffs have been phased out, there are no limitations in the agreement concerning the use of domestic support.

Mexico also benefits from preferential tariffs in the EU market. The average preferential tariff (effectively applied tariff) is 2.4 per cent compared to 7.2 per cent had the same exports faced MFN rates. Exports to Japan face a preferential tariff of 9.7 per cent compared to a potential MFN level of 20.1 per cent.[22] Likewise, Mexico offers trade preferences to its trading partners with which it has a FTA.

Table I.12 : Average applied tariffs in agriculture between the US, Canada and Mexico

Import country	Export country	Preferential tariff %	MFN rate for export basket %
Mexico	United States	0.0	31.1
	Canada	0.0	16.7
United States	Mexico	0.0	5.4
Canada	Mexico	0.0	5.8

Source: UNCTAD TRAINS Database, 2009 and 2010. MFN rate is the trade weighted average MFN tariff for the actual export basket from the indicated export country. Preferential tariff is the theoretical rate since some products may face the MFN level if they do not fulfill e.g. rules of origin requirements.

3. Current domestic support policies

Subsidies in the US

Total support for US agricultural producers has risen and fallen since NAFTA was implemented in 1994. The latest figure for producer support, according to OECD estimates, is $26 billion. This is currently about 7 per cent of the total value of production, which is around $339 billion. The decline shown in Figure I.7 is attributable in part to an increase in commodity prices. As some of the payments are countercyclical, in times of high prices payments are reduced.

Total domestic support for US agriculture in 2010 was still significant, totally $133 billion. However, little of this was paid to producers according to output ($1.9 billion) or input use (($9.6 billion). These are the categories that are considered most production distorting.

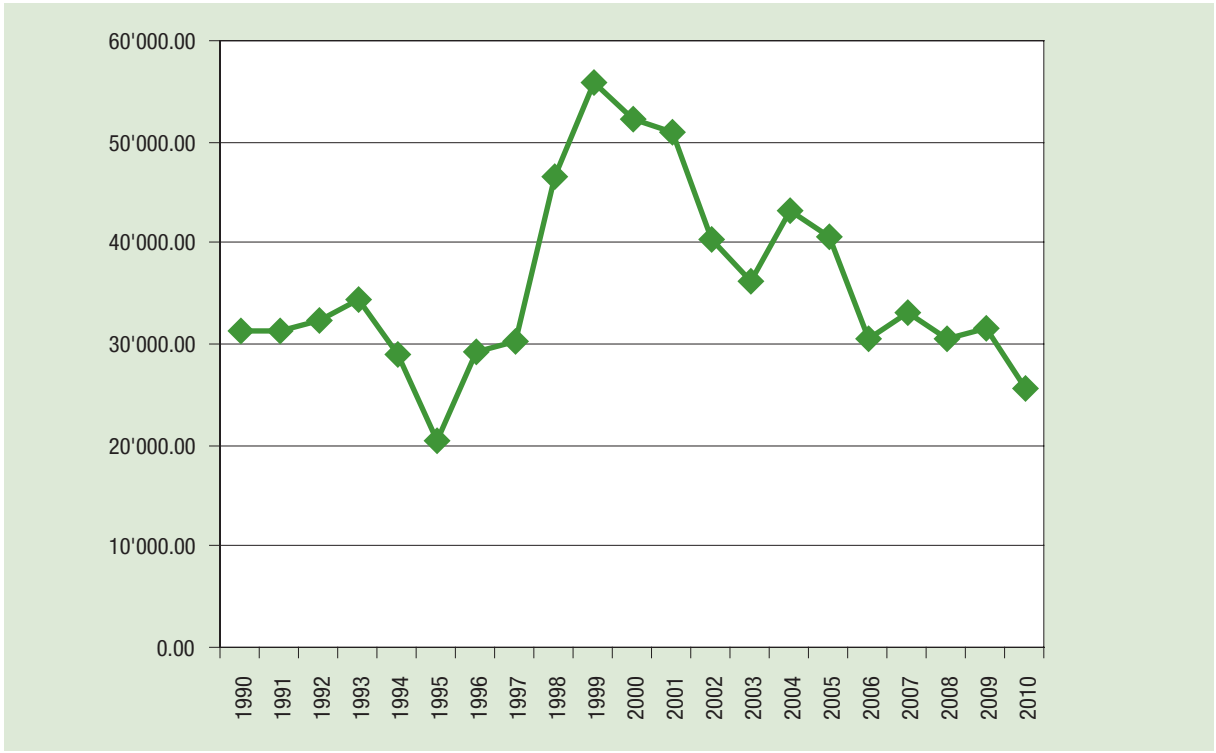
A larger component of support is through marketing and promotion. This includes food stamps, now called the Supplemental Nutrition Assistance Program (SNAP), which provides targeted income support for low income families. Most of the $70 bill. general service support estimate and the $38 bill. consumer support estimate is non-product specific food stamp program support. Almost all of the domestic support is provided by taxpayers rather than consumers.

There are further payments not based on output. These are so-called decoupled payments. Payments based on previous production are considered decoupled, and are, supposedly, non-distorting as they don't affect current production. However, if farmers expect future payments to be rebased on to production in some future year, they may continue producing in anticipation. In this way the distortions are locked in.

It is therefore difficult to assess how distorting the US production subsidies are. A generalization that production subsidies in the United States are not highly distorting because little of the support is directly related to output may not hold, especially not for every commodity.

Of particular interest is maize, as both Mexico and the United States grow this crop, and at the signing of NAFTA Mexican producers were concerned about

Figure I.7: Producer support in the US (US$ mill.)



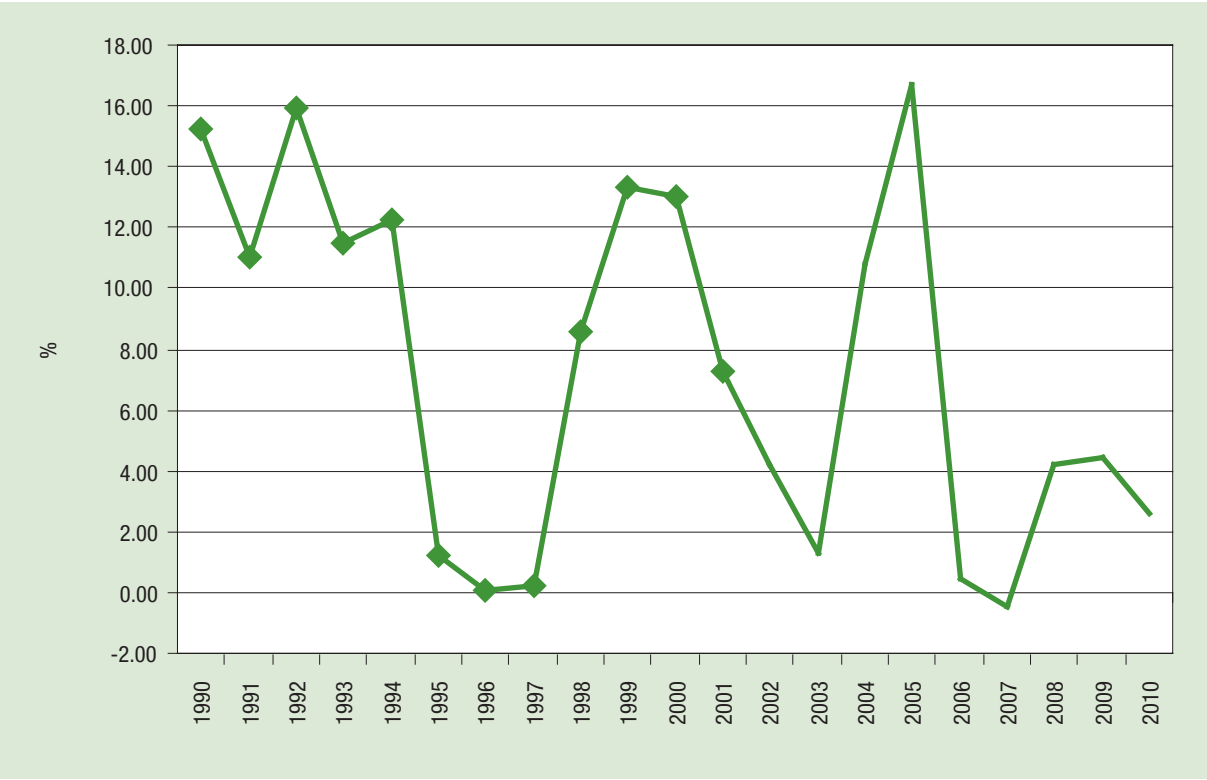
Source: OECD

Table I.13: Mexico domestic support for agriculture, 2010 ($m)

I. Total value of production (at farm gate)	339'075
II. Total value of consumption (at farm gate)	282'673
III.1 Producer Support Estimate (PSE)	25'551
A. Support based on commodity outputs	1'886
B. Payments based on input use	9'568
C. Payments based on current A/An/R/I, production required	5'638
D. Payments based on non-current A/An/R/I, production required	0
E. Payments based on non-current A/An/R/I, production not required	5'852
F. Payments based on non-commodity criteria	2'608
G. Miscellaneous payments	0
III.2 Percentage PSE	7
IV. General Services Support Estimate (GSSE)	69'849
H. Research and development	2'293
I. Agricultural schools	0
J. Inspection services	1'065
K. Infrastructure	4'297
L. Marketing and promotion	60'018
M. Public stockholding	24
N. Miscellaneous	2'152
V.1 Consumer Support Estimate (CSE)	35'390
O. Transfers to producers from consumers (-)	-1'500
P. Other transfers from consumers (-)	-1'160
Q. Transfers to consumers from taxpayers	38'050
R. Excess feed cost	0
V.2 Percentage CSE	14
V.3 Consumer NAC	1
VI. Total Support Estimate (TSE)	133'450
S. Transfers from consumers	2'660
T. Transfers from taxpayers	131'951
U. Budget revenues (-)	-1'160

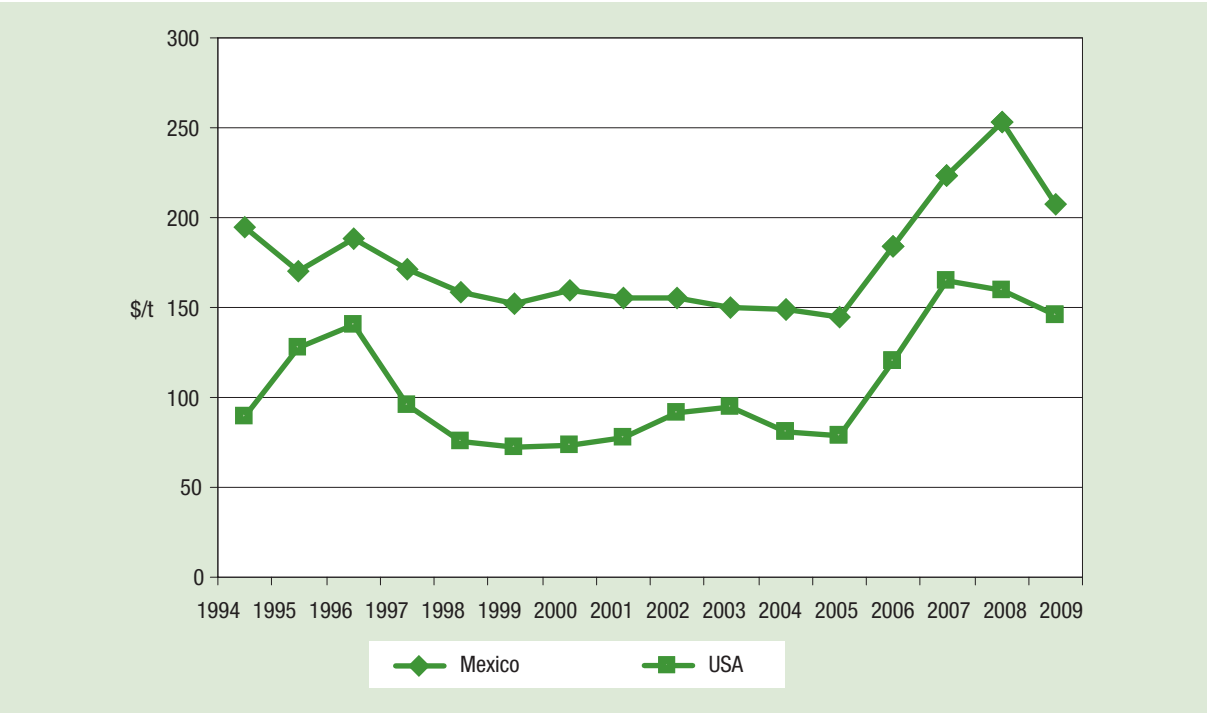
Source: OECD.

Figure I.8: Producer support for maize in the US as a percentage of production value



Source: OECD

Figure I.9: Producer prices for maize



Source: FAOSTAT http://faostat.fao.org/site/570/default.aspx#ancor

being flooded with cheap imports of maize following the removal of tariffs.

Domestic support for maize as a percentage of production in the United States, according to OECD estimates, is shown in Figure I.8. Product specific support was very high in certain years and reached 16 per cent in 2005. Since then it has been decreasing and reached a level close to two per cent in 2010.

Maize producer prices in US dollars are shown in Figure I.9. Mexican prices were double US prices in 1994 when the NAFTA agreement was first implemented. Some convergence appears to have occurred in the first year, but little since then. Prices have generally moved in the same direction, with the exception of 2008, when US prices fell.

Maize prices have risen in the United States, and consequently, in Mexico, in part because of US and EU policies on biofuels. The 2007 US Energy Independence and Security Act specifies that a proportion of the maize crop be used to produce ethanol for use as a fuel. Some 40 per cent of the US maize crop is diverted for this purpose, according to the USDA.[23] Stocks in 2011 are at their lowest level in 30 years, down to six month's consumption. This not only raises the price of maize, but also the prices of other crops, such as vegetable oils and sugar which are used in ethanol production, and wheat and coarse grains which are a substitute as animal feed.

Other products that are important for Mexican producers are also among the products on which US support is concentrated. According to OECD's Producer Single Commodity Transfers estimate[24] mainly crops (maize, wheat, rice, sugar, sorghum) and milk are subsidized (Table I.14). In 2000 rice had been subsidized by 37 per cent. Meat producers receive no support that is directly linked to the production of the corresponding product.

The data in Table I.14 on US producer support reflect the countercyclical nature of some of the support, indicating relatively low levels of support in 2010 and higher levels in previous years. In 2000, for example, both refined sugar and milk specific transfers were 50 per cent of the value of receipts from the sugar and milk production.

To the WTO, product specific domestic support of US$ 6.4 bill. has been notified by the US for 2008, the latest available year (*de minimis*, i.e. support below 5 per cent of the value of production, and total AMS). Almost 98 per cent had been spent on cotton dairy and sugar. Other products such as corn, rice, wheat, sorghum and meat products received very little (below *de minimis* levels) according to the WTO notifications for 2008. However, a problem for producers in developing countries is the potential increase of support in developed countries if e.g. world prices for commodities fall. Subsidies in the US are currently well below its commitment levels at the WTO. Furthermore, trade distorting domestic support can be shifted between products as there are currently now product specific commitments. Thus, high amounts of support can be concentrated on few

Table I.14: US producer support for selected products

	1995 %	2000 %	2005 %	2010 %
Barley	29	4	12	4
Beef	-0	0	0	0
Eggs	9	0	0	0
Maize	1	13	17	3
Milk	24	50	19	2
Pork	-0	0	0	0
Poultry	1	0	0	0
Rice	24	37	6	2
Sorghum	4	14	15	4
Sugar, refined	38	50	44	28
Wheat	39	16	2	6

Source: OECD.

Table I.15: Mexico domestic support for agriculture, 2010 (MXNmn)

I. Total value of production (at farm gate)	592'322
II. Total value of consumption (at farm gate)	638'453
III.1 Producer Support Estimate (PSE)	78'553
A. Support based on commodity outputs	21'864
B. Payments based on input use	39'822
C. Payments based on current A/An/R/I, production required	773
D. Payments based on non-current A/An/R/I, production required	3'781
E. Payments based on non-current A/An/R/I, production not required	12'312
F. Payments based on non-commodity criteria	0
G. Miscellaneous payments	0
III.2 Percentage PSE	12
III.3 Producer NAC	1
IV. General Services Support Estimate (GSSE)	10'984
H. Research and development	1'283
I. Agricultural schools	4'845
J. Inspection services	721
K. Infrastructure	2'828
L. Marketing and promotion	915
M. Public stockholding	0
N. Miscellaneous	392
V.1 Consumer Support Estimate (CSE)	-21'382
O. Transfers to producers from consumers (-)	-20'783
P. Other transfers from consumers (-)	-5'444
Q. Transfers to consumers from taxpayers	4'746
R. Excess feed cost	98
V.2 Percentage CSE	-3
V.3 Consumer NAC	1
VI. Total Support Estimate (TSE)	94'283
S. Transfers from consumers	26'227
T. Transfers from taxpayers	73'500
U. Budget revenues (-)	-5'444

Source: OECD.

products. Due to the absence of any tariffs between the US and Mexico, any change in the US agricultural policy has a direct impact on Mexican farmers. For example, since the beginning of the implementation of NAFTA three new farm bills were agreed (1996, 2002 and 2008).

In addition, products that do not receive direct subsidies or only little may be indirectly subsidized (Starmer et al., 2006) through subsidies on feed. Wise (2009) argues that beef, pork and poultry have been implicitly subsidized in the US through this mechanism.

Mexican domestic support

Mexico supported its producers according to OECD information with MXN 79 billion in 2010 (US$ 6.2 bill.)[25], 12 per cent of the value of agricultural production, which is about MXN 592 billion. The total support estimate, which includes transfers from consumers, was MXN 94 billion.

The largest items are support based on commodity outputs and input use. Market price support is provided primarily to poultry meat and sugar (MXN 5 billion each) and milk (MXN 3 billion). Subsidies on input use include electricity (MXN 7 billion), price hedging (MXN 9 billion) mainly on maize, sorghum and wheat, and fixed capital formation (MXN 16 billion). On farm services, which includes plant and animal health, amounted to (MXN 5 billion) in 2010. Expenditure on research and development is relatively low at (MXN 1.2 billion). During many years in the past, product specific subsidies on crops were lower in Mexico than in the US. For instance, maize support was 8.8 per cent and support on Barley 0 per cent in 2005.

Official data notified by Mexico to the WTO on domestic support are not available for recent years.[26] In 2004, Mexico reported a total of 1.4 billion of constant 1991 Pesos of product-specific support. Most of this, 954.5 mill. Pesos, falls under de minimis support (i.e. its value is less than or equal to 10 per cent of the value of production). The remaining 488.7 mill. Pesos support on rice, safflower, cotton, coffee and beans, which was above 10 per cent of the value of production, has been notified under total AMS support. In absolute terms, maize received the highest support, 418 mill. Pesos, which was 29 per cent of the total product-specific support in 2004.

Scott (2010) also notes that market price support and output-linked payments have targeted mostly traditional crops, particularly maize and other grains, as well as raw sugar and some animal products like milk and poultry meat. Fruits and vegetables, on the other hand, have not received significant support, but would have benefited from the liberalization of agricultural markets.

4. WTO Doha Round Negotiations

The Doha Round negotiations were launched in 2001 and agriculture is one of the most important components of the single undertaking under which negotiations on industrial and agricultural goods, services and other issues take place. Until 2012, no agreement has been reached and the future of the Doha Round is uncertain.[27] Mexico is an active negotiator and member of the G-20, a group of developing countries with a relatively wide range of interests, including offensive and defensive interests. A common interest of the group was a high level of special and differential treatment for developing countries, i.e. favoring a higher ambition for developed countries in terms of reduction commitments than for developing countries. Mexico is not a member of the G-33 group that focuses on defensive instruments for developing countries such as special products and a special agricultural safeguard mechanism.

According to the draft modalities text, Mexico, as a developing country, would have to apply a tariff reduction formula to reduce bound rates. WTO members had agreed[28] on a tariff reduction formula that classifies tariffs into four bands and applies larger cuts for higher tariffs. DCs would undertake a two-thirds cut of developed countries in the corresponding band and thresholds for their tariff bands are more favourable from a defensive perspective. Cuts on highest tariffs in developing countries would be 47 per cent. A maximum average cut for DCs of 36 per cent, had been proposed. For Mexico, a large majority of the bound tariffs would fall into the second tier (tariffs between 30 and 80 per cent) with cuts of 38 per cent. Most Mexican bound rates are around 40 per cent. Reducing a tariff by 38 per cent gives a new bound rate of 24.8 per cent, which would be for most products higher than the current applied rate. A couple of sensitive products (5.3 per cent of tariff lines in DCs) where applied rates are up against or close to bound rates could be excluded from full reduction commitments[29] and another 12 per cent of tariff lines would also be allowed to be designated as Special

Products which are important for food security, livelihood security and rural development with lower or no tariff reductions. Thus, most applied rates and those on sensitive products would not be affected. However, it would reduce the policy space to change the agricultural trade policy in future substantially.

Mexico's biggest trading partners, the US, EU, Canada and Japan would all have to make substantial cuts in bound and applied rates. They also can select sensitive products but those would most likely not be the typical export products of Mexico but rather temperate products produced in their countries. Mexico would be negatively affected by preference erosion since it has free trade agreements with its most important trading partners. The effect for the US market might be limited since the US has already relatively low agricultural tariffs on most products. However, since the preference margin is already relatively low, competition on the US market could increase.

On trade distorting domestic support cuts for the newly created concept of Overall Trade Distorting Support (basically AMS support, de minimis and blue box support) are proposed to by 80 per cent for the EU, 70 per cent for the United States and Japan, and 37 per cent for developing countries such as Mexico. Each component of the OTDS would have its own reduction commitment or, in the case of developing countries. Since Mexico has a AMS allowance, it would not be excluded from the de minimis reduction commitment. This would further limit Mexico's flexibility to strengthen its agricultural sector but probably enough possibilities would remain. On "green box" support, the text provides for clearer dissociation of direct payments from production by fixing the historical base period so as not to create an incentive for producers to expand production. The reduction commitment for the US would be a huge benefit for Mexico. Though the formula has been criticized since it starts reductions from an inflated base, the upper limit for the US would be lower and there would be newly agreed product specific caps. Commitments for developed countries on domestic support are probably the most important element for Mexico in the current round of negotiations since those have not been bound in NAFTA. Even if current subsidies are low due to high commodity prices, they may rise again in the future.

On export subsidies, it had been agreed at the WTO Hong Kong Ministerial Meeting (WTO, 2005) to eliminate all forms of export subsidies, including components in export credits, food aid and state trading enterprises, in 2013. This agreement was, in 2005, a major success in the negotiations and would have a positive though small effect for the agricultural sector in Mexico.

To summarize, Mexico would, like all countries except LDCs, lose flexibility if the Doha Round would conclude along the lines of the current draft modalities text. Furthermore, preference erosion could negatively impact Mexico's export to its main markets. However, the positive elements such as domestic support constraints in its neighboring country would probably outweigh those negative effects.

D. IMPACT OF TECHNICAL STANDARDS ON THE AGRICULTURAL SECTOR IN MEXICO

1. Standards and other measures

As tariffs have been lowered over time, non-tariff measures (NTM) to trade have become relatively more important. Nicita-Olarreaga-Kee (2006) found that NTMs contribute more than 70 per cent on average to world protection. Since Mexico has free trade agreements with its major trading partners, US, EU, Canada, Japan, as well as several Latin-American countries such as Guatemala and Chile, where tariffs are below MFN levels or even eliminated, other measures become more relevant instruments, determining market entry conditions.

Restrictions applied at the border such as anti-dumping measures and certain customs formalities are NTMs, as well as certain behind-the-border internal measures, such as certain customs formalities, and can become barriers to trade and discriminate against imports. Other examples include technical standards, for instance health and safety standards and environmental and consumer information requirements. Fugazza and Maurer (2008) confirm that technical measures account for a high proportion (58.5 per cent) of NTMs that are covered in the UNCTAD TRAINS database. Technical regulations generally serve as a means to achieve legitimate public policy purposes such as to protect human, animal and plant life and health. Such measures may incidentally or intentionally discriminate against imports in favor of

domestic firms. . In this case, such measures would increase the costs of producers disproportionately for foreign suppliers. In the perception of many exporters, domestic regulations are more problematic (than border measures) for firms seeking to sell abroad.[30] In addition to official standards and other measures imposed by governments, private standards such as those required by supermarket chains are becoming increasingly important.

Two WTO Agreements, the Technical Barriers to Trade (TBT) Agreement and the Sanitary and Phytosanitary (SPS) Agreement, determine basic rules and guidelines for WTO members in relation to international trade and technical regulations and sanitary and phytosanitary requirements. Both agreements encourage the use of international standards and require scientific evidence and risk assessment while at the same time recognizing the sovereign rights of WTO members to set their own standards and to take "precautionary" measures in case of lack of scientific evidence. The interpretation and application of measures have not been the same across countries and given the complexity and heterogeneity of agrifood production systems, as well as national interests and have thus led to many concerns raised in corresponding WTO committees as well as trade disputes. The design and implementation of standards can have a strong impact on international trade.

However, standards and their effect on trade are difficult to assess. This section tries to analyze the impact of such measures of Mexico's major trading partners on its agricultural sector. The section also looks at Mexico's measures related to trade to protect the health and safety of its human beings and animals. Domestic regulations that are relevant for the production of safe food are discussed in chapter 2. .Macro-economic policies that are included in extended taxonomies are not analyzed.

2. Standards and other measures faced by Mexico's exports

2.1. Measures in the US

Technical standards (Sanitary and Phytosanitary Measures)

Sanitary and Phytosanitary standards (SPS) refer to measures implemented nationally in order to ensure that the country's consumers are being supplied with food that is safe to eat, as well as ensure animal and plant health.

A study by Clemente Ruiz Duran[31] on NTMs affecting Mexican exports in different member countries of APEC, highlighted that SPS measures have an important impact reducing potential trade opportunities in the US market for the following products: live animals, meat, edible meat offal, dairy products, eggs, coffee and cereals, sugar and fish, crustaceans and mollusks.

In the context of this report (undertaken in 2011-2012), interviews to several representatives of producers' associations highlighted the perception that sanitary and phytosanitary measures are the most important type of non-tariff measure affecting Mexican exports of agriculture products to the US.

In the case of poultry and pork meat, sanitary requirements were cited as a major factor limiting the exports to the US; delays and complicated long procedures, by US authorities, to obtain certification in the case of sanitary standards have also affected Mexican exports of chicken.

In the case of pork, sanitary and phytosanitary measures were cited a barrier impeding exports from Mexico. They cite a zero increase in exports from Mexico in spite of market access opening that resulted from NAFTA. Producers underscored the fact that Mexico has made a lot of progress in terms of eradication of pests and diseases in the pork sector. This lack of equivalence of pest and disease control measures[32] has also been raised by Canada, as an issue of concern, which has affected Canadian beef meat exports to the US market[33].

A recent UNIDO (2011) report on border rejections of agrifood imports confirms that sanitary and phytosanitary standards as well as technical barriers to trade are problematic for Mexico's exports (see Chapter II, Table II.18). The main reasons for U.S. rejections of agrifood exports from Mexico were based on sanitary and phytosanitary concerns.

The impact of SPS measures is also revealed by observing the number of questions to the US in their WTO Trade Policy Review (TPR). In this context, Mexico raised questions regarding the lack of effective equivalence of standards for meat, poultry and egg-based products.

An important proportion of Mexico's comments related to due process and transparency in the formulation of SPS. For instance, when posing questions on measures related to security (i.e. Biosecurity Act, Container Security Initiative), the main concern appeared to be burdensome procedures that may lead to delays in the clearance of goods. Another source of concern, of a procedural nature, related to situations of conflict between measures at the subfederal level (which were perceived as being more stringent) than those applied at the federal level. Complex regulation and unclear and non-transparent requirements and procedures were cited in the case of procedures to ensure equivalence, the requirement of site "re-inspection" and guidelines for risk assessment in the case of products that are being imported for the first time into US territory. Finally, questions also sought to clarify situations where standards applicable to disease control were different and more stringent for foreign producers than for local producers.

Technical standards (Technical Barriers to Trade)

Technical regulations and standards set out specific characteristics of a product — such as its size, shape, design, functions and performance, or the way it is labeled or packaged before it is put on sale.

Analyzing the disputes brought by Mexico against the US and questions to the US in their TPR, labeling requirements seem to be the most problematic technical barrier to trade faced by Mexico in the US. Concerns were recorded regarding labeling requirements applicable to: meat (including goat meat), poultry, ginseng, pecan and macadamia nuts. The main sources of concern encompass: labeling requirements that are different and more stringent for foreign producers than for local producers and unclear procedures on instances where labelling of GMOs is required.

An example is the Mandatory Country of Original Labeling COOL in the US, which outlines requirements for retailers to notify their customers of the country of origin of beef (including veal), lamb, pork, chicken, goat, wild and farm-raised fish and shellfish, perishable agricultural commodities, peanuts, pecans, ginseng, and macadamia nuts. Constituencies in Mexico and Canada were of the view that COOL imposed a tracking, segregating, and recording system that increased significantly production costs, leading to a drop in bilateral trade, due to American producers avoiding the onerous and expensive labeling requirements by choosing 100 per cent U.S. products. This matter was brought to the WTO in 2010. WTO's Dispute Settlement Panel ruled, in November 2011, that although the United States had the right to require COOL regulations, specific requirements enacted in 2008, such as those calling for segregation of imported livestock before processing, provide less favorable treatment to Canadian and Mexican livestock. The US appealed this decision in 2012 arguing, among other issues, that its COOL labeling does not impose unfavorable treatment of imported products.[34]

Issues related to due process and transparency also raised many questions. For instance, Mexico posed questions regarding whether the US did regulatory impact assessment studies prior to introducing technical regulations and whether these were available to the public (including foreign nationals). Mexico also raised questions regarding the extent to which US technical regulations were based on international standards. They also raised a concern over the fact that the subfederal level can impose measures without necessarily notifying them to the WTO, and which could create a conflict between the standard at the federal and subfederal level.

In the context of the WTO Committee, Mexico also raised concerns regarding *quality control checks and certification along the supply chain*, which are perceived to lead to increased costs for producers and exporters.

Other measures

According to WTO documents containing concerns raised by Mexico with respect to the implementation of WTO agreements, prior trade disputes[35] and Trade Policy Review records, agricultural exports of Mexico to the US have been affected by antidumping measures (fresh tomatoes), subsidies (including export subsidy components and food aid related concerns, for corn, milk), discriminatory taxes (orange and grapefruit products and juices) and import prohibitions (shrimp). Rules of origin and changes that affect the concept of substantial transformation in NAFTA

These concerns are similar to concerns raised by Canada in its bilateral trade relation with the US. In this sense, it is worth noting that most of NAFTA's trade disputes between US and Canada have been related to dumping (wheat, live cattle, beef and swine). Like Mexico, Canada has raised concerns regarding US labeling requirements, particularly regarding requirements to inform consumers about origins of

food products (chicken, goat, meat, ginseng and macadamia) that imposed disproportionately high costs along the value chain for imported products (see Box 1). Canada has questioned US border security measures that are deemed to have caused disruptions to trade (due to security control) and increases costs of trade[36]. During the latest TPR of the US, Canada has also expressed concerns on the proliferation of voluntary and private standards that seem to be proliferating (and influencing imports) without a Code of Practice or Governmental oversight[37].

The Dolphin-safe certification is such a voluntary standard. It is supposed to ensure that tuna is caught by methods that do not harm dolphins and protect the marine ecosystem. Arguing that these voluntary standards had become a *de facto* discriminatory measure, Mexico brought these to dispute settlement in the WTO in 2008. Mexico claimed that the labeling requirements were discriminatory and unnecessary. The Panel found in 2011 that the US dolphin-safe labeling requirements were more trade-restrictive than necessary to fulfill legitimate objectives. Later the Appellate Body found in 2012 that the US dolphin-safe label violates WTO law by discriminating against Mexican tuna.[38]

Standards in NAFTA

Efforts to remove or discipline non-tariff measures that negatively impact trade have been undertaken by Mexico at the bilateral and regional levels. The following box summarizes NAFTA commitments with respect to technical standards: these include the promotion of use of international standards and the use of equivalence.

In practice, NAFTA has allowed differing levels of standards to develop (as opposed to effective equivalence). Vollrath[39] (2004) notes that SPS-related issues and standards remain contentious in the context of NAFTA, in areas such as dairy, beef, sugar, wheat, rice, corn and livestock due to lack of harmonized product, health, safety and environmental standards which, in turn, stem from differences in national laws and regulations, divergent farm programs and incompatible macroeconomic policies. Products legally produced in one country in NAFTA cannot automatically be sold in other NAFTA countries but may require additional certification. This is a difference to the EU where according to the "Cassis de Dijon principle" goods produced legally in any member state can be sold in any other EU country.

In conclusion, from the Mexican perspective, the problem affecting agricultural exports to the US seem to stem from a combination of the following factors: (i) differing level of standards and lack of equivalence, and (ii) procedural barriers (namely delays with certification process). In this context, it appears that improving compliance standards does not seem to be enough to ensure increased exports from Mexico to the US.

Attempt to quantify standards and other measures in the US

Estimates of ad valorem equivalents (AVEs) of NTMs confirm their importance for trade. Kee, Nicita and Olarreaga (2004b)[40] provide estimates of AVEs of core measures (price and quantity control measures, technical regulations, as well as monopolistic measures, such as single channel for imports) and agricultural domestic support at the tariff line level for several countries including Mexico and its trading partners.

The United States' simple average ad valorem equivalent NTM for agricultural goods is 48 per cent with a high variation between products. For the export basket of Mexico, the average NTM is equivalent to a 26.9 per cent tariff. [41] This is high compared to the relatively low average MFN agricultural tariff (4.9 per cent) and slightly higher than the average NTB for the total agricultural imports from the world (23.9 per cent). On fruits and vegetables, major exports of Mexico to the US, NTBs are relatively high. Other Latin-American countries such as Brazil and Colombia export products to the US that face on average lower NTB.

Box I.1: NAFTA commitments with respect to technical standards

Basic Rights and Obligations

The NAFTA confirms the right of each country to establish the level of SPS protections that it considers appropriate and provides that a NAFTA country may achieve that level of protection through SPS measures that:

are based on scientific principles and a risk assessment;

are applied only to the extent necessary to provide a country's chosen level of protections; and do not result in unfair discrimination or disguised restrictions on trade.

International Standards

To avoid creating unnecessary barriers to trade, the NAFTA encourages the three countries to use relevant international standards in the development of their SPS measures. However, it permits each country to adopt more stringent, science-based measures when necessary to achieve its chosen level of protection.

Equivalence

The three countries have agreed to work toward equivalent SPS measures without reducing any country's chosen level of protection of human, animal or plant life or health. Each NAFTA country will accept SPS measures of another NAFTA country as equivalent to its own, provided that the exporting country demonstrates that its measures achieve the importing country's chosen level of protection.

Risk Assessment

The NAFTA establishes disciplines on risk assessment, including for evaluating the likelihood of entry, establishment or spread of pests and diseases. SPS measures must be based on an assessment of risk to human, animal or plant life or health, taking into account risk assessment techniques developed by international or North American standardizing organizations. A NAFTA country may grant a phase-in period for compliance by goods from another NAFTA country where the phase-in would be consistent with ensuring the importing country's chosen level of SPS protection.

Adaptation to Regional Conditions

This section also establishes rules for the adaptation of SPS measures to regional conditions, in particular regarding pest- or disease-free areas and areas of low pest or disease prevalence. An exporting country must provide objective evidence whenever it claims that goods from its territory originate in a pest- or disease-free area or area of low pest or disease prevalence.

Procedural Transparency

The NAFTA requires public notice in most cases prior to the adoption or modification of any SPS measure that may affect trade in North America. The notice must identify the goods to be covered, and the objectives of and reasons for the measure. All SPS measures must be published promptly. Each NAFTA country will ensure that a designated inquiry point provides information regarding such measures.

Control, Inspection and Approval Procedures

The NAFTA also establishes rules governing procedures for ensuring the fulfillment of SPS measures. These rules allow the continued operation of domestic control, inspection and approval procedures, including national systems for approving the use of additives or for establishing tolerances for contaminants in foods, beverages or feedstuffs, subject to such disciplines as national treatment, timeliness and procedural transparency.

Source: NAFTA agreement.

Table I.16: Average ad valorem equivalents of NTMs

Importer	Export basket	Trade weighted average %
United States	World	23.9
	Mexico	26.9
	Canada	33.1
	Brazil	7.6
	Colombia	10.1
Mexico	World	33.7
	United States	33.2
	Canada	18.4

Source: UNCTAD calculation based on World Bank estimates of NTMs.

2.2. Measures in the EU and Canada

The comments presented in the latest trade policy review of the EU and Canada are revealing of sources of concern regarding NTMs in the trade relation with Mexico. These concerns coincide to a great extent, with those observed in the case of the US, particularly regarding the importance and incidence of SPS measures and labeling requirements.

In the case of the EU, main sources of concern regarding SPS measures relate to conditions to trade products, particularly GMOs (beef, honey from genetically modified corn and seeds derived from GMO products) and exotic products (known as Novel foods). The main source of concern is delay in approval due to extensive requirements and long processes.

One area of concern regarding due process in SPS measures relates to the provisional application of trade restrictions in the event of a potential risk, even if this risk cannot be fully demonstrated or quantified or its effects determined because of the insufficiency or inclusive nature of the scientific data.

Another problematic issue in the Mexico-EU trade relation due to NTMs relates to tequila. Mexico is concerned about the fact that EC imports and markets beverages alleged to be tequila, which do not comply with Mexican legislation on eligibility to use this name. Mexico concern about the use of the appellation of origin for tequila relates to potential fraud, adulteration and counterfeiting of tequila. Mexico has also expressed concern regarding EU export subsidies for products derived from milk (refunds applicable to milk, cheese and butter and aid scheme for private storage) and for milk.

3. Measures applied by Mexico on imports

On the import side, technical regulations and SPS standards are important to guarantee the protection of health of people, plants and animals. It appears that Mexico has made a lot of effort to develop the institutional and regulatory framework that deals with the array of issues involved with technical regulations and SPS standards. In addition, according to NAFTA provisions, Mexico undertook commitments related to reinforcing sanitary and phytosanitary measures in order to guarantee the quality and safety of agricultural products and procedures and mechanisms to mutually recognize standards do exist and are being used.[42]

In the current context of increased fragmentation of production in global value chains, such standards can ensure imports of quality intermediate goods or raw material that may be necessary to remain competitive. However, in certain situations, these standards can be perceived as barriers to trade that intend to discriminate against foreign suppliers to protect the domestic industry.

Disputes brought by trading partners, records of Mexico TPRs and concerns voiced in meetings of the agriculture, TBT and SPS committees provide a picture of the perception of other trading partners regarding measures used by Mexico that are considered problematic. In this sense, measures considered problematic include: antidumping (high fructose corn syrup, live swine, beef and by-products and rice), countervailing duties (olive oil) and domestic support. The USTR (2010) also mentions issues regarding customs and administrative procedures (e.g. non-uniform application of requirements at border ports of entry, and lengthy and burdensome procedures)[43] as a source of concern.

In the specific area of standards and technical regulations, issues of concern include: lack of access to information about requirements and delays to obtain SPS certificates (black beans), restrictions introduced to control pests and diseases (such as BSE).[44] The USTR (2010) also mentions uneven enforcement of Mexican standards and labeling requirements and inspection and clearance procedures that are considered to be long, burdensome, non-transparent and unreliable.[45]

Attempt to quantify standards and other measures in Mexico

The ad valorem equivalent NTB in Mexico is on average 44 per cent and thus only slightly lower than the corresponding value for e.g. the US (48 per cent, see above). For the export basket of the US, the average AVE NTB is 33.2 per cent and thus higher than the average AVE NTB faced by Mexico on exports to the US (26.9 per cent). The approach chosen by Kee, Nicita and Olarreaga (2004b) is to predict imports using factor endowments and observe its deviations when NTBs are present. The quantity impact of NTBs on imports is then converted into a price equivalent

by moving along the import demand curve using estimated import demand elasticities.

Thus, according to these estimates, both Mexico and the US have significant NTB on imports from their NAFTA trading partners. The order of magnitude is roughly in line with those of other countries. A weakness of this quantification approach is that it does not differentiate between different sources of imports. Imports of the same product from NAFTA members are assumed to face the same NTMs as imports from non-NAFTA members. However, the fact that trade disputes between NAFTA members are often brought to the WTO rather than solved inside NAFTA indicates that this could be a reasonable assumption.[46] Nevertheless, limitations of this approach should be kept in mind.

4. Sources of concern for Mexico regarding standards from the domestic and import perspective

Interviews conducted in the context of this Outlook point to fact that, although legislation and institutional frameworks are in place, there seems to be a problem with implementation (namely inconsistent application of regulations). The problem appears to stem from the lack of capacity to enforce and verify application of quality regulations. In turn, this is perceived as unfair competition with low quality and cheap imports of agricultural products (particularly from the US, the main source of agricultural imports) and lack of consumer protection. Interviews conducted identified areas of weakness in the case of milk, maize (including Genetically Modified Maize), wheat, rice and soybeans and chicken.

In the case of milk, Mexico has quality regulations aiming to ensure safety and nutritional value and appropriate and accurate information for the consumers. However, producers perceive that enforcement capabilities of quality regulations (particularly regarding labeling) remain weak. This situation could be perceived by consumers as misleading them, and this in turn favors consumption of imported goods. Producers also noted that the lack of enforcement capability of regulation also relates to the verification of production costs. This situation leads to incapacity to address unfair competition in instance of products imported from the US that are produced below production cost or subsidized. Producers believe that in order to overcome these weaknesses, there is need to update certain aspects of standards and to strengthen the capacity to verify and enforce them.

In the case of genetically modified maize, Mexico has in place a regulation that impedes production of Genetically Modified Organisms (GMOs) but allows imports of GM maize (whether for human consumption but also as feed products), most of which come from the US.[47] In view of Mexican producers this regulatory contradiction impedes developing local production. Some producers believed the main area of weakness was the lack of regulation regarding requirements for cross border trade of transgenic maize and control of toxins. Others suggested the weakness consisted of relaxed enforcement of control measures for products coming from the US, depending on food import needs.

In the case of maize, wheat, rice and soybeans, quality regulation exists in Mexico but producers pointed to a lack of consistency in their application and enforcement, for instance quality regulation seems to be overlooked in periods of shortages. In the specific case of rice, Mexican standards are developed and based on international standards and are applied by buyers (processors). Rice producers' are of the view that regulation is manipulated to obtain lower prices (i.e. when grains are not according to the standard a lower price is paid to the producer). This problematique is particularly relevant for smaller and "less technified" producers, who often have problems with facilities to stock and dry grains, which in turn has an impact in ensuring the quality of grains.

In the case of chicken, regulation exists regarding quality, packaging, expiry date and labeling. In addition, producers believe Mexico has a good track record in terms of eradicating and controlling pests and diseases that affect chickens. However, it appears that imported chicken (that mainly come from the US) complies with these regulation but national products do not (because they believe the regulation is complicated). This situation is perceived as inducing consumers to prefer imported chicken over chicken produced locally.

Policies for technical standards and other measures

From the export perspective, problems faced by Mexico with respect to standards and other non-tariff measures are similar to the one of other exporting

developing countries and related to grey areas in trade rules disciplining them. Despite the fact that policies aimed at protecting health and safety of people, animals and plants, as well as the environment are considered legitimate, the concern from the export perspective relates to situations where such policies are perceived as seeking to help domestic firms at the expense of foreign firms. In the particular case of Mexico, the standards that seem to be most problematic to exporting firms and producers are labeling requirements which can cause disproportionately high costs for exporters, SPS measures and security/customs procedures. This Outlook reveals that these technical standards and other measures are very relevant to the trade relation between Mexico and its main trading partner, the US, but also apply to other trading partners. Since Mexico's main trading partners are all developed countries with high standards and additional private standards, the issue of NTMs is of particular interest to Mexico.

Standards cannot easily be reduced in trade negotiations. For example, private standards are not developed in the context of governmental oversight and reflect voters or consumers choices for healthy and environmentally friendly products. On the other hand, mutual recognition and equivalence seem to have not worked well to overcome barriers identified. Working together in the future with key trading partners towards harmonization of measures and regulation could be an interesting path to explore.

Technical knowhow on the market entry requirements related to NTMs, particularly standards and technical regulations, as well as the implementation of both public (mandatory) and private (voluntary) food safety certification schemes by small producers, processors, packers and exporters in Mexico's agrifood supply chains is critical for export success. Sufficient resources for training, innovation and technology transfer and capacity building is needed. Several of the trade agreements, for instance the SPS and TBT agreements, call for technical assistance for developing countries. This is important including in light of the shift in the US from reaction and response to prevention of food borne illnesses from the 'farm to fork' (food Safety Modernization Act (FSMA), signed into law in January 2011). The US Food and Drug Administration (FDA) is mandated by the FSMA, under the 'importer compliance certification' provisions, to provide such assistance to foreign governments, such as Mexico, so that these countries are able to add value to their products, as well as improve process management procedures – on- and off-form packing and handling, storage, and shipment facilities. Tailor made trainings, for instance for meet producers, and internationally recognized public and/or private food safety certification schemes could be implemented. Potential adverse consequences on Mexico's agrifood production costs should be taken into account.

From the import perspective, the problem seems to be related to the weak domestic capacity to enforce and verify quality regulations, which in turn can lead to a non-uniform application of requirements at border ports of entry. From the point of view of producers, this situation is perceived as contributing to (1) unfair competition with low quality and cheap imports of agricultural products, which affect the price and quality of inputs along the value chain and (2) lack of consumer protection. A possibility is to introduce a grading system similar to the USDA grading system where meat can (voluntarily) be classified according to quality grades.

Overcoming these challenges require clearly determined quality standard on imports, strengthening enforcement and quality control measures in the local market, strengthening the ability of producers and exporters' to comply with standards in key markets and a good consumer protection.

E. LINKING TRADE, POLICY AND DEVELOPMENT IN AGRICULTURE

Mexico's agricultural trade reform coincides with increasing imports, decreasing employment in agriculture and high poverty rates in rural areas. Imports have increased from all major trading partners and particularly from NAFTA members who supply more than 80 per cent of Mexico's agricultural imports.

Although tariffs with Mexico's partners within RTAs have been gradually reduced and MFN rates remained relatively stable, many Mexican producers have expressed concern about the removal of tariff protection. In addition, although bilateral agreements such as NAFTA the reduction of removal of bilateral tariffs on both sides of the border have been specified, there are no limitations in the agreements concerning the use of domestic support (Wise, 2009).

Agricultural subsidies

For a time the US subsidized maize production by as much as $4.4 billion a year (in 2005).[48] This is an instance where tariffs have been reduced substantially but domestic support contributes to distortions. Wise (2009) analyzed the impact of US agricultural policy on Mexican producers and assess to which extent subsidized products were exported to Mexico at prices below production costs between 1997 and 2005. Maize producers were by far the most heavily affected with $6.6 billion in losses.

Maize is not the only product where US production is benefiting from subsidies and which competes with Mexican production. For eight products, maize, soybeans, wheat, cotton, rice, beef, pork and poultry, Wise (2009) estimates that subsidies in the US caused losses of $12.8 billion for Mexican producers for the period 1997 to 2005. His calculation is based on dumping margins that are supposed to capture not only the effect of direct subsidies but also other subsidies that allow exports below production costs. Livestock producers in the US who receive less direct support, benefit from subsidies on two of its most important feed mixture components, corn and soybean (Starmer et al., 2006). Wise (2009) takes these indirect subsidies into account by assuming that they allow US farmers to export at prices below their cost of production which has a negative effect on those farmers in Mexico producing livestock and not benefiting themselves from subsidized inputs as they are using alternative feed such as domestic feed or grazing. This dumping margin differs from the producer subsidy equivalent calculated by the OECD. For crops, the average dumping margin from 1997 to 2005 is between 12 per cent and 34 per cent, and for meat products between 5 per cent and 10 per cent.

The calculation of losses for Mexican producers is based on the assumption that the Mexican producer prices were depressed by the same percentage as the dumping margin. With this assumption, Wise (2009) assess that the US subsidies eliminates, for the lowest productivity smallholders, any positive income from corn sales. Similarly, Polaski (2004)[49] argues that U.S. exports of subsidized crops such as corn have depressed agricultural prices in Mexico. The rural poor would have borne the brunt of adjustment to NAFTA.

Others, however, are positive and argue that agriculture cannot be looked at separately within the context of NAFTA. Hufbauer and Schott (2005) acknowledge that expanded agricultural trade under NAFTA auspices caused adjustment costs in Mexico but argue that static and dynamic gains probably exceed adjustment costs within Mexico by a factor of five or higher. The World Bank (2004) argues that the reduction in producer prices was rather a long-term trend and cannot be blamed on NAFTA. McMillan (2006) reviews quantitative literature on the impact of US subsidies on Mexican prices. Several studies find smaller effects than Wise (2009) discussed above. An adverse effect of US subsidies on Mexican farmers is acknowledged by most analysts but the degree to which prices are negatively affected is controversial and varies from year to year.

Suppressed commodity prices reduce the incentives to invest in agriculture. A lack of investment in infrastructure and research and development reduce productivity growth in agriculture. Quantitative analysis and case study evidence by FAO and UNCTAD indicates that agricultural subsidies in developed countries have been associated with rapidly increasing food imports in developing countries, alongside the decline in agricultural production (UNCTAD, 2008).

Producers in Mexico importing inputs such as feed for livestock, e.g. grain and soybean, benefit from US subsidized inputs. A concern of Mexican producers competing with US products is that certain input prices are still higher in Mexico than in the US. On average, prices for soybeans, for example, in Mexico between 1993 and 2009 were 11 per cent higher in Mexico (Figure I.10).

Since 2005 product specific domestic support has dwindled to very low levels. A major reason is the rise of US commodity prices. The US maize prices, for instance, have risen from a little over $2 per bushel in 2001 to $8 per bushel in 2011. Some observers have attributed part of this rise to the influence of US and EU mandated biofuels polices (see section on biofuels). For example, Babcock (2011) suggests US maize prices were 17 per cent higher in 2011 than they would have been otherwise.

US and Mexican maize is not completely substitutable. The US produces mainly yellow maize which is used as a stock feed. Mexico produces white maize which is also used as a food for human consumption.

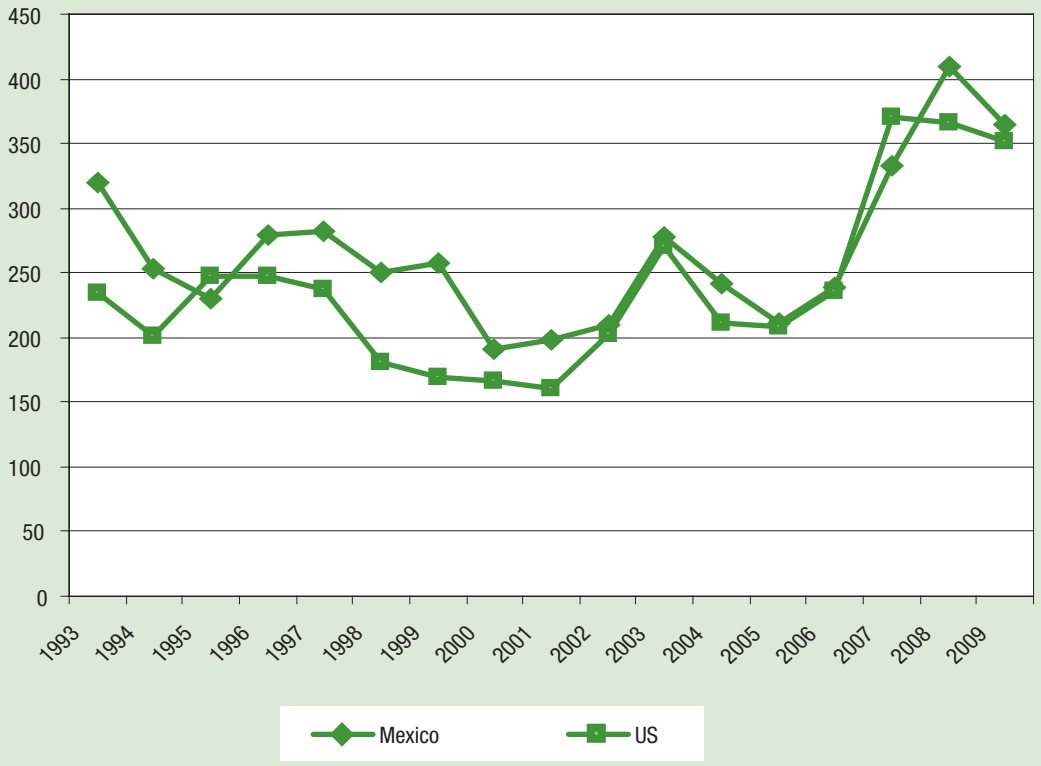
While previous US policies may have had a detrimental effect on Mexican maize producers, the data suggests this effect is now small or indeed may have reversed. If the US policy which supports the production of maize for ethanol production leads to higher prices,

Table I.17: Average dumping margin of US exports to Mexico, 1997 to 2005

Product	Dumping margin (%)
Beef	5
Cotton	38
Maize	19
Pork	10
Poultry	10
Rice	16
Soybeans	12
Wheat	34

Source: Wise (2009), page 16

Figure I.10: Producer prices for soybeans in Mexico and the US between 1993 and 2009 (US$/tonne



Source: FAOstat

the maize sector could benefit from that policy. While beneficial for maize producers, higher maize prices are likely to be detrimental for Mexican livestock producers and consumers access to food. Wise (2012) assesses that from 2006-2011, U.S. ethanol expansion cost Mexico about $1.5 billion due to ethanol-related corn price increases.

Despite these relatively new developments which would need further analysis, the policies of many of Mexico's main trading partners to subsidize agricultural production is negatively affecting those Mexican producers producing the same products or close substitutes. Commitments on upper ceilings on tariffs, especially ambitious ones in RTAs, have increased Mexican farmers' exposure to agricultural policies of its main trading partners.

Agricultural tariffs and non-tariff measures

NAFTA has not excluded agriculture from liberalization and has most likely contributed to trade creation between participating countries. Trade between border countries, however, has been traditionally high. Mexico's imports of certain sensitive products have increased significantly with likely adverse effects on producers of those products. It is unclear to what extent increasing exports of other products, notably fruits and vegetables, as well as processed agriculture products, can be attributed to NAFTA, due to relatively low preference margins in the US. The highest tariffs on imports outside of NAFTA are limited to very few products like tobacco or ground-nuts for US's imports from Mexico. Traditional or historic business relations, as well as cultural or geographical proximity, may have contributed to the trend in agricultural trade. Furthermore, it is unclear to what extent higher exports of horticulture and processed products and lower input prices for animal feed have compensated farmers for increased imports of cereals and meat products. Khor (2007) is critical about NAFTA and argues that the increase in exports of some agricultural products has not been strong enough to compensate for the substitution of domestic agricultural products through imports of others. Barron and Rello (2000) analyzed the growing tomato agro-industry and argue that vegetable exports have proved to be an alternative to rural unemployment and are crucial to the survival of entire villages. They are, however, critical of poor working conditions.

Prina (2011) finds that NAFTA-induced tariff cuts caused a reduction in the real Mexican border price of corn and an increase in border price of tomatoes and melons. Nicita (2009) finds that tariff liberalization in Mexico decreased the price of a basket of agricultural goods.

Various non-tariff measures, such as quantitative restrictions or rules of origin, may impede trade. Non-tariff measures in the chapter in agriculture are related to quotas for sugar, dairy, egg goods, poultry products and special safeguard for fruits and vegetables, meat and coffee.

Policies

The commitments on agricultural tariffs, the phase-out of the possibility to use in NAFTA tariff rate quotas, the fact that subsidies have not been addressed in existing RTAs and that a successful conclusion of the Doha round where subsidies would be limited is currently unlikely, leaves Mexico with few policy options if the development of the agricultural sector is to be changed. Some are discussed in the next section.

The need to strengthen the rural sector in Mexico is evident with its high unemployment and poverty rates. If the agricultural sector is strengthened it can also have positive effects on non-farm activities in rural areas such as upstream and downstream activities as well as potentially related activities such as tourism. Agriculture can make an important contribution to the development.

UNCTAD (2011) argues that agricultural development can facilitate economic take-offs, can promote higher value addition and provide export-led growth opportunities while generating positive externalities for society, such as on poverty reduction, employment and food security. World Bank (2008) earlier also argued that agricultural development can make positive contributions to development. In recent years, agriculture has contributed little to Mexico's growth. Between 1996 and 2010 the contribution of agriculture to real GDP growth was 2.6 per cent, considerably lower than the contribution in, for instance, Brazil or Turkey. In developing countries on average, the contribution was with 5.7 per cent much higher (Table I.18).

The contribution to growth has to be looked at in relation to the share of agriculture which is about 4 per cent in Mexico. If the agricultural sector would be as dynamic as other sectors, the contribution to growth should be similar to its share in GDP. This is not the case in Mexico though this could change.

Table I.18: Contribution of agriculture to real GDP between 1996 and 2010

	Contribution of Agriculture to real GDP growth %
Brazil	6.6
Mexico	2.6
Turkey	3.9
US	1.4
Developing economies	5.7
World	3.2

Source: UNCTAD calculation based on UNCTADstat.

Scott (2010) notes that gap between the national and agricultural growth rates has narrowed in more recent years. One factor is the high commodity prices though it is uncertain whether the trend will continue. Many analysts expect price levels to remain at relatively high levels. This could also fuel investments in agriculture.

It is important though to increase productivity of the agricultural sector. Agriculture in Mexico is the least productive sector in Mexico while this is not the case in many other Latin American countries where agriculture is often more productive than e.g. wholesale and retail trade, construction or even business services (Rodrik and McMillan, 2011). On reasons for the low agricultural productivity in Mexico and measures how to increase it, see Chapter II of this publication. Poverty in rural areas is correlated with a low productivity. A reason for the unsatisfactory low total growth in recent decades in Latin America has been identified by Rodrik and McMillan (2011) as the low contribution of structural change to growth. While individual sectors became more productive, including due to increased trade competitiveness, the overall growth was low because there were no significant employment movements in Latin America from low productive sectors to high productive sectors or employees even moved from high productive to lower productive sectors.

What can the Mexican Government do to strengthen its agricultural sector so as to increase employment and food security while reducing poverty? The scope for trade measures appears limited as Mexico has committed itself in the WTO and in various regional trade agreements (RTAs) to abstain from certain types of measures. There is limited scope for increasing tariffs on imports or reducing tariffs that its exports face.

If agricultural tariffs were to be raised, trade agreements may need to be revised. Corresponding revisions have been advocated including by presidential candidates and discussed in the literature.[50] Mexico would probably have to offer Canada and the United States something in return, and any benefits to the agricultural sector could be offset by additional costs to others sectors in Mexico. Because of the links between grains, oilseeds and livestock, trade policies raising prices for feedgrains could have negative effects on livestock producers and consumers. Peters and Vanzetti (forthcoming) assess the effect of an increase of tariffs on imports from the US to MFN levels. A reduction of imports from the US is partly compensated by higher imports from other countries as their products become relatively less expensive. As a result of decreasing imports of most agricultural products, domestic agricultural output increases by 2.5 per cent, with some sensitive products such as meat and rice would increasing between 10 and 20 per cent. Employment in agriculture would increase but at the expense of employment in industrial sectors. Thus, there would be distributional effects.

Some countries complain that non-tariff measures have been used in some cases to protect domestic industries. Disputes at the WTO indicate different perceptions of certain measures. However, using measures other than allowed tariffs and other charges should be only the case in exceptional circumstances. Normally, “Members shall not maintain, resort to, or revert to any measures of the kind which have been required to be converted into ordinary customs duties”, which includes all kinds of non-tariff measures (Article 4 of the Agreement on Agriculture). Exceptional circumstances could be, for instance, measures “necessary to protect human, animal or plant life or health” (Article XX, GATT) or other security exception (Article XXI, GATT). Sanitary and phytosanitary (SPS) measures should be applied only to the extent necessary to protect human, animal or plant life

or health and should not arbitrarily or unjustifiably discriminate between Members. Members are encouraged to base their measures on international standards but may maintain or introduce measures which result in higher standards if there is scientific justification or as a consequence of consistent risk decisions based on an appropriate risk assessment (WTO, SPS agreement). Thus, it is important that Mexico defends its export interests and ensures standards on imports such as technical standards, including SPS and technical barriers to trade (TBT), that reflect Mexico's appropriate level of health and security protection.

An alternative policy is to provide additional domestic support, or provide the same amount in a different fashion, possibly better targeted to producers in need. Input subsidies, on electricity or credit, for example, have the advantage of distorting only one side of the market, production, as opposed to two sides as do output subsidies. Increasing domestic support would increase the self-sufficiency ratio and have a positive effect on employment in agriculture, but at the expense of the government's budget and other sectors. In general, output subsidies are distorting and move resources into sectors where they are not used most efficiently. External effects, however, may economically justify subsidies. For example, when rural urban migration causes costs to the society that are not reflected in prices and when subsidies can reduce such migration, certain subsidies may be rational. Distribution effects such as reducing poverty, most prevalent in rural areas, may also be achieved with a strengthening of the agricultural sector by domestic support.

Mexico spends relatively little on research and development in agriculture and has a low labour productivity. It has been shown in studies that increasing research and development can increase the productivity of the agriculture sector and that this policy can have a high rate on investment (Zepeda, 2001). Peters and Vanzetti (forthcoming) analyze the effect of a hypothetical one per cent increase in productivity of the Mexican agricultural sector. Increasing productivity has the consequence of increasing production and exports and decreasing imports. Thus, it leads to higher self-sufficiency ratios is agriculture. Employment effects are positive but small. The impact on employment is also positive but small. Total employment of unskilled labour in agriculture increases by 1 per cent. The reason for a significant change of exports and imports but small positive employment effects is that an increase of productivity leads to less factor demand for a given output. Thus, if the real output increases only slightly more than the productivity then the employment effect is small.

Eliminating the payroll tax on agricultural labour is an opportunity to increase employment in the sector. Although the payroll tax in Mexico is on average not very high, removing it leads to an increase in employment of about 2.5 per cent in the agriculture sector (Peters and Vanzetti, forthcoming).

Alternative production techniques

Modern agricultural methods resulted in spectacular increase in productivity but have hardly reached small farmers in developing countries. Competitive advantage in cereals requires scale effects. High value crops (e.g. cut flowers, asparagus and broccoli) often need high initial capital investments. Both require high annual input costs and technological support.

Sustainable agriculture could be a good alternative for some Mexican small scale farmers to increase their productivity and rentability. It relies on techniques such as crop rotation, compost and biological pest control to increase soil productivity. Yields increase, need less expensive inputs such as GMO seeds and agro-chemicals and use locally available inputs and technologies. Production is more labour intensive than conventional agriculture thus having a positive impact on employment and poverty reduction. In Mexico, organic production is dominated by small-scale producers. A UNCTAD/UNEP study confirmed that this is an economically meaningful approach for small farmers in developing countries to escape the dependency on rising input prices with the side effects of a positive impact on environment, climate and employment (UNCTAD, 2008).

F. FINDINGS AND POLICY RECOMMENDATIONS

Agriculture remains a very important sector for Mexico. Mexico's agricultural trade reform coincides with increasing trade, decreasing employment in agriculture and high poverty rates in rural areas. Imports have increased from all major trading partners, including those with which Mexico has a FTA. The bulk of agricultural imports are imported under preferential agreements, mostly with the US. Exports have also increased. In terms of trade, a higher specialization

has taken place with some products accounting for the main share of import growth and others for the main share of export growth. In recent decades, more staple crops and meat products have been imported and more fruits and vegetables and certain processed agricultural products have been exported. While at the aggregate level import growth was only slightly higher than export growth since the early and mid-1990s, import growth for certain sensitive products such as maize, beans, pork and sugar was particularly high, partly four to eight times higher in the late 2010s than in the early 1990s. The self-sufficiency ratio for important staple products such as wheat, maize, rice, beans and meat declined.

Mexico's trade policy has led to much more open markets, especially within the NAFTA region. Tariffs on agricultural products between the US and Mexico have been eliminated but in terms of standards and other measures regulating cross border trade the markets are not fully integrated and do not have a common agricultural policy. High subsidies in the US on products such as maize, rice, sugar, sorghum and wheat during the late 1990s and early 2000s have led to significant losses for Mexican farmers producing such commodities. The degree to which prices have been affected is controversial and varies from year to year. It is likely that this contributed to low investments which in turn are a major course for the low productivity in Mexico. Consumers and exporters of fruits and vegetables and certain processed products have benefited from the market opening. Non-tariff measures are the dominant obstacle to exports. With regard to exports to other markets, including dynamic developing country markets, Mexico has not very successfully increased its supply.

Agriculture could play an important role to increase growth, food security, poverty alleviation and employment creation. The appropriate policy measures to strengthen the agricultural sector depend on the specific objectives. Policies to reduce poverty and rural-urban migration may differ from those that increase export revenue or maximize agricultural output. Some policy options may be limited by Mexico's commitments in trade agreements. A stated objective is to use the existing policy space with a view to enhancing Mexico's benefits from its agricultural sector including in increasing the number of jobs in the sector, reduce dependency on imports and promoting exports in agriculture. Priorities should be determined because policies are unlikely to achieve all three goals at the same time. With regard to trade policies the following areas have been identified as being important.

How trade policy can contribute to strengthen the agricultural sector:

- Mexico's external agricultural trade relations are dominated by bilateral agreements which provide opportunities and challenges. Differences in agricultural support and productivities are challenges. Since Mexican producers are not protected through tariffs in the NAFTA region, for example, any changes in US agricultural policy such as new US farm bills have a direct impact on Mexican farmers. The government should review the exposure to external shocks, try to identify measures to limit the impact of such shocks and ensure fair market conditions as well as coherence between trade and development policies.
- Globally there is a tendency to move away from border measures towards behind the border measures including allowed subsidies such as decoupled domestic support. The agreement on agriculture provides flexibility for support which could include income loss insurance, investment subsidies and other measures. Domestic support would have a positive impact on production and employment in agriculture but would impose a cost on other sectors.
- Mexico has free trade agreements with a high number of trading partners including those with interesting and highly protected agricultural markets such as the EU and Japan. It appears that Mexico's agricultural sector has not increased its exports to these partners at a higher pace than other countries and remains to have a small market share. Mexico also has signed RTAs with developing countries and in few cases has been able to disproportionately increase its exports. However, exports to its developing country trading partners remain very low. Despite many difficulties including exclusion of sensitive products or competition from highly productive countries, Mexico has proven to be very competitive with certain products and should explore increasing exports to the markets with which it has trade agreements markets.
- Participation in new free trade agreements is currently discussed, among them the Trans-Pacific Partnership. Although Mexico has agreements with various TPP countries such as Chile, Peru

and the US, it would be a far reaching agreement. Mexico should assess the implications of such an agreement.

Policies to strengthen productivity and alternative production methods:

- Mexico has a relatively low productive agricultural sector and spends relatively little on research and development. Supporting activities that would lead to a higher productivity has a positive effect on output and exports. Imports would be lower and thus the self-sufficiency rate would increase. The impact on employment is likely to be small.
- Another promising approach are sustainable environmentally friendly production systems that use less synthetic fertilizers, reduce tillage and, in the case of certified organic farming, may benefit from price mark ups. Often these production processes are more labour intensive and could thus create or preserve employment. Especially since Mexico focuses on sophisticated markets in developed countries, shifting from conventional, industrial, mono-culture based and high-external-input dependent production to sustainable production systems could be a good alternative for some Mexican small scale farmers to increase their productivity and rentability.

Standards and other non-tariff measures:

- Regarding exports, problems faced by Mexico with respect to standards and other non-tariff measures are similar to those of other countries. They relate to difficulties to meet high official and private standards in developed country markets and grey areas in trade rules disciplining them. Since Mexico's main trading partners are all developed countries NTMs are of particular interest to Mexico. Standards in export markets have to be met and Mexican producers could be supported through appropriate agricultural extension services.
- Mutual recognition and equivalence seem to have not worked well to overcome barriers identified. Working with key trading partners towards harmonization of measures and regulation could be an interesting path to explore, particularly for food packaging and nutrition labeling regulations, which is very controversial in the current context of trade with the US. This path could also be explored in the case of food safety, risk assessment and risk reduction. Standardized and mutually facilitated customs procedures with its main trading partner are important.
- From the import perspective, concerns exist over (1) unfair competition and (2) lack of consumer protection. To overcome these challenges, Mexico should examine the need to strengthen quality control measures and enforcement in the domestic market to improve consumer protection. Furthermore, a strong monitoring of import prices could detect potential "dumping". If a company exports a product at a price lower than the price it normally charges on its own home market, it is said to be dumping the product. This allows the importing country to take certain measures.

UNCTAD can provide support, first, by an indepth analysis of several aspects identified in this Outlook such as the employment effects of increased specialization and technical standards and other measures in specific sectors. Another area could be analyzing the link of the agricultural sector to other sectors such as upstream, e.g. fertilizer, and downstream sectors, e.g. retailer and transport, including other extension services. Second, technical assistance and capacity building could support the implementation and strengthening of certain measures linked to trade and related areas. Monitoring external trade and related aspects such as concentration and diversification could be supported technically. UNCTAD also provides support for organic certification bodies. Third, exchange of views and potential measures could be discussed with all stakeholders.

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ANNEXES

Annex 1: US MFN tariffs on Mexican agricultural imports

Product	MFN (%)
Paddy rice & proc rice	2.59
Other cereals	0.43
Sugar	26.00
Oilseeds	6.54
Vegetable oils and fats	4.95
Vegetables and fruit	4.72
Other crops	3.63
Milk	-
Dairy products	18.48
Cattle and sheep	0.29
Pigs and poultry	0.74
Ruminant meat	7.92
Non-ruminant meat	3.23
Other processed agriculture	4.11

Source: GTAP 8

Annex 2: Imports Mexico, selected agricultural products

	Imports from the world				Imports from the US (Mexico data)				Imports from the US (US data)				Share US imports of total imports	
	Volume	Change	Value		Volume	Change	Value	Change	Volume	Change	Value	Change	Value	Value
	Average 2008-10	1991-93 to 2008-10	Average 2008-10		Average 2008-10	1991-93 to 2008-10	Average 2008-10	1991-93 to 2008-10	Average 2008-10	1991-93 to 2008-10	Average 2008-10	1991-93 to 2008-10	1991-93	2008-10
	1'000 tonne	%	US$ mill.		1'000 tonne	%	US$ mill.	%	1'000 tonne	%	US$ mill.	%	%	%
Barley	104.4	-1.1	43.3	214.7	63.2	-4.9	25.0	164.2	76.9	11.4	22.0	106.6	68.9	57.8
Beans	129.1	852.6	126.1	1330.0	117.3	859.3	114.5	1305.9	150.8	426.8	112.5	573.0	92.4	90.8
Beef	318.9	70.2	1152.7	198.6	266.1	71.8	975.0	211.6	218.8	121.3	837.7	281.1	81.1	84.6
Coffee	8.0	218.8	54.8	912.3	5.4	676.4	29.9	1121.1	2.4	380.4	15.3	688.1	45.2	54.6
Eggs	9.9	-10.6	33.2	159.8	9.9	10.3	33.2	216.6	13.7	95.0	27.9	175.3	82.0	99.9
Maize	8179.6	670.3	1854.6	947.7	8174.3	675.6	1842.0	950.8	9183.0	788.6	1815.3	1033.3	99.0	99.3
Milk	309.5	22.4	654.4	91.8	246.2	95.4	493.9	314.5	209.6	101.6	460.7	354.0	34.9	75.5
Pork	478.4	664.1	843.3	791.5	438.0	773.6	762.8	929.3	294.3	886.4	577.6	808.8	78.3	90.5
Poultry	642.6	390.2	757.9	506.4	616.9	375.2	687.5	458.6	440.9	262.6	532.5	294.2	98.5	90.7
Rice	820.7	173.7	345.5	390.8	818.1	279.0	343.6	575.4	830.3	375.2	337.3	711.0	72.3	99.5
Shrimp	6.1	39.6	33.0	62.2	0.2	-95.2	1.1	-94.4	0.5	-50.4	3.8	-48.0	98.9	3.4
Sorghum	2101.0	-44.4	411.3	-3.9	2100.9	-44.1	411.3	-3.4	2376.8	-41.4	402.8	-10.4	99.4	100.0
Sugar c.	2.1	-98.3	0.6	-98.1	1.9	-93.3	0.5	-93.6	2.7	-78.7	0.5	-88.7	25.2	84.6
Sugar	4556.5	1031.5	649.7	413.1	1193.4	596.4	480.4	772.7	1082.3	589.2	466.0	692.5	43.5	73.9
Tuna	33.9	1121.5	71.2	1451.3	1.8	-31.6	3.3	-12.4	0.1	-91.6	0.5	-73.3	81.1	4.6
Wheat	3323.2	191.7	1006.8	484.0	2527.1	282.7	765.9	654.2	3038.5	363.0	723.0	652.7	58.9	76.1

Source: UN Comtrade.

Annex 3: Change of imports of selected products between 1991 - 1993 and 2008 - 2010

Product / Description	HS	Import quantity 2010 tonnes	Change quantity (Mexico data) %	Change quantity (US data) %	Import value 2010 US$ mill.	Change value (Mexico data) %
Raw cane sugar, in solid form	170111	142	-99	-94	0.2	-97
Eggs	0407, 0408	10502	-93	-95	35.5	231
Grain sorghum	1007	2252495	-44	-41	427.6	-3
Beef	0201, 0202	168795	104	155	713.5	222
Rice	1006	840497	279	379	318.8	575
Wheat and meslin	1001	2606002	318	420	628.7	752
Meat and edible offal of poultry	0207	668054	375	262	760.6	459
Milk	0401, 0402	184843	484	533	433.4	1048
Coffee; coffee husks and skins; cof	0901	7843	575	228	31.0	1940
Maize (corn)	1005	7844736	742	870	1572.6	1151
Meat of swine, fresh, chilled or frozen	0203	447925	844	889	876.2	993
Dried kidney beans, incl. white peas	071333	108471	869	604	104.1	1319

Source: UN Comtrade; Change is based on the increase of average imports between 1991 and 1993 and 2008 and 2010.

Annex 4: Comparison of data sources, change in imports from 1995 to 2010

	UN Comtrade (reporter Mexico)	UNCTADStat
Barley	124.4	24.4
Beans	748.0	509.1
Beef	714.0	716.8
Coffee	318.0	218.0
Eggs	286.5	186.5
Maize	386.1	320.9
Milk	209.0	132.1
Pork	2272.7	591.9
Poultry	473.4	591.9
Rice	406.7	306.7
Shrimp	451.0	444.5
Sorghum	168.1	71.4
Sugar c.	6.6	-
Sugar	1499.6	1399.6
Tuna	1860.6	2330.2
Wheat	394.0	297.0

Annex 5: Exports of Mexico, selected agricultural products

	Exports to the world (Mexico data)				Exports to the world (mirror data)				Exports to the US (Mexico data)				Share exports to US of total exports	
	Volume	Change	Value	Change	Volume	Change	Value	Change	Volume	Change	Value	Change	Value	Value
	Average 2008-10	1991-93 to 2008-10	Average 2008-10	1991-93 to 2008-10	Average 2008-10	1991-93 to 2008-10	Average 2008-10	1991-93 to 2008-10	Average 2008-10	1991-93 to 2008-10	Average 2008-10	1991-93 to 2008-10	1991-93	2008-10
	1'000 tonne	%	US$ mill.	%	1'000 tonne	%	US$ mill.	%	1'000 tonne	%	US$ mill.	%	%	%
Barley	0.1	1067.2	0.0	800.4	0.0	-100.0	0.0	-99.9	0.1	1648.1	0.0	798.8	100.0	99.8
Beans	24.5	121.3	29.2	770.1	23.7	946.5	29.0	1849.9	21.1	161.2	24.7	989.0	67.6	84.6
Beef	53.7	2088.4	231.6	3182.0	45.7	3509.6	225.9	4363.9	27.7	1245.1	149.4	2892.1	70.7	64.5
Coffee	130.6	-38.0	484.0	44.0	145.1	-32.6	522.7	47.5	85.8	-52.6	335.0	17.9	84.6	69.2
Eggs	2.9	11730	11.1	7061.8	1.4	1186.0	10.5	18064	0.0	-90.5	0.0	-99.7	59.0	0.0
Maize	340.7	728.7	112.0	1132.7	144.0	606.4	68.3	1174.9	7.7	-47.7	7.6	143.6	34.4	6.8
Milk	34.1	1353.0	63.2	1666.6	26.3	1577.7	54.0	2932.0	23.7	11387	54.2	20205	7.5	85.8
Pork	60.1	1981.1	277.5	1987.8	54.6	1859.3	283.2	1845.0	5.7	187.3	23.3	151.2	69.6	8.4
Poultry	6.0	9.6	5.4	-51.9	0.5	-84.3	0.6	-90.5	0.1	-95.6	0.1	-95.0	14.9	1.6
Rice	7.8	10513	4.5	16162	6.7	18.6	3.7	125.9	5.9	966993	3.1	125650	9.1	70.3
Shrimp	34.5	75.7	307.6	27.0	36.0	100.7	336.6	72.0	32.0	66.2	285.4	20.3	97.9	92.8
Sorghum	0.0	-99.9	0.0	-99.3	0.3	235.4	0.5	1089.1	0.0	-99.9	0.0	-99.8	100.0	27.0
Sugar c.	510.0	418.9	170.1	647.3	479.8	993.2	192.7	3489.4	417.1	371.2	159.1	2046.7	32.6	93.5
Sugar	1233.0	438.7	690.5	835.3	1142.4	789.9	737.6	1026.6	1081.9	561.2	575.4	3770.9	20.1	83.3
Tuna	18.4	25.3	69.7	395.3	17.6	27.1	72.2	337.5	4.5	20.0	20.4	329.7	33.7	29.2
Wheat	1086.9	245651	369.5	155899	1031.6	220007	446.1	259417	44.8	83769	19.0	62547	12.8	5.1

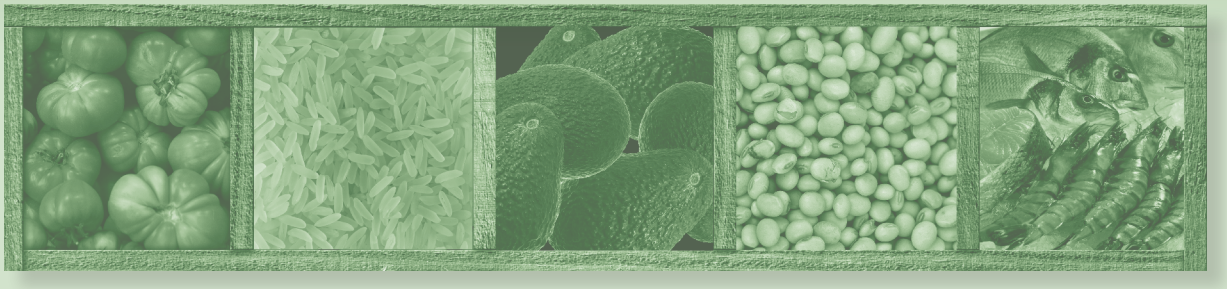
Source: UN Comtrade.

Annex 6: Product definition

	SITC Rev.3	ProductDescription	HS
Barley	043		
Beans	05423	Dried kidney beans, incl. white peas	071333
Beef	011 01251 01252 01681 0176	Beef	020 0202
Coffee	071	Coffee; coffee husks and skins; cof	0901
Eggs	025	Eggs	0407 0408
Maize	044 04721 05677 08124 4216 59212	Maize (corn)	1005
Milk	0221 0222 02241	Milk	0401 0402
Pork	0122 0161	Meat of swine, fresh, chilled or frozen	0203
Poultry	0123	Meat and edible offal of poultry	0207
Rice	042	Rice	1006
Shrimp	03611		
Sorghum	0453	Grain sorghum	1007
Sugar cane	06111 06151	Raw cane sugar, in solid form	170111
Sugar	061		
Tuna	03414 03423 03713		
Wheat	041 046 08126 59217	Wheat and meslin	1001

Source: UNCTADstat

CHAPTER II



AGRICULTURE COMMODITY POLICY REVIEW FOR MEXICO

A. INTRODUCTION

Mexico is the home of avocado and corn (or maize), with both having long and protracted histories, which are deeply engrained in Mexican tradition, culture and lifestyle. Agriculture value added – as per cent of GDP – in Mexico had fallen over the past 2 decades – 1991 (7.5 per cent), 2001 (4.2 per cent), 2010 (3.9 per cent). However, agriculture is the lifeline for an estimated eight million rural farmers (or 7 per cent of total population), 3.4 million of them small-scale farmers who cultivate farm holdings of 5 ha (or 12 acres) or less,and produce much of Mexico's agricultural and food produce (agrifoods) for export and domestic markets, on landholdings no bigger than five hectares. Mexico is among the world's leading agrifoods producer: ranked first in avocado, lemon and limes, grapefruit (3rd), corn (4th), and beans, coconut oil, oranges and poultry (5th). The market value chains in Mexico are concentrated in the hands of few medium- to large-scale private sector oligopolies, who secure much of the benefits from domestic farm support (subsidy) programs instituted by the Mexican government.

Mexico is Latin America's second largest economy after Brazil. It is highly liberalized, export-oriented and is ranked number 10 in world merchandise trade. In 2010, Mexico exported US$ 298 billion worth of merchandise, representing 2.5 per cent of global trade, and 28.9 per cent of its GDP. Its agricultural and food (agrifoods) products[51] exports in 2010 were valued at US$18.8 billion, of which $14.4 billion (76.6 per cent) was destined for the U.S. market.[52] NAFTA contributed to further opening up the Mexican market following the complete removal of tariff and quota restrictions in 2008. This had increased Mexico's non-oil exports fourfold and expanded foreign direct investment by 14 times. However, the terms of trade for its farmers, had declined. The influx of below-cost consumer goods and import key agrifoods – for which Mexico has comparative advantage in producing them, interacted with other factors affecting Mexican agricultural production and contributed to squeezing farmers out of farming and into poverty or excluded them from high value markets. Grinding rural poverty is a leading 'push factor' that is driving millions of asset-poor rural farmers to sell off their lands, leave homes and families and migrate north of the border to U.S. in search of work and better lives.

Trade liberalization offers Mexico's agricultural sector distinct opportunities for broad-based economic growth, increase employment and incomes, curb migration, provide sustainable livelihoods and reduce rural poverty. Value addition and diversification of products and export markets are central to export success. Concrete moves to increase agrifoods exports to China as well as the nine-member countries of the proposed Trans-Pacific Partnership Agreements, are steps in the right direction. The settlement of the long-standing, long-haul trucking dispute between U.S. and Mexico, and the push by global companies operating in China to 'reshore' manufacturing back to Mexico in the wake of surging productivity-adjusted wages, offer solid development prospects for Mexico in the medium- to long-term. It is Mexico's proximity to the global superpower, the U.S., that offers lower logistical and transportation costs which is driving this structural shift.

While targeted investment in small-scale farmers is generally considered as the most cost-efficient instrument for reducing poverty, in reality though, both public policies and private actions have not fully exploited this potential. It is therefore incumbent on public policy and private action to help improve infrastructure, access to credit and technologies, business skills, supply-side capacities (e.g. food safety standards), and design and implement, where appropriate and feasible, market-based innovative schemes (e.g. crop and weather insurance schemes) for farmers.

Against this backdrop, this chapter reviews (i) the current public policies and support programs and services, (ii) market value chains, (iii) food security, (iv) market access and agrifoods standards, and (v) proposes public and private policy choices to refashion government policies to address the root causes of the continued economic marginalization of agriculture, enhance its resilience, ensure food security, and improve the welfare of millions of farming families in Mexico.

B. OVERVIEW: MEXICO'S RURAL AND AGRICULTURAL DEVELOPMENT POLICY

This section provides an overview of rural and agricultural development policy in Mexico since the beginning of the 1990s. During this period Mexico's rural economy has experienced important transformations, marked by a steady decline of agriculture's importance and a

corresponding increase in non-agricultural activities. But despite its dwindling share of Mexican GDP and export earnings, agriculture continues to be a major employer and source of livelihood in many rural areas.

1. Theoretical framework

Indeed, much of the literature on pro-poor rural development recognizes that thriving rural economies with a low incidence of poverty avoid deemphasizing agriculture in favour of non-farm activities. Instead, these economies thrive by fostering mutually reinforcing income opportunities for rural inhabitants across three sectors (J. R. Davis 2006):

- Agriculture;
- Non-farm activities driven by agriculture; and
- Autonomous non-farm activities.

Sustainable poverty reduction requires that the rural poor capture at least a living wage from a country's overall economic activity. Therefore, the linkages between agriculture and non-farm activities must be strengthened and the three sectors above developed in concert, so that a country's economic growth is felt in rural areas, providing inhabitants with opportunities of sufficient income to motivate them to stay and to continue to participate in the rural economy.

Along with generating increased economic activity, successful rural development therefore also involves increasing the remuneration of rural inhabitants. Since small farmers are not price setters, they cannot simply demand a higher price for the same product, produced at the same cost. Instead, farmers and other rural inhabitants must improve their productivity and/or convert to higher value added activities.

These transitions require investments, often by the state, in productivity and human capital enhancements, as well as in the conversion to higher value added activities.

Without proactive oversight, these increased opportunities often fail to reach the population segments they target, for example, those who are less educated and more geographically isolated; young adults and women, or anyone excluded from important social organizations or networks.

To ensure that opportunities reach the rural poor and other target segments, successful state poverty reduction strategies restrict their assistance on the basis of either financial need and/or social exclusion.

The analysis contained in this chapter proceeds according to this general theoretical framework, namely that government rural development programmes should aim to provide more numerous, diversified and remunerative income opportunities to rural inhabitants, with access priority given to poor and excluded groups.

2. The rural sector

In 2011, 22 per cent of Mexico's population lived in rural areas defined as localities of fewer than 2,500 inhabitants (see Table II.1).[53] In dispersed rural areas, agriculture is the main source of employment, with 44 per cent of the population occupied in the primary sector.[54] However, the agricultural labour force in Mexico has been shrinking since 1996 (see Table II.2). As well as shrinking, Mexico's rural population is ageing more rapidly than the urban population, due mainly to relatively high rates of out-migration of the labour force to cities and to overseas destinations, in particular to the USA.

Despite their importance to rural employment, agriculture, forestry, fishing and agribusiness activities represented just 4 per cent of Mexico's GDP in 2011.

Poverty in Mexico is high, especially in rural areas, and has been increasing. In 2008, 61 per cent of the rural population was classified as poor, as compared to a national rate of 45 per cent. Average income in the same year was 3,800 pesos compared with 10,200 pesos in communities of over 15,000 inhabitants. Figure II.1 (a) and (b) shows that, at the federal level, the states with the largest populations often also have the highest share of their population earning an income below the minimum welfare line, for example: Chiapas, Guerrero, Oaxaca, Zacatecas, and Veracruz. This implies large variations between the rural north and rural south.

The average size of land holdings in the agricultural sector is 8 Ha, although this average hides an increasing polarisation of farm sizes, with small farms (under 5 Ha) and large farms (100 Ha or larger) increasing their share at the expense of middle-sized farms (see Table II.3). For example, small farms represented approximately 66 per cent of total production units in 1991, a proportion that increased to 73 per cent by 2007.

Small and medium producers employ a majority of rural population. However, their potential to provide a decent

Table II.1: Rural population and agriculture labour force

	Share (%)				Annual growth rate (%)		
	1996	2001	2006	2011	1996-2001	2001-2006	2006-2011
Rural population (% of total population)	26.3	25.0	23.4	21.9	-1.1	-1.3	-1.3
Labour force in agriculture (% of total labour force)	23.8	21.1	18.2	15.7	-2.5	-2.9	-2.9
Females (% of labour force in agriculture)	12.5	12.0	12.3	12.3	-0.8	0.6	0.0

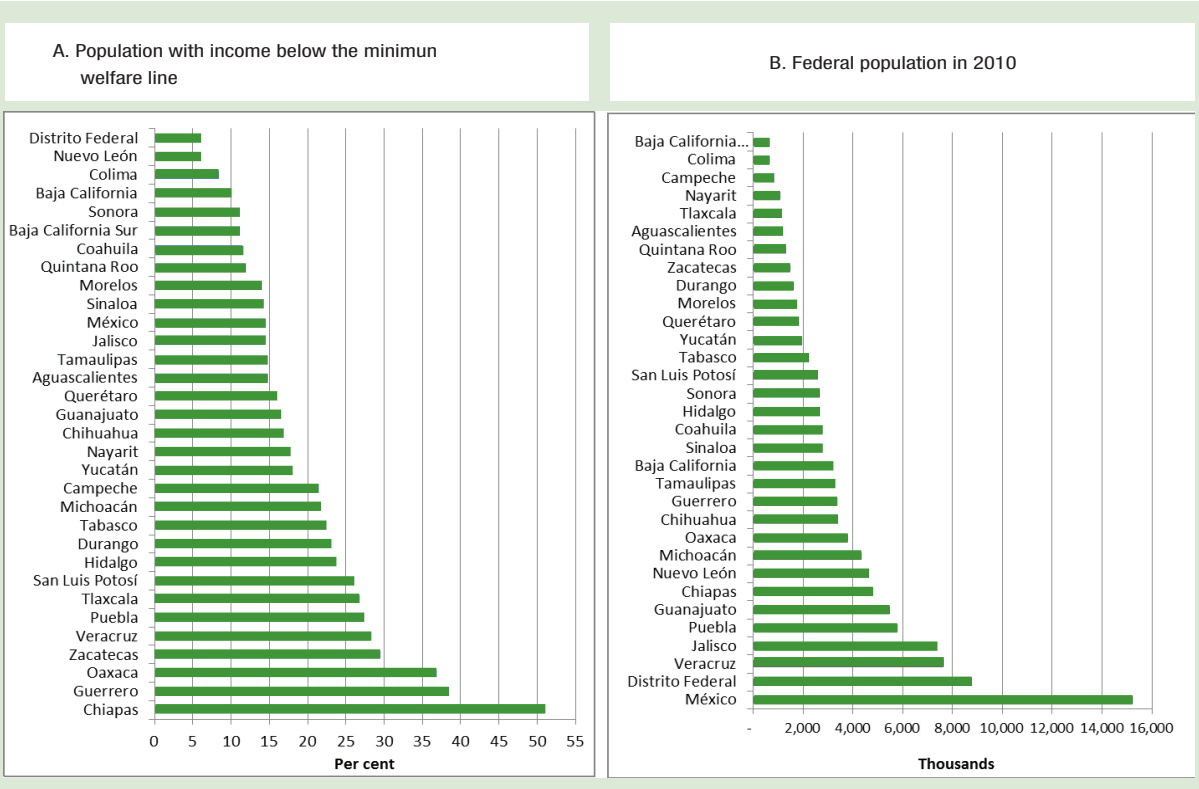
Source: FAOstat

Table II.2: Population and labour force size

	Size (Millions)				Annual growth rate (%)		
	1996	2001	2006	2011	1996-2001	2001-2006	2006-2011
Total population	93.9	101.3	107.8	114.8	1.5	1.3	1.3
Agricultural population	24.5	23.6	21.6	20.0	-0.9	-1.6	-1.6
Total labour force	36.4	40.7	46.3	49.6	2.3	2.6	1.4
Labour force in agriculture	8.7	8.6	8.4	9.8	-0.3	-0.4	-1.2

Source: FAOstat

Figure II.1: Income disparities between Statestween States



Source: CONEVAL estimates based on MCS-ENIGH 2008 and 2010.

Note: Estimates for 2010 using growth factors adjusted for the final results of Population and Housing Census 2010, estimated by INEGI.

livelihood for themselves and to constitute a viable base of economic activity in rural areas is curtailed by many constraints, including rising costs of input (e.g. agrochemicals, fertilizers, and appropriate technologies), increasing competition from below-cost imports, and structural rigidities (e.g. concentration of agrifoods input markets, and buyers and sellers). In addition, poor soil and water use practices magnify the negative effects of climate change on production, particularly among small producers that are dependent on rain-fed cultivation. This feeds a vicious cycle of increasing rural poverty, lack of opportunities and out-migration. The key features of the Mexican rural economy are presented schematically in Figure II.2.

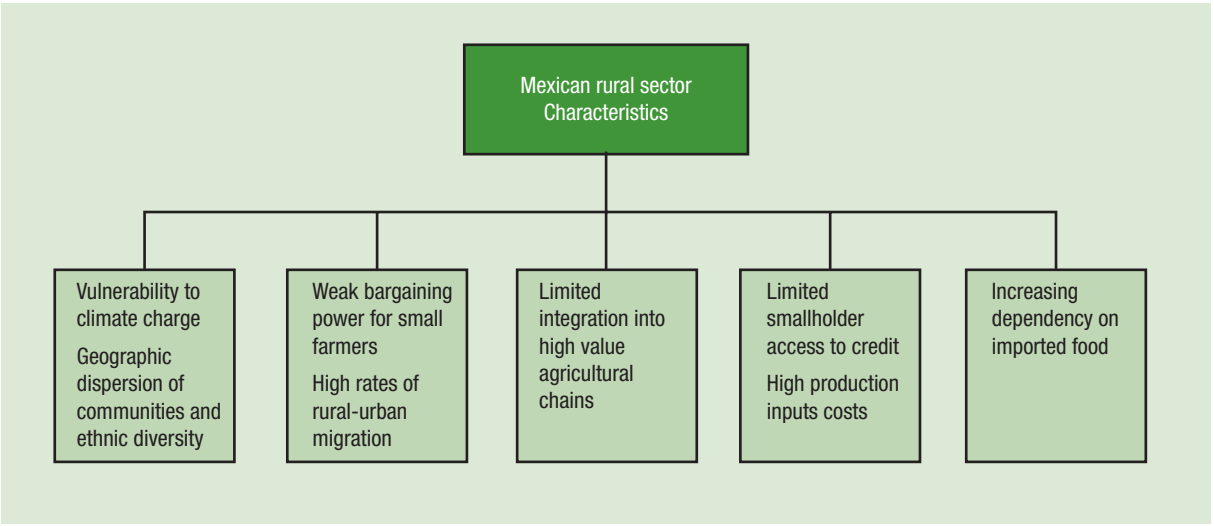
Rigid land tenure is one of the main obstacles to agricultural development. Following the first agrarian reform initiated at the beginning the 20th century, Mexico's land tenure is characterized by the coexistence of private property and social property which includes ejidos and communal land, and represents more than half of the national land. Unclear definition of property rights for the communal land, caps on the land areas, which can be owned by commercial farmers and limitations to private ownership of land inhibit investment and finance in the agricultural sector. Despite the land tenure reforms carried out in the 1990s to strengthen private property rights, further reform of regulations may be needed to make the land market more flexible.

Another important obstacle is the trade barriers aiming to control domestic prices before 1990. The trade restricting measures, including import license and export tariffs, were imposed to support domestic market prices of agricultural commodities. According to OECD, import licenses covered 38 per cent of agricultural products in the late 1980s. The high export tariffs not only prevented farmers from integrating into the world market, but also discouraged agricultural production resulting in low

Table II.3: Mexican farm structure characteristics

Size of production unit (in hectare)	Share of total farmed area in 2007 (in %)	Share of total production units in 2007 (in %)
Under 2	6.5	47.3
2 – 5	11.0	24.8
5 – 20	27.3	22.0
20 - 50	15.3%	4.0
50 -100	10.6	1.2
Over 100	29.3	0.7

Figure II.2: Mexico rural sector characteristics



productivity and investment in the agricultural sector. When the agriculture market was liberalized under the NAFTA, Mexican producers were unable to compete with their counterparts in the US.

3. Agricultural and rural development programmes and institutions

To overcome the development challenges facing its rural and agricultural sectors, the Mexican government has implemented a collection of well-funded national programmes, several of which have endured for many years.

Since the early 1980s, these programmes have generally followed the country's overall process of trade liberalization. The liberalization process began as part of the International Monetary Fund's (IMF) recommended reform package after it bailed out Mexico's government during the country's 1982-3 debt crisis.

Since that time, Mexico's liberalization programme has continued to advance, albeit with periods of rapid change balanced by periods of consolidation. Progress has manifested into a succession of free trade-related agreements that Mexico has signed with trading partners, such as: the General Agreement on Tariffs and Trade (GATT) in 1986; the North American Free Trade Agreement (NAFTA) in 1994; and bilateral agreements with the US in particular in the early 2000s, on deepening NAFTA-related liberalization.

Although it represents just one milestone in Mexico's longer liberalization process, NAFTA is rightly regarded as a watershed moment in the reform of Mexico's agricultural policies.

CONASUPO

Prior to 1994, Mexico's agricultural policies were centred in the state's vast National Company for Popular Subsistence (CONASUPO). The Mexican government formed CONASUPO in 1965 to consolidate all of its food regulatory activities into a single entity. Over the following 30 years, CONASUPO executed the government's far reaching intervention programme in the agricultural sector.

CONASUPO's two broad objectives were to promote the international and domestic trade of agricultural products, as well as guarantee the livelihoods of low-income farmers. It accumulated a vast network of subsidiaries involved in activities throughout the value chain. At its peak prior to the 1982-3 crisis, CONASUPO regulated markets; supported prices for eleven crops;[55] provided subsidized processing, logistics and marketing services; and distributed subsidized food to low-income families. In 1981, its producer supports, as a per centage of the total crop value, amounted to 20 per cent for rice, 66 per cent for the all-important corn crop, and 110 per cent for barley (Yunez–Naude 2003).

After the debt crisis, its operations were reduced, but slowly, such that by 1990 it was still active, and even dominant, in its core portfolio of price support and marketing activities. In 1991, the government created a separate marketing agency named Support Services for Agricultural Marketing (ASERCA) under the Ministry of Agriculture. At first, ASERCA assumed only some of CONASUPO's marketing responsibilities, but its importance as the institutional structure that would remain after CONASUPO was steadily unwound.

Post-NAFTA transition to PROCAMPO

A major transition came in 1994, when the Mexican government eliminated domestic price supports for corn, which reduced CONASUPO's marketing role to a minimum. It continued to act as a more circumspect buyer of last resort for corn and beans until its final liquidation in 1999.

At the same time, as it eliminated price supports in 1994, the Mexican government also removed the second pillar of CONASUPO's activities – its income support programmes for farmers. The government transferred these funds to a new Program of Direct Payments to the Countryside (PROCAMPO), under ASERCA.

Ostensibly, PROCAMPO inherited the same objectives from its predecessor CONASUPO programmes, namely: a) to improve the competitiveness of Mexican agricultural exports, now in the new NAFTA zone; and b) to guarantee the livelihood of small farmers. Initially, the Mexican Government gave PROCAMPO a set term of 15 years, ending in 2008, when it intended to have fully implemented its NAFTA obligations. But the programme continues as of the spring-summer 2012 growing season.

More important than the institutional shuffle was the fundamental change in the vector of the government's income support programmes. Under previous CONASUPO programmes, income support to farmers was transmitted through prices, quotas and subsidized

inputs and services. The big trading companies in the agricultural value chains dominated the marketing of major crops and were therefore the main beneficiaries of government market price support. By contrast, PROCAMPO payments are calculated based on eligible land (cultivated before 1993 with one of nine key crops[56]) and paid as a direct transfer to the producer.

The roster of eligible parcels was established based on land use as of August 1993 and no new eligible lands were added after 1994. The roster covers approximately 95 per cent of the cultivated area in Mexico that were planted with the target crops in 1993. Of these eligible lands, PROCAMPO support was paid on an average of 14 million ha per year. In value terms, for example, PROCAMPO paid MXN 963 per ha during the autumn winter season in 2005 (OECD 2006). PROCAMPO's budget has remained at approximately $1 billion through the late 2000s. Since its inception, PROCAMPO has therefore been Mexico's largest agricultural programme, representing approximately half of its agricultural support expenditures.

To receive PROCAMPO disbursements, farmers who either own or have usage rights for eligible parcels must prove that the land for which they are claiming payment is being used for agricultural production (i.e. fallow parcels are ineligible). Farmers can apply for two payments per year under PROCAMPO, based on two growing seasons.

In the early 2000s, almost 90 per cent of PROCAMPO recipients cultivated fewer than five ha of land to be eligible. These smallholders received approximately half of the total PROCAMPO disbursements. This smallholder profile corresponds more or less to that of the ejidatarios that participate in PROCAMPO: 84 per cent of ejidatarios participated in the programme in 2000, receiving payments for an average of five ha each (Cord & Wodon 2001).

Gender is another important dynamic of the PROCAMPO programme. PROCAMPO issues its payments to the right-holders of eligible land, of which approximately 90 per cent are men (Ruiz-Arranz et al. 2006). To address this imbalance, the PROGRESA programme, created in 1997 (see below), was designed to channel payments to households through women.

Other than the biannual review of eligibility and production proof, the implementation of PROCAMPO included little follow-up or monitoring (Paul Winters & Benjamin Davis 2009; Ruiz-Arranz et al. 2006). For example:

- The proof of planting was rarely visually verified;
- There was little follow-up on whether the crops were eventually exported, sold locally or consumed by the producer household; and
- There was little follow-up on how the subsidy was used, for example for productivity enhancing investments or for consumption.

Alianza

In 1996, the Mexican government launched the Alliance for the Countryside (Alianza), a program of matching grants for productive investments and support services to help farmers diversify into export crops.

After the final liquidation of CONASUPO in 1999, Alianza became Mexico's second-largest agricultural support programme, after PROCAMPO. That said, its budget is only about 20 per cent of the PROCAMPO budget, and only 10 per cent of *ejidatarios* participate in the Alianza matching grants programme (Cord & Wodon 2001).

PROGRESA / Oportunidades

In 1997, to complement the production-oriented PROCAMPO and Alianza programmes, the Mexican government launched the Program of Education, Health and Food (PROGRESA, renamed Oportunidades in 2002). The programme was initially implemented for poor households in rural areas, but due to its success, it was expanded to urban areas in 2001.

Oportunidades aims to reduce poverty among vulnerable populations by targeting specific vectors by which poverty is transmitted from one generation to the next, for example by improving infant and toddler nutrition; increasing school enrolment rates among children; and enabling employment mobility for young adults entering the workforce (Oportunidades 2008).

Oportunidades targets predominantly women and children and channels its assistance through mothers (Ruiz-Arranz et al. 2006). It provides poor families with direct cash transfers to offset children's school enrolment fees, as well as fees for the family to visit medical clinics.

After its creation, the Oportunidades continued to grow over the next decade. In 2008 it distributed slightly less than $4 billion to five million Mexican families across the country (Oportunidades 2008).

Approximately three million of these families live in rural areas, representing just under half of all rural families (Skoufias 2005).

Unlike PROCAMPO, Oportunidades has specific, long-term objectives. Indeed, since it aims to reduce the intergenerational transmission of poverty, it has yet to receive definitive results from its first phase of operations, despite its 15 years of operation.

To stay focused on its plan and identify any necessary adjustments to its activities, Oportunidades has implemented a robust monitoring function that includes an annual external evaluation of the impacts of its various programmes.

PEC

By the early 2000s, frustration was high among rural populations in Mexico about the lack of progress on poverty and economic development in rural areas. This discontent coalesced around the peasant movement El Campo no Aguanta Más ("The Countryside Can Stand no More"). Along with demands to halt the expansion of NAFTA, the movement called on then-President Vicente Fox to commit new funds and new policies to rural development and food security.

For the Mexican government, pressure from the peasant movement coincided with the expansion of agricultural subsidies in the US as part of the US Farm Security and Rural Investment Act of 2002 (the US Farm Bill).

In early 2003, the Mexican government passed the Agro-Food Armour (AFA), a set of policies designed to counteract the protections contained in the US Farm Bill. The AFA contained a safety net scheme for producers of grains and oilseeds, as well as subsidies on inputs, among other provisions.

Then, in April 2003, the Mexican government signed the National Farm Agreement (Acuerdo Nacional para el Campo) with farmer and peasant organizations. The National Farm Agreement set out a number of principles related to rural development, food security and food self-sufficiency.

To preserve a comprehensive vision of rural development, such as the one framed in the NAC, the Mexican government grouped all of its programmes related to rural development into its Special Concerted Program for Sustainable Rural Development (PEC). Since 2003, the PEC summarizes and oversees rural programmes undertaken by a variety of ministries, including the PROCAMPO, Alianza and Oportunidades programmes.

In 2006, the total budget of the projects grouped under PEC was approximately MXN 130 billion, equivalent to 43 per cent of the government budget and 2 per cent of Mexico's GDP. Of this total, Oportunidades was the single largest programme, at approximately MXN 30 billion, and PROCAMPO the second largest at MXN15 billion. Allianza's budget within the PEC was MXN 6 billion (OECD 2007).

Agricultural outcomes

Despite the advent of NAFTA and the recalibration of government agricultural support from the price-based CONASUPO programmes to the direct transfer-based PROCAMPO programme, Mexican small stakeholders in agriculture have not fully benefited from such changes and approaches.

The prices farmers receive for their crops have fallen somewhat, but analysis by Yunez-Naude and Taylor (2006) suggest this is more or less a continuation of a general convergence between Mexican and world prices that preceded PROCAMPO.

Similarly, food imports have made inroads into the Mexican market since the advent of NAFTA and PROCAMPO, worsening the country's agricultural trade deficits. Moreover, NAFTA appears to have had a major impact on domestic agricultural production. For example, the corn imports have led to the dramatic decline of corn production in Mexico. Within one year, the production of Mexican corn and other basic grains fell by half, and millions of peasant farmers lost their income and livelihoods (IAASTD Global Report, 2009). The increasing reliance on imports is the continuation of a trend that began before 1994 (Taylor et al. 2004).

The liberalization of trade and agricultural markets may have had a negative impact on the environment, threatening the traditional agricultural ecosystem and biodiversity in Mexico. A case study from El Colegio de Mexico found that to cope with the income reduction, both commercial and subsistence producers expanded the intensive cultivation of hybrid maize varieties and abandoned the traditional *milpa* system where maize, beans, squash and other crops are intercropped. Monoculture cultivation became thus the main feature of the production system, agro-chemical inputs developed into a necessity, and the old method based on agro-diversity starts to break apart (Wise 2007). Monoculture hybrid maize appears

attractive to producers because it increases yields and needs less land and labour inputs. However, monoculture maize requires high level of agro-chemical use, which pollutes environment and leads to the loss of local gene varieties.

Because PROCAMPO payments were not linked to need, a significant portion of them went to owners of large farms. This state support has served to protect large farms somewhat from competition in NAFTA export markets from Canadian and US producers.

Small farmers have in general not used state support to diversify into other activities or crops, apart from a small number that used Alianza funds to convert to fruit and vegetable export crops. Corn remains the staple crop among small farmers, who produce it for subsistence and to sell to a healthy domestic demand.

Altogether, government agricultural programmes have largely failed to spur capacity building investments or to a diversification of activities among small farmers. Without these transformations, the rural economy cannot generate sufficient income opportunities to overcome poverty among vulnerable groups; much less dissuade young workers from migrating to the city.

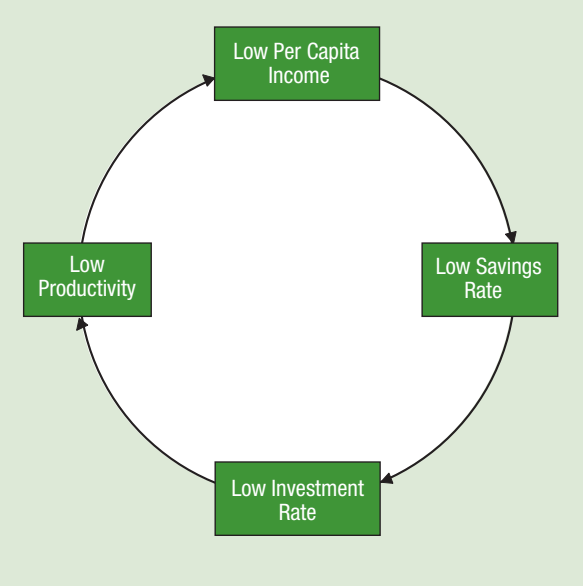
Regarding productivity and diversification investments, many producers cite a lack of access to working capital through credit as a key constraint on improving and intensifying their agricultural activities.

4. Rural finance

Credit and rural development are linked. In Mexico, new demands for financial services are emerging from a process of rural structural transformation that is, to some extent, bypassing smallholder farmers. The process of specialization and formalization in terms of international product standards compliance, demands comparatively sophisticated financial services.

On the other hand, the rural population, which is comprised of household-farms with varying degrees of access to non-agricultural occupations, are struggling to diversify their sources of income and to manage risks (financial and climatic) and uncertainty. A different set of demands for financial services emerge from such households. These typically smallholder farmers are often trapped in a vicious cycle of rural capital formation (see Figure II.3). These farmers demand a variety of comparatively simple services, such as safe

Figure II.3: Schematic of rural capital formation trap

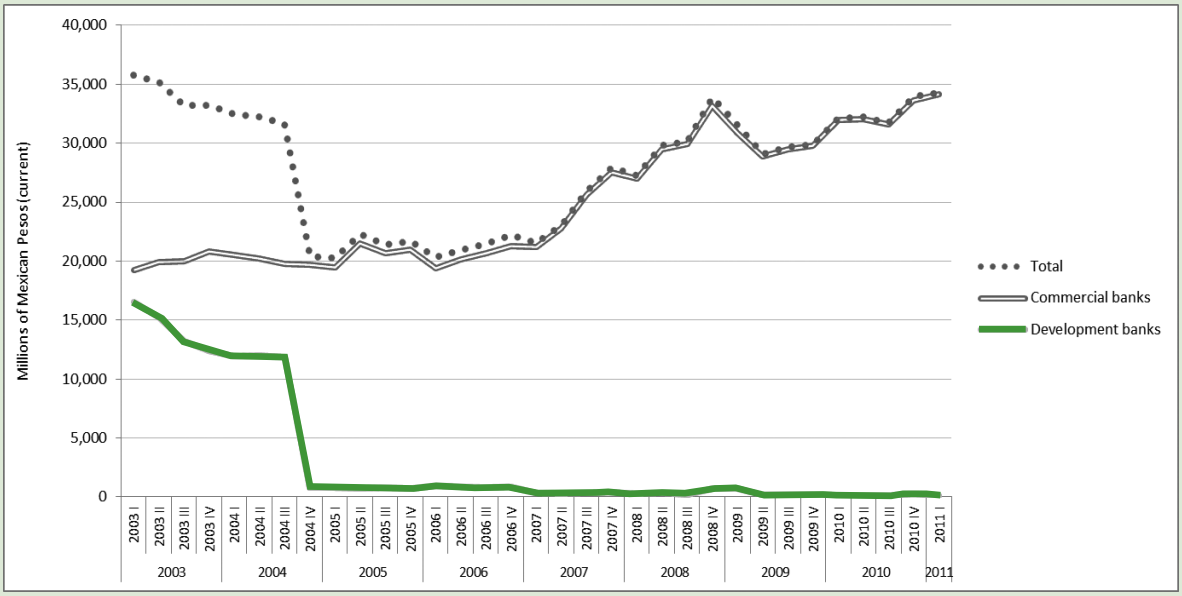


and convenient savings/deposit facilities, inexpensive mechanisms to transfer funds, and progressive access to loans with improving terms and conditions. In Mexico there are diverse banking systems that seek to cover the demands for rural, agricultural and livestock credit.

One of the main issues for small and medium-scale producers is access to financial services. In 2008, 52 per cent of 'municipios' (smallest Mexican administrative entity) lacked any access to financial institutions. It is further estimated that only 25 per cent of adults have access to financial services. This 75 per cent rate of financial exclusion in Mexico is very high by international standards. In other countries of the OECD, for example, the average rate of financial exclusion is only 8 per cent

This is further illustrated in Figure II.4, which shows that the credit granted by Mexican commercial and development banks for agricultural, livestock, forestry and fisheries activities declined sharply during the period 2003-2004, and although it has since recovered steadily, it has not returned to 2003 levels. This was primarily due to the near total disappearance of development bank lending in the sector since the third quarter of 2004. Therefore, the overall growth in the value of credit granted to the agricultural sector is due almost entirely to the growth in commercial bank credits.

Figure II.4: Quarterly credit granted by commercial and development banks for agricultural, livestock, forestry and fisheries activities: 2003 – 2011 (nominal balances in millions of pesos



Source: SIAP with figures on funding and financial information of financial intermediaries of Banco de México forestry and fisheries activities: 2003 – 2011 (nominal balances in millions of pesos (Mexico's central bank).

Similarly, Figure II.4 shows that credit granted by development banks for agricultural, livestock, forestry and fisheries activities in Mexico declined from 3 per cent of the total portfolio of their loans in 2003 to 0.03 per cent in 2011; the equivalent proportion for commercial banks fell from 2.2 per cent in 2003 to 1.5 per cent in 2011. In recent years, private commercial banks have reduced their loan portfolio in the agricultural sector due to:

- High default rates;
- Lower loan repayment rates; and
- Relatively small size of loans.

As such, rural inhabitants tend to borrow from informal lenders, who tend to offer loans with shorter terms and higher interest rates than do lenders in the formal sector.

Compounding the paucity of financial services in rural areas is the fact that the financial services offered are often ill-adapted to the needs of agricultural producers, especially to the needs of small and medium-scale producers. Loan interest rates are too high and maturities too short for smaller producers to employ credit in developing their productive capacities.

This lack of adaptation stems from an observed lack of interest on the part of financial institutions in Mexico in lending to the agricultural sector in general, and to small and medium-scale producers in particular. The few private banks that operate in the agricultural sector only deal with large-scale producers and, occasionally, with producer cooperatives. Existing lenders have therefore failed to capitalize on the potential demand for financial services in rural areas.

Financiera Rural,[57] Mexico's development finance institution for rural areas, has a mandate to improve access to finance in rural areas, but its services only reach small farmers indirectly. The stringent regulatory requirements and cost imperatives have driven Financiera Rural to focus on the financial services of large farmer cooperatives. Nonetheless, Financiera Rural does seek to develop financial service provision in rural areas, notably through non-bank financial institutions and capacity-building for rural financial intermediaries. Table II.4 compares the key features of financial services offered by Financiera Rural with those of its predecessor, Banrural.

Micro-finance institutions do exist in rural areas of Mexico, but they tend to focus mainly on rural non-farm activity. This is in part due to a regulatory regime

Table II.4: Key features of Financiera Rural

Banrural (1975-2003)	Financiera (2003 to present)	Financiera types of credit	Sector specific programs
Development bank focused on agricultural activities	New Development Agency focuses on rural productive projects	Inventory Credits (Depository Receipts). (Prendario)	PROCAMPO (government guaranteed); Preauthorized credit lines for specific products.
Funding through "unlimited" access to loans from the Federal Government; Highly vulnerable to political pressures to lend.	Legally banned from taking deposits, loans or market funding. It must maintain endowment value over time to sustain operations.	Mid-term loans (for any purpose). (Simple); Working capital. (Avío)	Agro-industry providers; Microcredit; Credit Unions; Other financial intermediaries
Inefficient cost structure; operating costs over 100% of operating income 29% of Non-Performing Loans (average 1991-2002).	Operates with credit processes that apply international best practices. It has spread payment culture among clients; Efficient cost structure 2.88% Average of Non-performing loans (2003 – 2006)	Long-term, asset-backed loans. (Refaccionario); Factoring (Factoraje)	Specific product programs: sugar cane, rice, cotton; Regional programs

that does not recognize the structural and operational differences between micro-finance institutions and large commercial banks. As such, micro-finance institutions are often constrained in lending to small and medium-scale farmers because of a scarcity of accepted collateral among these potential borrowers. Typically, small farmers have little else but their land with which to guarantee the repayment of a loan. Most of these producers are on land that is under Ejido-type tenancy and whose title is not accepted as collateral by financial institutions.

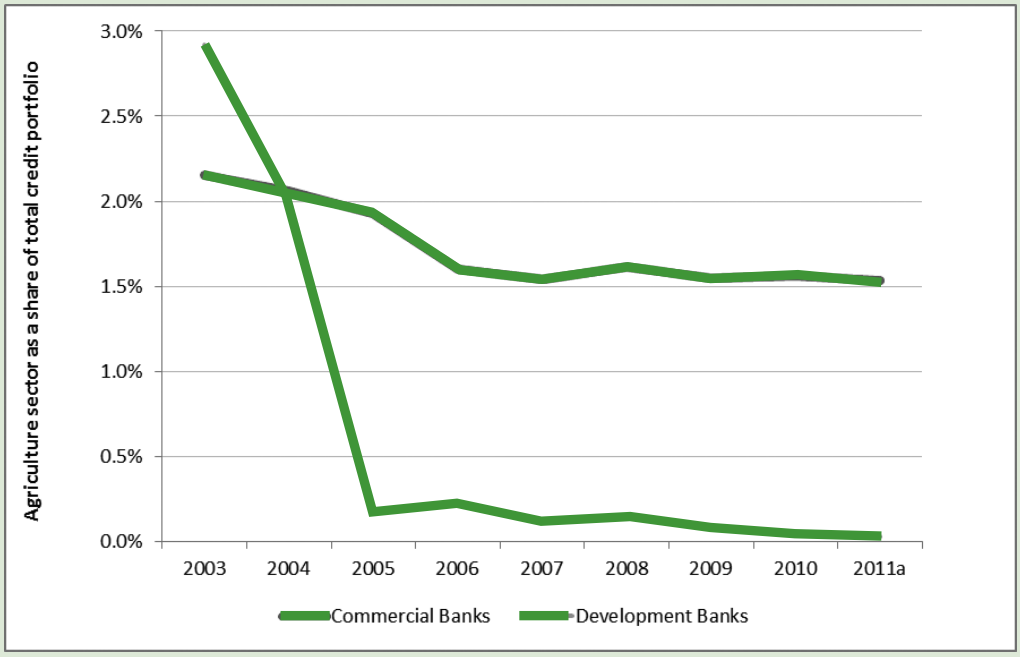
The scarcity of rural credit also constrains small producers by limiting the number of risk-management tools at their disposal. Agricultural insurance is largely unavailable to small and medium-sized producers, as it is most often tied to credit.[58] The government recently put in place a form of insurance for natural disasters but this has been described by producers as insufficient taking into account the many types of risk they face.

Although this section does not disc-uss the potential impact of NAFTA on agricultural producers and rural financial intermediation, it is nonetheless clear that many of NAFTA-related reforms taken by the government since 1994 impact the rural sector, for example: (i) the privatization of common property land, (ii) decoupled transfer payments for subsistence crops; (iii) the withdrawal of the state from supplying agricultural inputs and buying outputs, and (iv) the dismantling of price supports. Perhaps most pertinent to rural financial intermediation in Mexico, the 1995 devaluation of the peso resulted in drastic declines in the value of agricultural credit provided by both the development and commercial sectors.

Figure II.5 shows that the credit provided by development banks to the agricultural sector — as a share of total credit portfolio — witnessed a sharp decline between 2003 and 2005. This could probably be explained by the following two facts: (i) the culture of non-reimbursement of loans among agricultural clientele which resulted in a high ratio of non-performing loans; and (ii) the withdrawal of government support in agricultural production and marketing in line with the rules under NAFTA. As a result, the 2002-2003 witnessed a restructuring of rural finance landscape: the closure of Banrural and the creation of Financiera Rural in 2003.

From the interviews that UNCTAD's Special Unit on Commodities conducted during September to December 2011 with key rural financial stakeholders,

Figure II.5: Credit given by commercial and development banks to the agricultural sector as a share of total credit portfolio, 2003-2011



Source: SIAP with figures on funding and financial information of financial intermediaries of Banco de México (Mexico's central bank).

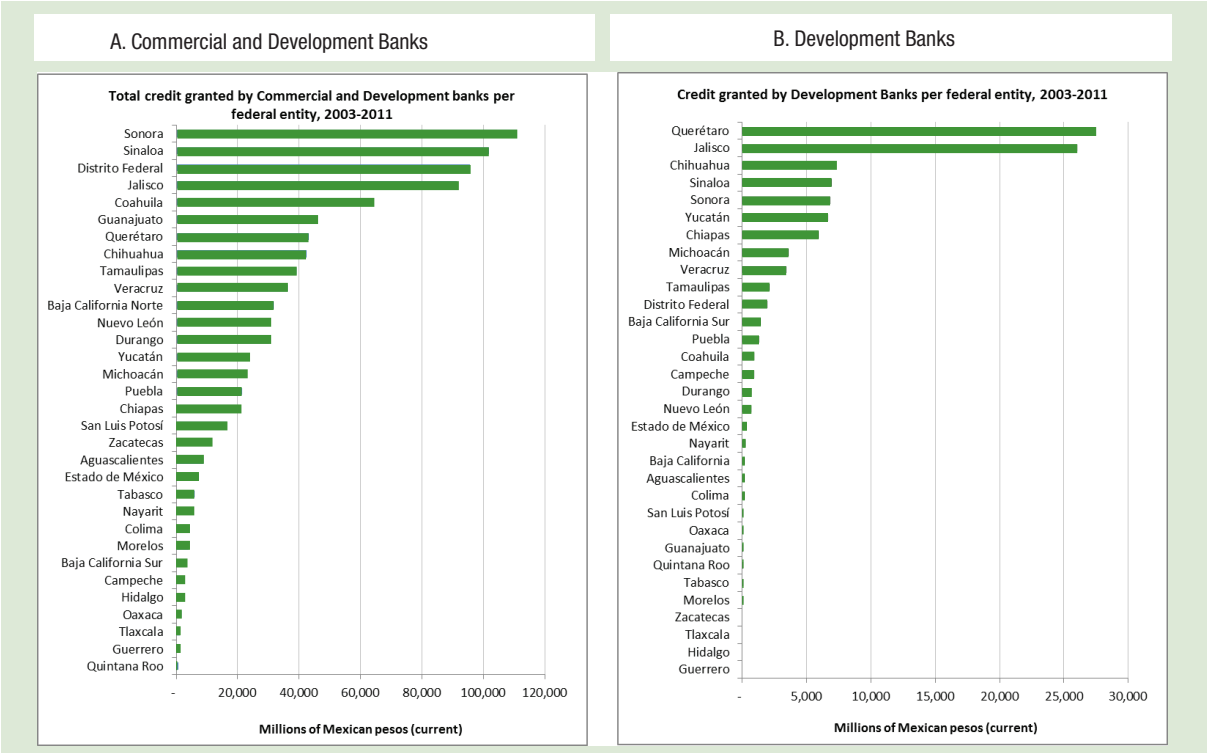
and from the data presented in Section 2 of this Chapter, it is clear that Mexico's rural population requires the following financial services:

- **Intermediation**, involving the mobilization and transfer of savings from surplus to deficit units. It comprises the provision of safe, liquid and convenient savings (deposit) facilities and expanded access to credit facilities, with all products tailored to the needs of the rural population.
- **Savings** facilities, which allow wealth to be kept in a durable form while remaining liquid and readily accessible.
- **Credit** for consumption smoothing and for investment in agricultural production, as well as for marketing, processing and input supplies.
- Locally accessible systems for transacting **payments** and transferring **remittances**.
- General **insurance** as well as cover against variability in output (especially as agriculture is largely weather-dependent) and price and marketing uncertainty.

The importance of credit for the agricultural sector has often been stressed, particularly as justification for the failed state and donor-supported subsidised credit programmes of the 1950-1980s (Richter et al. 2006). To some extent, the Mexican rural economy is characterised by financial fragility.[59] Therefore, a lack of access to credit tends to be a binding constraint for small farmers, often limiting investment in productivity-enhancing technology and inputs, as shown in this Chapter where very low input often use accounts for low yields.

Mexican financial markets have the potential to contribute to increased quantity and quality of investment in the rural economy. Moreover, improved access to payments systems offered by Mexican financial institutions would allow rural producers and traders to participate in modern, more efficient commodity trading systems that offer better prices and reduce corrupt practices (Richter, Boucher and Woodruff, 2006). It is clear that with greater rural financial deepening, these institutions could also provide low-cost, low-risk channels for transfer of remittances, which are crucial to the coping strategies

Figure II.6: Total credit granted by commercial and development banks to agriculture, livestock, forestry and fisheries activities per federal entities



Source: SIAP with figures on funding and financial information of financial intermediaries of Banco de México (Mexico's central bank).
Note: The federal entity registered matches the credit recipient's place of residence.

of most Mexican rural households. Despite their vulnerability, Mexican rural households lack access to any formal insurance, and thus rely primarily on informal safety nets. Therefore, they are highly risk averse, which discourages investment in productivity enhancement (Richter, Boucher and Woodruff, 2006).

A close look at the distribution of financial institutions shows a strong regional inequality. Poor states in the South and South East are particularly affected by financial exclusion. In the entire state of Chiapas, for example, there are only 30 bank branches. This means a ratio of branch to population of 1:160,000. In comparison, the state of Nuevo Leon in the North has one bank branch for every 5,500 inhabitants. In terms of cultivated area, Table II.5 shows a large difference between the Federal district with other states. This is a reflection of its high urbanisation, with an understandably high concentration of non-agricultural activities.

Innovations in the financial system, financial organization, financial administration and processing and financial products, as well as the productive use of remittances will contribute to improving the service offered by financial institutions in Mexico to their rural clientele.

Financial system innovations at the macro level are aimed at creating a reliable, fair and enforceable legal and regulatory framework, including standardised accounting procedures together with politically and institutionally independent supervisory bodies whose decisions are strictly enforced. This is crucial in an environment where there may be a close relationship between enterprises, banks and state institutions. At the same time, macro-economic stability is essential for an efficiently functioning financial system.

The term **financial organisation innovation** refers to changes in the structure, management, and legal form of an institution. The restructuring of banking organisations, with regard to the development of their capability in dealing with new market segments (e.g. rural clientele) is particularly important for the loan departments of rural development banks in most developing countries. In the case of Mexico, would it be a more promising option to either establish new micro-finance organisations (institution building)

Table II.5: Number of bank offices per radius of 15 km of cultivated area per state 2011

State	Land use for Agriculture	No. of bank branches per 15km x15 km of cultivated area
Distrito Federal	2 408	1082.98
Quintana Roo	4 653	33.18
México	1 836	27.29
Nuevo León	2 331	22.32
Baja California Norte	7 536	16.68
Yucatán	1 838	16.16
Morelos	13 343	15.10
Querétaro	19 042	11.65
Jalisco	372	11.14
Baja California Sur	11 943	10.66
Tabasco	14 822	9.81
Aguascalientes	10 642	9.38
Colima	9 035	9.01
Coahuila	18 799	8.67
Guanajuato	10 352	7.67
Campeche	16 273	6.55
Sonora	2 705	6.37
Puebla	5 140	6.01
Veracruz	8 160	4.97
Tlaxcala	15 175	4.80
Michoacán	15 492	4.69
Hidalgo	3 562	4.31
Guerrero	1 037	4.24
Chihuahua	12 845	4.21
Tamaulipas	19 079	4.07
Nayarit	10 602	3.64
Sinaloa	3 856	3.63
San Luis Potosí	20 505	2.98
Oaxaca	2 954	2.68
Durango	22 812	2.09
Zacatecas	2 262	1.17
Chiapas	18 768	0.48

Source: SIAP with figures on funding and financial information of financial intermediaries of Banco de México (Mexico's central bank).

Note: The number of bank branches divided by the cultivated area in square kilometers, multiplied by 215 km2 equals to an area of 15x15 km, considered a reasonable travel distance to the closest bank office.

or to strengthen already existing rural financial intermediaries (institution strengthening)? In Mexico, the upgrading of, for instance, credit cooperatives into more commercially oriented banking intermediaries geared towards the small and medium private enterprise could be an important innovation, which to some extent has been encouraged by Financiera Rural. The most promising options are either to establish new micro-finance organisations (institution building) and/or to strengthen existing rural financial intermediaries such as credit cooperative systems (institution strengthening).

Process innovations focus on improving organisational and service distribution aspects of financial institutions, such as the simplification of financial transactions. A process innovation in the area of improved marketing would be a participatory client approach. To ensure that process innovations are beneficial to all rural clients, the target group ought to be included in the design process of rural institution building.

Financial product innovations are defined as new or modified financial services that have not existed in the market before or differ substantially from existing ones. For example, an often emphasised product innovation is the introduction of flexible savings facilities in rural financial intermediation. At the rural enterprise level, deposit schemes reduce the risk of seasonal income shortfalls, since stress periods can be bridged through accessing savings. Rural finance schemes that offer savings contracts are important in improving the capital and income situation of the rural population. Also, medium- and long-term loan schemes will be necessary to restructure Mexico's private agricultural sector.

Remittances, both domestic and from abroad, are of growing importance in the livelihoods of rural households. The key delivery mechanisms, which exist to transfer remittances both domestically and abroad include the following formal and informal intermediaries: small businesses, large corporations, individual entrepreneurs, and individuals carrying money home themselves. Hernandez-Coss (2005), in a study of the US-Mexico remittances corridor on shifting from informal to formal transfer systems, identified three stages of basic operations of remittance systems: origination, system operation and distribution. His study shows that remittances sent by traditional channels such as money orders have lost ground to electronic transfers. In addition, large immigrant populations helped create a market and competition for transfer services, therefore reducing transaction and transfer costs. Interestingly, Hernandez-Coss (2005) notes that the longer the migrant stays in the USA, the more the remittances decrease over time. The use of the "Matrícula Consular"[60] was also identified as one of the key innovations that helped open the door of formal banking institutions. The study also shows that the cost of international financial transfer systems in rural parts of Mexico may be higher than formal channels, but transactions are faster and delivery is door-to-door. For most Mexican migrants, although the cost of the service is important, cultural familiarity with the channel plays a key role.

Formal money transfer costs range from 4 to 20 per cent of the value sent, the price of which depends on the presence of informal networks, aggregate volume and competition, as well as the presence of banking institutions and technology. There is rising interest in promoting systems that reduce the cost of transferring remittances, as well as strengthening the link between the flow of remittances and rural enterprise and community development (Orozco 2003; Orozco 2002). The following incentives encourage the productive use of remittances:

- Preferential conditions to import equipment or to access capital goods;
- Business counseling and training services to returning migrants; and
- Entrepreneurship programmes.

To help maximize potential benefits of remittances, government and donors need to address transaction cost and access issues related to monetary transfers by launching initiatives with bilateral and multilateral partners to address the physical and regulatory barriers that may exist.

C. AGRICULTURAL COMMODITIES: COMPETITIVENESS AND VALUE CHAINS ANALYSIS

1. Background

The previous section provided an overview of rural development in Mexico and showed how the role of agriculture in the national economy has been decreasing. While agriculture remains the main source of income for approximately 20 per cent of the population, the sector experienced a sharp decline over the last twen-

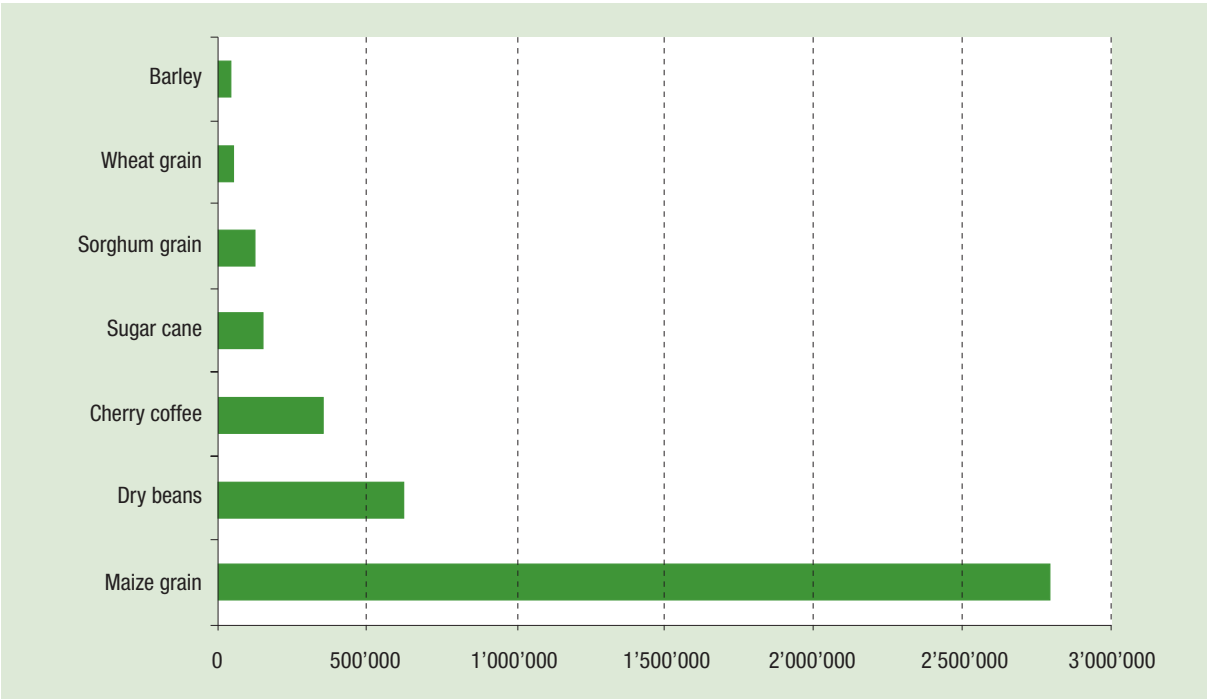
ty years with its contribution to GDP (agriculture, hunting, forestry and fishing) decreasing from 7.5 per cent in 1990 to 4 per cent in 2011. However, in terms of international competitiveness, the sector maintained or even slightly increased its strength with a share of global agricultural commodities exports, growing from 1.2 per cent in 1995 to 1.4 per cent in 2010.

This section discusses the competitiveness and diversification of Mexico's agricultural sector by focusing on 15 products. It begings with presenting a summary of the evolution of key variables of these selected products, including their production values, prices, yields, incomes and participation in international trade. Then cost, yield and technology data of the selected crop products is used to estimate gross margins[61] and assess their competitiveness at the producer level. The section then turns to global value chains and the role of smallholder farmers[62] and how they could capture higher values. For this purpose the value chains of three key products, namely: coffee, maize and wheat are analyzed. These products have high economic and social implications on the agricultural sector in terms of their relative weight in agricultural output or international trade, the number of production units involved, their geographical coverage or concentration, or importance in domestic consumption. The market segment of high-value agriculture (HVA) products will then be discussed in the context of product standards and the functioning of international agro-food markets. The section will conclude with an assessment and policies on how smallholder farmers in Mexico can enhance their competitiveness and better integrate into global agricultural value chains.

2. Agricultural and foods products of strategic importance to Mexico

Mexico identified 15 agricultural and food products (agrifoods) that are of strategic importance for its agricultural sector (in terms of their contribution to production values[63] and/or growth potential). These agrifoods include eight crops (barley, coffee, maize, dry beans, rice, sorghum, sugarcane and wheat), five livestock products (beef, eggs, milk, pork and poultry) and two fisheries products (shrimp and tuna). Those selected agrifoods[64] made an important contribution to Mexico's total production value of crops, livestock and fisheries in the period 1990 to 2009 (on average

Figure II.7: Number of production units engaged in production of selected crops, 2007



Source: SIAP

Note: A production unit can be engaged in the cultivation of more than one crop.

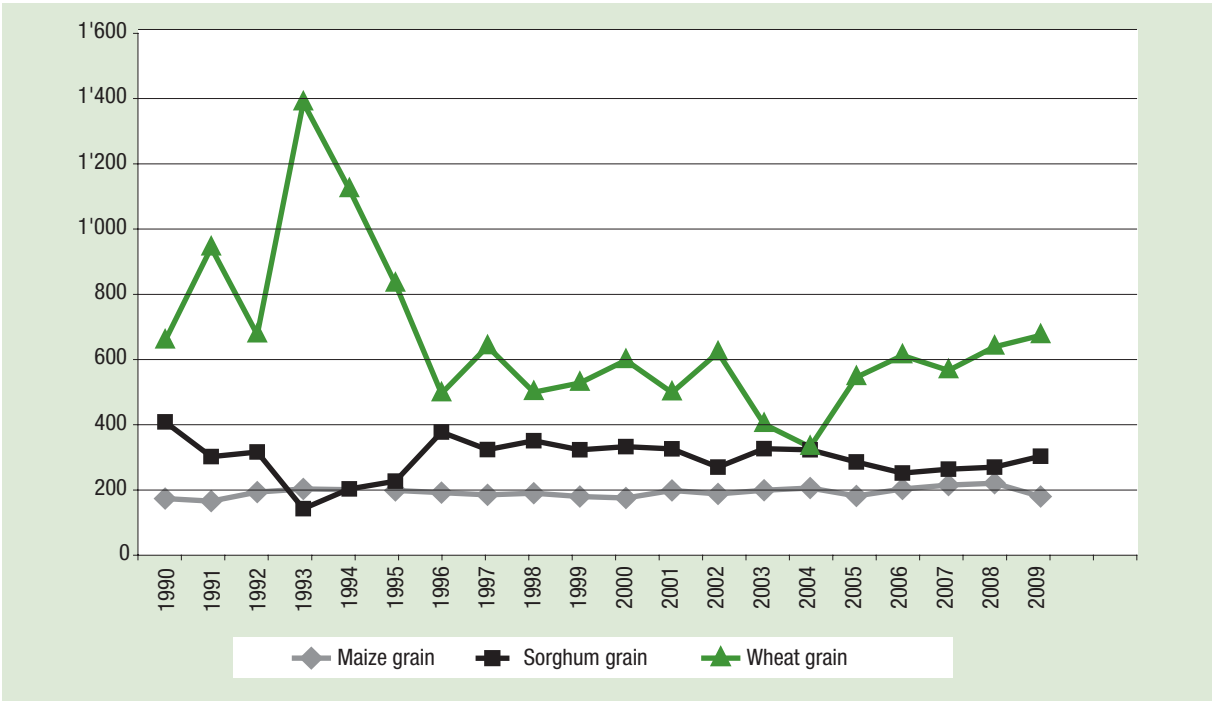
65 per cent). Therefore, the analysis of these agrifoods has the potential to provide important insights into agricultural production patterns and competitiveness in Mexico.

It is important to note that to achieve the objectives of the diagnosis, quantitative and qualitative analysis was carried out but several limitations were encountered. No single measure was sufficient to lead to meaningful interpretation of production patterns, efficiency of the marketing system and competitiveness of selected agrifoods. Therefore, a combination of tools has been used in the analysis to reach a conclusion about marketing and product competitiveness. The main analytical methods used include: descriptive statistics, gross margins analyses, price and operational efficiency analyses. Given that more detailed data were available for crops than for livestock and fisheries, crop analysis is broader and provides the main basis for the evidence-based recommendations.

2.1. Agrifoods

Agrifoods production has a long tradition in Mexico. The distribution of agrifoods production depends not only on climatic conditions and soil quality of the area but also on the importance of the crop for self-subsistence or marketability. Figure II.9 illustrates where the eight selected agrifoods were predominantly cultivated in 2009 (a state is highlighted when it produced more than 10 per cent of national production in that year).[65] Coffee, wheat and sorghum production were particularly concentrated in a few states while maize was produced throughout the country. Sugarcane and coffee are perennial crops while the other crops are grown predominantly during seasons. In 2007, more than 4.1 million production units were engaged in the production of these crops (see Figure II.8) with some units being engaged in the cultivation of more than one. Multi-cropping as well as drawing income from several activities (different agricultural activities or combining agricultural with non-agricultural activity) work for many smallholder farmers as essential insurance mechanisms. A comparison between principal production areas and incomes below the minimum welfare line (see Figure II.8) shows that coffee is predominantly grown in the states with a high share of low-income population (compared to the national average), while wheat is mainly produced in the more prosperous state.

Figure II.8: Evolution of selected crop production (1990-2010 in kgs per caput)



Source: UNCTAD calculations based on SIAP data

Note: The ratio of production to total population was computed to each year to benchmark the production of staple foods on population growth. This helps to calibrate raw production figures to interpretable trends.

Agrifoods production

In terms of production values, the share of the eight selected agrifoods in the total current production value of all crops averaged 42.1 per cent during 1990 and 2009. Maize generated the highest value (see Figure II.8), followed by sugarcane, sorghum and wheat. Rice and barley accounted for the smallest shares. While all crops registered increases of production values, a large part of this was the result of the sharp rise of commodity prices from 1995 to 2008, reflecting the international commodity boom. Farmgate prices increased similarly across all products with the exception of coffee, whose price increased exponentially from 1994 to 2000 before the sector entered a severe international crisis.

Figure II.8 indicates that the relative production of wheat has dropped continuously from a per caput level of 916 to 1,032 kgs in 1990-1996 down to 473 to 623 kgs in 2006-2009. After a lowest performance at or below 400 kgs per caput in 2003 and 2004, wheat production has somewhat improved later in the decade to over 600 kgs per caput. As for maize, the per caput production remained at about 200 kgs of the past two decades. That of sorghum has continuously oscillated between 182 kgs and 205 kgs over the past two decades. Over two decades, Mexico has not improved the production of its staples, with respect to consumption needs of the population.

Agrifoods yields

Turning to yields per harvested ha, which are a crucial indicator of productivity and competitiveness, it is observed that between 2000 and 2009 the yields of maize and dry beans increased by more than 30 per cent while coffee recorded a downward trend (-23 per cent). The yields of the other crops varied between -4 per cent and 11 per cent. The comparison between Mexico's yield to global averages (Figure II.10A and B) shows that Mexico has a comparative advantage in sorghum and wheat production, while for rice, sugarcane, dry beans and barley yields are at a similar level to the world average, especially in recent years. On the contrary, yields of maize and coffee production are below the world average which is partly explained by maize and coffee being produced by many small production units that lack access to adequate technology.

Figure II.9: Main producing states of selected crops, 2009

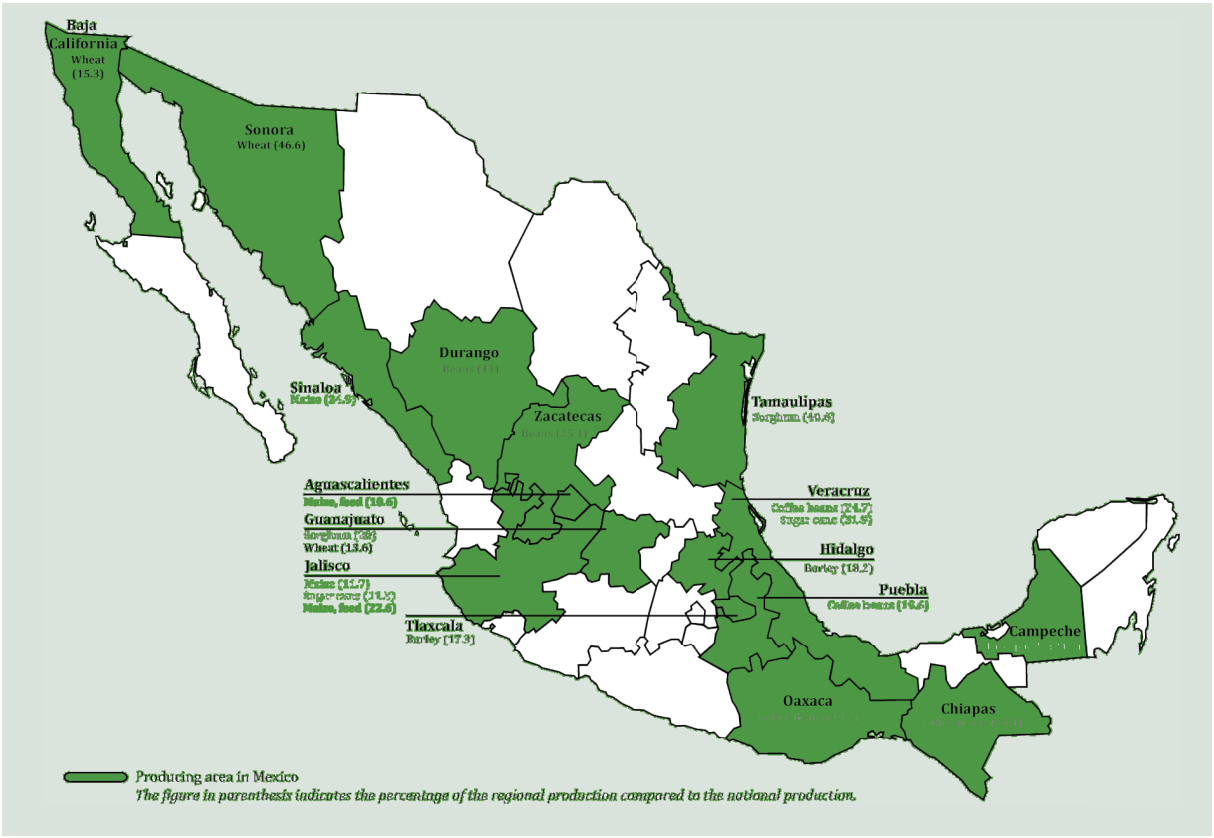
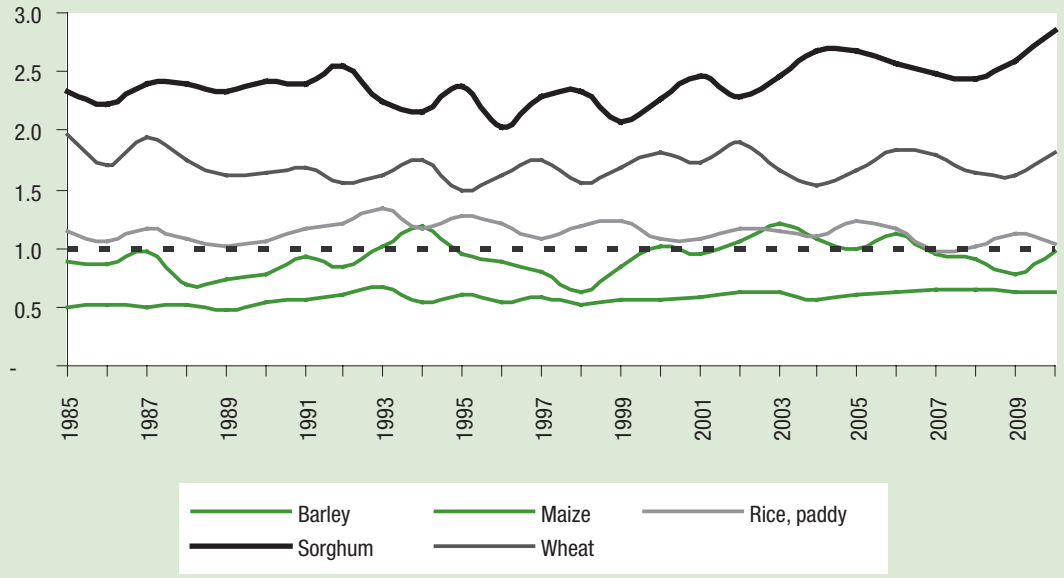
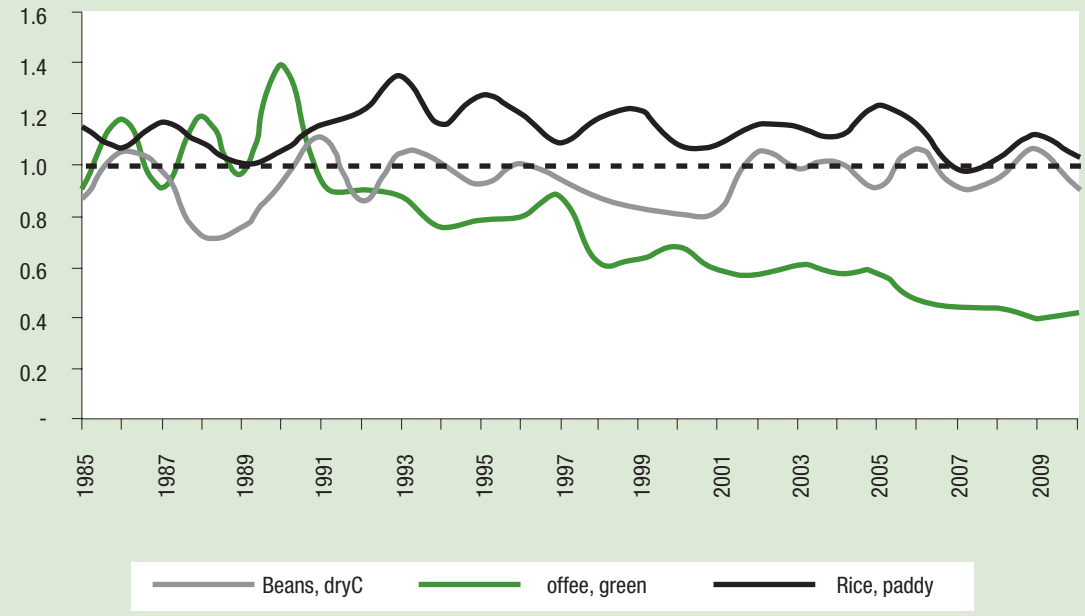


Figure II.10A: Yields of selected crops: Mexico compared to World, 1995-2010



Source: FAOstat

Figure II.10B: Yields of dry bean, coffee and rice: Mexico compared to World, 1995-2010



Source: FAOstat

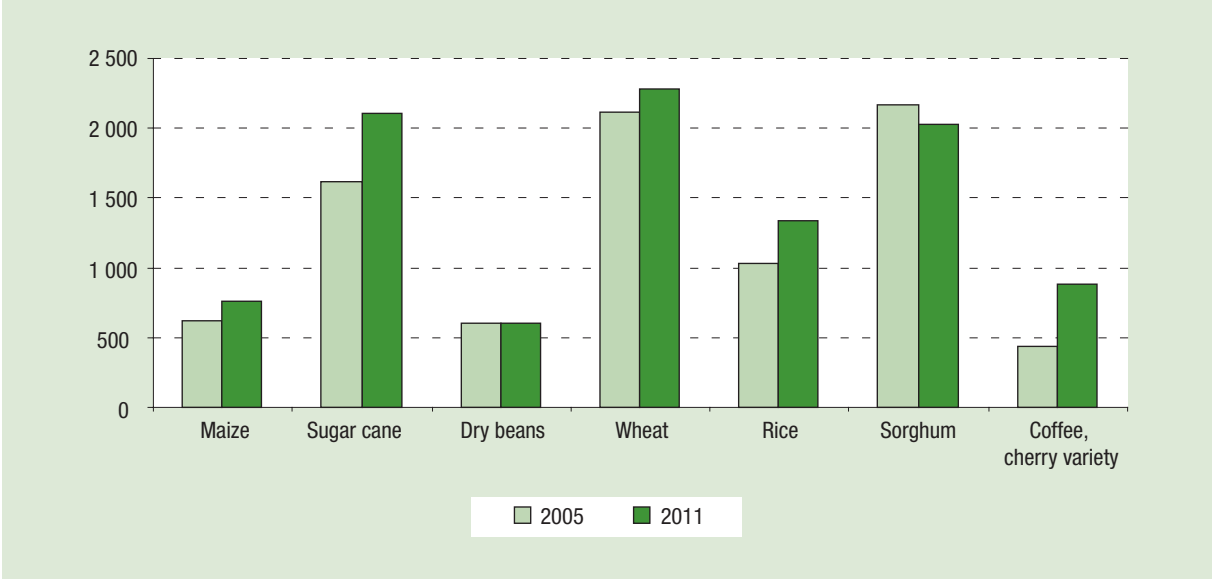
Agrifoods technologies

Access to and use of technologies has a major impact on the productivity of production and thus competitiveness. Production methods which comprise controlled irrigation, fertilizers and improved seeds lead to higher yields (see next subsection). However, during the period 1980-2010, production volumes of irrigated maize, dry beans, sorghum and sugarcane were lower than production volumes that did not benefit from irrigation. This suggests that access to this technology was still limited. For maize and sugarcane the gap has generally narrowed. Coffee irrigation is largely non-existent. Wheat production without irrigation is very low as it can barely grow without water and is thus economically unsustainable. Given that wheat is predominantly produced in the northern states where little rainfall is recorded, one can infer that irrigation for many wheat producers is available. Regarding fertilizer and improved seeds, the available information is limited. However, it can be said that due to the fact that the price of fertilizer increased particularly rapidly (in 2008 urea registered a 59.3 per cent, potash a 184.8 per cent and dap a 123.6 per cent increase), input-dependent forms of agriculture have become less profitable. The next subsection estimates the impact of fertilizers on unit costs in Mexico.

Agrifoods labour inputs

Coffee and sugarcane are highly labour intensive crops: in 2009 coffee required 124 eight-hour (jornales) working days per ha and sugarcane 100, while all other selected crops only required 5. Of the total eight-hour working days that were required to grow the selected crops, coffee production absorbed more than 40 per cent, followed by sugarcane (around 30per cent) and maize (around 17per cent). Rice and barley (less than 1per cent) generated the least employment. This is not only the result of coffee and sugarcane being more labour intensive crops but also linked to the fact that both are perennial crops while the others are grown during seasons. In terms of average monthly income, wheat (~MX$ 2280), sugarcane (~MX$ 2110) and sorghum (~MX$ 2030) generated the highest monthly incomes in the second quarter of 2011. At the lower end were coffee (~MX$ 880), maize (~MX$ 760) and dry beans (~MX$ 600). Thus, two of the lowest income-providing crops are at the same time major employers (coffee and maize), while the second most important employment generator - sugarcane - produced one of the highest incomes. Some of these incomes are very low and risk leaving the producer or the daily worker in poverty. It should, however, be noted that the farmers drawing incomes from these crops may be engaged in more than one activity.

Figure II.11: Average monthly income (MX$), selected crops



Source: SIAP

International trade of agrifoods products

With regard to international trade, in the period 1991 to 2010 Mexico's imports of the eight profiled crops from the world and from the United States evolved similarly, that is, they increased at similar rates from both sources. This is not surprising, as a very large share of imports to Mexico originates from the United States. Of the selected products, beans, maize and coffee recorded the steepest increase (1,330 per cent, 950per cent and 910per cent, respectively)[66]. In terms of values, maize and wheat were the principal import crops. The imports of the selected products accounted for more of the import bill than they generated foreign exchange. On average in 1991-1993 imports of these products amounted to more than US$ 1 billion while they generated US$ 450 million in terms of exports, and in 2008-2010 these imports increased to an average of US$ 4.5 billion while they only generated US$ 1.9 billion of foreign exchange, therein registering growth rates of more than 330 per cent for imports and 320 per cent for exports. As shown in Figure II.12, Mexico's trade in these crops with the US and the world has evolved similarly with both groups. Coffee was clearly the main export product at the beginning of the period (see subsection value chain for further discussion) but it lost its predominant role to sugar/sugarcane as the principal foreign exchange earner and is also closely followed by wheat. Rice, wheat and maize exports were very dynamic but they started from a low base. Exports were less concentrated in terms of destination markets than the imports. A detailed discussion of international trade is presented in Chapter I.

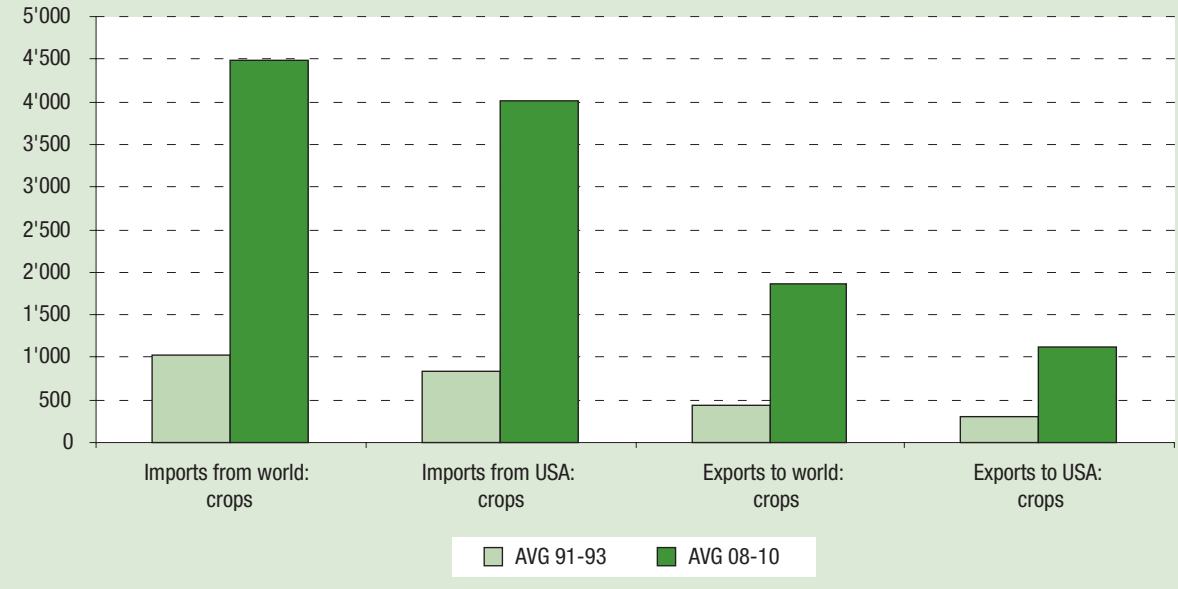
2.2. Livestock

Approximately 314,000 production units were engaged in animal breeding and exploitation in 2007. Given that livestock production is less dependent on weather or soil conditions, it is not surprising that it is far less concentrated than the production of crops. Only egg production shows a high concentration, notably in Jalisco and Puebla.[67] Figure II.14 depicts the states that produce more than 10 per cent of national total for one of the profiled livestock products (beef, pork, poultry, milk and eggs).

Livestock production values

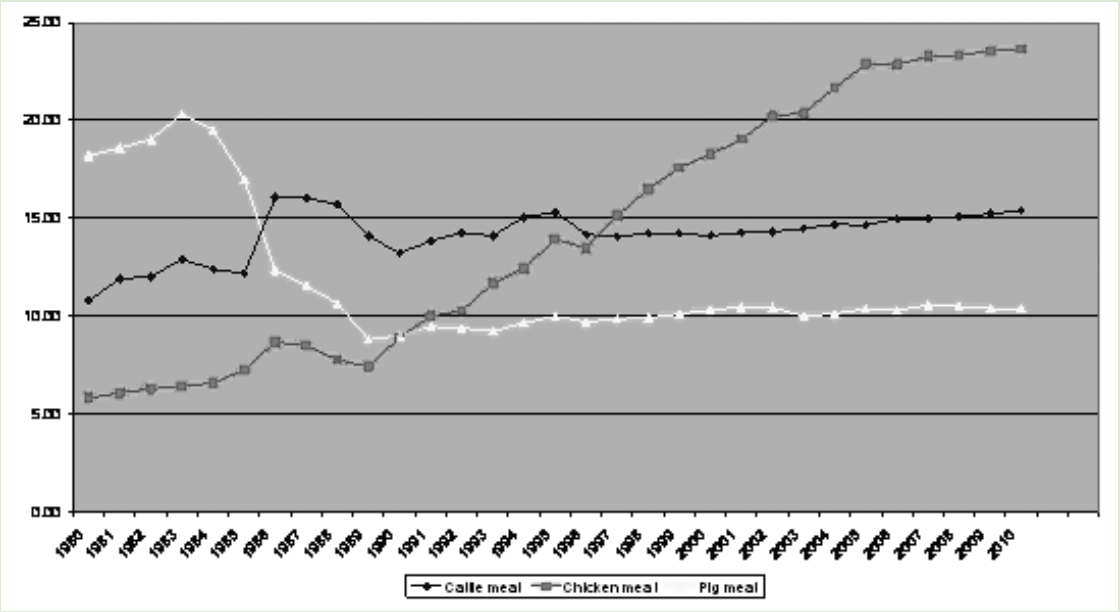
Production values of the selected livestock products were stable and similar at the beginning of the 1990s (Figure II.13). Thereafter, they started a steady increase with a broadening gap. This is largely explained by the

Figure II.12: International trade of selected crops (in US$ million) between Mexico and the world and the world and with the US, 1991-2010



Source: UN Comtrade

Figure II.13: Per caput production of beef, poultry and pork in Mexico, 1980 – 2010 (in kilograms)



Source: UNCTAD calculations based on FAOSTAT

Figure II.14: Main producing states of selected livestock and fisheries products, 2009

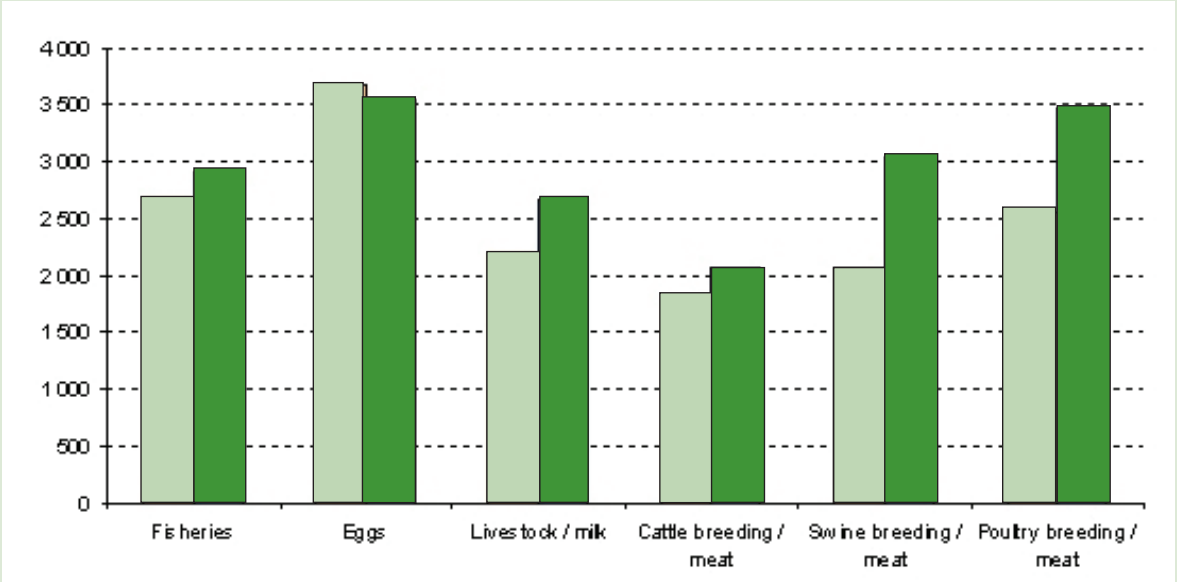
underlying evolution of prices, given that farmgate prices depict a similar pattern with relatively stable prices at the beginning of the 1990s, followed by sharp increases and widening gaps. In 2009, the main product in terms of value was poultry meat, closely followed by beef and cow milk. Although egg production has the lowest value, it is crucial for national consumption given that Mexico's per capita egg consumption is the highest in the world.[68]

As regards production, Figure II.13 shows the per caput production of key Mexican livestock products – beef, poultry and pork – between 1980 and 2010. During this period, per caput pork production dropped dramatically, from 18-20 kgs to level out at around 10 kgs thereafter. Chicken meat production increased exponentially from 6 kgs to 23 kgs per caput during this period. Meanwhile beef production had stabilized at around 15 kgs per caput since the late 1980s, after an increase at the start of the 1990s. This trend is consistent with the number of cows in Mexico, which has been hovering around seven million animals per year since 2005. [69]

In spite of zero tariff and quota restrictions under NAFTA to US, the largest destination market for Mexico's livestock products, per caput production of beef and pork has remained static relative to poultry for the period 1990 to 2010. This trend may be explained by the lack of investments by small-scale ranchers in the haciendas of Mexico where cattle is raised on Common lands with ill-defined ownership,[70] high feed costs and adverse weather conditions, particularly severe drought which limits water supplies for cattle. Furthermore, price competition from below-cost imports from U.S. and Canada, particularly after NAFTA, had contributed to small-scale livestock producers having to exit or leave the industry.[71] For instance, U.S. exports of beef and veal to Mexico had increased 278 per cent and 707 per cent in the period 1990-2005 and 2006-20008, respectively.[72] Concerns over food safety and animal-related illnesses, and increased rejections of Mexican livestock products at U.S. borders, may have also contributed to the stagnant production of beef and pork.

On the other hand, per caput production of poultry remains high in spite of the food safety issues in US, because the structural changes – increased vertical integration, substantial protection even after NAFTA[73], and concentration in the hands of few dominant players[74] – in the supply chain as well as the high domestic demand in Mexico. It is estimated that domestic demand account for over 65 per cent of total production.

Figure II.15: Average monthly income (MX$), selected livestock and fisheries, 2005 - 2011



Source: SIAP

Livestock labour inputs

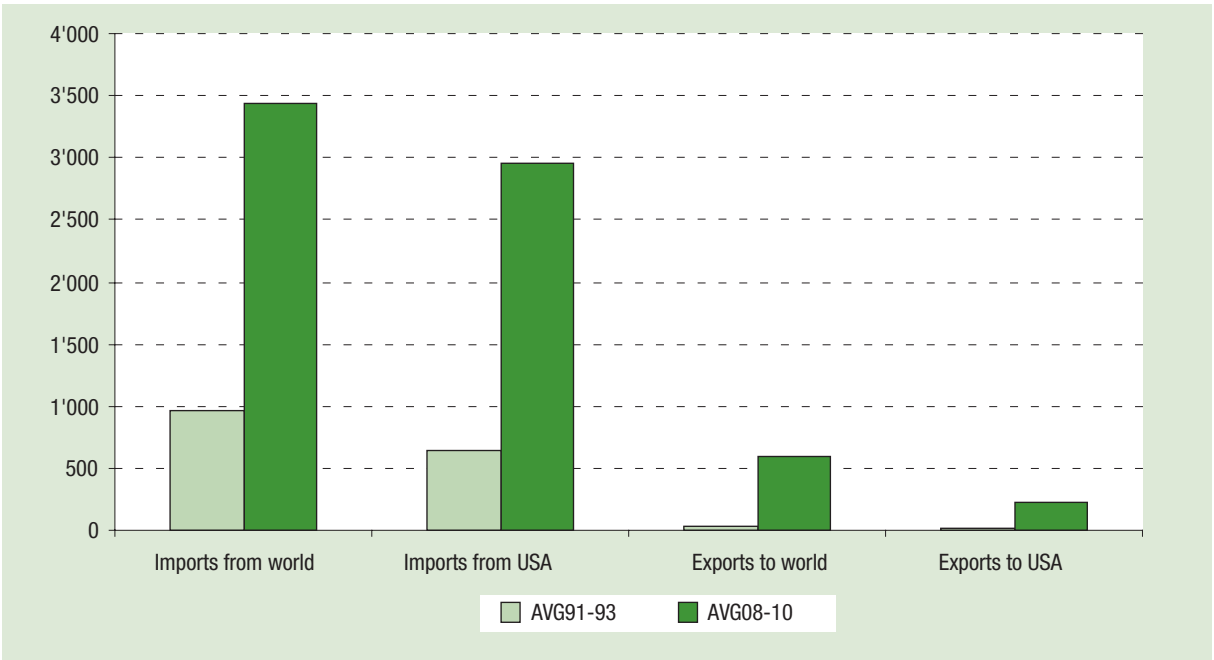
In terms of labour use, during 2000 to 2009 beef production accounted for approximately 70 per cent of the total eight-hour working days of the five selected livestock products, followed by milk (~19 per cent) and pork (~9 per cent). Labour use for beef production also surpassed the crop with the highest labour use (coffee). Labour use of poultry and eggs was marginal. Thus relatively little labour input generated a high production value of poultry. Average monthly incomes generated by these products during the second quarter of 2011 are for almost all 'products' higher than for the selected crops (compare to Figure II.11).

However, from these data one cannot derive how much time was allocated to each product and thus whether producing the product constituted a full time activity or allowed deriving income also from other activities. Moreover, data are only available on an aggregated level, thus they do not show differences in farm size, locational and enterprise type factors. Egg production generated the highest monthly incomes (MX$ 3,540), closely followed by poultry breeding and exploitation for meat (MX$ 3,470), then swine breeding and exploitation (MX$ 3,050), milk (MX$ 2670) and cattle breeding and exploitation for meat (MX$ 2,080). Average income generated from swine/pork and poultry registered a steep increase between 2005 and 2011 (47.2 per cent and 35.4 per cent, respectively) while the average monthly income for eggs slightly decreased (-3.7 per cent). It should be noted that beef/cattle, which is the activity with the highest labour use, produced the lowest monthly livestock income. On the other end, egg production, which recorded a marginal labour use, generated relatively high average monthly incomes.

International trade of livestock products

Livestock imports to Mexico from the rest of the world and the United States again show a similar evolution given that the United States is also the main trading partner for these products. Between 1995 and 2010, meat and milk imports amounted on average 20 per cent of the total food import bill while egg imports were marginal. Pork and poultry imports from the rest of the world as well as the United States (and milk imports from the United States) increased by more than 450 per cent from 1991-2010. The imports of the selected livestock products consumed much more foreign exchange than the respective exports generated (see Figure II.16), however, imports grew by 260 per cent between 1991 and 2010 while exports registered stronger growth of almost 1,570 per cent.

Figure II.16: International trade of selected livestock products, 1991-2010 (in US$ million)



Source: UN Comtrade

Moreover, the destination markets of livestock exports were less concentrated than for imports. Beef and pork are the principal livestock export products but they are not as important foreign exchange earners as the principal crop export products (coffee, sugar or wheat) but they have been dynamic and increased greatly in the reporting period. Although egg exports remain marginal despite their recent increase, they benefit from exceptionally strong domestic demand.

2.3. Fisheries

Four coastal states account for the near totality of tuna fisheries (93 per cent) and two states for almost 80 per cent of shrimp fisheries (see Figure II.17).[75]

Fisheries production values

Data for production values are only available for the period 2005 to 2009. During this period, on average, the production/fisheries value of shrimp and tuna accounted for 53.4 per cent of the total fisheries production value, with shrimp contributing almost eight times more than tuna. This latter finding is driven by significantly higher prices of shrimp. The longer time series of fishing volumes (Figure II.17) show that until 2004 tuna production/fishing exceeded shrimp fishing, but that thereafter shrimp fishing increased sharply while tuna fishing continued its downward trend.

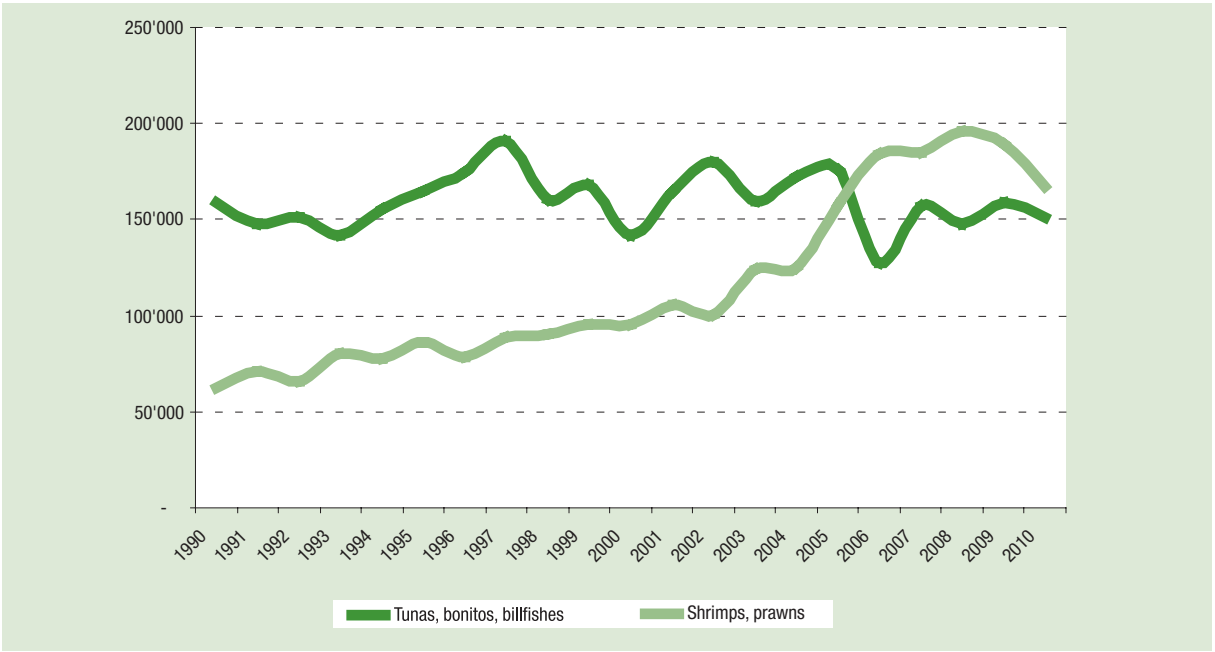
Fisheries labour inputs

In 2008, shrimp fishing was undertaken by around 45,000 people or 30 per cent of the total personnel occupied in fisheries while tuna fishing only occupied 2,000 people. The latter tend to be organized in larger economic units. As shrimp fishing generated only more than double the eight-hour working days than tuna fishing in 2010 (3.7 million versus 1.7 million eight-hour working days), many shrimp fisheries do not pursue this activity at a full time basis year around.[76] No disaggregated data are available for average monthly incomes. As shown in Figure II.15, for the fisheries as a total, the monthly average income in the second quarter of 2011 stood at MX$ 2910 which is 8 per cent higher than in the equivalent quarter in 2005.

International trade in fish and fishery products

Shrimp and tuna imports to Mexico increased during the period 1991 to 2010. While the United States used to be the trading partner of almost the totality

Figure II.17: Production volumes of selected fisheries, 1990-2010



Source: FishStat Plus FAO

of these imports at the beginning of the 1990s, this has changed dramatically. They now account for less than 5 per cent. Shrimp and tuna imports account for a very small share of the food import bill, but shrimp is an important foreign exchange earner (with the United States being the predominant export market). Destination markets of tuna exports are more diversified than those of shrimp. Although less important in terms of value, tuna has been a more dynamic export product, recording a growth rate of almost 400 per cent in the reporting period. In total, Figure II.18 shows that fisheries generated more foreign exchange than they absorbed through imports. This finding contrast with those of the selected crops and livestock products.

3. Technologies and competitiveness of selected agrifoods production and trade

The present context of economic openness of the Mexican economy, with the ensuing growth in access to imported crops, is putting pressure on the competitiveness of Mexican agricultural sector. This threatens the livelihoods of small and medium-scale farmers that are highly dependent on this activity as it represents the main source of their annual income, and whose productive capacity and crops yields are, in general, less competitive compared to international standards.

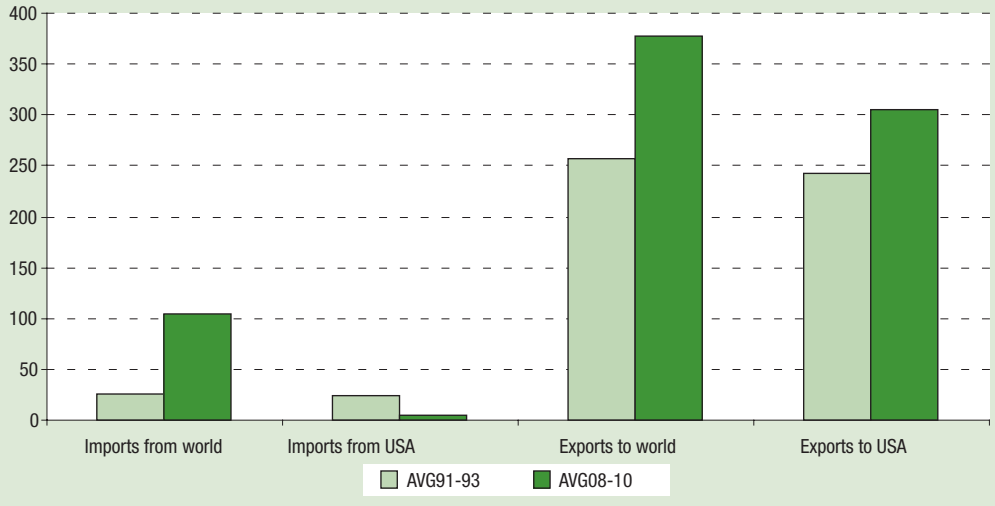
To reinforce the economic sustainability of these small and medium-scale producers and to increase their competitiveness, the introduction of irrigation and improved farm management practices, including the use of high quality seeds, fertilizer and new technology, are increasingly necessary. These practices must be precisely targeted to generate the best possible impact on higher yields and sustainable incomes for producers.

However, the way to reach higher crop yields to produce a positive impact on margins is not a simple task. It raises important data measurement and sample size requirements, as well as interpretation concerns, since yields, along with the technology used, are affected over the course of time by exogenous factors such as rainfall. Agriculture practices such as mixed (inter-) cropping and multiple or continuous harvesting also affect the output.

From the producer's perspective, productivity improvements rely on two basic elements: the increase in productivity (better yields) and the reduction of unit costs. This latter factor is key to ensure competitive margins for small and medium-scale farmers, since they are basically price takers and lower unit costs strengthen competitiveness in the context of prevalent price fluctuations.

The introduction of new technologies must prioritize these two elements. In order to contribute towards a focused and efficient implementation of policies aimed at increasing the competitiveness of the agricultural sector, this section analyzes the impact of different tech-

Figure II.18: International trade of selected fisheries products, 1991-2010 (in US$ million)



Source: UN Comtrade

nologies and agricultural management practices in the competitiveness of Mexico eight main crops. Based on national panel data for 2005[77] provided by the Mexican government, for each crop, a comparison was made of yields and unit production costs from different combinations of technologies (for which data were available) based on the following three production variables:

- Irrigation: pump irrigation (B), surface irrigation (G) or rain-fed (T)
- Fertilizers: applied (F) or not applied (S)
- Seeds genetic improvement: indigenous (C) or improved (M)

Table II.6 lists the technology combinations assessed:

Table II.6: Technology combinations

BMF	Pump irrigation, improved seeds, fertilizer applied
BCF	Pump irrigation, indigenous seeds, fertilizer applied
BMS	Pump irrigation, improved seeds, fertilizer not applied
BCS	Pump irrigation, indigenous seeds, fertilizer not applied
GMF	Surface irrigation, improved seeds, fertilizer applied
GCF	Surface irrigation, indigenous seeds, fertilizer applied
GMS	Surface irrigation, improved seeds, fertilizer not applied
GCS	Surface irrigation, indigenous seeds, fertilizer not applied
TMF	Rain-fed, improved seeds, fertilizer applied
TMS	Rain-fed, improved seeds, fertilizer not applied
TCF	Rain-fed, indigenous seeds, fertilizer applied
TCS	Rain-fed, indigenous seeds, fertilizer not applied

The average yields (Tons/ha) and unit costs ($/kg) for each combination of technology available are the following:

Table II.7: Yields and unit costs per crop and technology combination

	Barley		Coffee		Corn		Beans		Rice		Sorghum		Sugar Cane		Wheat	
	Tons/ Ha	$/Kg.	Tons/ Ha	$/Kg.	Tons/ Ha	$/Kg.	Tons/ Ha	$/Kg.	Tons/ Ha	$/Kg.	Tons/ Ha	$/Kg.	Tons/ Ha	$/Kg.	Tons/ Ha	$/Kg.
BMF	7.50	1.54			6.32	1.64	2.05	4.55	4.61	1.62	8.67	1.45	84.25	0.33	6.90	1.52
BCF					4.18	1.96	1.39	6.43								
BMS											5.00	1.04				
BCS							1.65	4.69								
GMF	8.50	1.10			5.83	1.47	1.88	6.08	8.33	2.33	9.63	1.14	98.71	0.23	6.15	1.50
GCF					3.66	2.14										
GMS					2.25	1.44					4.50	1.19				
GCS					2.50	1.51	1.50	5.16								
TMF	3.15	2.16	2.50	4.25	2.62	2.53	0.75	7.54	3.50	1.70	4.92	1.51	51.00	0.22	2.50	2.61
TMS					1.41	2.97	0.54	5.11			2.50	1.42				
TCF	2.00	2.15	5.00	2.54	2.48	2.74	0.64	7.51					71.25	0.27	2.40	2.85
TCS			1.58	2.27	1.50	2.86	0.63	8.21								
Average	5.29	1.74	3.03	3.02	3.28	2.13	1.22	6.14	5.48	1.89	5.87	1.29	76.30	0.26	4.49	2.12
Min	2.00	1.10	1.58	2.27	1.44	1.44	0.54	4.55	3.50	1.62	2.50	1.04	51.00	0.22	2.40	1.50
Max	8.50	2.16	5.00	4.25	6.32	2.97	2.05	8.21	8.33	2.33	9.63	1.51	98.71	0.33	6.90	2.85

Source: SAGARPA.

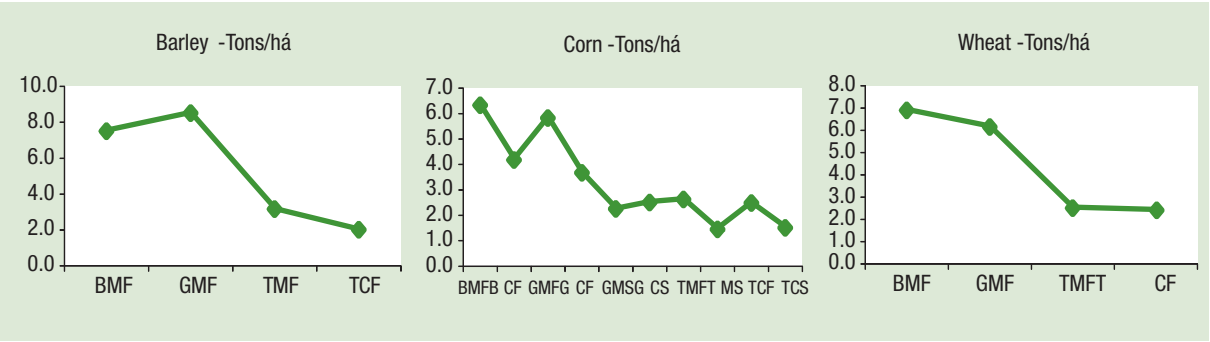
3.1. Technology impacts on yields

Regarding the impact on yields of the different combinations of technologies, results suggest that, in general terms, the introduction of methods comprising controlled irrigation (B) and (G), as well as fertilizers and improved seeds, have positive impacts on yields per ha.

Controlled irrigation provides a significant increase in yields in most of the crops analysed. In the case of wheat, barley and maize, the introduction of controlled irrigation (pump or surface) increases the yields in almost 150 per cent. The availability of water for these crops in very specific stages of their development is vital for the plant growth and the grain formation, which is a critical factor to obtain higher yields that cannot be controlled in rain-fed plantations.

Accordingly, the greatest dispersion in yields is observed in the rain-fed group (T), normally associated with producers with less resources. In this group, the high dependence on seasonal availability of water has negative effects on predictability of output, increasing the risk margin for small producers. This is the case of cherry coffee, typically produced mainly by small farmers in the South of Mexico (Chiapas, Puebla, Oaxaca, Veracruz) and which rely mainly on rainfall for water supply. In these states, the effects of climate change on rain can have a negative impact on the yields and the quality of their production, damaging the annual income for many poor familiesResults also indicate that, in order to obtain higher yields, the variables "fertilizers" and "seeds" are mutually dependent. That is, the application of fertilizers gives rise to increases in yields per ha, which are higher when improved seeds are used. Likewise, improved seeds

Figure II.19: Effects of selected technologies on yields of wheat, barley and maize



Source: SAGARPA, UNCTAD calculations

Table II.8: Impacts of technological improvements on yields in maize

		Technology change impact Tons/ha.					All
From	Tons./Ha	w/Fert	w/Imp. Seed	w/Fert+Seed	w/irrig. B	w/Irrig. G	w/Irrig. G
BMF	6.32						
BCF	4.18		2.15				
GMF	5.83				0.50		
GCF	3.66		2.16		0.51		
GMS	2.25	3.58					
GCS	2.50	1.16	-0.25				
TMF	2.62				3.71	3.21	
TMS	1.44	1.17				0.81	4.38
TCF	2.48		-1.03		1.70	1.19	3.35
TCS	1.50	0.97	-0.06	1.11		1.00	4.32

Source: SAGARPA, UNCTAD calculations.

translate into better yields mainly when fertilized, which confirms that good quality seeds can only develop to their full productive potential in an environment that allows them to do so. Hence, with many crops, best yields are obtained when combining technological upgrades (simultaneously introducing more than one "technological variable").

A good example of the abovementioned relation is seen in the case of maize (see Table II.8). In the group of surface irrigation (G), the estimated increase in yields is 3.58 tons/ha when adding fertilizers to improved seeds, and only 1.16 tons/ha when adding it to indigenous seeds. The switch from indigenous seeds to improved seeds but without the use of fertilizers (GCS) generates a loss in yields (-0.25 tons/ha), which reverts to a rise of 2.16 tons/ha when fertilizers are added. The combined effect of fertilizers and improved seeds generate an increase of 3.33 tons/ha.

3.2. Technology impacts on unit costs

The analysis of technological impacts in unit costs confirms, to a considerable extent, what has been said about yields, especially in the case of grasses or extensive crops– with substantial economies of scale– like barley, maize and wheat. As seen in the graphs below, for these crops, the introduction of irrigation technologies has positive effects in reducing unit costs.

Nevertheless in certain crops, although technological improvements in irrigation bring about better output levels, yield growth is not proportional to associated cost increases, and unit costs rise. For example, in sugarcane production, unit costs grow significantly when introducing pump irrigation.

Introducing fertilizers and improved seeds has mixed impacts in unit costs. It is not evident that the widespread use of these inputs will always have positive effects in crops competitiveness. Depending on the initial technological situation, the cost increase associated with the innovation may be proportionately superior to its results in terms of yields, generating a reduction of unit margins. While at producer's level this may amount to better total profit margins (when the increase in yield is proportionately superior to the decrease in unit margin in absolute terms), high unit costs widen the vulnerability of margins to falling sale prices.

For example, in the case of rain-fed (T) maize (see Table II.9), adding fertilizers or improved seeds separately varies unit costs increases in -$0.12/kg and $0.11/kg,

Figure II.20: Effects of selected technologies on unit costs of wheat, barley, maize and sugarcane

Table II.9: Impacts of technological improvements on unitary costs in Maize

		Technology change impact Tons/ha.					All
From	Tons./Ha	w/Fert	w/Imp. Seed	w/Fert+Seed	w/irrig. B	w/Irrig. G	w/Irrig. G
BMF	1.64						
BCF	1.96		-0.31				
GMF	1.47				0.17		
GCF	2.14		-0.67		-0.18		
GMS	1.44	0.03					
GCS	1.51	0.63	-0.07	-0.04			
TMF	2.53				-0.88	-1.06	
TMS	2.97	-0.45				-1.53	-1.50
TCF	2.74		0.23		-0.78	-0.60	-1.27
TCS	2.86	-0.12	0.11	-0.34		-1.35	-1.39

Source: SAGARPA, UNCTAD calculations.

respectively. The mutual dependence of both inputs is confirmed: their combined introduction generates a decrease of $-0.34/kg in unit costs. The same «combined effect» is evident in irrigated maize (G).

Therefore, technological changes and new practices may have different effects in yields and unit costs. Their impact varies significantly with types of crops, initial technological situation and implementation method (combined or separate introduction) of technological inputs.

Preliminary results demonstrate that the design of efficient policies aimed at increasing the agricultural sector's competitiveness has to be crop-based and must take into account the initial technological level of the producer (or producing area), as well as the combination effects of technology changes applied. Since farmers in Mexico do not all have the same realities, the impact of the same policy can differ widely on their margins, which can lead to poor results at a national level.

Nevertheless, it must be considered that– apart from its effects in higher yields and lower unit costs– technological improvements have qualitative benefits on products, including better output quality, homogeneity and predictability, which also reduce the risks of output volatility. These characteristics not only increase the competitiveness of the commodity and open better market niches but also facilitate its use as collateral to access to working capital financing or even to new investments in technology.

3.3. Technology impacts on margins

The purpose of this part is to estimate the producer's margins for the selected 8 crops and-- in each case-- the effect of different types of technology on these margins. This exercise gives a broad mapping of the profitability of these crops in the Mexican agriculture sector, as well as a quantification of the impacts that the different technologies methods can have on the producer's margins.

Establishing an indicative producers' sales price is crucial to calculate margins, since with the same unit costs, unit margins may differ considerably depending on sales prices. These can vary greatly depending on the geographical area, the distance to consumption centers and the potential import centers, as well as on the concentration of supply in a region. To capture these differences among markets, annual average prices per state and crop published by the SIAP are used. Likewise, to reflect more accurately the margins, the difference between production and harvest/sale periods must be taken into account. In this case, since the production costs of spring-summer 2005 and autumn-winter 2005/2006 correspond to harvests sold mainly in 2005 and 2006, the average prices for both years were used.

In Mexico, the farmgate prices of the eight crops show important differences among states. Higher production areas closely related to main trade channels tend to have greater influence in price formation. On the contrary, in remote areas lacking

good transport infrastructure and in which production is internally traded, including through retail sale, prices may be extremely high or very low. For example, wheat prices are lower in the North ($1.7/kg in Sonora, Baja California), an area which concentrates 60 per cent of the crop's national production and is very exposed to imports from the United States, and higher in the South ($2.6/kg in Chiapas, Veracruz, Oaxaca), an area that accounts for 1 per cent of national wheat production. On the other hand, more geographically concentrated crops have more uniform prices. For example, sugarcane prices show an 8 per cent deviation from average.

According to Table II.10, estimated margins of the eight main crops differ widely. Sugarcane shows the higher margins per ha with a maximum of $ 13,438, and coffee the lowest with a minimum of $ 4,064. Within crops, there are also wide dispersions depending on the technologies used, especially in sugarcane, barley and wheat.

Figure II.21 shows a clear positive correlation between technology and profits in most crops, especially in maize, wheat and beans. The analysis also corroborates the effectiveness applying fertilizers together with improved seeds. For example, in the case of maize and beans, the gains amount to $0.3/kg and $1.7/kg, respectively.[78]

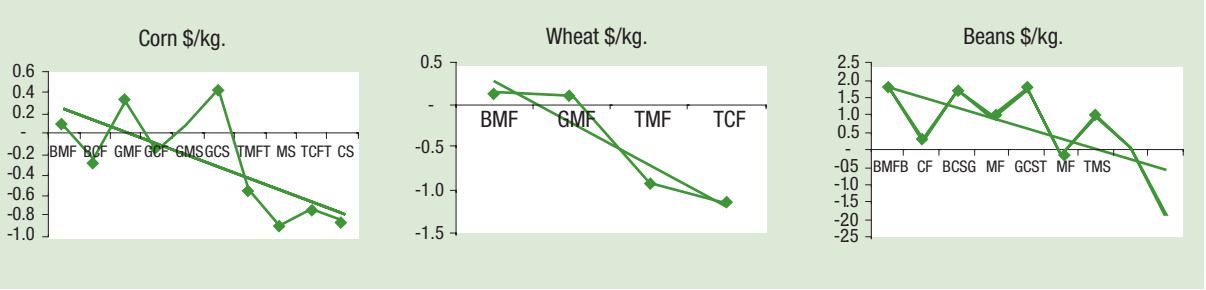
But the most evident conclusion of this exercise is the dependence of profits on irrigation. With the exception of sugarcane, negative margins are highly

Table II.10: Margins per crop and per crop and technology combination ($/kg and $/ha)

	Barley		Coffee		Corn		Beans		Rice		Sorghum		Sugar Cane		Wheat	
	$/kg	$/ha	$/kg	$/ha	$/kg	$/ha	$/kg	$/ha	$/kg	$/ha	$/kg	$/ha	$/kg	$/ha		
BMF	0.29	2'152			0.06	382	1.83	3'758	0.23	1'051	-0.02	-161	0.04	3'591	0.14	954
BCF					-0.26	-1'089	0.30	420								
BMS											0.18	924				
BCS							1.73	2'858								
GMF	0.76	6'431			0.30	1'757	0.96	1'804	-0.12	-1'012	0.33	3'221	0.14	13'438	0.11	674
GCF					-0.17	-636										
GMS					0-06	132					0.13	591				
GCS					0.40	1'009	1.75	2'628								
TMF	-0.09	-286	-1.63	-4'064	-0.57	-1'480	-0.13	-95	0.15	512	-0-07	-359	0.16	8'186	-0.91	-2'282
TMS					-0.91	-1'317	0.98	524			-0.15	-369				
TCF	-0.12	-238	-0.26	-1'312	-0.74	-1'843	0.09	59					0.09	6'347	-1.14	-2'743
TCS			-0.05	-79	-0.86	-1'298	-1.84	-1'147								
Average	0.21	2'015	-0.65	-1'818	-0.27	-438	0.63	1'201	0.08	184	0.07	641	0.11	7'891	-0.45	-849
Min	-0.12	-286	-1.63	-4'064	-0.91	-1'843	-1.84	-1'147	-0.12	-1'012	-0.15	-369	0.04	3'591	-1.14	-2'743
Max	0.76	6'431	-0.05	-79	0.40	1'757	1.83	3'758	0.23	1'051	0.33	3'221	0.16	13'438	0.14	954

Source: SAGARPA, UNCTAD calculations.

Figure II.21: Effects of selected technologies on margins earned on corn, wheat and beans



Source: SAGARPA, UNCTAD calculations

concentrated in the rain-fed group. These figures confirm that the lack of irrigation affects almost all crops, and represents a limitation that threatens the competitiveness of broad sections of small and medium-scale farmers, who depend on rain to grow their crops.

Negative margins are not only an indicator of the low level of economic efficiency in the agricultural sector, but also of the low annual family income received by small farmers. In calculating these margins, unit costs data incorporate all necessary production activities at market value, including the cost of activities normally performed by small farmers with their family group such as preparing the soil, applying fertilizers and herbicides or manual harvesting, among others. Since, in practical terms, small farmers production decisions are limited to cash flow criteria, these costs are not considered into their real cash outflows. Thus, only the result of the comparison between how much they receive and how much they paid is relevant for them to produce year by year, since this difference represents the retribution for their work and, at the end, their annual income.

For example, in the case of coffee in Mexico (which only shows negative margins) the following figures were found:

- Technology level: TCF (rain-fed agriculture)
- Total cost: $12,721/ha
- Yield: 5.0 tons/ha
- Sales price: $2.28/kg
- Revenue from sales: $11,409/ha
- Profit: $ - 1,312/ha

The unit margin is negative; but the costs of manual activities-- carrying, pruning, weeding, application of fertilizers, etc.-- add up to $12,000/ha (of $12,721/ha of total costs). Since these activities are normally performed by the farmers and their families, their direct profit (in cash terms) is: $12,000 -$1,312 = $10,688 per ha. Farmers owning 5 ha of land would have an annual income of $ 53,444 or $ 4,100 dollars. Since this is their main source of income, they will continue producing despite negative margins.

That is why these economic inefficiencies, reflected in negative economic margins, tend to perpetuate themselves in small-scale farmers and poverty. As their annual income reaches the level of subsistence, farmers are unable to undertake significant changes in their productions systems. They face restrictions such as the impossibility to introduce structural changes in their lands (because of the need for investments and the limitations embedded in the type of soil or the geographical area), their lack of knowledge (or of means of access to knowledge) to switch to more profitable crops, and the cultural attachment to agriculture, as the sole source of income for the whole family.

4. Value chain analysis

The following section provides an analysis of the value chain of three main crops- wheat, coffee and maize. They have been selected due to the high economic and social implications that these activities have in the agriculture sector, which is reflected in their weight in the sector's output, the large number of production units involved, their extensive or highly concentrated geographical coverage and their importance in Mexican consumption. In terms of production dispersion, maize is produced practically in all the country, while 80 per cent of wheat production is concentrated in the north and northwest region, and almost all the coffee comes from the south and southwest. In 2009, these three activities accounted for almost a third of all 8 hours working days reported for the 15 profiled products.

Commercialization and final consumption of these products have a relevant social impact on Mexican families, as they are not only a major source of income and auto-consumption for small producers, but also a key component of the Mexican daily diet. Wheat and maize represent over 90 per cent of family expenditure in cereals and are by far the most important crops imported. Coffee is produced in one of the poorest regions of Mexico, mainly by small holders (often indigenous), for whom it represents the main source of work and annual income for entire family groups.

Therefore, the mapping of these value chains would be broadly representative of the main relations, actors and market structures that are currently operating in the agricultural sector.

4.1. Wheat value chain

The wheat value chain (depicted in Figure II.22) is composed of four stages: (i) production, (ii) storage and trading, (iii) processing, and (iv) final commercialization. Wheat is not consumed raw; it requires a transformation process, starting with milling in order

to produce flour. The flour industry is thus a strategic segment in the wheat value chain. The main demand for wheat comes from this industry, which in turn provides the raw material to the final-product producers, which are dominated by the bread industry. The quality of these final products depends on the quantity and quality of the protein present in the grain.

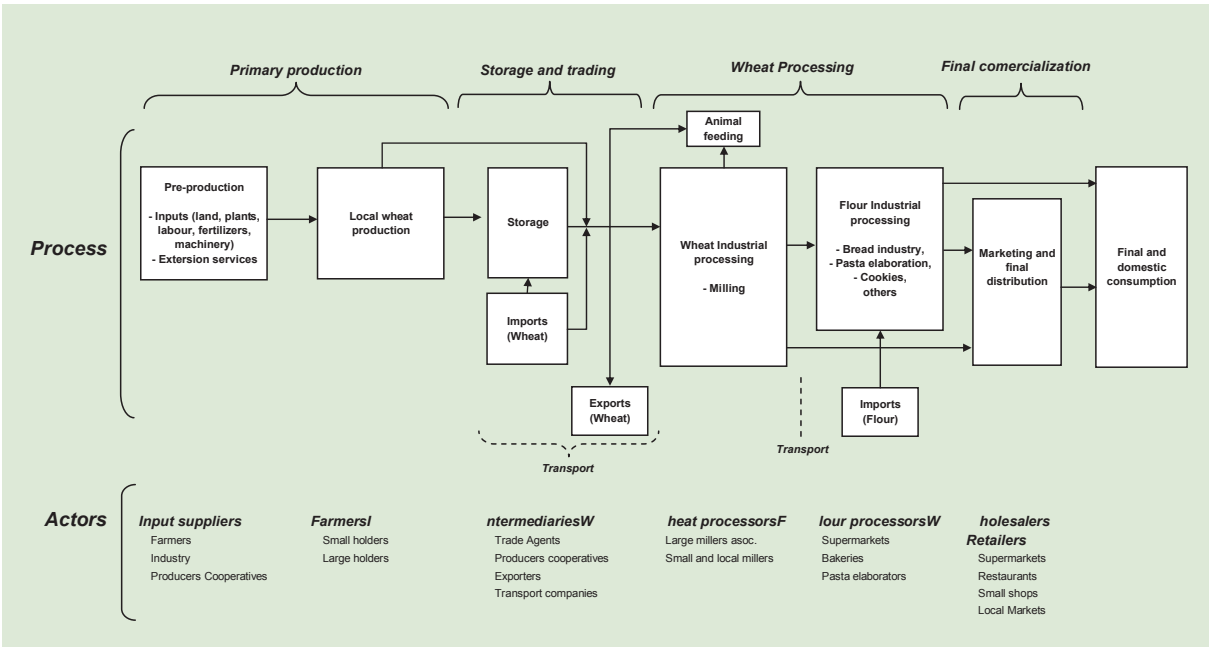
Primary production -- crop growing -- occurs in more than 20 states. The main producer states are Sonora, Sinaloa, Baja California, Guanajuato, Michoacán, Chihuahua, Jalisco and Tlaxcala, in the northwest of the country, accounting for more than 90 per cent of national wheat production. The autumn-winter season represents almost 90 per cent of yield for the agricultural year, and the spring-summer season, the remaining 10 per cent. This is due to the fact that the crop requires the greater humidity and milder temperature prevalent in northwest and north states in the later months of the year. Therefore, the bulk of the annual harvest (almost 85 per cent) is concentrated between May and June,and, according to the Census of Agriculture 2007 (INEGI), 53.575 production units were involved in the wheat crop, resulting in an average area of 13 ha each.

In wheat production, there is high differentiation depending on the industrial use and final product for which the crop is intended. As said, the quality of the final product relies on the type of flour used and, ultimately, on the content and quality of protein in the grain.

The most common grain type produced in Mexico is durum wheat. The national production of durum wheat meets the demand of specific national industrial sectors (mainly pasta manufacturers) and is even exported. However, national wheat production falls short of the demand for bread making wheat-- a softer type of wheat.[79] Thus, the processing industry is constantly turning to the international market for supply. In 2005, the national production of group V wheat (hard or durum) accounted for 44.4 per cent of total national wheat production; that of the group III (soft), for 53.2 per cent; and those of the groups I and II (hard and semi-hard), for 1.0 per cent and 1.3 per cent, respectively. As a general rule, durum wheat reaches better prices in the international market and, in consequence, in the national market. Lowest prices are paid for soft wheat.

Imports to cover the bread-making demand come mainly from North America (75 per cent of them from the United States). There are three main entry areas: the Mexican Gulf (Veracruz and Yucatán), the border with the United States (Tamaulipas, Sonora, Coahuila and Chihuahua) and the Pacific (Michoacán y Colima). Wheat coming from the U.S. enters mainly through the former two areas, which in 2010 concentrated 52 per cent and 32 per cent of total imports, respectively.

Figure II.22: Wheat value chain



Wheat trading involves three basic channels: (a) commission agents (brokers); (b) traders, credit unions and agricultural associations; and (c) producers selling directly to the milling industry. The former two channels concentrate most of the volumes; however it depends in the region. For instance, Baja California is dominated by brokers, who buy the grain to the milling industry or for trading companies, whereas in the Northwest area, trading companies prevail, acquiring the wheat to re-sell it to the agro-industry. Direct sales to agro-industry, through farm organizations or individual producers, are mechanisms that are not relevant due to their high degree of dispersion[80]

Installed milling capacity includes 93 active mills (each with a daily capacity oscillating from 40 to 1,600 tonnes), which are mainly grouped in the Millers´ National Association (Cámara Nacional de la Industria Molinera de Trigo, CANIMOLT) that represents more than 80 per cent of the national milling industry. According to this association, in 2010 the wheat supply for the milling industry reached 5.7 million tonnes, of which 60 per cent came from imported sources and 40 per cent from national production. It should be mentioned that many mills are far away from production areas-- increasing wheat transport costs-- and closer to consuming areas, to the advantage of the bread industry, which sees its transport cost reduced. Table II.11 shows that Northwest region concentrates 71 per cent of the wheat production and consumes only 9 per cent, while 55 per cent of the wheat consumption is done in the Metropolitan, South and Southwest regions of Mexico.

In 2010, production of flour for final consumption was of 4,256 tonnes, and final consumption covered bread - artisan and industrial - (67 per cent), cookies (12 per cent), pasta (10 per cent), tortilla and others (11 per cent). Commercialization of end products to end consumers is mainly done by big supermarket chains and small neighborhood shops.

As mentioned above, wheat products are important in the Mexican diet. According to data from the National Survey on Household Income and Expenditure, in 2000-2004, 19 per cent of household current expenditure on food and drink was allocated to cereals and, from this percentage, 41 per cent corresponded to wheat products.

According to figures from SIAP (SIAP 2007) for 2006, the average farmer's price represents only 39 per cent of the final product sold to the consumer. Taking as a reference the average production cost for wheat in the 2005 sample data, the gross margin for the producers would represent around 5 per cent of the total margin of the value chain. Likewise, that margin is about 8 per cent of the selling price for producers.

Table II.11: Wheat production, milling and flour consumption in Mexico, 2010

2010	Production (%)	Milling Consumption (%)	Floor Consumption (%)
Northwest	71	9	11
North	10	14	13
Center - West Region	18	22	27
Metropolitan Region, South-South West	2	55	48
Total	100	100	100

Source: CANIMOLT.

Table II.12: Distribution of price margins along wheat value chains

$/kg. - 2006	Cost	Price	Margin	% Marg/Price	% Marg/Com. Mg
Producer	1.82	1.98	0.16	8	5
Wholesale	1.98	3.62	1.64	45	50
Retailer	3.62	5.09	1.47	29	45
Commercialization Margin: 3.27					
Producer Price / Final price: 39%					

Source: SIAP.

Likewise, and according to the SAGARPA,[81] primary wheat production represents only 8 per cent of the total value of the wheat chain, while the industrialization of wheat reaches 91 per cent, corresponding to 20 per cent milling, biscuits and pastries to 19 per cent and 51 per cent bakery, figures that confirms the low participation of the wheat producers in the value chain.

Strengths and weaknesses of the wheat value chain

Strengths:

- Products derived from wheat are staple foods, and domestic consumption is likely to increase. (Per capita consumption: Mexico 48 kgs vs. 180 kgs per year recommended by FAO).
- Geographic location near world's largest wheat exporter (USA) allows an easy access to ensure the annual supply of wheat for milling industry and to cover the consumer's requirements of quality.
- Local yields are above the world average, and there is high potential to improve them by incorporating new technology and varieties.

Weaknesses:

- The Pricing formula, based on import parity, transmits the volatility of international prices and exchange rates to the internal market (C. Salazar - V. Suarez).
- The distance between production areas and consumption areas increases transportation costs and, according to the price formula, reduces the reference price paid to producers.
- Small production units prevent substantial improvements in competitiveness. These are represented in high production costs and low margins.
- Wheat production is not adapted to the varieties required for the local consumption, depending on imports to supply the quality required by the market.
- There is a lack of organization of small farmers. Moreover, there is a certain degree of politicization of existing producer organizations, whose objectives may differ from the objective to boost agriculture (C. Salazar).
- Poor logistic infrastructure and high transportation costs.
- Underutilized rail network with high tariffs.
- Transportation must be done mainly by land, which limits the charge to a maximum of 61 tons of payload.
- Excessive participation of intermediaries in commercialization.
- Commercialization margins show that producer's low gross margin represents a small proportion of the total value chain, discouraging production.

Regarding market operation, there are certain segments in the value chain where concentration of market power in the hands of a few players is evident, which may reduce competitiveness. In the presence of market concentration, increases in prices and costs are distributed asymmetrically along the value chain: the most concentrated sectors (input suppliers, intermediaries, millers or wholesalers) may defend or increase their margins by transferring upstream or downstream cost variations, affecting consumer prices or producer margiln fact, transnational grain traders have had increasing influence in the production, storage and transportation of bulk wheat (V. Suarez-CANIMOLT). This is because their higher operation volumes allow the integration of the local transport systems with the U.S. (rail transport in combination with the operation in port facilities), which can determine the origin of the wheat consumed, and can influence domestic prices, as well as the production and marketing of domestic wheat by the sales of seeds, fertilizers and the storage provision.

Similarly, according to miller's organization information (CANIMOLT), some degree of concentration has been formed in the flour processing sector, where there are large customers who impose their purchase conditions and price on small and medium millers.

The atomization of wheat farmers is a structural negative element in the value chain. It prevents producers from organizing themselves to increase their power in buying inputs and selling their products to the processing industry. In practical terms, the local demand for wheat may be met by the trading companies and brokers, who are able to manage big volumes and provide the type of grain that the milling industry requires. Furthermore, the easy access to imports of wheat from the U.S. makes arbitration possible for these big buyers, and the fact that most of the Mexican wheat harvest is concentrated in a short period of time limits the possibilities for small producers to negotiate better prices.

General recommendations

The integration of small and medium producers necessarily require a more effective and representative organization. This would optimize the use of state benefits for increased yields, the purchase of inputs at convenient prices, the access to better storage facilities and the acquisition of technology that would ultimately improve production margins.

Along with the abovementioned, improvements in infrastructure and logistics would have a direct impact on the selling price of the producer. Low value added products such as agricultural grains are the most sensitive to logistical operation costs. Therefore reducing transport costs from producers to consumers would be particularly beneficial. To this end, it would be advisable to study a way to improve rail infrastructure.

Moreover, the concentration of market power in certain stages/actors of the value chain should be revised, since it is likely that there is exploitation of oligopsony power in which only a few large buyers can exert a great deal of control over the sellers and can effectively drive down prices. This is likely to occur especially during harvest periods, when small producers are forced to sell their production to meet their financial requirements.

4.2. Coffee value chain

As mentioned above, coffee has accounted for the highest number of crop working days in Mexico and, in 1995, it was the main export product of the selected crops for this diagnosis. At the turn of the century, the sector entered a severe crisis and lost large market shares in both the world and the U.S., and it has yet to recover its former strength.

The sector had already struggled adjusting to the changing international market environment when the clauses of the International Coffee Agreement were suspended from 1989 onwards and countries were forced to move from a quota system with regulated prices to a free market system.[82] The crisis had important implications on all agents of the sector and foremost the coffee growers. While coffee prices have recovered during the recent commodity boom, the sector is still in the process of restructuring and finding ways to better integrate into its global value chain.

In 1995, Mexico was the fourth largest coffee producer in the world but by 2010 it had fallen to the 7th place, following Brazil, Vietnam, Indonesia, Colombia, Ethiopia and India. Almost the totality of its production is exported. Approximately 70 per cent is exported in the form of green coffee to mainly U.S. and the European Union (EU), where green coffee is processed to the final product. The remaining 30 per cent are processed by the domestic coffee processing industry before it is predominantly shipped abroad. Domestic coffee demand has been increasing but remains low compared to international per capita consumption.

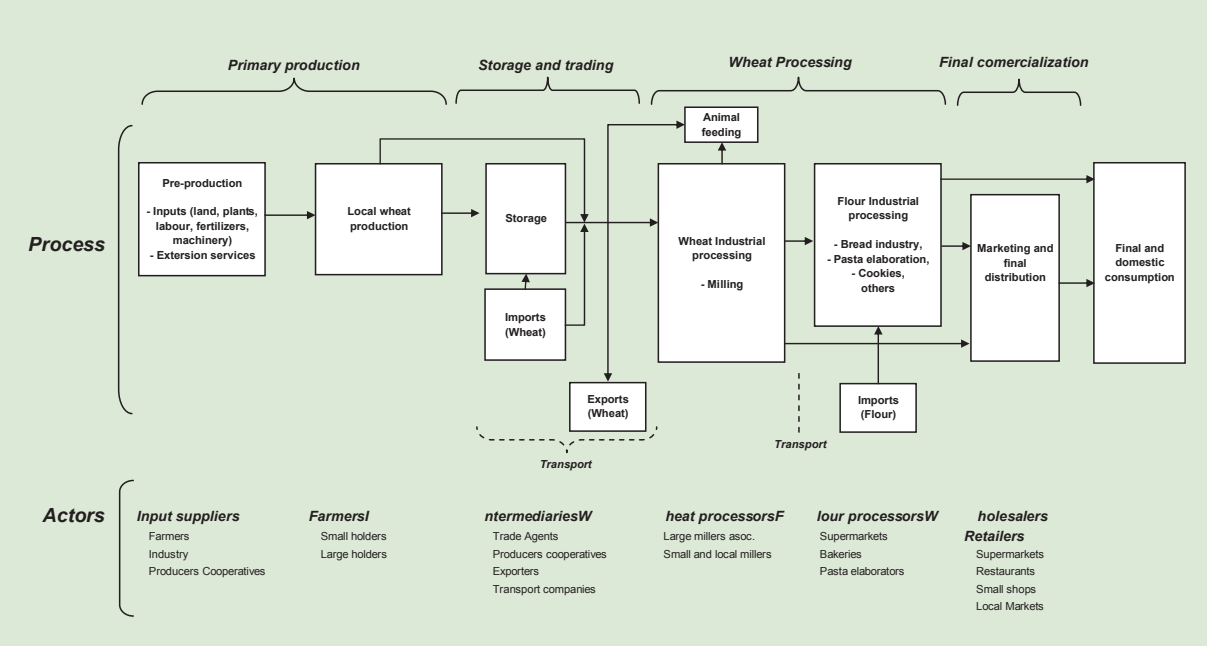
Coffee is grown by approximately 350,000 producers (2007 census) in 12 states with more than 90 per cent of production being concentrated in Chiapas (~36 per cent), Veracruz (~25 per cent), Puebla (~20 per cent) and Oaxaca (~11 per cent). While these states offer a suitable climate and land in terms of altitude, the areas tend to be difficult to access, have only basic infrastructure and a large part of their population is trapped in extreme poverty. More than 90 per cent of coffee producers are smallholder (and often indigenous) farmers who own less than 5 ha (in 2004 the average coffee farm land stood at less than 1.5 ha).

Figure II.23 depicts Mexico's coffee value chain, distinguishing between the production and distribution process and the main actors that are involved at each stage.

Access to extension services are an important ingredient for efficient coffee production and support is needed already at the pre-production stage. In the early 1990s, however, the national institutional support provided to coffee producers was partly dismantled when the Instituto Mexicano del Café disappeared abruptly and extension services and research were cut.

Coffee growers were not only left with less support from specialized institutions, the sector also suffered from internal and international migration which reduced the availability of daily workers, on whom their production depends. However, compared with other crops, labour input for coffee growing is relatively low. Given their small farm size, most coffee growers have rarely access to insurance or credit which would allow them to invest in new coffee plants and technology (e.g. irrigation system, machinery for harvesting and processing, fertilizers, etc). These factors keep their production costs high. While they receive subsidies, the funds are barely linked to value addition (interview with G. Barreda, leader of coffee producers) and thus the incentives are inefficient.

Figure II.23: Coffee value chain



They grow predominately Arabica coffee and little Robusta coffee. Many farmers sell the fresh coffee cherries to the local market without adding higher value to the product through dry or wet processing. The price they can get often only covers the cost of harvesting (Perea & Rivas 2008), which is one of the main cost elements but barely exceeds 40 per cent of the total coffee production cost. Those farmers who process the cherries to Pergamino coffee capture more value but are often unable to recover their costs due to poor selection, quality and certification. However, many farmers do not have a choice other than dry processing as their farms are too far from the market and thus part of their harvest would perish during transport if the coffee cherry beans were not processed. Given that machinery for humid processing requires more capital, poorer farmers tend to process the cherries mainly with the cheaper but lower value dry method (in Chiapas, for instances, the installed capacity for dry processing surpassed the capacity for humid processing by a factor of more than 2.5 in 2002).

Another constraint for many coffee growers is their lack of market information, such as the international coffee market price set by the New York Coffee Exchange. Given that many farmers are not, or only poorly organized, in cooperatives, they are at the risk that intermediaries exploit this asymmetry of information by offering below market prices. It is estimated that in several countries middlemen and brokers keep a high percentage of profits (agrocafe.org). As shown in the previous subsection, on average coffee producers operate with a negative gross margin, thus they sell at a price that does not cover their full production cost. Coffee production has thus become an activity that leaves many smallholder farmers in poverty. It should, however, be noted that many farmers engage in multi-cropping or pluri-activities to reduce their risk and vulnerability to decreasing coffee prices.

The limited capacity of producer cooperatives is a particular constraint in terms of negotiating prices, managing coffee processing, grading and certifying, contracting for warehousing and transport, marketing the product and providing extension services. Due to these inefficiencies, only 3-4 per cent of production is managed by these organizations. Perez and Echanove (2006) maintain that access to storage and marketing systems have always worked as entry barriers for producers, whereas capital has been the main barrier for engaging in value-adding processing.

Approximately 30 per cent of coffee producers sell their cherry coffee to intermediaries who transport the cherries to agents (exporters or domestic processing industry) that process them to green coffee (mostly by the humid method). Given that rural transport infrastructure is inadequate, internal transport costs are

significant (ECLAC 2005) and, for many smallholders, a barrier to integrate vertically with processors and buyers. The latter, both national and transnational companies, increasingly purchase coffee beans based on quality criteria. To meet these criteria and to successfully participate in this value chain, knowledge of quality requirements, plots in suitable altitude, skills and equipment to produce higher quality coffee, as well as access to recognized grading and certification systems are essential.

Only 30 per cent of Mexico's coffee production is processed domestically. The national industry produces both caffeinated and decaffeinated products, in the form of soluble, roasted and milled coffee (decaffeinated products account for an important share). For the production of soluble coffee Robusta coffee is imported. A large share of the processed coffee products is then also exported. Coffee demand in Mexico has increased but remains low by international standards (in 2010 1.2 kg per person per year compared with an annual per capita consumption of 4.1 kg per year in the US, 6.8 kg in Germany or 5.8 kg in Brazil). Large coffee estate owners have financial resources to process (humid processing, grinding, roasting) and export their own harvest and thus capture a larger share of the value.

Most of Mexico's coffee production is exported, mainly through transnational corporations (TNCs). TNCs usually purchase and export green coffee, thus the bulk of the value addition occurs outside Mexico. However, some TNCs have coffee processing industry plants in Mexico. According to Hernandez (2005), five TNCs (namely AMSA, Jacobs, Expogranos, Becafisa-Volcafé and Nestlé) dominate this part of the chain through their local branches. They fix prices for producers, warehouses and local processors, set quality standards, grade coffee beans, take over part of the warehousing and marketing, and can buy future contracts to lower their exposure to coffee price volatility.

Only very few smallholder farmers are directly linked to TNCs. According to the interview with Mr. Barreda, leader of coffee producers, there have recently been some initiatives, under the corporate social responsibility programmes of TNCs, which aim to link firms to farmers and improve the latter's productivity, access to technology and livelihoods. This approach responds to an increasing awareness and sensitivity of consumers in developed markets about social and environmental concerns. Thus, traceability and monitoring have become more important. This requires that coffee quality can be certified by trusted agents. In some cases, exporters directly engage with producers wherein the latter produce according to international standards and receive inputs from the former (contract farming). This could be an interesting opportunity for organic and fair trade coffee which are growing niche markets. The current coffee production method of low input is very suitable in this context. In fact, Mexico could already successfully position itself as the second largest organic coffee producer in the world.

With the liberalization of the coffee market, the coffee value chain has become buyer-driven (Pérez & Echánove 2006; Ponte 2002). Currently, the market is concentrated and dominated by a few TNCs which start with supplying inputs to growers and end with selling the final product to consumers. The TNCs benefit from the weak capacity of coffee producers to organize and negotiate.

In the destination markets, importers of Mexico's green coffee and other coffee products buy large quantities and hold inventories to sell gradually through numerous small orders. They thus exert great influence on the type of green coffee that is sold on the market. The foreign coffee processing industries then capture large shares of the value chain. The location of coffee-grinding production is in general highly centralized, based on easy access to seaports. According to Agrocafe the highest profit margin is achieved by roasters. Technological development has enabled processers to produce a standardized product with coffees from different origins, varieties and qualities and therein better ensure stable delivery of their product (with also lower quality inputs).

Retailers tend to be highly concentrated. In the United States, for instance, Kraft, Procter & Gamble and Nestlé maintain 60 per cent of the total green bean volume. To meet the demand and the high quality standards of consumers in developed country, retailers and importers apply stringent sanitary and phytosanitary (SPS) measures, and food safety and quality requirements, not forgetting, divergent technical regulations and food laws on producers and exporters in producing countries.

This market structure affected very negatively coffee growers in Mexico and enabled the non-farmer participants of the coffee value chain to capture a large share of the added value. Some estimates are as follows:

Table II.13: Price estimates for coffee: 2005 (in Mexican Pesos)

Farmers MX	Production cost cherry coffee	4.25/kg	Veracruz, TMF technology (rain-fed, improved seeds, fertilizer applied)
	Farmgate price cherry coffee	2.26/kg	
Producers of green coffee (intermediaries, producer cooperatives)	Production cost green coffee	USD 2.1/kg	SEM study covering 2001-2005, adjusted average for Meso America
	Price paid to grower (green coffee)	33.38/kg	For exports, ICO
Consumer price MX	Roasted coffee	97.6/kg	Estimate, metropolitan area
	Soluble coffee	204.31/kg	Estimate, metropolitan area
Retail price USA	Roasted coffee	78.33/kg	
	Retail price Germany	Roasted coffee	97.50/kg

Source: International Coffee Organization, SAGARPA, Banco de México, SEM (2010)

As mentioned earlier, Mexico lost market shares of the global coffee market. Over the last decade production capacity and volumes increased significantly in Brazil and Viet Nam due to the use of more efficient technology, mechanization of harvesting, provision of technical assistance, availability of credit, amongst other factors. This resulted in that in 2009 yields in Brazil were approximately 4 times higher and in Viet Nam more than 6 times higher than in Mexico (FAO). Their production methods and institutional frameworks could provide important insights into how smallholder producers in Mexico could benefit better from global coffee value chains.

In sum, the analysis suggests that the coffee value chain of Mexico has suffered from several weaknesses:

- Atomized production pattern inhibiting economies of scale
- Institutionally and technically weak capacity of co-operatives / producer organizations to integrate producers and share price information, negotiate prices and contracts, buy inputs, set up warehouses to sell product when prices are favourable, lower transportation costs by selling in larger quantities, provide extension services, etc
- Lack of credit and insurance to the sector, thus inability to invest and improve production methods. Banks often do not accept Government backed guarantees (fondos de garantía).
- Large part of value addition occurs outside Mexico
- Lack of certification programmes

On the other side, Mexico's coffee sector offers several natural strengths, including:

- Suitable soil and climate for coffee production
- Accumulated experience of coffee production
- Being an internationally recognized coffee producing country

General recommendations

- Enable smallholder farmers to better organize themselves in producer cooperatives so as to increase their negotiation power and benefit from economies of scale.
- Support coffee sector initiative funded by government (US$ 4 million) which aims at increasing competitiveness and productivity of the sector, attracting investment, enabling technological transfer, better integrating into value chains, setting up of a certification programme (together with Nestlé) and accounting for the preservation of the natural environment.
- Support producer organizations that provide training/extension services to growers with the help of agronomists, engineers and agricultural technicians. Train cooperatives in handling contract and delivery agreements and requirements, post-har-

vesting handling, upgrading the skills of washing station mangers, and facilitating the introduction of new washing technology that uses less water than the current system.

- Encourage producer cooperatives to collaborate in contracting transportation and warehousing services and collecting and sharing market information and technical assistance.
- Strengthen domestic production by linking smallholder farmers and cooperatives to industry. This will enable increasing local value addition and benefiting from higher margins (roasted and soluble coffee generate higher margins). Also stimulate domestic coffee consumption to lower dependence on foreign markets.
- Strengthen rural financial sector, including microfinance and non-bank financial initiatives, to increase loan funds for marketing and investments in production and processing, including purchase of new and more productive coffee plants, fertilizer and machinery.
- Assist producers to position their product in international trade fairs. This also required creating a distinctive Mexican coffee label.
- Improve and extend certification programmes, especially for organic products (e.g. Fair Trade). A study on linking Ethiopian coffee producers[83] to international markets demonstrated the importance that consumers attribute to quality production being traced to origin with substantial buyer monitoring and involvement with coffee growers. This will also allow for product differentiation.
- Link subsidies to producers productivity and value addition and not to size of land or sales volume (Parea and Rivas, 2008).

4.3. Corn value chain

The corn (or maize) value chain is composed of four stages: (i) production, (ii) storage and trading, (iii) processing and, (iv) final commercialization (Figure II.25).

In 2010, Mexican corn production reached 22.4 million tons, mainly distributed in two varieties: white maize, which constitutes 91 per cent of the total, used primarily for human consumption, and yellow maize, with 9 per cent, used especially for animal feed and other industrial purposes (Financiera Rural 2011).

Annual production volumes are distributed along the year. Seventy per cent are obtained from the spring-summer season, which harvest falls mainly between November and February, and 30 per cent comes from the autumn-winter cycle which harvest is concentrated between May and June. Maize production is obtained in all states, however 14 of them account for 90 per cent of the national total.

At a national level, there are about 2.5 million farmers engaged in growing corn, of which 85 per cent of them use land holding no bigger than 5 ha. Thus, in Mexico coexist two production systems with different characteristics: a system of commercial production with high technology, irrigation and intensive inputs, and whose yields are equal to those of U.S. producers (Sinaloa, Sonora, Jalisco, Tamaulipas); and a system generally oriented to auto-consumption and small commercial production, with low yields, with rain-fed irrigation, associated with small farms under 5 ha and intensive family labour (Chiapas, Guerrero, Hidalgo, Mexico, Morelos, Puebla , Oaxaca, Veracruz, Yucatan).

As shown in Table II.14, the raise in production volumes of the last decade are explained only by the higher yields achieved by the group of irrigation crops that reached an average of 7.3 tons per ha, while the production from rain-fed areas, mainly associated with the second group of producers mentioned above has remained almost constant at 2 tons / ha.

The vulnerability of the Mexican production to climatic factors is significant, and it is closely related to the quality of seed and the method of irrigation used. Improved seeds provide a better adaptation to the different and sometimes extreme weather conditions and soil qualities used for corn production. Despite their well-known benefits, only 30 per cent of the agricultural land is planted with them. In terms of the water, in 2010 the proportion of rain-fed area was 82 per cent and contributed with only 54 per cent of total production. That year, the loss associated to this method (defined as the percentage of sown area affected on the total area sown) reached 11 per cent, whereas in the case of the irrigated area it was only 1 per cent. These percentages - which might vary depending on the presence and intensity of weather events such as El Nino or La Niña[84]- indicate that small holders that depend on rain, apart from having lower yields, must assume higher risks due to the loss of crops, increasing the gap between the two groups of producers in terms of margins and competitiveness (see margins comparison of this Chapter.

Table II.14: Maize production in Mexico

Year	Area (M. Ha)		PROD. Mtons.	YIELDS (Ton/ha)		
	Sown	Harv.		Irrigated	Rain fed	Average
2000	8.4	7.1	17.6	5.5	1.9	2.5
2003	8.1	7.5	20.7	6.2	2.2	2.8
2006	7.8	7.3	21.9	6.8	2.1	3.0
2010	7.8	7.1	22.4	7.3	1.9	3.1

Source: SIAP-SAGARPA.

With respect to consumption, in 2010 total corn consumption reached about 30 million tons: 74 per cent (22 mill tons.) of white corn and 26 per cent of yellow corn. Eighteen million tons of white corn, or approximately 60 per cent of the total production, were intended for human consumption, 12 of which through the milling industry and 6 million thought direct auto-consumption. The rest (4 mill tons) corresponds mainly to livestock consumption, seed and others. The yellow corn is mainly consumed by the livestock feed production industry, and to a lesser extent, by the starch and the cereal industries.[85]

Despite the increase in production volumes, Mexican corn production is not sufficient to fulfill the local demand and the country must import about 25 per cent of its consumption. In 2010, imports reached a total of 7.8 million tons, mainly of yellow corn from USA, which ranked Mexico as the second world largest importer of corn, a situation that makes it vulnerable to international price changes. On the other hand, corn exports are almost exclusively of white corn, which in 2010 amounted to 0.6 million tons. The main export destinations were Venezuela and Colombia.

Storage and trading are performed by different methods: (i) direct purchases of processing companies (mainly from the two major flour groups MINSA and MASECA), (ii) purchases from traders that transport the volumes purchased to urban areas for resale, (iii) purchases of regional storage companies that store the grain for deferred sales, and (iv) other direct sales to livestock producers associations or processing industries (e.g. starch production).

For local selling prices, the import parity rule is applied. ASERCA is the institution responsible for setting the domestic prices, based on the price of the futures exchange in the closest month to delivery plus the standard basis of the consumer zone minus the regional basis. Consequently there are many different prices, depending on the producing zone.

The elimination of tariffs as a result of NAFTA benefited the processing sectors of the value chain; however, it also eliminated the protection for corn producers sectors, which had to compete openly against heavily subsidized U.S. producers. The convergence between local and international prices had adverse and uneven effects in domestic producers, as commercial producers are compensated with programs to support commercialization or access to technology, while small-holders in general have not had enough Government support.

The processing of corn for human consumption plays a key role in the value chain. In 2010, it accounted for almost 67 per cent of the total corn devoted for final consumption, providing the main raw material for tortilla elaboration. The milling and flour elaboration industry is concentrated in few companies. The MASECA Industrial Group has 71 per cent of the market share, and it is followed by the MINSA group, with 24 per cent. The rest is distributed among Harimasa, Cargill, Molinos Anahuac, and other small players. On the contrary, the tortilla elaboration industry is scattered all over the country, with around 80,000 players such as small local mills and tortilla producers.

The processing of corn for livestock has grown significantly in the last years due to the relevance acquired by the poultry and porcine industries, as mentioned previously. Processing industries for livestock are classified in independent, dedicated to feed production for sale to other industries, and integrated, producing only food for poultry and egg production (Bachoco and Pilgrim's Pride). Therefore, with the support of the livestock industry, some corn producers could increasingly focus their efforts in producing yellow corn. This could represent a new business option.

With regard to the final consumption, corn is one of the most important components of the Mexican diet, especially for the lowest income segment of the

Figure II.24: Maize value chain

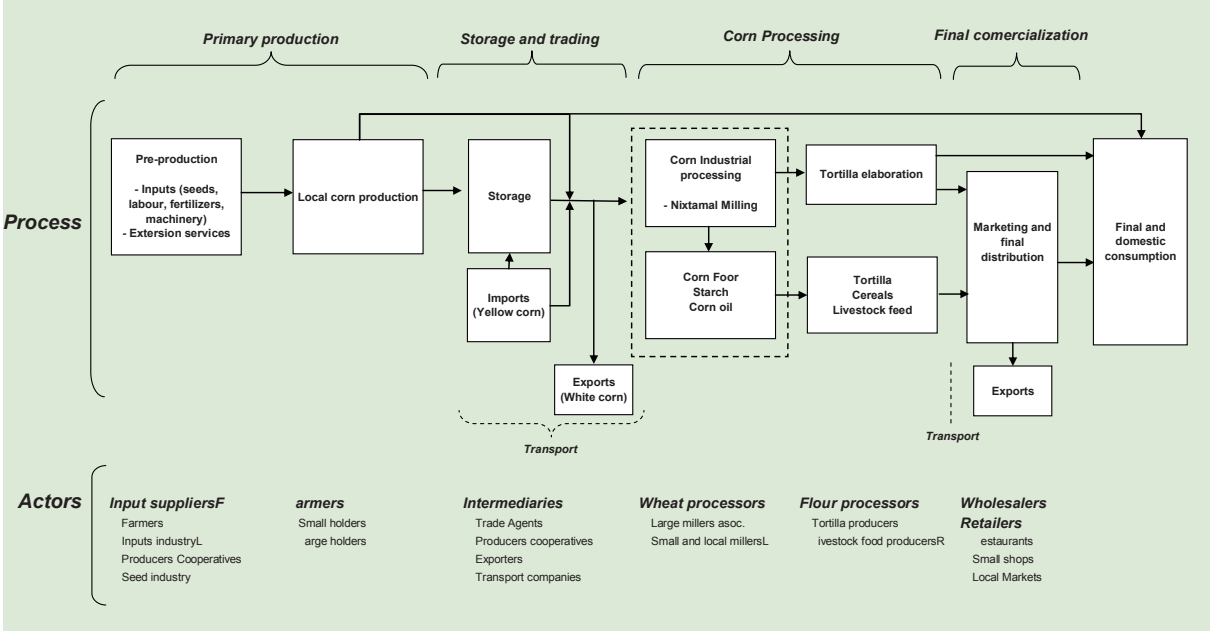
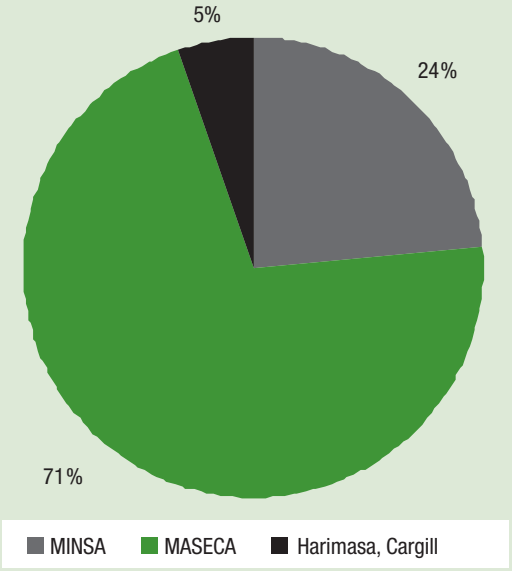


Figure II.25: Main companies in corn flour subsector



Source: Secretaría de Economía 2012

Table II.15: Distribution of price margins along corn value chains

$/kg. - 2006	Cost	Price	Margin
Producer		1.93	
Wholesale	1.93	4.89	2.96
Retailer	4.89	5.76	0.87
Commercialization Margin: 3.83			
Producer Price / Final price: 34%			

Source: SIAP.

population. In 2010, households in lowest income decile devoted about 10 per cent of their total food and beverages expenditures to tortilla, compared to only 3.1 per cent among households in the highest income decile. Also, tortilla consumption is significantly higher in rural areas (220 gm/d in 2010, compared to 155 gm/d in urban areas).[86]

Value Chain Margins

According to figures from SIAP, in 2006, the average farmer's price represented only 34 per cent of the final product. In the same year, the total value of the agro-industrial chain of corn for human consumption reached $ 90,871 millions of pesos. The primary sector accounted for 36 per cent of that figure, and the secondary sector for the remaining 64 per cent. Within the chain, the most important activity is that of the milling industry, which contributed with 38.8 per cent of the gross value.

Strengths and weaknesses of the value chain

Strengths:

- As with the wheat, the geographic location, near the world's largest corn exporter (U.S.), allows for an easy access to imports, which can ensure the annual supply. However, subsidized farmers in the US are strong competitors.
- There is still room to increase yields by incorporating wider irrigation infrastructure, new technology and varieties.
- Products derived from corn are staple foods, and local animal feed consumption (fuelled by the poultry and porcine industries) is likely to increase yellow corn consumption.
- White corn, which is the main grain for human consumption, is completely supplied by local production.

Weaknesses:

- Mexico is currently the second largest importer of yellow corn in the world, a fact that places it in a very sensitive position against changes in international corn prices, world inventory variations, or even agricultural policies or subsidies especially applied in the US.[87]
- High vulnerability of domestic production to climatic factors, which primarily affects the rain-fed areas that belong to the largest number of small producers.
- High market concentration in some segments of the value chain, such as trading, flour industry, financing, marketers, and inputs to farmers (certified seed, agrochemicals, fertilizers, etc.)
- Very small size of production units, which precludes improvements in production methods, and a better organization among small farmers.
- Commercialization margins show that producer's price represents a small proportion of the total chain margin, and that the wholesaler receives the higher proportion.

General recommendations

- Search for incentive schemes targeted at improving yields, especially in rain-fed areas. The wide difference observed between the irrigated and non irrigated land indicates that the potential to expand yields is significant. These schemes should include the creation of incentives to build irrigation infrastructure where water is available, or the utilization of improved seeds resistant to extreme water/ weather regimes where water is scarce. Likewise, shifting production to other crops in rain-fed areas where corn is not viable must be considered.
- There is evidence of market concentration in the value chain. This should be analyzed, as it might impede free competition. As in the case of wheat, in the corn value chain there is a concentration of market power in certain stages/actors. It is likely that there is an exploitation of an oligopsony or oligopoly power, and this could be affecting the primary production stage. This concentration seems to exist not only in the marketing/ processing of grains, such as the corn milling industry, but also in the sale of inputs and seeds to farmers. In the case of seeds, in the recent years the entry and massive expansion of transnational corporations has generated a significant concentration: in 2009, 95 per cent of planted hybrid seeds were produced only by Monsanto and Pioneer.[88]
- Promote research for the development and expand the utilization of improved seeds. The production and distribution of improved seeds is an important source of technology transfer to producers and,

along with irrigation and efficient use of fertilizers, it has positive impacts on yields.

- Strengthen the link between smallholder farmers and cooperatives and the agro-industry. Interesting opportunities could arise of stimulating the link between yellow corn producers and the pig and poultry industry. Supplier development programmes could result in valuable technology transfer, higher margins (avoiding intermediaries) and would also reduce the imports dependency.
- Strengthen, recapitalize, and revitalize small-scale agricultural producer organizations, for example, cooperatives such as the Avocado Producers and Export Packers Association of Michoacán. Over the long term, this would increase the farmer's negotiation power, give rise to economies of scale, allow small producers to participate in technology transfer and supplier development programmes, as well as in instruments designed to avoid the negative effects of volatility in their selling prices.

5. Small-scale farmers participation in high-value agriculture and food chains

Several countries have moved into producing non-traditional agricultural products to diversify their agricultural exports and increase foreign exchange earnings (Narrod et al. 2007). High value agricultural (HVA) products, such as fruit and vegetables or processed foods, offer interesting market opportunities and benefit from several advantages, including year-round demand in developed markets (as well as increasing demand from developing countries), higher income elasticities of demand in most cases and lower price volatility than many 'traditional' commodities (J. R. Davis 2006). HVA products have both downstream linkages in terms of employment they generate for producing and selling the demanded goods, and upstream linkages if the required specialized inputs such as fertilizer, seeds, etc, are produced with local labour.

However, HVA products are demanding in terms of their supply chains due to the perishable nature of the products and the stringent food safety standards and other specific standards in importing countries or in the modern sector in developing countries (e.g. supermarkets). For retail sectors these standards have turned into minimal entry requirements (before commercial factors such as price competitiveness, volumes, regularity of supplies, etc). These non-tariff barriers and how they impact on the functioning of agro-food markets will be discussed in chapter 2 of this report. this section focuses on how HVA products can turn into sustainable market opportunities for smallholders.

With increasing incomes, consumers not only become more demanding in terms of quality and safety standards, they also show more interest in tracing the products back to their origins. To this awareness technological improvements have greatly contributed as they enabled more rigorous monitoring of the chain. These trends are further nurtured by the media and thus required food retailers and their counterparts to adjust.

In their efforts to adjust to new standards of food safety and satisfy requirements of grading, consistency and supply schedule, Narrod *et al.* (2007) argue that smallholder farmers in developing countries face four distinct problems:

- How to produce safe food;
- How to be recognized as producing safe food;
- How to identify cost-effective technologies for reducing risk; and
- How to be competitive with larger producers.

To participate in the value chains of HVA products, large amounts of information and investments are required. In addition, relationships, networks, skills and coordination mechanisms matter greatly. This has led to the co-existence between traditional and modern urban and export markets with the latter two having more integrated and durable relationships within the supply chain, often on a contractual basis with a high degree of cooperation between buyers, exporters and growers on technology, information and sometimes even finance. Buyers often work very closely with farmer groups or with their own farms by providing training and technical support to facilitate compliance with the required standards, invite experts to train farmers on integrated pest management, pack hygiene, and establishing and maintaining a functional traceability system.

In this context supermarkets have increased their market shares. They tend to procure food from a few large-scale suppliers, which help them standardize the products. Similarly multinational firms have increased their presence in sourcing countries with higher

Table II.16: Horticulture marketing chain

	Traditional Sector	Modern Sector
Production	Large number of producers of varying sizes, with significant presence of smallholders	Fewer number of large scale farms (high input systems e.g. IPM varictics, irrigation, etc), some operating out-grower schemes with 3rd pary audited GAP systems, and full traceability
Packhouses	Producers use non-audited packhouse systems, producing product for a range of customers using manual systems	Fully audited (BRC or HACCP[11] certified) packhouses, often with automated grading and packaging systems)
Transport	May have refrigerated transport	Refrigerated transport from pakhouse to market or export point
Traders	Local traders oftern collect from a large number of rural farmers, and then sort for exporter's demands, No traceability	No intermediary traders in the chain
Processors	Minimal semi-processed products, usually confined to trimming and simple packaging	Processing plants to produce ready-to-eat and ready-to-cook, frozen or chilled fruits and vegetables. Oftern prepared into slices and cacuum-packed. Implementation of HACCP and audited by 3rd party.
Experter	Deal with range of players, often directly with farmers and traders	Export agents are used if the processing plant does not export directly.
Transport to expoert market	Transport vy sea or air - but sometimes problems with guaranteeing air freight space	Transport by sea or air, Air-freight managed either through own company or with firm contract with air companies.
Importer	Importer suppling wholesale, catering and some retail outlets.	Dedicated category manager will procure for whole supermarket chain, manages producers to ensure quality assurance, compliance with its requirements, responsible for technology development and informatin flows. May also seek new produc lines.
Wholesalers	Wholesale markets play an important role in the marketing chain in some importing countries.	Bypasses wholesale markets.
Retailers	Local retailers and superjmarkets.	Supermaket chains with high demands in relation to GAP, due diligence and traceability. Often with own in-house codes of practice and/or EUREPGAP, due regard also given to environmental and social welfare of all players in the supply chain.
Consumers	Local and international consumers. Impoerts.	Overseas consumers. USA, EU and Japan are main export markets, but regional markets are becoming more important (e.g. Middle East).

Source: Davis, J. (2006).[90]

involvement in the production, marketing and trade of food in producing countries. These developments exemplify that HVA value chains are strongly buyer-driven with greater levels of governance and vertical integration between retailers, their buyers and producers. Table II.21 summarizes stakeholders and key characteristics of the horticulture marketing chain for the traditional and the modern sector.

Production, transaction and marketing costs of sourcing from smallholders are high. The post-harvest facilities involve lumpy investment and entail economies of scale, hence, competitiveness is achievable only with high volumes. The dominant transaction cost in linking with smallholders is the cost of monitoring compliance with the International Food Safety Standards (IFSS) and the insistence on traceability by importers. The traceability and residues limit requirements further disadvantage the smallholders as they cannot access or benefit from technical support services (e.g. quality inspection and certification, testing laboratories) given that they generally imply a cost (Davis, 2006). This inhibits smallholders to refine products and make them marketable. Therein, governments as well as the international research community can play an important role by conducting and disseminating research on market requirements, demand and expectations, developing appropriate technologies and systems and building public-private sector research partnerships which account for the evolving standards and incorporate smallholders in their processes. By comparison, larger farmers can invest in specialized skills needed to comply with agrifoods safety standards and quality requirements (Collins 1995).

Access to finance and information to engage in HVA production practices and establish the required infrastructure and management system are inevitable. Given that a switch to new products entails a relatively high risk for small-scale producers in terms of becoming more indebted and uncertainty regarding the marketing of their outputs, public policy has an important role to play. A supportive environment is therefore essential to support the establishment of appropriate legal, regulatory and food control frameworks, land tenure, credit and water use systems.

Furthermore, collective action offers a means to over-come some of these barriers. For this purpose small-holders need to get well organized in producer groups which can pool resources and exert their negotiation power. They can address the following bottlenecks:

- Undertake investments to coordinate supply and upgrade hygienic conditions at the farm/packing house. Closely monitor handling and hygiene practices during harvesting, grading and packing. Set up testing laboratories.
- Disseminate information related to international food safety standards.
- Enforce standards: Certification is expensive and smallholders cannot individually bear the costs.
- Provide training and other technical support for production.

Producer organizations tend to have a comparative advantage in the activities related to production. For marketing activities, such as installation of cold chains and pre-cooling facilities, it can be more efficient to collaborate with specialized marketing agents who are also connected to exporters.

With regards to market access and agrifood safety and quality standards, Mexico, like so many other developing countries, do not have the institutional capacity, much less, the financial and technical resources to meet and enforce both mandatory public standards and voluntary private standards (Loader & Hobbs 1999). Chapter I Section D and Chapter II Section E detail the Mexico's agrifoods production and trade in the light of the global proliferation of standards, technical regulations and laws, including examples of recent food safety violations and its impact on trade.

6. Policy recommendations: enhancing competitiveness and integration into global agrifood value chains

This section analysed 15 agricultural commodity products that are of strategic importance to Mexico's agricultural development with the objective of assessing the sectors competitiveness. It was found that over the last ten years Mexico improved crop yields for two commodities (maize and dry beans) while for coffee, yields plummeted especially at the beginning of the decade. This latter finding is particularly worrisome as coffee yields also performed poorly in comparison to the global average, while for maize a slow catch-up process is observed. On the positive side, at the global level Mexico has a potential comparative advantage in sorghum and wheat production. The sector as a whole could maintain or even increase its strength

with a slightly increasing share of global agricultural commodities exports

Technology is a key input for competitiveness. The analysis of the technological aspects of crop production showed that controlled irrigation, fertilization and application of improved seeds have positive effects on yields and margins of most of the selected crops. Controlled irrigation was identified as the main factor for producing higher yields (especially for seasonal crops), while the lowest yields were observed when only rain-fed irrigation was available. This is particularly a constraint for small and low-income farmers as they tend to be limited to this type of irrigation. Results also indicated that fertilizers and seeds are mutually dependent, thus the highest yields are obtained when technological upgrades are simultaneously combined (introducing more than one technological variable).

Then gross margins are analyzed and found that results varied greatly by crop and by the combination of technology. Of concern was the existence of negative margins per ha particularly in the rain-fed irrigation group, in which the vast majority of smallholder farmers are included. Moreover, monthly average income per worker data revealed that crops generated very low incomes that risk leaving farmers in poverty. Average incomes of livestock producers were significantly higher. However, income data were only available at an aggregate level and thus income disparities by farm size could not be identified.

Thus for many smallholder farmers making a living of their agricultural activity is a challenge but at the same time they are rational agents. The fact that many of these producers operate with negative economic margins is indicative of (i) their production decisions responding to cash flow criteria (what I receive minus what I pay) with subsidies compensating and masking inefficiencies, (ii) a presence of multi-cropping where smallholder farmers draw income from the production of several crops or agricultural activities; and (iii) a presence of pluri-activities, combining agricultural and non-agricultural sources of income. Multi-cropping and pluri-activities and thus diversifying income sources work as an insurance mechanism as they allow farmers to spread risk.

In order to improve their prospects, smallholder farmers need to strengthen their productive capacities and find ways to better integrate into global agricultural value chains. They face many constraints that limit their ability to produce efficiently enough to provide a decent livelihood for themselves and to constitute a viable base of economic activity in rural areas.

The following policy recommendations are proposed to mitigate these constraints:

Facilitate access to credit and better technology

The lack of access to credit has been responsible for blocking investment in improved production methods and other infrastructures. Smallholder producers are caught in a vicious cycle of poor productivity, low returns, insufficient income, and underinvestment. As a result, they cannot access better technologies, such as fertilizers, irrigation systems or improved seeds, and are often poorly mechanized using inefficient and old machinery. State mandated credit schemes and models of contract farming could be envisaged in this context.

Enhance skills - training and access to information

Many producers lack knowledge of the most efficient production methods and relevant information for their production decisions, such as price information. Therefore the availability of extension services and sharing of information are essential. Some governments have successfully implemented farmer field schools with «train the trainer» schemes. As mentioned in the case of coffee, a market potential exists in organic niche markets given that adopted production methods already follow agro-ecological approaches.

Encourage strengthening of producer cooperatives / farmers associations

Given the small production volumes of smallholders, they forego scale economies and cannot exert bargaining power. Through being better organized in producer cooperatives or farmers associations, they could benefit from pooled input buying, setting up recognized grading and certifying systems, contracting warehousing and transport services, and negotiating prices with intermediaries, processors and exporters.

Capture more value of the value chains (vertical integration)

Underinvestment is evident not only in production itself but also in further steps of the value chain where it

further penalizes producers, such as the lack of storage facilities and access to basic processing facilities. This is critical for producers who are therefore forced to sell their production immediately following harvest, which dramatically lowers their bargaining power with regard to potential buyers. Concerning processing facilities such as simple drying, grain producers have only very limited access as it requires investment and additional skills. This inhibits them to retain more value added from their production as well as to have greater bargaining power with regard to buyers. To facilitate efficient trading and marketing, reliable and secure warehouses are of high importance.

Target subsidies

Currently subsidies are not benefiting smallholder farmers (there is leaking from the targeted smallholders to the non-targeted large famers). Targeting should be enhanced with clearly defined eligibility criteria to be closely monitored and time-bound exit strategies.

For southern smallholder farmers, the key challenge is to devise institutional arrangements which are able to reduce transactions costs and also induce a much stronger strategic commitment to investing in the required specific (and co-specific) assets. The way forward is likely to involve a rethinking of the role of the Mexican state (at sub-national, national and international levels) and of the roles of producer organizations and other stakeholder (including trader) associations.

Actions will need to have two aims: (i) to determine and elaborate an agreed way in which the state and other powerful chain actors can initiate deliberative processes and take a lead in encouraging appropriate asset-specific investments to support the market integration of smallholders into higher value markets. (ii) Initiate through public-private partnerships institutional developments which will have the state and other stakeholder (prominent among these major producers, exporters and supermarkets) acting as equal partners with producer organizations in formulating sectoral policies.

D. FOOD SECURITY: IN THE CONTEXT OF MEXICO'S AGRICULTURAL POLICIES AND TRADE

Food security has been a crucial concern in recent years, both at the national as well as the international level. This section analyzes food security issues in Mexico with respect to international food price increases and volatility and how it affected households in rural and urban areas. It explores ways in which food security can be improved through national and international policies.

FAO (2003) defines food security as the situation where all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life. Given that expenditure on food items constitutes for many families on lower incomes the bulk of their household expenditure, food security is closely associated with the evolution of food prices. It is thus not surprising that the increasing food prices, which since 2006 have risen by approximately 70 per cent, put pressure on the food consumption of millions of people and have even created food riots and social unrest in several developing countries (UNCTAD 2012). The World Bank and FAO estimate that between 119 to 180 million additional people have been pushed into hunger as a result of the 2008 food crisis. Figure II.26 depicts the prices of three important staples - wheat, maize and rice - and a composite food price index which show that prices have not only been increasing sharply but also been volatile.

Food poverty in Mexico, defined as the 'incapability to obtain a basic food basket,[90] even if using the entire household's available income for buying the goods in said basket', has been on a declining trend since 1996 (CONEVAL). The food crisis of 2008, however, pushed the percentage of the population in food poverty up from 13.8 per cent in 2006 to 18.2 per cent in 2008 (latest available data). At the same time, undernourishment (population whose food intake is insufficient to meet dietary energy requirements continuously) remained at a prevalence rate of below 5 per cent (World Bank). Thus, while the food intake in terms of calories was not negatively affected - in fact, on average, the daily food supply and dietary energy consumption increased (FAO) - the type of food consumed (food basket) had to be adjusted.

It could be expected that rising food prices have different impacts on urban and rural populations, as urban dwellers are mainly net food purchasers and thus fully exposed to the immediate negative consumption effect of rising food prices (UNCTAD 2012). However, in Mexico the share of food consumption expenditure in total household consumption is significantly higher in rural than in urban areas, which puts the rural population at higher risk of rising food prices (Figure

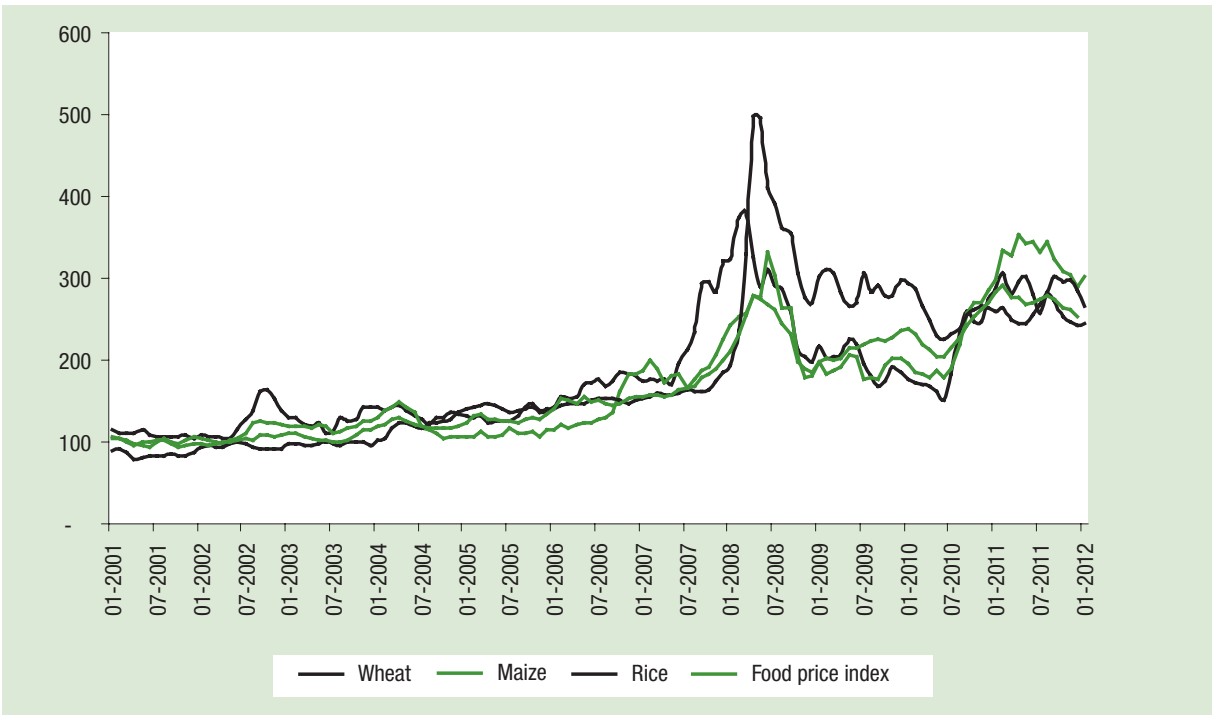
II.27). Moreover, CPI data for 46 cities suggest that food prices in Mexico City, which is by far the main metropolitan area, were not higher than in other cities. In fact, rather than a distribution by size of city, there is a geographical distribution, i.e. the food CPI tends to be highest in the Border States of the North and lowest in the South. This pattern may be the result of a high level of competition amongst food suppliers in Mexico City combined with more demand and higher transaction costs (i.e. transport costs for getting food to markets) in Northern than Southern states.

Securing sufficient access to food is not only an issue of domestic food production but also one of international trade as most countries, including Mexico, procure large amounts of food through imports. Such integrated markets led to price shocks on world markets being globally transmitted through the international trading system to domestic markets. This was particularly the case for wheat, rice and maize, but also for agricultural input prices such as fertilizers. Given that the latter have increased particularly rapidly (in 2008 urea registered a 59.3 per cent, potash a 184.8 per cent and dap a 123.6 per cent increase), input-dependent forms of agriculture have become less profitable.

Rising food prices have had a strong impact on the food import bills, especially in countries whose currency did not appreciate against the US dollar (such as the Mexican peso). In these cases, the import bills increased as a result of prices and not of volumes. The higher food import bills negatively affected the trade and current accounts and put strains on responsible macroeconomic management. In Mexico, the food import bill increased and reached as a share of GDP approximately 2 per cent in 2008 and 2009. Moreover, its food trade balance plummeted to -0.5 per cent of GDP in 2008, which was in stark contrast with the majority of the countries in South and Central America that are net food exporters.

Several countries adopted measures (see Table II.17) to mitigate the direct impact of rising food prices on their populations' food security. While in the short run the protectionist measures delayed the transmission of the price inflation on the international market to domestic consumers, they came at a high cost in the medium run, even for food exporting countries. Once

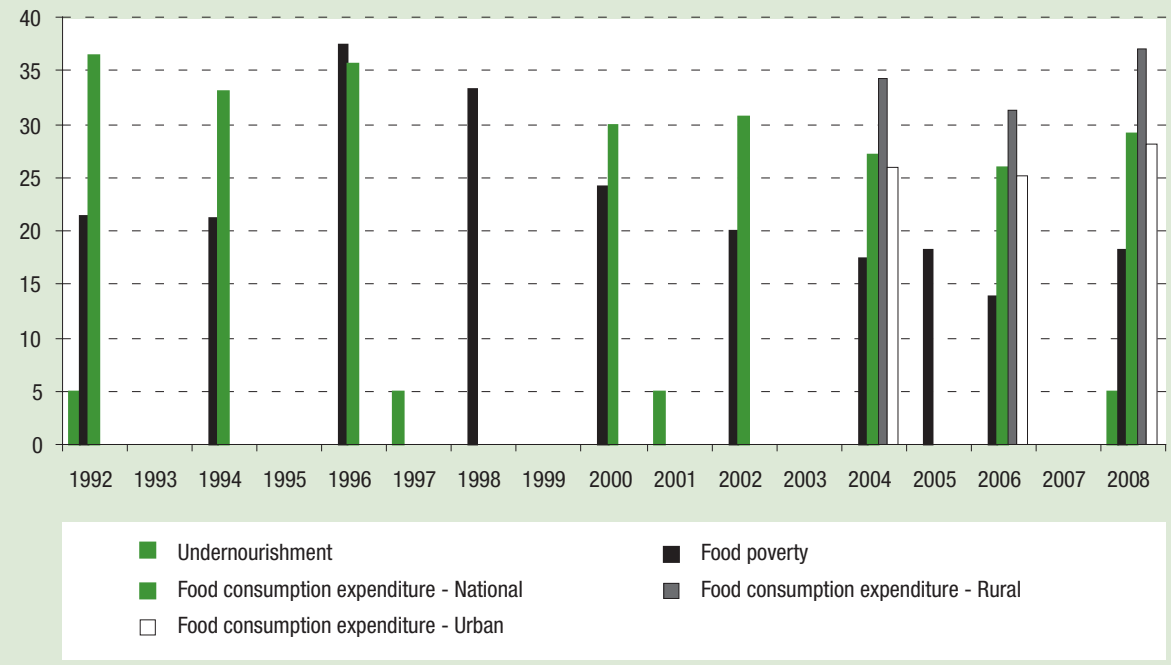
Figure II.26: Recent food rice spikes, 2001-2011



Source: UNCTADStat

Note: Wheat: United States, n°2 Hard Red Winter (ordinary), FOB Gulf, Maize (Maize): United States, yellow n°3. Rice, Thailand, white milled, 5 per cent broken, nominal price quotoes, FOB Bangkok.

Figure II.27: Percentage of undernourished population, food poverty and consumption expenditure on food in Mexico, 1992-2008



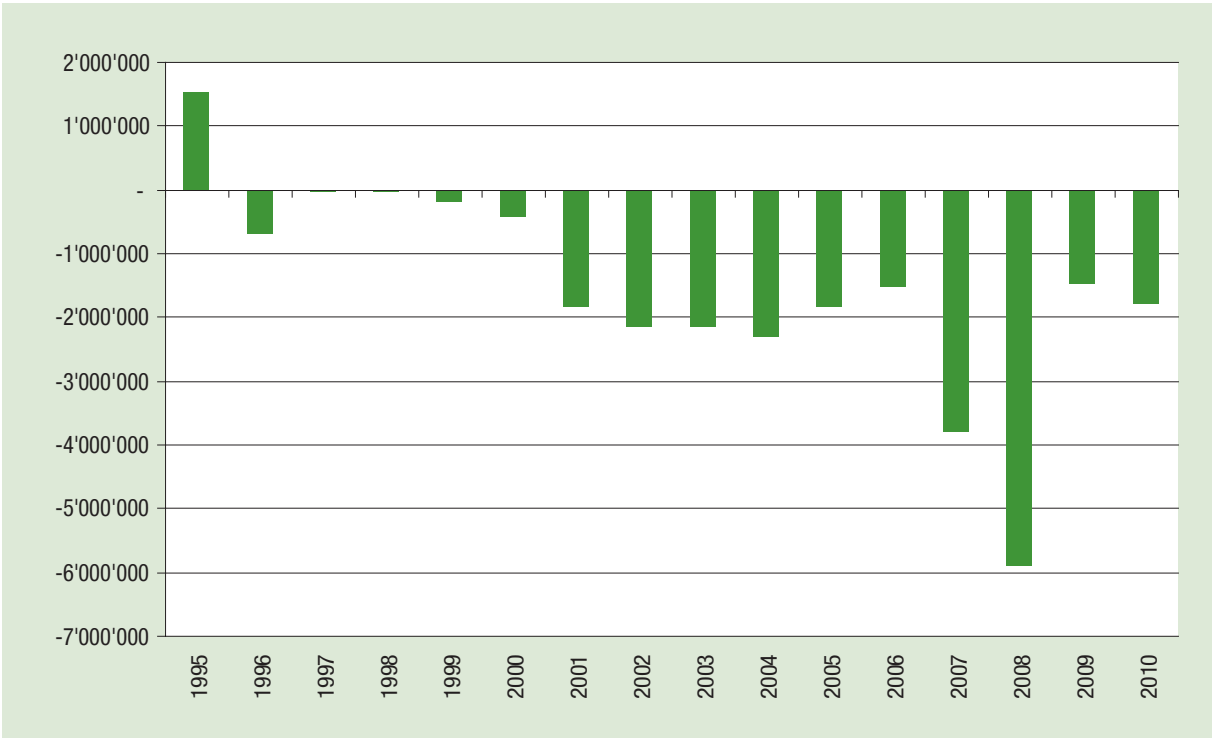
Source: World Bank (undernourishment), CONEVAL (food poverty), FAO (share of food consumption expenditure to total household consumption)

the measures could no longer be maintained food had to be procured from international markets where prices were still high and thus the transmission produced a strong price shock on the domestic market. Moreover, the measures worsened the relations between the exporting country and its import-dependent trading partners and decreased incomes of domestic producers as they had to sell at lower domestic prices (set by price controls). Naturally, the net food importing countries suffered most and had to rely on their foreign exchange reserves to cover the increasing import bills.

The government of Mexico announced three types of measures to alleviate the impact of rising food prices on the poor in May 2008: cut or eliminate import tariffs on some food products, including maize, wheat, rice and soy meal, provide more support to farmers to increase production, as well as provide further support to families on low incomes. The president also announced the creation of a strategic maize reserve.[91] In the previous month Mexico established a food support programme in priority areas, which aimed at improving nourishment and nutrition in households in very isolated areas not covered by other Government food programmes. Moreover, in June of that year the government, in accordance with industry, decided to freeze the prices of more than 150 food products until the end of the year.[92]

Food prices have not only been increasing, they have also been marked by high volatility, especially since 2006. This generated additional challenges, such as fluctuating revenues from food exports which made fiscal planning more difficult, farmers facing higher uncertainty which made optimal production decisions almost impossible, and the increased risks associated with volatility worked as a disincentive for farmers' willingness and ability to invest. Thus, while the combination of rising and volatile food prices triggered a series of measures that provided some relief in the short term, they did not address structural problems of agriculture and rural development in the country, a symptom of which could be the continued internal migration from rural to urban areas.

Figure II.28: Mexico's food trade balance, 1996-2010 (iin US$ 1,000)



Source: UNCTADStat

Table II.17: Policy responses to rising food prices, 2008-2010

Consumption	Production	Management and regulation of food markets
Possible responses: • Food assistance • Cash transfers • Food for work • Price subsidies • Price controls • Taxes	Possible responses: • roducer input subsidies • Lower taxes • Other support	Possible responses: • Lower import tariffs • Export bans / tariffs • Build-up of food reserves • Price support • Import bans or raise tariffs
Mexico's response: • Food support programme in priority (isolated) areas not covered by other Government programmes • Price controls	Mexico's response: • A 10% increase in credit for the rural sector through Financiera Rural and FIRA	Mexico's response: • Lower or eliminate import tariffs in third country markets.* • Maize reserve

Source: (UNCTAD forthcoming; ECLAC 2010)

* Tariff were eliminated under NAFTA in 2008.

Policy recommendations: for increasing food security and agricultural productivity

To improve food security in a sustainable manner actions are required at both the national and international level. On one hand, Mexico needs to raise its agricultural productivity and implement institutional mechanisms that can prevent or quickly react to food shortages, while on the other hand, the international community should also assume responsibility for setting up mechanisms that limit sharp price spikes and curtail severe volatility of food prices.

As discussed in the previous section a country's agricultural productivity is the result of a combination of natural (including climatic) and locational factors which determine crop suitability and accessibility to markets. During 1995 and 2010 Mexico's agricultural sector as a whole could maintain its strength with a slightly increasing share of global agricultural commodities exports. In terms of cereal yields (Figure II.29), however, Mexico's productivity was in general below the world average except during the last decade when the gap nearly closed. Climate change has the potential to aggravate agricultural productivity when it hampers land productivity and/or decreases the availability of arable land. The country benefits from rich soils and a favourable climate for agriculture with regular rainfall and more than 50 per cent of agricultural land, part of which can be cultivated perennially. However, several interviewees pointed out that agriculture has been increasingly affected by phenomena of climate change such as unusual frosts in the North, more flooding in the South, severe droughts and land degradation. Given its geographic location, Mexico is close to one of the main markets in the world (United States)[93] and has the potential to be well connected to the east as well as the west. However, this competitive advantage is partly offset by higher land and maritime transport costs in Mexico than, for instance, the United States (IMC n.d.).

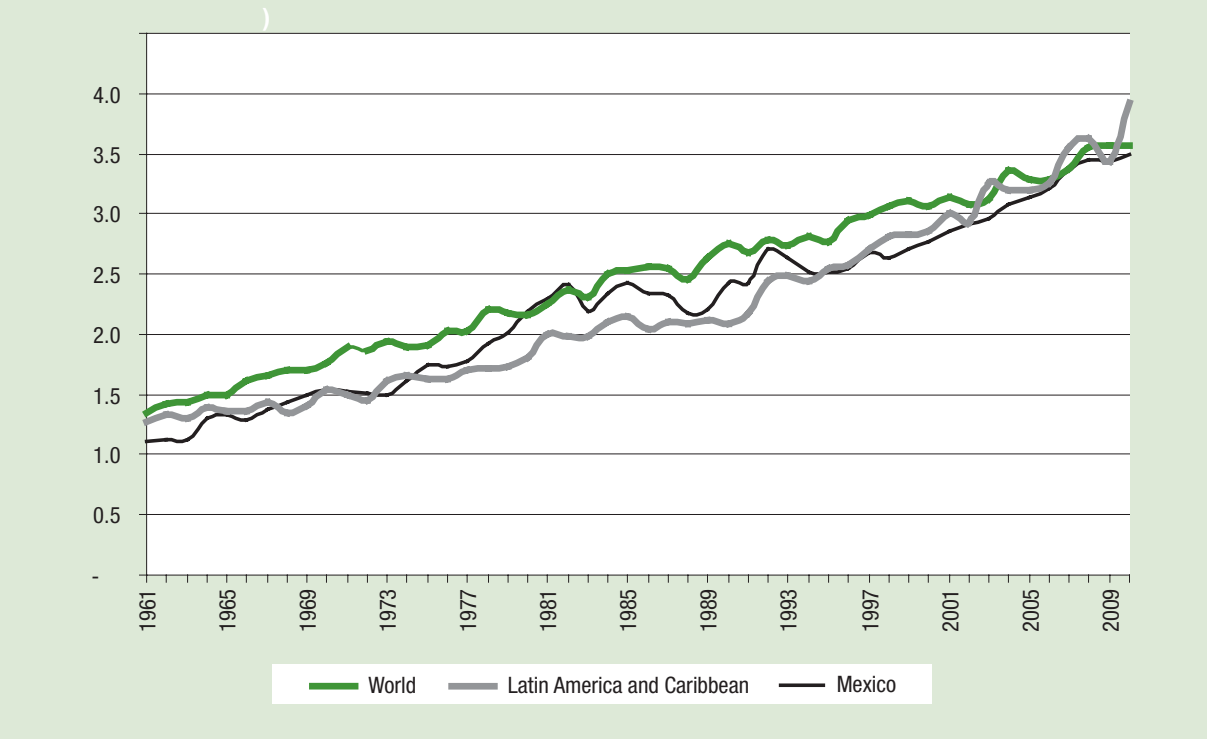
The adoption of technology is a major driver of productivity. As shown in Section C.3 of this Chapter, the introduction of methods comprising controlled irrigation, fertilizers and improved seeds has positive impacts on yields per ha. Access and use of technology, however, varies greatly amongst farmers.

In order to increase domestic food production, Mexico should adopt policies that stimulate agricultural productivity. But the development of agriculture as the basis for enhanced food security and poverty reduction requires extending the analytical and programmatic perspective beyond the narrow confines of farming to encompass a macroeconomic perspective that emphasizes the importance of generating an increasing agricultural surplus, which requires agricultural labour productivity growth to exceed the growth of labour's own consumption requirements by an increasingly larger margin' (UNCTAD, 2011). An agricultural surplus does not only generate non-agricultural growth from the demand as well as the supply side, but also tends to lower the system's exposure to food-price inflation. Following the discussion in the previous section, policy should aim to enable farmers to better integrate into global value chains and also participate in high value added agriculture products which generate higher incomes.

With regard to institutional mechanisms to prevent or quickly react to food shortages, Mexico could establish an emergency fund, which could rapidly disburse resources when relevant criteria are met. Secondly, setting up more and efficient warehouse receipt systems would enable farmers to store their produce and sell when prices start rising, thereby increasing their incomes and resources for investment, lowering the volume of food that perishes, and facilitating their access to credit if warehouse receipts are accepted as collateral. Thirdly, as part of financial innovations, the government could further expand its hedging strategy for grains and other crops, which aims to protect farmers from price volatility. The current programme consists of buying options contracts and providing subsidies to producers and the Mexican food industry farmers, but the strategy may expand to trading in over-the-counter markets.[94] Fourth, lessons could also be drawn from successful experiences with food-for-work programmes. Botswana, for instance, implemented a food access programme consisting of human supplementary feeding and cash for work (public work schemes), with the notable result that even in the country's worst drought no death of hunger was recorded (Asefa 1991).

At the international level, several initiatives have been taken to address food insecurity, notably through the G20. In the Final Communiqué of the G20 Leaders Summit (November 2011) and the Ministerial Declaration of the G20 Agriculture Ministers entitled 'Action Plan on Food Price Volatility and Agriculture' (G20 2011), a series of recommendations and commitments were put forward for stimulating agricultural development and mitigating food price increases. They include, amongst other

Figure II.29: Aggregate Mexican cereal yields compared with world and regional averages, 1961-2010 (in tones/Ha)



Source: FAOstat

- Better regulation and supervision of agricultural financial markets based on the endorsement of the IOSCO recommendations to improve regulation and supervision of commodity derivatives markets
- Investment in and support for research and development of agriculture productivity
- Launch of the 'Agricultural Market Information System' (AMIS) to reinforce transparency on agricultural products' markets, and within this framework establish a 'Rapid Response Forum'
- Development of appropriate risk-management instruments and encouragement of vulnerable regions to integrate risk assessment and management strategies into their agricultural development programmes[95]
- Development of appropriate humanitarian emergency tools; food purchased for non-commercial humanitarian purposes by WFP not to be subject to export restrictions or extraordinary taxes
- Adoption of the International Research Initiative for Wheat Improvement (IRIWI)
- Launch of a Global Agricultural Geo-Monitoring Initiative
- Creation of an enabling environment to encourage and increase public and private investment in agriculture, including public-private partnerships
- Promotion of sustainable crop diversification and agricultural systems
- Upholding of the 'Principles for Responsible Agricultural Investments'
- Finalization of the Doha Development Round

The issue of setting up grain reserves has also been receiving renewed attention from policy makers as part of these discussions. In this context, it may be useful to incorporate lessons learned from existing systems and the challenges that were faced by the recent food crisis in the design of such supranational grain reserves. Therein, new regional reserves initiatives should aim for the following: (i) setting achievable objectives, (ii) identifying feasible scale and components, (iii) identifying mix of commodities to stockpile, and (iv) aligning interest of exporters, importers, rich and poor

neighbors (UNCTAD forthcoming) The existing system in the Latin American and Caribbean region called Latin American and Caribbean Emergency Response Network (LACERN) could be further developed along these lines. Currently it serves, as its name suggests, as an emergency response (SWAC 2010).

E. AGRIFOOD STANDARDS, TECHNICAL REGULATIONS AND LAWS, AND TRADE

1. Proliferation of standards in agrifood production and trade and food safety incidences relevant to Mexico

Over the past 30 years, there has been a proliferation of stringent food safety and quality standards, both public (mandatory) and private (voluntary) standards, often complex technical regulations and food laws in the marketplace, applied especially in major developed and emerging economies. This phenomenal rise in standards is reflective of the heightened public policy responses of governments in the wake of global concerns over human and animal health (sanitary), plant protection (phytosanitary), climate change (environment), ethics (fair trade) and more. The global media is replete with news of the agrifood industry being inundated with rising incidences of food- and water–borne illnesses in the global food chain. These include, among others, Escherichia coli (E.coli) bacteria (in food and water), Listeria monocytogenes (avocados), 'mad cow disease' or BSE–Bovine Spongiform Encephalopathy (beef), avian flu (poultry), melamine (infant milk), Salmonella typhimurium (peanuts), Salmonella Enteritidis (shell eggs), Listeria (avocados), growth hormones (feedstock), and pesticide residues (fruits and vegetables).[96] Many of these food- and water-borne illnesses have been documented – press, electronic media, studies, research and analysis – as prevalent in the global agrifood supply chains. In the context of this report, Mexico's agrifood trade with U.S. and other countries has been linked to some high profile incidents of food borne illnesses. Tables II.23 and II.24 highlight some of the food safety and phytosanitary problems related to Mexico's agrifood trade in the U.S. market.[97] Section D in chapter I discusses in detail the issue of standards and other non-tariff measures in international trade. This section focuses on food safety standards linked to Mexico's domestic production and administration.

These have led to human fatalities, rising health – insurance and hospitalization – costs, major food recalls, and filing of expensive lawsuits.[98] Also the costs to the food industry tend to increase in tandem with the rising panoply of NTMs. These costs, both direct and indirect, are linked to production, adjustments, research and analysis, technology and innovation, and inputs (e.g. energy). Also there are costs which are associated with regulatory (e.g. sanitary and phytosanitary) compliance[99], standards and certification, audits and conformity assessment systems, and third party validation programmes. The resultant high costs not only squeeze profit margins and deteriorate the terms of trade of Mexican farmers, but raise the overall cost structure of the economy, with the industry (e.g. higher adjustment costs for food processors) and consumers having to pay higher prices at the retail end of the supply chains.

A recent UNIDO (2011) report on border rejections of agrifood reveals sector and product, as well as systemic weaknesses, in compliance capacities in a group of countries, including Mexico. During the period between 2002 and 2008, the total EU and U.S. border rejections of food products, although small in terms of value, averaged $72 and $71 million per year, respectively. Nuts and seed dominated ($55 million) the EU rejections. Meanwhile fish and fishery products ($47 million) and fruits and vegetable ($21 million) dominated U.S. rejections. During this period, the total number of U.S. border rejections of food products from Mexico totaled 11,926, with an annual average 1,500 rejections. Mexico accounted for 25 per cent of U.S. rejections of fruits and vegetables. The U.S. unit rejection rate[100] for herbs and spices was much higher than any of the other commodities analyzed over the period 2004-08. Mexico, Sri Lanka, Canada, Thailand and Guatemala recorded unit rejection rates above one. In fact, Mexico had the highest U.S. unit rejection rate of almost three rejections per $1 million of exports over the period 2006-08. The main reasons for U.S. rejections of agrifood exports from Mexico ranged from filth unsanitary (3,476 rejections), labeling (3,328), pesticide residues (2,109), unauthorized food additive (1,475), microbiological contaminants (1,328), and the lowest (1 case) for adulteration.[101]

Table II.18: Value of US border rejections of agrifood products from selected countries 2004-2008 (US$ Millions % of total)[105]

Country	Fruits and Vegetables	Fish and Fishery	Nuts and Seeds	Herbs and Spices
Mexico	24.6 (23)	5.2 (2)	1.3 (20)	1.0 (13)
China	26.7 (25)	53.0 (23)	1.2 (19)	0.5 (6)
India	-	11.6 (5)	1.9 (30)	3.6 (47)
Brazil	7.3 (7)	4.9 (2)	-	0.7 (9)
Total	106.4	234.8	6.4	7.7

Source: UNIDO (2011). Trade Standards Compliance Report 2010 (www.unido.org/tradestandardscompliance). Data from Tables 3, 9, 15 and 21.

Notes: (i) The totals may not add up to hundred percent because data from other countries are not included here.
(ii) - (das) means negligible

Table II.19 highlights selected incidences of food safety and trade issues, in particular, food borne illnesses, linked to Mexico's agrifood trade with U.S. during the period 2003-2012.

2. Mexico's food safety laws and agrifood trade

Mexico's food safety laws are anchored on (1) the Plant Production Law (revised 2008), and (2) the federal General Health Act. The Plant Protection Law authorizes the Secretaría de Agricultura, ganadería, Desarrollo Rural, Pesca y Alimentación de México (SAGARPA) – the Agriculture Secretariat – to regulate plant health, implement systems to reduce risks contamination, including minimum sanitary measures and defines good agricultural practices (Buenas Prácticas Agrícolas – BPAs) in agrifood production. Implementation of BPAs and BPMs are not mandatory. The Secretaría de Salud (Health Secretariat) exercises its powers with respect to food safety through the Comisión Federal para la Protección Contra Riesgos Sanitarios (Federal Commission for Protection Against Health Risks (COFEPRIS).

These laws do not mandate traceability of agrifood 'from farm to fork'. However, the voluntary Programa de buenas practicas agricolas (BPA) y de empaque (BPM) require farms and packing houses to cover good agricultural practices for production, storage, packing and maintain records of fresh fruit vegetables from the field to the store. Whether these schemes integrated the HACCP approach or HACCP-based hazard analysis in their development remains unclear. However, during the period 2006-2008, 1047 farms and 294 packers had implemented BPA and BPM, respectively.

In 2003, the México Calidad Suprema (MCS) brand was established for a wide-range of agrifood products. It is operated by growers, packers and producer organizations. The program specification covers; health, food safety and quality, product traceability and management. To be certified, fresh-cut processors must have HACCP in place, and must be in compliance with BPA and BPM requirements. Farms and packers certified by MSC have exported fresh produce to the U.S. Mexico had also developed MexicoGAP, which covers only fruits and vegetables. It is operated by MCS. As of 30 April 2010, GlobalGAP, upon which MexicoGAP is benchmarked, reported 24 farms certified to MexicoGAP.[102]

There are considerable challenges in the marketplace in terms of food safety and quality requirements, not forgetting technical regulations and food laws that Mexico agrifood producers and exporters must comply with or meet in order to export, particularly to the U.S. which is by far its largest destination market for its agrifood products. There are also significant challenges facing Mexican agrifood producers, packers and exporters entering the U.S. market in particular, and markets of its other trading partners. The next section provides key areas that require attention from all sectors – public and private actors, particularly those organizations engaged in Mexico's agrifood supply chain.

3. Policy recommendations: towards improving standards compliance

The Government of Mexico, through SAGARPA and Health, should keep on track with its reform and mod-

Table 19: Selected incidences of food safety and trade issues related to Mexico's agrifood trade with U.S., 2003 – 2012

Period	Agrifood Product	Food Safety and Trade Issue	Geographical Spread	Outcome
May 2012	Poultry	H7:N3 avian (or swine) flu virus outbreak.	Jalisco, Mexico[A]	Mexican authorities culled 870,000 chickens, and declared national emergency to prevent the spread of the avian flu to other parts of Mexico.
July 2011	Papaya – fresh, whole and unprocessed.	Salmonella Agona bacteria – contamination in papaya imported from Mexico.	U.S. and Canada	U.S. FDA released potential outbreak of Salmonella in papaya imported from Mexico by Agromod Produce, Inc., in Texas. Agromod Produce, Inc. voluntarily recalled all its four brands of papaya – Blondie, Yaya, Mananita, and Tastyilicious – sold to retail shops and wholesalers.[B]
May 2011		Salmonella bacteria – contamination in fresh, whole and unprocessed papayas from Mexico.	Texas, and Bronx, NY, USA	The Papaya Maradol brand fruit was distributed by Caribe Produce Co. Inc., McAllen, Texas. Caribe Produce notified all its wholesale and retail customers, and recalled 286 cartons of the Maradol Caribena Brand. No illnesses were reported.
July 2009	Cilantro – herb	Salmonella bacteria	U.S. States – Texas, Oklahoma, Colorado, Louisiana, and New Mexico	In-house testing by U.S. importer, Frontera Produce, Texas detected Salmonella in the Cilantro herb. No illnesses were recorded.
June 2008	Tomato – raw, round and red	Salmonella bacteria	Mexico – tomato producing States in Mexico, for example, Sinaloa.	U.S. FDA probed the contamination of Salmonella in raw red tomatoes originating from Mexican (and Florida). Tomato is Mexico's $1-billion export industry. Although the FDA did not impose a ban on imports, its official probe plunged sales resulting in millions of dollars in economic looses to Mexican producers, exporters and distributors.
June 2008	Pepper – Jalapeño	Salmonella bacteria	Georgia and Texas, USA	Jalapeño peppers were recalled by the company, Agricola Zaragoza, Inc.., McAllen, Texas. The recall followed scientific test results which revealed that jalapeño peppers from Mexico were contaminated with the Salmonella Saintpaul virus. 1,200 illnesses were linked to Jalapeño peppers.
June 2008	Pepper – Jalapeño	Salmonella bacteria	Georgia and Texas, USA	alapeño peppers were recalled by the company, Agricola Zaragoza, Inc.., McAllen, Texas. The recall followed scientific test results which revealed that jalapeño peppers from Mexico were contaminated with the Salmonella Saintpaul virus. 1,200 illnesses were linked to Jalapeño peppers.

[A] Jalisco is Mexico's largest poultry producing region, accounting for over 3 million metric tones of poultry products – meat and shell eggs – per year.

[B] At least 109 illnesses, including 10 hospitalizations, across 23 States in U.S., were linked to Salmonella Agona contamination of papayas imported from Mexico.

Period	Agrifood Product	Food Safety and Trade Issue	Geographical Spread	Outcome
September 2005	Infant Milk Formula	Tainted Infant Milk Formula – meant 'only' for animal feed were exported to Mexico for human consumption.	Mexico – 14 distributors of dairy products in Mexico, including Obregon and Chihuahua.	The State of Texas sued and won court ruling against the distributor Milky Way Traders Inc. (now Via Lactis) of El Paso, for exporting 27,000 tonnes of tainted infant milk formula for human consumption to Mexico. The distributor was fined a total of $48,000 in court fines and fees. Mexican authorities (i) obtained restraining orders halting Milky Way Traders from distributing the tainted baby formula in the country, and (ii) impounded products shipped or on their way to 14 dairy distributors who bought stock from Milky Way Traders.
August 2004	Candy	Lead contamination – unacceptably high levels of lead found in four candy flavors.	Illinois, U.S.	State of Illinois imposed statewide embargo on the sale of the 4 candy flavors – Lucas Limon, Supa Lucas. Lucas Acidito, and Lucas Limon eon Chile – which were produced by Lucas Candies, a subsidiary of Mars, Inc. In August 2004, the Chicago Department of Health had also embargoed to sale of candy from Mexico for containing high levels of lead.
November 2003	Green onions	Hepatitis A virus – in green onions imported from Mexico.	U.S. States – Pennsylvania, Tennessee and Georgia.	4 deaths, 660 illnesses and 9,489 immunization injections due to the Hepatitis A outbreak. The outbreak was linked to the consumption of green onions that originated from Mexico.[C] U.S. FDA and Centers for Disease Control (CDC) inspectors visited farms in Mexico, accompanied by officials from Mexico.[D] FDA and CDC confirmed the Hepatitis A outbreak was caused by green onions from Mexico, after tracing its source to farms in Mexico. The Government of Mexico shut down the four firms that exported green onions to the U.S. for failing to meet good agricultural practices in their processing facilities.[E] U.S. and Mexico authorities engage in joint programs to ensure safe and quality agrifood entering U.S., and improve the health of citizens on both sides of the border. For example, the Government of Mexico implements a grower inspection program on a regular basis in order to prevent further occurrences of the same 'at the source.

Notes:
(i) The totals may not add up to hundred percent because data from other countries are not included here.

(ii) – (dash) means negligible.

[C] 660 confirmed cases of Hepatitis A in Pittsburgh, Pennsylvania. The victims were linked to consumption of green onions – 'salsa' – at the Beaver Valley Mall Chi Chi's restaurant. FDA and CDC traced the source of the green onions to two farms in Mexico. Chi Chi's restaurant filed for bankruptcy, and closed all its restaurants in September 2004. This Hepatitis A outbreak is considered to be the largest in U.S. history.

[D] Four Mexican companies implicated in the Hepatitis A outbreak were; Dos M Sales de Mexico, located in Mexicali and San Luis Rio Colorado; Agricola La Laguna, or Sun Fresh, of Ensenada; Tecnoagro International in San Luis Rio Colorado and Ensenada, and Agro Industrias Vigor in Tijuana, Ojos Negros and San Quintin, Baja California

[E] However, Mexican officials have maintained that there was no evidence linking the Hepatitis A outbreak to green onions originating from Mexico.

ernization of the national food safety laws and regulations, in order to fully establish new public oversight of its agrifood supply chains. Overcoming trade-related standards compliance challenges needs innovative technical assistance. It also requires additional resources – financial and technical assistance – for training, innovation and technology transfer, and capacity-building on the ground for farmers, producers, packers and exporters. Technical knowhow on the market entry requirements of NTMs, particularly standards and technical regulations, as well as the implementation of both public (mandatory) and private (voluntary) food safety certification schemes by small producers, processors, packers and exporters in Mexico's agrifood supply chains is critical for export success.

Given the direction of trade for agrifood to the U.S. market, it is imperative that Mexico periodically review and maintain its agreement on food safety rules with the U.S. In reviewing the agreement, as and when necessary, it is necessary to invoke provisions on technical and financial support for Mexican agrifood sector so that it strengthens, 'at the source', the scientific and public health risk related to food safety regulation before the products arrive in the U.S. market. This would entail reviewing the provisions under NAFTA and other free trade agreements Mexico has with other countries

As the US shifts focus away from reaction and response to prevention of food borne illnesses from the 'farm to fork' (Food Safety Modernization Act, FSMA, signed into law in January 2011),, the Government of Mexico may consider engaging in consultative dialogue with its U.S. counterparts, the FDA, and seek technical and financial support in order to continue its reforms, improve, and scale-up its national food safety programs. The FDA is mandated by the FSMA, under the 'importer compliance certification' provisions, to provide such assistance to foreign governments, such as Mexico, so that these countries are able to add value to their products as well as improve process management procedures – on- and off-form packing and handling, storage, and shipment facilities. Improvements to the process or system management entail the development and implementation of the science- and risk-based HACCP procedures and standards which is purported by FSMA. This type of strategic assistance programs – through FMSA provisions – would most certainly assist Mexico tot develop and implement prudent preventative measures so that food borne diseases and trade consequences are prevented at the 'at the source'. Doing so will also help improve the public (consumer) confidence knowing that the preventative measures should be able to halt, if not safeguard, the borders so that the agrifood products that do enter the U.S. market are safe and healthy. However, in the implementation of the FSMA provisions, it is imperative that FDA be aware of, and takes into account the adverse consequences it may have on the Mexico's agrifood industry costs, its impact on domestic food prices, product diversity, and options for diversification.

Assistance sought from these avenues should then be invested into Mexico's agrifood sector to develop and implement credible internationally recognized public or private food safety certification schemes. This is important, given the credence the U.S. FDA gives to the use of third-party certification programs for extending its oversight of imported agrifood and feeds.

Finally, there should be joint programs – e.g. seminars, capacity building training programmes, etc., – in conjunction with key Mexican authorities, both public and private, and major trading partners, U.S., Canada, China, Japan and others. For example, given the economic importance of meat and meat products trade between U.S. and Mexico, it may be prudent for the key partners in U.S. (e.g. American Meat Institute) and the Agriculture Secretariat (SAGARPA, Mexico) to conduct tailor-made seminars and training at key border crossing locations (e.g. Reynosa, Tijuana, Nuevo Laredo, Ciudad Juarez) to help familiarize customs authorities with U.S. food safety systems and the safety requirements of meat and meat products. This is made all the more urgent and necessary in the light of the October 2011 invocation of the cross-border trucking provisions under NAFTA by the U.S.

F. MAJOR PUBLIC AND PRIVATE POLICY ACTIONS: TOWARDS REVITALIZING AND ENHANCING THE COMPETITIVENESS AND GROWTH OF MEXICO'S AGRIFOODS SECTOR, AND SUSTAINABLE RURAL DEVELOPMENT

Agriculture's declining importance, both in terms of GDP and merchandise exports, and its continued

marginalization in the public policy, particularly the neglecting of small-scale farmers in agricultural support services and programmes pose profound impact on the prospects of Mexico's broad-based economic growth and sustainable development. In the main, federal government-sponsored agricultural and rural development support programmes and services channeled through key government agencies – e.g. SAGAPA – are lacking, if not, insufficient to raise the competitiveness of small-scale farmers, spur sectoral growth and reduce rural poverty. What is more: significant proportions of the federal support programmes and services accrue to large-scale producers and firms engaged in Mexico's agricultural sector, which are well organized and resourced, and command considerable political clout to influence government policy.

Despite this, the sector's multi-functionality and its intricate linkages with other productive sectors of the economy offers solid prospects for sustainable livelihoods and poverty reduction for the millions of Mexican farm families. Further the sector is the principal depository for Mexico's rich and diverse cultures, history, landscapes and natural capital. It is prudent, therefore, to 'get it right' with both public and private policy reforms and actions so that the sectors' chronic problems – e.g. poor infrastructure, lack of support services (e.g. access to finance and credit), economies of scale, declining terms of trade, rising input costs (e.g. fertilizers), low and declining public investment, economic marginalization of the sector, etc. – are addressed comprehensively, so that agriculture regains its rightful place in Mexico's economic and development agenda now and into the 21st Century.

In drawing together the disparate elements to map out the major recommendations for both public and private policy actions, *first* the case for policy reform is made, and *second* the parameters for policy reform in key areas of Mexico's agricultural and food sector are elaborated.

1. The case for policy reform

The various subsidies that constitute government support to agriculture were introduced at different times and for different reasons. Despite the existence of the Special Programme (PEC), there is no clear policy coherence between these government programmes and support measures. By far the largest agricultural subsidy is PROCAMPO, which is a system of direct payments per hectare unrelated to need, price or production. This subsidy is poorly targeted, with 29 per cent of the total going to the top income decile and 57 per cent going to rural populations.

According to SAGARPA, the current agricultural support system lacks both efficiency and effectiveness and is not results-oriented. The objectives of the various support measures are inconsistent and the PEC has not succeeded in creating clear overarching policy goals and implementation guidelines. It is common knowledge, that there has not been sufficient investment in the provision of public goods, particularly rural infrastructure, information and communication services, single payment scheme (SPS) systems, soil conservation, and agricultural research and extension services.

Rural development legislation (e.g. AFA and NAC) as well as the PEC programme have been unsuccessful in coordinating and harmonising the various agencies and programmes under their purview. According to SAGARPA, 52 public programmes that support rural development show significant areas of duplication, 19 indicate complementarities and 4 a cross-purpose. Therefore, the governance structures of current policies lack enforcement coordination across the various actors proactively engaged in these programmes to effect change and realize the stated objectives. This situation is not at all helped by the shortages in human capital and material resources, which in turn impede programme implementation, as well as its monitoring and evaluation. As a result, there is little conformity of programmes with deadlines and objectives. Importantly, it is also recognised that there is a need to create a system to ensure popular consultation for programme design and for effectiveness monitoring.

The major problem with regard to the current policy environment, insofar as it concerns the agrifood small-scale producers and producer organizations, beyond the lack of support for productive capacity development, is the lack of policy reliability and predictability.

In terms of rural finance, the Financiera Rural has put in place a number of initiatives to improve the access of producers to financial services and products. However, currently these initiatives are not reaching the intended targets — small-scale farmers. This is partly due to the strict regulations that govern the conduct of its operations, and the paucity of commercial banking services in rural areas.

There is a clear need to reform the current situation of Mexico's agricultural sector. In particular, the situation of smallholder producers must be improved. Productive and efficient small farmers are central to effective rural development, as they are both significant contributors to domestic food security, as well as of the engines of rural economic activity that can counteract poverty and emigration. Building a prosperous rural sector therefore requires smallholders to not only carve out a decent livelihood from their farming activities, but also sustains the natural capital into perpetuity.

2. Parameters for policy reform

Policy reforms and line activities have two objectives: (i) to define and implement means and ways, either unilaterally or collectively (e.g. strategic partnerships), to induce appropriate asset-specific investments that supports integration of smallholders into higher value markets, and (ii) to initiate institutional reforms through public-private partnerships, and non-governmental organizations (NGOs) including producer-organizations, towards formulating sectoral policies that impact them (farmers).

To achieve these objectives, the suggested parameters for policy reform ihave been grouped nto eight actionable themes:

- Expand access to finance among rural populations;
- Develop risk-management options;
- Build productive capacity;
- Resolve commodity value chain imbalances;
- Improve market access and compliance with agri-foods standards;
- Recommit to basic rural infrastructure and other public goods;
- Address international trade imbalances, and
- One-stop-shops' for rural services delivery.

2.1. Expand access to finance among rural populations

- Improve access by:
  a. Encouraging private financial institutions in better serving the rural areas through incentives, infrastructure provision, and by better publicizing the real savings potential of the rural population.
  b. Facilitating state mandated credit schemes
  c. Developing the role of non-bank financial institutions in the provision of basic financial services in rural areas (e.g. post offices, petrol stations, corner shops, etc.) through incentives, appropriate regulation, and information campaigns.
  d. Helping to expand the use of ICTs to improve rural banking through infrastructure provision, appropriate regulation, and information campaigns.
- Encourage the development of more appropriate financial products to meet the needs of producers through incentives, regulation, and information.
- Address issues related to land tenure to help small and medium producers to use their land as collateral.
- Develop financing models that focus on building credit arrangements around the supply chain itself. For instance, use 'factoring' as a tool to finance trade, in order to help small-scale producers and agribusiness improve their cash-flow and profit margins, and enhance their linkage with other lucrative sectors such as tourism.
- Encourage the development of micro-finance and other semi-formal financial institutions through a multi-tier structure of financial regulation.

2.2. Develop risk-management options

- Develop innovative and adequate agricultural insurance scheme for small and medium producers either through direct state provision or through PPPs, such as weather index insurance products as a means of avoiding the problems associated with traditional crop insurance. [103]
- Ensure appropriate regulation of contract farming to allow speedy judicial action in case of non-payment.
- Assess the feasibility of developing commodity exchanges to help agricultural sector players, including small producers, reduce their transac-

tion costs and address the key challenges in their market: access to price information and price risk management (through hedging). The commodity exchanges can also facilitate access to finance by using warehouse receipt systems and improve the quality of agricultural products through specially defined programmes that help them meet the necessary public and private standards.

2.3. Build productive capacity

- Assist smallholder producer organisations in acquiring access to storage and warehousing systems and basic processing facilities, contracting transport services, buying inputs, among others, either through support or through direct provision and user fees.
- Improve the research and extension system with a clear objective of helping smallholder producers to increase their productive capacities. Extension services should facilitate access to knowledge about improved production techniques, improved seed varieties, or more efficient resource use (e.g. water harvesting techniques). For this purpose some governments have successfully implemented farmer field schools with 'train-the-trainer' schemes.
- Revise subsidy system. Targeting should be enhanced with clearly defined eligibility criteria to be closely monitored and time-bound exit strategies.

2.4. Resolve commodity value chain imbalances

- Encourage the establishment and strengthening of producer organisations such as cooperatives or farmers associations through information, incentives, and appropriate regulation.
- Facilitate easy and affordable access to market intelligence and price information to ensure that producers receive a fair price from buyers. Enhance market transparency schemes.
- Set up a market information system that is accessible to smallholder producers.
- Seek to better integrate local rural and urban markets.
- Concentration of market power – in both buyer and seller – given oligopolistic behaviour in Mexico's agrifoods sector, distorts markets and prices, which impacts negatively on the millions of 'price-taking' asset-poor farmers and small- to medium-scale agritrade entrepreneurs. It is therefore imperative for the development of 'new' approaches to national competition policy that addresses the inconsistencies and the negative impacts of market power concentration on both producer and consumer welfare. Enforcement of transparency and accountability is central to this process. In this connection, apportioning of benefits and costs between the participants along the different agrifoods value chains, and procedures and policies in that trading relationship.
- Reduce the quasi-monopoly situation of buyers and processors through stricter application of competition law and/or encouraging new market participants (e.g. large producer cooperatives). Competition policy is discussed in detail in Chapter 3.

2.5. Improve market access and compliance with agrifoods standards

- SAGARPA should keep on track with its reform and modernization of the national food safety laws and regulations, in order to fully establish new public oversight of its agrifoods supply chains.
- Relevant authorities in Mexico should periodically monitor, review and maintain its Agreement on Food Safety Rules with the U.S. Where feasible and mutually beneficial for contracted parties, invocation of necessary provisions on technical and financial support that strengthens 'at the source' the scientific and public health risk related to food safety regulation in Mexico, is central to this process, before the agrifoods products arrive in the U.S.; its biggest export destination market.
- Mexico should examine provisions under NAFTA and other free trade agreements it has with other countries, in order to explore and source out trade-related technical assistance packages that are available to her, under such agreements including the WTO-led Aid for Trade Initiative and other development assistance frameworks.
- Mexican authorities, both public and private, should work closely with their counterparts in U.S., particularly the FDA, as the latter is mandated to implement and facilitate compliance, in developing

countries, trade-related food safety regulatory provisions and develop standards as enshrined in the 'new' Food Safety Modernization Act (FSMA).[104]

2.6. Recommit to basic rural infrastructure and other public goods

- Enhance provision of rural public goods according to careful needs assessment and with priority to the needs of smallholder producers. Many rural areas in Mexico remain very poorly connected to transport networks. Rail networks have been privatised, leading to severe underinvestment in rural service provision. Access to water and electricity can be problematic in some areas. Port and border facilities are also inefficient, which contributes to Mexican agriculture's lack of international competitiveness. Overall, logistical costs are twice as high in Mexico as they are in the US and other OECD countries. Thus, the Mexican government should increase its budget allocation for public investment in basic rural infrastructure.
- Mexico has low research spending in general and research into agriculture represents only 6.6 per cent of government spending on science and technology. There is furthermore almost no private spending on research and development in this sector in Mexico. Total spending on agricultural R&D amounts to only 0.17 per cent which is considerably lower than in Brazil or Chile. Moreover, research is poorly targeted to the actual needs of smallholder producers. Research is generally undertaken in academic institutions that are poorly linked to the producers.

2.7. Address international trade imbalances

- This is a delicate area given the commitments of Mexico under the WTO and NAFTA but steps should be taken to correct some of the biggest imbalances that affect the agricultural sector.
- Greater efforts should be made to ensure that national certification is duly recognized in other markets, especially in the United States, to allow Mexican products to be exported there.
- Emphasis should be placed on further diversifying Mexico's agricultural export markets to take advantage of new opportunities and reduce dependence on the United States market.

2.8. 'One-stop-shops' for rural services delivery

- The government of Mexico may opt to establish 'One-stop-shops' in rural areas where service delivery is poor or non-existent. This innovative citizen-centric service model will provide the rural- and agricultural-population of Mexico with a single access point, whether through front office, telephone, website or other delivery channels. The 'One-stop-shops' models are already been implemented in a number of countries such as U.S., Canada, United Kingdom and Australia. Key issues in setting up a government 'One-stop-shops' include a clear understanding of the needs of the targeted customers, breaking down the siloed government structures to one that is connected to the needs of the people, and efficiently delivers programmes and services to meet these needs, including the millions of farm families in Mexico

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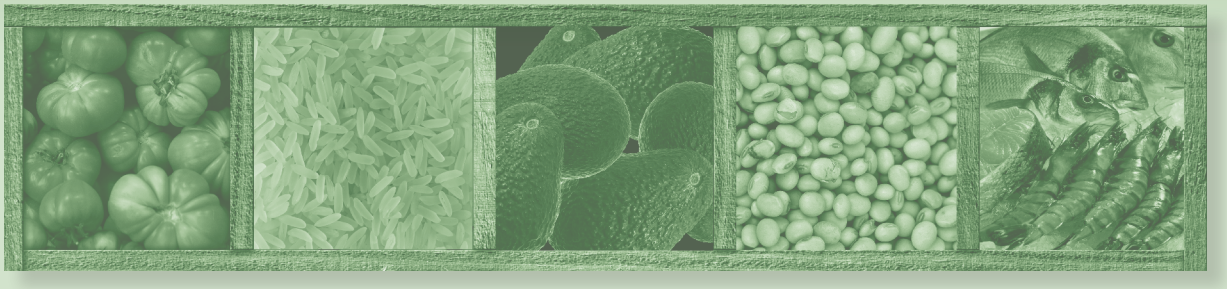
CHAPTER III



COMPETITION POLICY ISSUES IN MEXICO AND AGRICULTURE DEVELOPMENT

A. INTRODUCTION

It is expected that markets, which are characterised by effective competition not only deliver the best outcome for consumers in terms of product quality, variety and prices, but also offer fair chances to participate in the economic process to enterprises. While competition is considered to be the driving force for a thriving market economy, it is not always present in practice and needs a policy framework to be adequately protected and promoted. Restrictions to competition may be private as well as public in nature. Anticompetitive agreements between market players, such as price fixing and market sharing, the abuse of dominant position and mergers that lead to a substantial lessening of competition are considered as common forms of private restrictions to competition. Public restrictions to competition include, for instance, government policies and actions that restrict access to specific markets, distort the interplay between supply and demand, institute legal monopolies or treat economic actors unequally. In particular but not only, state aid may lead to such distortions of competition of a public nature. Even in well-established market economies, restrictions of competition can be found in many industry sectors, including agriculture.

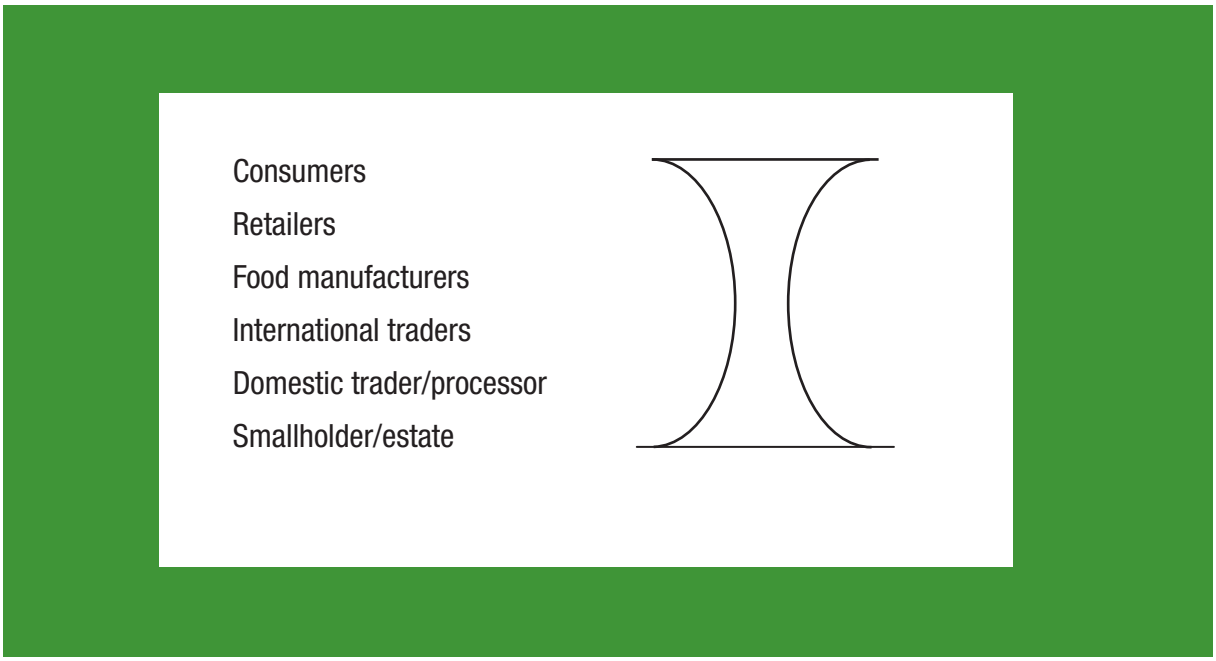
As regards the agricultural sector, two features make it particularly sensitive: firstly, the imperative of ensuring food security and secondly, the fact that in many developing countries, the agricultural sector accounts for a large share of employment. For this reason, governments may be hesitant to leave the agricultural sector to the free play of market forces and put in place special regulatory regimes that may have an impact on competition, for instance, state interventions to guarantee minimum and maximum prices for a country's main agricultural products.[105] Within the European Union, for example, the agricultural sector is regulated by the single Common Market Organisation for all agricultural products, which essentially comprises a complex system of rules concerning public intervention in agricultural markets, quota and aid schemes, marketing and production standards, and provisions on trade with third countries.[106] This legal framework replaces the formerly existing 21 different, product specific Common Market Organisations. Similarly, the agricultural sector in the United States has been subject to specific regulation that evolved over time with today's government intervention in agricultural markets taking the form of price floors,[107] State purchases of excess supply and the limitation of supply.[108] In other cases, States have introduced statutory marketing boards as central purchasing entities for agricultural products with the aim of setting central purchasing prices.[109] For instance, in Tanzania, so-called crop marketing boards have the responsibility of regulating prices and distribution dynamics for major cash crops such as coffee, cotton, cashew nuts and tobacco.[110] Furthermore, a number of competition laws provide for exceptions of the agricultural sector or for specific exemptions, e.g. for producers organisations.[111]

These general remarks on the benefits of competition, the sources of threats to competition and the particular sensitivity of the agricultural sector, being made, the present chapter is dedicated to an assessment of competition issues in selected agricultural markets in Mexico with a view to identify impediments to agricultural development and policy options to address these.

At the outset of this Outlook, the possible existence of particular restrictions to competition in the Mexican agricultural was highlighted, namely the presence of large suppliers of agricultural inputs (fertilizer, seeds, etc.) and buyers (such as processors and retail chains) that might abuse their market power to the detriment of farmers and consumers. It is true that starkly differing degrees of concentration at different levels of the agricultural value chain constitute competition concerns not only in Mexico, but can be described as a common feature of many agricultural systems. The OECD points out that while in most agricultural markets, both production and consumption are highly atomised, agricultural commodities typically pass through a number of highly concentrated functional markets between growers and consumers.[112] This phenomenon has been illustrated as follows:

Furthermore, the OECD reports that a similar feature can be observed in upstream markets: «Multitudes of growers in many agricultural industries are often caught between upstream and downstream bottlenecks. Growers are often 'price takers' both when they are purchasing essential inputs ad when they are selling their product."[113]

In the following, the above mentioned concerns will be assessed, as well as further competition issues that possibly affect the Mexican agricultural sector. Consecutively, it shall be analysed how those competition issues can be addressed through the existing competition law and policy system in Mexico



Source: OECD

and what type of further measures might be required. In this context, experiences from other countries will be taken into account.

Thirteen products were identified by the Government of Mexico for the Outlook as priority products for closer scrutiny. While it would be desirable to carry out a thorough assessment of all these 13 product markets, this exercise would go beyond the scope of the current diagnosis. Therefore, corn production and commercialisation have been chosen for more detailed assessment within the framework of this chapter. Nevertheless, Section B provides an overview of market concentration in selected agrifood products.

By way of introductory remark, it further needs to be emphasised that while this diagnosis can identify some of the possible competition issues affecting corn production and commercialisation in Mexico, our assessment is by no means exhaustive. Certain forms of anti-competitive practices, such as cartels are secretive by nature. Thus, their detection requires strong investigative powers, which are outside the jurisdiction of UNCTAD. Furthermore, being based on desk research, findings from stakeholder interviews and data provided by SAGARPA, the findings in this Outlook are preliminary in nature and would need to be carefully validated by stakeholders in Mexico.

B. MARKET CONCENTRATION IN SELECTED AGRIFOOD PRODUCTS: AVOCADO, BEEF, CORN, PORK AND POULTRY

In the case of Mexico, the concentration of market power[114] in the hands of a few vertically integrated firms, particularly in livestock (e.g. beef, egg production and pork) and crops (e.g. corn flour milling), portrays an oligopolistic situation. The often complex array of vertically integrated firms – acting as buyers and sellers – control almost all processes from the 'farm to fork'. The growth and modernization of these agribusiness firms, for example, supermarkets in the retail sector, often proceed under radar of public policy, with minimum government intervention and support. This section, therefore, focuses on market concentration in selected agricultural and food products – avocado, beef, corn (maize), pork, and poultry – of Mexico.

1. Avocado

Avocado, like corn (maize), is native to Mexico. Mexico has the comparative advantage in producing avocados.[115] Mexico and U.S. are the world's largest producers of avocado, accounting for 68 per cent and 15 per cent of global production, respectively. Over 70 per cent of Mexico's Hass variety of avocado is consumed locally, and the balance, 30 per cent, is exported largely to U.S. (75 per cent), Japan (10 per cent) and Canada (7 per cent). Production of export-quality Hass avocados is concentrated in the state of Michoacán (88 per cent), followed by Jalisco and Sinoloa. Michoacán is forecast to produce 1.25 million metric tons in the 2011-12 crop-year (June-July). Avocado Producers & Exporting Packers Association of Michoacán (APEAM) is solely responsible for exporting Hass avocados from the state of Michoacán.

During the 2011-12 crop-year, Mexico exported more than 781 million pounds of Hass avocado to the U.S., 25 per cent more than the previous year. Exports of avocados to U.S. is forecast to increase, on the back of burgeoning demand, by more that 5.6 per cent (or (825 million pounds) during the 2012-13 crop-year. Hass avocado exports to U.S. had increased over the years following the complete removal of the import ban on Hass avocados on 31 January 2005.[116] An import ban on Mexican avocados was first imposed in 1914 over phytosanitary concerns, which were proven later to be scientifically untrue.[117] There are 56,645 ha cropped with Hass avocados are certified by the U.S. authorities – Animal Plant Health and Inspection Services (APHIS) – to export the product duty-free to U.S markets.

Avocado production is concentrated in the state of Michoacán. Avocado is a staple for Mexican's, and thus over 70 per cent of the produced in Mexico is consumed locally.[118] In 2010, the Mexican avocado export market size was 248,643 metric tons, valued at US$600 million.

In terms of market share, Calavo de Mexico Sa de CV controls 11 per cent of the export market, followed by 4 other major firms accounting for 25.7 per cent. The balance, 63 per cent, is taken up by small- to medium-sized avocado packing houses, who directly supply U.S.-based firms.

Burgeoning demand for Mexican avocados, both locally and in the U.S., has had a strong and positive impact on the industry. The boom in the avocado industry has boosted local businesses and employment, driven investments in technologies and equipments, while trucking fleets, packing plants, sanitary inspectors and orchard workers thrive in the industry which injects about $400 million annually into the local economy, a 50 per cent increase from 10 years ago. Even Mexico's major competitor firm, Calavo Growers Inc., California, has stepped-up capital investments in Uruapan, Michoacán – the heart of Mexican avocado production – by upgrading and expanding its packinghouse facility to keep up with strong consumer demand in U.S.[119]

The growth is explained by the opening of the U.S. market to Mexican avocados, rising incomes and growing Hispanic population in U.S. That being said, however, a large part of this success could be apportioned to the implementation of APEAM's fully integrated market programs. APEAM's avocado promotion drive includes massive advertizing blitzes across U.S., increased awareness to help retailers drive demand in-

Table III.1: Market Share of Avocado Export Volumes, 2010

Company	Market share (%)
Calavo de Mexico SA de CV	11
Mission de Mexico SA de CV	8
Frutas Finas de Tancitaro SA de CV	7
Empacadora Agroexport SA de CV	6
Global Frut	5
Others	63
Total	100

Source: USDA Grain Report (25 May 2011)

store, strong brand – "Avocados from Mexico" – promotions, and e-blasts that reach millions of consumers.[120] APEAM is aggressively targeting the Japanese markets in order to diversity its export markets. Breaking into the 1.34 billion consumer-market of China should be pursued as it would most definitely change the dynamics of the avocado industry in Mexico.

2. Beef

Mexico is the natural market for U.S. beef exports – chucks and round cuts, given Mexico's geographical proximity, burgeoning economy and rising middle-class, and big population with an appetite for meat consumption, for U.S. beef exports, particularly chuck and round cuts which have minimum market potential in U.S.

Mexico's beef sector is diverse in terms of cattle production, beef processing, and domestic marketing. Small-scale ranchers are highly fragmented and raise calf-cow on grass or pasture. Big producers, on the other hand, are more concentrated and use feedlot operations[121] (as discussed in beef value chain analysis in this chapter). Mexico's domestic market is still very much carcass-based, where beef is sold through small butcher shops clustered together in public markets. In recent years, however, supermarkets have increasingly taken over retail sales of beef in major urban centers. Retail sale of beef is therefore more concentrated in supermarkets than in small butcher shops.[122]

In 2010, the market size for feedlot beef production was 1.75 million metric tonnes, and valued at approximately $8.75 billion. Three companies – Grupo VIZ (16 per cent), Grupo GUSI (6 per cent) and Praderas Huasteca (5 per cent) – capture 27 per cent of feedlot processing capacity. The balance, 89 per cent, is scattered among smaller feedlot operations (USDA, 2012). The market share of these companies is shown in Table III.2.

3. Corn

Corn (or maize) is a native crop – like avocado – to Mexico, and it is the most important staple food – as corn tortillas – for Mexican's.[123] Sinaloa is Mexico's biggest maize-producing state. Roughly three million Mexican families (or 15 per cent of Mexico's 105 million people) grow corn, 85 per cent of whom have landholdings no bigger than 5 ha (USDA Grain Report, 2011, p.7). Mexico primarily produces white corn, over

Table III.2: Market Share of Feedlot Beef Production, 2010

Company	Market share (%)
Grupo VIZ	16
Grupo GUSI	6
Praderas Huasteca	5
Others	89
Total	100

Source: USDA Grain Report (25 May 2011)

Table III.3: Market share in selected corn products - flour, starch and animal feed, 2010

Corn Flour Production Volume, 2010		Corn Starch Production Volume, 2010		Animal Feed Processing Volumes, 2010	
Company	Market share (%)	Company	Market share (%)	Company	Market share(%)
Gruma SAB de CV	75	Corn Products International Inc.	65	AMEPA, AC	30
Grupo Minsa SAB de CV	15	Controladora ADM SA de CV [Almex]	35	CONAFAB	22
				UNA	20
Others	10			Others	29
Total	100		100		100

Source: USDA Grain Report (25 May 2011)

85 per cent of which is consumed locally by people, and the balance is processed into animal feed. Yellow corn, imported largely from U.S., is used primarily for livestock feed and industrial use —corn starch, cereals, and snacks. Mexican farmers use seeds from their native corn species, which are stored from harvest to harvest.[124] Commercial corn production is undertaken mostly by medium–to large-scale growers, who apparently wring most of the benefits out of Government support (subsidy) programs such as the US$869.2 million Forward Contract Program.[125]

Prolonged severe drought, in more than seven decades, battered 70 per cent of Mexico and its agricultural production sector in 2010. The financial loses accruing to the corn sector is estimated at US$710 million.[126] Mexico's total corn production estimate for the 2011-12 crop-year was revised downward to 18.6 million metric tons (MMT). For the next crop year (2012-13), Mexico is forecast to produce 21 MMT, from an estimated of 7 million ha. Mexico is the fifth largest corn producer in the world after U.S., China, the E.U., and Brazil.

The removal of all tariff and quota restrictions under NAFTA had opened the floodgates for imports into Mexico. Corn imports increased eightfold, pushing down domestic prices as much as 40 per cent, and forcing over 750,000 farmers to quit farming. This had led to nationwide protests (in 2006 and 2008) and ongoing campaigns such as "Sin maíz, no hay país" ("Without corn, there is no country").[127]

During the 2011-12 crop year, Mexico imported 11.5 MMT of corn, up 45 per cent from 7.9 MMT in the 2010-11 crop year. Of this, U.S. supplied 10.5 MMT, making U.S. the most dominant player in Mexico's corn market, but also reveal the extensive dependency of Mexico on its closest neighbor. A closer look at the 10.5 MMT of corn imported from U.S. reveal the extent of Mexico's high import-dependency: 91 per cent of imports, 34 per cent of total supplies, and 35 per cent of domestic consumption. From U.S.'s perspective, Mexico is its second largest export market, after Japan, accounting for 16 per cent of the U.S. corn exports (USAD, 2012, p.3).

As detailed in the 'Maize Value Chain' (see Chapter II), Mexico's corn market value chain can be broken down in five levels: producers (or farmers); silo owners (store maize); traders (sell and market maize); millers (process maize for different uses); and end users. The maize value chain is highly concentrated in corn flour milling and corn starch processing.

In terms of market share, Gruma SAB de CV and Corn International Inc., dominate the corn flour and corn starch subsectors, controlling 75 per cent and 65 per cent of production, respectively. In 2010, the market size for corn flour and corn starch were approximately $500 million and $358 million, respectively. Production of corn starch uses 2.3 MMT of yellow corn yearly. Up to 95 per cent of yellow corn for starch preparation is imported from U.S. (USDA Grain Report, 2011).

The animal feed processing sector is rather evenly distributed among three companies – Amepa AC, Conafab and UNA – controlling 72 per cent of the market. Other small- to medium-sized firms account for the remaining 28 per cent. In 2010, the market size, total animal feed consumption was 24.85 MMT, valued at about $5 billion. Mexico is one of the world's largest animal feed producers, accounting for 27.3 MMT in 2010 or 3.8 per cent of world production (USDA Grain Report, 2011).

4. Pork

Pork is the second-most popular meat consumed in Mexico, second only to poultry. Chilled and processed pork are most preferred, of which hot dogs and ham top the list. Mexico appeases its burgeoning domestic demand for pork with imports. In 2010, for example, Mexico imported 786 million kgs of pork and pork products from U.S. (85 per cent) and Canada (13 per cent), at the cost of US$1.42 billion.[128]

During the same year (2010), Mexico's pork and hog production was 1.17 million tonnes carcass weight of 100 kgs (worth $2.92 billion) and 16 million pigs (worth $2.5 billion), respectively. Rising feed costs, particularly that of grains, which account for some 60 per cent of hog production costs, dampens the terms of trade for hog producers. This situation is aggravated further by the U.S. government's biofuel mandates, which ensures that subsidized maize is diverted to animal feed.

The hog industry is highly fragmented with about one million registered producers. In terms of market share, Granjas Carroll de Mexico and Grupo Porcicola Mexicano (Kenken) account for 10 per cent and 7 per cent, respectively. The balance, 83 per cent, is taken up by the multitudes of small and medium-scale firms.

Table III.4: Market Share of Hog and Pork Production, 2010

Hog (pig) Production, 2010		Pork Production, 2010	
Company	Market share (%)	Company	Market share (%)
Granjas Carroll de Mexico	10	Grupo Porcicola Mexicano (Keken)	10
Grupo Porcicola Mexicano (Keken)	7	Grupo Kowi SA de CV	8
Others:	83	Norson	7
		Sonora Agropecuaria	6
		Grupo Bafar	5
		Others	64
Total	100	Total	100

Source: USDA Grain Report (25 May 2011)

Table III.5: Market Share of Broiler Meat and Egg Production, 2010

Broiler Meat Production, 2010		Table Egg Production Capacity, 2010	
Company	Market share (%)	Company	Market share (%)
Industrias Bachoco SAB de CV	38	Proteina Animal (Proan)	13
Pilgrim's Pride S de RL de CV	14	Industrias Bachoco SAB de CV	8
Tyson de Mexico	12	El Calvario	6
Others	36	Empresas Guadalupe	5
		Others	68
Total	100		100

Source: USDA Grain Report (25 May 2011)

5. Poultry

At present, Tyson de Mexico— the world's largest integrated producer, processor and marketer, along with Pilgrim's Pride and the Mexican company Bachoco, control up to 52 per cent of chicken production in Mexico, thanks largely to favorable foreign investment rules under NAFTA.[129] Tyson is the number three chicken processor and top producer of 'value added' poultry products in Mexico, serving the retail and foodservice industries.[130]

Jalisco is Mexico's largest poultry producing region, accounting for over 3 million metric tonnes of poultry products – meat and shell eggs – per year. The broiler meat and table eggs market size (in 2010) was valued at US$4.91 billion and US$2.47 billion, respectively

C. STATUS OF COMPETITION IN CORN PRODUCTION AND COMMERCIALISATION IN MEXICO

As described in the value chain assessment conducted within the framework of Chapter II of this publication,[131] the corn value chain is composed of four stages: (i) production, (ii) storage and trading, (iii) processing, and (iv) final commercialisation. In the following, these four stages will be assessed from a competition policy perspective.

The assessment of the production stage will have a look at production volumes at national and regional level, the structure of production units including the

production methods applied by different types of producers, import competition from the US, different key inputs for corn production, as well as State aid related to corn production.

1. Production

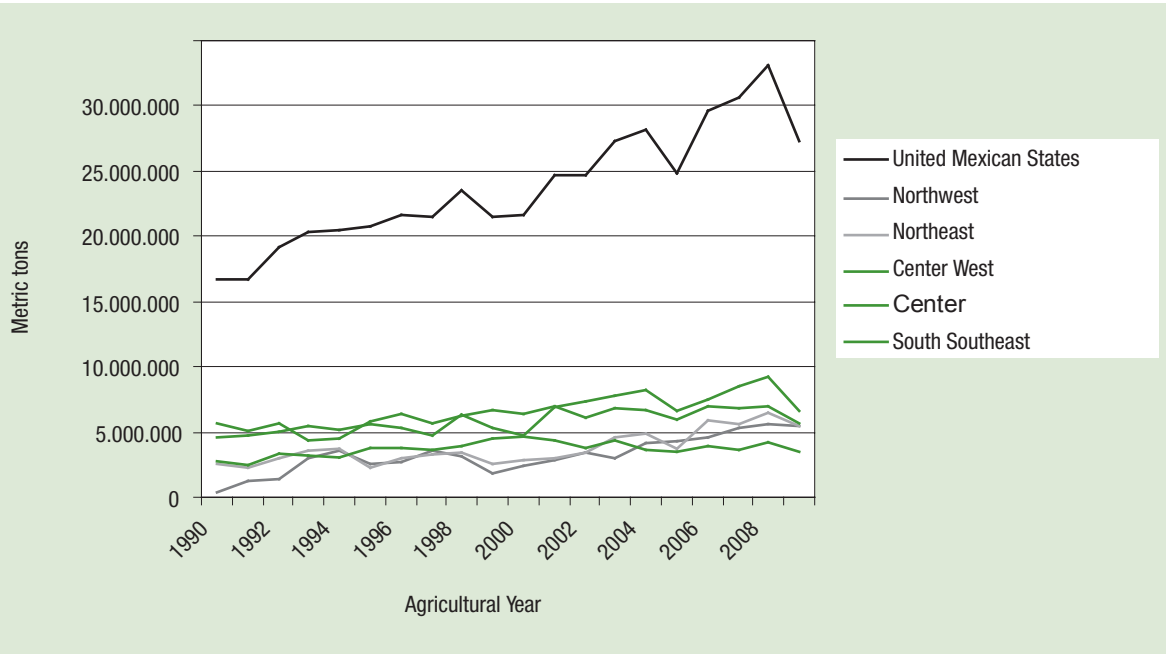
Overall corn production in Mexico

With a production volume of around 23 million metric tons, Mexico is the fifth largest producer of corn worldwide.[132] Its production grew considerably between 1990 and 2009, as shown by Figure III.1. In fact, the Mexican production of corn in 2009 was equal to 164 per cent of the level of production in 1990. Nevertheless, with a yearly corn consumption that has grown to approximately metric tons 30 million, Mexico is a net importer of corn.[133]

Mexico's corn production falls into two main categories, corn for human consumption (mainly white corn) and forage corn (mainly yellow corn). Around 8 million metric tons of the white corn production is used for human consumption, predominately in the form of tortillas. The rest of the white corn production is used for animal feed, which means that yellow and white corn are substitutes with respect to this use. Prices for white and yellow corn differ significantly, with white corn being more expensive. However, when white corn is being used for animal feed, producers can only achieve the equivalent of the price for yellow corn, given that animal feed users would only pay the price for yellow corn.[134]

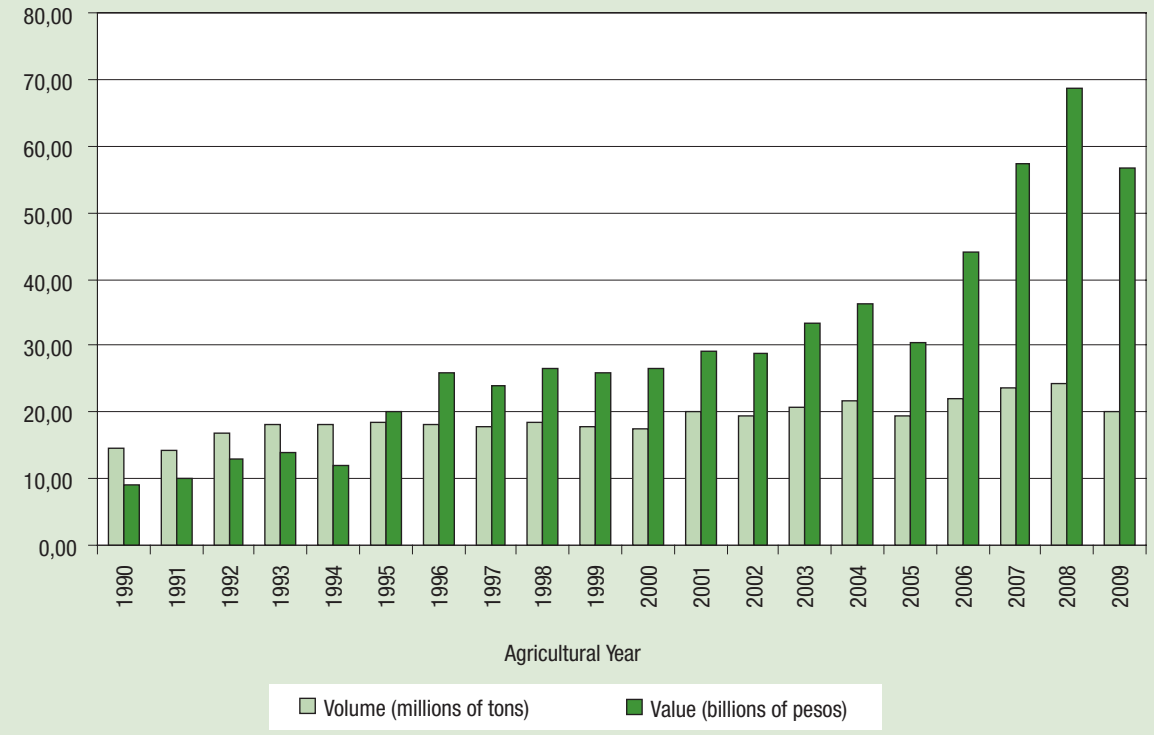
Figures III.2 and III.3 provide an overview of Mexico's production volume and value of corn for human consumption and for feed. In particular, Figure III.2 reflects the stark increase of prices during the food crisis starting in 2006. Furthermore, a comparison of the two tables reveals that the production volume of forage corn has grown much stronger in the period from 1990 to 2009 than the production volume of corn for human consumption.

Figure IIII.1: Overall corn production in Mexico



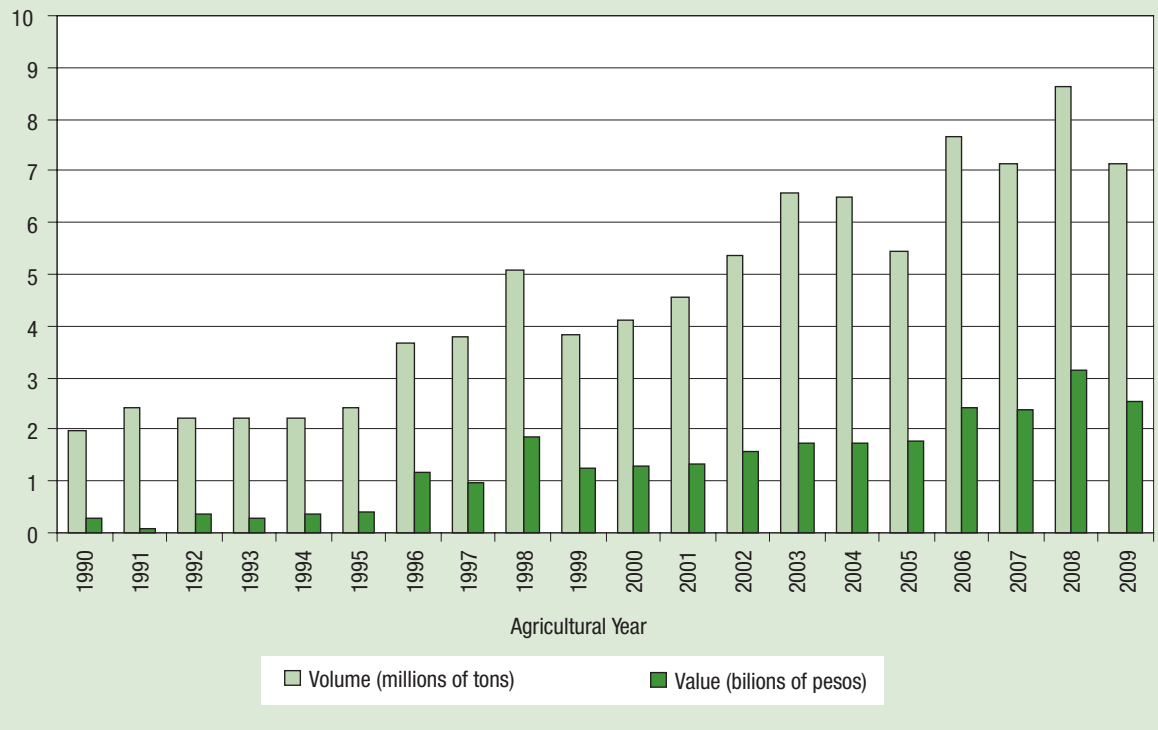
Source: SAGARPA

Figure III.2: Mexican corn production for human consumption



Source: SAGARPA

Figure III.3: Mexican forage corn production



Source: SAGARPA

Corn production per province

Among the five regions,[135] the Center West region accounts for the largest share in the total corn production (24 per cent in 2009), followed by the Northeast, Northwest and Center regions, each accounting for 21 per cent of the total corn production in 2009. The South Southwest region accounts for the lowest share in the overall production of corn (13 per cent in 2009), see Figure III.4.

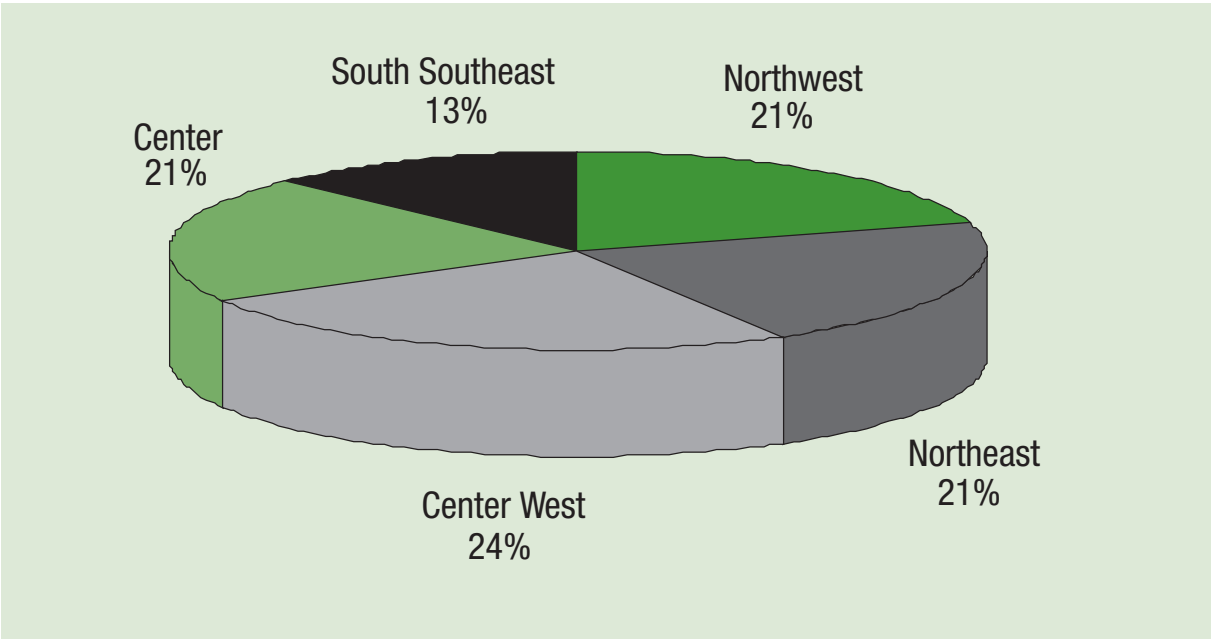
While the regions have a similar share in the overall production of corn, with the exception of the region South Southwest, the picture differs when considering the subcategories of corn for human consumption and forage corn.

As regards the production of corn for human consumption, the region Northwest had the largest share in the production volume in 2009 (28 per cent), followed by the region Center West with a share of 25 per cent and the region Center with 20 per cent. The share of the region South Southeast accounted for 16 per cent in 2009 and the one of the region Northeast for 11 per cent. Remarkably, the region Northwest had the lowest share in production of corn for human consumption in 1990 and achieved the largest share in 2009, as shown by Figure III.5. This is mainly due to the increase of production in Sinaloa, the only state within Mexico which succeeded to increase its production volume through an increase in productivity as opposed to an increase through an enlargement of the production area.[136]

While the region Northeast had the lowest share in the production volume of corn for human consumption, it accounted for nearly half of the production volume of forage corn in 2009 (49 per cent), followed by the regions Center West (25 per cent) and Center (22 per cent). Production of forage corn in the regions South Southwest and Northwest did not contribute significantly to the overall production of forage corn in 2009. Their shares were 4 per cent and around 0 per cent at that point in time, see Figure III.6. This overview also shows a significant increase in the production volume of forage corn in the regions Northeast, Center West and Center, with the first of these regions experiencing the starkest growth.

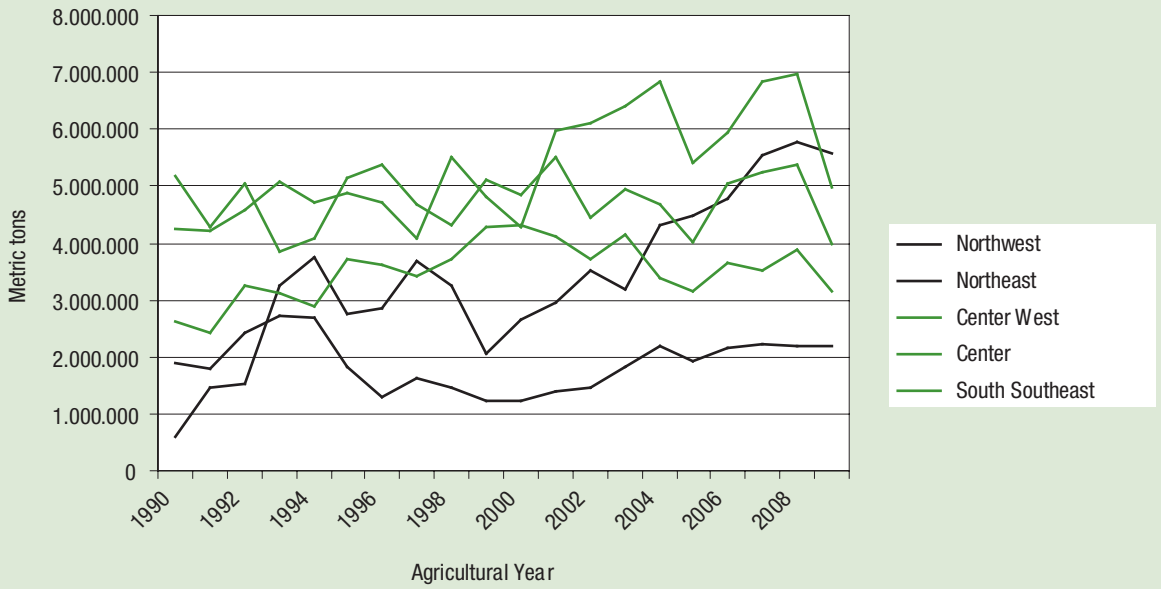
A comparison of Figures III.5 and III.6 allows to draw the conclusion that the provinces Northwest and South Southeast are specialised in the production of corn for human consumption, while the region Northeast specialises in the production of forage corn. As to the two provinces Center and Center West, no particular specialisation can be observed.

Figure III.4: Overall corn production per province in 2009



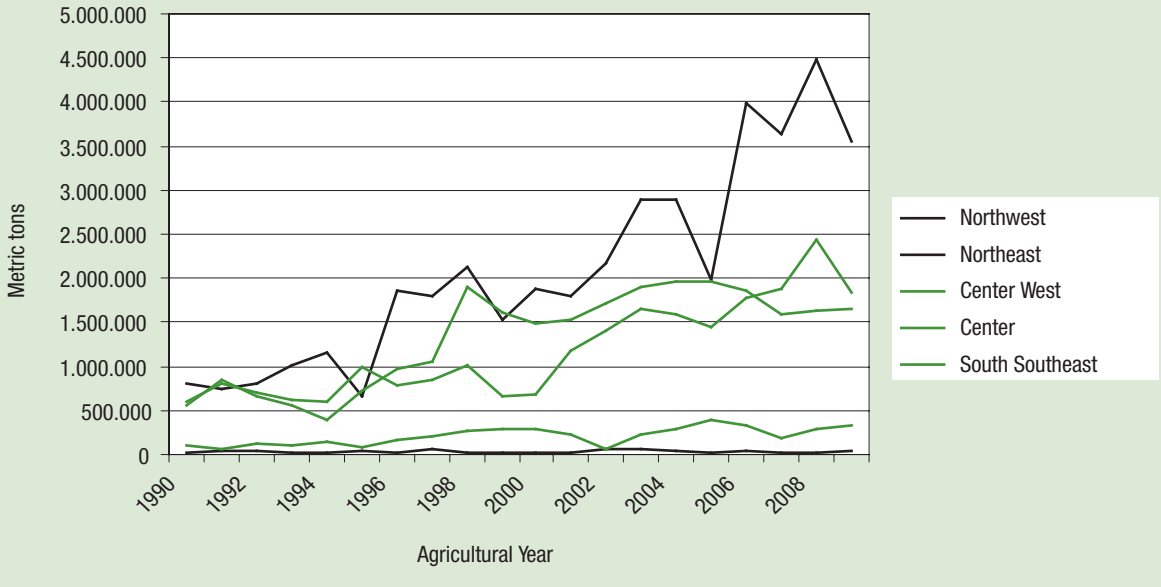
Source: SAGARPA

Figure III.5: Corn production for human consumption per province



Source: SAGARPA

Figure III:6. Forage corn production per province



Source: SAGARPA

Production units

While, overall, there are 2 million producers of corn in Mexico, they differ significantly in terms of size, production methods and productivity. Production methods can be divided into two categories: commercial and traditional. Commercial farmers would typically use machinery, fertilizers, improved seeds and irrigation, while traditional farmers would use modern agricultural technologies only to a limited extend, if at all. It is estimated that the minimum surface for commercial corn production is around 30 hectares per farmer,[137] which means that only large and medium sized farms are actually in a position to participate in commercial production. However, less than 6 per cent of all farmers in Mexico benefit from land possession of more than 20 hectares[138] and most of the larger farms are located in the Northern regions. The large majority of small holders engaging in traditional farming are located in the Southern region where they either produce solely for self-consumption or sell corn to persons living near their farms.[139] The productivity of traditional farmers is reported to be 15 to 20 per cent of the level of productivity of commercial farmers.[140] Yields achieved in some of the Northern States are around 10 to 11 metric tons per hectare and are comparable to the US, whereas yields achieved in the South are of 1 to 1.5 metric tons per hectare.[141] The average yield for corn production for human consumption equalled 2.8 metric tons per hectare in 2007.[142]

1.4. Import competition

Since the domestic production of corn is not sufficient to fulfill local demand, Mexico has to import about 25 per cent of its consumption.[143] Nearly the entirety of Mexico's corn imports originates in the US. In fact, in the period from 2008 to 2010 the share of imports from the US equaled 99.3 per cent of Mexico's overall corn imports.[144] This is not only due to geographical proximity between the US and Mexico and the fact that the US are the largest corn producer worldwide, but also to the elimination of tariffs and quota for agricultural products between these two countries since the end of NAFTA transition periods on 1 January 2008.[145]

As a consequence of this liberalisation of agricultural trade, today local corn production in Mexico freely competes with corn production in the US. This has a major impact on the formulation of corn prices in Mexico. In this context, it is reported that prices for corn produced in Mexico are based on the corn future prices at the Chicago Mercantile Exchange plus international and national transport costs that would occur when importing corn from the US minus cost for local transportation from the production to the consumption point, which would not occur in the case of imports. This formula clearly reflects the interchangeability of US and Mexican price from a demand side perspective.

While strong import competition generally benefits domestic consumers in terms of lower prices and greater supply stability, it increases the competitive pressure on local producers. In instances of great differences in the levels of productivity of local and foreign producers, import competition may cause severe challenges for the domestic industry. In fact, import competition from the US caused great fear among Mexican producers at the signing of NAFTA: taking into account US agricultural subsidies as well as high levels of productivity in the US, Mexican corn producers were indeed concerned about the competition by U.S. corn producers and the risk of being flooded with cheap imports of corn following the removal of tariff protection. A recent study on this issue concludes that these fears were well founded and that until the price peaks of agricultural products during the recent food crisis, dumping by subsidised corn from the US eliminated for the lowest productivity smallholder in Mexico any positive income from the sales of corn in the market place and forced them to retreat into subsistence.[146] Furthermore, the assessment of margins realized by Mexican producers per crop and technology combination also shows that smallholders who produce corn according to purely traditional production methods (rain fed, indigenous seeds, fertilizers not applied) cannot realize positive margins.[147] Nevertheless, the present diagnosis concludes in Chapter I of the Outlook that while previous US policies may have had a detrimental effect on Mexican corn producers, the data suggests that this effect is now small or may have reversed.

Inputs

Inputs for the corn production vary significantly depending on the production method that is used. While traditional production of corn does not need irrigation, agrochemicals (fertilizers and pesticides) and machinery, industrial production heavily depends on these inputs in order to realize higher yields. Both

types of production require land, seeds and manpower as basic inputs.

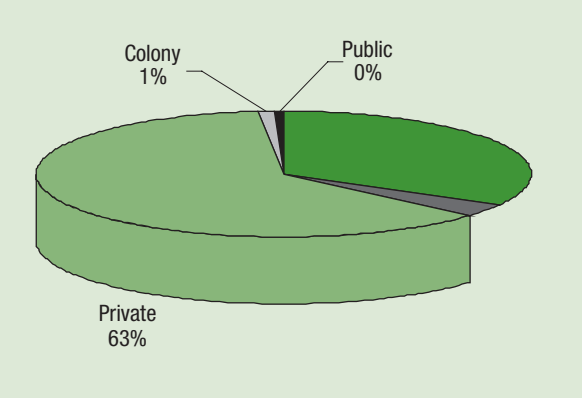
The level of competition in input markets, as well as possible anticompetitive practices in these markets, has a clear impact on the economic situation and productivity of producers. For instance, high input prices caused by collusion among input producers lead to higher production costs, which are likely to reduce margins of growers, as they are hardly in a position to pass on higher costs to their buyers. In the following, it will be assessed to what extent competition issues possibly affect the various input markets for corn production.

Land tenure

During the stakeholder interviews carried out for the purpose of this Outlook, the limited size of production units was mentioned several times as one of the most restricting factors for traditional farmers to become more productive and participate in the commercial market. Land possession can therefore be considered as a crucial barrier to entry the commercial corn production. [148] For this reason, it is worth assessing the Mexican land tenure system in more detail.

Land redistribution following the Mexican revolution is at the origin of today's strong fragmentation of arable land in Mexico and the large number of smallholder. Contrary to today's situation, land tenure was highly concentrated when Mexico declared independence in 1810: 97 per cent of the land was in the hand of few privileged farmers, 2 per cent corresponded to small holdings and 1 per cent belonged to indigenous peoples and communities.[149] Under the slogan "land and liberty", farmers who took part in the Mexican revolution of 1910 claimed for a redistribution of land. In the original version of its Article 27, the Mexican constitution acknowledged the need for a land reform and the first of a series of land reforms and redistributions took place in 1917. This essentially let to the creation of three different types of land: (i) public land owned by the nation and assigned to public institutions, (ii) social land that comprised the subcategories of ejido and communal land, and (iii) private land. Figure III.7 gives an overview of today's distribution of the different types of land.

Figure III:7: Land possession regime



Source: SAGRAPA

The regimes of social and private land tenure are of particular importance for the agricultural sector. Ejido land is land granted by the state to groups of peasants called ejido. While individual members of the ejido could be allocated a parcel of land to work, this right of use or exploitation did not amount to ownership. The ultimate ownership of the land remained with the ejido as a group.[150] Until the agrarian reform of 1992, it was not possible to transfer ownership of ejido land. However, with the view to reverse the strong fragmentation of rural land tenure, the 1992 reform introduced a specific legal procedure to privatize ejido land. As a consequence, ejido land has lost its characteristics of strict social property. The possibility to privatize ejido land was accompanied by the end of the state's constitutional obligation to redistribute land to peasants. Communal land, the second type of social land, is land that was restituted by the state to traditional communities or peasants or indigenous groups, in recognition of the fact that they were in possession thereof before the agrarian reform of 1917. As in the case of ejido land before 1992, communal land cannot be alienated.

As regards the category of private land, it should be pointed out that private ownership in land may not exceed 300 ha for an individual. Since the reform of 1992, commercial companies, however, may own 25 times the amount of rural land to which an individual is entitled. Taking into account that the land possession of the majority of Mexican farmers is below 5 ha, this legal limitation does not appear to very relevant in practice.

In summary, it can therefore be stated that while the strong fragmentation of land tenure and the small size of most farms stems from land redistribution following the Mexican revolution, today's legal system would theoretically allow farmers to acquire larger land possessions (up to the size of 300 ha). It is

however assumed that the economic situation of most smallholder detains them from seizing this opportunity.

Seeds

Seeds used for corn production in Mexico can be divided into traditional varieties and hybrids.[151] It is estimated that today around 30 per cent of the agricultural land is plated with hybrid seeds.[152] Whereas traditional varieties stem from centuries of selection and breeding of seeds by farmers using parts of their harvests as seeds for the next season, hybrid seeds stem from industrial crossing of selected lines of corn. Whilst such hybrids offer specific advantages such as higher yields and stronger resistance against vermin, these advantages can only be fully obtained from the first generation of plants produced with those hybrid seeds and decrease with later generations. In practical terms, this means that farmers using hybrid seeds need to buy these for every season and cannot use a part of their harvest for the next season. Furthermore, prices for hybrid corn seeds are significantly higher than traditional seeds. Based on these reasons, the Mexican competition authority found in its decision on a merger between Monsanto Company (Monsanto), Asgrow Mexicana, S.A. de C.V (Asgrow Mexicana) and Cargill de México, S.A. de C.V (Cargill Mexico) [153] that traditional corn seeds and hybrid seeds cannot be considered as close substitutes and therefore constitute different relevant markets.[154]

As regards the market for hybrid seeds, in the same decision, the Mexican competition authority found that Monsanto through its (indirect) subsidiaries Asgrow Mexicana and Semillas Híbridas, S.A. de C.V. (Sehisa) held a market share of 47.1 per cent. The notified acquisition of Cargill Mexico's intellectual property rights and other assets necessary for the production of hybrid corn seeds combined with a non-compete clause would have let to an increase of Monsanto's market share up to 59.9 per cent, while the rest of the market was divided between three competitors holding more than 1 per cent of the market (Híbridos Pioneer, S.A. de C.V. (Pioneer) - 17.3 per cent, Ceres Internacional , S.A. de C.V - 9.2 per cent, and Productora Nacional de Semillas «PRONASE» - 5.1 per cent) and 17 small competitors each holding a market share of less than 1 per cent. Against this background, the Mexican competition authority came to the conclusion that the notified transaction would significantly lessen competition and prohibited the transaction. Upon appeal of the notifying parties, the transaction was later approved with the condition that the brand Cargill would not be used by Monsanto and that a production plant of Cargill Mexico would be divested within 12 months together with a commercial license to use the intellectual property and know how for the production of Cargill Mexico's hybrid corn seeds. Furthermore, a similar license free of charge was to be granted to universities and research institutes. While this decision was taken more than 10 years ago, it nevertheless suggests that the market for hybrid corn seeds remains highly concentrated to date with Monsanto holding a dominant position. This assumption is strengthened by the fact that PRONASE, the government run seed producer, exited the market of hybrid corn seed production due to its liquidation that started in the early 2000s. In fact, according to a more recent study, 95 per cent of the hybrid seeds planted in 2009 were produced by Monsanto and Pioneer only.[155]

While competition laws generally do not prohibit that a company holds a dominant position/significant market power, the abuse of such position, e.g. through excessive or predatory pricing, tying and bundling etc., is typically considered as anti-competitive and therefore prohibited. However, even in the absence of abusive practices by a dominant company, highly concentrated markets are characterised by less competition compared to less concentrated markets, which can have a negative impact on prices and product innovation. While the stakeholder interviews have not revealed any indications for abusive practices in the market for hybrid corn seeds, the likelihood of a very high market concentration suggests the possibility of a low level of competition which could be expressed by prices above the competitive level, lower quality of seeds or less product innovation.

In contrast, the market for traditional seeds is not characterised by the same level of concentration, given that any local producer can keep a part of the corn harvest for the purpose of using it personally or selling it as seeds for the next season.

Agrochemicals

Corn farmers in Mexico use agrochemicals, that is to say fertilizers and pesticides, to significantly different extents. As mentioned previously, traditional and organic farming methods only use agrochemicals very scarcely, if at all, whereas industrial corn production depends heavily on agrochemicals to realise high yields.

At first glance, it appears that the Mexican market for agrochemicals is not characterised by the same level of concentration as the market for hybrid seeds. The industry association AMIFAC (Asociación Mexicana de la Industria Fitosanitaria, A.C.), which according to its 2009 annual report represents 70 per cent of the Mexican market for agrochemicals, lists amongst its members 12 multinational producers of original agrochemicals, one importer, 21 producers of generic agrochemicals and 16 distributors. In addition, the industry association UMFFAAC (Unión Mexicana de Fabricantes y Formuladores de Agroquímicos, A.C.) groups the main Mexican agrochemical companies. This means that more than 50 players are active in the Mexican market for agrochemicals, which has been described as highly competitive.[156] Furthermore, while stakeholder interviews have revealed a great concern about the high concentration in corn processing, a similar concern has not been voiced with respect to the market for agrochemicals. This first impression does however not exclude the possibility of anti-competitive structures/behaviour in the Mexican markets for agrochemicals.

Based on the enforcement practice of other jurisdictions, an in-depth assessment of markets for agrochemicals in Mexico would firstly require identifying the respective relevant markets, which starts with a distinction between fertilizers and pesticides. As regards, fertilizers further categories can be distinguished, which may constitute separate relevant markets, for instance, organic and mineral fertilizers (the latter including subcategories for straight nitrogen, phosphorus and potassium fertilizers, as well as compound or blended fertilizers).[157] In particular, as regards the key ingredients for potassium fertilizer, recent research suggests the existence of a worldwide operating potash cartel: it appears that three Canadian potash producers do not only operate an export cartel (which benefits from a specific exemption under Canadian competition law), but also collude with further potash producers from Russia and Belarus in order to limit output and thereby control prices. [158] The alleged potash cartel - even though operating outside of Mexico, would have a clear impact on the prices of potassium fertilizers in Mexico.

As regards pesticides, a closer assessment of the competition situation in Mexico would likewise require the definition of relevant markets taking into account the different production stages of plant protection products: (i) the production of active substances, (ii) the manufacture of the formulation from active substances and inert ingredients, and (iii) the packaging of such formulations. The case law of the European Commission suggests that different active ingredients are not substitutable and form separate product markets, while formulated products can be distinguished according to their purpose, e.g. herbicides, insecticides, etc.[159] With respect to the producers of agrochemicals that are active in the these segments, a study from 2005 finds that at the time 75 to 80 per cent of the overall market were controlled by only six companies: Syngenta, Bayer, Monsanto, BASF, Dow and DuPont.[160] This relatively high level of concentration on the international level suggests that it may be worth assessing the Mexican market for agrochemicals in more detail.

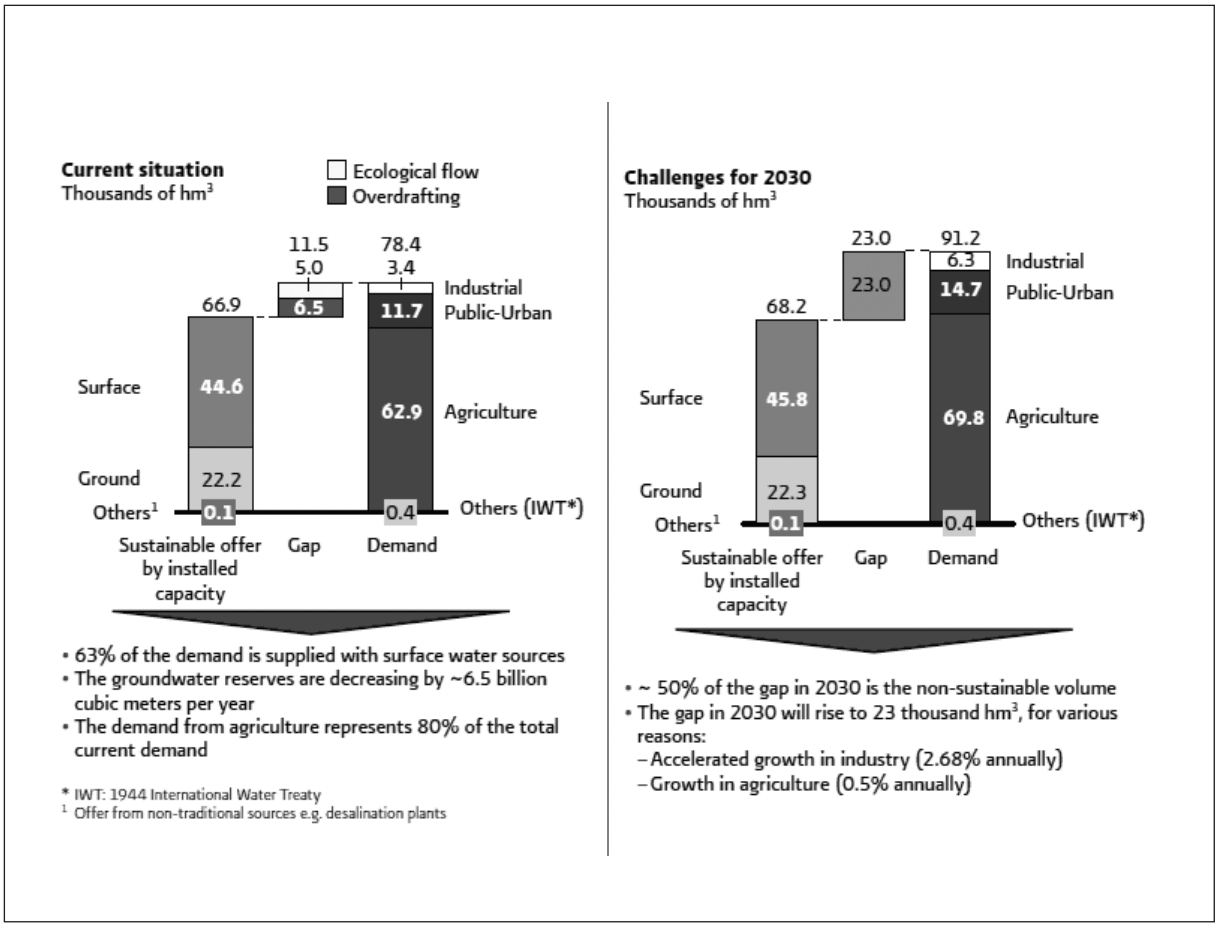
In summary, it can be stated that while the Mexican markets for agrochemicals have been described as highly competitive, there may be impediments to competition in these markets that originate outside of Mexico given the relatively high concentration of pesticide producers worldwide and the possible existence of an international potash cartel, which concerns inputs for at least one type of fertilizers.

Water

The assessment of the impact of technology on the competitiveness of eight selected crops carried out within the framework of Chapter II of this publication has clearly shown that irrigation is the key input to profitably produce corn in Mexico. Even if traditional farmers use improved seeds and fertilizers, they do not realize positive margins unless they switch from rain fed production methods to irrigation.[161] However, today the irrigated land represents only about 30 per cent of the total cultivated lands in Mexico. It is estimated that there is an irrigation potential of some 10 million hectares in the country, approximately 60 per cent more than the area with irrigation facilities at present.[162] Thus, the increase of productivity of corn production in Mexico would create an important demand for increased irrigation.

In this context, it is reported that while there is some private and state governments' investment participation, financing new irrigation, drainage and flood control works, depends mainly on the federal government.[163] In fact, in the past most of Mexico's water infrastructure works were built by CONAGUA, Mexico's National Water Commission.[164] In other words, farmers depend on the provision of infrastructure for irrigation by the State. Otherwise, they are left to continue growing

Figure III.8: Current situation and challenge for 2030 for balanced supply and demand for water



Source: CONAGUA, 2030 Water Agenda

corn on rain fed fields. For this reason, the assessment of competition issues affecting irrigation as an input for corn production is closely linked to the assessment of government support and State aid programs in the agricultural sector. Indeed, there are allegations that State aid has been concentrated on the Northern regions, which would allow the respective states to benefit from well-functioning irrigation systems today, while farmers in the South would have been neglected.

Furthermore, CONAGUA states a shortage of water available for different types of uses in Mexico, which will grow considerably until 2030, see Figure III.8.

In this context, it is also important to highlight that different types of water users, such as growers, manufacturers and private households compete with each other for the scarce resource. Competing interests will have to be balanced and a political comprise for the distribution of water will be necessary.

State aid

State aid is considered to be one of the main tools to implement industrial policies (shaping certain industry sectors, facilitating the establishment of national champions, supporting disadvantaged economic players etc.). State aid is also used to remedy consequences of natural disasters - or even economic crises, such as the recent financial and economic crisis, in which governments felt compelled to intervene in order to safe banks and remedy the economic downturn by stimulus packages. However, from a competition perspective, State aid creates the significant risk that the granting State favours certain economic actors over others and thereby distorts competition. Taking into account this threat and acknowledging that there is a magnitude of definitions for State aid across different legal systems; the OECD that a government measure would generally be

considered as State aid if it involves a certain degree of selectivity i.e. if it is directed towards a specific industry sector or a specific enterprise and thus susceptible of significantly distorting competition.[165] Being afraid of the detrimental impact of national State aid on competition, in particular regional competition regimes, such as the community law of the European Union, often contain a general prohibition of State aid with clearly defined exceptions and an ex-ante notification procedure for national aid.[166] However, also national competition regimes may incorporate specific provisions on State aid or be complemented by specific State aid laws, which may give the competition authority advisory powers with respect to the design of State aid regimes in order to ensure that aid does not distort competition.

As described in Chapter II of this publication,[167] the Mexican agricultural support policies, including subsidies for corn production, have significantly changed over time. Prior to 1994, the National Company for Popular Subsistence (CONASUPO) regulated agricultural markets, supported prices for eleven crops (including corn), provided subsidised processing, logistics and marketing services, and distributed subsidised food to low-income families. In 1981, CONASUPO's producer supports, as a percentage of the total crop value amounted to 66 per cent for corn. However, this level of subsidies was not sustainable and CONASUPO's activities were slowly reduced and it was finally substituted by a new government institution created in 1991, the Support Services for Agricultural Marketing (ASERCA) that is affiliated to SAGARPA. Furthermore, in 1994, the Mexican government eliminated all domestic price support for corn and transferred CONASUPO's income support programme as a new Farmers Direct Support Program (PROCAMPO) to ASERCA, which still operates today and actually constitutes the main pillar in Mexico's agricultural support policies. The budget of the second largest support programme Alianza amounts to only 20 per cent of the PROCAMPO budget. By contrast to the former CONAPSU programme, PROCAMPO payments are calculated based on eligible land (cultivated before 1993 with one of the nine key crops) and paid as direct transfer to the producer. It is reported that in the early 2000s, almost 90 per cent of PROCAMPO recipients cultivated fewer than five ha of eligible land. These smallholder received approximately half of the total PROCAMPO disbursements.

Notwithstanding the fact that large farmers in the Northern parts of Mexico are sufficiently profitable, the selection criterion for PROCAMPO payments clearly favours lager farmers with significant tenure of eligible land over smallholder. Furthermore, it is estimated that the agricultural subsidies paid in the past have actually failed to increase productivity of small farmers and to improve their overall economic situation. For these reasons, PROCAMPO has been heavily criticized for not pursuing agricultural development, but instead administering poorness and maintaining political control.[168]

Taking into account the huge difference in the size of land tenure of Mexican corn farmers, it has to be admitted that the selection criterion for PROCAMPO payments, which on its face does not look as if it would favour any particular agricultural enterprise, clearly confers a competitive advantage on large, industrialized farmers in the Northern region.

2. Storage and trading

As described in the corn value chain assessment, storage and trading are performed by different methods: (i) direct sales to processing companies (mainly from the two major processing companies, see below), (ii) sales to traders that transport the volumes purchased to urban areas for resale, (iii) sales to regional storage companies that store the grain for deferred sales, and (iv) other direct sales to livestock producers associations or processing industries (e.g. starch production).

Taking into account the fact that in agricultural commodity markets, demand and supply are both inelastic (which means that in times of food price increases, consumers can hardly consume less and producers of food commodities can usually only try to increase production in the next growing season), the OECD has highlighted the importance of storage and transport to commodity market outcomes: «The effect of storage is that it significantly increases the flexibility of the market. In times of abundance, the operator of the storage facility will purchase commodities so the price will not fall so low. In periods of shortage, the operator of the storage facility will make additional stocks available above the amount produced that season. […] Enabling or facilitating market participants such as co-operatives of farmers to invest in storage and preventing dominant players from abusing their position in relation to storage can significantly improve commodity market outcomes."[169]

In stakeholder interviews it has been indicated that in particular in the Southern regions of Mexico, storage capacity was insufficient.[170] This would actually create an additional challenge for smallholder in this region since they do not have any flexibility as to when to sell their harvest and therefore are even more vulnerable with respect to strong buyer power in downstream markets, as described below.

3. Processing

In contrast to the large number of corn producers in Mexico, there are only few companies that are engaged in the processing of corn. The two major ones are GIMSA, S.A.B. de C.V (GIMSA) and Grupo Minsa SAB de CV (Minsa). According to the information available on its website,[171] GIMSA is engaged principally in the production, distribution, and sale of corn flour in Mexico under the MASECA® brand name. It owns 18 plants located throughout the country with which it serves mainly industrial, retail, and wholesale corn flour customers and has an estimated annual corn flour capacity of 2.8 million metric tons.[172] GIMSA's market share is estimated to be over 70 per cent.[173] Minsa is also principally engaged in the production and sale of corn flour and related products under the brand name Minsa. It owns and operates six corn flour plants located in Mexico and two plants located in the United States.[174] Minsa distributes its products to the manufacturers of corn-based products, as well as to the Mexican government, retailers, wholesale supply markets, supermarket chains and food service clients. It estimates its own market share in the corn flower market at around 27 per cent.[175] Further corn processing and flour producing companies present in Mexico[176] include Cargill Mexico, a subsidiary of the transnational Cargill Group, as well as two smaller players. Molinos Anahuac SA de CV started as a family business in 1993 and has meanwhile two productions site in Mexico as well as one in the US.[177] The fifth is Hari Masa S.A. de C.V that indicates to have yearly production capacity of 80,000 metric tons.[178] Based on this basic information of the corn processing market, there is no doubt about its high concentration of the corn processing market. In particular, taken into account that the smaller processors have limited geographical presence and milling capacity, most farmers appear to be in a situation where in the best case, they can sell their corn to the two major processors.

According to interview findings, there are two main types of contracts between corn producers and processors. The first type of contract benefits from a subsidy by ASERCA. The specific subsidy («Apoyo a la Agricultura por Contrato»)[179] applies to futures contracts between corn producers and processors which are registered with ASERCA. It is reported that only those small farmers that are part of an agricultural organisation/ producers' association actually benefit from this scheme.[180] The second type of contract is concluded directly between corn producers and processors without any intervention of ASERCA.

It is reported that theoretically, prices for corn produced in Mexico are based on the corn future prices at the Chicago Mercantile Exchange that are closest in time to the date of the physical harvest plus international and national transport costs which would occur when importing corn from the US minus cost for local transportation from the production to the consumption point. This formula is based on strong import competition by corn produced in the US. However, it is alleged that corn processors take advantage of their superior market power compared to the corn producers, as well as the fact that many local producers do not have good knowledge about international prices, and pay less than international prices to local corn producers while charging international prices to local customers.[181] In this context, it is equally alleged, that corn processors sometimes refuse to source locally and thereby put small domestic corn producers in the difficult situation to store their harvest over long periods given that they don't have alternative buyers, e.g. from abroad. Another allegation is that the corn processing companies only honour their contractual obligations towards the smaller producers if they are actually favourable for them and that there are hardly any legal or economic remedies in the event of contract breaches.

While these allegations cannot be verified within the scope of this diagnosis, it needs to be pointed out that the corn processing market is highly concentrated with a few companies only and it is not unrealistic that buyers in a oligopsony take advantage of their buyer power.[182]

4. Final commercialisation

Corn is mainly processed into maize flour and maize dough (nixtamal), which serve both as basis for maize tortillas - one of Mexico's most important stable

foods. There are about 65 thousand tortilla stores in Mexico, so-called tortillerías which have a combined share of 75 per cent of the market for tortillas while the combined share of supermarkets in this area is around 7 per cent. However, it is expected that the supermarkets' share will rise in the future. Although the market for tortilla production is very fragmented with many players, there have been several documented cases of price fixing and other cartel behaviour over recent decades. In its submission to the OECD Global Forum on Competition 2012, the Mexican Federal Competition Commission has summarized these cases, in Box III:1.

In addition, in 2010, the Commission investigated regulatory restrictions that impacted on the well-functioning of the markets for production, commercialisation and distribution of tortillas.[183] Within the framework of this investigation, the Commission detected 98 municipal regulations containing elements that restricted competition in the tortilla market and estimated the loss consumers were suffering from these public impediments on competition. This investigation let to an advisory opinion by the Commission on how to prevent regulatory restrictions of competition in the markets

Box III.1: An overview of the Mexican Federal Competition Commission's prosecutions of anticompetitive agreements in the markets for maize tortillas

In 1997, the Union of Maize Tortilla of the Mayan Zone and other independent producers promoted concerted practices to distribute the market for these products. The agreement was supported by the municipal authority and intended to maintain exclusivity for certain producers in geographic areas in the municipality of Carrillo Puerto in Quintana Roo. The firms tried to stop the distribution of tortillas in the municipality by the owners of two stores. The Commission decided that the concerted action of the firms and the performance of the Municipal Authority constituted violations to the FLEC. In this case, the Commission sanctioned individuals and advised the government of Quintana Roo to abstain from participating and supporting actions that would harm competition in the tortilla market. File: IO-041-1996.

In 1999, the Commission carried out in Baja California and the region of the Comarca Lagunera two investigations against tortilla producers for agreeing to fix prices. The agreements were facilitated by regional business organizations. The Commission determined that the maintenance of these mechanisms eliminated price competition. Both investigations were concluded after the associations involved agreed to, to inform their members about their freedom to set prices for their products. Files: IO-001-1999 and IO-002-1999.

In 2001, the company Club Cadena Maíz Tortilla, SA de CV (Camato), which gathers producers, millers and manufacturers of maize tortilla, suggested its affiliates to fix the price of maize tortillas in the Federal District and metropolitan area. At that time, Camato represented 17 thousand producers and millers of maize, which supplied 10% of the domestic market and 5.8% of 12 thousand tortillerías of Mexico City. The Commission determined that Camato members could not regarded as a single economic agent and therefore, instructions or suggestions on the price of the tortilla issued that Organization constituted and infringement to the FLEC. The Commission ordered the suspension of the practice and imposed a fine. Files: IO-02-2000 and RA-40-2001.

In 2002, the government of the state of Yucatan filed a complaint before the Commission against leaders of the Trade Association of Tortilla Manufacturing in Yucatan for publishing in the local media a new price for maize tortillas in the region. The FLEC provides that recommendations of trade associations to its members intended to fix, raise, agree or manipulate the price of goods or services, or exchange information with the same purpose are evidence of an infringement to the FLEC. During the investigation, the leaders recognized that the trade association had no power to fix or establish official prices of maize tortillas, and reported not knowing the accuracy of newspaper's reports. However, the Commission got access to several transcripts of the trade association meetings proving that its members had gathered to exchange information on the sales and price of maize tortillas and as a result of such meetings had agreed on the sale price of the good. Also, from information published by the Bank of Mexico and price monitoring conducted by the Federal Attorney's Office of Consumer Protection, it could be established that the price of maize tortillas in several municipalities of Yucatan had increased after the trade association published the new price for maize tortillas. This provided the evidence that the producers had agreed increases in the price of tortilla. The investigation ended with the commitment by the leaders of the trade association to cease the anti-competitive agreements, and report to its members that the association had no authority to regulate prices of maize tortilla and that that agreements among competitors to fix prices constituted a violation of the FLEC. Finally, the group pledged to monitor the behaviour of its members in order to prevent agreements among competitors. Also, the trade association agreed to send to the Commission a copy of the meetings minutes. File: DE-07-2002.

Sources: Contribution from Mexico to Session I of the OECD Global Forum on Competition, 27 January 2012, DAF/COMP/GF/WD(2012)43

for production, commercialisation and distribution of tortillas.[184]

In 2012, the Commission prosecuted a market sharing cartel concerning the sales of tortillas using motor vehicles in the city of Tuxtla Gutiérrez.[185] This cartel was formed between associations of tortilla producers and representatives of the municipality.

5. Summary of possible competition issues affecting corn production and commercialisation in Mexico

First of all, it can be concluded that as many other agricultural markets around the world, the Mexican markets for corn production and commercialisation are characterised by starkly differing degrees of concentration along the agricultural value chain. While both production and consumption of corn are highly atomised, upstream markets for key inputs such as hybrid seeds and downstream processing of corn are highly concentrated. There are two dimensions of this specific industry structure. In those markets that are characterised by a high level of concentration, competition is likely to be reduced, which would have a negative impact on prices, product quality and innovation. Furthermore, from a vertical perspective, the strong difference in concentration along the different parts of the value chain causes strongly diverging levels of market/negotiating power between input providers and farmers and between farmers and processors. This puts producers, and, in particular but not only, the huge number of smallholder engaging in traditional farming mainly located in Southern Mexico, in the position of 'price takers' and makes them vulnerable to possible abuse of market power by hybrid seeds producers and corn processors. Indeed, there have been allegations of abusive behaviour of corn processors, which however cannot be verified within the scope of this diagnosis.

Secondly, taking into account insufficient storage capacity of small farmers, there is potential to improve bargaining situation of smallholder vis-à-vis the buyers of corn by introducing sufficient storage capacity.

Thirdly, there are factors outside of Mexico which have an impact on competition in the Mexican markets for corn production and commercialisation: (i) corn producers face strong import competition from the US, which in the past may have amounted to dumping and may have caused the least productive smallholder to exit the market and retreat into subsistence. (ii) In addition, while the Mexican markets for agrochemicals have been described as highly competitive, it cannot be excluded that the fact that only six companies control 75 to 80 per cent of the worldwide markets for agrochemicals and the possible existence of a worldwide cartel for potash (the key ingredient for potassium fertilizer) have an impact in Mexico.

Fourthly, PROCAMPO's Farmers Direct Support Programme favours large farms by way of its selection criteria of eligible land size compared to smallholders and thereby distorts competition to the detriment of smallholders.

Furthermore, as regards water as a key input for corn production, farmers face strong competition from different users (industry and private household) and there is a gap between supply and demand. Growers will depend on public support for building the infrastructure necessary to expand the surface of irrigated land.

Finally, as regards the stage of the final commercialisation, there are several documented cases of price fixing and market sharing among the producers of tortillas - at times even with involvement of municipal representatives. Furthermore, a number of municipal regulations that restrict competition in the commercialisation of tortillas have been identified by the Mexican Federal Competition Authority.

D. LEGAL AND INSTITUTIONAL FRAMEWORK OF MEXICO'S COMPETITION REGIME

1. The Federal Law of Economic Competition and the Federal Competition Commission

Mexico's competition policy was introduced as part of the country's reform initiative to develop a market based economy, which started in the-mid 1980s. The Mexican competition law (Ley Federal de Competencia Económica - LFC) that constitutes the legal framework of Mexico's competition regime was adopted in 1993. It is enforced by the Mexican Federal Competition

Commission (CFC) that was established in the same year.

The CFC comprises the Plenum that is formed by five Commissioners including the Commission's President and the Executive Secretariat. While the Plenum is the adjudicative body, the Executive Secretariat is charged with the operative and administrative functions of the CFC. It conducts the proceedings under the LFC and prepares the decisions by the Plenum.

The LFC fully applies to the agricultural sector in Mexico. The general exemption of Article 6 LFC applies only to associations and cooperatives directly exporting their products and fulfilling specific conditions. As such it can be considered as an exemption for certain export cartels, but not as an exemption for agricultural cooperatives.

Under the title «absolute monopolistic practices», Article 9 LFC prohibits the following anticompetitive agreements, which are commonly qualified as hard-core cartels and which constitute the most egregious forms of competition law infringements: price-fixing, output restriction, market sharing and bid-rigging. These absolute monopolistic practices are *per se* prohibited and null and void by law.

A second category, so-called "relative monopolistic practices" (Article 10 LFC) are prohibited, if their object or effect is to unduly eliminate other market players, impede substantially their market access or confer exclusive advantages to one or several persons. The following practices fall in this second category: exclusive distribution agreements and non-compete clauses, resale price maintenance, tying and bundling, the prohibition to sell competing products, refusal to deal and the exercise of joint pressure on clients or supplier, as well as any other act that unduly restricts competition. For the finding of a relative monopolistic practice, it is further required that the market player under scrutiny enjoys substantial market power. Therefore, the prohibition of relative monopolistic practices is similar to the prohibition of the abuse of a dominant position in other jurisdictions.

In addition, the LFC establishes mandatory merger control above certain thresholds. Mergers that would substantially lessen competition are to be prohibited by the Mexican Competition Authority.

The LFC does not contain specific provisions on State aid, and in Mexico there is not separate law dedicated to State aid. However, as part of its advocacy functions, the CFC is empowered to issue advisory opinions on competition issues either ex officio or upon request of other parts of government, which could be used to render advice on State aid issues.

2. The CFC's enforcement record in the agricultural sector

Within the framework of this Outlook, it needs to be mentioned that the CFC has actively enforced the LFC in the agricultural sector. So far, it has reviewed 40 mergers in the agricultural sector, carried out 11 investigations in potentially anti-competitive behaviour affecting the agricultural sector, and issued 4 advisory opinions on competition issues in agriculture. Some of its decisions are reflected in this Outlook. Further information on the individual cases is published on the CFC's website.

3. Remedies under the LFC against possible competition issues affecting corn production and commercialisation

As evidenced by the CFC's case law, specific competition issues affecting corn production and commercialisation have been remedied through enforcement of the LFC. Thus, the question arises whether further competition issues possibly affecting corn production and commercialisation which have been identified in this Outlook can as well be remedied through enforcement of the LFC.

Prevention of further increases in concentration in already highly concentrated input and processing markets through the LFC's merger control regime

A further increase in concentration in corn input and processing markets through external growth, i.e. through mergers and acquisitions, can be prevented by a strict application of the LFC's merger control regime. With its decisions in the Monsanto/Asgrow/Cargill merger, the CFC has shown that it takes its merger control function seriously and that it is not afraid of enforcing the law against large market players. However, it also needs to be pointed out that

it is not possible to address already existing levels of high concentration through merger control.

Remedies under the LFC to address abuse of market power by dominant suppliers

As noted, the LFC does not contain any remedy to address a high level of market concentration as such. However, the prohibition of relative monopolistic practices allows remedying abuses of market power by dominant suppliers of corn producers like tying and bundling or the prohibition to use competing products from other suppliers. This is of particular relevance for the market for hybrid seeds, which is characterised by a very high level of concentration, with Monsanto being likely to hold a dominant position. In other words, the LFC allows the CFC to intervene when abuses of market power by dominant input suppliers become apparent.

Remedies under the LFC to address collusion among suppliers

Although the present diagnosis has not unveiled indications for collusion, such as price fixing and market sharing, among Mexican input suppliers, for the sake of comprehensiveness, it shall be mentioned that the LFC would allow to prosecute such type of collusion among suppliers as absolute monopolistic practice.

Taking into account that Mexican corn producers are also exposed to collusion among input suppliers located outside of Mexico, as well as to collusion among raw material suppliers for agricultural inputs outside of Mexico (such as the possible potash cartel), the question arises whether such conduct would be captured by the LFC's prohibition of absolute monopolistic practices. In fact, several competition laws also apply to foreign conduct under the condition that it produces a measurable impact on domestic markets. However, experience has shown that, in practice, the prosecution of foreign anti-competitive conduct is a difficult process and generally requires close cooperation with other competition authorities that can assist in this task.

Remedies under the LFC to address abuse of buyer power

With respect to the high concentration of the corn processing market and the allegation of abusive behaviour of large processors vis-à-vis small suppliers (such as paying prices below the competitive level and not honouring their contractual obligations), the question arises to what extent the LFC allows to remedy abusive behaviour of powerful buyers.

This question is to be put in the context of the ongoing debate to what extent competition law should deal with abuse of buyer power, which is intrinsically linked to the debate on the objectives of competition law and policy. If maximizing consumer welfare is conceived as the sole objective of competition law and policy,[186] the abuse of buyer power will only be considered as a competition issue if it harms consumers, for instance, if it can be demonstrated that the payment of prices below the competitive level by a monopsonist leads to the production of low quality products as producers do not realize sufficient margin to keep up production standards. Consequently, in the absence of any consumer harm, competition law and policy could not be used to help producers who are subject to the abuse of buyer power. However, if the objective of competition law and policy is defined as the protection of competition as an open process, not only consumer harm, but also producer harm can be taken into account to assess whether the use of buyer power is to be considered abusive.[187]

Having this general debate in mind, the question needs to be assessed whether the abuse of buyer power would be captured by the prohibition of relative monopolistic practices in Article 10 LFC. This would firstly require that the respective buyer enjoys substantial market power according to Articles 11, 13 LFC. From the reading of the respective Articles, it is not entirely clear whether the Mexican concept of substantial market power covers substantial buyer power. With this respect, the objectives pursued by the LFC may provide some guidance for interpretation. According to its Article 2, the LFC shall protect the competitive process and free competition through the prevention and elimination of monopolies, monopolistic practices and further restrictions to the effective functioning of the markets for goods and services. It thus appears that the LFC is not exclusively concerned with maximizing consumer welfare, but it also aims at protecting the competitive process as such for the benefit of all participants. This consideration would allow understanding the concept of market power in Articles 11, 13 LFC to include buyer power. As a consequence, one could argue that buyers with substantial market power meet the first condition

of the prohibition of relative monopolistic practices according to Article 10 LFC. Secondly, it would be required that the behaviour of the economic agent who enjoys substantial buyer power corresponds to one of the specifically prohibited forms of abusive behaviour, or that it falls under the general prohibition in Article 10 VII LFC. While it appears that the specific examples of prohibited practices relate to situations of dominant suppliers, the general prohibition of any act that unduly harms or impedes the competitive process and the free competition in production, manufacture, distribution and commercialisation of goods and services would allow capturing as well abusive behaviour of buyers who restricts competition. Based on this understanding of the LFC, it may be possible to prosecute abuses of buyer power under the Mexican competition law.

In this context, it should though be mentioned that the CFC in the past considered that the former version of Article 10 LFC did not capture discriminatory pricing practices by buyers with substantial market power.[188] However, as the CFC mentioned in the respective submission to the OECD, at that time "Mexico's experience regarding complaints on problems arising from buyer power was quite limited." Furthermore, Article 10 LFC was amended since then. Thus, it might be possible that the CFC would understand Article 10 LFC differently today.

While there seems to be theoretically a possibility to remedy abuse of buyer power through the enforcement of Article 10 LFC, it needs to be pointed out that cases that deal with the abuse of market power are very difficult to prove in practice. In particular, cases of pricing below or above the competitive level are challenging for competition authorities that shall not assume the role of price regulators.

It therefore, can be summarized that the prospects of remedying abuse of buyer power under the LFC are very uncertain.

Remedies under the LFC to address anticompetitive behaviour affecting the final commercialisation of corn

The LFC prohibits price fixing and market sharing, which have been found in the market for commercialisation and distribution of tortillas, as absolute monopolistic practices. The CFC's case law shows that this type of anti-competitive behaviour has been actively prosecuted.

Use of the CFC's advocacy power in order to support the design of pro-competitive State aid schemes in the agricultural sector

By means of its advisory functions, the CFC could render support to eliminate possible distortions caused by the current design of agricultural subsidies schemes and help to design pro-competitive aid schemes.

Summary

The LFC's merger control regime allows the prevention of any increase in concentration of already highly concentrated agricultural market through external growth. However, it does not provide for any means to remedy existing high levels of concentration which are unfavourable to competition. Furthermore, while the LFC allows prosecuting hard core cartels (absolute monopolistic practices) and the abuse of substantial market power by suppliers (relative monopolistic practices), it is doubtful whether it allows to effectively prosecute the abuse of buyer power. Finally, the CFC's advisory function can be used to support the design of pro-competitive schemes for agricultural subsidies.

E. FINDINGS AND POLICY RECOMMENDATIONS

1. Findings

Status of Competition in corn production and commercialisation in Mexico

- The Mexican markets for corn production and commercialisation are characterised by starkly differing degrees of concentration along the value chain. While both production and consumption of corn are highly atomised, upstream markets for key inputs, such as hybrid seeds, and downstream processing of corn are highly concentrated. This may lead to a low level of competition with a negative impact on prices, product quality and innovation in those markets that are highly concentrated. It further causes strongly diverging levels of market/negotiating power between input providers and farmers and between farmers and processors. As a consequence, corn producers find themselves in the position of 'price takers' who are vulnerable to

the possible abuse of market power by hybrid seeds producers and corn processors. Indeed, there have been such type of allegations, which however cannot be verified within the scope of this diagnosis.

- Small farmers do not have sufficient storage capacity, which further weakens their bargaining situation vis-à-vis the buyers of corn.
- Certain factors outside of Mexico may impact on the status of competition in the Mexican markets for corn production and commercialisation: (i) import competition from the US; (ii) a small number of transnational companies controlling 75 to 80 per cent of the worldwide markets for agrochemicals; and (iii) the possible existence of cross-border anticompetitive practices in upstream raw material markets (alleged potash cartel).
- The current design of specific agricultural subsidy schemes appears to favour large farms compared to smallholders and could thereby distort competition.
- Different users (agriculture, industry and private household) compete strongly for the key input water. Growers will depend on public support for building the infrastructure necessary to expand the surface of irrigated land.
- At the stage of final commercialisation, there are several documented cases of price fixing and market sharing among the producers of tortillas - at times even with involvement of municipal representatives. Furthermore, a number of municipal regulations that restrict competition in the commercialisation of tortillas were identified by the Mexican Federal Competition Authority.

Legal and institutional framework of Mexico's competition regime

- The LFC constitutes the legal framework of Mexico's competition regime. It is enforced by the CFC.
- The LFC's merger control regime allows to prevent any increase in concentration of already highly concentrated agricultural market through external growth.
- However, the LFC does not contain any remedy to address a high level of market concentration as such.
- While the LFC allows to prosecute hard core cartels (absolute monopolistic practices) and the abuse of substantial market power by suppliers (relative monopolistic practices), it is doubtful whether it allows to effectively prosecute abuse of buyer power.
- The CFC's advisory function can be used to support the design of pro-competitive schemes for agricultural subsidies.

As evidenced by its case law, the CFC has been actively enforcing the LFC in the agricultural sector.

2. Policy recommendations

The proposed policy recommendations aim at addressing the possible competition issues affecting specifically corn production and commercialisation in Mexico. If similar issues exist in other agricultural markets, the same type of measures might be useful. However, this would need to be assessed on a case-by-case basis. Following this Outlook, the status of competition in further agricultural markets could be assessed by SAGARPA in cooperation with the CFC.

Strengthening existing associations/ cooperatives of small corn growers and supporting the establishment of new associations/cooperatives

As discussed in this Outlook, the existing market structure of a huge number of corn producers facing highly concentrated upstream and downstream market cannot be changed through competition law enforcement. Therefore, further policy measures are needed. One option is to strengthen the market position and negotiating power of smallholders by grouping their demand and supply via farmers' associations/ cooperatives. Those associations/cooperatives could also invest in storage facilities, which would allow for certain flexibility when selling their harvest.

In fact, Mexico has already embarked on this road as reported in a submission to the OECD Policy Roundtable on Competition and Regulation in Agriculture: Monopsony Buying and Joint Selling: «Small firms are permitted to co-ordinate some activities by joining together in «integrating companies» created under a program administered by the Economic Ministry. The program is designed to help small and medium sized firms in several economic sectors to take advantage of scale economies and purchasing efficiencies in order to attain bargaining power in the provision, commercialization, financial

and technology markets. The CFC considers that firms participating as partners of shareholders in such en entity are not acting as competitors. Consequently, their price standardization practices are not considered illegal under the LFC. Currently, 210 integrating firms exist in the agricultural sector and eight of them are considered successful.»[189]

It appears recommendable to carefully assess why only 8 out of 210 integrating firms were considered successful at that time and use the respective results to design appropriate measures to strengthen existing farmers' associations/cooperatives and support the establishment of new ones in areas, where farmers' are not yet well organized for economic purposes.

In this context, it should also be mentioned that strengthening cooperatives in the agricultural sector is a policy option also pursued by other countries. E.g. the government of Odisha in India adopted a specific law for the establishment of co-operatives of sugar growers. This law also provides for a mechanism to ensure that the co-operatives and their members do not engage themselves in exclusionary practices.[190]

Promoting new entry in highly concentrated corn input and processing markets

Changing the market structure of highly concentrated corn input and processing markets would require new entry. This could be promoted through supportive policy measures, e.g. co-operatives and associations of farmers could be supported to invest not only in storage facilities, but also in processing facilities, so that a larger number of players would be present in the highly concentrated processing markets. As for input markets, such as the market for hybrid seeds, support for research and development might incentivize new entry.

Enabling small corn producers to grow and compete successfully in commercial markets through pro-competitive state-aid schemes

As discussed in this Chapter, as well as in Chapters I and II, there is a large array of reasons why small corn producers today are unable to grow and successfully compete in commercial markets. These reasons include amongst others small possession of arable land, use of traditional farming methods, insufficient rural infrastructure, lack of rural financing, etc. Public investment in infrastructure and further public support will be needed in order to enable smallholders to successfully enter commercial corn markets. Experience has however shown that it is crucial that respective state aid schemes be designed in a pro-competitive manner and do not lead themselves to further distortion of competition. By means of its advocacy function, the CFC could render its support to design schemes for pro-competitive agricultural subsidies.

Continuation of an active enforcement of the Mexican competition law in the agricultural sector, including production and commercialisation of corn

Continuing to actively enforce the LFC in the agricultural sector would help to address certain of the possible competition issues affecting corn production and processing. In particular, continuing to vigorously assessing mergers that affect those agricultural markets that are already highly concentrated, e.g. the market for hybrid corn seeds and the corn processing markets, will prevent further concentration through external growth.

Furthermore, corn producers could be encouraged to bring to the CFC's attention any indication of absolute or relative monopolistic practices in input markets, which would allow the CFC to initiate respective investigations and prosecute these practices, if there is sufficient proof.

The CTC could further use its good working relations with other competition authorities in the region and worldwide to jointly address competition issues originating outside of Mexico, but impacting on the Mexican agricultural sector.

Strengthening competition advocacy in the agricultural sector

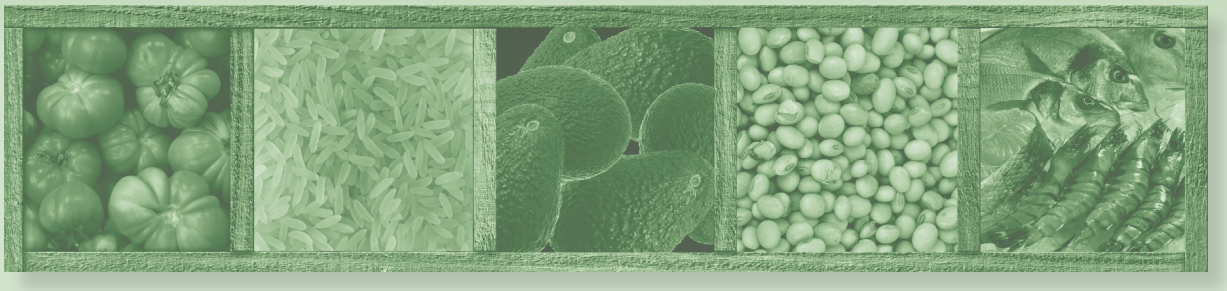
As mentioned above, the CFC's support to design pro-competitive agricultural support programmes would be very beneficial. In addition, competition advocacy targeted at the various players of the agricultural value chain would increase their awareness of and respect for competition law requirements. Furthermore, advocacy measure targeted at smallholders could increase their capacity to denounce of anti-competitive conduct from which they suffer and to provide the CFC with the required information to start an investigation.

Exploring ways to prevent and remedy possible abuses of buyer power

For several grain markets, there are no more than two to three buyers/processors that control the near totality of the market. Thus a few large buyers can exert a great deal of control over the sellers and prices (commercialization and processing). This is likely to occur especially during harvest periods, when small producers are forced to sell their production to meet their financial requirements. Ultimately for smallholders to either enter or remain in high-value or potential export markets, the Mexican government needs to encourage the larger processing, integration and supermarket industries to use the small-scale sector. Both exporters and buyers in the main urban areas need to be flexible in allowing smallholders time to adapt to changing conditions and standards. Research has shown that small-scale growers did not represent such a high risk as the many supermarket or other retailers might suppose, and also that standards could be met cost effectively if the correct approach to division of management responsibility between farmer, depot and product market operatives (supermarkets, wholesalers, exporters, etc.) were adopted. There is need to consider way to reduce concentration of market power in certain stages/actors of the agricultural commodity value chain.

For instance, taking into account that the market for corn processing is highly concentrated with allegations of corn processors not honouring their contractual obligations vis-à-vis small corn producers, it could be explored with the CFC to which extent such possible abuses of buyer power could be prosecuted under Article 10 LFC. Additionally, alternative ways to prevent and remedy such situations should be thought of; e.g. establishing a complaint mechanism at ASERCA if contracts that benefit from an ASERCA subsidy are not honoured.

CHAPTER IV



AGRICULTURE AND BIOFUELS AS A CONTRIBUTOR TO RURAL DEVELOPMENT

A. INTRODUCTION

Agriculture remains a major source of employment and income in rural Mexico. Rural regions, however, have experienced declining income when compared to urban areas of the country. Employment patterns have also been prone to seasonal fluctuations, with large numbers of workers gainfully employed only during harvest seasons. Moreover, the quality and availability of energy services in rural Mexico are far inferior to those available in urban areas.

Expanding opportunities for rural job creation, raising farmers' income levels and improving rural energy services are key rural development goals for Mexico. The country seeks to achieve these goals within a sustainable development policy framework emphasizing food security and rural development, while promoting a diversified and secure energy supply.

This Chapter demonstrates that the promotion of biofuels in conjunction with the agricultural sector development in Mexico can help enhance income opportunities and improve access to energy services. Mexico's policies supporting sustainable development open significant business opportunities for biofuels and bioenergy using residue streams from agriculture, while at the same time deepening value chains of agricultural products. This could considerably help rural areas enhance economic diversification while supporting a national transition to a low-carbon economy.

The use of residual by-products of agriculture to produce biofuels can add value to the lifecycles of agricultural goods whilst addressing energy needs in rural areas. This Chapter examines prospects for the production of biofuels using low-cost, non-edible agricultural residues, paying special attention to employment creation, income generation and alternative energy solutions, while safeguarding food security in Mexico. Potentials are estimated for the production of bioelectricity, biogas and second-generation biofuels using residue streams from the industrial processing of 13 agricultural products in Mexico (corn, sugarcane, beans, wheat, rice, sorghum, coffee, egg, milk, beef, pork, poultry and fish). The use of harvest residues as a feedstock was not considered due to their role in protecting soils against erosion and use as a natural fertilizer.

Energy potentials from the residues of the 13 products analyzed shows a large under-utilized and untapped potential: bioelectricity could produce 10.5 per cent of the yearly national electricity consumption in Mexico; 2nd generation bioethanol could replace 6.3 per cent of gasoline used (in energy terms); biodiesel produced via biomass-to-liquid technologies could replace 23.2 per cent of diesel demand; and biomethane could meet up to 14 per cent of natural gas demand in the country.

By integrating energy and agricultural production, estimates suggest significantly increased income-generation in rural areas. By considering only residues from the 13 agricultural products analyzed, the production of bioelectricity, bioethanol and biodiesel could generate between USD 2.2 and 4.1 billion in additional revenue for Mexican agriculture. Biogas potentials could add another USD 234 million to revenue earnings.

The production of biofuels from agricultural residues could also provide substantial net employment opportunities in Mexico. Bioelectricity from agricultural residues could add over 39.000 new jobs (direct and indirect); bioethanol over 49.400 jobs; biodiesel 71.700 jobs and biogas 4.000 jobs. These jobs would provide better worker wages and offer higher-skilled employment opportunities than the current average in Mexican agriculture. While the average revenue per job created in the entire Mexican agricultural sector is USD 9.020 per employee, the equivalent in bioenergy has been estimated to average USD 57.400 per employee. Since many of the products analyzed are also cultivated in smallholder systems with low remuneration, income diversification arising from the additional bioenergy revenue streams could help to reduce rural poverty, seasonal fluctuations in agricultural employment and rural emigration.

However, before these potentials can be realized, many regulatory and technological hurdles need to be overcome. Some of these challenges an ways of addressing them will be examined in the Chapter.

Mexico's territorial heterogeneities call for solutions which are flexible enough to accommodate different residue streams and produce different outputs to meet local energy demand, be it for transport, cooking or electrification needs. In addition to the 13 agricultural products analyzed, policies and incentives should thus support production from a wider spectrum of residues. Moreover, an optimal rural energy policy should consider a broader set of residues including forestry and municipal waste.

B. BIOFUELS AS A DRIVER OF RURAL DEVELOPMENT IN MEXICO

In order to provide additional dimensions to Mexico's agricultural development outlook, this chapter seeks to explore the country's potential to enhance its agricultural development through the production of biofuels produced from agricultural residues. This chapter assesses the potential benefits of promoting biofuels production from agricultural residues in Mexico to expand employment and income opportunities in rural areas, as well as to diversify the set of economic activities available for rural populations and steer the country's energy mix towards more sustainable energy sources.

While biofuels can be an alternative source of energy for transport, cooking and electrification, their production based on dedicated, large-scale crops such as sugarcane, corn and palm carries a number of risks to environmental and social systems (UNEP, 2009). Therefore, the production of biofuels from agricultural residues could act as an additional competitive force in rural areas, while at the same time avoiding the risks bound to bioenergy based on dedicated crops. In the Mexican context, the well-known biofuel production pathway based on the usage of cereals should be avoided given the country's reliance on corn as a primary foodstuff and source of nutrition, and its large trade deficit in cereals. In this regard, new technological options are being developed to enable the cost-efficient conversion of agricultural waste into biofuels, promoting renewable energy concerns without jeopardizing food security.

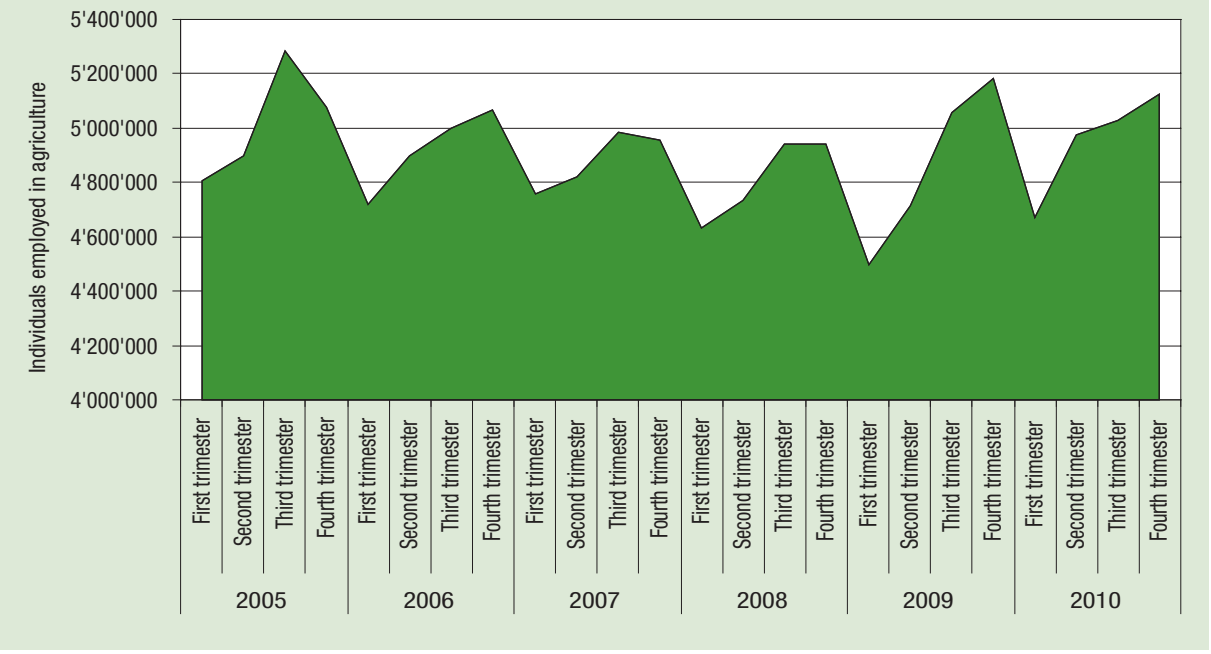
Adapting models for sustainable biofuel production and use to the realities of Mexico holds the potential to improve the country's national accounts. Although Mexico is an oil producing and exporting country, declining reserves and limited refining capacity has led to a growing dependency on gasoline imports. Furthermore, as the agricultural sector faces a rising dependency on imported fossil fuels, a cost burden emerges and impact on the overall competitiveness of agriculture. Mexico has already sought alternatives by introducing legislation to raise native biofuel production capacities (Mexican Congress, 2008). Since 2009 the Mexican Ministry of Agriculture has introduced support schemes for the development of renewable energy and biofuels, and since 2010 there have been incentives for heat and power generation based on biomass (SAGARPA, 2009; SENER, 2009a). However, targeted support measures are still not in place to stimulate large scale usage of agricultural residues to produce surplus electricity to the national grid, ethanol, biodiesel or biogas. Given the Government's priority of ensuring energy security without compromising food security and environmental sustainability, biofuels produced from agricultural waste could be a viable option provided that the necessary rigorous assessment of alternatives is undertaken.

As a contribution to the diversification of energy sources, particularly as a result of new technologies that allow for the use of agricultural waste in electricity co-generation and as non-agricultural feedstock for biofuels[191], this chapter complements the broader agricultural development outlook in the country by assessing the option to produce biofuels from agricultural residues. Based on a set of 13 key agricultural and livestock products of interest identified by the Government (corn, sugarcane, beans, wheat, rice, sorghum, coffee, egg, milk, beef, pork, poultry, and fish), this chapter is structured in four parts: An exploration of the rationale for biofuel production from residues in Mexico; A survey of current and emerging technology options which allow conversion of agricultural residues into biofuels; A quantitative scoping exercise to estimate the national potential for the production of biofuels based on residue streams from 13 agricultural products of interest; and an analysis of the progress made thus far in Mexico in the area of biofuel production from agricultural residues. Policy recommendations are then discussed in the conclusion.

C. RATIONALE FOR BIOFUELS FROM AGRICULTURAL RESIDUES IN MEXICO

Mexico's rural areas account for more than 80 per cent of the land in the country and are home to 22 per cent of the population[192]. In dispersed rural areas, agriculture is the main source of employment with 44 per cent of the population occupied in the primary sector. Overall, agriculture accounted for about 14 per cent of employment in Mexico, in 2011.[193] The availability of employment in rural areas varies according to harvest seasons, causing income-pressure on laborers during off-seasons (Figure IV.1). Rural and rural semi-urban municipalities respectively accounted for 25 per cent and 43 per cent of the average national GDP per

Figure IV.1: Total employment in Mexican agriculture between 2005 and 2010, by season



Source: SIAP

Box IV.1: The potential of developing economies to develop energy potentials from agricultural residues

Nepal is a poor economy with a yearly per-capita income of only US$ 350 and a high share of its population living in rural areas. The country faces tremendous problems to secure the supply of petroleum products necessary to meet the national demand for the transport, residential and industrial sectors. NOC (Nepal Oil Corporation) is the state owned venture responsible for oil imports and the only supplier of oil products in the market. According to NOC, 752,446 m3 of petroleum products (diesel: 39.8% and gasoline: 13.1%) were imported from India in 2006/2007, mainly to meet transport needs. The number of vehicles in the country is increasing at an average rate of 13.5% per year since 1990/1991,and more than 56% of the vehicles are registered in the Kathmandu Valley, the capital city of Nepal.

By having an established sugarcane production, the country has a large installed capacity for sugar and ethanol production. Still, it is the production of ethanol based on a by-product of sugarcane (molasses) which possesses the most interesting prospect for Nepal. At present conditions, 18,045 m3 ethanol can be annually produced from molasses in Nepal without compromising the production of primary food products from sugar cane such as sugar, chaku and shakhar. The effects for the country can be manifold. By introducing biofuel blends such as E20, as much as 14% reduction in gasoline imports could be achieved, which can be translated in an economy of US$ 10 million to the country's national accounts. Furthermore, the activity can provide an incentive for improved yields in sugarcane production, and help develop the industrial sector. This, in turn, will have a positive effect in terms of job and income generation in the rural areas where 85% of the Nepalese population currently lives. Improvement of agricultural practices for sugarcane could also have an indirect and positive effect on improving other agriculture activities. Furthermore, the use of ethanol in the transport sector will have a positive environmental effect while reducing CO2 emissions and combating pollution in the Kathmandu Valley. Nine sugar mills were operational in Nepal in 2010, with the total installed capacity of 17,050 cane-tonnes per day. One of the sugar mills only has a 30 m3/day molasses-based ethanol plant installed but it is not operational yet due to inadequate support from the government and lack of a joint commitment of all stakeholders.

Source: Khatiwada and Silveira, (2010)

capita in the country (INAFED, 2000). In spite of recent reductions in rural poverty levels since the mid-1990s, 61 per cent of population in rural areas live below the national rural poverty line.[194] Furthermore, the contribution of main rural activities (agriculture, forestry and fisheries) to GDP declined from 8 per cent in 1990 to 4 per cent in 2011.

Compounding to their relative poverty, rural populations in Mexico suffer from lack of infrastructure - the provision of health, communications and energy services is logistically difficult and expensive for local authorities. This has led to a situation where full electricity coverage has not yet been achieved; electrification rates in Mexico were 87 per cent in 2000, 95 per cent in 2004 and 97 per cent in 2008, yet still 3.5 million people in rural areas of southern states remain unserved because of distance from the grid, small size of communities and general poverty (World Bank, 2004; World Bank, 2008). These figures do not take into account access to other energy services, such as clean cooking technologies for isolated areas, which results in a pattern of low-efficiency biomass-based cooking which is often detrimental to the health of women and the youth (Masera et. al., 2005).

The rural landscape in Mexico has unique characteristics. The land tenure system is based on small properties (ejidos) which developed after the 1910 Mexican revolution. This turned a large part of the country's peasants into small landowners bound by collective property rights.[195] Therefore many properties are small scale, with farmers unable to replicate extensive plantation modalities such as those in place in Brazil. This is compounded by a limited availability in rain-fed areas in Mexico, as 60 per cent of its territory is arid or semi-arid in nature (Herrera-Arreola et al., 2008). The large majority of small agricultural producers in Mexico are still poorly diversified, with efforts concentrated in low value-added crops which are highly vulnerable to price shocks.

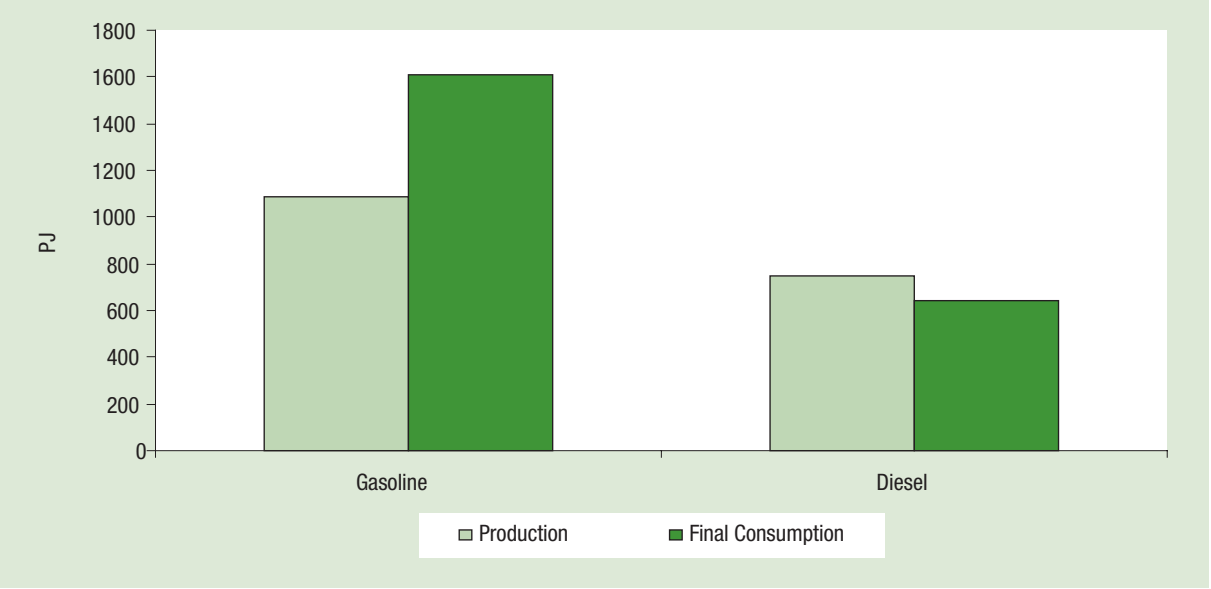
Despite their relative economic and social hardships, as well as structural specificities, rural areas in Mexico are endowed with abundant natural resources, which are often underexploited (OECD, 2007). If potentials are realized, biomass resources may deliver to up to 16 per cent of the total energy consumed in the country (Islas et. al., 2006). By better utilizing these assets, Mexico could improve its rural income and promote employment, ultimately strengthening national growth. The development of rural energy potentials based on residue streams of current agricultural products presents an additional opportunity to meet one of the main goals of the Mexican Program for Rural Development, which seeks to diversify the rural economy and increase its economic and social resilience to regional and global market shocks (ECLAC, 2007). Previous studies show that rural areas can deliver substantial contributions to enhance energy services, while at the same time fostering income and employment opportunities for local populations (Box IV.1).

The case for residue utilization is strengthened by Mexico's trade preferences within NAFTA. Since Mexico enjoys advantageous conditions for its agricultural exports to the US, producing biofuels directly out of dedicated crops such as sugarcane and corn would cause trade-offs with missed export opportunities. As an example, the membership in NAFTA allows Mexico to trade sugar with the US under contract #14 of NYSE instead of the common international sugar contract #11. The existence of a developed sugar industry in Mexico with favourable trade conditions makes it costly and therefore unlikely that bioethanol be produced at large scales based directly on sugarcane. Consequentially, the option of utilizing by-products of sugarcane processing, such as bagasse, could emerge as a more interesting bioenergy pathway for the country.

Adding to the motivations to consider energy alternatives is the current decreasing state of Mexico's oil production (Kerr, 2011). Mexico's energy matrix is strongly dominated by fossil fuel energy, whose imports are growing in order to meet national demand. While Mexico has been traditionally a large oil producing country, decreasing extraction and limited refining capacity have constituted a situation of reliance on gasoline imports, and a reduced export margin for diesel (Figure IV.2). In 2008, Mexico relied on other sources (imports and stocks) to meet domestic demand for gasoline. As Mexico is a net exporter of diesel and gasoline imports have been on the rise in recent years, from an energy security perspective, action towards reducing dependency on gasoline is a priority. This puts special emphasis on ethanol initiatives, especially those which avoid conflicts with food security and do not reduce agricultural export opportunities in the country.[196]

Enabling an economic transition from fossil to renewable sources of energy is already a stated goal of the Mexican energy strategy (SENER, 2012). Gradual increases in gasoline and diesel prices between 2009 and 2012 have brought fossil fuels in Mexico closer

Figure IV.2: Gasoline and diesel in Mexico: Native production and consumption



Source: International Energy Agency (2008)

to subsidy-free levels (AMEGAS, 2012; GIZ, 2011). As gasoline and diesel fuel become sources of tax revenue, additional resources brought by taxation could theoretically be used to cross-subsidize second generation biofuels pertinent to the conversion of agricultural residues. In general, the necessity for subsidies will strongly depend upon the technology development, reductions in production prices, and the reference price for fossil fuels (IEA, 2010).

In addition to its domestic mismatch between energy production and demand, Mexico's commitments to climate change mitigation and air pollution make the case for alternative sources of energy. The country's fourth communication to the UNFCCC indicated its consideration of biofuels as an instrument to reduce emissions (p. 193) and improve air quality (p. 197). The current oxygenate used in Mexican gasoline is MTBE, a petroleum-derived product which improves the combustion of gasoline in automotive engines. Despite the positive burning performance of MTBE, which contributes to improved air quality, the concentration of this chemical in water sources has prompted worries in the United States about its potential carcinogenic effects.[197], [198] A shift towards residues-based and sustainably-produced ethanol could help reduce health risks in areas of high vehicle density, while at the same time contribute to reducing the carbon intensity of Mexican transport.

In addition to the landscapes in rural areas and international trade, the legal framework for renewable energy in Mexico is already supportive of alternative biofuel options. A federal law for the promotion of biofuels was introduced in early 2008, focusing primarily on first generation biofuels; and in the national energy strategies from 2007-2012 and 2012-2026, emphasis was given to energy conversion of residues. These core documents, in addition to their focus on energy diversification and environmental sustainability, indicated rural development as an important goal for a biofuel policy in the country (SENER, 2009b; SENER, 2012). A more in-depth analysis of the legal framework for biofuels in Mexico is presented in the next section.

1. Legal framework for Biofuels and rural development in Mexico

Investigations towards the development of biofuels in Mexico falls within broader strategies for national development, climate change and new sources of energy. In November 2006, an ambitious evaluation of the potential and feasibility of bioethanol and biodiesel was published by the Mexican Secretariat of Energy (SENER). The study was financed by the Inter-American Development Bank (IADB) and the German Technical Cooperation Enterprise (Gesellschaft Für

Technische Zusammenarbeit - GTZ, now GIZ). This initial 600-page study was the technical base for subsequent laws aiming at a systematic promotion of biofuels in Mexico (SENER, 2006).

In 2007, the country adopted its National Development Plan (*Plan Nacional de Desarrollo*), stating the Government's intention to diversify the primary sources of energy in the country for the period between 2007 and 2012.[199] At the same time, the plan promoted the uptake of renewable energy to secure affordable energy supply for consumers. As a complement to its broader development strategy, Mexico launched the Sectoral Energy Program for the same planning period of 2007-2012, which emphasized the promotion of renewable sources of energy (p.33). [200] Still in 2007, President Felipe Calderón put forward Mexico's Climate Change Strategy (Estratégia Nacional de Cambio Climático) which strengthened the call for alternative energy sources to promote decarbonization in the Mexican economy.[201]

In April 2007, the Mexican Congress approved an initial version of a law aimed specifically at promoting biofuels in the country. However, later in 2007, the law proposal suffered a setback, as President Felipe Calderón vetoed the bill with the argument that too much emphasis was put on the usage of corn and sugarcane for biofuel production, downplaying other options such as algae and cellulosic processes based on residues (APEC, 2008). The biofuels law (Ley de promoción y desarrollo de los bioenergeticos) was reformulated and presented again to the congress in early 2008, being finally adopted on February 1st of that year. The final law text was approved without specific references to maize (corn), going as far as to forbid the usage of such feedstock in the production of ethanol in the country (Mexican Congress, 2008).

In January 2009, the Government published a study on low carbon technologies and a plan for clean technology investment in the country (World Bank, 2009a, World Bank, 2009b). While the documents did not have a direct rural focus, both mentioned biofuels and better management of production residues as sectors of interest to promote low-emission development in Mexico, amongst which were advanced biofuels. The documents provided a basis for a refined Special Climate Change Program (Programa Especial de Cambio Climático – PECC), which was adopted in August 2009 (SEMARNAT, 2009).

The Mexican biofuels law states that corn can only be used for ethanol production if there is a national surplus and domestic demand has been met.[202] According to Felix (2008), the Mexican biofuels law aimed to fully expand on constitutional articles 25 and 27, especially on section XX that discusses the state planning tool of the federal executive to orient economic development, particularly in the rural sector.

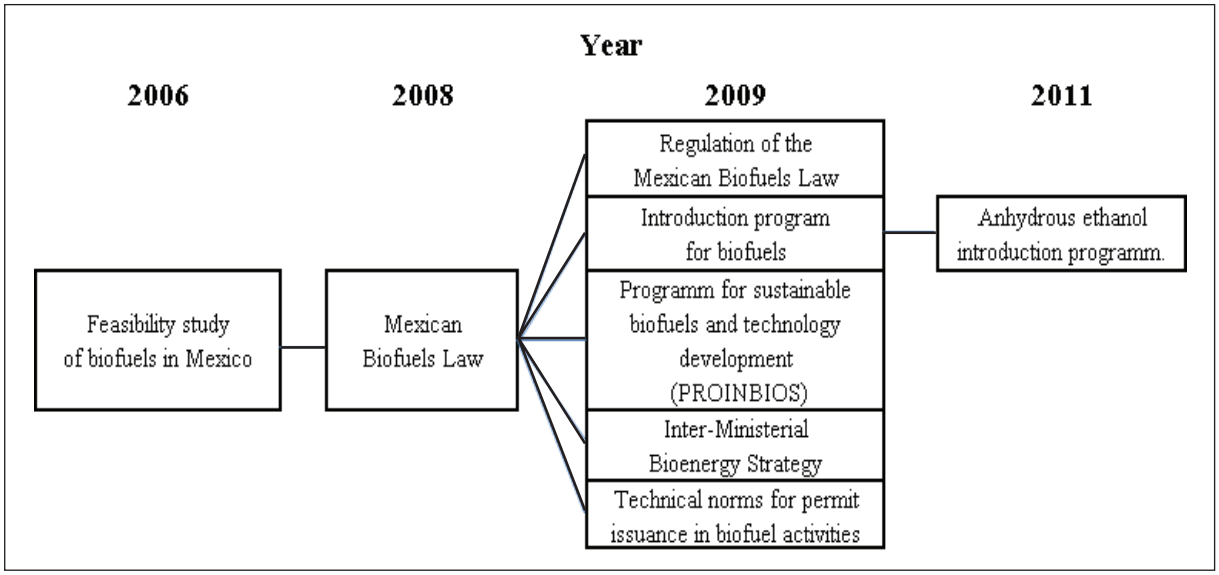
Following the adoption of the biofuels law, the Mexican government introduced an initial strategy for biofuels in the country based on four guiding documents: (1) The introduction program for biofuels, (2) The inter-ministerial strategy for biofuels,[203] (3) The regulation of the biofuels promotion and development law and (4) The requirements for the issuance of permits concerning biofuels activities. [204, 205, 206]

While the framework for biofuels in Mexico sought goals of economic decarbonisation and sustainability, its primary aim was to tackle worries related to energy dependency in the country. The strategy for biofuels which followed the 2008 law in Mexico focused on using bioethanol to substitute for the oil-derived gasoline oxygenate MTBE. The plan called for the introduction of ethanol blends in the main metropolitan areas of the country: Guadalajara, Monterrey and finally Mexico City. Problems with the ethanol procurement process made it difficult to secure the volumes of ethanol needed, which prompted a re-evaluation of the large-scale introduction program for biofuels in the country.

In face of the challenges faced in procuring ethanol as envisioned in the initial plans drawn in 2009, SENER introduced a revised approach for the introduction of biofuels in the country, publishing a new strategy in December 2011 (Figure IV.3). The new strategy, which also focuses on anhydrous ethanol, sets lower and upper targets for the amounts of anhydrous ethanol to be blended into gasoline to be adopted from 2012 until 2015. The new strategy also grants PEMEX more freedom on tendering processes and on deciding upon which regions to perform blending with gasoline (in contrast with the earlier predefined plan for a stepwise blending in Guadalajara, Monterrey and Mexico City). The strategy focuses primarily on procuring ethanol from national producers, making no mention to whether foreign producers will be able to bid on supply contracts (SENER, 2011).

An additional law adopted in 2008 in Mexico set the framework for renewable electricity. The *Ley para Aprovechamiento de las Energías Renovables y*

Figure IV.3: Development of a policy for biofuels in Mexico



Financiamiento para la Transición Energética (LAERFTE) provides a national strategy and financial instruments to promote energy transition in the country, aiming at 35 per cent share of renewable energy in Mexico by 2024 (LAERFTE, 2008). A subsequent program (2009) entitled *Programa Especial para el Aprovechamiento de las Energías Renovables*, details the payment mechanisms and incentives for producers generating electricity from renewable sources, including biomass (REMBIO, 2011).

2. Current state of biofuels in Mexico

Mexico has already introduced a framework for biofuels in the country, but concrete market developments have been uneven. Legislation efforts have had a strong focus on bioethanol promotion and blending in order to replace gasoline oxygenates (MTBE). However, partially due to issues in the procurement process for ethanol, more progress has been actually achieved on the sides of the mainstream strategy for biofuels; examples include the usage of biodiesel for public transportation in the state of Chiapas and the steps taken towards biofuel usage in Mexican aviation (REMBIO, 2010; ASA, 2012). There have been a number of biogas projects in the country, either financed by indigenous schemes or through CDM activities, amounting to 721 biodigestors by 2011 (REMBIO, 2011).

The Mexican biofuels law has laid some of the foundations for a biofuels industry in the country. Supply-side support mechanisms have been introduced by the Agricultural Secretariat (SAGARPA) through a MXN 1 billion (USD 71 million) co-financing scheme for investments in biofuels projects.207 On the other hand, the absence of mandatory biofuel utilization targets produces demand insecurity, especially for second generation technologies. The only concrete initiative adopted was the indicative blending targets, through an initial 6 per cent ethanol blend with gasoline in the city of Guadalajara in 2012 (176 million litres/year), to be subsequently expanded to Monterrey (133 million litres per year) and Mexico City (493 million litres per year) (SENER, 2009b; USDA 2009, p. 5). In this sense, the 2008 biofuels law and subsequent strategy can be seen as initial steps towards a broader framework to create a country-wide blend mandate to realize the full potential of the biofuels sector in Mexico.

Technical considerations for the adoption of biofuels were addressed by a decree (Diario Oficial, 2009 p.1), which established technical norms for the concession of permits related to the production, storage, transport and retail of anhydrous ethanol and biodiesel. Interestingly, the same document uses only two terms when referring to biofuels: anhydrous ethanol and biodiesel. The allusion to anhydrous ethanol refers to ethanol which will be blended into gasoline. No consideration is made towards hydrated ethanol

(E100) or E85, a sign that no high blend (separate choice at pump stations) is planned for Mexico.

Mexico's new national program to introduce anhydrous ethanol mentions explicitly its intention to generate market conditions favourable to the development of biofuels (SENER, 2011). According to Felix (2008), the Mexican legislation characterized biofuels with an independent legal definition, attributing them a separate legal framework for regulation, not limited by the traditional fuel regulations in place. Adding to this, the Mexican biofuels law attributed regulatory competences to different government agencies in order to coordinate future steps in the matter (Felix, 2008). However, the absence of mandatory blending targets and the lack of specific incentives for residue-based biofuels have been considered a possible shortcoming of the Mexican biofuel law (USDA, 2009).

Empirical evidence points to the need for specific support in large renewable energy projects.[208] Hira and Oliveira (2009) indicated that the Brazilian sugarcane industry received substantial targeted government support in the initial years of the Brazilian biofuel program (Proalcool). The support was subsequently phased out as costs decreased with larger production scales (Goldemberg et al, 2004). The Swedish biofuels strategy introduced tax-breaks to promote ethanol sales, as well as grants for consumers willing to purchase flex-fuel vehicles (Pacini and Silveira, 2010). In Mexico, the format and scope of support mechanisms are sometimes overlapping. There are two sets of incentive "pools" which could in principle be used to the development of bioenergy from agricultural residues.

The first set of incentives consists of existing programs in place to support rural producers and the fisheries sector in order to promote rural development. These programs are:

- Programa para la Adquisición de Activos Productivos;
- Programa de Apoyos Directos al Campo;
- Programa de Inducción y Desarrollo del Financiamiento al Medio Rural;
- Programa de Uso Sustentable de Recursos Naturales para la Producción Primaria;
- Programa de Atención a Problemas Estructurales (Apoyos Compensatorios);
- Programa de Soporte (sanidad, asistencia técnica, transferencia de tecnología, etc.);
- Programa de Atención a Contingencias Climatológicas;
- Programa de Fortalecimiento a la Organización Rural.

Detailed rules on the programs can be obtained at the website of the Mexican Secretariat of Agriculture, Rural development, Fisheries and Food (SAGARPA). Most of the support is oriented to promoting agricultural production and supporting services (financing, health, technical assistance, technology transfer, and organization amongst others). As a possible application in biofuels, the Programa de Atención a Problemas Estructurales considers offering support to seed exports and oily seed surpluses. However, according to the Mexican Government, the support is not frequently applied. This constellation of programs can be confusing for producers as there is no clear objective to provide finance, research support or demand instruments for advanced, residue-based biofuels. The biofuels law delegated to the Energy Secretariat (SENER) the competence of market oversight and fuel blending, to be done in partnership with the Mexican state oil company PEMEX. The key function of fuel purchaser and blender indicates PEMEX as major player in the market, as many of the key conditions for market access are dependent on its tendering rules (UNICA, 2009). The monopsonistic character of PEMEX gives it an important role as a purchaser of biofuels made from agricultural residues, if tender requirements evolve in this direction.

The second set of incentives consists of targeted support mechanisms for biofuels and agroindustry development. Four trust funds for risk-sharing offer investment co-financing schemes covering from 14 – 20 per cent of total costs (FIRA); 30-50 per cent (FIRCO); up to 50 per cent (FOCIR) while support from the SAGARPA-CONACYT fund is granted on a discretionary basis, with co-financing amounts depending on individual project characteristics.

- FOCIR: up to MXN 200 million
- FIRA: up to MXN 200 million
- FIRCO: up to MXN 500 million
- Sectorial Fund SAGARPA-CONACYT: up to MXN 100 million

Together those instruments amount to MXN 1 billion (USD 71 million). The instruments support investments in sustainable natural resource management linked to biofuels production. While the initial strategy for

the introduction of ethanol proposed in 2009 lacked mandatory blending targets (thus reducing the propensity for investors to take risks even supported by co-financing schemes), the new strategy introduced in 2011 has partially addressed this by establishing minimum biofuel blending targets starting in 2012 (SENER, 2011). Yet, investors and producers seeking to develop biofuels activities based on agricultural residues, could still find it difficult to identify which of those programs might be best suitable to support research, development and deployment of biofuels made from residual biomass, since the main national strategy focuses on first-generation ethanol.

Since second-generation biofuels technologies are not yet commercially available, efforts made by the Mexican government through the Ministry of Agriculture (SAGARPA) have focused on research, development and technology transfer aiming at validating technologies suitable for residue conversion. There are, however, no demand-pull instruments in the near future, as no provisions in the new ethanol introduction strategy calls for PEMEX to purchase advanced, residue-based ethanol until 2015, the last planning year of the new biofuels strategy (SENER, 2011).

3. Improved usage of natural resources and diversification of rural income

In the background of efforts to improve residue management and develop bioenergy potentials, the broader pursuit of sustainable development in rural areas of Mexico requires a number of policy, governance and technical components. Rural populations have access to many potential sources of renewable energy ranging from water and air streams to alternative uses of their agricultural and livestock products (and residues), which could be converted into biofuels. A number of initiatives and legal instruments have been put in place during the last decade in Mexico, with the objective to improve and diversify the economy of rural areas. This section briefly covers the existing legal framework for rural development in Mexico, analyzing how biofuels could help achieve its strategic goals.

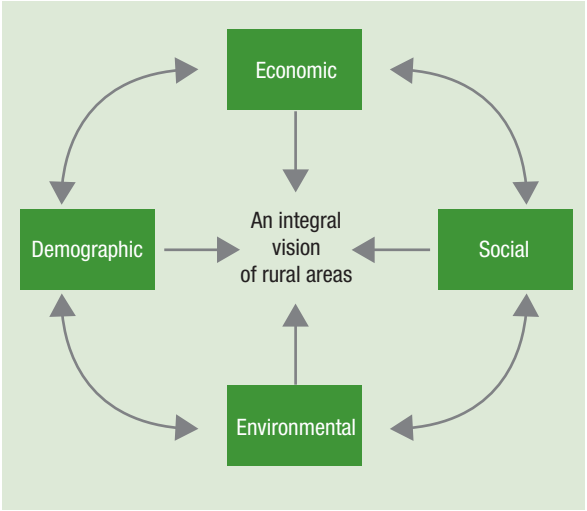
Different challenges have been identified for rural policies in Mexico (OECD, 2007). Those include poverty alleviation, provision of basic public services, strengthening and diversification of the rural economy, as well as better exploitation of untapped cultural, natural and energetic resources. Mexico has taken steps to coordinate action in those areas. In 2001, it published the Law for Sustainable Rural Development (LDRS), which called for the creation of a horizontal coordination body at the federal level, the so-called Inter-Ministerial Commission for Sustainable Rural Development (CIDRS), as well as the establishment of a participatory body for civil society (Councils for Sustainable Rural Development), and the elaboration of a Special Concerted Program for Rural Development (PEC), which was updated in 2007 (SAGARPA, 2001; PEC, 2007). The financial resources allocated to the rural budget (PEC) have emphasised social policy (poverty alleviation, education and health) and productive support. The latter, under objective 6 of the PEC, calls for measures which enhance economic and environmental lifecycle performance of crops, by means of diversification of income sources for rural producers, as well as promotion of access to electricity and development of bioenergy resources (PEC, 2007, p. 27).

The Mexican Ministry of Agriculture and Livestock (SAGARPA) is in charge of a major sub-component of the PEC named Rural Development Program (PDR). The PDR is undertaken by the Undersecretary of Rural Development of SAGARPA, and as its name indicates, it seeks rural development outside the boundaries of agriculture, livestock and fisheries which are also part of the mandate of the ministry. PDR contains three main sub programmes: the program of support to rural investment projects (PAPIR) which seeks to support capital investments; the program of development of rural capacities (PRODESCA) which seeks to develop human capital; and the program for strengthening rural enterprises and organisation (PROFEMOR) which devotes itself to the construction of social capital. In parallel, the Mexican Ministry of Agriculture (SAGARPA), has introduced in 2010 resources amounting to MXN 1 billion (USD 71 million) with the purpose of supporting investments in the production of biofuels.[209] In developing bioenergy potentials from residue streams, all three initiatives have fundamental roles to play in enabling the deployment of cost-effective and socially-inclusive technologies and production models for agricultural residue management, adding value to the current lifecycles of agricultural products by allowing better usage of residue streams.

However, an OECD report from 2007 identified issues with the governance of the PEC which should be improved, including the need for clearer leadership, responsibility attribution among government agencies and coherence of various actions to enhance efficiency of rural spending (OECD, 2007 p. 21). In order for Mexico to achieve its rural policy objectives, the involvement of ministries that do not have a rural focus is important. While a level of cross-ministerial work has been done through inter-service commissions, the components of the Mexican rural policy dealing with energy are also not clearly incorporating important stakeholders. According to the same OECD report (p. 34), while ministries in charge of education, health and environment have significant impact on rural development, other ministries related to economic policy such as the Ministry of Economy (SE), Transportation and Communications (SCT), Finance (SHCP), Tourism (SECTUR), Labour (STPS) and Energy (SENER) have had low rural focus (see Figure IV.5).

In the context of the Inter-secretarial Commission established to define strategies for biofuels, there has been close cooperation between SAGARPA, SENER, SE, SHCP and SEMARNAT, seeking an integrated approach to the construction of a national policy in field. However, there has been a degree of separation between two key actors in the delivery of policy documents, namely the energy and agricultural Ministries, which is counterproductive to the development of a sustainable biofuels industry based on agricultural residues. The main policy undertaker in biofuels matters has been the Ministry of Energy, which spearheaded both the first and second strategies for

Figure IV.4: The strategy toward the main development concerns of rural areas in Mexico



anhydrous ethanol blending in the country (SENER, 2009; SENER, 2011). Cooperation has been gradually improving with the joint effort between SAGARPA and SENER to map production potentials of first-generation ethanol in the country (SENER, 2011). A better degree of coordination between energy, rural and agricultural policies - as well as mutual accountability for their results - could help improve the effectiveness of public resource usage towards developing rural areas in Mexico, with positive impacts on income and employment creation.

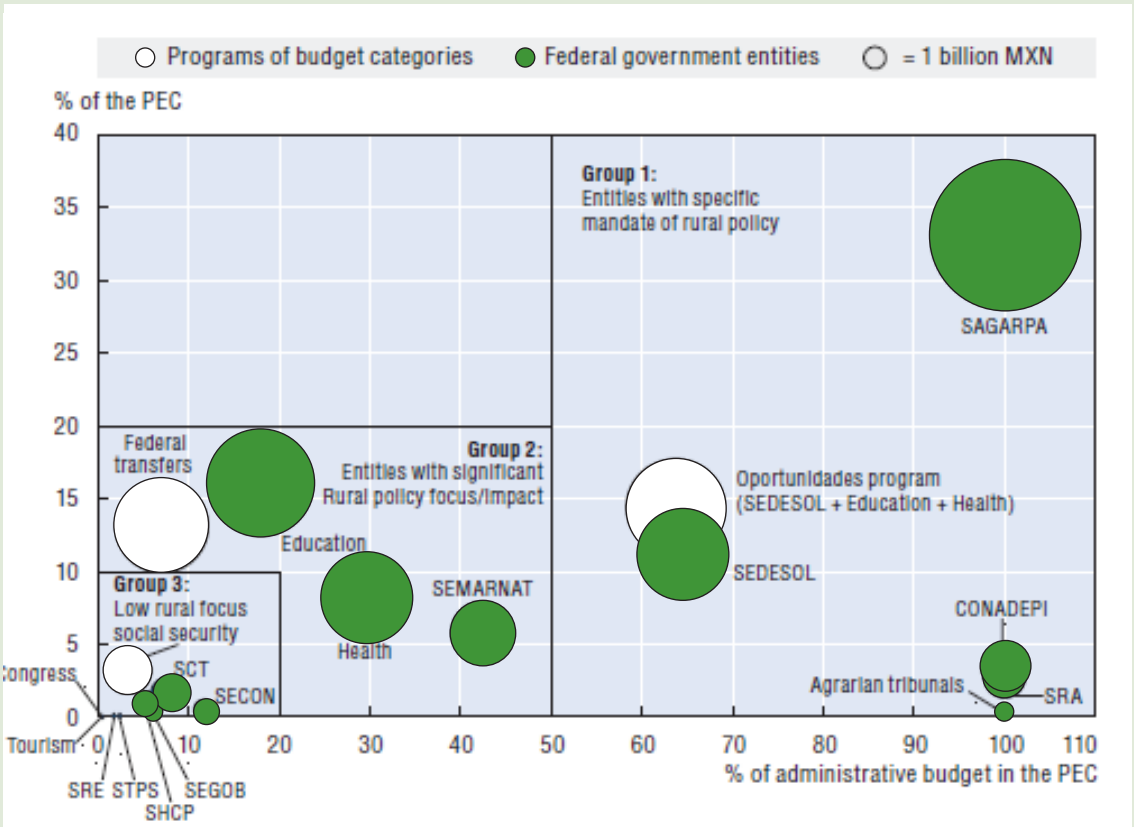
Similarly, private investment could take on a much bigger role in promoting agricultural development, by

Table IV.1: The strategy toward the main development concerns of rural areas in Mexico

	Rural Strategy	
	Old Approach	New Approarch
Objectives	Equalisation, farm income, farm competitiveness	Competiveness of rural areas, valoraisation of local assest, explotation of unused resources
Key target sector	Agriculture	Various sector of rural economies (ex rural tourism, manufacturing, ICT industry, ecosystem services, energy, etc.)
Main tools	Subsidies	Investments (public and private)
Key actors	National governments, farmers	All levels of government (supra-natural, national, regional and local), various local stakeholders (public, private, NGOs)

Source: Adapted from OECD (2007, p. 117)

Figure IV:5: Ministries and resources involved in rural policy in Mexico



Source: OCED, 2007; based on PEC, 2007

making larger investments possible in public service delivery and business development in diversified, non-core agricultural activities such as biofuels. Investments in infrastructure and innovation, coupled with improved consistency between policy efforts in agriculture, environment, rural development and poverty alleviation, are likely to be the most important challenges facing regulators seeking to strengthen rural development in Mexico. The critical issue for policymaking is to find innovative ways in which rural properties can benefit from the energy resources that are available to them, especially in terms of employment and income creation.

4. Why avoiding a sole focus on dedicated bioenergy crops might be a good idea for Mexico

Some aspects compound to the difficulties of establishing dedicated crop-to-energy models in Mexico. Those include the characteristics of land tenure laws in the country, the context of its international trade, geographical conditions, sustainability aspects, and difficulties encountered by recent policy efforts in the area.

4.1. Land tenure and food security

In face of the characteristics of the rural landscape in Mexico,[210] the implementation of dedicated models of agroenergy faces several difficulties, since there are clear limits to scale when compared with large-scale systems such as those adopted in Brazil or in the United States (Valle, 2011). Geographic conditions compound to that; while Mexico receives large amounts of solar radiation which favours agriculture, 61 per cent of the country is covered with arid or semi-

arid land, making large extents of its territory unsuitable for non-irrigated agriculture (SENER 2006, p. 119). Small scale production poses economic and logistic challenges, but could be socially rewarding. New transport systems must be put in place to allow for more dispersed feedstock (residues) inflows towards cooperatives or processing sites. However, residues collected at industrial processing sites of crops and livestock can profit from significant scale effects which could offset the problem of feedstock dispersion.

It is important to learn from examples of other countries and regions which have implemented biofuel models in contexts sharing similarities with Mexico's agriculture. There have been experiences with small-scale biofuel production models in Brazil, India, Colombia, and some countries in Africa.

A national-level fuel blending program using small-scale production exists in Brazil for the biodiesel sector (Lehtonen, 2009). The Brazilian Biodiesel Program consists of both large and small scale producers (mostly soybeans) and as of 2012 fulfils a 5 per cent blend mandate in the Brazilian diesel pool. In order to maintain the control of land with small farmers, the program attracts small producers by granting access to a special credit mechanism which reduces the borrowing costs, which would otherwise be prohibitively high in conventional financing channels.[211] Scale is achieved by an auctioning system, in which accredited companies purchase feedstock from large and small producers, processing and selling the biodiesel for buyers like Petrobras. Participating companies receive a contractual bonus if they purchase raw materials from family agriculture holdings (Soares et al, 2007). The Brazilian program, however, has very little participation of 2nd generation production technologies, nor uses agricultural residues as its main source of inputs.

In India, the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) also develops activities in the promotion of alternative energy crops and small-scale bioenergy farming. ICRISAT's BioPower initiative focuses on three points: enabling small-scale bioenergy farming; identifying comparative advantages and technologies suitable for resource-limited bioenergy production; and aspects of sustainability. The initiative identifies sweet sorghum as the focus crop for ethanol production given its suitability for dry climates and degraded lands. In addition, the initiative promotes investments in pro-poor bioenergy projects.

Colombia is another example of a country with ongoing experience in small-scale biofuel activities. The country has two demand-creating instruments for biofuels, in the form of blending mandates for ethanol (E10) and biodiesel (B5). The Colombian strategy gives priority to small scale pilot projects instead of larger plants. In face of the production based in small scale projects, logistic issues have been reported in routing feedstocks to the processing centres (USDA 2009). While Colombia has engaged in research on 2nd generation biofuels using agricultural residues, most feedstocks consist of jatropha and sugarcane plantations (Proexport, 2010, p. 12).

In Africa, the potential of small-scale biofuel production has been assessed by the United Nations Department of Economic and Social Affairs. The survey highlighted examples of experiences with jatropha-based biodiesel in countries of sub-saharan Africa like Ghana, Mozambique, Tanzania and Zambia (UNDESA, 2007 p. 21-13). However, unlike Brazil and Colombia, the small-scale experiments in Africa did not seek country-wide fuel blend mandates; output was intended towards other markets such as cooking, fuels for electric generators and illumination.

Therefore, alternative approaches to large-scale production could make better sense in the Mexican context. In addition to issues of scale and production ownership, the issue of technology is very important to enable residue conversion models. If proper models are implemented with adequate technologies, the utilization of agricultural residue carries less risk to food security since the food vs. fuel dilemma can be avoided (Rosillo-Calle and Johnson, 2010). Residue utilization would at the same time enhance product lifecycles in Mexican agriculture, promoting the competitiveness of Mexico's rural landscape.

4.2. Avoiding trade-offs with current agricultural exports

Adding to the specificities of Mexico's rural land tenure regime, the country's agricultural exports could also suffer from the large-scale production of ethanol in the country. As an example, the context of the highly attractive sugar market in NAFTA represents a costly trade-off for the production of sugarcane-based ethanol, as that would compete with sugar exports and necessarily cause some level of missed export opportunities. Mexico trades sugar with the US under contract #14 of NYSE instead of the common

international sugar contract #11. The access of Mexican sugar producers to the higher sugar quota price of the United States may make the domestic sugarcane-ethanol route uneconomic (at least while the gap between the US sugar price and the world sugar price exists).

4.3. Overcoming supply hurdles

A national strategy for the introduction of biofuels followed the biofuels law adopted in 2008. The plan has been focused on using bioethanol for gasoline blending purposes, aimed at ultimately substituting the oil-derived gasoline oxygenate MTBE in the country. The program design called for a stepwise introduction of ethanol blending in the main metropolitan regions in Mexico: first in Guadalajara, then Monterrey and finally Mexico City (SENER, 2009b).

An initial attempt to purchase ethanol for the Guadalajara phase of blending was initiated via a tendering process from PEMEX (n. 18576112-022-09). The conditions for this tender included a minimum requirement of 50 per cent domestically-produced ethanol. The supply contract, however, was not signed, at least in part due to high prices of sugar which exacerbated the opportunity cost of ethanol production in the country, making the production of ethanol uneconomical for the tender winners (El Universal, 2012). In face of these developments, the main biofuels introduction program is being re-evaluated, and a new tendering process for ethanol is being designed for launch in 2012 (SENER, 2012).

4.4. Emerging sustainability requirements

Since the mid-2000s, a great debate emerged on the wisdom behind the promotion of large-scale biofuels production and consumption strategies for energy security and environmental reasons (Schmitz, 2007). Risks of enlarged biofuel production were strengthened by the lack of sound science in the area, such as uncertainties regarding the lifecycle emissions of biofuels production, their indirect impact on land use, possible conflicts with land rights in developing

Box IV.2: The emergence of regulatory bonuses for trade of biofuels made from residues

The pressing need to make biofuel strategies compatible with overarching social, economic and environmental objectives has prompted the emergence of a number of sustainability schemes in recent years. In particular, GHG balances in life-cycles of biofuels are increasingly scrutinized, and thresholds of "acceptable" performance have been adopted in both Europe and the US.

In Europe, a sustainability Scheme for biofuels was adopted in 2009 and determined a number of criteria which biofuels should meet in order to be certified as sustainable, which is an effective pre-condition for market access in all 27 European Memberstates. The European Renewable Energy Directive (RED) provided a regulatory "premium" for some types of biofuels. Art. 21 of the RED states that biofuels originating from cellulosic or lignocellulosic non-food material (the basis of 2nd generation biofuels), as well as those made from waste and residues will count double towards the 10% national renewable energy obligations in the transport sector, on an energy basis.

Regional actions also signal sustainability as one of the future market conditionalities to be faced by prospective biofuel producers. The US state of California has launched an evaluation of the carbon-intensity of biofuels, and in 2009 the California Air Resources Board (CARB) published favourable indexes for those based on cellulosic materials and agricultural residues. According to Junginger et al (2010), the adoption of sustainability criteria in Europe and elsewhere is seen by biofuel traders as a possible market barrier which will tighten biofuel trading conditions worldwide. Biofuels produced from agriculture residues, however, profit from much more benevolent certification procedures than those based on dedicated energy crops.

Mexico is a member of the Global Bioenergy Partnership (GBEP) which has among its goals the transformation of biomass use towards more efficient and sustainable practices. The sustainability policy for biofuels in the country is in similar to the fundamentals proposed by the Roundtable on Sustainable Biofuels (RSB), which also considers streamlined certification procedures for biofuels produced from agricultural residues. The authority in charge of biofuels sustainability is the secretariat for the Environment and Natural Resources (SEMARNAT), which cooperated with the agriculture ministry (SAGARPA) in outlining the national strategy for biofuel sustainability published in 2009. Some provisions are made, such as the social dimensions of potential conflicts with food affordability, the creation of information systems and a ban on conversion of forest areas to dedicated biofuels crops.

Source: EC, 2009; Hodson et al, 2010, p. 217; US EPA, 2010; Junginger et. al., 2010; RSB, 2010; SAGARPA, 2009.

countries, as well as potential pressures on biodiversity and water sources. In face of those risks, a number of sustainability requirements for biofuels emerged around the world. Such requirements are, in practice, already becoming preconditions for the production and trade of biofuels in some regions (UNICA, 2012, EC, 2009, UNCTAD, 2008a). Some types of biofuels, such as those based on cellulosic or lignocellulosic non-food material, as well as those made from waste and residues, tend to receive a bonus in sustainability requirements, such as what can be observed in the European Union, where biofuels from residues count double towards Europe's 10 per cent national renewable energy obligations in the transport sector, on an energy basis (Hodson *et al.*, 2010).

Under these difficult circumstances, instead of promoting a costly sugarcane or corn-based output shift towards ethanol production, Mexico could look for alternatives which would avoid socio-economic trade-offs that would otherwise be inevitable. Hence other forms of agricultural models or alternative feedstocks could be more suitable to the Mexican reality.

D. TECHNOLOGICAL OPTIONS FOR RESIDUES CONVERSION TO BIOFUELS IN MEXICO

There are numerous benefits of using agricultural residues to produce biofuels. Biomass production is inherently rural and labour intensive, and this may offer the prospects for new employment associated to the lifecycle of agriculture. The potential for producing rural income by production of high-value energy carriers (such as liquid and gaseous fuels) is attractive, as those fuels could be used both domestically, displacing imported fuels, as well as for exports, both of which generate income.

By realizing the potentials currently missed in residue streams from agriculture, Mexico can complement its demand for a broad spectrum of products presently derived from petroleum (Figure IV.6). By consequence, this can generate new income opportunities in rural areas, more employment, improvements in energy and food security, as well as a reduction in the overall reliance of the national economy on fossil energy. Biofuels derived from residues can even help improve cooking technologies used in areas subserviced by electricity grids and gas distribution networks (Figure IV.7).

However, in order for these potentials to be realized, technology options have to be deployed, up-scaled and researched.

This section aims at providing an overview of biofuel production technologies, with special focus on those which may be useful in the conversion of feedstock inputs similar to agricultural residues from the key products of interest in this Outlook (corn, sugarcane, beans, wheat, rice, sorghum, coffee, egg, milk, beef, pork, poultry, and fish). By looking into the pros and cons of current and emerging technologies used in the production of biofuels, as well as their respective states in Mexico, this section gives special attention to those which have the largest potential to be applied in conversion from agriculture residues.

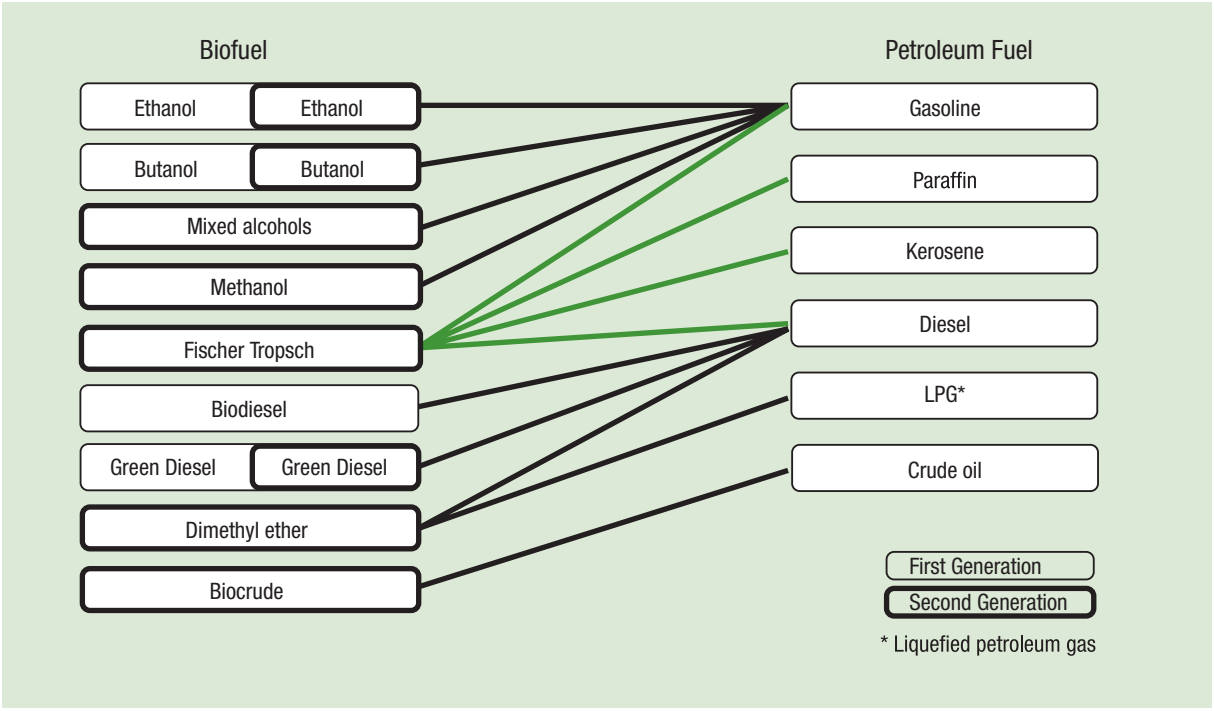
1. First-generation biofuel technologies

Biofuels of first generation consist of three main types. The first corresponds to petroleum-gasoline substitutes produced via biological fermentation of starch and sugar-rich crops (e.g. corn, sugar beet, sugarcane). The second type relates to petroleum-diesel substitutes, such as straight vegetable oil and biodiesel (e.g. FAME, FAEE, RME and SME) produced by trans etherification of plant oils and fatty residues (e.g. soy, palm, jatropha, used cooking oil and animal fats). The third type corresponds to natural gas substitutes such as biogas, generally produced via anaerobic digestion of organic matter (Monreal, 2008; UNCTAD, 2008; IEA, 2010).

First generation processes are based on mature technologies, relying on relatively simple processing equipment, modest investment per unit of production and can achieve favourable economics at smaller production scales. They represent the bulk of commercial biofuels today.

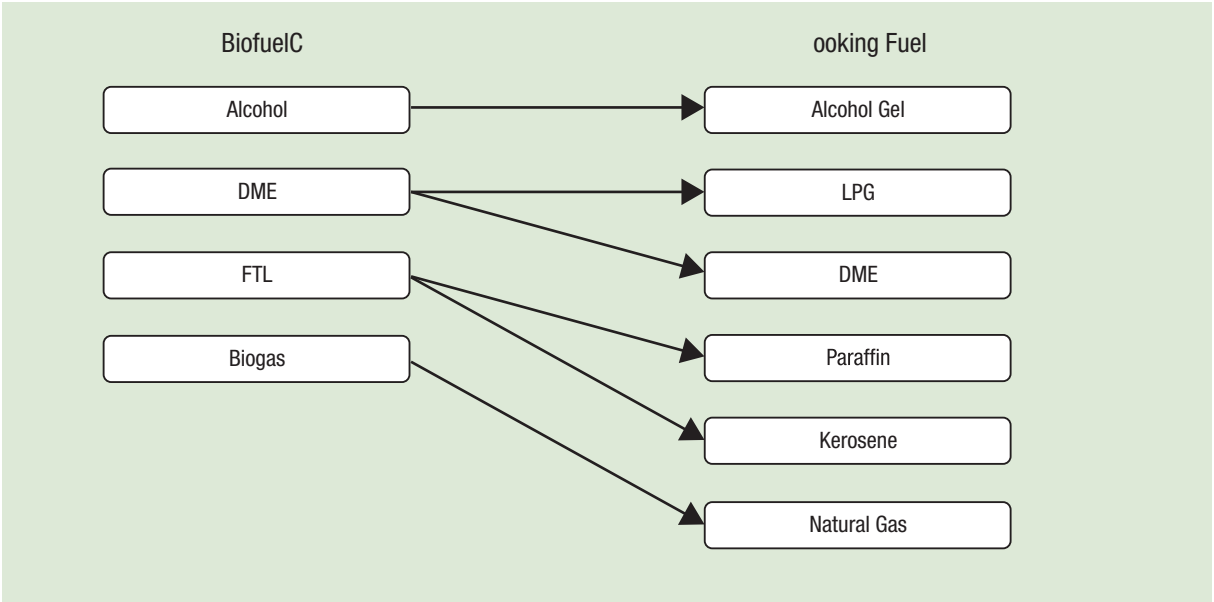
In spite of their relative ease of production, first generation biofuels have important limitations in the context of this diagnosis, especially given Mexico's limited availability of non-arid farmland. According to UNCTAD (2008b), starch-based first generation biofuels have the lowest land use efficiency. When measured in the energy production achievable with one hectare of land, sugar-based first generation biofuels fare slightly better, with about the double of the land-use efficiency. Second generation biofuels, discussed in the next section provide an additional increase of 50 per cent or more in land-use efficiency.

Figure IV.6: Substitutability of biofuels with common petroleum derived fuels



Source: UNCTAD (2008b)

Figure IV.7: Substitutability of biofuels for clean fossil fuels used for cooking



Source: UNCTAD (2008b)

Note: Fuels listed as cooking fuels above are made from fossil fuels today. Some of these fuels can also be made from biomass.

In terms of net energy balances, first generation biofuels have generally lower performance (i.e. require higher amounts of fossil energy inputs for each unit of energy output delivered) than second generation biofuels.

Most first generation biofuel production processes depend on crops with dual usage as both energy and food purposes, augmenting risks related to food security and affordability in Mexico. While first-generation processes might promote employment in production areas, the jobs created usually command low wages (REMBIO, 2011). In addition to the social risks arising from competition between the food and energy markets, an additional economic argument adds caution on the usage of first-generation biofuels in country. While production based on dual-purpose crops (food and fuel) provide ample markets, the usage of crops for biofuel purposes imply in somewhat uncompetitive production due to the high costs of feedstock (SENER, 2006; UNCTAD, 2008b). With second-generation feedstocks, such as the bulk of agricultural residues, this trade-off is avoided.

As of 2012, Mexico does not produce first generation anhydrous ethanol for energy purposes. However, hydrated ethanol (96 per cent ethanol, 4 per cent water content) is produced in modest amounts, based mostly on sugarcane and on the conversion of molasses (leftovers from sugar production), which have dual usage as food sweeteners. While 96.4 per cent of the national production of molasses was destined for exports (mainly towards the USA), 3.6 per cent went to the production of 14.5 million litres of ethanol in 2009, used mostly in beverages, cosmetics and medicine production (REMBIO, 2011). The relative small ethanol production contrasts with the installed production capacity, which according to the Mexican Chamber of the Sugar and Ethanol Industry consists of 91.8 million liters/year for 14 sugarcane mills with distilling facilities in Mexico (USDA-FAS, 2007). This potential is underutilized partly because of attractive sugar markets in NAFTA, what prompts producers to often choose routing sugarcane into sugar production.

As of 2012, the Mexican Government has been attempting to advance its strategy for the introduction of bioethanol in the country. After an unsuccessful attempt in 2010, PEMEX is preparing another tender process to introduce ethanol blends in the country. The tendering process is ongoing as of 2012, seeking to guarantee supply of anhydrous ethanol for blending levels between 36.8 and 46 million liters (SENER, 2011).

In contrast with ethanol, Mexico is already producing first-generation biodiesel for energy purposes. Two major experiences, the biodiesel production program *Chiapas Bioenergetico* in the state of Chiapas, and ENERGEX's program of biodiesel production based on animal fat residues and waste oils, in Cadereyta, Nuevo Leon, are two examples of initiatives aimed at delivering transportation energy (REMBIO, 2010). In Chiapas, the main feedstocks for biodiesel production were African-palm crops, jatropha and residual vegetable oils. The biodiesel produced was used to power 113 public transportation buses in the city of Tuxtla Gutierrez, both via blends with conventional diesel (B5 and B20), as well as in pure biodiesel form (B100, since 2010). In Nuevo Leon, the *ENERGEX* program operated until 2011 and was strongly based on fat residues from animal origin, as well as recycled vegetable oils. Demand-pull was provided by *PEMEX Refinacion*, which used the biodiesel as an additive to its ultra-low sulfur diesel. PEMEX ceased to purchase biodiesel from *ENERGEX* in late 2011, prompting the end of the program.

Some first generation technologies can however be readily applied to convert non-food biomass. Examples consist of biogas production via anaerobic digestion of biomass, and biodiesel production from residual animal fats and vegetable oil. Those can be both relatively straightforward to deploy if coupled with conducive incentives.

Concerning biogas, there were 721 biodigestors in Mexico as of 2010, of which 367 are in operation and 354 are in construction. About 8 per cent of the of the pig farms in the country had biodigestor facilities to process manure, but of those only 20 per cent had electric generators using the biogas produced, and 30 per cent of the generators were still not operational. This resulted in a total biogas-fired electricity production of only 5.7MW, while the national potential is estimated to reach 3000MW (SENER, 2010). Examples of agricultural sites producing biogas include the pig farm *El Chancho* in Cadereyta, Nuevo Leon and the Poultry farm *La Estrella,* in Leon, Guanajuato. Most of the biodigestors in the country (563) are financed through participation in CDM projects, while others (154) rely on support from the Mexican fund for shared risks (FIRCO). Only 4 biodigestors are financed by an USAID-backed initiative named methane to markets (*Metano a Mercados)* (REMBIO, 2011; IRRIMEXICO, 2009).

2. Second-generation biofuel technologies

Biofuels of second generation can be classified in three main types (UNCTAD, 2008b). The first type corresponds to those produced via biochemical processes delivering petroleum-gasoline substitutes, such as alcohols (e.g. ethanol or butanol) produced by enzymatic hydrolysis. A second type of gasoline substitutes are those produced when biomass is subject to thermochemical processes, including methanol, Fischer-Tropsch gasoline and mixed alcohols. A third type of second-generation biofuels can be classified as petroleum-diesel substitutes produced by thermochemical processes, such as Fischer-Tropsch diesel, Dimethyl ether and other varieties of green diesel.[212]

While second-generation biofuels are mostly based on lower-cost, residual and non-edible biomass, they still depend on skilled human capital and sophisticated technologies for their production. These results in larger capital costs per unit of production when compared to biofuels produced through first-generation processes (UNCTAD, 2008b). On the other hand, lower-cost feedstocks tend to offset the greater capital intensity of second generation and bring costs down once technologies mature, akin to the cost-learning process seen in the Brazilian ethanol industry (Goldemberg, 2004).

Much of the potential held in agricultural residues, however, depends on emerging technological solutions. Unlike sugar, starch and oil-rich plants (e.g. sugarcane, corn and soybeans), agricultural residues like foliage, straw, leftover cereal shells, slaughter residues and residual oil often require more complex - and costly - conversion methods to be turned into useful biofuels.

Second-generation biofuels are not yet produced at commercial scales. Yet, a number of pilot and demonstration plants have been announced or set up in recent years, with research ongoing in places like North America, Europe, Brazil, China and Thailand and Mexico, all of which have the level of human capital necessary to investigate and deploy technologies associated to second generation processes (IEA, 2010; REMBIO, 2011). There is one documented experience with thermochemical production processes (gasification) in Universidad Autonoma de Mexico, which is, however, at experiment level (Masera et. al., 2006).

In face of a number of parallel efforts being undertaken in many countries to improve technologies and bring down costs of second generation biofuels, it might be difficult and costly for Mexico alone to engage in all R&D, demonstration and deployment phases of second-generation technologies applicable to its agricultural context. Given the necessity to develop 2nd generation processes which are suitable for the Mexican context, it could be highly interesting for the country to engage in regional and international cooperation, aimed at scaling up potential markets, promoting technology transfer and sharing of R&D costs.

Furthermore, as suggested by UNCTAD (2008b) and Andersen (2011), for successful technology adoption and adaptation, it is essential for Mexico to have a technology innovation system in place, as well as mechanisms to allow regional cooperation and scales beyond Mexico's indigenous markets. One possible innovation platform in those lines could be the nascent Mesoamerican biofuels program (Box III.3). An innovation system refers to people involved in a broad set of activities and institutions, including (a) research universities/institutes generating fundamental knowledge and assimilating knowledge from the global community; (b) industries with the capacity to form joint ventures with foreign companies and to introduce innovation and learning into shared technologies; (c) government agencies able to recognize and support the required research and technology adaptation needs; and (d) a technology-informed public policymaking system. Under those premises, there is an important role for the national government in fostering the development of biofuels industries in the country, advancing the goals laid out in the legislation already in place (SENER, 2012).

Since first generation biofuel technologies often depend on edible crops as feedstock and can conflict with Mexico's land tenure and food supply, special emphasis of public efforts on second generation biofuels may be appropriate. The development of competitive second generation biofuel industries could be facilitated (especially in large countries such as Mexico or in regional clusters of smaller countries as in the Mesoamerican region) by the establishment of regulatory mandates for biofuel use, as a complement to public procurement efforts to introduce biofuels via PEMEX tenders. Direct financial incentives – including grants for research, development and demonstration, or biofuel price subsidies – could also be considered, but clear "sunset" provisions and/

Box IV.3: Mexico's international cooperation on biofuels technology

Mexico has had significant cooperation with multilateral banks and international agencies to survey its potential for a biofuels industry. The German Technological Cooperation Enterprise (GTZ) helped in the development of Mexico's 2006 study on biofuels potential. Shortly after that, private investors and government-backed groups approached the Inter-American Development Bank (IADB) for loans relating to the production of a sweet sorghum-based ethanol mill and jatropha-based biodiesel. PEMEX also applied for financing from the IADB in order to train its distributors and service providers.

Private market agents already have cross-border business relations in the Mexican sugarcane industry. The Brazilian company DEDINI, a large industrial equipment supplier for ethanol and sugar processes, had large commercial transactions with the Mexican group Piasa in 2007. High level meetings took place between Presidents Lula and Felipe Calderon, who in August 2007 signed a cooperation agreement for producing biofuels, including research cooperation on advanced and residue-based biofuels. Soon after, the Mexican government invited a Brazilian technical mission to discuss ethanol, which took place via the Mexican export promotion agency (ProMexico) in 2009.

Mexico has also engaged in biofuels cooperation with other countries in the Latin American Region. The Mexican state of Chiapas is participating in the Mesoamerica project, aimed at promoting inter-regional connections of transport, telecommunications and energy networks in Central America. A special initiative within the project is the Mesoamerican biofuels program (Programa Mesoamericano de Biocombustibles), which is based on the installation of pilot plants for the production of biofuels using non-food feedstocks. The project is developed in partnership with a network of universities responsible for research and technology transfer. At the first stage, three biofuel plants were installed in Central America (Honduras using palm, El Salvador using castor beans and one pending in Guatemala using Jatropha). These plants were financed by the government of Colombia. The next stage aims to install three additional biofuel plants in Mexico, Panama and Dominican Republic as well as the establishment of the Mesoamerican network of biofuels research and development.

Sources: SENER (2006), Midiacon (2007), IADB (2009), UNICA (2011), Mesoamerica (2011).

or subsidy caps (e.g. tied to oil prices and with finite durations) should be designed into such provisions. Policies supportive of international joint ventures would also help provide access to intellectual property owned by international companies. With a natural favourable climate for biomass production, developing country partners in such joint ventures might contribute host sites for demonstration and first commercial plants, as well as avenues for entering local biofuels markets (UNCTAD, 2008b).

Research and development of second generation biofuels is likely to be costly, but Mexico can profit from international partnerships, such as the Mesoamerican region, to both share R&D costs and provide mutual demand for advanced biofuels in a broader geographic area.

3. Solid biofuels

Solid biofuels are those originating from biomass, with uses ranging from residential applications such as firewood and charcoal for cooking purposes, to more sophisticated uses such as industrial-scale, high-pressure combustion of processed sugarcane bagasse, corn stover, forestry residues and solid municipal waste.[213] Solid biofuels are usually used for the production of heat (which has numerous industrial and district-heating applications) and electricity, substituting or complementing the usage of fossil fuels such as coal and natural gas (Karkania, 2012). Recent increases in prices of oil and natural gas strengthen the demand for briquettes and pellets in large markets such as the European Union (Pellets-Woods, 2012).

Simple, unprocessed agricultural residues such as straw, bagasse, corn stover and rice rusk can be used as feedstock for simple combustion and energy generation in processing sites, albeit at limited efficiency. However, the same types of residues can be processed by undergoing dehydration and compression to improve combustion performance and energy density. Once processed, residues can be transformed into higher value briquettes and pellets, which can cater for heating and electricity-generation purposes, as well as be transported for exports over transcontinental distances. In Mexico, agricultural residues have a large potential to contribute to production of solid biofuels, even as some of the residual post-harvest biomass is required to remain in the fields as a fertilizer and protection against erosion. Still, as of 2012, there is no large-scale production or demand for briquettes and pellets, nor a broad regulatory effort beyond the LAERFTE to promote non-fossil (e.g. biomass-based) cogeneration in the country

(SENER, 2012). Adding to that, some limitations on agricultural residues have been mentioned, such as the seasonal availability of residues (dependent on harvest periods), high geographic dispersion, ash contents and competition for other usages, such as animal feed (REMBIO, 2011, p. 32).

4. Categorization of residue types from the 13 products of interest

In a simple conceptual framework, there are two main phases where agricultural residues are produced. The first phase occurs when crops are harvested, with residue flows consisting of large amounts of residual biomass in form of straw, foliage. The second phase relates to the industrial processing of agricultural products, where crop products such as cereals or residues produced by livestock in confinement produce residue flows such as husks, shells, manure and slaughter residues.

Apart from new income and employment opportunities, one of the advantages of biofuel production from agricultural residues lies in the fact that those production pathways do not compete with food crops. However, agriculture should not be seen as a residue-generator - the residues produced are often necessary for the upkeep of fields, due to their fertilizing and erosion-shielding properties.

In crops where advanced, highly mechanized harvesting technologies are applied (e.g. soy, corn, beans, sorghum, sugarcane, rice, wheat and coffee), harvest is made with specialized machinery which collects only the biomass of interest, for example, the cereal grains or sugarcane stalks. What remains in the field, mostly straw, is beneficial to the field since it provides fertilizer to the soil, as well as protection against erosion. The biomass which remains on the ground not only can be passed on to future crops, but also conveys protective attributes to the soil. For example, residual straw protects against erosion, provides nutrients for the soil, shields against solar irradiation (limiting thermal variances and improving water performance, what helps microorganisms to thrive), and acts as a physical buffer against raindrop impact and wind shear, primary drivers of erosion (USDA, 2006). Furthermore, in warm conditions like those present in most of Mexico, degradation of residues is accelerated - thus, surface ground protection is not fully guaranteed even if residues are maintained on the soil.

As argued, residues at the field level do not represent an environmental problem, as they become natural fertilizers and provide protection against the elements. However, residues produced at the post-harvest phase have different, more polluting dynamics. There are different types of industrial residues produced by the products of interest in this Chapter.

Soy, sorghum and corn usually do not produce residues at the industrial phase. When the grains are routed towards production of animal feed, the grains are basically crushed with little or no residues left. The same happens during oil extraction, where basically all components of the grains are used. Other products, however, generate substantial amounts of residues when undergoing industrial processing. In the case of sugarcane, while straw remaining on the field plays a positive role as a fertilizer, during the juice-extraction phase in mills, large amounts of bagasse are produced. Independently if sugarcane is used to produce sugar or ethanol, bagasse will always be produced, at a proportion of about 230kg per ton of sugarcane harvested (UNCTAD, 2012). While this is already used by many sugarcane mills in Mexico as a source of energy for industrial boilers, the low efficiency in many boilers represents a large untapped potential to develop this resource for improved heat and electricity usage. Furthermore, dehydrated sugarcane bagasse is a proven feedstock for pellet production, and can also be processed with gasification technologies which employ skilled labour and deliver high value-added bioliquids (Kumar et al, 2009).

The industrial processing of rice generates a large amount of residues. About 22 per cent of harvested rice corresponds to husks, which have high energy content. About 500 kg of rice husks corresponds, in energy, to the equivalent of a barrel of oil. Usages include pelletization, direct burning for heat and electricity purposes, as well as conversion into second generation biofuels. Coffee beans when processed result in 10-15 per cent oil, which can be used to produce biodiesel. While promising, those pathways still require research.

Finally, one of the main producers of residues with bioenergy interest are activities concerning intensive livestock breeding in confined spaces. Stable washing processes, areas for milking cattle, pigsties and aviaries make large amounts of outflowing residues, which include manure and slaughter residues from cattle, swine, poultry and fish production. Animal

residues produced in those systems can be classified in three main types: agroindustrial residues produced during processing of feed, fibers and leather; residual waters from product washing, boiling, pasteurization, cooling and equipment washing; and solid residues like process leftovers and trash from packaging materials, and mud from residual water treatment facilities.

If untreated, animal residues can be harmful to the environment when directly disposed into waterways. They can contain fat, organic and inorganic solids, in addition to chemicals added during processing operations. Nevertheless, all organic residues can be used in biodigestors to produce methane (biogas).[214] Residues from biodigestion serve as an odorless fertilizer which can be used in crops without risking toxicity to soils, saving resources by reducing the need for chemical fertilizers.

A summary of the residues produced by each of the 13 products of interest in this chapter can be seen on Table IV.2.

It is important to remember that a number of traditional uses for agricultural residues occur in Mexico. Common types of use include animal feed and natural fertilizer. According to the International Energy Agency (2010), the main sources of feedstocks for second generation biofuels in Mexico derive from harvesting and processing agricultural crops. For example, large potential exists in the huge quantities of residues produced after the harvest of sorghum in the more arid regions of Tamaulipas, Guanajuato, and Michoacàn, and sugarcane in the tropical sub-humid and humid regions. However, considering the competing uses of the residues as feed for livestock or as fertilizer, the amount of unused residues (or harvest-phase residues which could be safely extracted from the field) is significantly smaller. Residues from processing sugarcane (bagasse) or maize (corncobs) form another potential major source of biomass residues. However, these have other uses; for example, bagasse is often used for power and heat production.

In general, it must be considered that the use of sugarcane and maize straw (harvest-residues) in Mexico could lead to higher expenditures to achieve an equalized nutrient and humus balance, resulting in an increase in the environmental impact if harvest residues are used for production for second generation biofuels. On the other hand, since 97 per cent of dry straw is burnt before harvest and 50 per cent of sugarcane tops and leaves are burnt after harvest, current contribution of cane residues to nutrient cycles in Mexico can be seen as limited. Therefore, the removal of this biomass for second generation biofuels might not significantly reduce nutrient contribution in areas where humus return is limited to nutrients in the ash. The environmental impact of removing maize stalks could be low as well, since most of them are grazed or harvested to be used as fodder (IEA, 2010). The optimal level of extraction of harvest residue for biofuel purposes is location-specific and needs additional research (Cruse and Herndl, 2009).

E. MAPPING OF BIOFUEL POTENTIALS FROM RESIDUES OF 13 AGRICULTURAL PRODUCTS

In this section, the biofuel production potentials were estimated based on low-cost residues for the 13 agricultural products analyzed in this chapter. The estimations sought to produce figures for bioelectricity production, liquid biofuels (bioethanol and biodiesel), as well as biogas from agricultural and livestock residues. The calculations took into account those residues with low social trade-offs in their usage, particularly those which do not have dual use as food products. This approach was taken in order to focus the assessment on alternatives which would avoid the «food vs. fuel» dilemma. Additional calculations were made to extrapolate the potential income and employment creation which could be triggered by the development of biofuel potentials from the 13 products analyzed in Mexico.

Estimations are conservative, as only industrial-phase residues were considered. This approach was used due to at least three reasons: the larger residue-density at industrial / processing plants; the often-polluting characteristic of residue flows at processing sites (e.g. water contamination from untreated manure in confined livestock production); and the role played by harvest-phase residues (straw) in soil cover, fertilization and protection against erosion. Results can be seen in Table IV.3. Results are compatible with other studies assessing the residue-to-biofuels potential in Mexico (IEA, 2010; REMBIO, 2011).

Residues from agricultural sectors beyond the thirteen products of interest were not considered in the assessment. In addition to that, the calculations also did not consider other large feedstock bases

Table IV.2: Residues from production of 13 selected agricultural products in Mexico

Product	Field / Harvest phase			Industrial phase		
	Residue types	Usage	Perceived market value	Residue types	Usage	Perceived market value
Sugarcane	Straw / folliage tops	Fertilizer, soil cover animal feed	low low	Bagasse Filter cake Vinasses Molasses	fuel for electricity and heat generation organic fertilizer organic fertilizer (liquid) food, feed, ethanol production	low low low high
Soy	Straw (minimal)	Fertilizer, soil cover	low	soybean shells soybean bran soy lecithin soy oil lees	fuel for electricity and heat generation animal feed nutritional suplement (medical use) soap (bars or powder)	medium medium high medium
Corn	Straw / folliage	Fertilizer, soil cover	low	corn flour corn bran corn oil corn oil lees	food product food product used in multiple industries soap (bars or powder)	high medium high medium
Beans	Straw / folliage	Fertilizer, soil cover	low	Straw	animal feed / discarded	low
Rice	Straw / folliage	Fertilizer, soil cover	low	rice husks rice bran	fuel for electricity and heat generation ingredient in food industry	medium medium
Wheat	Straw / folliage	Fertilizer, soil cover	low	Wheat husks Wheat bran	boiler fuel, food industry food industry	medium medium
Sorghum (sweet) Sorghum (grain)	Straw / folliage Straw / folliage	Fertilizer, soil cover, animal feed (bales)	low-medium low-medium	Sorghum molasses (Sweet) sorghum bagasse (Sweet) sorghum flour (grain) sorghum bran (grain) sorghum oil (grain) sorgum oil lees (grain)	food industry, ethanol production fuel for electricity and heat generation food product food product multiple usages soap (bars or powder)	high medium high medium high medium
Coffee	Straw / folliage	Fertilizer, soil cover	low	Cofee pulp shells seed skins boiler ash Cofee mead	discarded returned to field as fertilizer fuel for electricity and heat generation fertilization of fruit trees fertilizer	low low medium-high low low
Beef	Manure (unfeasible to manage in free-ranging cattle)	Pasture fertilizer	low	fats (suet) slaughter residues manure (in confinement) residual water	cosmetics, food industry, biodiesel Animal feed, biogas, discarded. discarted, biogas, biofertilizer discarded, biogas production	high medium medium low
Pork	Manure (unfeasible to manage in free-ranging swines)	Pasture fertilizer	low	fats (suet) slaughter residues manure (in confinement) residual water	cosmetics, food industry, biodiesel Animal feed, biogas, discarded. discarted, biogas, biofertilizer discarded, biogas production	high medium medium low
Poultry	Manure (unfeasible to manage in free-ranging birds)	Pasture fertilizer	low	fats slaughter residues manure (in confinement) residual water	cosmetics, food industry, biodiesel Animal feed, biogas, discarded. discarted, biogas, biofertilizer discarded, biogas production	high medium medium low
Fish	Manure Amonnia (unfeasible to collect in natural waterways)	Not applicable	low low	fats fish trimmings manure (in confinement) residual water	cosmetics, food industry, biodiesel Animal feed, biogas, discarded. discarted, biogas, biofertilizer discarded, biogas production	high medium medium low
Milk	Not applicable	Not applicable	Not applicable	white water organic cake whey	discarded organic fertilizer nutritional supplement	low low low-medium

Sources: Questionnaires with Mexican producers, expert interviews

such as forestry residues and solid municipal waste. It is safe to assume that overall potentials would be much greater when also considering these mentioned residues from other agricultural products in Mexico.[215]

Estimation results should be taken with caution, since results depend on assumptions which may not be uniform for the total production of the products analyzed. The adopted conversion factors between biomass residues and their energy potentials, while based on specialized sources, are always subject to debate and could vary depending on regional characteristics of crops and livestock produced. Additionally, as in any theoretical potential, the capacity to deliver the potentials identified ultimately depends on various aspects of technological capacity, agricultural market dynamics, investment and conducive policy frameworks for bioenergy development.

The estimations did not consider agricultural residues which have a dual use as food, nor residues from harvest-phase of crops (which serve as a natural fertilizer to the fields). Figures in Table IV.3 also did not consider resources from forestry or municipal waste. Even so, the survey found large biofuel and bioelectricity production potentials based on low-cost agricultural residues for the 13 products analyzed in the country.

The production of biofuels from agricultural residues could also boost income in rural areas. By considering only residues from the 13 agricultural products analyzed, the production of bioelectricity, bioethanol and biodiesel could bring between USD 2.2 and 4.1 billion in additional revenue for Mexican agriculture. Biogas potentials could add another USD 234 million in revenue.

Based on the 13 products surveyed, bioelectricity could produce 10.55 per cent of the yearly national electricity consumption in Mexico; second generation bioethanol could replace 6.33 per cent of gasoline used (in energy terms); biomass-to-liquid biodiesel could replace 23.22 per cent of diesel demand and biogas could make up to 14.03 per cent of natural gas demand in the country.

Biofuels from residues could also deliver substantial employment to Mexican agriculture. Bioelectricity from agricultural residues could add over 39.000 new jobs (direct and indirect), bioethanol over 49.400 jobs; biodiesel 71.700 jobs and biogas 4.000 jobs. Those jobs would have better wages and demand higher qualification than the current average in Mexican agriculture. While the average revenue per job created in the entire Mexican agricultural sector is USD 9.020 per person employed, equivalent in bioenergy has been estimated to average USD 57.400 per employee (Bacon and Kojima, 2011).

Before becoming reality, those potentials depend on the establishment of conducive frameworks to accelerate technology development and demand for biofuels produced from residues. Comprehensive policy frameworks to bring down costs and investment risks, as well as research and deployment of second generation biofuel technologies, either indigenously or in cooperation with other countries, will be critical for the realization of those potentials. Policy efforts should also go beyond the 13 products of interest, targeting all agricultural residues, as well as forestry products and municipal waste.

This section did not attempt to estimate the investments necessary to realize the production potentials, nor did it attempt to forecast production costs for biofuel production. Except for the figures for bioelectricity and biogas, potentials are heavily dependent on second generation technologies. While estimations of production costs for advanced biofuels already exist (IEA, 2010, REMBIO, 2011), the final cost in Mexico will ultimately depend on technology development and learning curves associated to the level of deployment and market size for biofuels produced from residues. As of 2012, technological research in second generation biofuels is still limited in Mexico, with no commercial production in place yet.

F. FINDINGS AND POLICY RECOMMENDATIONS

Expanding opportunities for rural job creation, raising farmers' income levels and improving rural energy services are key rural development goals for Mexico. The country seeks to achieve these goals within a sustainable development policy framework emphasizing food security and rural development, while promoting a diversified and secure energy supply. The promotion of biofuels in conjunction with the agricultural sector development in Mexico can help. Energy potentials from the residues of the 13 products analyzed shows a large under-utilized and untapped potential for generating more sustainable energy sources including from bioelectricity, second generation bioethanol, biodiesel and biomethane. Development of these energy sources could also

Table IV.3: Biofuel production potentials based on residues from 13 agricultural products in Mexico

Product	Electricity				Bioethanol (2nd gen)			
	Potential (GWh)	As % of total Mexican consumption in 2009	Additional Income (USD million)	Additional jobs	Potential (Million L)	%Mexican of gasoline in 2009	Additional Income (USD million)	Additional jobs
Sugarcane	6054.40	3.01%	642.39	11177.52	3405.60	5.31%	2383.92	41480
Soy	7.52	0.00%	0.80	13.89	2.90	0.00%	2.03	35
Corn	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Beans	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Rice	48.22	0.02%	5.12	89.02	17.36	0.03%	12.15	211
Wheat	274.41	0.14%	29.12	506.61	98.79	0.15%	69.15	1203
Sorghum (sweet)	578.69	0.29%	61.40	1068.37	381.09	0.59%	266.77	4642
Sorghum (grain)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Coffee	446.92	0.22%	47.42	825.10	150.84	0.24%	105.59	1837
Beef	3020.57	1.50%	320.49	5576.51	N/A	N/A	N/A	N/A
Pork	9560.60	4.75%	1014.40	17650.60	N/A	N/A	N/A	N/A
Poultry	1231.06	0.61%	130.62	2272.77	N/A	N/A	N/A	N/A
Fish	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Milk	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
TOTAL	**21222.39**	**10.55%**	**2251.75**	**39180.39**	**4056.58**	**6.33%**	**2839.61**	**49409.20**

Product	Biodiesel (2nd gen)				Biogas (100% Methane-equivalent)			
	Potential (Million Liters)	% Mexican consumption in 2009	Additional Income (USD million)	Additional jobs	Potential (million M3)	% Mexican consumption in 2009	Additional Income (USD million)	Additional jobs
Sugarcane	4631.62	19.50%	3323.07	57821	0.10	0.00%	0.01	0
Soy	3.95	0.02%	2.83	49	N/A	N/A	N/A	N/A
Corn	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Beans	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Rice	23.61	0.10%	16.94	295	N/A	N/A	N/A	N/A
Wheat	134.35	0.57%	96.39	1677	N/A	N/A	N/A	N/A
Sorghum (sweet)	518.29	2.18%	371.86	6470	N/A	N/A	N/A	N/A
Sorghum (grain)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Coffee	205.14	0.86%	147.18	2561	N/A	N/A	N/A	N/A
Beef	N/A	N/A	N/A	N/A	1360.53	8.92%	149.39	2599
Pork	N/A	N/A	N/A	N/A	484.83	3.18%	53.23	926
Poultry	N/A	N/A	N/A	N/A	294.55	1.93%	32.34	563
Fish	233.86	N/A	167.79	2919	N/A	N/A	N/A	N/A
Milk	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
TOTAL	**5750.81**	**23.22%**	**4126.07**	**71793.62**	**2140.00**	**14.03%**	**234.97**	**4088.52**

Source: UNCTAD calculations, based on parameters collected from Mexican producers, the Mexican Service for Agriculture and Fisheries (SIAP), expert interviews and specialized literature. Considering 100 per cent of unused residues for each biofuel conversion option; 20 per cent conversion efficiency assumed for bioelectricity production. Liquid biofuel production implies usage of second generation biofuel technologies (ethanol and biodiesel) and biogas production considers anaerobic digestion processes. Estimations do not take into account the following types of residues identified in Table 1: edible by-products, high-value residues or harvest-phase residues. Additional income generation is estimated using 2011 market prices in Mexico for electricity, ethanol, diesel and natural gas. Employment creation factor is based on (Bacon and Kojima, 2011), consisting of 17.4 jobs per million USD in revenue.

contribute to income-generation in rural areas, provide new employment opportunities. However, before these potentials can be realized, many regulatory and technological hurdles need to be overcome.

The legal framework for biofuels in Mexico has advanced since the publication of the National Biofuels Law in 2008. While it has prompted an interest in first-generation biofuel production, little attention has been paid to the use of agricultural residues to produce biofuels or to foster technological options for second generation biofuels. Demand-pull instruments have been based on public procurement mechanisms that focus primarily on first generation anhydrous ethanol, without including provisions to encourage second generation biofuel development and production. The new strategy for anhydrous ethanol blending in the country calls for the company *Petróleos Mexicanos* (PEMEX) to procure indicative amounts of ethanol to be blended into gasoline starting in 2012. However, there are currently no foreseen minimum purchase requirements on biofuels produced from residues.

Moving beyond the current focus on first generation biofuels is very important, In order to tap the wealth of resources existing in agricultural residues, the following strategic considerations are important:

a. Mexico may need to develop a comprehensive framework to accelerate technology development and demand for biofuels produced from residues. Since second generation biofuels are not yet produced at commercial scales, the government has made efforts to support research, as well as development and transfer of technologies in the sector. A number of programs are in place to support rural investments and R&D efforts in biofuels activities, notably in biogas projects from anaerobic digestion. Even as the government has sought to facilitate communication of instruments supporting production, storage, transport and retail of biofuels, it remains unclear for producers which programs are best suited to support development of biofuels made from agricultural residues. That, coupled with the lack of foreseeable market opportunities for advanced biofuels in the country, leads to an atmosphere of market uncertainty which discourages private investments in research.

b. Clear strategies to bring down costs and investment risks, as well as to promote research and deployment of second generation biofuel technologies, both indigenously and in cooperation with other countries, would be critically needed for the realization of the potential economic gains identified from second generation biofuels based agricultural residues. In addition, international cooperation will be important and needs to be mobilized to meet initial R&D costs, as well as to generate markets of sufficient size to exploit available economies of scale. For that, Mexico can profit from its ongoing biofuel partnerships in the Mesoamerican region, and from cooperation with countries and regions engaged in advanced biofuels research and deployment, such as the United States, Brazil and the European Union.

c. Policy efforts should also go beyond the 13 products of interest, targeting all agricultural residues, as well as forestry products and municipal waste.

d. The institutional enabling environment also deserves attention. The rural policy approach in Mexico has sought to promote dialogue and cooperation between different government ministries. An inter-service working group composed of Ministries of Energy, Agriculture, Economics, Finance and Environment has been established to define public policies for biofuels. While a similar inter-ministerial structure has been set up to cater for rural policy matters, the role of the Energy Ministry (SENER) n the later has been unclear. For the realization of an integrative approach between agriculture and biofuel production from residues, there is need for coordinated policies and common funding schemes will be important, especially between SAGARPA and SENER.

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CONCLUSION AND MAIN POLICY RECOMMENDATIONS TO THE OUTLOOK

A. CONCLUSION

The Outlook has highlighted some of the challenges and opportunities for Mexican agriculture development and trade and related policies, both historically and contemporarily, and suggested areas where improvements can be made. It suggests that the current agricultural support system is insufficiently results-oriented, whilst lacking both efficiency and effectiveness. There needs to be a coordinated approach to agricultural policy, both in terms of institutions and direction. There is weak coherence between the numerous subsidies, despite the existence of the Special Programme (PEC), and there exists no clear, long-term policy behind them. Eligibility criteria need to be more rigorously assessed, as subsidies are often poorly targeted with only a small majority going to rural populations. A lack of human and material resources associated with these programmes leads to suboptimal monitoring and evaluation procedures of stated objectives and time-bound exit strategies should be adhered to, as there is often little conformity with deadlines. The introduction of single payment scheme (SPS) systems could go some way to alleviating these problems. Aid schemes, subsidizing agricultural output or providing input subsidies could be carried out in a pro-competitive manner so as not lead to unnecessary distortions of competition. The need to create a system to ensure popular consultation for programme design and for effectiveness monitoring is self-evident and there is scope to create partnerships and institutional developments that may have the state and other stakeholders (e.g. major producers, exporters, supermarkets etc.) acting as equal partners with producer organizations in formulating and implementing sectoral policies.

Further, the objectives of the numerous support measures are often inconsistent and the PEC has yet to succeed in creating clear, comprehensive policy goals and operative guidelines. At present, the governance structure of agricultural policy is not strong enough to ensure coordination across the various stakeholders and achieve the programmes' objectives. Policy cooperation, common funding schemes and in general, coordinating and harmonising the various agents and programmes will be important.

The situation of agricultural producers needs to be improved as productive and efficient small farmers are the drivers of rural economic activity and the key to domestic food security and to effective rural development, counteracting poverty and emigration. A number of issues regarding small farmers need to be urgently addressed including, inter alia the possession of arable land, the use of traditional farming methods, insufficient rural infrastructure, lack of rural financing, a lack of market power, government control of prices of agricultural products and trade liberalization.

Some of the key policies should address farmers' needs in terms of access to knowledge about improved production techniques, improved seed varieties, soil conservation or more efficient resource use (e.g. water harvesting techniques). Indeed, a wholesale shift from industrial, mono-culture based production, which is highly dependent on external inputs, to sustainable production systems could be a good alternative for small scale farmers in order to increase productivity and rentability. This approach may reduce the use of synthetic fertilizers, reduce tillage and, in the case of certified organic farming, may benefit from higher price mark ups. Efficiently enforced standards certification systems would be a prerequisite for organic framers but would also aid conventional farmers in terms of quality grading. Indeed, from an import perspective, the domestic lack of capacity to enforce and verify quality regulations leads to an inconsistent application of regulations, which is detrimental to domestic producers and erodes consumer protection when cheap, low-quality agricultural products are imported.

In order to facilitate private rural investment in agriculture, the lack of access to commercial banking services in rural areas should be addressed, especially given the decline in development banking. The expansion of access to finance among rural populations could be achieved through encouraging private financial institutions, the use of state mandated credit schemes and ICTs, developing micro-finance and enhancing the role of non-bank financial institutions or other semi-formal financial institutions. By addressing the issue of land titling, small and

medium producers will be able to use their land as collateral. Furthermore, farmers should be supported with the development of risk-management options such as agricultural insurance, regulation of contract farming and commodity exchanges.

Public investment in infrastructure and further public support will be needed in order to enable farmers to successfully enter commercial agricultural markets. There is a necessity to build productive capacity, to increase access to storage and warehousing systems and to basic processing facilities, recommit to basic rural transport infrastructure to remedy poor connectivity to transport networks. Furthermore, reliable access to water and electricity is not universal and investment is required to guarantee supply to those in the poorest areas.

There is an urgent need to address and resolve commodity value chain imbalances, including a reduction in the quasi-monopoly situations of input suppliers, buyers and processors. This may be done through stricter applications of competition law, vigorously assessing mergers that affect already highly concentrated agricultural markets, continual close monitoring of firms that already exist in those markets and by encouraging new entry into highly concentrated input and processing markets. It would be beneficial to encourage the establishment of new producer organizations, such as cooperatives or farmers associations, and to strengthen existing ones, through information, incentives and appropriate regulation. Indeed, it is important that resources, such as a market information system, transparency schemes and internationally recognized certification systems, are accessible to smallholder producers. Encouraging larger processing firms and supermarkets to source from small-scale producers may be beneficial under an appropriately structured scheme.

Support may be given for investments in storage and processing facilities by these co-operatives and associations, so that issues of concentration in the processing markets may be addressed, and support for research and development might incentivize new entry into agricultural input markets, such as hybrid seeds. Further, competition advocacy targeted at key players within the agricultural value chain would increase their awareness of, and respect for, competition law and policy. Advocacy measures specifically targeted at smallholders would increase their capacity to denounce of anti-competitive conduct and to engage the CFC in order to start an investigation. Alternative measures, such as a complaints mechanism, should also be considered.

Mexico has a relatively low productive agricultural sector and spends relatively little on the research and development of agriculture science and technology. Research is generally undertaken in academic institutions that are poorly linked to the producers and is so often poorly targeted to the actual needs of smallholder producers. By supporting activities that lead to higher productivities, output and exports would increase whilst lowering the need for imports, increasing the self sufficiency rate.

Some policy options may be limited given the WTO and NAFTA commitments of Mexico but this does not preclude measures being taken that affect the agricultural sector. There is a strong need to address international trade imbalances as agricultural trade reform has coincided with increasing imports, decreasing employment in agriculture. Whilst committed to the NAFTA agreement, the US has revised and amended the Farm Bill on a number of occasions. Mexico needs to continually monitor these changes, be aware of their effects, proactively respond and observe how they may repackage their own domestic policies, consistent with NAFTA, in a similarly effective manner.

Further, emphasis should be placed on additional diversification of Mexico's agricultural export markets to take advantage of new markets, thereby reducing dependence on the United States. Indeed, trade with developing countries appears to present a good, albeit competitive, opportunity for Mexico's exports. Working towards harmonization of measures and regulations with key trading partners, particularly for food packaging and nutrition labeling regulations, may address important concerns of food safety, risk assessment and risk reduction and open up new export opportunities. Greater efforts should be made to ensure that national certification is duly recognized in other markets, especially in the United States, to facilitate Mexican exports. Port and border facilities are also inefficient, which contributes to Mexican agriculture's lack of international competitiveness

It has been demonstrated that it is critical that there is a clear, continuously evaluated structure to any set of policies applied to Mexico's agricultural sector but it is equally important that any policy package form a coherent whole. Policy options that may achieve reductions in rural poverty or lower rural to urban migration could, in

principle, differ from those that increase export revenue or maximize agricultural output. The interdependence of agricultural policies, in terms of poverty, employment, trade, competition, infrastructure etc., needs to be addressed in order for reforms to achieve a significant degree of the potential for success.

There is significant potential for energy extraction from the residuals of thirteen key agricultural products, in terms of bioelectricity, bioethanol, biodiesel and biomethane. It is estimated that revenues of between USD 2.4 and 4.3 billion could be generated for Mexican agriculture and given that many of the thirteen products are cultivated in smallholder systems, bioenergy revenue streams could significantly increase income-generation and (skilled) job opportunities within rural areas and help reduce rural poverty, seasonal fluctuations in agricultural employment and rural emigration. It is important that Mexico is cognizant of the potential of biofuels as a contributor to rural development, in particular as a source of employment and income creation in rural areas.

There are many challenges that need to be met, however, before the potential of second generation biofuels can be realized. Many regulatory and technological objectives need to be addressed including initializing a comprehensive framework to accelerate the evolution and adoption of related technology and demand for biofuels produced from residues. Regarding the latter, the inclusion of minimum purchase requirements within public procurement mechanisms would encourage second generation biofuel production. There are existing rural investment programs but they are too numerous and complex that it is unclear which if any, would provide support for biofuel production. International cooperation will be fundamental in terms of both research and development of related technologies (cost reduction, speed of development) and through the creation of large markets in order to exploit available economies of scale. Most importantly, second generation biofuel adoption will only become widespread after considerable strategic, political and economic integration between energy and agricultural production.

It is important to note the need for a further research and analysis to compliment this Outlook and elaborate specific policy recommendations. Whilst many stakeholders were consulted in order to facilitate the completion of this work, it is acknowledged that much of the research and analysis carried out could be characterized as ‘deskwork’. It should be recognized that the Outlook needs to be augmented with further work carried out in the field and that widespread stakeholder engagement, in terms of an advocacy process, needs to take place before policy recommendations are acted upon. Moreover, there are obvious extensions to aspects of this Outlook that would aid agricultural policy reform. For example, the third chapter analyses the corn market from a competition perspective and although it is expected that many features of this market are replicated across those for other agricultural products, it is not assumed that these markets are perfectly homogenous and it would be beneficial to analyze the competitive framework in the markets of other key agricultural products. Likewise, the fourth chapter explores the biofuel potential of exploiting waste from thirteen agricultural products. A comprehensive energy policy would consider a more extensive set of exploitables, including forestry and municipal waste.

Lastly, any newly implemented policies should include clear objectives that may be appraised after a pre-specified time period. In this manner successful programmes and mechanisms may be replicated and weaknesses can be addressed and resolved. To this end, UNCTAD may again be of assistance to Mexico in furthering the diagnosis of Mexico’s agriculture development.

B. MAIN POLICY RECOMMENDATIONS

The Outlook provides a number of preliminary policy recommendations to strengthen Mexico’s agricultural sector into a dynamic component of sustained growth and inclusive development. These are highlighted below.

To use trade policy to strengthen the agricultural sector, the following are suggested:

1. The Government should review the exposure of Mexico’s agricultural sector to external shocks, including to any changes in US agricultural policy such as new US farm bills that have a direct impact on Mexican farmers, to identify measures to limit the impact of potentially negative shocks and ensure fair market conditions for agriculture production and trade as well as coherence between trade and development policies.

2. Mexico has proven to be very competitive with certain agricultural exports and should explore means of increasing such agriculture exports to the markets with which it has trade agreements, despite many difficulties faced including exclusion of sensitive agricultural products from trade agreements to which Mexico is a party, or competition from highly productive countries.

3. Mexico should assess the implications – benefits and costs - on its agriculture production and exports of its participation in far reaching new free trade agreements such as the Trans-Pacific Partnership that is currently discussed so as to integrate aspects that bring net benefits to Mexico.

4. Flexibilities provided under the WTO Agreement on Agriculture, such as allowed subsidies which could include income loss insurance, investment subsidies and other measures, can be used more effectively to bolster agriculture production and employment while paying due attention to potential costs such support can impose on other sectors.

5. At the same time current Mexican agricultural subsidy programmes need to be reformed to target more the small-scale farmers as they appear to not have benefited much.

6. Mexico should explore trade-related technical assistance provisions and packages that are available under trade agreements like NAFTA, the WTO-led Aid for Trade Initiative and other development assistance programmes to build up its agriculture section.

To strengthen agricultural productivity and production, as well as competitiveness and integration into agrifood value chains, the following are proposed:

7. Mexico should consider augmenting public (and private) expenditure on agriculture research and development to foster higher agricultural sector productivity with positive effects on output and exports.

8. Alternative agricultural production systems that are sustainable and environmentally friendly, use less synthetic fertilizers, reduce tillage and, in the case of certified organic farming, may benefit from price mark ups should be enhanced. Often such production processes are more labour intensive and could thus create or preserve employment, as compared to conventional, industrial, mono-culture based and high-external-input dependent agricultural production systems.

9. Government should facilitate smallholder farmers' access to credit and appropriate technology. Input suppliers and output processors may also consider providing credit to smallholders in areas where access to financial services is unavailable.

10. Government should continue with its regulatory and institutional reforms to support the rural sector, including the Savings and Rural (BANSEFI) Project which has increased the capacity of the Savings and Credit Institutions in Mexico.

11. Increased public investments in tailor-made financial services – credit, savings, insurance and market intelligence – are required to scale up existing innovations to improve the quantity and quality of the services so that they meet the demands of smallholder farmers. These services may be best channelled through self-help groups, producer organizations like cooperatives to be more cost effective.

12. Agricultural producer organizations – such as cooperatives – should also be strengthened, well-resourced and functional to help farmers benefit from scale economies, increase bargaining power (hence prices), pooling of resources to buy inputs (e.g. fertilizers), reduction of transaction costs, and expansion of supply-side capacities and competitiveness.

13. The Government and private sector should join forces and forge partnerships where applicable to make readily available to agricultural producers, including agrifood value chain participants, key information – such as prices, market intelligence, weather, input markets and technologies –through 'information kiosks', mobile phones, and 'train the trainer' schemes that enables the producers to make informed on- and off-farm decisions regarding planting, harvesting and marketing.

14. Enhanced and improved provision of reliable and secure warehouse facilities for storage and basic

processing of agricultural products, which is critical to increasing value addition, negotiating better prices, and facilitating efficient trading and marketing. This also enables farmers to store their produce and sell when prices rise, thereby increase their incomes, and facilitate access to credit where warehouse receipts are accepted as collateral.

15. Focus on capturing more value of the agricultural value chains via vertical integration. Public-private partnerships should be encouraged that support the integration of smallholders into higher value markets.

To enhance food security, the following is proposed (in addition to the above mentioned policy recommendations on enhance productivity and production):

16. At the national level, Mexico needs to raise its agricultural productivity, implement early warning systems and other mechanisms that prevent and/or respond promptly to food shortages.

17. Regional and international mechanisms are also needed to mitigate food shortages such as through regional or supranational grains reserves or emergency funds, and curtail severe volatility of food prices.

18. The Government could further expand its current hedging strategy for grains and other crops, which aims to protect farmers from price volatility.

19. The Government should explore ways to solicit resources from the G20, where feasible, to integrate the recommendations embodied in the 'Action Plan on Food Price Volatility and Agriculture', including the Agricultural Market Information System (AMIS) which aims to reinforce transparency on agricultural products' markets.

To address compliance with agricultural standards and other non-tariff measures that hinder agriculture development the following can be considered:

20. Agricultural standards in Mexico's main export markets, which are mostly developed countries, have to be met and Mexican producers should be supported in meeting these standards through appropriate agricultural extension services.

21. Working with key trading partners towards harmonization of measures and regulation could be an interesting path to explore, particularly for food packaging and nutrition labeling regulations which is very controversial in the current context of trade with the US. Standardized and mutually facilitated customs procedures with its main trading partner are also important.

22. From the import perspective, Mexico should examine the need to strengthen quality control measures and enforcement in the domestic market to improve consumer protection. Furthermore, a strong monitoring of import prices could detect potential "dumping" and seek remedial actions.

23. SAGARPA should keep on track with its reforms and modernization of the national food safety laws and regulations, in order to fully establish new public oversight of its agrifoods supply chains.

24. Mexican authorities, both public and private, should work closely with their counterparts in US, particularly the FDA, on ensuring compliance in trade-related food safety regulatory provisions and develop standards as enshrined in the 'new' Food Safety Modernization Act (FSMA).

25. Mexico should periodically monitor and review its Agreement on Food Safety Rules with the U.S. Where feasible and mutually beneficial for contracted parties, Mexico could invoke and utilize necessary provisions on technical assistance and support that strengthens 'at the source' the scientific and public health risk related to food safety regulation in Mexico.

To address possible competition issues affecting specifically corn production and commercialisation in Mexico (and if similar issues exist in other agricultural products, the same type of measures might be useful), the following is proposed:

26. Strengthening of existing associations/cooperatives of small corn growers and supporting the establishment

of new associations/cooperatives to strengthen their market position and negotiating power in dealing with highly concentrated upstream and downstream market that cannot be changed through competition law enforcement.

27. Promoting new entry in highly concentrated corn input and processing markets through supportive policy measures, for instance by supporting co-operatives and associations of farmers to invest in storage facilities as well as processing facilities, so that a larger number of players would be present in the highly concentrated processing markets. As for input markets, such as the market for hybrid seeds, support for research and development might incentivize new entry.

28. Enabling small corn producers to grow and compete successfully in commercial markets through pro-competitive state-aid schemes, including public investment in infrastructure and further public support/ aid. Experience has however shown that it is crucial that respective state aid schemes be designed in a pro-competitive manner and do not lead themselves to further distortion of competition. By means of its advocacy function, the CFC could render its support to design schemes for pro-competitive agricultural subsidies.

29. Continuation of an active enforcement of the Mexican competition law in the agricultural sector, including production and commercialisation of corn, would help to address certain of the possible competition issues affecting corn production and processing. In particular, continuing to vigorously assessing mergers that affect those agricultural markets that are already highly concentrated, e.g. the market for hybrid corn seeds and the corn processing markets, will prevent further concentration through external growth.

30. Corn producers furthermore could be encouraged to bring to the CFC's attention any indication of absolute or relative monopolistic practices in input markets, which would allow the CFC to initiate respective investigations and prosecute these practices, if there is sufficient proof.

31. The CTC could further use its good working relations with other competition authorities in the region and worldwide to jointly address competition issues originating outside of Mexico, but impacting on the Mexican agricultural sector.

32. Strengthening competition advocacy in the agricultural sector, targeted at the various players of the agricultural value chain would increase their awareness of and respect for competition law requirements. Furthermore, advocacy measure targeted at smallholders could increase their capacity to identtify anti-competitive conduct from which they suffer and to provide the CFC with the required information to start an investigation.

33. Prevent and remedy possible abuses of buyer power by considering measures to reduce concentration of market power in certain stages/actors of the agricultural commodity value chain, especially as for several grain (including corn processing) markets, there are no more than two to three buyers/processors that control the near totality of the market and can exert a great deal of control over the sellers and prices (commercialization and processing). For example, the Mexican government can encourage the larger processing, integration and supermarket industries to use the small-scale sector to enable them to either enter or remain in high-value or potential export markets. Both exporters and buyers in the main urban areas could be flexible in allowing smallholders time to adapt to changing conditions and standards. Explore with the CFC the extent to which the possible abuses of buyer power could be prosecuted under Article 10 LFC. Or establish a complaint mechanism at ASERCA if contracts that benefit from an ASERCA subsidy are not honoured.

To foster promotion of biofuels in conjunction with the agricultural sector development in Mexico, and move beyond the current focus on first generation biofuels, the following is proposed:

34. Development of a comprehensive framework to accelerate technology development and demand for biofuels produced from residues because; (a) a number of programs are in place to support rural investments and R&D efforts in biofuels activities, notably in biogas projects from anaerobic digestion,

however it remains unclear for producers which programs are best suited to support development of biofuels made from agricultural residues; and (b)coupled with the lack of foreseeable market opportunities for advanced biofuels in the country, this leads to an atmosphere of market uncertainty which discourages private investments in research.

35. Promote clear strategies to bring down costs and investment risks, as well as to promote research and deployment of second generation biofuel technologies, both indigenously and in cooperation with other countries.

36. Foster international cooperation to meet initial R&D costs, as well as to generate markets of sufficient size to exploit available economies of scale. In this regard, Mexico can make use of its ongoing biofuel partnerships in the Mesoamerican region, and from cooperation with countries and regions engaged in advanced biofuels research and deployment, such as the United States, Brazil and the European Union.

37. Examine opportunities that go beyond the 13agricultural products surveyed in this Outlook would be of interest, such as targeting all agricultural residues, as well as forestry products and municipal waste.

38. There is need for coordinated policies and common funding schemes, especially between SAGARPA and SENER, fostering an enabling institutional environment for the realization of an integrative approach between agriculture and biofuel production from residues.

ENDNOTES

1 See Chapter II, Section B.2

2 OECD Rural policy reviews Mexico 2007 p. 14.

3 World Development Indicators 2011; FAO reports that the agricultural population is 19 per cent in 2008, down from 30 per cent in 1990.

4 World Bank Development Indicators, 2012. Data for 2010.

5 WTO definition of agricultural trade.

6 Data here are based on UN Comtrade data. The starting period has been chosen to be 1995 because of the Peso crisis which led to extreme changes of import values before that period.

7 The import growth is affected by many elements including trade policy changes, transport cost changes, population growth and changing consumption and production patterns. Thus, the comparison with the import growth of other countries is not a clear indicator whether a trade policy change did or did not have an impact.

8 For example, comparing three- and five-year averages from 1991 to 1993 (1990 – 1994)) with 2008 to 2010 (2006 - 2010) reveals that both exports and imports were similarly dynamic with a slightly higher increase of exports. Exports grew by 393 per cent from 1991-93 to 2008-10 while imports grew by 278 per cent. Data are based on UN Comtrade data reported by Mexico. Results, but not broad pattern, depend on whether data reported by the US or Mexico are used and which definition of agriculture is used, e.g. the WTO definition based on HS classification or another frequently used definition based on SITC classification. UNCTADstat, and a slightly different definition of agriculture where fish products are included but some other agriculture raw materials are not, confirms that imports of food items grew at a higher pace than exports (223 per cent for imports and 160 per cent for exports) from 1995-98 to 2008-10. The above stated pattern, that in some periods between the 1990s and late 2010s average export growth was higher than import growth and vice versa in other periods remains valid using different data sources.

9 The average MFN rate in Mexico has not decreased since the implementation of NAFTA. It remains relatively stable at around 20 per cent for the simple average. It is possible, however, that the non-NAFTA trade which accounts for about 20 per cent of agricultural trade is not MFN-trade but under other preferential schemes.

10 Since Table I.4 focuses on shares in total imports, the valuation of the Peso during the Peso crisis has a small impact only and therefore the base year 1993 could be taken. Relative price changes, however could influence the ranking.

11 Even though trade data quality is usually relatively good analyzing specific commodities can be problematic. Controlled and consistent data, e.g. from UNCTADstat, are not available for all of the above shown disaggregated products and start only in 1995. The annex compares changes in imports and exports using various data sources. Imports from the US reported by Mexico are compared with US exports to Mexico reported by the US and exports to the world are compared with corresponding mirror data from all of Mexico's trading partners. Where possible, data were also compared with UNCTADstat data. Data partly vary significantly. For example, Mexico reports an increase of beans from the US by 1306 per cent while the US reports only an increase of 573 per cent (in US$). In general, however, the data show very similar patterns. Maize imports from the US is an example where one reports an increase of 950 per cent and the other one of 1033 per cent, a small discrepancy for such a long time period. Also for exports are patterns gathered from Mexico's data from UN Comtrade in line with those reflected in mirror data. High discrepancies in per centage changes are observed where the base is very low, e.g. for barley exports.

12 www.Organic-World.net.

13 The difficulties are not discussed here. Despite the efforts by the FAO to collect the data and to make them consistent have they to be taken with caution.

14 World Development Indicators 2011; FAO reports that the agricultural population was 21.9 per cent in 2011, down from 30 per cent in 1990; OECD statistics report 13.1 per cent employment in agriculture as a share of total civilian employment, down from 25.7 per cent in 1993; Mexico National Employment Survey ENOE reports 13 per cent for 2008 (Scott, 2010).

15 ILO data confirm the order of magnitude for the period 1995 to 2008.

16 Mexico Agriculture Policy Review, Agriculture and Agri-Food Canada.

17 World Bank Development Indicators.

18 Prina (2011) finds that NAFTA-induced tariff cuts caused a reduction in the real Mexican border price of corn and an increase in border price of tomatoes and melons (see section 5).

19 Bridges Weekly Trade News Digest, Volume 16, Number 17, 2nd May 2012.

20 Fact sheet on NAFTA, USDA 2008.

21 The Mexican tariff schedule for 2009 includes a tariff of 15 per cent on US imports for HS “21069006”. This is most likely an error.

22 Since the EU, Canada and Japan have many specific tariffs, tariff data respond to 2009 for which ad valorem equivalents are available. Data based on UCTAD Trains database.

23 http://www.usda.gov/oce/commodity/wasde/

24 Producer Single Commodity Transfers (producer SCT): the annual monetary value of gross transfers from consumers and taxpayers to agricultural producers, measured at the farmgate level, arising from policies linked to the production of a single commodity such that the producer must produce the designated commodity in order to receive the transfer. OECD (2008): OECD’s PRODUCER Support Estimate and Related Indicators of Agricultural Support: Concepts, Calculations, Interpretation and Use (The PSE Manual)

25 Exchange rate from USDA ERS 12.64.

26 Domestic support under the WTO agreement on agriculture differs from the OECD definition.

27 See UNCTAD 2010 and 2011 and earlier versions of the annual report to the Trade and Development Board of UNCTAD on the Evolution of the International Trading System.

28 In this section this does not mean formally agreed but rather reflects the view of the Chair where he saw an agreement or a possible agreement. The draft modalities text was welcomed in 2008 by all sides.

29 As a form of compensation, tariff rate quotas would have to be expanded. Peters and Vanzetti (2011), Agriculture Negotiations: Do Sensitive Products undermine Ambition?

30 A comparative analysis carried out by OECD of 12 business surveys around the world capturing perceptions about trade barriers, in particular NTBs, found that technical measures (including health and phytosanitary regulation) and customs rules and procedures are areas of shared concern for the companies participating in the surveys. Other broad categories of NTBs reported relatively consistently across surveys are internal taxes or charges and competition-related restrictions on market access (i.e., monopolistic trade measures, such as state trading, distribution restrictions as well as restrictive business practices). OECD (2005), Looking Beyond Tariffs: The Role of Non-Tariff Barriers to World Trade, OECD Trade Policy Studies, Paris, p. 21.

31 Ruiz Duran, Clemente (2004). APEC NTBs to Mexican imports. Universidad Autonoma de Mexico

32 i.e. lack of a situation where a trading partner can demonstrate that its domestic measures achieve the same level of food safety/consumer protection of another trade partner

33 Agriculture and Agri-Food Canada (2009). NAFTA: outcomes, challenges and prospects

34 Reuters Press Release (2012) and Shook Hardy & Bacon LLP, Mark Anstoetter and Madeleine McDonough (2012).

35 Brought by Mexico against the US or where Mexico participated as a Third Party

36 Agriculture and Agri-Food Canada (2009). NAFTA: outcomes, challenges and prospects

37 WTO (2010). Trade Policy Review of the United States. Records (Concerns raised by Canada)

38 ICTSD (2011 and 2012) and WTO (2012).

39 Vollrarth, Thomas (2004). «Gauging NAFTA's success and confronting future challenges»

40 Kee, Hiau Looi, Alessandro Nicita and Marcelo Olarreaga (2004b), "Ad-Valorem Equivalents of Non-Tariff Barriers", The World Bank, Washington DC.

41 The estimates are not differentiated by trading partner, i.e. it is assumed that Mexico and, say, the EU face for one and the same product the same NTB for exports to the US. If preferential trade agreements comprise measures that significantly reduce NTBs among members the actual trade NTB that trading partners face would differ. Since NAFTA includes few measures to address NTBs and these do not appear to significantly reduce NTBs on within NAFTA trade it is assumed that Mexico and non-NAFTA members face the same NTB. Data quality for NTBs is poor and results have to be taken with caution.

42 WTO (2008).

43 USTR (2010).

44 Bovine spongiform encephalopathy.

45 Ibid.

46 NAFTA has dispute settlement procedures which are used. McRae and Siwiec (2010) argue that the WTO dispute settlement system has been influenced by the NAFTA system and that the WTO system is used more due to advantages in procedural matters and possibility of retaliation.

47 Most recently the Mexican government approved the commercial planting of transgenic soybeans (Wise, 2012). Without going into the risks and opportunities of GMO this paragraph points to the discrepance between import and production rules.

48 OECD 2010.

49 Polaski (2004), Brief Submitted to the Canadian Standing Senate Committee on Foreign Affairs: Mexican Employment, Productivity and Income, A Decade after NAFTA.

50 See e.g. DTB Associates and AgRisk Management. Implications for the U.S. and Mexico of Mexico Withdrawing Certain Agricultural Products from NAFTA. 2006

51 Includes exports food and food products, fish and raw materials.

52 WTO (2012), International Trade Statistics 2011.

53 The connotation, localities, is more associated with the degree of dispersal or density of the rural population.

54 OECD (2007)

55 The 11 crops covered by the various CONASUPO programmes were: barley, beans, copra, corn, cotton, rice, sesame, sorghum, soybeans, sunflower and wheat.

56 The nine qualifying PROCAMPO crops are: white corn, beans, rice, wheat, sorghum, barley, soybeans, cotton and cardamom.

57 «Financiera Rural» is a state-owned financial institution which provides rural credit to agricultural cooperative societies and individual producers.

58 Some farmers can mitigate crop yield risk by means of crop insurance, where claims can be made if the yield is below a pre-determined average. However, traditional insurance is not feasible in most rural communities because the high cost of intensive monitoring to avoid the moral hazard problem implies high premiums (to ensure sustainability) and most farmers cannot afford them. Only high-risk farmers, who may need insurance to access credit, will have sufficient incentive to buy insurance, implying that adverse selection becomes a major problem. Thus, in many developing countries, crop insurance has, in the past, been promoted as part of government credit programmes and cases of success are few and far between.

59 An economy in which most entrepreneurs with bankable projects have equity which is very small in relation to the size of their financing requirements, as a result of poverty and lack of capital markets.

60 “Matricula” are named from the Spanish (lat. matricula) word «matricula,» which means to register. The cards originally were made for identification of Mexican nationals when they are outside of Mexico, for use when re-entering Mexico, and to track Mexicans living abroad. They are issued by the Mexican government. Most are issued in Mexican consulate offices located in the United States.

61 Gross margins will refer to revenues minus variable costs given that no data is available on overheads, capital investment or cost of borrowed capital.

62 We follow the definition of smallholder /small-scale farmers proposed by Davis (2006). He notes that there is no universally agreed definition of small-scale farms in developing countries, but that in much of the development literature, farms of less than five ha are considered “small”. In general these farms have limited capital or other assets. A small-scale farmer derives its livelihood from a holding of < 5ha and around 10 to 20 heads of livestock (although often there is < 2 or none at all). Small-scale farmers may practice a mix of commercial and subsistence production (in crops or livestock), where family provides the majority of labour and the farm provides the principle source of income.

63 For crop and livestock products, this is the arithmetic product of production volume and current farmgate price. For fisheries, it is the arithmetic product of production volume and current first hand price.

64 Only core and no derivative products are included. More specifically the products are: Grain barley; cherry coffee; grain maize; dry beans; rice, paddy; grain sorghum; sugarcane; grain wheat; beef carcass; pork carcass; poultry carcass; cow milk; eggs; tuna; and shrimp.

65 Barley: predominantly produced on the central Plateau (Hidalgo, Tlaxcala) Beans: predominantly produced in the central states of Zacatecas and Durango . Coffee: predominantly produced in the southern states of Chiapas, Puebla and Oaxaca and the Gulf coast state of Veracruz Maize: a principal product in most federal states with a production concentration in Sinaloa and Jalisco on the Pacific coast Rice: predominantly produced in the Caribbean region (Campeche) Sorghum: predominantly cultivated in the north-eastern state of Tamaulipas and central state of Guanajuato Sugarcane: predominantly produced in the coastal states of Veracruz and Jalisco Wheat: Production concentrated in the northern states of Sonora, Baja California and the central state of Guanajuato

66 Growth rates are based on moving averages of 2008-2010 to 1991-1993

67 In Jalisco, in particular, climatic conditions for egg production are very favourable due to the altitude with lower average temperature and humidity. Moreover, the relative proximity to the main market, Mexico City, represents another comparative advantage. The dominant form of production is commercial in battery egg.

68 www.elsitioavicola.com/articles/1912/el-sector-de-gallinas-ponedoras-de-maxico

69 Michael L. Galyean, Christian Ponce and Jennifer Schutz (2011), “The future of beef production in North America”, Animal Frontiers – The review magazine of animal agriculture, Vol. 1, No.2, October 2011 (http://animalfrontiers.fass.org/content/1/2/29.full.pdf)

70 Common land accounts for up to sixty per cent of Mexico’s land use for livestock production.

71 The exit of small-scale beef and pork producers from the industry not only adversely affects costs, but also competitiveness and consumers choices in terms of product diversity and prices

72 Wise, T.A. (2007), "Policy Space for Mexican Maize: Protecting Agro-biodiversity by Promoting Rural Livelihoods", Global Development and Environment Institute Working Paper No. 07-01, Tufts University, Massachusetts, USA..

73 The poultry sector was substantially protected before NAFTA (2004). Although NAFTA called for removals of all tariff and quota protection, Mexico and U.S. negotiated sa safeguard mechanism which allowed Mexico to protect its poultry industry up to year 2008.

74 In 2004, three producers accounted for up to 60 per cent of Mexican poultry production, of which, two are U.S.-based firms: Tysons and Pilgrims Pride, with high foreign direct investments in meat- and broiler-production subsectors.

75 The analysis of this section focuses on capture fisheries

76 Need for data verification: Production units involved in tuna fishing may be counted in fisheries (and not only in tuna fishery) and/or there may be underreporting as mentioned by Mr. R. Ruiz in interview. Total number of eight-hour working days reported in tuna fishing cannot be obtained with only 2000 people employed.

77 This was the most recent and complete dataset available for the analysis.

78 It results from the difference between TCS technology and TMF

79 There are soft, hard and semi-hard wheat types.

80 Plan Rector Sistema Producto Nacional Trigo. SAGARPA 2005.

81 Plan Rector Sistema Producto Nacional Trigo. SAGARPA 2005

82 www.ico.org/history.asp

83 http://www.acdivoca.org/site/Lookup/WRSpring06-Page5-7-ValueChainCoffee/$file/WRSpring06-Page5-7-ValueChainCoffee.pdf

84 El Niño creates drought conditions in the central south and heavy rains in some parts of the north region, causing a more humid winter. Meanwhile the Niña provokes excessive rains in central and south regions, while in the North the effects are mixed from droughts and normal rainfall, however, winter rains are absent.

85 Figures from Secretaría de Economía 2012.

86 Secretaría de Economía 2012.

87 According to González, García, Matus y Martínez (2011); a 10 per cent reduction in the corn planted acres in the US would increase the import price in Mexico by 8.7 per cent, and a 10 per cent increase in oil prices would increase world demand for corn, raising the price by 20.4 per cent.

88 See Luna et al. 2012

89 Davis, J. (2006) How can the poor benefit from the growing markets for high value agricultural products? Natural Research Institute, Kent, UK. (http://www.fao.org/docs/eims/upload/210971/global_issues_paper.pdf)

90 Composition of basic food basket: http://www.coneval.gob.mx/cmsconeval/rw/pages/medicion/Pobreza_2010/Lineas_de_bienestar_07022012.en.do. In terms of price evolution, the CPI of the basic food basket increased much less than the food price index depicted in Figure 26.

91 Source: El Universo, 26 May 2008 http://www.eluniverso.com/2008/05/26/0001/14/934F3C262E344A38A75F591A6310CEC5.html

92 Source: CNN Expansion, 18 June 2008 http://www.cnnexpansion.com/economia/2008/06/18/mexico-congela-precios-150-alimentos

93 Potential impact of membership of NAFTA will be discussed in Chapter 2.

94 Source: http://www.commodities-now.com/news/agriculture-and-softs/4454-mexico-eyes-new-ideas-for-grains-hedging.html

95 This would imply to help governments, firms and farms to develop their capacity to evaluate risk and ways of managing it. More specifically, it means to develop, in connection with the private sector, hedging strategies for international humanitarian agencies to optimize food procurements, counter-cyclical instruments and mechanisms for vulnerable countries to access financing in the event of external shocks, weather index insurance, and possible guarantee instruments to facilitate contract farming to enhance price predictability in the food chain

96 UNCTAD, March 2011 (TD/B/C.I/MEM.2/15; p.8).

97 The data presented in Table 18, in particular, does not necessarily imply or mean that Mexico is the source of or responsible for all the foodborne illnesses in the U.S. market. On the contrary, Bill Marler, the leading attorney in foodborne illness in U.S. contends that "the vast majority of food- and water-borne outbreaks in the U.S. are caused by agrifood products grown, raised or manufactured in the U.S." http://www.marlerblog.com/case-news/mexico-warns-about-us-grown-salmonella-tainted-cilantro/

98 In the U.S., foodborne disease cause an estimated 48 million illnesses and 3,000 deaths per year. The U.S. economic costs are estimated at $152 million to $1.4 trillion each year.

99 Agrifood producers, traders, exporters and manufacturers are subject to multiple levels of regulatory compliance at all levels – firm, national, regional and international.

100 The unit rejection rate is the number of rejections per US$1 million of exports over the period 2002-08. The measure takes account of changes in the volume of exports such that it provides a direct measure of the rate of non-compliance. It is presented as a moving average to smooth out often appreciable year-on-year variations.

101 UNIDO (2011). Trade Standards Compliance Report 2010 (www.unido.org/tradestandardscompliance).

102 GlobalGAP (formerly EurepGAP) is the dominant certification requirement for entry into the EU market. A HACCP-based food safety program, it includes requirements respecting environmental protection, occupational health and safety criteria on farms, and awareness and responsibility regarding socially related issues.

103 Weather index insurance refers to the insurance which is linked with an objectively measurable index such as rainfall rather than the actual loss. A distinctive feature of this type of insurance is that it eliminates the costly claim and verification process associated with traditional insurance products and allows for the issue of payout automatically based on the trigger threshold. Weather index insurance can be purchased by governments and relief agencies for disaster relief purpose. It is also used by small producers to manage the crop weather risk and have access to finance. In recent years, index-based weather insurance schemes have been piloted in a number of developing countries, such as Malawi and Ethiopia.

104 The FDA is mandated by the FSMA, under the 'importer compliance certification' provisions, to provide trade-related technical assistance to foreign governments (e.g. Mexico), so that these countries are able to add value to their products, and improve process management procedures, such as packing and handling, storage, and shipment facilities.

105 For the assessment of several agricultural regimes from a competition law perspective, including Argentina, Brazil, Chile, Colombia, the European Union, Mexico, the United States, see Agricultural Exceptions to Competition Law by Juan David Gutiérez R., 2010.

106 Council Regulation (EC) No 1234/2007 of 22 October 2007 establishing a common organisation of agricultural markets and on specific provisions for certain agricultural products (Single CMO Regulation).

107 The level of agricultural subsidies in the United States, in particular for the production of corn, is discussed in Chapter I.C.3 of this publication.

108 Agricultural Exceptions to Competition Law by Juan David Gutiérez R., 2010, pages 197 to 202.

109 Competition and Commodity Price Volatility, OECD Background Note, DAF/COMP/GF(2012)2/Rev1, page 20.

110 UNCTAD Voluntary Peer Review of Competition Law and Policy: A Tripartite Report on Tanzania, Zambia and Zimbabwe, page 69 of the report on Tanzania, forthcoming June 2012.

111 Competition and Commodity Price Volatility, OECD Background Note, DAF/COMP/GF(2012)2/Rev1, page 20.

112 Ibid, page 14.

113 Ibid, page 15.

114 Market power is defined as the ability of the firm or groups of large firms to manipulate the price and quantity of the goods (and services) they sell by virtue of being one of the few players in the marketplace.

115 Generous rainfall in the state of Michoacán – the world's largest producer of avocado, and thus nullifying the need for expensive irrigation systems, coupled with lower labour costs compared to the three U.S. avocado-producing states – California, Florida, and Hawaii.

116 Avocados from Mexico are allowed to enter all U.S. states expect for three avocado-producing states – California, Florida, and Hawaii. Mexico supplies approximately 17–20 million pounds of Hass avocado to the U.S. market on a weekly basis.

117 Evidence suggests that were strong economic incentives for rent-seeking behavior from avocado-producer organizations that opposed the imports of Mexican avocados (see Russell L. Lamb, 2006, p.166-168).

118 Mexico's per capita consumption of avocado is about 6.6 kgs, relatives to U.S. and Chile, with 1.86 kg and 5.58 kg, respectively.

119 Calavo Growers Inc. is agricultural cooperative with more than 2,300 growers as members, and markets more than half of the California crop. Calavo procures, prepares and markets avocados and other food products to wholesalers, supermarkets, and restaurants around the world (www.calavo.com).

120 Avocado Export Co. in Michoacán had hired additional workers on relatively higher wages, invested $40 million in computerized avocado sorting system to increase efficiency.

121 About 1.5 million head (cattle) are fed through feedlots that are distributed across several smaller centers of feedlot production.

122 The four top grocery retail supermarket chains in Mexico are Wal-Mart, Hipermercado Soriana, and Chedraui.

123 The consumption of white corn and tortillas account for about 40 per cent of average caloric intake.

124 Mexico has up to 60 traditional species of corn. Only 25 per cent of the corn planted by farmers in Mexico comes from commercially sold seed.

125 The subsidy program, operated by SAGARPA, supported 13 commodities in 2011, with corn, wheat and sorghum receiving 50 per cent, 24 per cent and 20 per cent of the coverage, respectively.

126 A total of 1.2 million ha planted to corn was damaged by the severe drought, which is 87.4 per cent higher compared to 2010.

127 "Without corn, there is no country" is the popular campaign slogan on banners used by Mexican civil society including farmers not only against the end of tariffs – under NAFTA – on corn imports from the U.S. in 2008, but also against genetically modified (corn) seeds threatening food sovereignty, biodiversity, lifestyles and culture. On tariffs, Mexico had gradually reduced its tariffs on corn since 1994, when they stood at more than 200 per cent.

128 The long-standing, long-haul trucking dispute between U.S. and Mexico ended in July 2011. Part of the agreement impels Mexico to reduce tariff duty from 5 per cent to 2.5 per cent on pork imports from U.S. The reduction in tariff is expected to increase the volume of U.S. pork and pork products destined south of the border to Mexico.

129 Under NAFTA all tariff and quota restrictions where eliminated in 2004. Poultry products – meat and eggs – were not included in the 'original' list for final tariff elimination in 2008. Instead, it was slated for zero tariffs and import quotas for 2003. However, the influx chicken – leg quarters – imports from U.S., the Mexican government – under pressure from the industry – asked for a safeguard to restore tariff protection up to 2008, which was granted.

130 USDA, "Market Concentration in Selected Agricultural Food Subsectors—Mexico," Gain Report MX1042, 25 May 2011. [http://gain.fas.usda.gov/pages/default.aspx]

131 Chapter II.C.4.3.

132 Ranking of the five largest corn producers in 2010 according to the statistics of the FAO available at http://faostat.fao.org: (1) United States of America: 316.165.000 metric tons; (2) China: 177.540.788 metric tons; (3) Brazil: 56.060.400 metric tons; EU 27: 48.060.647metric tons; (5) Mexico: 23.301.900 metric tons.

133 See Table I.7.

134 See Interview with José Cacho, MINSA.

135 The following five regions are distinguished for the purposes of this study: Northwest (Noroeste) Baja California, Baja California Sur, Sonora, Sinaloa and Nayarit; Northeast (Noreste) Chihuahua, Coahuila, Durango, Nuevo León, Tamaulipas and Zacatecas; Center West (Centro Occidente) Aguascalientes, Colima, Guanajuato, Jalisco, Michoacán, Querétaro and San Luis Potosí; Center (Centro) Distrito Federal, Estado de México, Guerrero, Hidalgo, Morelos, Puebla and Tlaxcala; and South Southeast (Sur Sureste) Campeche, Chiapas, Oaxaca, Quintana Roo, Tabasco, Veracruz and Yucatán.

136 Secretaría de Economía, Análisis de la Cadenca de Valor Maíz-Tortilla: Situación Actual y Factores de Competencia Local, April 2012, page 14.

137 Interview with representative from the corn processing industry.

138 See Table II.3.

139 Interview with representative from the corn processing industry.

140 Ibid.

141 Ibid.

142 SIAP with figures from the Agricultural Livestock Census 2007.

143 See Chapter II.C.4.3

144 See Chapter I.5

145 Agricultural Dumping under NAFTA: Estimating the Costs of U.S. Agricultural Policies to Mexican Producers Timothy A. Wise, 2010, page 2.

146 Ibid, page 36.

147 See Table II.10

148 Interview with representative from the corn processing industry; Interviews with representatives from associations of grain producers.

149 See Land Tenure, Housing Rights and Gender in Latin America by UN Habitat, 2005, page 29.

150 Ibid, page 36.

151 Note that the production of genetically modified corn is currently tested. Once allowed, there might be a third category of corn seeds, i.e. genetically modified corn.

152 Perspectivas de Desarrollo de la Industria semillera de Maíz en México by Bethel Luna Mena et al., 2012.

153 CNT-114-98.

154 In competition law assessments, the concept of the relevant market is used to define those products and services that actually or potentially compete with each other and therefore constitute the market that is relevant to measure competition. The relevant market is commonly defined from a demand side perspective by applying the so called SSNIP-test that asks whether in the event of a Small but Significant (5-10 per cent) Non-transitory Increase in Price, a buyer of a specific product would switch to a specific alternative product. If yes, both products are considered to belong to the same relevant market. In specific circumstances, this demand-side assessment is complemented by supply-side considerations, in particular the possibility for producers to easily switch to the production of an alternative product, if the price for this alternative product increases significantly.

155 Perspectivas de Desarrollo de la Industria semillera de Maíz en México by Bethel Luna Mena et al., 2012.

156 See Mexico Special Report 2009 by Speciality Chemicals Magazine in cooperation with Global Business Reports, page 8 available at http://www.gbreports.com/admin/reports/Mexico_Special_Publication_SCM0909.pdf.

157 For a definition of relevant markets in the field of fertilizers, see e.g. the merger decision of the European Commission in the Case No. COMP/M.4730 YARA / KEMIRA GROWHOW.

158 For the details of the alleged cartel, see the presentation: «Price instability and competition law: the case of the potash cartel» by Frederic Jenny, 2012, available at http://www.oecd.org/dataoecd/56/9/49737333.pdf.

159 See merger decision of the European Commission in the case COMP/M.6141 CHINA NATIONAL AGROCHEMICAL COOPERATION / KOOR INDUSTRIES / MAKHTESHIM AGAN INDUSTRIES; available at http://ec.europa.eu/competition/mergers/cases/decisions/m6141_20111003_20310_2025936_EN.pdf.

160 Corporations and Pesticides by Barbara Dinham in The Pesticide Detox, Towards a More Sustainable Agriculture, by Jules Pretty, 2005, page 55.

161 See Table II.9

162 See Country Profile Mexico of the International Commission on Irrigation and Drainage, available at http://www.icid.org/cp_mexico.html.

163 Ibid.

164 See National Water Program 2007 - 2012 «CONAGUA in Aaction», available at http://www.conagua.gob.mx/home.aspx

165 Background Note for the OECD Policy Round Table on Competition, State Aids and Subsidies, 2010, DAF/COMP/GF(2010)5, page 9.

166 See Articles 107 - 109 of the Treaty on the Functioning of the European Union and respective secondary legislation, available at http://ec.europa.eu/competition/state_aid/legislation/provisions.html.

167 See Chapter II.B.3.

168 Interview with representative from an association of grain producers.

169 Competition and Commodity Price Volatility, OECD Background Note, DAF/COMP/GF(2012)2/Rev1, p. 12-13.

170 Interview with representative from the corn processing industry.

171 http://www.gimsa.com/htmli/index.htm

172 http://www.gruma.com/vlng/Relacion/relacion_informacion_gimsa.asp?idEmpresa=2

173 Secretaría de Economía, Análisis de la Cadenca de Valor Maíz-Tortilla: Situación Actual y actores de Competencia Local, April 2012, page 20.

174 See information provided on MINSA by the Financial Time Market Data, available at http://markets.ft.com/Research/Markets/Tearsheets/Business-profile?s=MINSAB:MEX (visited on 4 April 2012).

175 Interview with representative from the corn processing industry.

176 See GIMSA's annual report 2010, page 22.

177 See information provided at the company's website: http://macsa.us/page2.html.

178 See information provided at the company's website: http://www.harimasa.com/index.html.

179 See information available at ASERCA's website: http://www.aserca.gob.mx/artman/publish/article_2254.asp

180 Interview with representative from an association of grain producers.

181 Interview with representative from an association of grain producers.

182 For instance, in a background paper for a meeting dedicated to the treatment of buyer power under competition law, the German Federal Cartel Office points out that a monopsonist can abuse its buyer power by reducing demand and thereby pushing prices below the competitive level. This abuse of buyer power may lead to reduced investment and innovation by producers, given their loss in profit, see Bundeskartellamt, Nachfragemacht im Kartellrecht - Stand und Perspektiven, Tagung des Arbeitskreises Kartellrecht am 18. September 2008 - Hintergrundpapier, pages 2 to 4.

183 Secretaría de Economía, Análisis de la Cadenca de Valor Maíz-Tortilla: Situación Actual y Factores de Competencia Local, April 2012

184 Advisory Opinion PLENO-MCE of 11 March 2010 of the Mexican Federal Competition Commission.

185 Decision DE-014-2010 of 22 March 2012 of the Mexican Federal Competition Commission.

186 This position is, for instance, favoured by Prof. Steven C. Salop in discussing the objectives of US antitrust law: «the true consumer welfare standard would condemn conduct if it actually reduces the welfare of buyers, irrespective of its impact on sellers,» see Question: What is the Real and Proper Antitrust Welfare Standard? Answer: The True Consumer Welfare Standard, page 1, available at http://govinfo.library.unt.edu/amc/public_studies_fr28902/exclus_conduct_pdf/051104_Salop_Mergers.pdf. Note, however, that this view is opposed by Gregory J. Werden, Senior Economic Counsel, Antitrust Division of the U.S. Department of Justice in Monopsony and the Sherman Act: Consumer Welfare in a New Light. Werden argues that the objectives of the Sherman Act included inter alia remedying losses which farmers in the U.S. incurred due to trusts with significant buyer power reducing the farmgate prices for agricultural products such as cattle, while raising prices charged to consumers.

187 This is for instance the position traditionally attributed to German competition law, see see Bundeskartellamt, Nachfragemacht im Kartellrecht - Stand und Perspektiven, Tagung des Arbeitskreises Kartellrecht am 18. September 2008 - Hintergrundpapier, page 13.

188 See Mexico's submission to the OECD's Roundtable on Buying Power of Multiproduct Retailers in 1998, DAFE/CLP(99)21, page 201.

189 Mexico's contribution to the OECD Round Table on Competition and Regulation in Agriculture: Monopsony Buying and Joint Selling, 2004, DAF/COMP(2005)44, page 128.

190 OECD Round Table on Competition and Commodity Price Volatility, DAF/COMP/GF(2012)2Rev1, page 33.

191 Biofuels are considered in this document to be liquid and gaseous fuel made from plant and animal residues that can be used as a substitute for fossil fuels. This broad definition of biofuels includes biodiesel, bioethanol, heating pellets and biogas.

192 FAOstat, 2011. See Chapter 2.2 of this paper, p. 70

193 World Development Indicators 2011.

194 World Bank Development Indicators, 2012. Data for 2010.

195 In 2007, 5.6 million Mexicans were land owners (ejidatarios, comuneros, or posesionarios), what correspons to 5.2 per cent of the population in that year. Source: SIAP, IX Censo Ejidal 2007.

196 In Mexico, the food national food security index achieved 92.8 in 2010, after decreasing to 91.8 during the heights of the financial crisis between 2008 and 2009. Source: SIAP and Bank of Mexico.

197 http://www.epa.gov/mtbe/water.htm

198 See: Erdal and Goldstein (2000) and CRS (2006)

199 Plan Nacional de Desarrollo 2007-2012. Avaliable at: http://pnd.presidencia.gob.mx/

200 http://www.sener.gob.mx/webSener/portal/index.jsp?id=57

201 Avaliable at: http://www.semarnat.gob.mx/Documents/Estrategias_libro_completo_compress2.pdf

202 There was an attempt to limit the price volatility of a corn product of primary importance as a staple food for the Mexican population (tortillas) in Mexico in early 2007. The so-called Tortilla Price Stabilization Pact introduced caps for the price of a kilogram of tortillas, as to try to maintain the affordability for the poor. See: http://www.presidencia.gob.mx/buscador/index.php?contenido=28666

203 See: http://www.ine.gob.mx/descargas/est_intersecretarial_bioenergeticos.pdf

204 See: http://www.energia.gob.mx/res/0/Progper cent20Introdper cent20Bioen.pdf

205 See: http://sener.gob.mx/webSener/res/9/Reg_LPDB_DOF_180609.pdf

206 See: http://www.dof.gob.mx/nota_detalle.php?codigo=5119506&fecha=13/11/2009

207 See: http://www.bioenergeticos.gob.mx under section Apoyos.

208 The German feed-in tariff system for renewable electricity, the Proalcool program in Brazil, and hydroelectric capacities in Scandinavia are among the technologies which received initial public support before reaching market competitiveness.

209 See: http://www.bioenergeticos.gob.mx/index.php/apoyos.html (in Spanish).

210 See Chapter 2.2 of this paper.

211 Programa Nacional de Agricultura Familiar (PRONAF). See: http://www.ceplac.gov.br/radar/Artigos/artigo26.htm (In Portuguese)

212 Thermochemical processes also include gas-to-liquid technologies, also known as syngas or biomass gasification. See Kumar et. a.l (2009)

213 Charcoal can also be used for industrial applications, replacing fossil coke as a reducing agent for the metallurgical industry. See (REF)

214 In Mexico, most biodigestor facilities rely on support from CDM credits.

215 For illustration, the potential of sustainable forestry biomass for energy purposes has been estimated to reach 1923 PJ/year, which corresponds to 26.2 per cent of Mexico's total primary energy supply in 2009 (7312 PJ).