OECD Review of Agricultural Policies

ISRAEL







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OECD Review of Agricultural Policies: Israel 2010



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Foreword

This Review of Agricultural Policies: Israel *is part of a series of reviews of national agricultural policies undertaken on behalf of the OECD's Committee for Agriculture. It was prepared as part of the process for the accession of Israel to the OECD.*

On 16 May 2007, the OECD Council decided to open discussions with Israel on accession to the Organisation and, on 30 November 2007, an Accession Roadmap was adopted, setting out the terms, conditions and process for accession [C(2007)102/FINAL]. In the Roadmap, the OECD Council requested a number of OECD Committees to provide it with a formal opinion. The Committee for Agriculture was requested to review Israel's agricultural policies in order to provide a formal opinion on the degree of coherence between Israel's policies and those of OECD member countries. In light of the formal opinions received from OECD Committees and other relevant information, the OECD Council will decide whether to invite Israel to become a member of the Organisation.

The Review *classifies and measures support provided to agriculture using the same approach employed for OECD countries and a growing number of non-member economies. It also evaluates the performance of agricultural policies and gives particular attention to Israel's efforts to improve the environmental performance of agriculture. The study is a precursor to continued OECD engagement with Israel on agricultural policy issues through regular monitoring of agricultural policy developments.*

Andrzej Kwieciński co-ordinated the report and wrote Chapter 1 with Darryl Jones. The other authors were Piret Hein (Chapter 2) and Kevin Parris (Chapter 3). Florence Bossard provided research and statistical support, with assistance from Blanche Basilien, Michel Lahittete and Noura Takrouri-Joly. Anita Lari provided secretarial assistance. Carmel Cahill and other colleagues in the OECD Secretariat made useful comments. The study benefited from substantive contributions provided by the Israeli Ministry of Agriculture and Rural Development, Ministry of Finance, Central Bureau of Statistics and Ministry of Environmental Protection. Experts from these institutions provided most of the data and essential information on the functioning of agricultural programmes in Israel, as well as comments on the draft report.

The study was reviewed at an in-country Roundtable with Israeli officials and experts in September 2009. Subsequently, Israel's agricultural policies were examined by the OECD's Committee for Agriculture at its 153rd session in November 2009, bringing together policy makers from Israel and OECD member states. Israeli officials have been involved from the initial discussions of the study outline through to the peer review and final revisions, but the final report remains the sole responsibility of the OECD.

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Acronyms and Abbreviations

AES	Agricultural Extension Service
ANDP	Agricultural Net Domestic Product
ARO	Agricultural Research Organisation
ASHRA	The Israel Export Insurance Corp. Ltd.
ATAP	The US – Israel Agreement on Trade in Agriculture Products
AVG	Average
BARD	The United States – Israel Bi-national Agricultural Research and Development Fund
BOI	Bank of Israel
BOT	Budgetary and Other Transfers
CBS	Central Bureau of Statistics
CIF	Cost Freight Insurance
CINADCO	Center for International Agricultural Development Co-operation
CMBI	Citrus Marketing Board of Israel
CSE	Consumer Support Estimate
CUE	Critical Use Exemption
EEC	European Economic Community
EFTA	European Free Trade Association
EIU	Economist Intelligence Unit
EPF	Exports Promotion Fund
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FOB	Free on Board
FTA	Free Trade Agreement
GAO	Gross Agricultural Output
GDP	Gross Domestic Product
GHG	Greenhouse gases
GNP	Gross National Product
GSSE	General Services Support Estimate
HS	Harmonised System
IDB	Israel Dairy Board
IDF	Israeli Defence Forces
IEICI	Israel Export and International Co-operation Institute
ILA	Israel Land Administration
ILS	New Israeli Sheqel (in Israel an abbreviation commonly used is NIS)
IMF	International Monetary Fund
IPM	Integrated Pest Management
ISO	International Organization for Standardization

JNF	Jewish National Fund
KANAT	The Fund for Natural Damages in Agriculture
MARD	Ministry of Agriculture and Rural Development
MEP	Ministry of Environmental Protection
MERCOSUR	Southern Common Market
MFN	Most Favoured Nation
Mm^3	Million metric cubic metres
MOF	Ministry of Finance
MOITAL	Ministry of Industry, Trade and Labour
MPS	Market Price Support
NAC	Nominal Assistance Coefficient
NDP	Net Domestic Product
NMP	National Master Plan
NOP	National Outline Plan
NPC	Nominal Protection Coefficient
NWC	National Water Carrier
OECD	Organisation for Economic Co-operation and Development
PB	Poultry Board
PPIS	Plant Protection and Inspection Service
PPMB	Plant Production and Marketing Board
PPP	Purchasing Power Parity
PSAD	Plan for Sustainable Agricultural Development
PSE	Producer Support Estimate
RDP	Rural Development Programme
SCT	Single Commodity Transfer
SII	Standards Institution of Israel
SPS	Sanitary and Phytosanitary
TFP	Total Factor Productivity
TRQ	Tariff Rate Quota
TSE	Total Support Estimate
UK	United Kingdom
UN	United Nations
URAA	Uruguay Round Agreement on Agriculture
USD	United States Dollar
USDA	United States Department of Agriculture
VAT	Value Added Tax
WA	Water Authority
WB	World Bank
WTO	World Trade Organisation

*Executive Summary**

The relative importance of agriculture in the Israeli economy has declined over the last two decades, with its share in total employment and in domestic product falling to just under 3% and 2%, respectively, in recent years. Growing labour productivity was a key contributor to the almost two-fold increase in total factor productivity in agriculture in 1990-2008, much stronger than in any other sector of the Israeli economy.

Israel is unique amongst developed countries in that land and water resources are nearly all state-owned. Another distinguishing characteristic of Israeli agriculture is the dominance of co-operative communities, principally the *kibbutz* and *moshav*. While the co-operative aspects of agricultural production management have gradually been replaced by more privatised management systems, these communities still account for about 80% of agricultural output.

Since the late 1980s Israel has gradually removed policies based on the provision of subsidies, central planning of agricultural industries, allocation of production quotas, price controls and import protection. Objectives are being more effectively met by policies that better target the intended outcomes while generating fewer distortions to trade and resource allocation. But, the government still plays a much larger role in the agricultural sector than in other industries, as reflected in its involvement in allocating key factors of agricultural production: land, water and foreign workers. Indirect assistance to the agricultural sector is provided via the permit system for foreign workers. Agricultural producers are protected (but consumers taxed) by high tariffs on imports of the majority of agro-food products. Water and capital continue to be subsidised. Some sectors such as milk and eggs are covered by sector-specific policy measures such as minimum guaranteed prices and quotas aiming at securing profitability of production for a majority of producers.

Progress in agricultural policy reforms is indicated by the fact that the level of support to agricultural producers has decreased gradually and that the cost of the support to the overall economy has been reduced. These changes are captured by the OECD indicators showing the share of support in farmers' gross receipts (%PSE – Producer Support Estimate) and support for the whole agricultural sector (%TSE – Total Support Estimate) expressed as a percentage of GDP. Both indicators have decreased since 1995, with the level of the %PSE at 17% and %TSE at 0.7% in 2006-08, compared with an OECD average of 23% and 0.9%, respectively. While the level of agricultural support has been falling, the PSE results show that the share of the most distortive types of support has increased over the last two decades. This mostly reflects continued high border protection for agricultural commodities pushing domestic prices above international levels and resulting in high market price support.

* This review is not intended to cover the territories known as the Golan Heights, the Gaza Strip or West Bank. However, for technical reasons, this review sometimes uses Israel's official statistics, which include data relating to the Golan Heights, East Jerusalem and Israeli settlements in the West Bank.

Israel has opened imports for land-intensive products, in particular for grains. It has also made substantial efforts to address growing concerns about the environmental situation of the country, in particular water shortages. However, further agricultural policy reforms are needed to reduce the cost for consumers and taxpayers and to improve the efficiency of the various policy measures applied. These reforms should include: reductions in administrative costs associated with agricultural land market transactions; better enforcement of labour market legislation; reduction and simplification of agricultural import tariffs; and implementation of less distortive policies for the livestock sector.

A key challenge for Israeli agriculture will be to reconcile producing enough to feed a growing population with public expectations that agriculture should improve its environmental performance. Strengthening policy coherence, especially in improving the management of water resources in agriculture, will be important in this context. To date the government's water policy reforms have led to reduced support provided to agriculture for water resources, paralleled by rising real prices for water, being achieved without negative consequences for farm output. But as agriculture consumes around 55% of water resources and in view of projected climate change impacts, further efforts are needed to improve water use efficiency.

Overall, Israel has made significant progress in achieving its agricultural policy objectives. It has achieved self-sufficiency in those agricultural products that can be produced in Israel and has successfully promoted exports of fruit and vegetables, benefiting from favourable climate conditions, advanced technologies and accumulated farm management expertise. The agricultural sector has benefited from high levels of investment in research and development, well developed education systems and high-performing extension services. Israel is a world leader in many aspects of agricultural technology, particularly those associated with farming in arid conditions. Thus, agriculture relies not so much on a "natural" comparative advantage in farming, but on an "induced" comparative advantage built on technological progress. The future success of Israeli agriculture and further productivity gains will rely heavily on ensuring an effective system of research, development and technology transfer, and on maintaining well established extension services.

*Résumé**

Le poids de l'agriculture dans l'économie israélienne a diminué ces deux dernières décennies, sa part dans l'emploi total et dans le produit intérieur tombant juste en-deçà de 3 % et 2 %, respectivement, au cours de la période récente. L'augmentation de la productivité du travail a joué un rôle déterminant dans celle de la productivité totale des facteurs, laquelle a pratiquement doublé dans l'agriculture entre 1990 et 2008, soit une progression beaucoup plus forte que dans tous les autres secteurs de l'économie israélienne.

Israël est un cas à part parmi les pays développés, en ce sens que les terres et les ressources en eau appartiennent presque en totalité à l'État. L'agriculture israélienne a aussi ceci de particulier que les collectivités coopératives, notamment les *kibboutz* et les *mochav*, y occupent une place prédominante. Le caractère coopératif de la gestion de la production agricole cède peu à peu le pas à des modalités de gestion plus proches de celles du secteur privé, mais ces collectivités représentent encore quelque 80 % de la production agricole.

Depuis la fin des années 80, Israël supprime progressivement les interventions faisant appel au versement de subventions, à la planification centralisée des activités agricoles, à l'attribution de quotas de production, au contrôle des prix et aux mesures de protection à l'encontre des importations. Le pays atteint ses objectifs avec davantage d'efficacité, au moyen de politiques qui ciblent mieux le résultat recherché tout en entraînant moins de distorsions dans les échanges et dans la répartition des ressources. Cependant, les pouvoirs publics continuent de jouer un rôle beaucoup plus important dans l'agriculture que dans les autres secteurs, comme en témoignent leurs interventions dans la répartition de facteurs de production essentiels à l'activité agricole : la terre, l'eau et la main-d'œuvre étrangère. Le secteur agricole reçoit un soutien indirect par l'intermédiaire du système de permis concernant la main-d'œuvre étrangère. Les producteurs agricoles sont protégés (mais les consommateurs taxés) par les droits de douane élevés qui frappent la majeure partie des produits agroalimentaires importés. L'eau et les investissements continuent de donner droit à des subventions. Certaines filières, comme celles du lait et des œufs, font l'objet de mesures spécifiques telles que l'établissement de prix minimums garantis et de quotas, qui visent à assurer la rentabilité de la production d'une majorité d'exploitants.

Les progrès accomplis dans le cadre des réformes de la politique agricole sont illustrés par la diminution progressive du niveau du soutien apporté aux producteurs et par la baisse du coût de ce soutien pour l'économie dans son ensemble. Cette évolution est mise en évidence par les indicateurs de l'OCDE qui révèlent la part du soutien dans les recettes agricoles brutes (ESP en pourcentage – estimation du soutien aux producteurs) et le soutien dont bénéficie le secteur agricole dans son ensemble (EST en pourcentage – estimation

* Le présent examen n'a pas pour objet de couvrir les territoires connus sous les noms de hauteurs du Golan, bande de Gaza et Cisjordanie. Toutefois, pour des raisons techniques, il utilise parfois des statistiques israéliennes officielles qui comprennent des données concernant les hauteurs du Golan, Jérusalem-Est et les implantations israéliennes en Cisjordanie.

du soutien total), exprimé en pourcentage du PIB. Ces deux indicateurs diminuent depuis 1995, l'ESP en pourcentage s'établissant à 17 % et l'EST en pourcentage à 0.7 % sur la période 2006-08, contre 23 % et 0.9 % en moyenne dans les pays de l'OCDE. Toutefois, même si le niveau du soutien à l'agriculture diminue, les résultats de l'ESP montrent que la part des mesures qui provoquent le plus de distorsions a augmenté ces vingt dernières années. Cela est principalement lié au fait que la forte protection aux frontières dont continuent de bénéficier les produits agricoles hisse les prix intérieurs au-dessus des cours mondiaux et se traduit par un soutien important des prix du marché.

Israël a ouvert ses frontières aux importations de produits dont la culture demande de vastes superficies, notamment aux céréales. Le pays déploie aussi des efforts considérables pour faire face aux problèmes croissants que soulève la situation de l'environnement, en particulier aux pénuries d'eau. Quoi qu'il en soit, il est nécessaire de poursuivre les réformes de la politique agricole, dans l'optique de réduire le coût qu'elle fait supporter aux consommateurs et aux contribuables, et d'améliorer l'efficience des différentes mesures appliquées. Cette action devrait viser à réduire les coûts administratifs associés aux transactions opérées sur le marché foncier agricole, à faire respecter plus rigoureusement la réglementation du marché du travail, à réduire et à simplifier les droits de douane sur les importations agricoles, et à mettre en œuvre des mesures entraînant moins de distorsions dans le secteur de l'élevage.

L'agriculture israélienne doit répondre à un enjeu majeur, qui consiste à concilier une production suffisante pour alimenter une population en augmentation, d'une part, et l'amélioration de ses performances environnementales souhaitée par les citoyens, d'autre part. Dans ce contexte, il importera de renforcer la cohérence de l'action publique, notamment pour améliorer la gestion des ressources en eau dans l'agriculture. Pour l'instant, les remaniements de la politique de l'eau mis en œuvre par les pouvoirs publics se sont traduits par une réduction des aides accordées à l'agriculture au titre de l'eau, à laquelle est venue s'ajouter une hausse du prix réel de l'eau, sans que cela ait de conséquence négative sur la production agricole. Quoi qu'il en soit, environ 55 % des prélèvements sont destinés à l'agriculture et, compte tenu des prévisions concernant les effets du changement climatique, de nouveaux efforts sont nécessaires dans l'optique d'utiliser les ressources en eau plus efficacement.

De manière générale, les objectifs de la politique agricole d'Israël sont en grande partie atteints. Le pays est autosuffisant pour les produits agricoles qui peuvent être produits sur place et a su encourager les exportations de fruits et de légumes, en tirant parti de ses conditions climatiques favorables, des progrès technologiques et de l'expérience accumulée dans le domaine de la gestion des exploitations. Le secteur agricole bénéficie d'investissements conséquents dans la recherche-développement, d'un système de formation élaboré et de services de vulgarisation très performants. Israël est à de nombreux égards l'une des figures de proue des technologies agricoles à l'échelle mondiale, notamment en ce qui concerne la pratique de l'agriculture en milieu aride. Par conséquent, l'agriculture s'appuie sur l'avantage comparatif que lui confère le progrès technologique, davantage que sur un avantage comparatif « naturel ». L'essor futur du secteur agricole israélien et l'accroissement de sa productivité seront très tributaires de la poursuite d'une intense activité de recherche-développement et du maintien des services de vulgarisation, qui ont fait leurs preuves.

Highlights and Policy Recommendations

This *Review* assesses the performance of Israeli agriculture over the last two decades, evaluates Israeli agricultural policy reforms and provides recommendations for continuing the reform process in the future. The evaluation is based on the operational criteria of decoupling, transparency, targeting, tailoring, flexibility and equity for good policy design as agreed by OECD Agriculture Ministers in 1998. These criteria, if implemented, would contribute to an economically viable sector within the wider economy that respects the environment and natural resources, ensures efficient use of inputs, and addresses social concerns, without resorting to production and trade distorting subsidies.

Unique features of Israeli agriculture

Israel is unique amongst developed countries in that 94% of agricultural land is state-owned and only 6% is in private hands. Land is administered by the Israel Land Administration (ILA) which distributes land use rights to farmers for varying periods. Another distinguishing characteristic of Israeli agricultural production is the dominance of co-operative communities, principally the *kibbutz* and *moshav*. While the co-operative aspects of agricultural production management have gradually been replaced by more privatised management systems, particularly since the mid-1980s, these communities still account for about 80% of agricultural output.

Macroeconomic reforms…

The Economic Stabilisation Programme of 1985 marked a turning point in Israel's macroeconomic policies. After more than a decade of high inflation, persistent balance of payments crises and high public debt, the programme comprised radical steps in monetary and fiscal policy to resolve these problems. From the beginning of the 1990s through to 2008 the Israeli economy has enjoyed, on average, high rates of economic growth combined with falling inflation rates and there has been considerable progress in bringing fiscal stability to the economy. This progress was supported by structural reforms and a general trend towards free markets, privatisation and deregulation.

… triggered agricultural policy reforms

Until the end of the 1980s, the government was heavily involved in regulating the agricultural sector through the provision of various subsidies, central planning of agricultural industries, allocation of production quotas, price controls and import protection. The macroeconomic policies introduced in the mid-1980s to quickly reduce and

stabilise inflation rates, had a strong impact on agriculture with the sector having to adjust to significant increases in interest rates while suddenly facing growing debts. There were also other factors which stimulated agricultural policy reform. These included a more peaceful external environment compared to previous periods that allowed the agricultural sector and government policy to focus on what it could do well rather than being driven by self-sufficiency considerations. A huge wave of new immigrants from the ex-Soviet Union in the 1990s, increasing the population by almost one-fifth, amplified demand for housing and contributed to some relaxation of strictly regulated land transactions.

Agricultural policy reforms undertaken during 1985-2008 can be divided into four stages:

- **1985-90:** In line with macroeconomic reforms, the agricultural sector had to face significant budgetary cuts and reductions in price subsidies for basic food products. The first steps to withdraw state planning in agriculture were taken with the abolition of the quota systems for flowers and some vegetables. In 1989, regional co-operatives providing various services to agriculture and organising the collective marketing of outputs collapsed due to a debt crisis which led to structural changes in co-operative agriculture.
- **1991-95:** The export oriented sub-sector was opened to competition and agricultural production planning by the state was further reduced. In 1991, the first steps were made to abolish monopolies and establish competition between exporting companies. Moreover, at the beginning of the 1990s, consumer price controls were removed, except for milk, eggs and flour. In 1994, reform was initiated in the broiler sector to modernise production and increase efficiency through the gradual loosening of the quota system. In 1991, so-called block rate pricing for fresh water, with higher prices for larger amounts of water used, was introduced to stimulate more efficient use of water.
- **1995-99:** Reforms were focused on import liberalisation. With the conclusion of the Uruguay Round Agreement on Agriculture, Israel undertook commitments to improve market access and to reduce export subsidies and domestic support in agriculture. Most significantly, numerous non-tariff import barriers were "tariffied" and tariff rate quotas (TRQs) established. While these steps improved the transparency of Israel's trade policy, border protection remained high for several sensitive product groups. In 1999, the fresh water quota for agriculture was reduced by 40% and a water extraction levy was imposed, including on farmers.
- **2000-09:** Further steps to reduce domestic support to agriculture were taken. Production quotas for broiler production were eliminated. Price support measures (surplus removal) were abolished in the fruit and vegetables sector in 2004. A major reform in the dairy sector was initiated to increase competitiveness and to meet environmental concerns. Government support was more and more selective and targeted to elements such as risk management tools (insurance programmes against natural damage) and other measures to promote less environmentally harmful means of production. Other support measures included sales promotion, research and development activities, and limited investment programmes mainly for export oriented production. An agreement was reached in 2006 between farmers and the government to further increase water charges paid by farmers so they cover the average cost of water production by 2015. During this period the government has also given greater attention to sustainable development in general, including to agri-environmental issues.

Despite the reforms undertaken over the last two decades, the government still plays a much larger role in the agricultural sector than in other industries, as reflected in the continued subsidisation of water and capital, and of natural-disaster insurance and compensation schemes. The government continues to be involved in allocating key factors of agricultural production: land, water and foreign workers (originating mostly from Thailand). Water resources and the vast majority of agricultural land are still state-owned. Indirect assistance to the agricultural sector is provided via the permit system for foreign workers. Agricultural producers are protected (but consumers taxed) by high tariffs on imports of the majority of agro-food products. Some sectors such as milk and eggs are covered by sector-specific policy measures such as minimum guaranteed prices and quotas aiming at securing profitability of production for a majority of producers. A short overview of current agricultural policy measures is provided in Box 0.1.

Box 0.1. **Overview of agricultural policy instruments applied in Israel**

Domestic policy instruments

- *Production quotas* and *minimum (target) prices:* Applied to milk and egg production. Minimum prices are also provided as a safety net for wheat producers. Other agricultural products are no longer regulated by quotas, minimum prices or surplus disposal schemes; selected fruit and vegetables benefited from a surplus disposal scheme until 2004.
- *Consumer price controls:* Applied for several basic food products, mainly for dairy products, eggs and bread.
- *Variable input subsidy:* Provided for water only. Farmers have been given access to water at lower rates compared to other users and benefit from compensation for the cut in the freshwater quota allocation to agriculture, as well as a concession on the water extraction levy.
- *Investment support:* Capital grants are provided to develop the agricultural export sector and to encourage the uptake of advanced technologies. Farmers who participate in the investment support scheme are also entitled to income tax exemptions and accelerated depreciation. As from 2009, a new investment support programme is being implemented to partly replace foreign workers in agriculture.
- *Restructuring and write-offs of debts:* A series of agreements to settle the debts accumulated up to the end of the 1980s; some of the debts are still to be paid until 2015.
- *Direct payments:* Provided to egg and broiler producers located in the Merom Hagalil area of northern Galilee. These have been provided since 1989 according to the Galilee Law (1988) to compensate the producers for adverse production conditions in this peripheral area, where two-thirds of the egg producers are concentrated.
- *Income support measures:* Provided to wheat producers in the southern part of the country to support rain-fed agriculture and preserve open space. Other income support programmes to preserve open space are provided to maintain cattle, sheep and goats in pasture and grazing areas.
- *Insurance schemes:* Support is provided to farmers to participate in an insurance scheme against natural damage and in a broader multi-risk insurance scheme. Farmers receive partial compensation of the premiums: 80% of the premium to participate in the multi-risk insurance scheme and 35% of the premium to participate in the insurance scheme against natural damages.

Box 0.1. **Overview of agricultural policy instruments applied in Israel** *(cont.)*

General services provided to the agricultural sector as a whole

- *Research and development:* Government funding represents a significant share of the government's agricultural budget.
- *Extension service:* Free for farmers; plays an important role in transferring the practical information learned from research to farmers.
- *Inspection services:* Fully funded by the government; expenditures on these services are tending to increase.
- *Agricultural infrastructure:* Includes government funded investments in water projects (in particular recycling of effluents) regional drainage and conservation projects, and infrastructure for villages.
- *Marketing and promotion* (including export subsidies): Expenditures were substantial until the early 2000s. They have decreased since then and are negligible at the moment.

Trade policy instruments

- *Tariffs:* Israel maintains a relatively uneven tariff structure for agro-food products (*e.g.* very high tariffs for animal products and low for cereals). The tariff system is complicated, involving a large number of non-*ad valorem* tariffs. A large part of agro-food trade takes place under various free trade agreements (the most important ones are with the EU and the US) which allow preferential access to the Israeli market, in many cases duty free.
- *TRQ:* Under the Uruguay Round Agreement on Agriculture, Israel has established TRQs for wheat, fats and oils, walnuts, prunes, maize, orange and other citrus juices, beef and sheep meat and various dairy products.
- *Licences:* Required to export agricultural products and issued by the Ministry of Agriculture and Rural Development for the purposes of data collection, monitoring the ability of exporters to meet quality requirements for fresh fruit and vegetables, and for ensuring the exporters' financial ability to pay the farmers for the supplied produce.

The agricultural sector underwent restructuring and…

Even if agricultural policy reforms can be considered as partial, they have stimulated important structural changes in the farming sector. Since the beginning of the 1990s, there has been a large decrease in the number of farms, a corresponding expansion in farm size, a considerable reduction in the number of self-employed farmers, an increase in specialisation in agricultural production combined with growing pluriactivity among farm households. Farmers have moved into producing new crops that can respond quickly to market demand, *e.g.* vegetables, or developed alternative income sources on-farm, *e.g.* agro-tourism. There has also been substantial structural change in the organisation and responsibilities of various co-operatives servicing agriculture, with new, private enterprises emerging both in the upstream and the downstream sectors.

While the sector has shown a capacity to adapt to the challenges presented by the reforms, adjustments were not without cost, particularly in terms of loss of employment in agriculture. Fortunately, high rates of economic growth greatly assisted the transition, providing alternative employment opportunities for displaced workers and sources of

income for farm households. Farmers have also benefited from falling interest rates and a stable macroeconomic framework. Adjustments were also underpinned by advances in technology due to research and development, agricultural training, effective transmission of research results to the farm level, partly through highly qualified extension workers, the high level of managerial skill of Israeli farmers, and their ability to adopt innovative technologies.

… productivity improved

As in most other countries, the relative importance of agriculture in the Israeli economy has declined over the last two decades, with the shares in total employment and in domestic product falling to just 2.7% and 1.7%, respectively, in recent years. Growing labour productivity was a key contributor to the almost two-fold increase in total factor productivity (TFP) in agriculture in 1990-2008, much stronger than in any other sector of the Israeli economy. While TFP increasing more rapidly in agriculture than in other sectors is a common feature of development, the increase has been greater in Israel than in many other countries. It accelerated between 1999 and 2006 due to a reduction in the labour force while output kept growing.

Overall, agricultural output expanded by 60% during the period from 1990 to 2007, with livestock and crop output growing equally. However, a deficiency of water resources, with two-thirds of the land area defined as semi-arid or arid, exposes agriculture to risks from changing weather conditions and leads to large year-to-year fluctuations in volumes produced. Nevertheless, the 2.2% average annual growth rate of agricultural production over the period of 1990-2008 is above the rates registered in most OECD countries and significantly above Israel's population growth.

Crop production accounts for about 60% of total output value with livestock products contributing the remaining 40%. Fruit (including citrus) and vegetables (including potatoes) are the most important products accounting for almost 50% of the total output value, with field crops contributing just 7% in 2008 – slightly less than in 1990. Poultry and cow's milk are the most important livestock products.

Growth in fruit and vegetable production is largely driven by exports. Israel's climate enables it to harvest fruit throughout the year; this gives the country a clear comparative advantage over many of its competitors. Over the long term there have been some important changes in crop production due to changing market conditions. The traditional fruit (citrus) and field (wheat and cotton) crops have all experienced a significant decline in production, with output levels in 2008 amounting to less than half of those in 1990. Melon and pumpkin production rose rapidly during the 1990s, but fell just as quickly during the 2000s. The quantity of potatoes produced in Israel has increased by about 200% since 1990.

Changes in trade flows tend to reflect Israel's comparative advantage

Partial trade liberalisation and some progress in domestic policy reforms contributed to stronger integration of the agro-food sector with international markets. This is demonstrated by a high ratio of agro-food exports to the value of agricultural net domestic product (ANDP) at around 80%-90%. The ratio of agro-food imports to the ANDP is even higher at 130%-170%. Both

ratios are significantly higher than the averages for the whole economy. Despite a large increase in the value of agro-food exports, in particular at the beginning of the 2000s, Israel has been a net importer at around USD 1 billion a year. In recent years, the net deficit has even tended to increase, mostly due to a stronger increase in prices for imported agro-food products than for exports, but also to a significant fall in crop production in 2008.

Israel's agricultural exports reflect its advantages in season and expertise – mainly winter vegetables, potatoes, seeds, tomatoes, flowers, and fruit, all of which are produced mostly for European markets. Israel has also been a large exporter of agricultural technologies and inputs. These were valued at USD 2.2 billion in 2007, even more than total agro-food exports. Livestock production, heavily dependent on imported grains, is predominantly destined for the domestic market with livestock exports accounting for just 2% of total agro-food exports in 2006-08. Over time, there has been a long term downward trend in citrus exports and an expansion in other horticultural exports, in particular of peppers and potatoes.

The main agricultural imports are cereals, bovine meat, oilseeds, sugar, tobacco, fish, and tropical products such as cocoa for further processing by the food industry. Imports tend to reflect Israel's disadvantage in products based on extensive use of land. Net imports of cereals, sugar and beef account for around 90%, 90% and 50%, respectively, of total domestic use of these products. In turn, Israel is practically self-sufficient in the production of milk, poultry and eggs, largely due to high border protection and commodity-specific support programmes.

There has been significant progress in achieving agricultural policy objectives…

Israel has succeeded in maintaining the rural population in the peripheral areas. It has achieved self-sufficiency in those agricultural products that can be produced in Israel, and has opened imports for products in which Israel has a comparative disadvantage. Also, Israel has been successful in promoting exports of fruit and vegetables, benefiting from favourable climate conditions, advanced technologies and accumulated farm management expertise. Israel has also made substantial efforts to address growing concerns about the environmental situation of the country, in particular water shortages. However, further agricultural policy reforms are needed to reduce the cost to the economy.

… the level of agricultural support has declined…

Progress in agricultural policy reforms that started in the late 1980s is captured by the level of support measured by the %PSE (Producer Support Estimate as a share of farmers' gross receipts) and the %TSE (Total Support Estimate expressed as a percentage of GDP). Both indicators have decreased since 1995 indicating that the level of support to agricultural producers decreased gradually and that the cost of the support to the overall economy has been reduced. The level of the %PSE decreased from 24% in 1995-97 to 17% in 2006-08. During the same period the %TSE decreased from 1.0% to 0.7%. However, it is important to note that not all progress, as measured by the two indicators, was due to policy reform, as it was partly due to world price increases in 2006-08 which reduced the gap between domestic and world prices. In addition, strong growth in agricultural output and in GDP relative to changes in absolute values of PSE and TSE caused further reductions in %PSE and %TSE during the period under review.

… but the cost for consumers has remained relatively high…

The current level of agricultural producer support in Israel (%PSE at 17%) is below the OECD average (23%) and below the EU27 level (27%), but considerably higher than in the United States (10%). The relative burden on the Israeli economy arising from agricultural support policies (%TSE at 0.7%) is below the OECD average (0.9%) and below the EU27 level (1.0%) and close to the levels in Mexico, the United States and Brazil. However, as indicated by the Consumer Support Estimate (CSE) which measures the cost to consumers arising from policies that support agricultural producers by raising domestic prices, the implicit taxation of consumers in Israel remains relatively high (%CSE at 18%) compared to the OECD average (13%) and to the EU27 level (12%).

… the composition of support has been increasingly distortive…

While the level of support to agriculture has been falling, the PSE results show that its composition has become increasingly distortive during the period under study. This mostly reflects continued high border protection for agricultural commodities pushing domestic prices above international levels and resulting in high market price support (which is coupled to production levels) – one of the most distortive forms of support. Furthermore, while on-farm budgetary support to agricultural producers has fallen and remained relatively low in recent years, around two-thirds of it is provided through payments for variable or fixed inputs that are (with market price support – MPS) known to have low transfer efficiency, meaning that only a small fraction of the transfers from taxpayers ends up as farmers' income.

… and focused on livestock commodities

Detailed analysis shows that support coupled to production (the Producer Single Commodity Transfers) as a share of commodity gross farm receipts is highest for livestock commodities, in particular for poultry, beef and veal and sheepmeat. This reflects lack of reform or its limited nature to date in this sector. Reforms undertaken so far were oriented towards increasing efficiency and compliance with environmental standards of production, but with the production planning system remaining intact. For example, while important reform efforts have been undertaken in the dairy and, more recently, egg sectors, they remain subject to production quotas, farmers are guaranteed minimum prices fixed by the government and benefit from income and investment support as well as from high border protection against international competition.

Actions for further reform

Since the early 1990s Israel has been gradually removing earlier policies based on the provision of subsidies, central planning of agricultural industries, allocation of production quotas, price controls and import protection. Objectives are being more effectively met by policies that better target the intended outcome while generating fewer distortions to trade and resource allocation. However, there remains scope for further reform as the current set

of agricultural policies still imposes relatively high costs on consumers and taxpayers in Israel and the efficiency of the various policy measures applied could be improved. The government could also consider if some policy objectives such as maintaining population in peripheral areas would not be more efficiently and effectively met with policies other than those based on agriculture, such as regional policies.

Administrative burdens on agricultural land market transactions should be diminished

Israel is unique among developed economies in that it has a high level of public ownership of land. Farmers lease the land from the ILA for a small fee. Agricultural land alone cannot be mortgaged. It has to be mortgaged together with the whole farm, including the residence and the surrounding garden. This limits farmers' flexibility in credit arrangements with banks and may limit farmers' access to credit. Moreover, while trading in land use rights between farmers living in the same village has been tacitly allowed, any land transfers beyond a given settlement have to be approved by the ILA and have to be based on formal partnerships between contractual parties. These partnerships have to be approved by the Ministry of Agriculture and Rural Development before final approval is provided by the ILA.

Concerns also exist regarding the movement of land out of agriculture into urban development. In the past, much of this was happening in a rather *ad hoc* and speculative manner. With high population growth rates, this pressure is likely to continue, so careful planning will be required. The new Master Plan introduced in 2005 provides a framework for controlling development activities. It also creates the possibility of increasing the amount of land in private ownership. The Land Reform Bill voted in August 2009 will facilitate private ownership of about 5% of ILA-regulated land, but does not concern agricultural land.

- The privatisation of agricultural land would ultimately be more efficient than the current approach. If this option is not considered feasible at present, consideration should be given to separating agricultural land from residential property to allow for more active and more transparent land market transactions.
- The requirement for formal partnership for any cross-settlement land lease transactions could be reconsidered.
- A new agricultural census is urgently needed for a more accurate assessment of the existing farm structures and for a better evaluation of effects of reforms undertaken over the last two decades.

Labour market legislation should be enforced

The agricultural sector relies heavily on the availability of relatively cheap foreign labour. Stated demand for foreign workers has been almost twice as high as the quota allocated to agriculture, even though the administrative processes tend to favour agriculture over other sectors. However, there are concerns regarding the working conditions of foreign workers in agriculture and the recruitment process. While foreign workers are covered by the minimum wage legislation and are eligible for supplementary overtime payments, the enforcement of the law, in particular related to overtime payments, is weak. The

government wishes to diminish the quota of foreign workers allocated to agriculture and a new investment support programme is being implemented with a view to partly replacing foreign workers in this sector.

- Better enforcement of the existing legislation and more transparent recruitment would improve working conditions of foreign workers. It would also increase the cost of foreign labour thus diminishing demand for foreign workers and for *ad hoc* policies to increase employment of Israeli workers in agriculture.

Import tariffs on agricultural products could be reduced and simplified…

As a result of the implementation of the Uruguay Round Agreement on Agriculture, Israel now maintains a more transparent and more open trade regime. However, the tariff profile for agricultural products is very uneven – with very high, sometimes prohibitive, tariffs for sensitive products such as dairy, meat, eggs and some fruits and vegetables, and low tariffs or sometimes duty-free entry for other commodities such as coarse grains, oilseeds and frozen beef. The simple average MFN tariff for agriculture is about three times higher than that for non-agricultural products.

- Israel should consider further reduction of trade barriers on agricultural products and further simplification of the current highly complex tariff profile.

… including on fruit and vegetables

Reforms in the fruit and vegetables sector, launched in the early-1990s, led to gradual elimination of state control over exports of fruit and vegetables and to the discontinuation of production quotas and regulated producer prices. Following the deregulation of production, the sector gained competitiveness, significantly increased its share on export markets and has become the leading agro-food export sector. Even though domestic prices for exportable fruit and vegetables are lower than their international equivalents, Israel maintains high border protection on fruit and vegetables imports.

- High border protection on fruit and vegetables could be removed.

Less distortive policies should be sought for the livestock sector

While the objective of self-sufficiency in dairy and egg production has been achieved, the cost for consumers and taxpayers is high. To limit costs, consumer prices for several dairy products and eggs for home consumption are controlled. While farm gate prices for other livestock products such as beef, poultry, and sheep meat are not regulated, high border protection remains in place which drives domestic prices above international levels at significant cost for consumers.

- Israel should take further steps towards easing the production planning system in the milk and egg sectors and to consider introducing complementary budgetary-financed policy measures to support livestock producers, while lowering border protection.

Support for the development capacity of the sector should be maintained

The agricultural sector has benefited from high levels of investment in research and development, well developed education systems and high-performing extension services. Israel is a world leader in many aspects of agricultural technology, particularly those associated with farming in arid conditions. Thus, agriculture relies not so much on a "natural" comparative advantage in farming, but on an "induced" comparative advantage built on technological progress. It is commendable that recently, expenditures on general services to the agricultural sector as a whole have increased, and particularly infrastructure-related investments in recycled effluent water treatment. Israel also stands out compared to the OECD average, in terms of expenditures on research and development. During the past five years these accounted for 18% of total budgetary expenditures on agriculture.

- The future success of Israeli agriculture might depend on ensuring an effective system of research, development and technology transfer in order to remain competitive as pressure on water resources and effects of climate change will intensify.
- Maintaining well established extension services for farmers would also contribute to further productivity gains in Israeli agriculture and ease pressures for more distortive policy measures.

The environmental performance of agriculture has been mixed and can be further improved

A key challenge for Israeli agriculture will be to reconcile producing enough to feed a growing population with greater public expectation that agriculture should improve its environmental performance. This is already an issue with scarce land and water resources, accentuated by the overarching issue of climate change. Strengthening policy coherence, especially in improving the management of water resources in agriculture, will be important in this context. To date the government's water policy reforms have led to reduced support provided to agriculture for water resources, paralleled by rising real prices for water, being achieved without negative consequences for farm output. But as agriculture consumes over 50% of water resources and in view of projected climate change impacts, further efforts are needed to improve water use efficiency, such as:

- Meeting the agreement conditions between the government and farmers in 2006 to further increase water prices to cover average costs of water production by 2015.
- Ensuring that regional and seasonal variation in the cost of supplying recycled effluent water is reflected in water charges to farmers.
- Exploring the possibilities of trading water quotas between different agricultural producers and over the medium term with other water users, including use for environmental needs.
- Eliminating the water extraction levy concession to better deliver the sustainable use of groundwater.
- Improving hydrological information to better guide policy makers in the allocation of rights to use groundwater.

As well as the progress made in water policy reforms there have been other achievements in improving the environmental performance of agriculture since the early 1990s. Notable progress has been made with the inclusion of environmental provisions as part of the dairy sector reform. Use of pesticides is being curbed through wider adoption of Integrated Pesticide Management, greater use of bio-controls and expansion of organic farming. Soil degradation and desertification in agriculture is being better managed through programmes to improve soil conservation, drainage and proving support for low/no-tillage equipment. Many of these measures have also had beneficial impacts for the conservation of biodiversity. In addition, a concerted effort has been made to reduce methyl bromide use in agriculture.

In addressing these many diverse and complex issues concerning the interaction between agriculture and the environment, developing a more integrated and coherent policy approach will be an important challenge. Despite successes, policies toward addressing environmental issues in agriculture appear to have evolved over the past decade in a piecemeal and uncoordinated manner, suggesting that the following approaches, including greater involvement of all relevant stakeholders, might be considered:

- Moving toward greater policy integration and coherence across agricultural, environmental, water and energy policies which could provide environmental co-benefits, including through greater use of market based approaches and payments for ecosystem services by agriculture.
- Ensuring greater integration of urban and industrial planning regulations with agricultural policies that are seeking to protect biodiversity and open spaces related to agriculture.

It will also be important to improve environmental monitoring and policy evaluation. Deficiencies in the data available to policy makers should be addressed, so that policy makers have the information to undertake an evidence-based environmental and economic evaluation of policies. To address data and monitoring gaps related to agri-environmental linkages it is suggested effort could be made to:

- Improve monitoring data sets, especially related to: water pollution; land degradation; biodiversity; open spaces; and a full inventory of greenhouse gas emissions and sequestration.
- Monitor and evaluate the economic efficiency and environmental effectiveness of agri-environmental policies, and cost-benefit analysis of measures before their introduction.

Synthèse et recommandations pour l'action publique

Cet *Examen* contient une évaluation des performances de l'agriculture israélienne sur les vingt dernières années et des réformes de la politique agricole du pays, ainsi que des recommandations concernant la poursuite du processus de réformes à l'avenir. Cette évaluation s'appuie sur les critères opérationnels définis par les ministres de l'Agriculture des pays de l'OCDE en 1998, selon lesquels, pour être satisfaisantes, les politiques agricoles sont censées être découplées, transparentes, ciblées, adaptées, flexibles et équitables. L'observation de ces critères devait aider le secteur à assurer sa viabilité économique au sein de l'économie dans son ensemble, à respecter l'environnement et les ressources naturelles, à utiliser les intrants rationnellement et à résoudre les problèmes sociaux, sans avoir recours à des subventions entraînant des distorsions de la production et des échanges.

Caractéristiques de l'agriculture israélienne

Israël est un cas à part parmi les économies développées, en ce sens que 94 % des terres agricoles appartiennent à l'État et seulement 6 % à des propriétaires privés. Les terres sont administrées par l'Administration foncière israélienne, qui attribue aux agriculteurs des droits d'utilisation de cette ressource pour des périodes plus ou moins longues. La production agricole israélienne a aussi ceci de particulier que les collectivités coopératives, notamment les *kibboutz* et les *mochav*, y occupent une place prédominante. Le caractère coopératif de la gestion de la production agricole cède peu à peu le pas à des modalités de gestion plus proches de celles du secteur privé, en particulier depuis le milieu des années 80, mais ces collectivités représentent encore quelque 80 % de la production agricole.

Les réformes macroéconomiques…

Le Programme de stabilisation économique de 1985 a marqué un tournant dans la politique macroéconomique d'Israël. Après plus d'une décennie caractérisée par une forte inflation, des crises persistantes de la balance des paiements et une dette publique élevée, ce programme prévoyait des mesures monétaires et budgétaires radicales pour résoudre les problèmes. Du début des années 90 à 2008, l'économie israélienne a bénéficié, en moyenne, d'une forte croissance, conjuguée à des taux d'inflation en diminution, et des progrès considérables ont été obtenus en matière de stabilité budgétaire. Cette évolution a été encouragée par des réformes structurelles et par une tendance générale favorable aux marchés libres, aux privatisations et à la déréglementation.

… ont déclenché les réformes de la politique agricole

Jusqu'à la fin des années 80, les pouvoirs publics intervenaient massivement dans le secteur agricole, moyennant le versement de subventions, la planification centralisée des activités, l'attribution de quotas de production, le contrôle des prix et les mesures de protection à l'encontre des importations. Les dispositions macroéconomiques adoptées au milieu des années 80, destinées à réduire et stabiliser rapidement le taux d'inflation, ont eu des répercussions sensibles sur l'agriculture, laquelle a dû s'adapter à la forte hausse des taux d'intérêt et faire face soudainement à un endettement croissant. D'autres facteurs ont eux aussi favorisé la réforme de la politique agricole. Ainsi, un climat extérieur plus pacifique, en comparaison avec les périodes antérieures, a permis au monde agricole et aux pouvoirs publics de concentrer leur attention sur l'exploitation des atouts du secteur au lieu d'être guidés par les problèmes d'autosuffisance. Dans les années 90, une énorme vague de nouveaux immigrants venus d'ex-Union soviétique a accru la population de près d'un cinquième, ce qui a fait augmenter la demande de logements et a contribué à un certain assouplissement de la réglementation stricte applicable aux transactions foncières.

Le remaniement de la politique agricole réalisé entre 1985 et 2008 peut être divisé en quatre phases :

- **1985-90 :** Consécutivement aux réformes macroéconomiques, le secteur agricole a subi le contrecoup de la forte contraction du budget et de la réduction du soutien des prix des produits alimentaires de base. Les premières mesures adoptées en vue de supprimer la planification des activités agricoles par l'État ont consisté à abolir les systèmes de quotas dans la culture des fleurs et de certains légumes. En 1989, les coopératives régionales qui fournissaient divers services à l'agriculture et organisaient la commercialisation collective des produits se sont effondrées sous le poids du surendettement, ce qui a entraîné des changements structurels dans l'agriculture coopérative.
- **1991-95 :** Le sous-secteur axé sur les exportations a été ouvert à la concurrence et la planification de la production agricole par l'État a été de nouveau réduite. En 1991, les premières dispositions ont été prises pour abolir les monopoles et soumettre à la concurrence les entreprises exportatrices. De plus, au début des années 90, le contrôle des prix à la consommation a été supprimé, sauf dans les cas du lait, des œufs et de la farine. En 1994, une réforme a été lancée dans l'élevage des poulets de chair, en vue de moderniser la production et d'accroître l'efficience grâce à l'assouplissement progressif du système des quotas. En 1991, un tarif progressif par tranches a été appliqué à l'eau douce pour encourager une utilisation plus rationnelle de la ressource.
- **1995-99 :** Les réformes ont porté essentiellement sur la libéralisation des importations. Dans le cadre de l'Accord d'Uruguay sur l'agriculture, Israël s'est engagé à améliorer l'accès à ses marchés et à réduire les subventions bénéficiant à ses exportations et le soutien interne à l'agriculture. En tout premier lieu, des droits de douane ont été substitués à de nombreux obstacles non tarifaires aux importations et des contingents tarifaires ont été établis. Ces dispositions ont amélioré la transparence de la politique commerciale d'Israël, mais la protection aux frontières est restée forte pour plusieurs groupes de produits sensibles. En 1999, le quota d'eau douce alloué à l'agriculture a été réduit de 40 % et un droit de prélèvement a été instauré, auquel les agriculteurs sont soumis.

- **2000-09 :** De nouvelles mesures ont été prises pour réduire le soutien interne à l'agriculture. Les quotas de production ont été supprimés dans l'élevage de poulets de chair. Les mesures de soutien des prix (écoulement des excédents) ont été abolies en 2004 dans le secteur des fruits et légumes. Une grande réforme a été lancée dans le secteur laitier pour renforcer sa compétitivité et pour répondre aux problèmes d'environnement. Le soutien des pouvoirs publics est devenu plus sélectif et il a été ciblé sur des éléments tels que les instruments de gestion des risques (programmes d'assurance contre les catastrophes naturelles) et d'autres outils destinés à favoriser les moyens de production moins préjudiciables à l'environnement. Les autres mesures de soutien adoptées ont porté sur la promotion des ventes, les activités de recherche-développement et de modestes programmes d'investissement concernant principalement les productions destinées à l'exportation. Un accord a été conclu en 2006 entre les agriculteurs et les pouvoirs publics en vue d'augmenter de nouveau les prix de l'eau acquittés par les exploitants, de manière à ce qu'ils tiennent compte du coût moyen de la production de l'eau d'ici 2015. Au cours de cette période, les pouvoirs publics ont aussi accordé une plus grande attention au développement durable en général et, entre autres, aux problèmes agroenvironnementaux.

Malgré les réformes entreprises ces vingt dernières années, les pouvoirs publics continuent de jouer un rôle beaucoup plus important dans l'agriculture que dans les autres secteurs, comme en témoigne le maintien des subventions en faveur de l'eau et des investissements, et des dispositifs d'assurance ou d'indemnisation des catastrophes naturelles. Les pouvoirs publics continuent d'intervenir dans la répartition de facteurs de production essentiels à l'activité agricole : la terre, l'eau et la main-d'œuvre étrangère (originaire pour la plupart de Thaïlande). Les ressources en eau et l'immense majorité des terres agricoles sont toujours la propriété de l'État. Le secteur agricole reçoit un soutien indirect par l'intermédiaire du système de permis concernant la main-d'œuvre étrangère. Les producteurs agricoles sont protégés (mais les consommateurs taxés) par les droits de douane relativement élevés qui frappent la majeure partie des produits agroalimentaires importés. Certaines filières, comme celles du lait et des œufs, font l'objet de mesures spécifiques telles que l'établissement de prix minimums garantis et de quotas, qui visent à assurer la rentabilité de la production d'une majorité d'exploitants. Un bref récapitulatif des instruments de politique agricole utilisés actuellement figure dans l'encadré 0.1.

Le secteur agricole a connu une restructuration et…

Bien que les réformes de la politique agricole puissent être considérées comme partielles, elles ont encouragé des changements structurels importants dans le secteur. Depuis le début des années 90, le nombre d'exploitations a fortement diminué – ce qui s'est accompagné d'une augmentation à l'avenant de la taille des exploitations –, le nombre d'agriculteurs installés à leur compte a considérablement baissé, la production agricole s'est spécialisée et les ménages agricoles ont diversifié leurs activités. Les exploitants ont commencé à cultiver de nouveaux produits permettant de répondre rapidement à la demande du marché, comme les légumes, ou à exploiter les nouvelles sources de revenus offertes par les exploitations, comme le tourisme à la ferme. D'importants changements structurels sont également survenus dans l'organisation et les responsabilités de plusieurs coopératives au service du monde agricole, de nouvelles entreprises privées apparaissant aussi bien en amont qu'en aval.

Encadré 0.1. **Récapitulatif des instruments de politique agricole utilisés actuellement en Israël**

Instruments de l'action interne

- *Quotas de production* et *prix (cibles) minimums* : Appliqués à la production de lait et d'œufs. Des prix minimums sont aussi destinés à servir de filet de sécurité aux producteurs de blé. Les autres produits agricoles ne font plus l'objet de quotas, de prix minimums ni de systèmes d'écoulement des excédents; certains fruits et légumes ont continué de bénéficier d'un système d'écoulement des excédents jusqu'en 2004.
- *Contrôle des prix à la consommation* : Appliqué à plusieurs produits alimentaires de base, notamment aux produits laitiers, aux œufs et au pain.
- *Subventions à l'achat d'intrants variables* : Au titre de l'eau uniquement. Les agriculteurs paient l'eau moins cher que les autres usagers, sont indemnisés de la réduction du quota d'eau douce alloué à l'agriculture et acquittent un droit de prélèvement minoré.
- *Soutien des investissements* : Des subventions d'équipement sont accordées pour développer le secteur des exportations agricoles et pour encourager l'adoption des technologies de pointe. Les agriculteurs qui prennent part au dispositif de soutien des investissements bénéficient aussi d'exonérations de l'impôt sur le revenu et d'un régime d'amortissement accéléré. À compter de 2009, un nouveau programme d'aide à l'investissement est mis en œuvre dans le but de faire diminuer les besoins en main-d'œuvre étrangère dans l'agriculture.
- *Réaménagements et annulations de dettes* : Une série d'accords a été conclue en vue du règlement des dettes accumulées jusqu'à la fin des années 80; une partie des dettes doit encore être payée jusqu'en 2015.
- *Paiements directs* : Versés aux producteurs d'œufs et de poulets de chair du secteur Merom Hagalil, dans le Nord de la Galilée. Ils sont accordés depuis 1989 en application de la loi sur la Galilée (1988), pour indemniser les producteurs des conditions de production défavorables qui prévalent dans cette région périphérique où sont concentrés les deux tiers des producteurs d'œufs.
- *Mesures de soutien des revenus* : Destinées aux producteurs de blé du Sud du pays pour soutenir l'agriculture non irriguée et préserver les espaces libres. D'autres dispositifs de soutien des revenus axés sur la sauvegarde des espaces libres sont en vigueur pour maintenir l'élevage de bovins, d'ovins et de caprins dans les zones de pâturage.
- *Dispositifs d'assurance* : Les exploitants qui adhèrent à un dispositif d'assurance contre les catastrophes naturelles ou à un système d'assurance multirisque de plus grande envergure reçoivent un soutien sous la forme d'un remboursement partiel de leurs primes, à savoir 80 % dans le cas du système d'assurance multirisque et 35 % dans celui du dispositif d'assurance contre les catastrophes naturelles.

Services d'intérêt général fournis au secteur agricole dans son ensemble

- *Recherche-développement* : Les fonds publics représentent un pourcentage important du budget que les pouvoirs publics consacrent à l'agriculture.
- *Services de vulgarisation* : Gratuits pour les agriculteurs; jouent un rôle important dans la transmission aux exploitants des connaissances pratiques apportées par la recherche.
- *Services d'inspection* : Entièrement financés par les pouvoirs publics; les dépenses consacrées à ces services ont tendance à augmenter.
- *Infrastructures agricoles* : Englobent les investissements publics dans les ouvrages hydrauliques (en particulier pour le recyclage des effluents), dans les infrastructures régionales de drainage et de conservation, et dans les infrastructures des villages.
- *Commercialisation et promotion* (y compris les subventions à l'exportation) : Ces dépenses étaient conséquentes jusqu'au début des années 2000. Elles ont diminué depuis lors et sont actuellement négligeables.

Encadré 0.1. **Récapitulatif des instruments de politique agricole utilisés actuellement en Israël** *(suite)*

Instruments de la politique commerciale

- *Droits de douane :* Les droits de douane appliqués en Israël aux produits agroalimentaires sont très variables (ils sont par exemple très élevés dans le cas des produits animaux et faibles dans celui des céréales). Complexe, le système tarifaire comprend de nombreux droits dont le montant n'est pas déterminé en pourcentage de la valeur des biens. Une grande partie du commerce des produits agroalimentaires est soumise à divers accords de libre-échange (les plus importants liant Israël à l'UE et aux États-Unis) qui fait bénéficier les partenaires d'un accès préférentiel au marché israélien, dans de nombreux cas en franchise de droits de douane.
- *Contingents tarifaires :* Dans le cadre de l'Accord d'Uruguay sur l'agriculture, Israël a établi des contingents tarifaires pour le blé, les matières grasses, les noix, les pruneaux, le maïs, le jus d'orange et d'autres agrumes, la viande bovine, la viande ovine et différents produits laitiers.
- *Licences :* Requises pour exporter des produits agricoles, elles sont délivrées par le ministère de l'Agriculture et du Développement rural dans le but de recueillir des données, de vérifier que les exportateurs ont la capacité de satisfaire aux normes de qualité applicables aux fruits et légumes frais, et de veiller à ce qu'ils aient les moyens financiers de régler aux agriculteurs les produits fournis.

Le secteur s'est relativement bien adapté à la nouvelle donne créée par les réformes, mais les ajustements n'ont pas été sans conséquences, entraînant notamment des pertes d'emplois dans l'agriculture. Heureusement, la vigueur de la croissance économique a nettement amorti le choc, offrant des débouchés professionnels de substitution aux travailleurs excédentaires et de nouvelles sources de revenus aux ménages agricoles. Les agriculteurs ont en outre bénéficié de la baisse des taux d'intérêt et d'un cadre macroéconomique stable. Les ajustements ont aussi été favorisés par les progrès technologiques imputables à la recherche-développement, la formation professionnelle, une transmission efficace des résultats de la recherche aux exploitations, en partie grâce au niveau de qualification élevé du personnel des services de vulgarisation, les bonnes compétences en gestion des exploitants israéliens et leur aptitude à adopter les technologies innovantes.

… la productivité s'est améliorée

Comme dans la plupart des autres pays, le poids de l'agriculture dans l'économie israélienne a diminué ces deux dernières décennies, sa part dans l'emploi total et dans le produit intérieur tombant à seulement 2.7 % et 1.7 %, respectivement, au cours de la période récente. L'augmentation de la productivité du travail a joué un rôle déterminant dans celle de la productivité totale des facteurs, laquelle a pratiquement doublé dans l'agriculture entre 1990 et 2008, soit une progression beaucoup plus forte que dans tous les autres secteurs de l'économie israélienne. S'il est courant que la productivité totale des facteurs augmente plus vite dans l'agriculture que dans les autres activités, sa progression a été nettement plus rapide en Israël que dans beaucoup d'autres pays. Elle s'est accélérée entre 1999 et 2006 du fait que la main-d'œuvre se contractait alors que la production continuait de croître.

La production agricole a globalement augmenté de 60 % entre 1990 et 2007, la progression étant équivalente dans l'élevage et dans les cultures. Cependant, les deux tiers de la superficie du territoire sont considérés comme semi-arides ou arides, et ce déficit de ressources en eau expose l'agriculture à des risques en cas de variations des conditions météorologiques et provoque de fortes fluctuations du volume de la production d'une année à une autre. Quoi qu'il en soit, la croissance de la production agricole s'est établie à 2.2 % par an en moyenne au cours de la période 1990-2008, soit au-dessus des taux enregistrés dans la plupart des pays de l'OCDE et nettement au-delà du taux de croissance de la population israélienne.

Les productions végétales représentent environ 60 % de la production totale en valeur, et les 40 % restants étant imputables aux productions animales. Les fruits (y compris les agrumes) et les légumes (dont les pommes de terre) sont les produits les plus importants, puisqu'ils représentent près de 50 % de la valeur totale de la production. Les grandes cultures ont compté pour 7 % en 2008, soit un peu moins qu'en 1990. Les produits animaux les plus importants sont la viande de volaille et le lait de vache.

La hausse de la production de fruits et de légumes est en grande partie imputable aux exportations. Le climat qui prévaut en Israël permet au pays de récolter des fruits toute l'année et lui offre donc un avantage manifeste par rapport à beaucoup de ses concurrents. Sur le long terme, les productions végétales ont beaucoup varié en fonction des fluctuations du marché. Les produits traditionnels, qu'il s'agisse de fruits (agrumes) ou de grandes cultures (blé et coton), ont tous vu leur production décliner sensiblement, les volumes récoltés en 2008 représentant moins de la moitié de ceux de 1990. La production de melons et de courges a augmenté rapidement dans les années 90, mais elle a reculé tout aussi vite dans les années 2000. Le volume de la production de pommes de terre a quant à lui enregistré une hausse de 200 % environ depuis 1990.

L'évolution des courants d'échanges tendent à refléter l'avantage comparatif d'Israël

Sous l'effet de la libéralisation partielle du commerce et de certaines réformes des politiques internes, entre autres, le secteur agroalimentaire est mieux intégré aux marchés internationaux que par le passé, comme en témoigne le ratio élevé des exportations agroalimentaires à la valeur du produit intérieur net de l'agriculture, qui s'établit aux alentours de 80 %-90 %. Le ratio des importations agroalimentaires au produit intérieur net de l'agriculture est encore plus élevé (130 %-170 %). Ces deux ratios sont sensiblement supérieurs aux moyennes atteintes dans l'ensemble de l'économie. Malgré la forte augmentation des exportations agroalimentaires en valeur, en particulier au début des années 2000, Israël est importateur net à hauteur de 1 milliard USD environ par an. Le déficit net a même eu tendance à se creuser ces dernières années, en grande partie parce que les prix des produits agroalimentaires importés ont augmenté plus vite que ceux des produits exportés, mais aussi parce que la production végétale a nettement diminué en 2008.

Les exportations agricoles d'Israël reflètent ses avantages en termes de saisons et d'expertise – principalement des légumes d'hiver, des pommes de terre, des graines, des tomates, des fleurs et des fruits, qui sont tous destinés en majeure partie aux marchés européens. Israël est aussi un gros exportateur de technologies et d'intrants agricoles, dont les ventes à l'étranger se sont montées à 2.2 milliards USD en 2007, soit davantage que les

exportations agroalimentaires totales. Les produits de l'élevage, très tributaires des importations de céréales, sont principalement destinés au marché intérieur, les exportations n'ayant représenté en l'occurrence que 2 % des exportations agroalimentaires totales en 2006-08. Sur le long terme, les exportations d'agrumes suivent une tendance à la baisse, tandis que les exportations de produits horticoles progressent, en particulier les exportations de piments et de pommes de terre.

Les principaux produits d'importation sont les céréales, la viande bovine, les graines oléagineuses, le sucre, le tabac, le poisson et les produits tropicaux comme le cacao que l'industrie alimentaire transforme ensuite. Les importations tendent à refléter le fait qu'Israël est désavantagé en ce qui concerne les productions qui demandent de grands espaces. Les importations nettes de céréales et de sucre représentent environ 90 % de la consommation intérieure totale de ces produits, et celles de viande bovine 50 % approximativement. En revanche, la production israélienne satisfait pratiquement tous les besoins du pays en lait, en viande de volaille et en œufs, notamment grâce à une forte protection aux frontières et à des mesures de soutien spécifiques.

La réalisation des objectifs de la politique agricole a bien avancé…

Israël parvient à maintenir sa population rurale dans les zones périphériques. Le pays est autosuffisant pour les produits agricoles qui peuvent être produits sur place, et il a ouvert ses frontières aux importations dans le cas des produits pour lesquels il est comparativement désavantagé. De même, Israël a su encourager les exportations de fruits et de légumes, en tirant parti de ses conditions climatiques favorables, des progrès technologiques et de l'expérience accumulée dans le domaine de la gestion des exploitations. Israël déploie aussi des efforts considérables pour faire face aux problèmes croissants que soulève la situation de l'environnement, en particulier aux pénuries d'eau. En tout état de cause, il est nécessaire de poursuivre les réformes de la politique agricole, dans l'optique de réduire le coût qu'elle fait supporter à l'économie.

… le niveau du soutien agricole diminue…

Les progrès accomplis dans le cadre des réformes de la politique agricole lancées à la fin des années 80 se reflètent dans le niveau du soutien mesuré par l'ESP en pourcentage (estimation du soutien aux producteurs en proportion des recettes agricoles brutes) et par l'EST en pourcentage (estimation du soutien total exprimé en pourcentage du PIB). Ces deux indicateurs sont en baisse depuis 1995, ce qui montre que le niveau du soutien aux producteurs agricoles a diminué progressivement et que son coût pour l'économie dans son ensemble se réduit. Ainsi, l'ESP en pourcentage est passée de 24 % en 1995-97 à 17 % en 2006-08. Dans le même temps, l'EST en pourcentage est passée de 1.0 % à 0.7 %. Cependant, il convient de noter que les progrès dont font état ces deux indicateurs ne sont pas dus uniquement aux réformes de l'action publique, mais aussi à l'augmentation des prix mondiaux survenue pendant la période 2006-08, qui a réduit l'écart avec les prix intérieurs. De plus, la forte progression de la production agricole et du PIB, au regard de l'évolution de l'EST et de l'EST en valeur absolue, a encore accentué la baisse de l'ESP en pourcentage et de l'EST en pourcentage au cours de la période étudiée.

… mais le coût pour les consommateurs demeure relativement élevé…

Actuellement, le niveau du soutien aux producteurs agricoles en Israël (ESP en pourcentage = 17 %) est inférieur à la moyenne de l'OCDE (23 %) et au niveau observé dans l'UE27 (27%), mais beaucoup plus élevé qu'aux États-Unis (10 %). Le poids que les mesures de soutien à l'agriculture font peser sur l'économie israélienne (EST en pourcentage = 0.7 %) est inférieur à la moyenne de l'OCDE (0.9 %) et au niveau constaté dans l'UE27 (1.0 %), et proche de celui du Mexique, des États-Unis et du Brésil. Néanmoins, comme l'indique l'estimation du soutien aux consommateurs (ESC), qui mesure le coût que les consommateurs ont à supporter du fait des mesures de soutien à l'agriculture qui majorent les prix intérieurs, la taxe implicite à la consommation reste relativement élevée en Israël (l'ESC en pourcentage s'établit à 18 %) si on la compare à la moyenne de l'OCDE (13 %) et au niveau atteint dans l'UE27 (12 %).

… la composition du soutien entraîne de plus en plus de distorsions…

Le niveau du soutien à l'agriculture diminue, mais les résultats de l'ESP montrent que sa composition est devenue de plus en plus propice aux distorsions au cours de la période étudiée. Cela est principalement lié au fait que la forte protection aux frontières dont continuent de bénéficier les produits agricoles hisse les prix intérieurs au-dessus des cours mondiaux et se traduit par un soutien des prix du marché non négligeable (subordonné aux niveaux de la production), alors que c'est l'une des formes de soutien qui provoquent le plus de distorsions. En outre, le soutien budgétaire destiné aux producteurs agricoles eux-mêmes a certes diminué, avant de se stabiliser à peu près ces dernières années, mais il est versé aux deux tiers environ sous la forme de paiements au titre de l'achat d'intrants variables ou fixes, lesquels sont – comme le soutien des prix du marché – réputés se caractériser par une faible efficacité de transfert. Autrement dit, seule une petite partie des transferts financés par les contribuables échoit en l'occurrence réellement aux agriculteurs eux-mêmes.

… et met l'accent sur les produits de l'élevage

Une analyse détaillée révèle que le soutien couplé à la production (transferts aux producteurs au titre d'un seul produit) exprimé en proportion des recettes agricoles brutes attribuables à un produit donné atteint son plus haut niveau dans le cas des produits de l'élevage, en particulier dans ceux de la viande de volaille, de la viande bovine et de la viande ovine. Cela indique que peu de réformes ont été conduites dans ce secteur à ce jour ou qu'elles n'ont eu qu'un caractère limité. Les réformes entreprises jusqu'à aujourd'hui visaient à accroître l'efficience et à mieux faire respecter les normes de protection de l'environnement applicables à la production, mais les systèmes d'organisation de cette dernière sont restés intacts. Par exemple, des mesures importantes ont été prises pour réformer le secteur laitier et, plus récemment, celui des œufs, mais des quotas de production continuent de s'y appliquer, les exploitants se voient garantir des prix minimums fixés par les pouvoirs publics et bénéficient d'un soutien des revenus et des investissements, ainsi que d'une forte protection aux frontières contre la concurrence étrangère.

Actions à mener pour poursuivre les réformes

À partir du début des années 90, Israël a progressivement modifié son action, qui s'appuyait jusque-là sur le versement de subventions, la planification centralisée des activités agricoles, l'attribution de quotas de production, le contrôle des prix et les mesures de protection à l'encontre des importations. Le pays atteint ses objectifs avec davantage d'efficacité, au moyen de politiques qui ciblent mieux le résultat recherché tout en entraînant moins de distorsions dans les échanges et dans la répartition des ressources. Cependant, de nouvelles réformes sont possibles, dans la mesure où la politique agricole en vigueur continue d'avoir un coût relativement élevé pour les consommateurs et les contribuables israéliens, et où l'efficience des différentes mesures appliquées pourrait être améliorée. Les pouvoirs publics pourraient aussi se demander s'il ne serait pas plus efficient et plus efficace de poursuivre certains de leurs objectifs, comme le maintien de la population dans les zones périphériques, en s'appuyant sur des mesures autres qu'agricoles, par exemple sur les politiques régionales.

Il faudrait diminuer les charges administratives qui pèsent sur les transactions opérées sur le marché foncier agricole

Israël est un cas à part parmi les économies développées, en ce sens qu'une grande partie des terres appartient à l'État. Les agriculteurs louent des terres à l'Administration foncière israélienne, pour un droit modique. Les terres agricoles ne peuvent pas être hypothéquées isolément : elles doivent l'être en même temps que l'exploitation tout entière, y compris le logement et le jardin qui l'entoure. Cela limite la latitude dont disposent les agriculteurs en matière d'accords de crédit avec les banques et peut restreindre leur accès au crédit. De plus, si les transactions portant sur les droits d'utilisation des terres sont tacitement autorisées entre agriculteurs d'une même localité, les transferts de terres à un exploitant vivant en dehors d'une localité donnée doivent obtenir le visa de l'Administration foncière israélienne et s'appuyer sur un partenariat officiel entre les parties au contrat. Ces partenariats doivent être préalablement approuvés par le ministère de l'Agriculture et du Développement rural pour que l'Administration foncière israélienne donne son accord définitif.

Les conversions de terres agricoles au profit du développement urbain suscitent elles aussi des préoccupations. Dans le passé, ces conversions s'opéraient la plupart du temps au coup par coup suivant le principe de la spéculation. Compte tenu de la forte croissance démographique, cette pression devrait continuer de s'exercer, de telle sorte qu'une planification rigoureuse sera nécessaire. Le nouveau schéma directeur adopté en 2005 prévoit un dispositif pour encadrer les activités d'aménagement. Il instaure aussi la possibilité d'accroître les superficies foncières qui relèvent de la propriété privée. Le projet de réforme foncière voté en août 2009 facilitera la détention privée de quelque 5 % des terres régies par l'Administration foncière israélienne, mais il ne s'applique pas aux terres agricoles.

- La privatisation des terres agricoles serait en définitive plus efficiente que la démarche suivie actuellement. Si cette formule n'est pas jugée faisable pour l'instant, il devrait être envisagé d'opérer une séparation entre les terres agricoles et les logements pour permettre des transactions plus actives et plus transparentes sur le marché foncier.
- L'obligation d'assortir d'un partenariat officiel les transactions sur les fermages entre parties de localités différentes devrait être reconsidérée.

- Il est urgent de procéder à un nouveau recensement agricole dans l'optique d'évaluer plus précisément les structures agricoles existantes et les effets des réformes entreprises ces vingt dernières années.

Il faudrait faire respecter la réglementation du marché du travail

Le secteur agricole est très tributaire de la disponibilité de la main-d'œuvre étrangère, relativement bon marché. Officiellement, la demande de main-d'œuvre étrangère est presque deux fois plus élevée que le contingent attribué à l'agriculture, alors même que les procédures administratives tendent à favoriser ce secteur par rapport aux autres. Cependant, les conditions de travail et les modalités de recrutement de la main-d'œuvre étrangère suscitent des préoccupations. Certes, la réglementation sur le salaire minimum et sur le paiement des heures supplémentaires à un taux majoré est censée s'appliquer aux travailleurs étrangers, mais les mesures prises pour faire respecter ces dispositions sont limitées, notamment en ce qui concerne la rémunération des heures supplémentaires. Les pouvoirs publics souhaitent diminuer le contingent de travailleurs étrangers attribué à l'agriculture et un nouveau programme de soutien à l'investissement est en cours de mise en œuvre dans l'optique de remplacer en partie la main-d'œuvre étrangère dans ce secteur.

- Une application plus rigoureuse de la réglementation existante et des modalités de recrutement plus transparentes amélioreraient les conditions de travail de la main-d'œuvre étrangère. Cela aurait aussi pour effet d'augmenter le coût de cette main-d'œuvre et donc d'en faire diminuer la demande, réduisant du même coup la nécessité d'adopter des mesures spécifiques pour accroître l'emploi de travailleurs israéliens dans l'agriculture.

Les droits d'importation qui frappent les produits agricoles pourraient être réduits et simplifiés…

Sous l'effet de la mise en œuvre de l'Accord d'Uruguay sur l'agriculture, le régime commercial en vigueur en Israël est désormais plus transparent et plus ouvert. Cependant, les droits de douane applicables aux produits agricoles sont très inégaux : ils sont très élevés, voire prohibitifs, dans le cas des produits sensibles comme les produits laitiers, la viande, les œufs et certains fruits et légumes, et modiques ou même nuls en ce qui concerne certains produits tels que les céréales secondaires, les graines oléagineuses et la viande bovine congelée. La moyenne simple des droits de douane appliqués en vertu du régime de la nation la plus favorisée est à peu près trois fois plus élevée dans le cas des produits agricoles que dans le cas des produits non agricoles.

- Israël devrait envisager de réduire encore les barrières douanières en ce qui concerne les produits agricoles, et de simplifier davantage le profil tarifaire très complexe en vigueur actuellement.

… notamment dans le cas des fruits et des légumes

Les réformes lancées au début des années 90 dans le secteur des fruits et légumes se sont traduites par une élimination progressive du contrôle étatique des exportations de fruits et

de légumes et par la suppression des quotas de production et des prix à la production réglementés. Consécutivement à la déréglementation de la production, la filière a accru sa compétitivité, a nettement augmenté ses parts de marché à l'étranger et est devenue la première filière exportatrice du secteur agroalimentaire. Bien que les prix intérieurs des fruits et légumes exportables soient inférieurs aux prix des équivalents étrangers, Israël protège sévèrement son marché contre les importations de ces produits.

- La forte protection douanière appliquée aux fruits et légumes pourrait être supprimée.

Il conviendrait d'appliquer des mesures causant moins de distorsions dans le secteur de l'élevage

L'objectif de l'autosuffisance est atteint en ce qui concerne la production laitière et la production d'œufs, mais le coût pour les consommateurs et les contribuables est élevé. Pour le limiter, les prix à la consommation de plusieurs produits laitiers et des œufs destinés à la consommation intérieure sont contrôlés. Les prix départ exploitation des autres produits d'origine animale, comme la viande bovine, la viande de volaille et la viande ovine, ne sont pas réglementés, mais le marché intérieur reste très protégé, d'où des prix intérieurs au-dessus des niveaux internationaux et donc un coût élevé pour les consommateurs.

- Israël devrait prendre de nouvelles mesures pour assouplir le système de planification de la production de lait et d'œufs, et envisager d'adopter des mesures budgétaires complémentaires pour apporter un soutien aux éleveurs, tout en réduisant la protection à la frontière.

Le soutien en faveur de la capacité de développement du secteur devrait être maintenu

Le secteur agricole bénéficie d'investissements conséquents dans la recherche-développement, d'un système de formation élaboré et de services de vulgarisation très performants. Israël est à de nombreux égards l'une des figures de proue des technologies agricoles à l'échelle mondiale, notamment en ce qui concerne la pratique de l'agriculture en milieu aride. Par conséquent, l'agriculture s'appuie sur l'avantage comparatif que lui confère le progrès technologique, davantage que sur un avantage comparatif « naturel ». Il convient de relever que, récemment, les dépenses au titre des services d'intérêt général, dont bénéficie le secteur agricole dans son ensemble, ont augmenté, en particulier les investissements dans les infrastructures nécessaires au recyclage des eaux usées. Au regard de la moyenne de l'OCDE, Israël se détache également pour ce qui est des dépenses de recherche-développement. Ces cinq dernières années, celles-ci ont représenté 18 % des dépenses budgétaires totales consacrées à l'agriculture.

- Pour rester compétitive et donc performante à l'avenir, l'agriculture israélienne devra sans doute continuer de s'appuyer sur une intense activité de recherche-développement, dans la mesure où les pressions exercées sur les ressources en eau et les effets du changement climatique vont s'accentuer.
- Maintenir en place les services de vulgarisation, qui ont fait leurs preuves, contribuerait aussi à améliorer encore la productivité de l'agriculture israélienne et à atténuer les pressions en faveur de l'adoption de mesures propices aux distorsions.

Les performances environnementales de l'agriculture sont mitigées et peuvent être améliorées

L'agriculture israélienne doit répondre à un enjeu majeur, qui consiste à concilier une production suffisante pour alimenter une population en augmentation, d'une part, et l'amélioration de ses performances environnementales souhaitée par de plus en plus de citoyens, d'autre part. La rareté des ressources en sols et en eau rend déjà la tâche difficile, et le changement climatique ne va faire qu'aggraver les choses. Dans ce contexte, il importera de renforcer la cohérence de l'action publique, notamment pour améliorer la gestion des ressources en eau dans l'agriculture. Pour l'instant, les remaniements de la politique de l'eau mis en œuvre par les pouvoirs publics se sont traduits par une réduction des aides accordées à l'agriculture au titre de l'eau, à laquelle est venue s'ajouter une hausse du prix réel de l'eau, sans que cela ait de conséquence négative sur la production agricole. Quoi qu'il en soit, plus de 50 % des prélèvements sont destinés à l'agriculture et, compte tenu des prévisions concernant les effets du changement climatique, de nouveaux efforts sont nécessaires dans l'optique d'utiliser les ressources en eau plus efficacement, par exemple :

- Respecter les conditions de l'accord conclu entre les pouvoirs publics et les agriculteurs en 2006 en vue d'augmenter les prix de l'eau, de façon à financer la production d'eau à hauteur de son coût moyen d'ici à 2015.
- Veiller à ce que les variations régionales et saisonnières du coût de la fourniture d'eau recyclée se reflètent dans la facturation de l'eau aux agriculteurs.
- Étudier les possibilités d'instaurer des échanges de quotas d'eau d'abord entre producteurs agricoles, puis, à moyen terme, entre les agriculteurs et d'autres usagers, sans omettre les usages destinés à satisfaire les besoins de l'environnement.
- Supprimer l'exonération du droit de prélèvement pour mieux assurer l'utilisation durable des eaux souterraines.
- Améliorer l'information hydrologique pour mieux orienter les responsables de l'action publique dans l'attribution des droits d'utilisation des eaux souterraines.

Parallèlement aux progrès accomplis dans le cadre de la réforme de la politique de l'eau, les performances environnementales de l'agriculture se sont aussi améliorées à d'autres égards depuis le début des années 90. Les dispositions sur la protection de l'environnement prévues dans le cadre de la réforme du secteur laitier se sont ainsi traduites par des progrès notables. La consommation de pesticides diminue à mesure que se généralise la lutte intégrée contre les ennemis des cultures, que s'accroît l'utilisation d'agents de lutte biologique et que s'étend l'agriculture biologique. L'action contre la dégradation des sols et la désertification en agriculture se fait plus efficace grâce à des programmes qui visent à améliorer la conservation des sols et le drainage, et à aider les exploitants à s'équiper pour travailler le sol superficiellement ou ne pas le travailler du tout. Bon nombre de ces mesures ont aussi des retombées bénéfiques sur la préservation de la biodiversité. En outre, une action concertée est menée pour réduire l'usage du bromure de méthyle en agriculture.

Pour résoudre ces problèmes nombreux, divers et complexes concernant l'interaction entre l'agriculture et l'environnement, il importera que les pouvoirs publics mettent en place une approche plus intégrée et plus cohérente. En dépit des succès obtenus, il semble que l'action publique axée sur les problèmes d'environnement rencontrés dans l'agriculture ait

été élaborée au coup par coup et sans coordination ces dix dernières années. Il pourrait donc être utile, tout en ménageant une plus grande participation de l'ensemble des parties prenantes, de prendre en considération les approches suivantes :

- Améliorer peu à peu l'intégration et la cohérence de l'action publique dans les domaines de l'agriculture, de l'environnement, de la gestion de l'eau et de l'énergie, ce qui pourrait accessoirement avoir des retombées bénéfiques sur l'environnement, y compris en recourant davantage aux approches marchandes et aux paiements au titre des services écosystémiques assurés par l'agriculture.
- Assurer une plus grande intégration entre les règlementations sur les aménagements urbains et industriels et les mesures de politique agricole qui visent à protéger la biodiversité et les espaces libres en rapport avec l'agriculture.

Il importera aussi d'améliorer le suivi de l'environnement et l'évaluation de l'action publique. Les lacunes dans les informations dont disposent les responsables publics doivent être comblées, de manière à ce qu'ils puissent asseoir leur évaluation environnementale et économique de l'action publique sur des données probantes. Pour remédier aux carences dans les données et le suivi en ce qui concerne les liens entre l'agriculture et l'environnement, il est suggéré d'envisager les deux possibilités suivantes :

- Améliorer les séries de données nécessaires au suivi, notamment en ce qui concerne : la pollution de l'eau, la dégradation des sols, la biodiversité, les espaces libres, et l'ensemble des émissions et la séquestration de gaz à effet de serre.
- Suivre et évaluer l'efficience économique et l'efficacité environnementale des mesures agroenvironnementales, et procéder à des analyses coûts-avantages des dispositions avant leur adoption.

Chapter 1

The Policy Context*

This chapter examines the key issues that have shaped the development of the agricultural sector and conditioned policy responses in Israel over the past two decades. It identifies the constraints, opportunities and challenges facing Israeli agricultural producers. Section 1.1 provides an overview of the social, natural and economic landscapes in which the agricultural sector functions. Section 1.2 examines the importance of the agricultural sector (including the agro-food industries) to the economy, and assesses agriculture's performance in terms of output, employment and other inputs, productivity, incomes and food consumption. Section 1.3 focuses on agro-food trade flows. Finally, Section 1.4 analyses structural changes in the agricultural sector including land tenure issues, changes in land use and farm size, and competition in the agro-food industries.

* The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law.

1.1. General aspects

Political and demographic features

The State of Israel is a parliamentary democracy with a single chamber parliament (the Knesset) of 120 members elected for a four-year term under a system of proportional representation. The leader of the largest party or voting bloc is called on to form a government and, if successful, will serve as prime minister. The formal head of state is the president, elected by the Knesset every seven years. In terms of official administrative areas, Israel is divided into six districts (from North to South): Northern, Haifa, Central, Tel Aviv, Jerusalem and Southern.

Israel's social landscape has been shaped by successive waves of immigration. The years following independence in 1948 saw the population triple with immigration from the Middle East, North Africa and Europe. The late 1980s and early 1990s saw a mass immigration of about one million people from the former Soviet Union. Population growth is easing, with an average growth rate of 1.8% in 2003-08, but remains high for a developed economy. Total population was at 7.2 million in 2007. Its age structure is relatively youthful, with a sizeable 44% of the population below the age of 25.

Israel is densely populated – with an average of 328 people per km^2 – and is also highly urbanised with as much as 92% of the total population classified as urban (localities with at least 2 000 residents) and the remaining 8% as rural. The two main cities of Jerusalem and Tel Aviv are less than 60 km apart.

Israel has a well-educated population. The adult literacy rate is about 97%, and illiteracy is negligible among the school-aged population. The tertiary education attainment ratio is well above the OECD average and the share of graduates in science and engineering, at 24.3%, is at a level commonly observed in advanced OECD countries (OECD, 2008a).

Natural resources and climatic conditions

Geographically, Israel is divided into four regions. A narrow coastal plain about 1 to 30 km wide extends along the Mediterranean Sea, and includes many of Israel's major cities and much of its agricultural land. Inland, a series of mountain ranges and highlands run from the north to the edge of the Negev Desert in the south, including the highest point in Israel, Mount Meron (1 208 metres). The land drops sharply to the Rift Valley, much of which lies below sea level and at its lowest point along the shore of the Dead Sea is 399 m below sea level, the lowest area on earth. The Negev Desert, an extremely arid area of flatlands and mountains, lies in the south.

Agricultural land of around 380 000 hectares represents approximately 17% of the land area of Israel. It consists of 290 000 hectares of arable land and of around 90 000 hectares of pastures. In turn, 52% of the arable land is irrigated and the remaining 48% rainfed. Some 94% of the agricultural land is owned by the state or quasi-state agencies and administered by the Israel Land Administration (ILA) (MARD, 2009).

Israel has a typical Mediterranean climate with cool, rainy winters and warm, dry summers, although it varies somewhat depending on the altitude and proximity to the sea. August is the hottest month. Although temperatures may reach 37 °C in the hills, they may soar to as high as 49 °C near the Dead Sea. January is the coldest month, with temperatures averaging 9 °C in Jerusalem and 14 °C in Tel Aviv.

Israel is not rich in natural resources, and has been confronted with a shortage of energy sources. Discoveries of offshore and onshore natural gas deposits since 2000 have raised hopes that Israel can meet some of its energy needs from domestic sources in the future. Attempts have been made to utilise alternative sources, and Israel has become the world's largest user per head of solar water heating. The mining of phosphate in the Negev and the extraction of potash, bromine and magnesium from the Dead Sea have become thriving industries in recent years, with exports in the sector growing strongly on the back of increasing volumes and high global prices.

Israel has also long faced a deficiency of water resources with two-thirds of the land area defined as semi-arid or arid. Israel's main source of fresh water is Lake Kinneret (the Sea of Galilee), which is fed by a river system originating in a mountainous region on the borders of Israel, Syria and Lebanon. The River Jordan flows from the north through Lake Kinneret and empties into the saline Dead Sea. Most of the rain falls between November and March, much of it in December/January. Rainfall declines from north to south and from west to east. Upper Galilee receives about 1 000 mm while the Negev receives only about 100 mm. Elat, at the top of the Gulf of Elat, only receives about 25 mm. During the 1950s and 1960s, a significant portion of national investment went into establishing the National Water Carrier to relocate water from the relatively abundant north to irrigate semi-arid plots in the centre and south of the country. However, as supply of natural fresh water remained limited, the government has invested heavily in developing alternative sources, specifically the purification of sewage water (primarily for use in irrigation) and the desalination of saline or sea water. Despite these initiatives, the increasing demand for water, driven partly by strong demographic growth, and irregular rainfall, put Israel's water supply under pressure (Chapter 3).

Water sources are owned by the state and the state designates them for various purposes: households, industry and agriculture. While the share of agriculture in overall water use in Israel tends to decline, it is still high at 57% in recent years (Chapter 3). The actual annual national quota of fresh water for agriculture is set subject to the annual water situation in the country. At the beginning of the 2000s the quota was cut by about 50% and since then has remained at the reduced level. Each farm is allocated an annual water quota that is set according to the water standard per homestead in a given region of the country.

Over the years the composition of water used by agriculture has changed. In 1990 fresh and surface water accounted for about 95% of water used by agriculture. This had decreased to 55% by 2001 and to 45% by 2008. Around one-third of water is from effluents with a further one-fifth from brackish (saline) water. Brackish water is used for irrigation of salinity-tolerant crops like cotton. In the case of several crops, such as tomatoes and melons, brackish water improves produce quality although lowers yields.

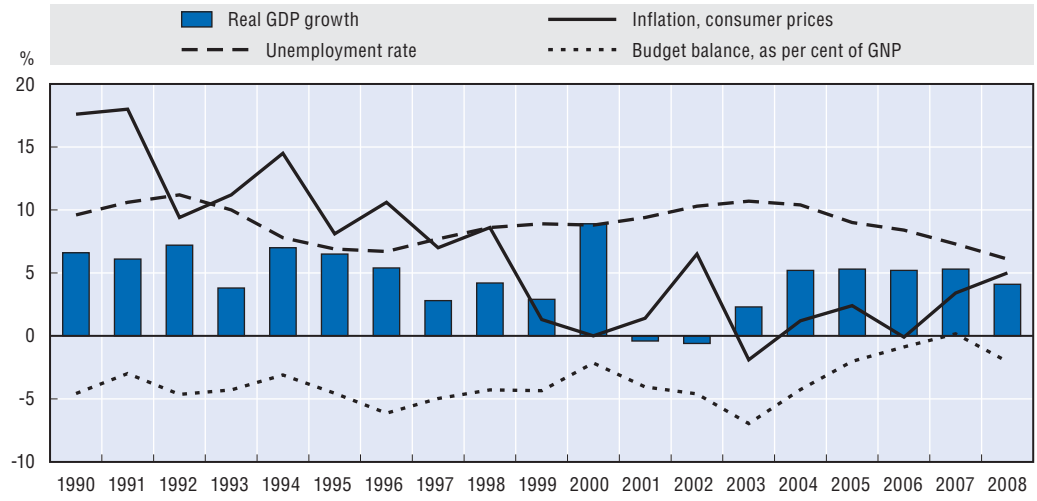
The standard of Israel's infrastructure is mixed. Some areas, such as telecommunications, provide a world-class service; others however, like transportation, do not. For example, Israel has one of the highest rates of mobile-phone penetration in the world (126 mobile-phone

subscribers per 100 persons), putting it on a par with countries such as Finland and Sweden. High-speed Internet penetration has grown exponentially, reaching some 4.3 million users by the end of 2006 and the penetration rate for households rose from 11% in 2002 to more than 60% by the end of 2006, a very high level by global standards. The main focus of government programmes during the 2000s has been to reverse the deterioration of Israel's transport system, after years of neglect. Growth in investment in roads has lagged behind that in other areas of infrastructure, and behind the average rate of business sector product growth (EIU, 2008).

Macroeconomic characteristics and economic policy

The Israeli economy has been characterised by important economic upswings and downturns (Figure 1.1). While GDP growth averaged around 5% per annum during the 1990s, it decelerated in 2001 and 2002, due to the global economic slowdown and the Second Intifada, then it started to recover in 2003 with strong rebound in external demand via the technology and tourism sectors. Between 2004 and 2007, real GDP expanded again by around 5% each year. The 2008-09 global financial and economic crises have so far brought less negative consequences for the Israeli economy compared to many OECD countries, partly due to the fact that a housing bubble did not develop in Israel, but also because the banking sector had only limited exposure to toxic assets. While Israel's real GDP is predicted exhibit zero growth in 2009 it is expected to rebound by about 2.2% in 2010 (OECD, 2009b).

Figure 1.1. **Israel: Selected macroeconomic indicators, 1990-2008**



Source: MOF, 2008; BOI, 2008; CBS, *Statistical Abstract of Israel 2009*.

In 2008, Israel's GDP was USD 199 billion. Its GDP per capita at purchasing power parity (PPP) was at USD 26.3 thousand in 2007, slightly below the OECD average of USD 32.7 thousand (EIU, 2009 and OECD, 2009c). Total public expenditure is relatively high (around 45% of GDP in 2007), but large spending on defence means that total civilian spending is only 37% of GDP which is below the average for OECD countries. Services account for almost two-thirds of GDP and industry for around one-third. Agriculture's contribution tended to fall in previous decades, but stabilised at around 2% in the 2000s (Section 1.2).

The high rates of economic growth in recent years have resulted in an improvement in the labour market. The rate of unemployment has fallen from over 10% in the early 2000s to around 6% in 2008, the lowest level during the period under review. A sizeable minority of the workforce is composed of non-Israeli workers – Palestinian day workers who have maximum 3-month renewable work permits and foreigners with work permits of maximum duration of 1 year, although renewable for up to 5 years. The proportion of non-Israeli workers in total employment peaked at 12% in 1999 and fell since then gradually to 8.7% in 2008. In 1990 almost all the non-Israeli workers were Palestinian; in 2008 almost 80% were from other countries. Non-Israelis work mostly in the domestic, construction and agricultural sectors (OECD, 2010a).

Despite the high rates of economic growth and improvements in the labour market, Israel suffers from high levels of relative poverty for a developed economy. Just over 20% of households are below the relative poverty line compared with an OECD average of 11%. Poverty is concentrated in two groups: the Arab-Israelis and Ultra-orthodox Jews with poverty rates at around 50% and around 60%, respectively (OECD, 2010b).

It can be argued that the economic issue that may have had the largest effect on the economy of Israel, was the inflation crisis of the 1970s and 1980s, when annual inflation rates peaked at over 400% in 1984. In 1985, the Economic Stabilisation Programme was implemented to deal with inflation and fiscal imbalances. The resolution of this crisis can be viewed as the beginning of the "modern" Israeli economy (Klein, 2005). In the early 1990s, inflation targeting was adopted which helped further reduction in inflation. Increases in the consumer price index have been in low single-digit levels since the end of the 1990s. During 1999-2006, the average annual rate of growth in the consumer price index was 1.4%. In 2007 and 2008, imported price pressures, via energy and food prices, and domestically generated pressures stemming from the strong economy, pushed inflation up (Figure 1.1). Inflation has not fallen by much over the recent downturn due to various increases in indirect taxation and exchange-rate effects. However, expectations of inflation implied by bond prices are within the Bank of Israel's target range and a sizeable output gap has developed. Both these suggest there are no significant upcoming inflationary pressures.

There has also been considerable progress in bringing fiscal stability to the economy. In 1992 the government enacted the Deficit Reduction Law. Then in 2004, as a result of the recession and large deficit recorded in the years 2001-03, a rule was introduced limiting the real increase in budgetary expenditures to 1% in 2005 and 2006 and 1.7% from 2007 (similar to the rate of increase in the population, meaning that the real per capita expenditure is to remain constant). In combination with strong growth in revenues linked to economic growth, this rule brought considerable progress in reducing both the budget deficit and the public debt as a share of GDP. The deficit fell from over 7% of GDP in 2003 to around zero in 2007. Similarly, public debt as a proportion of GDP fell from a peak of over 100% in 2003 to 78% at the end of 2008. However, the downturn will see the deficit rise in 2009 and 2010 and an increase in the debt to GDP ratio to nearly 85% of GDP (OECD, 2009b).

The government used to be substantially involved in nearly all sectors of the economy. Since 1990 it has implemented ambitious structural reforms aimed at reducing its intervention in the economy, and enhancing competition in some essential industries (WTO, 2006). Despite some fits and starts in the process, successive governments managed to press ahead with a general trend towards free markets, privatisation, and deregulation (EIU, 2008).

The country is relatively open to trade in goods and services, with the sum of exports and imports accounting for close to 90% of GDP. Since 1985 Israel has progressively reduced trade barriers, export subsidies and import licensing. A trade liberalisation programme launched in 1990 saw all licensing requirements on industrial goods imported from East Asia and eastern Europe replaced by a system of customs duties, bringing the majority of tariff rates within an 8%-12% band. Israel was the first country to sign a free-trade agreement (FTA) with the EU (then the EEC), in 1975, which was renewed and expanded in 1995. FTAs were also signed with the US in 1983, making Israel the first country to have FTAs with both the world's main trading entities, and with the European Free Trade Association (EFTA) in 1993. Israel has also signed preferential trade agreements with Mercosur (still subject to ratification by some Mercosur countries) and Jordan, and signed treaties to avoid double taxation with some 50 countries (EIU, 2008).

Manufactured products (including polished diamonds) remain the major exports, accounting for more than 90% of total merchandise exports. The share of diamonds in merchandise exports has increased from 27% in 1998 to around 32% in 2003-07 (EIU, 2008). On the contrary, exports of clothing have contracted due to the rise in international competition. On average, manufactured products account for more than 80% of merchandise imports. In particular, machinery and transport equipment, fuel, and other semi-manufactures (notably diamonds for further processing) are the most important items. Imports of fuel have increased steadily; this to a large extent reflected the upward evolution of the oil price (WTO, 2006).

In January 2003, Israel abolished all foreign exchange controls and fully liberalised capital movements. Since 1 January 2004, Israel's exchange regime has been reclassified to "independently floating", from the category "exchange rate within crawling bands" (WTO, 2006). Against the background of a current-account surplus, the capital account has seen a net outflow of Israeli investment funds overseas in some years. This has occurred despite a strong recovery in foreign direct investment (FDI) inflows rising from USD 2 billion in 2004 to a record USD 14.7 billion in 2006 and around USD 10 billion in both 2007 and 2008 (EIU, 2008 and 2009).

1.2. Agricultural situation

Agriculture played a vital role in the development of the Israeli economy. In the first half of the 1950s, the area of cultivated land increased by 150% and the number of Jewish farming communities doubled from 300 to 600. Agriculture was given a prominent place in government priorities for both practical and ideological considerations. The government needed to settle remote and less populated areas along the border, feed the rapidly growing population and create low skilled-jobs for immigrants.

During the initial years there were chronic food shortages as the state dealt with the influx of hundreds of thousands of new immigrants. Strict rationing was imposed, and the National Planning and Building Law was oriented such so that the default zoning for open spaces was for "agricultural usage". This period of collective hardship, known locally as the "Tsenah" (rationing), left an imprint on the national psyche and a commitment that for fifty years has supported agricultural self-reliance (Tal, 2007).

For the first thirty years of its existence, Israeli agriculture was heavily supported through the provision of subsidised water, price supports for many basic crops, disaster relief, an "army" of extension agents and generous support for research and development.

By the beginning of the 1980s Israeli agriculture was among the most subsidised in the world, with the rate of support exceeding European and USA levels (Tal, 2007). During these first decades production grew steadily and by the beginning of the 1960s, Israel reached food self-sufficiency. The opening of export markets for fruits, vegetables and flowers in the 1970s provided farmers with a further opportunity to expand production (Kimhi, 2004).

But the sector was also carrying a very high level of debt – the result of capital investments to expand production, encouraged by high inflation rates and continued government bail-outs of co-operatives which got themselves into financial difficulty (Chapter 2). Then, farm income and expenditure were both hit by the 1985 anti-inflationary stabilisation plan. On the income side, the plan involved deep cuts in government spending, including agricultural support. On the expenditure side, the plan resulted in a sharp rise in the real rate of interest, and caught the farm sector in deep indebtedness that could not be serviced. This led to the collapse of many co-operatives that governed most farm activity in the country.

Since Israel's signing of the Uruguay Round Agreement on Agriculture (URAA) in the mid-1990s, the restrictions on the import of agricultural products have been replaced with a system of tariff rate quotas, tariffs and duties to protect local production. Farmers buy water at subsidised rates and receive compensation in years of drought or when affected by other natural hazards. However, rising competition for scarce water resources as well as a more general drive towards more market-driven policies have put these traditional policy measures under scrutiny (Chapters 2 and 3).

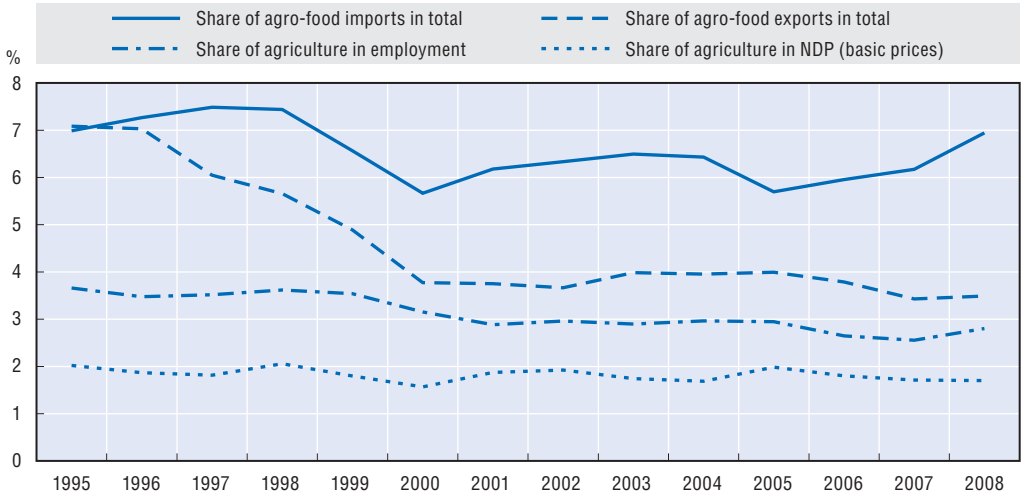
Agriculture and the food sector in the economy

The importance of agriculture has diminished in terms of its contribution to national income and as a source of employment (Figure 1.2). At the beginning of the 1960s agriculture provided about 10% of Net Domestic Product (NDP). Since then, the relative weight of agriculture has dropped to about 2% of NDP at the end of the 1980s, but then remained relatively constant at this level during the period under review. The share of employment in the sector has shown a steady decline, dropping from around 15% at the beginning of the 1960s to more than 4% in 1990 and then to under 3% in the second half of the 2000s.

Between 1995 and 2008, the share of agro-food (fresh and processed products) imports in total imports fluctuated at around 6%-7%. In contrast, the share of agro-food exports had fallen from 7% in 1995 to below 4% by the beginning of the 2000s, but since then agriculture has been able to maintain its contribution to exports at a roughly unchanged level (Figure 1.2).

The long-term decline in agriculture's contribution to GDP and employment is very much in line with changes seen in other developed economies (Figures 1.3 and 1.4). It is not as dramatic as the change in Korea but relatively close to developments in New Zealand, the two OECD countries most similar in terms of levels of per capita GDP. A recent OECD assessment of agricultural policy developments in seven emerging economies provides a further comparison (OECD, 2009). Among the countries reviewed, Chile – with a GDP per capita comparable to that of Israel – has experienced a change in the composition of GDP similar to that of Israel. The other six review countries (China, Brazil, India, the Russian Federation, South Africa and the Ukraine) have undergone comparatively more dramatic structural change at the macro level than either Chile or Israel (Figures 1.3 and 1.4).

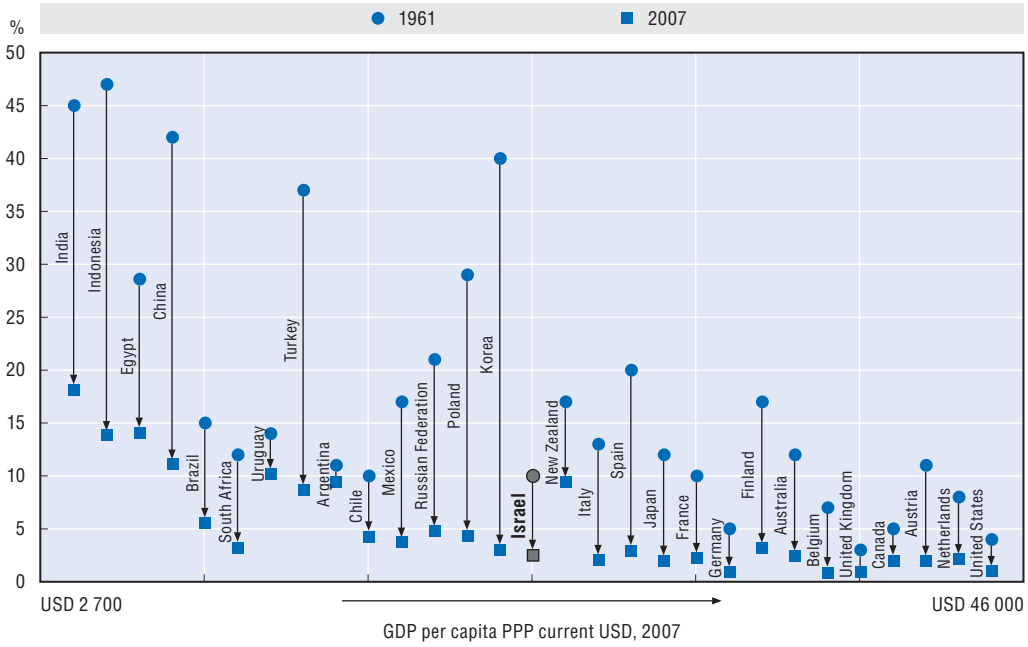
Figure 1.2. **Share of agriculture in NDP, employment and trade, 1995-2008**



Notes: Net Domestic Product at basic prices equals GDP at market prices after deduction for consumption of fixed capital and net taxes on products.
Trade data includes both unprocessed (fresh) and processed (food and beverages) agricultural products.
Employment data includes Israelis, Palestinian day workers from the West Bank and the Gaza Strip, and foreign workers.

Source: CBS, *National Accounts 1995-2007*; CBS, *Statistical Abstract of Israel 2009*; BOI, *Annual Report 2008*; CBS, *Agriculture in Israel 2006-07*; CBS Time Series-DataBank.

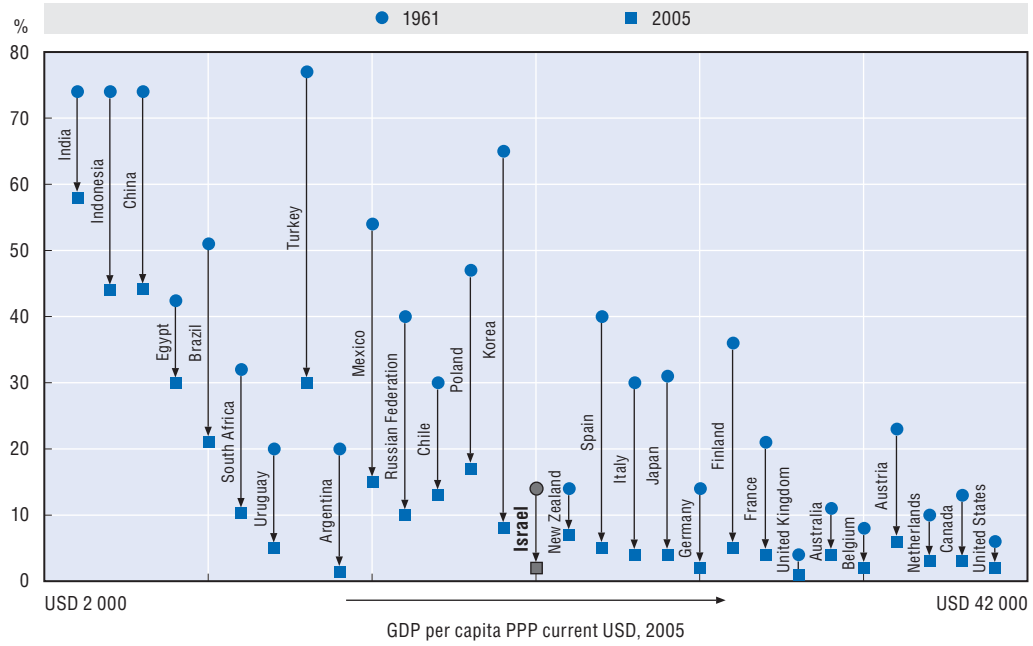
Figure 1.3. **Evolution of agriculture's share in GDP in selected countries, 1961 and 2007**



Note: The share of agriculture in GDP is for 1965 instead of 1961 for Egypt and for 2005 instead of 2007 for Canada, Japan, New Zealand and the United States.

Source: FAO, 1999; IMF, 2008; WB, *World Development Indicators*, 2008; adapted from Cervantes-Godoy and Brooks, 2008.

Figure 1.4. **Evolution of agriculture's share in employment in selected countries, 1961 and 2005**



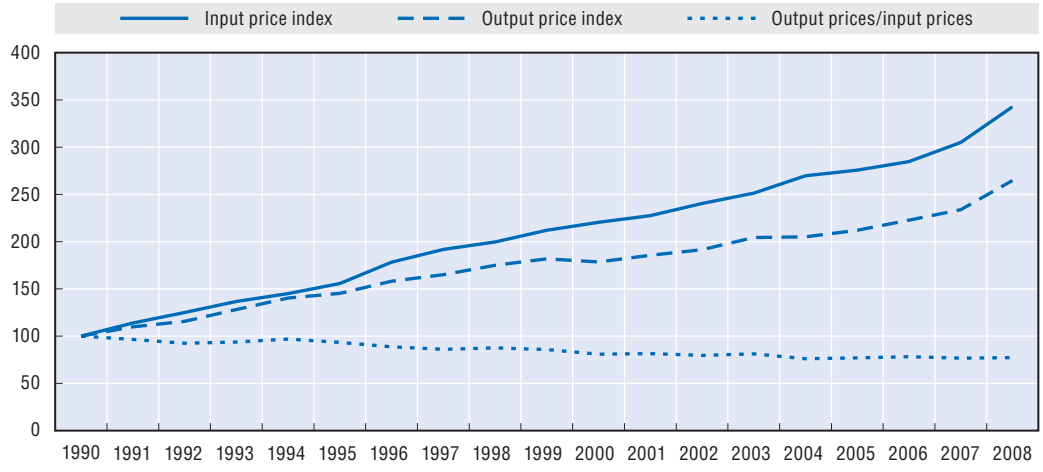
Note: The share of employment for Egypt is for 1980 instead of 1961 and for 2003 instead of 2005.

Source: FAO, 1999; IMF, 2008; WB, *World Development Indicators*, 2008; adapted from Cervantes-Godoy and Brooks, 2008.

Market conditions

Despite the strong role that Israeli government policies play in regulating agricultural markets and allocating key factors of agricultural production (land, water and foreign workers), agricultural producers face a long-term decline in the terms of trade (Figure 1.5) similar to that in other countries. Between 1990 and 2008 input prices rose on average by 7.1% each year while prices received for output increased by just 5.6% per year. During the 1990s producers were disadvantaged by the appreciation of the ILS,[1] reducing the value

Figure 1.5. **Output and input price indices, 1990-2008 (1990 = 100)**



Note: Input indices do not include the price and quantity of labour employed.

Source: CBS, *Statistical Abstract of Israel 2009*.

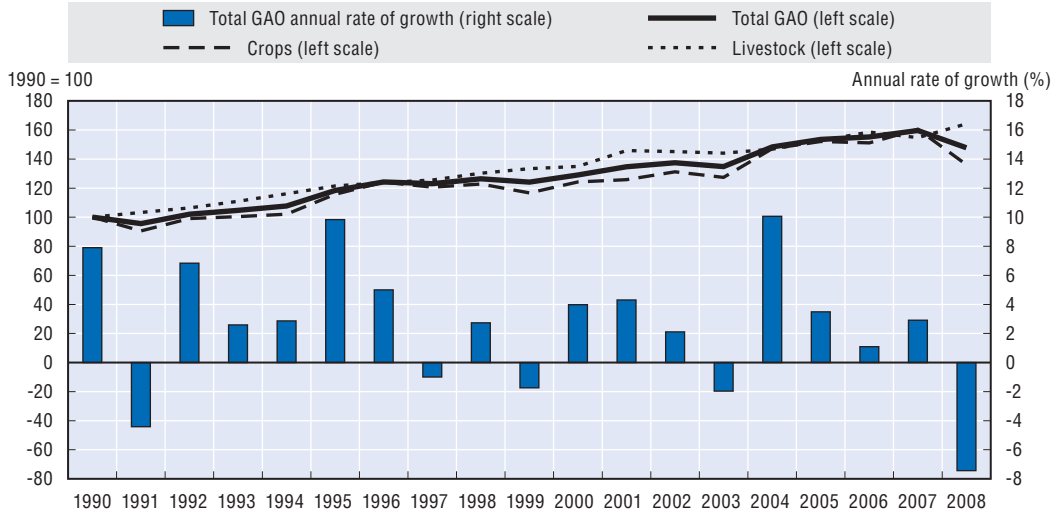
of export receipts, and by the rise of interest rates, contributing to higher input costs. Since 2000 output prices have been increasing at a faster rate than inflation – due in part to a more favourable exchange rate (the depreciation of the ILS against the euro) that helped to improve returns from exports to the European Union, the main export market.

Farm output

While the terms of trade have been generally declining, the productive performance of Israeli agriculture has been strong. Between 1990 and 2007, agricultural output increased by 60%, with separate production indices for livestock and crops both recording a 60% increase. In comparison, the quantity of inputs used has increased by just over 20%, thus indicating significant productivity improvements.

Breaking down the overall increase in output volume into annual changes, large year-to-year fluctuations can be observed (Figure 1.6). This is primarily caused by variation in climatic conditions, which has an important impact on crop production. Growth in livestock production is far more stable. For example, in 2008, crop output fell by around 15% leading to a fall in total output by more than 7% despite continued strong performance in livestock production. Annual growth in the volume of agricultural production has averaged 2.2% since 1990, with no significant change in the rate between the 1990s and 2000s. Increasing agricultural exports are responsible for nearly half the increase in output value observed since 2000 (Finkelshtain and Kachel, 2006).

Figure 1.6. **Annual growth rates in agricultural output volumes, 1990-2008**



Source: CBS, *Statistical Abstract of Israel 2009*.

Crop production accounts for almost 60% of output value with livestock products contributing just above 40% (Table 1.1). While the contribution of livestock rose during the 1990s, the value of crop production has increased at a faster rate during the 2000s, primarily due to the large expansion in exports. Fruit (including citrus) and vegetables (including potatoes and melons) are the most important crops contributing almost 50% of the total output value, while field crops contributed just 7% in 2008 – slightly less than in 1990. Poultry and cow's milk are the most important livestock products.

Table 1.1. **Changes in the composition of the value of agricultural production, 1990-2008 (%)**

	1990	2000	2008
Crops	***60.8***	***55.8***	***58.3***
Fruit plantations and other	29.7	26.5	24.1
Vegetables, potatoes and melons	16.7	18.1	23.6
Field crops	8.0	7.3	7.0
Flowers and garden plants	6.3	4.0	3.6
Livestock	***39.2***	***44.2***	***41.7***
Milk	13.9	13.2	11.6
Poultry	12.7	13.5	12.3
Eggs	7.3	6.5	5.9
Cattle (meat)	2.0	4.0	5.8
Sheep, goats, pigs and other	1.3	3.9	4.1
Fish	2.0	3.0	1.9
Total	**100.0**	**100.0**	**100.0**

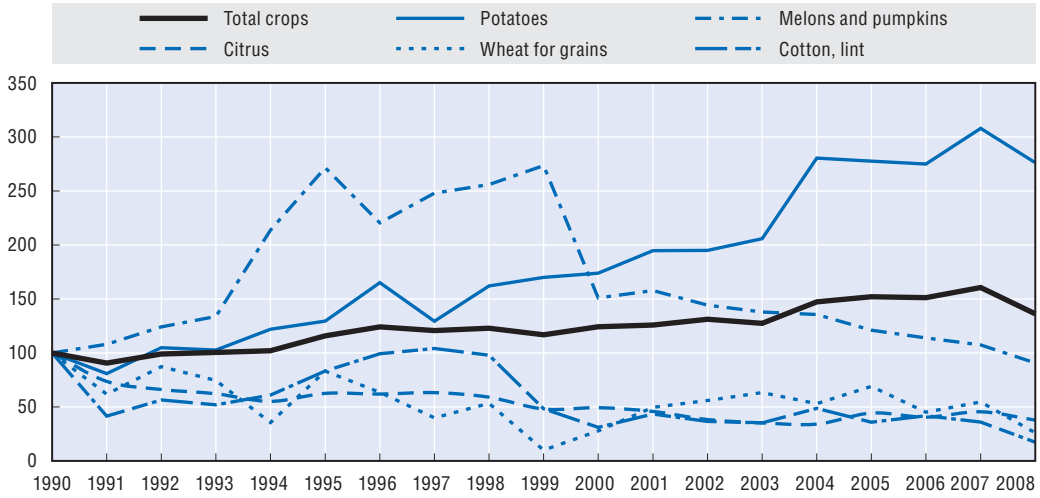
Source: CBS, Time Series-DataBank-Agriculture (for 1990); and CBS, *Statistical Abstract of Israel 2009* (for 2000 and 2008).

Israel produces a wide range of fruit, including citrus, table grapes, avocados, apples, pears, cherries, kiwis, litchi, guavas, mangoes, sweet bananas, and dates. Its varied climate enables it to harvest fruit throughout the year; this gives Israel a clear comparative advantage over many other countries. While expanding potato production is a category on its own, the main vegetables are table tomatoes, cherry tomatoes, peppers, green herbs, spring- and winter-sown watermelons and melons, and leafy vegetables. Field crops require a high degree of mechanisation. These crops are grown on about 190 000 hectares in Israel, 130 000 of which are winter crops, such as wheat for grain and silage, barley for grain, hay and grazing, and legumes for hay and seeds. Some 60 000 hectares are planted with summer crops, such as cotton, sunflowers, chickpeas, green peas, beans, corn, industrial tomatoes, groundnuts, and watermelon for seeds. Most of these crops are irrigated using modern technologies.

The development of total crop production, while more erratic than total livestock production, has been considerably smoother than for most individual crops. In the short-term, some crops are very susceptible to climatic conditions. The land used for annual crops (vegetables, field crops and some flowers) in any particular year is heavily influenced by the availability of water. The average yield of wheat harvested per hectare varies between 2.5 and 6.2 tonnes depending on the amount of annual rainfall and the region. Over the long-term there have been some important changes in crop production due to changing market conditions. The traditional fruit (citrus) and field (wheat and cotton) crops have all experienced a significant decline in production, with output levels in 2008 less than half the level in 1990. Melon and pumpkin production rose rapidly during the 1990s, but fell just as quickly during the 2000s. In turn, the quantity of potatoes produced in Israel has tripled since 1990 (Figure 1.7).

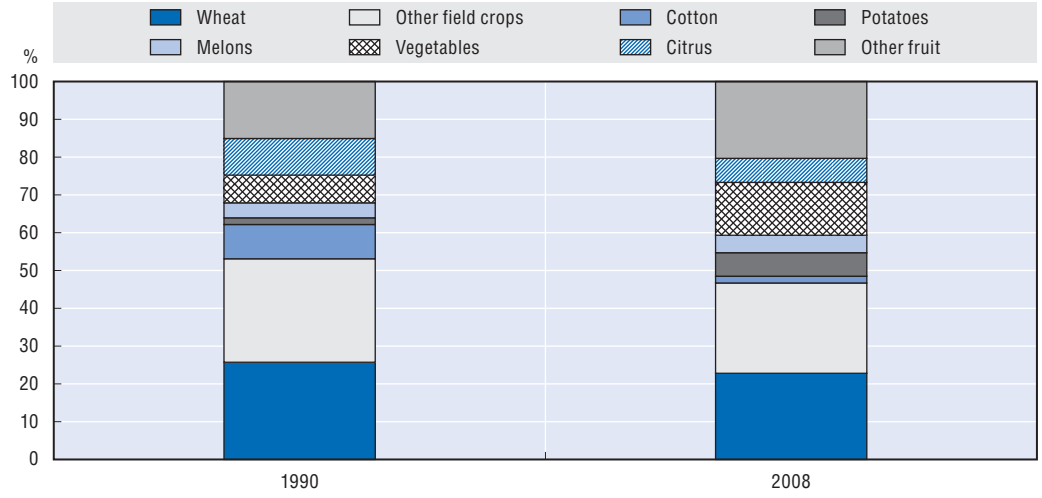
These changes in the pattern of crop production are also evidenced by changes in the area utilised for the various crops (Figure 1.8). The most significant change in the pattern of crop production has been the expansion in the area producing vegetables, potatoes and melons. Its share has increased from 13% to 25% of the total crop area, with the area of land used for these crops increasing by almost 60%. The area in potato production alone increased from 6 300 to 18 000 hectares in 1990-2006.

Figure 1.7. **Changes in crop production, 1990-2008 (1990 = 100)**



Source: CBS, *Statistical Abstract of Israel 2009*.

Figure 1.8. **Composition of crop area, 1990 and 2008**



Note: 2006 data instead of 2008 for potatoes, melons and vegetables.

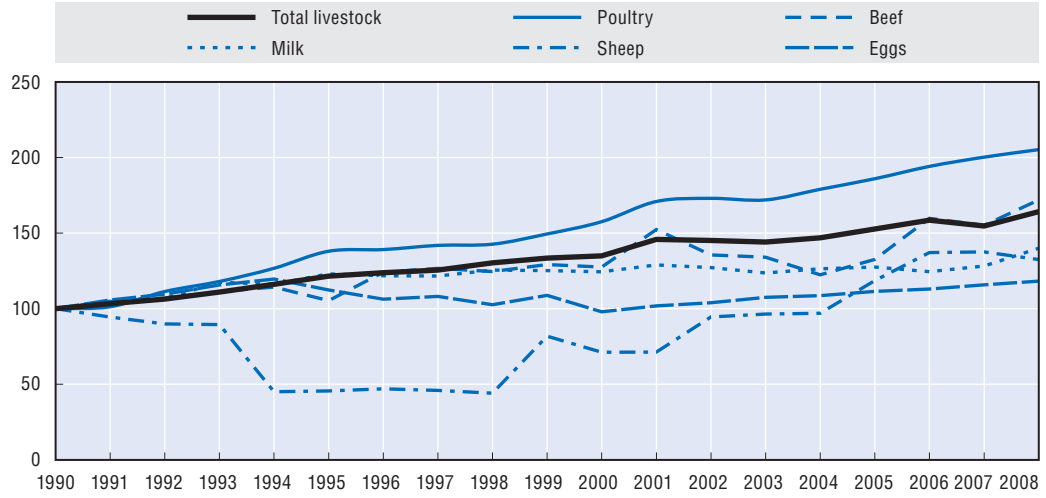
Source: CBS, *Statistical Abstract of Israel 2009*.

In terms of fruit production, there has been a decrease in citrus plantations with an increase in the planting of other fruits. The area employed for citrus production fell by 40% between 1990 and 2000, and a further 18% between 2000 and 2006, continuing a long-term trend away from citrus production in Israel. During the 1990s the area used to produce apples, peaches, table grapes, avocados, and mangoes all expanded, but then contracted during the 2000s.

Like citrus, the area used to produce the traditional field crops of wheat and cotton fell during the 1990s, with land either going into other field crops such as sunflowers and chickpeas or out of field crop production. However, since 2000 the area sown to wheat has slightly increased partly due to stronger prices.

In comparison to crop production, there has been a more steady increase in livestock production (Figure 1.9). The volume of production has risen in all the major sectors, although at significantly different rates. The differences in rates of growth in livestock output are also reflected in the changes in livestock numbers, with the number of broilers more than doubling between 1990 and 2008 and the number of milk cows and laying hens increasing by 17% each. High automation and strict hygienic conditions contribute to production of large quantities of a wide variety of poultry products. The sheep and goat milk subsectors have developed significantly in recent years, driven by a growing demand for locally produced cheeses. Israel's production of beef is much more modest as limited pasture area severely limits its capacity. Approximately 40% of the country's fresh red-meat requirement is supplied from the dairy herd. The rest of the local market demand is met by beef-breed herds located in grazing areas and by imported live bovine animals for slaughtering.

Figure 1.9. **Changes in livestock production, 1990-2008 (1990 = 100)**

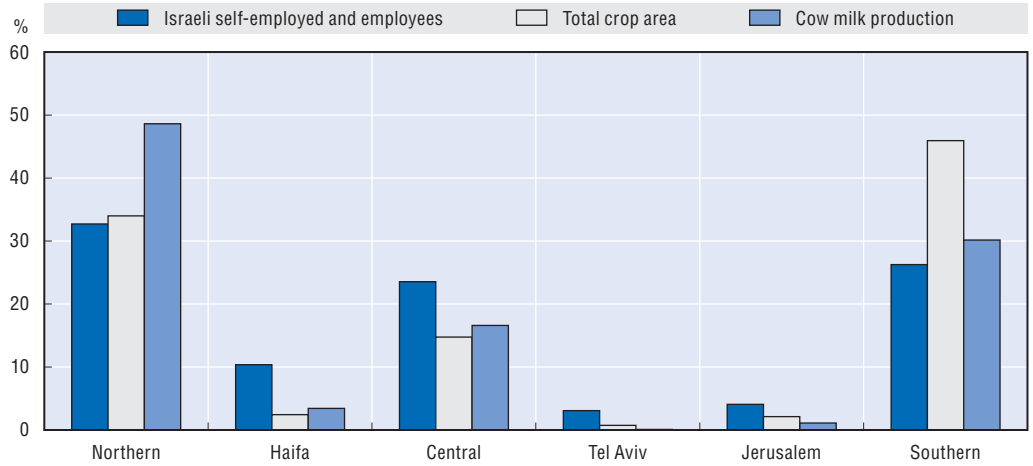


Source: CBS, *Statistical Abstract of Israel 2009*.

Israel's agricultural labour force, crop area and livestock production are spread unevenly across the regions (Figure 1.10), reflecting to a large extent the geographic distribution of co-operative farms across the country. Over 80% of the area used for crop production is concentrated in the northern and southern districts, with another 15% in the central region.

The distribution of specific crops varies from region to region, reflecting various climatic and land conditions. In terms of area, some 70% of fruit plantations are located in the northern region; 60% of the land used for field crops, vegetables, potatoes and melons is located in the south; while 56% of citrus orchards are located in the central region. Livestock production is concentrated in the northern region which accounts for almost half of Israel's milk production, around half of broiler production and almost 70% of egg production. The southern region contains a large proportion of the national sheep and goat herds. Over 10% of egg production and 8% of broiler production takes places in the Jerusalem region.

Figure 1.10. **Distribution of employment, crop area and milk production by district, 2007**



Notes: Excludes employment, crop area and cow milk production in Jewish localities located in Judea and Samaria. Employment of Israelis only, both employees and self-employed. Does not include employment of Palestinians or other foreign workers.
Crop area for 2006. Crop area excludes area used for flower production.
Crop area and milk production for Tel Aviv estimated at 50% of the figure provided for crop area and milk production for the combined Tel Aviv District and Rishon Leziyyon Region.
Source: CBS, *Statistical Abstract of Israel 2008*.

Farm employment

A large portion of Israeli agriculture can be characterised as intensive, requiring significant labour inputs for growing, harvesting and packaging of produce. Between 1990 and 2008, the total number of persons employed in agriculture (including self-employed, *kibbutz* members, unpaid family members, Israeli employees, foreign workers and Palestinians) varied from 70 000 to 80 000 persons (Figure 1.11).[2] Of those employed on farms some 23 000-26 000 are foreign workers, mostly from Thailand, who are granted labour permits for agriculture only.

In addition to those working directly in agriculture, the broadly defined agro-food sector employs 70 000 workers in production of agricultural inputs and some 100 000 in the "secondary circle of employment" linked with agricultural production. Thus, the overall level of employment related to agriculture amounts to some 240 000 workers which is almost 9% of the total labour force (MARD, 2009).

While the total number of persons employed in agriculture remained relatively stable, the composition of the labour force had changed dramatically. There was a significant decline in the number of persons classified as "self-employed", including members of *kibbutz* and unpaid family members. The number of self-employed fell from over 44 000 (62% of the agricultural workforce) in 1990, to 19 000 persons (24%) in 2008. In 1990 there were three paid workers for every five self-employed; in 2008 there were more than three paid workers for each self-employed person in agriculture.

There has also been a significant change in the composition of farm employees. In the early 1990s, around 18 000 Israeli employees worked on farms, comprising two-thirds of the paid labour force. The remaining one-third comprised some 9 000 Palestinians who worked as day labourers, commuting each day to work from the West Bank or Gaza Strip. Since then the number of Israeli employees (including Israeli Arabs) has increased by 60%

Figure 1.11. **Level and composition of employment in agriculture, 1990-2008**



Notes: Palestinian employees relate to day workers from the West Bank and the Gaza Strip.
Israeli employees include Israeli Arabs.
Self employed includes *kibbutz* members and unpaid family members.

Source: OECD Secretariat based on CBS, *Agriculture in Israel 2006-2007*; CBS, *Statistical Abstract of Israel 2002 and 2009*; BOI, *Annual Report 2003*.

to reach 28 600, but their share in the paid labour force declined to below 50%. The number of Palestinians employed on Israeli farms, while averaging around 8 500 during the 1990s, has fallen off dramatically at the beginning of the 2000s, but increased slightly in recent years and they now comprise 11% of the paid labour force. Meanwhile, there has been a significant increase in the number of foreign workers, rising from practically zero in 1990 to 24 500 in 2003. Although the number fell in 2004, it has since risen again to a peak of 25 900 in 2008, representing one-third of the total number of persons employed in agriculture and above 40% of paid workers.

The increase in the number of foreign workers employed in agriculture, mainly from Thailand, took place when their predecessors, Palestinian day labourers, started to be perceived as a security threat or simply were not allowed to cross check points due to mounting political tensions and violence. Political and public pressure by farmers forced the government to allow a limited number of workers from Thailand to come in on permits that allow them to work for a specified period of one year renewable up to five years maximum. In a short time, farmers discovered that these foreign workers were very efficient and reliable. They also turned out to be cheaper to employ than Israelis. While they are covered by the minimum wage legislation and are eligible for supplementary overtime payments, their average wages are lower than those of Israeli employees. In addition, they are readily available as they live on-farm and they are willing to work long hours. The influx of migrants also caused a decrease in the wages of Israeli employees in agriculture relative to wages in manufacturing. Hence, the employment of the Thai workers reduced labour costs in agriculture.

Within an overall quota of foreign workers destined to work in agriculture, at 28 500 in 2008, permits for employing foreign workers on each farm are allocated by the Ministry of Industry, Trade and Labour according to standards fixed by the Ministry of Agriculture and Rural Development (MARD). As the demand for foreign workers significantly exceeds the overall quota, the Planning Authority of MARD has established different criteria for

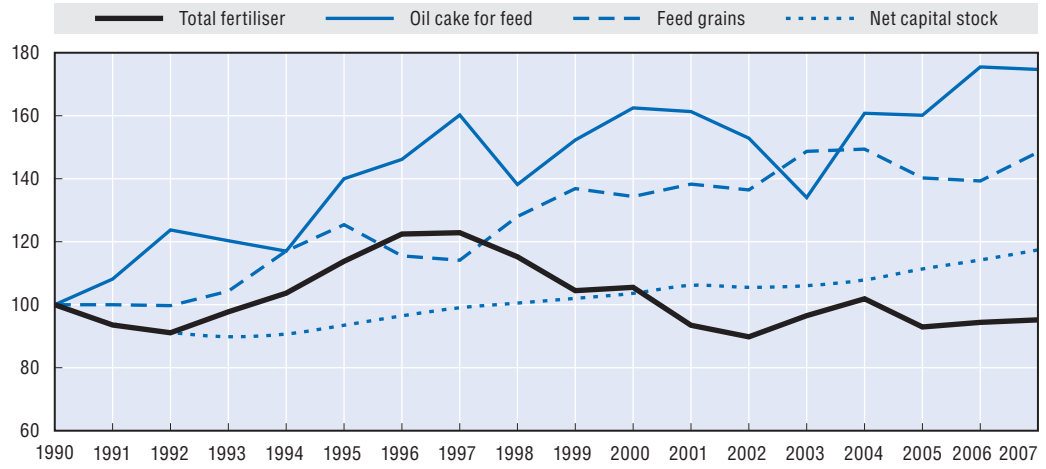
allocation of permits for 600 different crops and livestock branches, according to the labour norms established for each branch. An adjustment factor is applied, which gives preferences to smaller and medium-sized farms compared to the larger ones (MARD, 2009).

As part of the government's attempt to increase the employment of Israelis during the economic slowdown in 2001-02, an attempt was made to increase the cost of employing foreign workers by imposing an annual "permit fee" of ILS 1 000 per worker on top of the standard ILS 1 000 "request impost", still far lower than the ILS 4 000 paid per worker in construction (BOI, 2003). While it led to a temporary drop in the number of foreign workers, the number has increased again since then. Additional entries of 3 000 foreign workers were allowed in 2008, on the condition that farmers hire one Israeli worker for each foreign worker admitted. The Israeli hiring obligation was however not enforced. To reduce the number of foreign workers in agriculture, the overall quota is to be reduced to 18 900 by 2015. In turn, farmers will be eligible for up to 40% compensation for investments in mechanisation substituting for labour (Chapter 2).

Capital investment and input use

During the first half of the 1990s, the capital stock held on Israeli farms continued the decline that it began in the mid-1980s due to the serious financial difficulties many farms faced. From the mid-1990s on however, the net capital stock has shown a steady increase, flattening off briefly during the economically difficult years of 2002-03 (Figure 1.12). A number of factors possibly explain this development. First, after running down the capital stock for ten years or so, farmers needed to invest in order to keep producing. Second, the opening up of the labour market to foreign workers created a cheap labour source. Rather than being substitutes, labour and capital are often complements in the production of fruits and vegetables. In particular orchards and greenhouses are labour-intensive enterprises in which the inputs of capital and labour mostly increase together. Third, the high-tech transformation of the Israeli economy in general created a wide range of new

Figure 1.12. **Changes in capital and selected input use, 1990-2007 (1990 = 100)**



Note: Net capital stock equals gross capital stock less cumulative annual depreciation up to the surveyed year. Capital stock includes livestock.

Source: CBS, *Agriculture in Israel 2006-2007*.

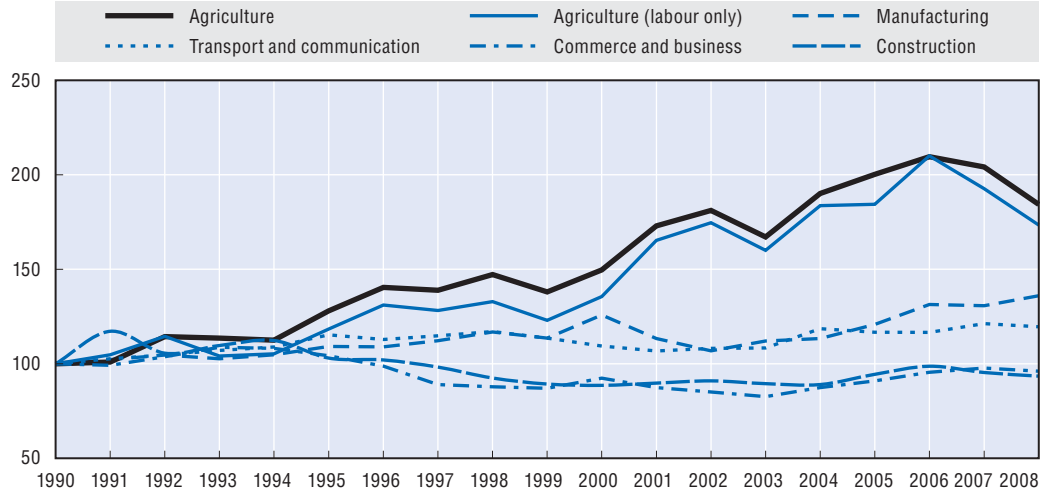
technologies requiring investment. In terms of changes in the type of capital stock, there has been a large increase in capital invested in "agricultural structures", while the value of livestock has decreased as a proportion of the total capital stock.

Total use of fertilisers tended to increase in the years up to 1997, but then declined by about one-fourth by the beginning of the 2000s. As crop production continued to increase, this decline indicates an important improvement in the efficiency of fertiliser use. Meanwhile, the use of oil cake for feed and of feed grains tended to increase roughly in line with the rise in livestock production.

Productivity

By a number of different measures, Israeli agriculture can be considered highly productive. For example, while in the early 1950s, one full-time agricultural employee supplied food for 17 people, by 2005 this number had increased to 95 (MARD, 2006). Between 1990 and 2006, total factor productivity (TFP) in agriculture doubled, increasing at a faster rate than in any other sector of the Israeli economy (Figure 1.13). While TFP normally increases more rapidly in agriculture than in other sectors, the rate of growth in Israel is particularly high. Especially, between 1999 and 2006 it grew at high rates due to a reduction in the labour force while output kept expanding. The long-term increase in productivity is the result of a number of factors including advances in technology due to research and development, agricultural training, the professionalism and high managerial skills of Israeli farmers, and their ability to adopt innovative technologies (MARD, 2009).

Figure 1.13. **Total factor productivity in agriculture and other sectors, 1990-2008 (1990 = 100)**



Source: BOI, *Annual Report 2008*, "Statistical Appendix", Chapter 2 "Output, Uses and Principal Industries".

A recent study suggests that technical progress (calculated as the increase in value added that is not accounted for by changes in land, labour and capital) is responsible for most of the increase in value added in agriculture, especially since the 1990s (Kimhi, 2004). For example, Israel's dairy industry employs advanced technologies that have changed the industry through automation, bringing it under strict control. A flow-metre is attached to the milking equipment, automatically measuring the milk flow and milking duration. It is also used as a means for early detection of mastitis, an udder infection. A tag containing an

"activity-metre" is used to identify the cow and transmit information to the computer regarding the cow's general activity, detecting sick cows as well as those in estrus (MARD, 2006). Israel has also been innovative in developing salt and drought resistant strains of fruits and vegetables through the creative and patient combinations of germplasm (Tal, 2007).

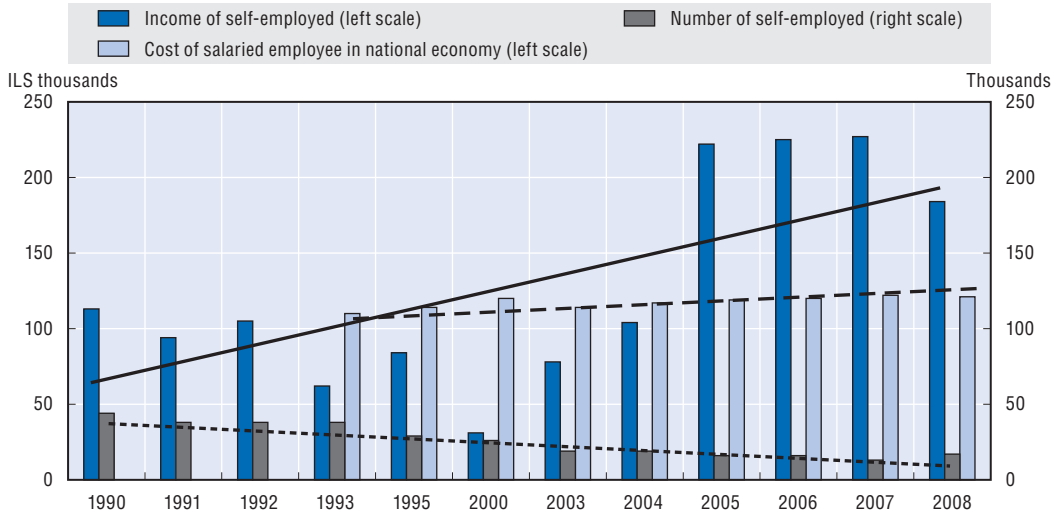
There has also been a significant improvement in the efficiency of water use with a fourfold increase in the volume of crops produced from each cubic metre of water between 1950 and 2007. Such growth was achieved due to economic incentives, such as progressive water prices depending on the amount of water used, and spectacular advancements in technologies applied such as the drip irrigation systems bringing water in precise quantities, with optimal fertiliser concentrations directly to the root zones of plants (MARD, 2009; Chapter 3).

Israeli agriculture has some of the highest yield rates in the world. A number of leading growers have succeeded in reaching peak yields in Israel, in particular for a wide range of fruit. Average milk production per cow has increased two and half times since the 1950s, from 3 900 kg annually to 11 200 kg in 2005. Fat and protein percentages increased dramatically during these years, reaching the highest level ever in Israel in 2005 (3.65% fat and 3.20% protein in each litre of milk produced). The annual amount of fat and protein production per cow in Israel is the highest in the world (over 750 kg) (MARD, 2006).

Farm incomes

There has been a marked improvement in income per self-employed person in farming (Figure 1.14). During the 1990s the average income per self-employed person was around ILS 100 000 (USD 33 000). By 2005-07, the average return in real terms had increased by more than 120% to around ILS 225 000 (USD 51 700), before falling to around ILS 180 000 in 2008 (but increased in USD terms to USD 58 500 due to the appreciation of the ILS). While the value of output has certainly increased as a result of higher production levels and output prices that have been relatively favourable for agricultural producers during the

Figure 1.14. **Income and number of self-employed farmers, 1990-2008**



Note: Income per self-employed in agriculture is defined as the total value of output less cost of inputs, depreciation, compensation to employees and the cost of interest rate, divided by the number of self-employed in agriculture.
Source: MARD, 2009.

mid-to-late-2000s, the most important long-term factor contributing to the increase in income per self-employed has been the exit from agriculture of a large number of self-employed during the period and a strong increase in productivity discussed in the preceding section.

While until 2004, the income per self-employed person in agriculture was significantly below the average for a salaried employee, used in Israel as a reference, *e.g.* for fixing target prices for eggs and milk, the situation reversed in 2005-07 with agricultural incomes almost twice higher than those used as the reference. In 2008 the gap diminished, but still agricultural incomes were about 50% higher (Figure 1.14). While income per self-employed improved significantly over the last decade and remained high in recent years, incomes earned by agricultural employees remained relatively low as demonstrated by a 35%-40% lower average wage per agricultural employee compared to the national average wage in 2005-07 (CBS, 2008a).

Food consumption

The level of food consumption in Israel is high and increasing. Measured in energy terms, average food consumption, defined as the food available to the public, is high at 3 643 calories per capita per day in 2006, about the same as in France. The number of calories per capita per day reached 3 000 in 1970 and was relatively steady at this level during the 1970s and 1980s. During the 1990s and 2000s it has shown a steady rise. Similar trends emerge in terms of the level of protein and fat consumed per day. The per capita level of protein consumption per day increased from 91.5 g in 1970 to 92.2 g in 1980 and 97.4 g in 1990. It has since increased to 115 g per day in 2006. The per capita level of fat consumption per day increased from 104 g in 1970 to 112 g in 1980 and 117 g in 1990. It has since increased to over 150 g per day in 2006 (CBS, 2008a).

According to the latest available food consumption data provided by the FAO, meat consumption per capita in Israel was at 97 kg in 2003, increasing from 56 kg in 1990 (Table 1.2). Consumption of poultry meat and eggs per capita, on a ready-to-cook basis, is among the highest in the world. Approximately 36 kg of chicken, 11 kg of turkey, and 240 eggs are consumed per capita in Israel annually. Israel is the world's largest per capita consumer of turkey meat. Milk consumption per capita has been slightly falling, but still reaches 180 litres per year in recent years (MARD, 2006).

Table 1.2. **Food consumption in Israel, 1990-2003 (kg/person/year)**

	1990	1995	2000	2003
Cereals – excluding beer	160	148	142	149
Vegetables	196	248	235	221
Fruit – excluding wine	154	126	126	115
Oilcrops	15	11	7	7
Sugar, raw equivalent	42	44	51	38
Meat	56	66	93	97
Milk – excluding butter	208	218	207	192
Eggs	17	13	10	9

Note: The figures in the table are derived from the FAO commodity balances and reflect the gross availability of food products per capita and do not necessarily indicate the actual amounts of food consumed by individuals.
Source: FAOSTAT, FAO, 2009.

Food, including fruits and vegetables, is decreasing as a share of consumption expenditure in Israeli households. In 1999, food consumption represented 17.3% of expenditure; by 2004, this had declined to 16.3%, though a rise in food prices in 2006 pushed it up again slightly to 16.6%. Expenditure on meals away from home tends to increase, with the share rising from 2% in 1999 to 2.3% in 2006 (CBS, 2008a).

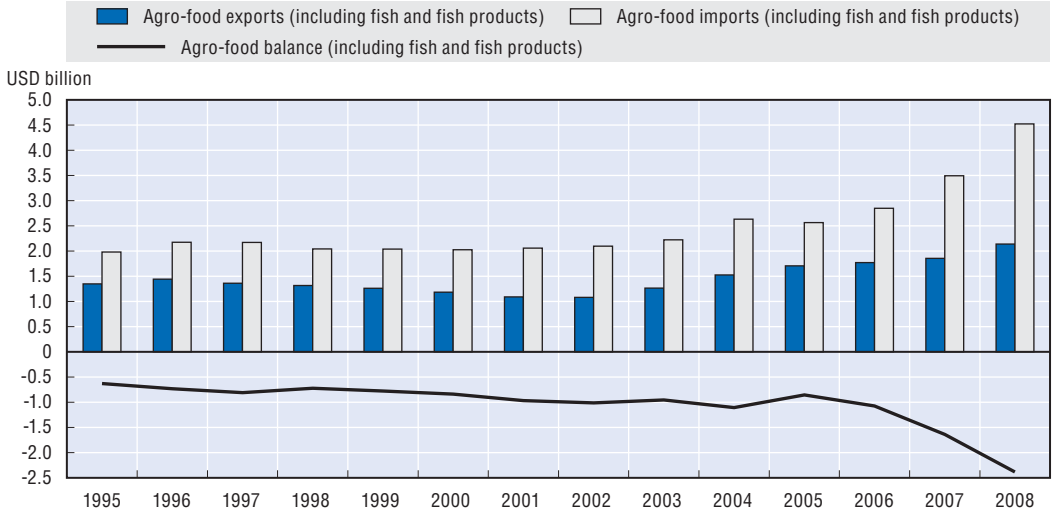
During the last decade, an increasing share of consumers preferred to buy their products through supermarket chains (about 55%) instead of through the traditional channels of open markets and small grocery stores. Except for meat, kosher certification is not an obligatory requirement for importing food into Israel (Chapter 2). However, non-kosher products have a much smaller market share as about two-thirds of consumers prefer kosher food products (USDA, 2008a).

1.3. Agro-food trade flows

Overall agro-food trade performance

Despite a large increase in the value of agro-food exports, in particular in the 2000s, Israel has been a net importer at around USD 1 billion a year (Figure 1.15). In recent years, the net deficit has even tended to increase, mostly due to a stronger increase in prices for imported than for exported agro-food products, but also due to a significant fall in crop production in 2008.

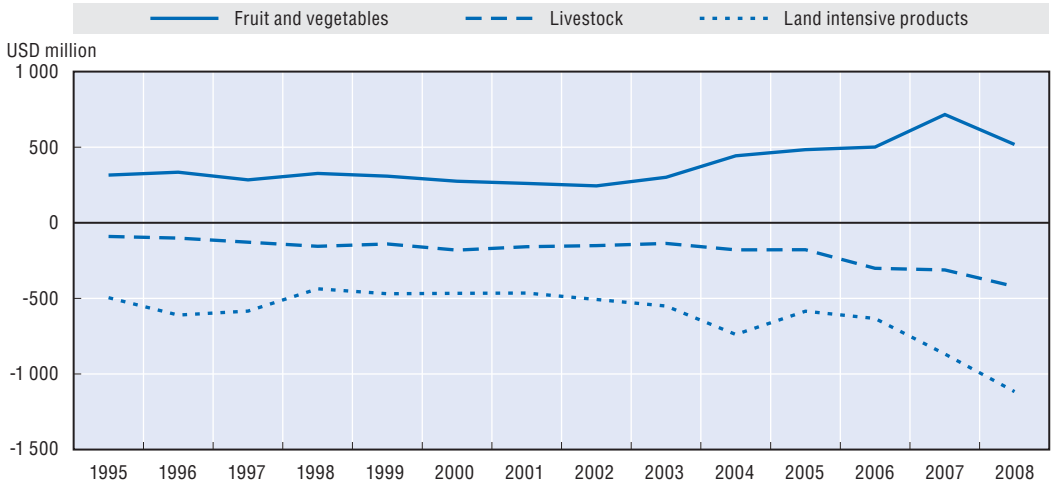
Figure 1.15. **Israel's agro-food trade, 1995-2008**



Source: UN, *UN Comtrade Database*, 2009.

Israel imports almost all its grains from land abundant countries. It also imports meat, fish, sugar and a few other items of lesser importance. Israel's agricultural exports reflect its advantages in season and expertise – mainly winter vegetables, flowers, and citrus in addition to seeds of improved variety (Figure 1.16, see also Kislev, 2003). Israel has also been a large exporter of agricultural technologies and inputs, which generated USD 2.2 billion in 2007, thus even more than total agro-food exports (Box 1.1).

Figure 1.16. **Net trade in basic groups of agro-food commodities, 1995-2008**



Source: UN, *UN Comtrade Database*, 2009.

Box 1.1. **Exports of agricultural inputs and technologies**

Agricultural technologies and their use in Israel have developed alongside a burgeoning export sector and have contributed to the development of agriculture itself. Israeli agriculture has been a country-wide experimental laboratory for the agricultural technologies (inputs) industry. In the quest of Israeli farmers and agronomists searching for new technologies to cope with water constraints, a water-related industry was born, with over 100 companies involved in the field of irrigation, fertigation and filtration equipment.

In 2007, the exports of these technologies amounted to USD 2.2 billion, which was more than the entire value of Israeli exports of fresh and processed produce combined. Almost half of this value relates to the exports of fertilisers and pesticides. The other exported products include primarily greenhouse technologies, mini-irrigation and drip technologies, control and measurement equipment both for crops and livestock production, seedlings and seeds, and export services such as development of agricultural projects. About 80% of the irrigation equipment manufactured in Israel is exported.

Israel's dairy-product and technology exports include advanced and computerised milking and feeding systems, cow-cooling systems (to reduce heat stress on cows in Israel's hot and dry summer), as well as milk processing equipment (especially mini-dairies), consultancy, and joint international project development. Israeli-Holstein genetic sources have the potential for better adaptation and performance under hot climatic conditions, a fact that makes import of heifers and frozen semen from Israel very attractive to countries with harsh climatic conditions.

There are more than 200 companies and entrepreneurs registered with the Agricultural, Water and Environmental Technologies Division at the Israel Export and International Co-operation Institute (IEICI). All these firms specialise in this field and export their products and services throughout the world. These exports are based, in some cases, on activities of companies that integrate technologies and know-how in turn-key projects for end users to developing countries. They occasionally collaborate with the MARD Center for International Agricultural Development Co-operation (CINADCO), which provides technical assistance to such countries.

Source: MARD, 2006 and MARD, 2009.

The Israeli agro-food sector has been strongly integrated with international markets as demonstrated by a high ratio of agro-food exports to the value of agricultural net domestic product (ANDP) at around 80%-90% and that of imports at 130%-170%, significantly more than the averages for the whole economy (Table 1.3).

Table 1.3. **Agro-food sector's integration with international markets, 1995-2008**

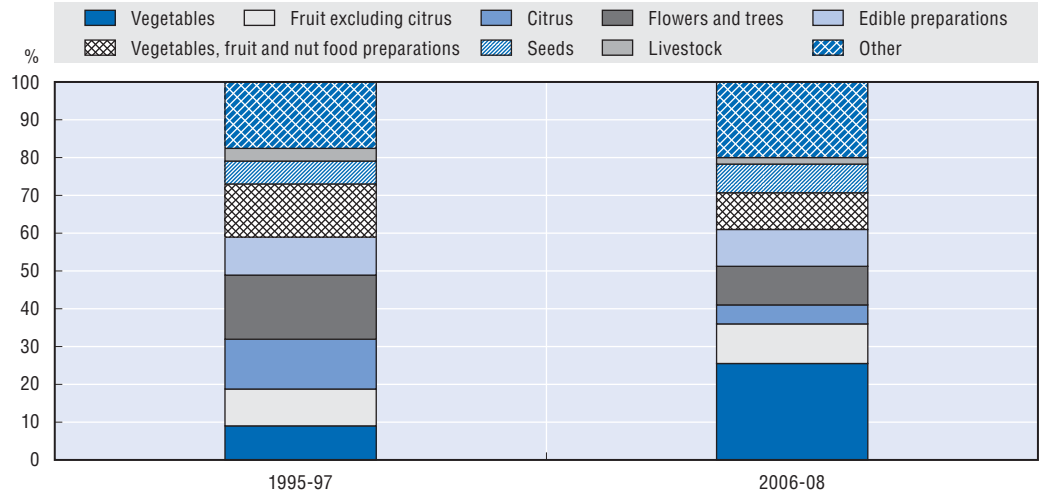
		1995	2000	2005	2006	2007	2008
Agriculture, Net Domestic Product (ANDP), current prices	USD million	1 490	1 505	1 992	1 998	2 160	2 631
Agro-food exports	USD million	1 349	1 185	1 708	1 772	1 855	2 141
Agro-food imports	USD million	1 981	2 026	2 565	2 849	3 495	4 525
Balance	USD million	–631	–840	–857	–1 077	–1 640	–2 384
The coverage degree of imports by exports	%	68	59	67	62	53	47
Share of agro-food trade in total trade:							
Exports	%	7	4	4	4	3	3
Imports	%	7	6	6	6	6	7
Ratio of agro-food exports to ANDP	%	91	79	86	89	86	81
Ratio of agro-food imports to ANDP	%	133	135	129	143	162	172
Ratio of total exports to total Net Domestic Product	%	26	33	43	42	43	40
Ratio of total imports to total Net Domestic Product	%	38	37	45	43	45	42

Source: OECD calculations based on CBS, *National Accounts 1995-2007*; UN, *UN Comtrade Database*, 2009.

Composition of agro-food trade

The predominant export products are crops, in particular vegetables, potatoes, seeds, tomatoes, flowers, and fruit, which are mainly destined for European markets (Figures 1.17 and 1.20). Livestock production, heavily dependent on imported grains, is predominantly destined for the domestic market and livestock exports accounted for just 2% of total agro-food exports in 2006-08. Crop exports are subject to wide fluctuations from year to year because of climatic conditions, with the value of exports varying even more than value of output. Over time a couple of important trends can be observed.

Figure 1.17. **Composition of agro-food exports, 1995-97 and 2006-08**



Source: UN, *UN Comtrade Database*, 2009.

First is the long-term downward decline in citrus exports. The citrus industry played a major role in the development of the economy and was initially the dominant export industry. In 1950, exports of fresh citrus fruit contributed nearly half of total exports and almost 100% of agricultural exports. In 1970, exports of fresh citrus fruit still accounted for 11% of total exports and 66% of agricultural exports. During the 1960s and 1970s, Israel was one of the main suppliers of oranges and the main supplier of grapefruit to European markets. Market shares of Israeli citrus in western Europe in the mid-1970s were close to 30% for oranges and about 65% for grapefruits, but these have fallen substantially since then (Kachel *et al*., 2004). In 2006-08 citrus exports accounted for just 0.2% of total exports and 5% of agricultural exports, although it still plays an important role in meeting demand in Scandinavian countries. There has also been a change in the type of citrus produced, with new varieties, primarily easy peelers, replacing the traditional ones.

The second important trend is the expansion of other horticultural exports. Israel's climate, together with extensive greenhouse production, enables production of vegetables, fruit and flowers during the winter off-season, especially for export to European markets. The export of vegetables in recent years has increased mainly due to the increases in pepper and potato exports (MARD, 2006).

Some 18% of total agricultural output is exported as commodities (fresh), including 30% for crops and less than 1% for livestock (Table 1.4). Almost all livestock production goes through a degree of domestic manufacturing, principally for domestic consumers and only marginally for international markets.

Table 1.4. **Agricultural output by purpose, 2008**

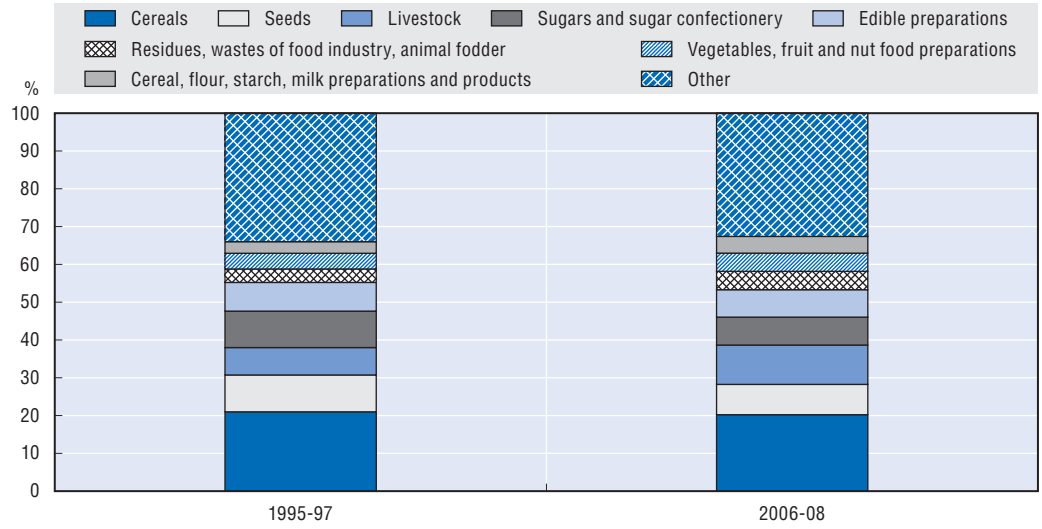
	Value, ILS million	Share of value of output			
		Domestic consumption	Domestic manufacturing	Export	Intermediate produce and miscellaneous
Agriculture – total	**25 108.5**	**38.1**	**35.9**	**17.8**	**8.2**
Crops	***14 647.0***	***56.4***	***5.0***	***30.1***	***8.5***
Field crops	1 766.9	14.4	7.2	39.5	38.9
Vegetables, potatoes and melons	5 937.6	66.8	4.6	27.8	0.8
Citrus	1 313.7	43.8	5.8	45.6	4.7
Plantations, excluding citrus	3 947.9	78.7	6.1	11.1	4.1
Flowers and garden plants	898.3	39.0	. .	61.0	. .
Miscellaneous crops	782.6	0.6	1.9	60.4	37.1
Livestock	***10 461.5***	***12.5***	***79.1***	***0.6***	***7.8***
Poultry	4 582.3	15.9	67.6	0.1	15.8
Cattle	4 217.0	0.7	99.3	. .	. .
Sheep and goats	895.3	9.7	90.3	. .	. .
Fish	482.0	88.0	. .	12.0	. .
Miscellaneous	284.9	14.9	64.0	. .	21.1

Source: CBS, *Statistical Abstract of Israel 2009*.

The main agricultural imports are cereals, bovine meat, oilseeds, sugar, tobacco, fish, and tropical products such as cocoa for further processing by the food industry. Import of fresh and processed produce has been rising gradually during the last decade, both in terms of the amount and variety. Imports have been increasing as a result of market opening multilateral commitments under the WTO, bilateral trade agreements and

unilateral liberalisation of imports. Net imports of cereals, sugar and beef account for around 90%, 90% and 50%, respectively, of total domestic use of these products. In turn, Israel is practically self-sufficient in the production of milk, poultry and eggs (CBS, 2008a). In contrast to the agro-food exports, the composition of agro-food imports has not changed significantly over the last decade (Figure 1.18).

Figure 1.18. **Composition of agro-food imports, 1995-97 and 2006-08**



Source: UN, *UN Comtrade Database*, 2009.

Destination and origin of agro-food trade

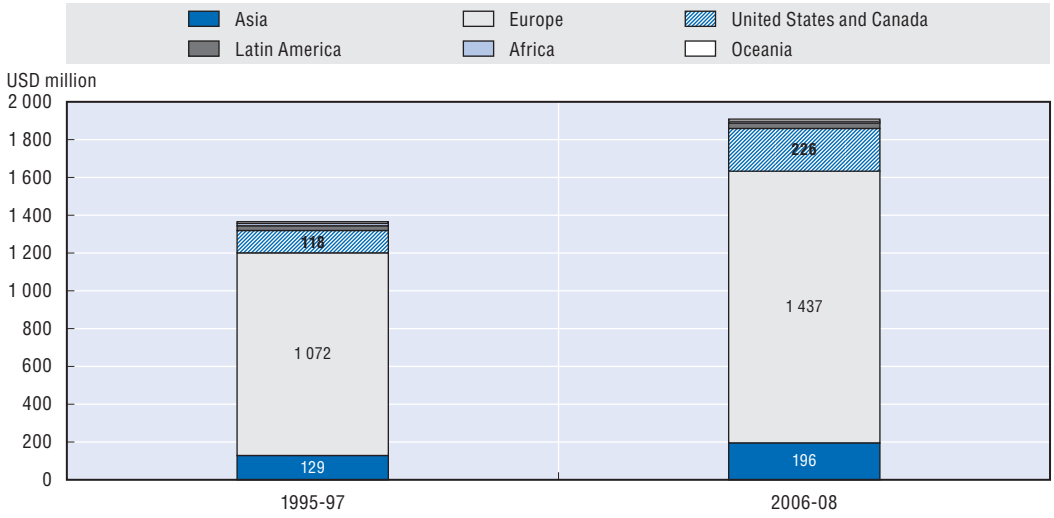
Most of Israel's agro-food trade is conducted under various preferential agreements (Chapter 2). The main trade partners are the EU, the US, EFTA and Mercosur. The most important export market is Europe, with the EU alone accounting for around 70% of total Israeli agro-food exports (Figure 1.19). Within the EU, the Netherlands is the key market, accounting for 17% of total agro-food exports, in particular for vegetables and flowers, most often for further transhipment to other EU countries. Other important EU export markets include the UK for vegetables, potatoes, and tomatoes; Germany for vegetables, tomatoes and cut flowers; France for avocados, potatoes and vegetables; and Belgium for vegetables, potatoes and cut flowers (Figure 1.20).

North America is the second largest export market, with the United States accounting for 11% of the total in 2006-08 (Figure 1.20). The main commodities exported are fresh and chilled vegetables, seeds, vegetable and food preparations.

The Russian Federation remains an important market for vegetables, juices and carrots, and its share in total agro-food exports was almost 8% in 2006-08 (Figure 1.20).

European countries also remain the main source of Israel's agro-food imports with the share at about 50%-55% of the total over the last decade (Figure 1.21). The share of the EU alone was at about 40% in 2006-08 with the Netherlands, the UK, Germany and France being the most important EU suppliers exporting to Israel such commodities as refined and raw sugar, cereals, bovine cuts and food preparations.

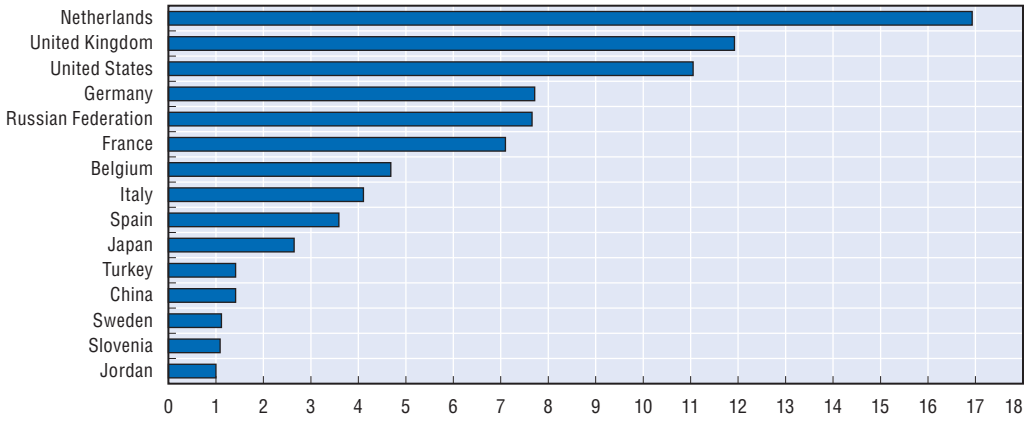
Figure 1.19. **Israel's agro-food exports by region, 1995-97 and 2006-08**



Source: UN, *UN Comtrade Database*, 2009.

Figure 1.20. **Main export markets for Israel's agro-food products, 2006-08 average**

As per cent of total agro-food exports

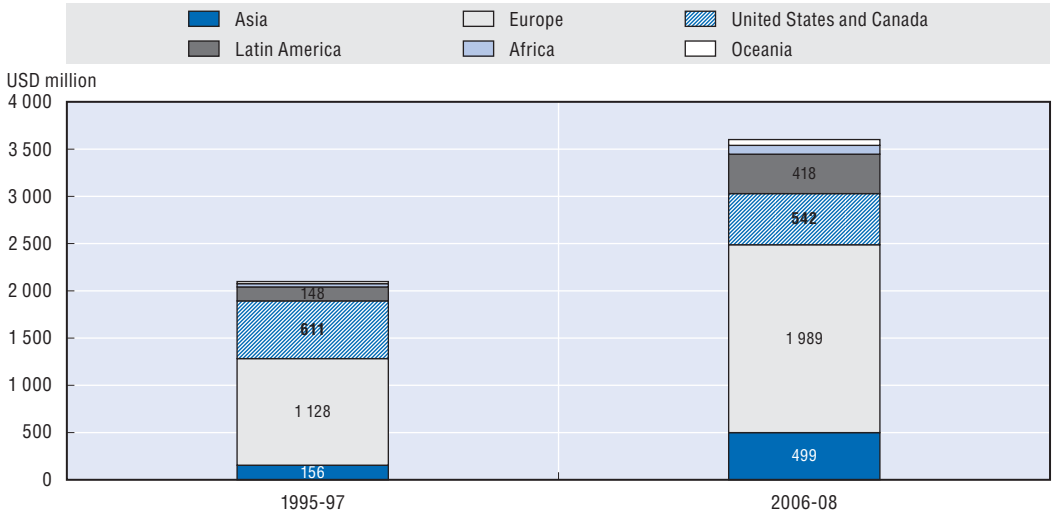


Source: UN, *UN Comtrade Database*, 2009.

While the share of the European countries in total imports remained almost unchanged, the share of the US halved from around 28% in 1995-97 to 14% in 2006-08. However, the depreciation of the USD combined with strong economic growth in Israel increased the competitive advantage of the US agriculture and contributed to an increase in Israel's agro-food imports from the US by one-third in 2008. The main commodities imported from the US are cereals, oilseeds, dried nuts and food preparations. Beef meat imports stopped totally due to kosher demands and Israeli concerns over mad-cow decease.

The share of Latin American countries in Israeli agro-food imports has increased considerably, mostly due to growing imports of bovine meat and oilseeds from the Mercosur countries. Among EFTA countries, Switzerland stands out as a provider of maize, wheat and soybeans, mainly re-exported from other countries.

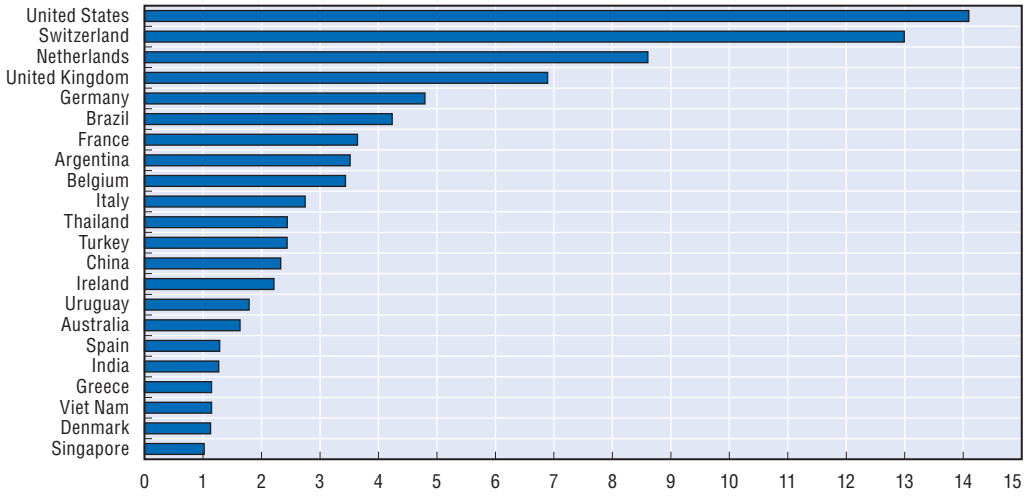
Figure 1.21. **Israel's agro-food imports by region, 1995-97 and 2006-08**



Source: UN, *UN Comtrade Database*, 2009.

Figure 1.22. **Main suppliers of agro-food products to Israel, 2006-08 average**

As per cent of total agro-food imports



Source: UN, *UN Comtrade Database*, 2009.

1.4. Structural change in the agro-food sector

Agricultural land tenure system and policies

Israel is unique amongst developed countries in that only 6% of land used for agriculture is privately owned, with the remaining 94% owned by the State of Israel, the Jewish National Fund (JNF) and the Development Authority (MARD, 2009). This high level of state ownership results from particular historical conditions within which the State of Israel was founded. One of them is the socialist ideology of the state's founders who regarded state ownership of land as a means to promote a just and egalitarian society.

The lands owned by the state and the two agencies are defined by law as "Israel lands" and are administered by the ILA under the supervision of the Israel Lands Council. ILA distributes land use rights to farmers for a symbolic fee not based on the value of the land.

Periods can vary, but most typical land use contracts for long-term allocation are for 49 years with an option for renewal. The allocation of agricultural land is carried out at the recommendation of the MARD, following an examination of applications and supported by agricultural-economic plans. The allocation of land is inseparably associated with the allocation of water quotas (Chapter 3). While providing recommendations on the allocation of land, MARD attributes great importance to the maintenance of a critical mass of farmers and takes into consideration such goals as the preservation of agricultural land, the preservation of "green lungs" areas, and the protection of national, social and public values. There are three main forms of lease contracts issued by ILA relating to agriculture (MARD, 2009):

- **Long-term allocations for settlement and agricultural activities:**
  - The allocation of land for family farms (within a pre-planned village – named *moshav*; see Box 1.2) through a long-term lease (49 years with an automatic option for renewal for three more terms of 49 years and an option transfer to heir). The allocation relies on an agricultural programme that has been approved by the Ministry. The programme determines the number of homesteads in the settlement (an average of 100 homesteads per settlement), and the standard amount of land and water per homestead. The size of a homestead varies from 2.5 to 8 hectares according to the region and the annual water quota ranges from 15 000 to 70 000 cubic metres per homestead. ILA distributes land use rights to family farms for a fee of ILS 700 (USD 172) per year per homestead, independently of its size, location and quality of land. The total area of a settlement is calculated by multiplying the number of homesteads by its standard size. Due mainly to the lack of authorised plans (programmes) dividing the agricultural land and residence into plots that could be registered as such in the land registry, most farmers in *moshavim* have no direct contract with the ILA. The lease contract is signed with the settlement co-operative (not with the individual homestead) and refers to the settlement's entire area. Farmers themselves are licensees.
  - The allocation of land to *kibbutzim* (see Box 1.2) is also through a long term lease (49 years renewable three times). There is no direct contract between the members of the *kibbutzim* and the ILA due to the collective nature of the *kibbutz*. However, houses can be leased directly to the *kibbutz* members under certain conditions.
  - Some lands that are part of the settlements area and are pre-planned for non-farm employment and industrial purposes are separated from the settlement and leased in a separate contract, in sizes that are determined according to the location of the settlement (primarily in the *kibbutzim*). The situation is different in the *moshavim*. The homestead is designated for residential uses, farm buildings and agricultural activities, while maintaining generational continuity in order to ensure ongoing operation of the farm. Subject to an approved plan, it is possible to initiate agro-tourism and other activities of a rural character within the homestead.
- **Agricultural projects:** The allocation of land, generally for long-term periods, for larger scale agricultural activities as part of an approved programme, though not in the context of a planned agricultural settlement and without an adjacent residential area. In exceptional circumstances, settlement by individuals is permitted – a settlement which is in effect a family farm unit.

- **Short-term allocation:** The allocation of land for short-term agricultural activity for the purpose of field crops, seasonal crops in open areas and grazing lands. Such allocation is carried out by committees designated for this purpose, which make decisions in accordance with criteria that take into consideration the availability of land and water.

Box 1.2. **Types of agricultural co-operatives in Israel**

A ***kibbutz*** (plural "*kibbutzim*" in Hebrew) is a collective community of 200-2 000 persons who run a large communal production unit. *Kibbutz* members jointly own the means of production and share the social, cultural and economic benefits on egalitarian principles and "according to needs". The first *kibbutz* was founded in 1908. By the end of 1948 there were 54 200 people (6% of the population) living on 1 477 *kibbutzim*. At the end of 2007 there were 267 *kibbutzim* with 123 000 inhabitants – 1.7% of the population. Almost 50% (130) are located in the Northern District, with a further 65 (24%) in the southern District. During the period 1992-98, the population of the *kibbutzim* decreased by approximately 11% while the total population increased by 19%. Agriculture was traditionally the largest branch of employment on *kibbutzim*, employing around 20% or more of workers. Since the late 1980s industry has become more important, with agriculture's share dropping to 12% by 1998. The median age of the population on *kibbutzim* is increasing at a faster rate than for the Israeli population as a whole. Many *kibbutzim* have parted ways with the Marxist utopian aspiration of their founders – members receive differentiated salaries and the level of shared commitment has given way to a preference for privacy and the profit motive.

A ***moshav*** (plural "*moshavim*" in Hebrew) is an agricultural co-operative based on 50 to 120 individual family farms. The individual farms are privately run, but all farmers are members of the village co-operative and are provided by it with local services: marketing, provision of inputs, finance and municipal services. The *moshav* is based on a shared allocation of resources, such as land, water quotas and other productive units, as well as in some cases, the provision of packing and marketing facilities. The first *moshav* was established in 1921, aimed, at least partly, to provide a suitable framework for families wishing to settle the land without accepting the rigor of communal life. It is the most common form of rural settlement in Israel. At the end of 2007 there were 441 *moshavim* and collective *moshavim* with 250 300 inhabitants – 3.4% of the population. Many *moshavim* have turned into little suburbs, with members joining the general labour force.

A third type of farming community is the ***collective moshav*** (*moshav shitufi*) – half way house between a *moshav* and a *kibbutz*, here the farm or non-farm enterprises are run collectively, *kibbutz* style, while families own their own dwellings. Members receive equal pay for working in the village enterprise, but run their own households privately. There are 45 communal *moshavim* in Israel.

The fourth major are ***secondary service co-operatives*** based at the regional level, the members of which are either *kibbutzim* or *moshavim* (seldom both in the same co-operative). These co-operatives provide a range of services including collecting, sorting, storage, transportation, cotton ginning and financial services.

Source: Kislev, 2000; CBS, 2000; MARD, 2006; Tal, 2007.

Land leased from ILA has to be used for designated purposes. A leaseholder who does not cultivate his land for ten years risks losing his land-use rights, but in fact this regulation has not been enforced. Legally, leaseholders are not allowed to trade their land leases (the same is true for water quotas) unless they sell the whole farm, including the residence, and

migrate out of the village. In recent years, land transactions between farmers living within the same village are permitted (see below). However, any land lease contracts across various settlements have to be approved by ILA and have to be based on formal partnerships between contractual parties. These partnerships have to be approved by MARD before ILA approves the lease contract. One of the consequences of the land lease system in Israel is that agricultural land alone cannot be mortgaged. It has to be mortgaged together with the whole farm, including the residence and the surrounding garden. This limits farmers' flexibility in credit arrangements with banks and may limit their access to credit.

Three significant changes in the administration of agricultural land occurred during the early 1990s. First, in response to the financial crisis many farmers faced in the late 1980s, a decision was made to allow limited residential development to occur on land designated as agricultural. This opened the co-operative agricultural communities to new non-farming residents. Second, as the crisis weakened the regulatory roles of co-operatives and given the financial hardships of the farmers, it became common for farmers to rent land to each other within the village, mostly on a short-term basis (Kimhi, 2004). Third, in 1993, the government approved the National Master Plan for Building, Development and Immigration Absorption (NMP 31) to assist the country absorb one million immigrants from the former Soviet Union, an influx that created an unprecedented and immediate demand for housing. An important feature of the plan was that it allowed the redesignation of agricultural land, under special circumstances, for non-farming uses, including both industrial parks and residential neighbourhoods. This has also been viewed as a way to help farm families overcome the debt crisis. Farmers could carry out the new activities themselves, or surrender their lease to enable others to make the necessary investments.

To encourage farmers to surrender their lease, a generous level of compensation was established. According to Resolution 727 of the Israel Lands Council a change in the designation of agricultural land entitled the leaseholders to compensation of 30% of the value of the land under its new usage. However as a result of an appeal, Resolution 727 was revoked by the Israeli High Court of Justice in 2001, which agreed that the compensation was excessive considering the preferential initial conditions on which the land was allocated to farmers. In its place, the amount of compensation to farmers is now set at a much lower rate, determined according to the type of agricultural crops grown, the stock of capital on the land, the length of time for which it had been leased and cultivated, the congestion of the planned construction, and the extent of the leaseholders' co-operation with the re-designation process (BOI, 2008).

In addition to these administrative changes, the housing shortage caused a boom in real estate prices. This allowed and still allows farmers in the central part of the country to sell off their farm to wealthy urban families who seek a rural residence and do not have any interest in farming. It should be noted, though, that this is mostly true for localities in the central part of the country. The real estate boom did not reach peripheral areas, and the value of farms in those areas tend to be much lower. This increased inequality within the rural sector and the disparity between the centre and the periphery (Kimhi, 2004).

These developments had a number of important ramifications. The changes accelerated in-migration into rural areas, with the population of many rural communities doubling within less than a decade. This brought about a change in the organisational structure of rural communities, which was based for a long time on unique co-operative structures (Sofer and Applebaum, 2006).

Second, it led to an unprecedented drop in prestige enjoyed by the rural sector in the society at large. Instead of being considered as pioneers in the service of the nation, farmers and rural residents came to be viewed as exploiters of national resources. The "selling off" of agricultural land resulted in the agricultural community being branded as "land speculators" (Tal, 2008).

Third, there has been a tangible erosion of open spaces. Between 1997 and 2000, 3% of the open space north of the Negev was redefined from farmland to other purposes, with half being redefined for construction and development purposes. In addition, large segments of farmland, particularly in the central region, were neglected and left untended, even without having their function redefined. According to one estimate, some 17.5% of total farmland in this region was left untended (BOI, 2004).

This culminated in the approval by the National Board for Planning and Building in 2005 of the Integrated National Master Plan for Building Development and Conservation (NMP 35). Based on the recommendations of landscape sensitivity mapping, NMP 35 sets out rules to prevent urban sprawl. While the NMP 35 establishes a new planning framework, it does not shift ownership away from the state. However, it is argued that with the establishment and protection of conservation worthy lands under NMP 35 consideration should be given to increasing the rate of private ownership in urban and rural areas (BOI, 2008). The Land Reform Bill voted in early August 2009 will facilitate private ownership of about 5% of ILA-regulated land, but does not concern agricultural land.

Farm structures

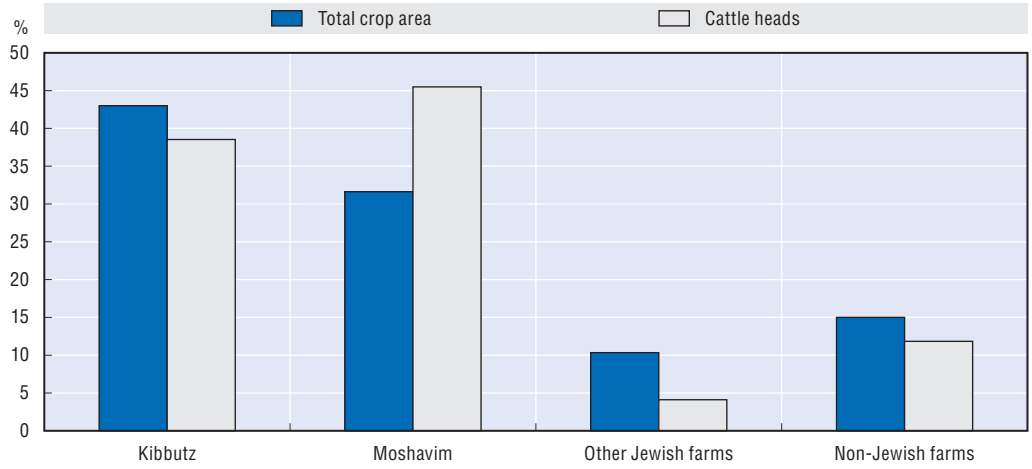
One of the most distinguishing characteristics of Israeli agricultural production is the dominance of co-operative communities, principally the *kibbutz* and the *moshav* (Box 1.2). While the co-operative aspects of agricultural production management have gradually been replaced by more privatised management systems, particularly since 1985, these communities still account for approximately 80% of agricultural output.

Almost three-quarters of total crop area in Israel is located in *kibbutzim* and *moshavim*, with the remaining 25% operated by private farms, 15% by other Jewish farmers and 10% by non-Jewish farmers located in Arab villages in Israel's rural areas (Figure 1.23). Just over 60% of Israeli persons working in agriculture (both self-employed and employees) are located on co-operative farms, with over one-quarter on *kibbutzim* and over one-third on *moshavim*.

The dominance of co-operative farming is even greater for specific crops, with *kibbutzim* and *moshavim* accounting for 85% and 80% of the area used for field crops and vegetables, potatoes and melons respectively. Although field crops remain the dominant land use on *kibbutzim*, their importance has decreased primarily due to a decrease in cotton growing in favour of vegetables, potatoes and melon. Co-operative farming accounts for only 56% of fruit plantations, with 21% located on other Jewish farms and 23% on non-Jewish farms. Non-Jewish farms produce mainly less water-intensive crops such as olives.

The main part of the Israeli cattle industry, particularly dairy production, is also located on *kibbutzim* and *moshavim*. Other Jewish and non-Jewish farms breed mainly cattle for beef. About 70% of the sheep and goat herds are located on non-Jewish farms. In recent years there has been a large increase in the number of sheep and goats, especially those producing milk, on other Jewish farms in response to the growing domestic demand for goat cheeses.

Figure 1.23. **Distribution of crop area and cattle heads by type of farm, 2002**



Notes: *Kibbutz* includes collective *moshavim* farms.
Employment on other Jewish farms is estimated as the share of agricultural employment located in urban localities.
Employment on non-Jewish farms is estimated as the residual.

Source: CBS, *Agriculture in Israel 2001-03*; CBS, *Statistical Abstract of Israel 2008*.

Since the mid-1980s there has been significant structural change within the farming sector – a large decrease in the number of farms, a corresponding expansion in farm size, an increase in specialisation and growing pluriactivity by households seeking to diversify income. There has also been considerable structural change in the make-up and organisation of the various co-operatives.

A regular count of the number of farms and their size is not conducted in Israel (Kislev, 2003). However, from the last agricultural census of 1981 and survey data, it is estimated that the number of active farms dropped by 40% between 1981 and 1995, from 43 450 to 25 900. This drop in numbers of farms took place in all forms of settlement. MARD estimates that there are currently some 14 000 farms in Israel that earn their living from agriculture. A proxy for the number of farm operators and hence of farms is the number of self-employed (including members of *kibbutzim* and unpaid family members). In the 30 years between 1955 and 1985 the number of self-employed in agriculture decreased at an annual rate of 0.6% (Kimhi, 2008). In the 20 years between 1987 and 2007 the exit rate was more than 10 times higher, at 7% annually. Whatever figures are used, the decrease in the number of farms has been remarkable. Consequently, in response, government support in training farmers for non-agricultural employment has taken on increased importance, in addition to agricultural extension for those remaining reliant on farming (MARD, 2009).

Parallel to the exit process, there has been a steady increase in the scale of agricultural production units involved in farming. Between 1981 and 1995 the average farm size increased from 9.5 hectares to 14.7 hectares (Kimhi and Rekah, 2007). The continued erosion in the profitability of various agricultural industries forced farmers to become more efficient whilst taking advantage of economies of scale from operating a larger production unit. Small farms were closed down and the remaining farms grew in size in order to survive. This increase in scale of operation took place across all farm types. A 1.2 hectare greenhouse was once considered enormous, now 4 hectares is the standard (Tal, 2007). Similarly, between 1996 and 2008 the number of flower growers more than halved while the area in flower production grew by about 50%. Consequently, the average area per flower grower has risen from 0.7 to 3.1 hectares (MARD, 2009).

Farms are becoming more specialised (Kimhi, 2004). Evidently the motive to reap the benefits of economies of scale is greater than the disincentive associated with the income risk from specialising in only one crop.

For spouses, there is a significant trend to off-farm employment (Sofer, 2001). This indicates that as the farm becomes larger and more specialised, the farm family allocates more of its labour to off-farm income generating activities, partly in order to mitigate the increased risk involved in more specialised farm production. These activities can be located off-farm, either in an urban area or located in the rural community itself, or on-farm in terms of the development of an alternative enterprise such as rural tourism (Box 1.3).

A number of factors have contributed to these structural developments. Like farmers in most countries, Israeli farmers have faced declining terms of trade for their production. Analysis suggests that the decline in terms of trade since the 1980s may have been even steeper in Israel than in many other countries (Kimhi, 2004). The decline in profitability of agriculture made it difficult to make a living from a farm and led to structural changes that gradually altered the range of economic activities of village inhabitants.

However, a key factor influencing the restructuring of the farming sector was the debt crisis triggered by the anti-inflationary policy of 1985 (Section 1.1 and Chapter 2). During that year, the real rate of interest on agricultural debt, which was negative since the early 1970s, increased almost overnight to 20%. The balance sheet of agriculture in 1988 showed little if any equity and the farm sector lost its capacity to service its debt (Kimhi, 2008). While the 1985 anti-inflationary policy was the trigger of the agricultural debt crisis, the cause of the problem lay in three inter-related factors. These were:

- **Structural fragility.** The vast majority of pioneering farmers came to Israel with little or no assets, and had to rely on institutional provision of land and capital. Individual farms organised into local and regional co-operatives, the most important service of which was financial intermediation. As farmers cultivated mostly national land, they could not use their assets as collateral and lacked direct access to the capital market. Co-operatives were able to borrow using mutual guarantees at the local (village) level, at the regional level, and at the national level. These mutual guarantees turned out to be worthless when the crisis became be national.
- **Policy failure.** The political influence of agricultural co-operatives, which was way above their share in society, caused the government to bail them out of financial difficulties again and again, and this made the co-operatives preferred borrowers in the eyes of the banking system.
- **Financial mismanagement.** Farmers did not take advantage of the negative interest rates of the 1970s in order to repay debt and increase equity. Rather, they continued to invest in farm capital, often leading to over-capacity, financed housing and infrastructure investments, and increased consumption.

While the government had an interest in rescuing both agricultural co-operatives and commercial banks, it could not simply take responsibility for the debt because of its volume – about USD 3.6 billion in 1988 – and because of the lack of public support for such action. What it could do, as presented in detail in Chapter 2 of this report, was convince the commercial banks to reach an agreement with the farmers on debt restructuring. The core of the settlements, both for the *moshavim* and the *kibbutzim*, consisted of two parts: *a)* assessment of income potential of farms in *moshavim* and *kibbutzim* and rescheduling

Box 1.3. **Development of rural tourism**

Rural tourism is the most rapidly growing economic activity in rural areas of Israel. It took off towards the end of the 1980s. Until then, residents of rural communities were engaged mainly in agricultural and off-farm activities. With the worsening of the terms of trade in agriculture and the resultant decline in real income, many farmers, similar to their counterparts in Europe and North America, started to look for an alternative source of income. As a result, many rural communities turned to rural tourism. Since its inception, the industry has been continuously growing, exhibiting an average annual growth rate of 15% over 20 years. By the year 2004, the rural accommodation industry accounted for 18% of the total domestic tourism market in terms of room nights. It consisted of 8 000 accommodation units, situated in about 210 villages: co-operatives (*moshavim*) and collectives (*kibbutzim*), and non-agricultural rural towns. These spread out from the Lebanese border in the north to the Red Sea in the south. Following the increase in accommodation units other attractions developed such as restaurants, galleries and other leisure activities.

The rural accommodation product has gone through significant changes during its existence. In the first stages, existing buildings in *kibbutzim* and *moshavim* were converted to serve as very basic accommodation units. The season was short with an average annual occupancy of 80 to 90 nights (this reflects the fact that demand consisted mainly of families with children, confined to holiday/vacation periods). With the years, new types of units began appearing. These were mostly log cabins, highly luxurious and accessorised with facilities such as air-conditioning, TV, VCR, Jacuzzi, fireplace, etc. Extras such as wines, natural juices, chocolates and pastries started being served as part of the hospitality. As a result, prices have increased, the high season has expanded and new segments have entered the market. The Internet has been supplying an ideal, low-cost marketing channel for the firms' owners. The rural accommodation industry in Israel relies mainly on domestic tourists; it has not penetrated the incoming tourism market. Dependency on domestic tourists makes service providers dependent on repeat visits and stimulates product differentiation.

In the early stage of development, the Jewish Agency was the only organisation giving support to the rural tourism industry. With the expansion of the industry and the recognition of its importance, the Ministry of Tourism started supporting it in 1993. Today the industry is regulated and supported by the ministries of Tourism and Agriculture and by non-governmental organisations.

Three main support programmes are employed: a tourism village programme, a small-business loan and guarantee fund, and a capital support fund for farmers (Chapter 2). The development of "tourism villages", formerly agricultural villages that have undergone a process of transformation and focus today on rural tourism, was a project administered by the Government Tourism Office for several years. Its purpose is to consolidate rural tourism within the rural area and settlements. In addition to the adjustment of infrastructure for the absorption of tourism, assistance is offered to the regional councils for the promotion of tourism in their regions, through participation in funding events and festivals that are related to rural tourism. This assistance encourages the use of the local tourist services. Agricultural tourism entrepreneurs can be supported through grants for constructing visitors' centres to integrate tourism into the existing agricultural activity.

Rural tourism revealed itself as a successful way to absorb some of the excess of the productive labour force (including unemployed women) in the village. This success can also be attributed to the availability of natural factors such as existing farm houses, landscapes and open spaces. However, most of the tourist businesses are small and depend on the development of the public and environmental infrastructure. For such purposes, public support is needed to provide retraining programmes for new entrants and to increase the attractiveness of rural areas as a place for a unique lifestyle and culture, *e.g.* wine route and festivals, olive, cotton, and cheese routes, contact with nature, customs and folklore.

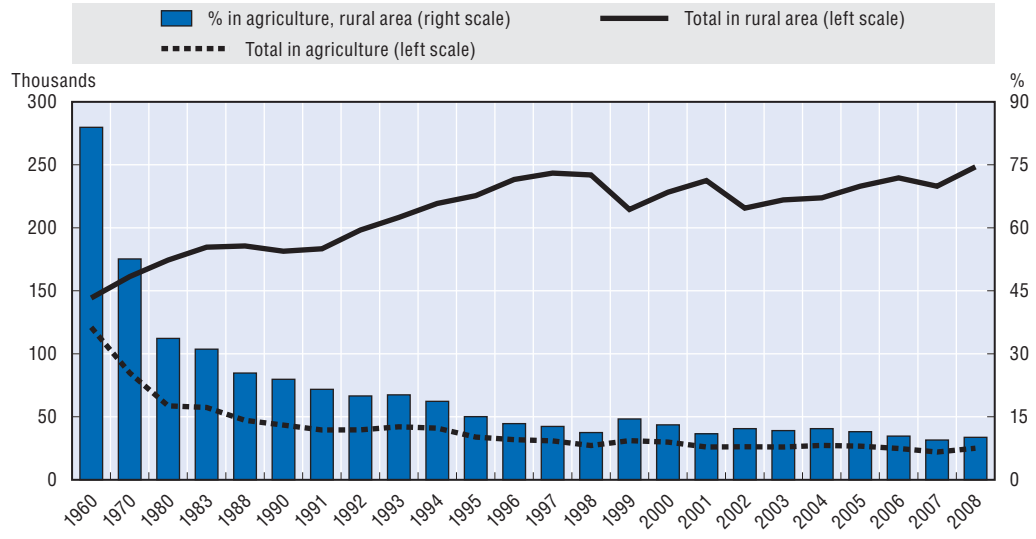
Source: Tchetchik *et al.*, 2006; MARD, 2009.

the part of the debt deemed repayable; and *b)* forgiveness of the debt that could not be repaid. In the *kibbutz* sector, where the debt was larger, the government shouldered approximately one-third of the loss, with banks and other creditors sharing the remaining two-thirds (Kislev, 2000).

In addition, most of the secondary co-operatives of *moshavim* ceased operating, while those of *kibbutzim* have continued operating in more modest form, and none as financial intermediaries. This caused a significant change in the financial environment facing co-operative agriculture. From this time on they had to deal directly with banks, and only those units demonstrating financial viability could obtain credit (Kislev, 2000).

The changes to the land tenure system outlined in the preceding section also played a significant role in farm restructuring. They provided farmers with more opportunities to develop non-agricultural businesses, and allowed rural localities to expand population with the addition of many non-farm families that in some cases outnumbered the farm families. Both outcomes contributed to the accelerated decline in the importance of agriculture as a source of income in rural localities. Today, in most rural communities only a minority of families are living off agriculture (Figure 1.24).

Figure 1.24. **Changes in rural employment structure, 1960-2008**



Source: MARD, 2009.

Another major influence on farm structures is the influx of foreign labour. Foreign workers have modified the social fabric, particularly in the family farm sector. Operators now run larger enterprises than they did in the past and "unpaid family members", spouses and youngsters, tend not to participate in the farm work anymore. These people seek alternative occupations (Kislev, 2003).

Sectoral reforms undertaken by government also contributed to farm restructuring, in particular in the dairy sector (Chapter 2). In order to improve the competitive position of Israeli farmers in light of the prospect of further reductions in tariffs (*e.g.* as would likely be required under a successful WTO Doha round of trade negotiations), the government reduced the farm gate price for milk; opened up trading of milk production quotas; and subsidised investments necessary to increase production capacity and meet environmental

regulations. The reform was implemented in 1999-2007 and led to a large number of exits of farmers (who gained from selling their quota to those wishing to expand) and to the establishment of joint venture arrangements amongst *kibbutzim* as well as *moshavim* milk producers. The number of milk producers declined by around 40% and average milk production per producer increased by 50% during the reform period (Chapter 2).

Competitiveness and structural change in the upstream and downstream sectors

In the 1990s and 2000s, Israel has gradually moved from state or co-operative based companies having monopoly positions in upstream and downstream sectors to a more competitive framework with the dominance of private enterprises.

Input supply

In the original agricultural co-operative, the farmer himself focused only on agricultural production. All other services – financing for the purchase of inputs, investments, management of his accounts and marketing – were provided by the co-operative. After the debt crisis of the mid-1980s, the co-operatives gradually reduced their involvement in such activities, remaining engaged mostly in water supply services and municipal activities (MARD, 2009).

Regional secondary co-operatives were first established in the 1940s and grew in number and size as agriculture developed. These organisations were engaged in the financing of investments and in the provision of guarantees for capital raised through the banking system, all on behalf of farms (Chapter 2). They were also involved in collective procurement of agricultural inputs and in organised marketing. The 1980s debt crisis led to the collapse of most of the regional agricultural support systems and they were replaced by competitive private structures (Kislev, 2000).

Marketing and processing

For years, Tnuva, the marketing co-operative established in 1926, marketed all the farm products of co-operative agriculture in the country, but then it gradually lost its market share in fruits and vegetables and shifted to concentrate mainly on the collection of milk and the processing of dairy products. Tnuva has become Israel's largest food conglomerate after successfully implementing major structural changes to meet the demands of the competitive local market and adapting its activities to advanced, global markets. Currently, it processes about 65% of the milk produced in Israel and offers the largest selection of milk products in supermarkets and grocery stores. Although officially belonging to *moshavim* and *kibbutzim*, Tnuva has been run independently for many years. In January 2008 Tnuva sold the majority of its shares to a private equity firm APAX Partners (55%) and an Israeli public finance company Mivtach Shamir Holdings (20%). The other major players in the dairy sector are Tara and Strauss Dairies, each collecting and processing about 13% of milk produced in Israel. The remainder is delivered to seven small dairies.

The poultry processing sector has also been experiencing far-reaching changes. Traditionally, slaughterhouses were owned by grower co-operatives, which in some cases were also suppliers of feeds and other inputs. Moreover, marketing and processing were performed, mostly, by companies owned by growers' co-operatives. In recent years, however, the market share of farmer-owned slaughterhouses has declined to less than 50%. An increasing percentage of production is processed by large, industrial slaughterhouses with a yearly processing capacity of more than 20 000 tonnes each. Currently there are seven such

industrial slaughterhouses. In addition, there are 13 medium-sized slaughterhouses. Vertical integration of production is increasing, and nowadays more than 60% of production is organised through production or marketing contracts with so called "integrations" or industrial slaughterhouses.

There are about 200 fruit and vegetable wholesalers in Israel, about half of them in one of the four main wholesale markets (Zrifin, Haifa, Rehovot and Jerusalem). In addition, there are about 20 wholesalers specialised in the marketing of bananas and 130 large farmers (or farmers' co-operatives) with wholesale licences marketing their own production and that of other farmers. The two main supermarket chains established their own logistic centre for fruit and vegetables and buy directly from producers. Other retailers buy fruit and vegetables from wholesalers or sometimes also directly from farmers. Prior to 1991, exports of horticultural products were controlled by two state trading enterprises: the Citrus Marketing Board of Israel (CMBI) exported all citrus fruit while AGREXCO (a company 50/50 owned by growers and the government) exported all other fruits and vegetables. Reforms commenced in 1991 with a comprehensive reform of the citrus sector, including the abolition of single-desk exports and the privatisation of export operations. AGREXO and a few commercial companies took over citrus exports. The CMBI continued to exist and perform some regulatory functions, generic promotion and R&D but it ceased selling operations (Finkelshtain and Kachel, 2006).

Starting from 1992/93, exporters could apply to MARD for export licenses for specific fruits and vegetables in addition to Agrexco, but only if they were able to demonstrate that they would export at least 30% of total exports of the specific product. While this condition was later abolished, AGREXO continues to export a large share of Israeli fruits and vegetables (Finkelshtain and Kachel, 2006). AGREXCO takes care of the logistics for export activities: planning, guidelines for quality, credit allocations, sales, marketing, special air and sea terminal services in Israel and abroad, air cargo, and organisational and financial management (WTO, 2006). The granting of the licenses by MARD is carried out under supervision and compliance with fair trade practices, required international standards in relation to procedural quality and product quality, and granting of preferences to Israeli exporting farmers who use locally developed varieties and technologies funded by public capital, while complying with plant protection regulations. The Ministry has been encouraging the liberalisation of export activities and the shipment of produce abroad. As a result, the number of authorised agricultural exporters has grown from a very small number in the 1980s to some 100 exporting companies at present. However, the concentration of exports in the hands of a limited number of companies remains high with just four out of 30 companies being responsible for 85% of citrus exports and just a few companies being responsible for nearly all avocado exports. Similarly, the four firm concentration ratio for pepper and potato exports is about 60% and 80%, respectively (MARD, 2009).

While the export monopoly for flowers had already been abolished in the 1970s, the Flower Board kept the exclusive concession for exports to the main market, the flower auctions in Holland, while Agrexco provided the logistic services for flowers sold through the auctions. At the end of the 1990s, the flower sector was also reformed and exports to the auctions were opened to additional exporters (Finkelshtain and Kachel, 2006).

Retail and food service

In 2007, the retail food market was valued at USD 8.2 billion, an equivalent of around 70% of domestic food consumption. Over 60% of this supply is sold through supermarkets and retail chains. Two major supermarket chains with hundreds of outlets throughout the country dominate the retail food market. The average floor size of a supermarket is 600 square metres. Some of the larger stores have areas of 1 000-2 000 square metres. There are approximately 5 500 grocery stores and 1 700 minimarkets in Israel. Due to the intensive competition in the Israeli food sector, the grocery stores and minimarkets are operating at very small profit margins. Typical middle eastern-style open-air markets and small groceries serve the remainder of the food market. These are the most significant sources for the purchase of fruits and vegetables, and are also the place where Israeli Arabs tend to make their food purchases. In recent years, specialty food stores have developed in all of the main metropolitan centres. More than 150 convenience stores, which are open 24 hours, were established in recent years (USDA, 2008a).

Food service, which accounts for the remaining 30% of domestic consumption, can be divided into two categories: commercial and institutional. The commercial sector comprises an estimated 360 hotels, 1 174 rural tourism houses, and 4 399 food business (restaurants, coffee shops, fast food, pubs and bars) of which 1 539 (35%) are kosher certified. Some of the restaurants that are not kosher certified still use only kosher ingredients (USDA, 2008a).

The institutional services include, *e.g.* the army and hospitals. The Israeli Defence Forces (IDF) is the largest institutional food consumer absorbing about 4% of all Israeli food through its purchasing channels (USDA, 2008a).

Notes

1. ILS stands for new Israeli sheqel in line with the International Organization for Standardization (ISO) codes for currencies.
2. This pattern in total employment is seen in the estimated number of hours worked per week. The average hours in agriculture increased from 3 million in early 1990s to 3.6 million in 1999-2001. Since then it has decreased to 3.3 million. Based on data contained in BOI (2009), *Annual Report 2008*.

Chapter 2

Policy Trends and Evaluation*

Israel has implemented substantial economic policy reforms since the mid-1980s. Major reforms in the agricultural sector began in the early 1990s and continued into the 2000s. Trends in agricultural and related policies during 1990-2008 are discussed in this chapter, followed by an evaluation of the support provided to agricultural producers.

Section 2.1 describes the framework of Israeli agricultural policy. The framework is examined with regard to key policy objectives, legal and institutional arrangements for administering agricultural policy, and the major instruments employed to implement policy.

Section 2.2 provides an overview of domestic agriculture-related policies. The section comprises the following sub-sections: price support measures, income support measures, reduction of input costs, insurance systems, environmental measures, rural infrastructure, rural development programmes and overall budgetary outlays.

Trade policies relating to the agro-food sector are examined in Section 2.3. The section outlines the overall reforms of the trade system, the objectives of Israeli trade policy in the agro-food sector, agro-food export and import policy measures applied by Israel, and trade relations.

Finally, Section 2.4 quantifies the extent of support provided to agriculture and the cost that this imposes on Israeli consumers and taxpayers.

* The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law.

2.1. Agricultural policy and institutional framework

Agricultural policy objectives: current and past

Agriculture was the top priority for the state of Israel during its early years for three reasons:

- A need to settle the undeveloped areas of the country for geopolitical security.
- A need to avoid food shortages, due in part to an inability to import agricultural products from the countries surrounding Israel.
- A need to provide employment and livelihood for new immigrants to Israel.

The goals of agricultural policy have to a large extent remained the same over the period under review. The main objectives are still to improve food supply and achieve self-sufficiency in agricultural products that can be produced locally, expand existing export markets, and maintain the rural population, particularly in the peripheral areas as part of the settlement policy.

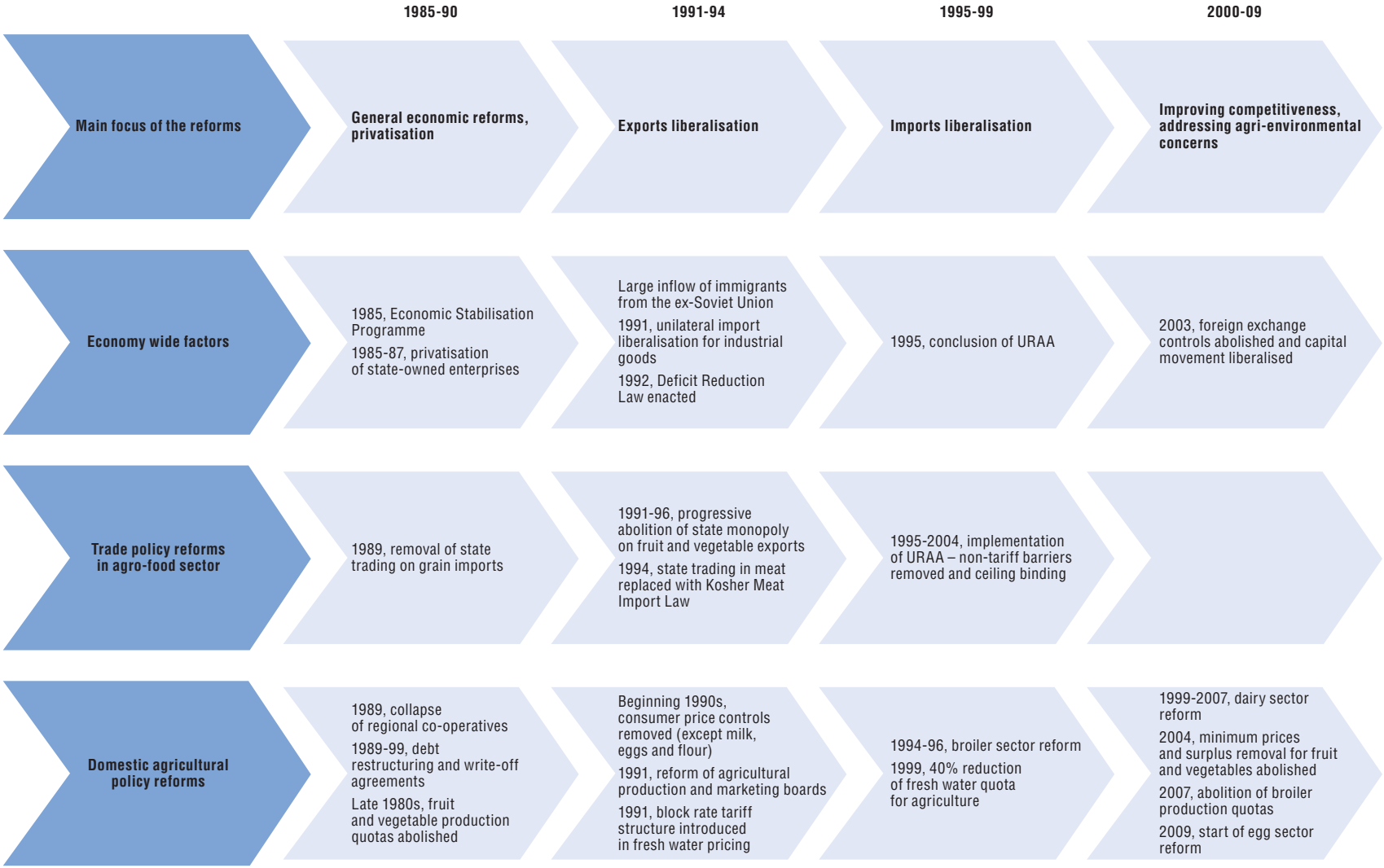
Great importance is attributed to the maintenance of a critical mass of farmers in order to preserve the conceptual foundation of the existence of planned agriculture in Israel. The government also desires to preserve agricultural land and green space areas as well as protect national social and public values. Due to growing concerns about environmental problems, an increasingly important policy objective is to develop environmentally friendly agriculture.

The Ministry of Agriculture and Rural Development (MARD) is responsible for setting agricultural policy objectives. While these are not stated in a broader governmental level strategic policy document, each year, MARD outlines and publishes its main goals with respect to developing the agricultural sector and budget for the coming year. For 2008, the following goals were listed: develop environmentally friendly agriculture; expand existing export markets and develop new export markets; develop rural areas; develop the non-Jewish sector; and develop legislation (USDA, 2008b).

Phases of agricultural policy reform

Until the end of the 1980s, the government was heavily involved in regulating the agricultural sector through the provision of various subsidies, central planning of agricultural industries, allocation of production quotas, price controls and import protection (MARD, 2009). As the levels of support provided to the agricultural sector were no longer financially feasible, the Israeli government initiated deregulation of agricultural sector in the late 1980s. The reform process was gradual, and driven by economy-wide anti-inflationary policies during the late 1980s and the conclusion of the Uruguay Agreement on Agriculture (URAA) in the mid-1990s. The general rationale behind the reforms was to increase the competitiveness of Israeli agriculture. Reforms were more far-reaching in fruits and vegetable sector as Israel is a net exporter of most of the fruit and vegetables, whereas protection and support levels remained high in animal sector. The period of 1985-2008 can be divided into sub-periods according to the gradual implementation of the reforms (Figure 2.1).

Figure 2.1. **Evolution of trade and agricultural policy reforms in Israel**



In **1985-90** major economic reforms and structural changes in co-operative agriculture began. Israel initiated reforms to increase the market-orientation of the economy in the mid-1980s. Government involvement in economic activities was reduced gradually: a number of public sector enterprises were privatised, subsidies were cut and the first steps towards a more liberal trade regime were taken. The agricultural sector had to face significant budgetary cuts and reductions in price subsidies for basic food products (GATT, 1994). The first steps to withdraw state planning in agriculture were taken with the abolition of the quota systems for plantations (planting permits), flowers, potatoes, tomatoes and onions. However, Israeli agriculture remained highly regulated.

After decades of stable development, co-operative agriculture faced dramatic changes during this period. In 1989, a serious financial crisis in the co-operative agricultural sector led to the collapse of the regional co-operatives that provided services to agriculture. The regional co-operatives were previously engaged in providing financial services, purchasing agricultural inputs and organising the collective marketing of outputs. These activities collapsed after the crises, especially financial intermediation. These developments led to significant structural changes in co-operative agriculture (MARD, 2009).

During **1991-94**, the export oriented sub-sector was opened to competition and agricultural production planning by the state was significantly reduced. Until 1991, exports of agricultural production was organised exclusively by the government through production and marketing boards. In 1991, the first steps were made to abolish monopolies and establish competition between exporting companies. The Citrus Marketing Board of Israel (CMBI) was the first to be reformed with the objective of increasing both the efficiency of citrus export marketing and the income of citrus growers. In 1994, state trading in meat was stopped and replaced by the Kosher Meat Import Law.

At the beginning of the 1990s, the policy of subsidising consumer prices, which had been maintained for 15 years for table eggs and poultry meat was phased out (MARD, 2009). In 1994, reform was initiated in the broiler sector to modernise production and increase efficiency through the gradual loosening of the quota system. In 1991, block rate pricing for fresh water, with higher prices for larger amounts of water used, was introduced to stimulate more efficient use of water.

During **1995-99**, reforms were focused on import liberalisation. With the conclusion of the URAA and the establishment of the World Trade Organisation (WTO), Israel undertook commitments to improve market access and to reduce export subsidies and domestic support in agriculture. However as Israel benefited from a developing country status in WTO, import liberalisation was rather limited. Most significantly, ceiling bindings were introduced for most of the agricultural tariff lines and a number of non-tariff import barriers were "tariffied" and tariff rate quotas (TRQs) established. While these steps improved the transparency of Israel's trade policy, border protection remained high for several sensitive product groups: mainly those that are produced domestically (fruit, vegetables and livestock products). Besides trade reform Israeli farmers faced a major change in fresh water allocation in 1999: the quota was cut by 40% for agricultural sector. Additionally, water extraction levy was introduced.

In **2000-09** further steps to reduce domestic support policies to agriculture were taken. Production quotas for broiler production were eliminated. However, quotas are still in place for milk and egg production. Price support measures (surplus removal) were stopped in fruit and vegetables sector in 2004. A major reform in the dairy sector was initiated to increase competitiveness and to meet environmental concerns. Government support was more and

more selective and targeted to elements such as risk management tools (insurance programmes against natural damages) and other measures to promote the application of less environmentally harmful means of production. Other support measures included sales promotion, research and development activities, and limited investment programmes mainly for export oriented production (MARD, 2009). During this period the government has also given greater attention to sustainable development in general, including agri-environmental issues.

Legal framework for policy implementation

Laws and regulations

The current legislation relating to agriculture regulates almost all aspects of agricultural production. There is no broad law laying down a general regulatory framework for agriculture; instead each law regulates specific subjects separately. The laws regarding land administration, water use and allocation, drainage management, plant protection, veterinary services, production and marketing boards, exemption from the antitrust law, the encouragement of capital investments in agriculture and others were enacted primarily during the 1950s and 1960s after the establishment of the state of Israel according to the needs of settlement and agriculture in their traditional structures. Laws are passed by the Knesset; regulations are adopted by the respective minister subject to consultations with other relevant ministers and approval by the respective Knesset committee. The main laws and regulations relating to agriculture are listed in Annex Table 2.A1.1.

MARD plans to introduce a number of new laws or change existing legislation to reflect developments in the agricultural sector during recent decades, including:

- The agricultural law will define the essence of agricultural activity and will serve as a legislative tool to ensure its continued long-term existence and proper functioning in accordance with policy objectives.
- The agricultural land law will: include clear anchoring of the farmers' rights to their agricultural land; determine the farmer's rights and obligations with respect to agricultural land; form a functioning interface between farmers and the Israel Land Administration (ILA) while ensuring the state's ownership of national lands.
- Changes and adjustment of the production and marketing boards' laws to the current organisational structure of Israeli agriculture.
- A law to ensure farmers' rights to the use of water for agriculture.
- A law for the regulation of risk management in agriculture: insurance of damage resulting from natural causes, natural disasters, multi-risk insurance and pension insurance for farmers.
- Adjustments in the law for encouragement of capital investments in agriculture to provide tax benefits for investment in agriculture.
- The dairy industry planning law will ensure the safety of production and milk quality in Israel, to increase efficiency of dairy products marketing and ensure fair prices for producers, as well as to ensure supply of fresh milk and provide proper conditions for the operation of dairies.
- Plant production and marketing law would ensure production and supply of fresh agricultural products at quality standards. The law will empower the minister to establish standards concerning the production, marketing and quality to regulate systems of control and supervision.

Development regions

In accordance with the policy of the government to encourage settlement and economic development in peripheral regions, the country has been divided into a number of priority zones by law. The regions far from the centre and close to the borders are higher priority regions and receive most public support. To determine the grade of a development region, its weighted contribution to the following national priorities is taken into account:

- Supply of agricultural products.
- Environmental aspects: protection of water sources and natural resources by ensuring water penetration to the aquifers; absorption of urban waste; use of recycled waste water for irrigation, sludge and pruned branches as nutrients.
- Dispersal of settlements, mostly in border and peripheral areas.

There are four regions identified:

- Region A (Negev desert and Galilee) is eligible for the highest rate of public support for achieving policy objectives in agricultural production, dispersal of settlements and agri-environmental programmes.
- Region B (area around Nazareth and area between North Negev, Jerusalem district, Mediterranean Sea and south from Rehovot) is the area aimed at receiving secondary national priority support.
- Ecological region B (most densely populated area including Tel Aviv and Haifa districts), created in 2009, is the area aimed at receiving support for agri-environmental programmes only.
- Mediterranean Sea region B is at secondary priority and receives support for fishing activities only.

Master plans

National master plans (also known as national outline plans – NOPs) are long term strategic plans prepared for land use and projects of national significance. Some 30 comprehensive and sector based master plans determine policy and designate land use on a national level. The Planning and Building Law (1965) is the main legislation that regulates spatial planning procedures in Israel. The Law acknowledges the basic commitment to involve citizens in decision-making that affects their lives. Master plans that are created under the Planning and Building Law are statutory and need to be approved by the government. National statutory plans usually focus on a specific sector or issue, for example, population dispersal, roads, national parks, forests and coasts.

The statutory layout planning in Israel is comprised of a three-tier system: national master plan conducted by the National Planning and Building Council; regional master plan conducted by the regional committee for planning and building; local development plans conducted by the local committee for planning and building.

The Ministry of Interior runs the National Planning and Building Council, the country's principal planning institution, whose functions and competences are defined by the Planning and Building Law. The Council advises the government on ground rules for the implementation of this law, provides funding and recommends national master plans, and authorises changes in regional master plans.

Institutional arrangements for administering agricultural policy

Agricultural policy is formulated jointly by departments within MARD although the Planning Authority is the main department responsible for policy design. Institutions outside MARD involved in agricultural policy formulation include: The Ministry of Finance, the Water Authority, the Ministry of Environmental Protection, the Ministry of Trade, Labour and Industry, and the ILA. A number of parastatal institutions are involved in policy implementation, of which the production and marketing boards are the most important.

Ministries and governmental agencies

Ministry of Agriculture and Rural Development (MARD) is responsible for the development of agriculture and rural areas. The Ministry plans the growing and distribution of farm produce, and designs and administers most of the support programmes for agricultural sector. It helps rural settlements to develop agriculturally and economically, manages the nation's land use and collaborates with the Rural Settlement Department of the Jewish Agency in the establishment and consolidation of new communities.

Ministry of Environmental Protection (MEP) is responsible for promoting sustainable and environment friendly agricultural practices. The Agro-Ecology Division deals with the prevention of environmental degradation arising from improper agricultural practices in the rural sector. It operates according to a holistic approach which seeks to reduce the negative impacts of agriculture on the environment while advancing sustainable agricultural development. The challenge is to cultivate high-quality produce which meets both agricultural and environmental and health standards.

Ministry of Industry, Trade and Labour (MOITAL) (specifically the Foreign Trade Administration) is in charge of formulation and administration of trade policy. This includes conducting and co-ordinating international trade negotiations, proposing tariff changes, establishing trade controls and rules of origin, administering quotas on products, and conducting anti-dumping, countervailing, and safeguard investigations. In terms of agricultural products it co-operates closely with MARD (WTO, 2006).

Ministry of Finance (MOF) together with MARD is responsible for setting the MARD budget for the following year and designing the policy reform. MOF is implementing the following laws concerning agriculture: Family Farms Sector Arrangements Law, Compensation for Victims of Natural Disasters Law and Encouragement of Capital Investments in Agriculture Law.

Israel Lands Council is appointed by the government. The Council has 22 members; 12 represent government ministries and 10 represent the Jewish National Fund (JNF). The Council sets policy for the ILA, supervises its activities and approves its draft budget.

Israel Land Administration (ILA) is responsible for managing the 94% of land in Israel that is in the public domain. These lands are either property of the state, or belong to the JNF or the Israel Development Authority. ILA is responsible for implementing the following policy objectives: designating land areas for public and state requirements; assuring land reserves for future needs; preserving agricultural lands; ensuring that land usage is in accordance with the law; and safeguarding the state lands. The Director General of the ILA is appointed by the government and is directly subordinated to the Minister of Agriculture. At least once a year a report on the activities of the ILA is submitted to the Israel Lands Council. The government submits a report on the activities of the ILA, at least once a year, to the Knesset.

Water and Sewage Authority operates under the Ministry of National Infrastructures and is responsible for conserving the water resources and allocating water efficiently and equitably for all users and among all users.

Rural local government in Israel is comprised of two statutory levels: the lower level is the local committee, which is responsible for the municipal affairs of a single village; the upper level is the regional council, which includes a varying number of villages within its area of jurisdiction. Local committees in particular have an important role in ensuring the principles put forward in the Planning and Building Law. Local committees for planning and building are responsible for implementing national policy concerning rural development, namely management of open and agricultural areas, settlements, infrastructure facilities, tourism, service systems, roads and railways.

Veterinary Service is a largely independent unit within MARD. Its activities and authority derive from six major laws: The Animal Diseases Ordinance; The Rabies Ordinance; Control on Export of Animals and Animal Products Law; The Veterinarians Law; Animal Protection Law; Business Licensing Law.

Plant Protection and Inspection Service is also a unit within MARD. Its main responsibilities include official certification and documentation of imported and exported plants and plant products; and monitoring new pests, restricting their distribution, suppressing their populations and, wherever possible, implementing eradication schemes. The activities of the Service are to a large extent based on Plant Protection Law.

Jewish National Fund (JNF) is one of the most influential quasi-governmental institutions in Israel that is active in developing rural and agricultural infrastructure. JNF is a non-profit corporation owned by the World Zionist Organisation. It owns 13% of the total land in Israel. The examples of the activities of JNF include afforestation, building dams and water reservoirs, land reclamation and in recent years developing towns and building infrastructure in Galilee and Negev to accommodate new Jewish immigrants.

Production and marketing boards

Thirteen production and marketing boards – 6 statutory (citrus fruit, flowers, vegetables, groundnuts, poultry and other fresh fruit) and 7 voluntary (*e.g.* Israel Dairy Board) – were set up from the 1960s onwards. The main objectives of the boards were to constitute a binding organisational framework for the regulation of the production and marketing of agricultural products in order to guarantee an uninterrupted supply of fresh agricultural produce in sufficient quantities at reasonable prices for producers and consumers (MARD, 2009). Their activities included planning, market regulation, preventing surpluses and disposing of them when they occur, guaranteeing a minimum price level for producers also providing advice, initiating research and development, and controlling marketing activities (GATT, 1994). The boards set production quotas for farmers, who were allocated land, water and equipment. As agricultural policies changed, so did the responsibilities of the boards, although they are still responsible for implementing agricultural policy in their respective sectors.

According to Israel's competition law, restrictive arrangements are generally prohibited. However the agricultural boards are explicitly exempted: arrangements applying to the cultivation and marketing of several domestically produced agricultural goods (fruit, vegetables, field crops, milk, eggs, honey, beef, mutton, poultry and fish) are exempt from restrictions in the trade practices imposed by the law (WTO, 2006).

The following boards are currently active on agricultural markets:

- Israel Dairy Board.
- Poultry Board.
- Plant Production and Marketing Board (created in 2004 by the merger of the Citrus Marketing Board of Israel, the Vegetable Production and Marketing Board, and the Fruit Production and Marketing Board).
- Israel Honey Production and Marketing Board.
- Israel Cotton Production and Marketing Board.
- Israel Olive Oil Board.
- Israel Groundnuts Production and Marketing Board.

The most influential boards in terms of policy implementation and their sectors share of total agricultural production are the Israel Dairy Board, the Poultry Board, and the Plant Production and Marketing Board.

Israel Dairy Board (IDB) is the central institution dealing with the planning and regulation of milk production and processing. It is managed by a board of directors that comprise representatives of: the Ministries of Agriculture and Rural Development, Finance, Industry, Trade and Labour, and Health; Israel Cattle Breeders Association; milk processors; and consumers. IDB is responsible for implementing government policy concerning the planning of milk production and marketing; managing the emergency stock of milk powder; dealing with disposal of surplus milk; improving the professional standards of dairy industry, promoting research studies and training programmes, assisting breeding programmes for dairy cows, sheep and goats; providing assistance in maintaining animal health standards; initiating extension services and other activities related to the quality of milk and milk contents; and promoting the consumption of milk and dairy products. It is financed through a mandatory levy withheld on each litre of milk sold by the farmer, and runs a number of funds and controls several grants that can be used to preserve the milk policy in its current form.

Poultry Board (PB) is responsible for implementing the policy relating to the breeding of poultry for egg production, fattening and hatching; supervising breed improvement; regulating the production of reproduction material and its marketing in Israel and abroad; regulating the marketing of eggs and poultry meat in Israel and abroad; and taking action to increase the consumption of the products of the poultry industry in Israel and abroad. It is also responsible for encouraging and assisting the:

- Processing of poultry meat for marketing, including freezing and canning.
- Establishment of sorting and packing depots for eggs, including freezing installations.
- Research into markets and production methods of the poultry industry and the ways of handling the products.

Plant Production and Marketing Board (PPMB) is responsible for licensing exporters, and for advertising and promoting new varieties and the generic "Produce of Israel", Jaffa brand and other variety brands. It manages public relations in overseas marketing, the industry's relations in Israel, pest control, and research and development.

Farmer organisations

Farmers' organisations represent farmer's interests in their relations with government, professional organisations and industry. The Farmers Association is an umbrella organisation for Israeli farmers' organisations. Following farmers' organisations are active in Israel: Vegetable Growers Association, Banana Growers Association, Israel Bio-Organic Agriculture Association, Israel Cattle Breeders Association, AMBAL Beef Cattle Breeders Association, Israel Poultry Growers Association, Israel Sheep and Goats Breeders Association and Israel Beekeepers Association.

Domestic and trade policy instruments

The government has a strong influence on agricultural production and the development of the sector as the state is the owner of the two major agricultural production factors: land and water. Both resources are scarce and allocated to the farmers by the government. This allocation is a major policy tool aimed at achieving the social objectives that agricultural production has to provide for the general public welfare (MARD, 2009). In addition, the government regulates agricultural production in a few sectors (such as milk and eggs), provides support for agricultural inputs use (water and capital), supports incomes and provides various services (research and development) to the agricultural sector. Certain sensitive products are also effectively protected against foreign competition (Figure 2.2).

Figure 2.2. **Domestic and trade policy instruments**



Note: Date in parentheses refers to the date of abolition of the measure, MK – milk producers, EG – egg producers, PT – poultry producers, WH – wheat producers.

2.2. Domestic policies

This section discusses in detail specific domestic agriculture related policy measures. A summary table with domestic and trade policy instruments, their objectives and design is provided in the Annex Table 2.A1.2.

Price support measures

Price support measures were an important part of the agricultural planning system in Israel until recently, and remain so for eggs and milk. The measures include production quotas, guaranteed minimum prices and a surplus absorption scheme. All price support measures are implemented by the relevant production and marketing boards that are heavily involved in agricultural activity in Israel.

Production quotas

A quota system was used to regulate the production of certain vegetables (potatoes, tomatoes and onions), plantations (planting permits), certain types of flowers, poultry, eggs, cow milk and sheep and goats milk. In the mid-1980s, quotas were eliminated for flower production and plantations. In the end of 1980s, they were removed for vegetable production. Quotas were enlarged for poultry production towards the end of the 1990s, with broiler producers allowed to produce up to 20% more than their quota. Later, the quota system was changed to regulate the number of production units and not production level. It was finally completely eliminated in 2007. Quotas are still used to regulate egg and milk production (Box 2.1).

Administered prices

Administered prices were set for fruit and vegetables (potatoes, tomatoes, onions and cucumbers) and poultry until 2004, and are still applied for milk, egg and wheat production.

Milk producers are supported through a guaranteed (or target) price system. The target price reflects the average cost of production plus an agreed profit percentage. Milk produced over the quota is purchased at lower prices by a percentage of the target price that varies over time (usually at around 20%). For egg producers the guaranteed price reflects production costs only. In both cases the target price is updated regularly to reflect changes in production costs (Box 2.1).

Minimum prices for wheat are fixed each year and implemented through purchases into the state security stocks. MARD is responsible for managing the security stocks and locally produced wheat is given priority in purchasing. Domestic wheat production accounts for 5% to 20% of domestic consumption. Stockholders are private businesses and they are chosen according to public tenders. At harvest time in May, MARD announces the fixed minimum price of wheat, which is based on the Kansas market price adjusted for quality and transportation costs. The price is obligatory for the stockholders in purchasing wheat from local producers. During the year there might be changes in the price according to developments in the international price.

Surplus removal

A surplus removal scheme allowed the government to achieve stability in the domestic market for the products supported by administered prices. Under the scheme, product surpluses were destroyed to prevent prices falling below certain levels. The government provided financial support for the surplus removal system until 2004. At that time the PPMB ceased all its surplus removal activities because of the unwillingness of the growers to continue financing it. In contrast, the PB and the IDB continue to occasionally intervene in the market to prevent a fall in producer prices. Funding for these operations stems from payments that the boards are authorised to collect by law from producers (MARD, 2009).

Consumer price controls

The Law on the Supervision of Prices of Goods and Services (1996) authorises the MOF and MOITAL to impose price controls on goods and services if they are supplied by a monopoly, or in the framework of restricted trade, or if producers benefit from government support. Various retail prices, constituting some 18% of the consumer price index, remain under the control of the government. These prices are either set directly by the government

Box 2.1. **Quota and price support systems in dairy and eggs sectors**

The Israeli **dairy sector** is strongly supported and protected: the industry is controlled from the production of raw milk through to retail sales. Raw milk production is controlled through production quotas and fixed producer prices. This overall planning policy of the dairy sector has not changed since the 1960s. The aim of the government in pursuing the planning policy is "to avoid the damaging effect of surpluses, ensure self-sufficiency, and guarantee income for milk producers". Quota allocation is also used as a tool to encourage settlement in less developed and border areas. The milk policy is based on voluntary agreements between farmers' representatives, dairies and the government (MARD and MOF).

The annual national milk production quota for the coming year is determined by MARD in accordance with the Milk Market Planning Law. The determination is based on the forecast of milk consumption, taking into account per capita demand for dairy products, population growth, income growth and consumption trends of different dairy products. An increase in consumption brings about an increase in the quota. The co-operative dairy-farm sector (*kibbutzim*) receives 56% of the quota; family owned dairy farm sector (*moshavim*) receives 43% of the quota and 1% is allotted to agricultural schools. The quota is then allocated to individual farms. The legal basis for the allocation of individual production quotas is the Milk Order. The annual milk quota is further divided into monthly quotas to encourage farmers to level-up production throughout the year so that the industry receives a more uniform supply. After the completion of the dairy sector reform in 2007 (Box 2.3), rules were established that allow milk quotas to be traded between farmers.

IDB is responsible for implementing the policy. It allocates the production quota, regulates the seasonal milk surpluses by fixing target prices for raw milk and decides on marketing channels for the surpluses (USDA, 2008c).

Milk producers benefit from the guaranteed (target) price per litre of milk paid by the dairies for any quantity of milk which is produced and marketed within the producer's quota. Milk marketed in excess of the quota is accepted, but purchased at lower prices than the target price. In 2008, over quota produced milk was paid 20% of the target price per litre.

The target price reflects the average cost of production plus an agreed return to the farmers' labour and invested capital (Israeli Dairy Board, 2007). The price is determined on the basis of a profitability analysis, which is carried out once every two years with respect to a representative sample of dairy farms. The findings of this analysis serve as the basis for calculating the target price. The price is updated once every three months in accordance with the detailed accounting procedure which concerns mainly price indices of inputs that are used in milk production (MARD, 2009).

Sheep and goat milk production is also covered by the quota system. The target price for goat milk is 160% to 171% of cow milk. The formula of calculating the target price is the same as that used for cow milk but the price is not reviewed as regularly. Target price for sheep milk is not mandatory. Sheep and goat milk accounts to 1.5% of total milk production in Israel. Sheep and goat dairy products are not subject to consumer price controls (MARD, 2009).

In 2008, MARD prepared "The Milk Law" for passing in Knesset that provides for the first time a full, comprehensive and organised basis for the planning and operation of the dairy industry, including establishing the legislative basis for the IDB and ensuring the payment of the guaranteed (target) price by dairies to the milk producers (USDA, 2008c).

The **egg industry** is also subject to a planning framework including production quotas and regulated prices. The Poultry Board (PB), established by the "Poultry Board Law" in 1963, is responsible for implementing the planning policy in the egg and poultry sectors.

Egg producers are subject to individual annual quotas that are strictly enforced. A guaranteed (target) price for the egg farmers is set on the basis of an agreed-upon cost accounting based on monitoring of production costs (but it does not include a profitability component as is the case for cow milk). The costs are monitored regularly (every three months) which serves the basis for updating the target price. Egg distributers are required to pay the target price to egg producers.

Source: MARD, 2009; USDA, 2008c; Israeli Dairy Board, 2007.

(such as certain utilities, communication and transportation fees) or are subject to supervision, requiring approval before they can be increased (certain food products, school books and medicines) (WTO, 2006).

MARD and MOF enforce the Law on the Supervision of Prices of Goods and Services for consumer dairy products. Until the end of the 1990s, all dairy products in the domestic market were subject to price regulation. In 1997, a gradual process of removing products from price regulation was initiated, according to their level of basic importance and to the level of competition characterising these products in the domestic market. As of 2009, the prices of ten dairy products, which are defined as basic consumer products, are subject to a price control framework (Annex Table 2.A1.3). These products constitute 25% of domestic dairy production in raw milk equivalent terms. IDB is responsible for implementing the price control.

Flour prices were completely deregulated in 2004, but five types of bread, accounting for about 35% of bread consumption, remain subject to government price controls. These price controls were terminated as scheduled on 1 January 2008. However, as a response to the global increase in wheat prices, the government reintroduced the fixed price of bread in mid-2008. In addition to basic bread and dairy products, consumer prices of table eggs, edible salt and yeast were subject to consumer price controls in 2009.

Reduction of input costs

In order to reduce input costs for agricultural producers MARD employs two policy measures: investment support and reduced water prices. These two instruments constitute an important part of total agricultural support. There is no additional support or reduction to variable inputs to agriculture.

Investment grants

In 1980, the Knesset passed the Law for Encouragement of Investment in Agriculture. Since then, the government has provided investment support to agricultural producers. The objectives of the Law are to improve the balance of payments by developing agricultural exports; develop agricultural activities in preferred regions; introduce advanced technologies for improving agricultural production while saving water and labour; and introduce technologies that minimise harm to the environment. According to the Law, investments are supported with an investment grant accompanied by tax concessions for the approved project.

The fields of assistance vary every year according to the priorities set by MARD. On the basis of the government decisions additional rates of co-financing for investment grants may be occasionally added beyond the permanent rate of grant set by the Law. All farmers are eligible for the grants provided that they meet the legal requirements and the priorities of MARD for a given year.

During 1980-96, the investment grant amounted uniformly to 20% of the cost of an investment project across the country. In 1997, the government decided to define the development regions and differentiate the rates of investment support according to these regions, based on the principle that peripheral areas get higher rates of support (see Section 2.1 for definition of development regions). The major change compared to the earlier system was that farmers located in the most populated areas in the centre of the country (ecological region B as defined above) were no longer eligible for investment

support. Farmers in development region A were eligible for a capital grant equal to 20% of the investment while farmers in the development region B were eligible for a capital grant equal to 10%.

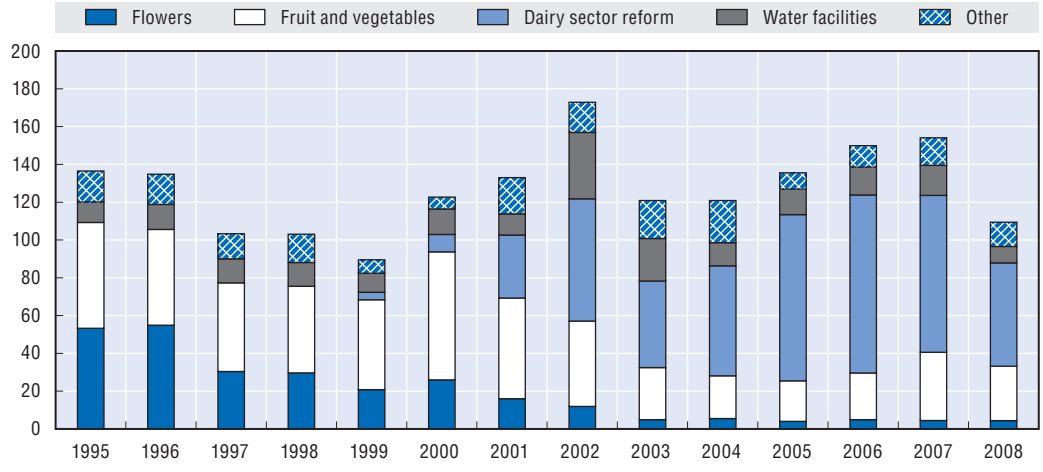
In 2009, the government redesigned the development regions. The central region was changed to an ecological region, where farmers are eligible for investment grants concerning environmental investments up to 25% of the investment (facilities for wood chopping in orchards, compost and biogas). Regions A and B continue to get the same rate of investment support as previously.

The investment grants are coupled with accelerated depreciation rates set for the investment. There is also an income-tax ceiling of 25% for a company that owns an approved agricultural enterprise and 30% for an individual who owns an approved agricultural enterprise, provided that he maintains separate bookkeeping for the enterprise. In both cases the entity is exempt from other income taxes on the enterprise. The tax concessions are given for 5-12 years for an individual and for 7-14 years for an enterprise depending on the crop they produce.

During 1995-2008, the annual support for investment grants in agriculture ranged between ILS 90 and 170 million (USD 22 to 45 million)[1] (Figure 2.3). Until 2000, the main beneficiaries were flower, fruit and vegetable producers. The supported projects involved mainly investments to greenhouses and heavy machinery for open-field crops as well as drip irrigation facilities. During the period, table vegetables production moved from open fields to covered areas (greenhouses, hothouses, net-houses) that save scarce resources like water and land as well as have resulted in improvement in product quality. Since the launching of the dairy reform in 1999, a substantial share of investment support has been directed to the restructuring of the dairy sector. During 2004-08, investment support for the dairy sector amounted on average to more than half of the total investment support to agriculture. The main objectives of the dairy reform were to increase the efficiency of milk production and create incentives for farmers to bring their production facilities into compliance with environmental requirements. Similar reform is planned in egg sector for coming years (Box 2.2).

Figure 2.3. **Investment support for agriculture, 1995-2008**

Unit: ILS million



Source: OECD, *PSE/CSE database for Israel*, 2009.

Box 2.2. **Reforms in the dairy and eggs sectors**

Investment support for reforming the dairy industry

By the end of the 1990s the dairy sector faced two major challenges: the opening of the domestic market to cheaper imported milk products due to international trade agreements, and the need to enforce the environmental regulations in order to decrease the pollution of land and water. The reform commenced in 1999 and continued until 2007. The aim was to provide incentives for farmers to improve their cost efficiency particularly through increasing the volume of production. The elements of the reform were:

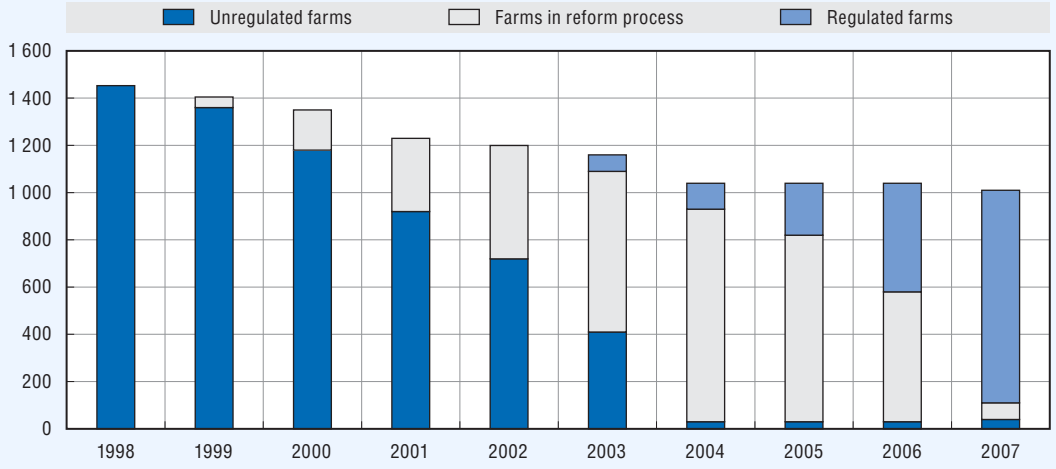
- To allow for trade in production quotas between existing producers, thereby encouraging inefficient producers to quit and efficient producers to expand.
- To subsidise investments in farm infrastructure that are necessary to increase production capacity and meet environmental regulations.
- To reduce gradually the farm gate price of milk (Kimhi, Rubin, 2006).

Government support for investments to meet environmental standards amounted to 50% of the cost of investment and was provided for enlarging covered spaces, building concrete floors in farms, separating running water from cow spread areas and preventing slurry from reaching the farm's periphery. Within the framework of the reform, strict criteria were formulated for the environment-friendly operation of dairy farms, largely based on guidelines developed by the Ministry of Environmental Protection. By the end of 2007, 98% of Israel's dairy farms presented improvement plans and nearly 90% had completed their environmental improvements (MEP, 2008a) (see Section 3.3 for further discussion of environmental aspects of the reform).

Government grants for investments to enlarge the production units amounted to 40% of investment costs. Enlargement of the farms was also encouraged by mergers or trading of quotas. During nine years of the reform the number of dairy farms declined by 30%, from 1 453 to 1 010, and the average size of production unit increased (Figure 2.4). During the same period, national milk production increased by 9%. The goals concerning increasing efficiency were also met as a result of the reform: although in general milk production costs did not decrease, the labour cost per litre of milk decreased, quality of milk improved and farmers earned more per production unit compared to the pre-reform period.

Figure 2.4. **Dairy farm reform, 1998-2007**

Unit: Number of farms



Source: www.sviva.gov.il/bin/en.jsp.

Box 2.2. **Reforms in the dairy and eggs sectors** *(cont.)*

Investment support for reforming the eggs sector

Reform of the egg sector began in 2009. The purpose is a wide-ranging adjustment of veterinary, health and environmental requirements, as well as the adaptation of the economies of scale through a significant enlargement of egg production units.

According to the reform plan, all table egg production units will have to be licensed by 2011. Licensed farms will have to conform to strict standards of cleanliness and health requirements. Currently, the majority of existing farms in Galilee do not meet these requirements. Some farms in the central part of the country were built according to the new standards and are already licensed. The government will help growers in Galilee to relocate farms in new areas out of the villages and rebuild their units according to the new requirements (ILS 260 million, USD 65 million), and will also invest in infrastructure in those new growing areas (ILS 40 million, USD 10 million). The government will grant the growers in Upper Galilee 50% of the investment cost while investors from other regions will be granted 20%.

The current planned production system will be extended for another ten years. Starting in 2008, the subsidy paid under the Galilee Law will be reduced gradually and will come to an end in 2017. Within the framework of the reform package, the government also intends to reduce the guaranteed basic price for table eggs by approximately ILS 0.05/egg (USD 0.01/egg). Total investment in the reform is estimated to be ILS 750 million (USD 187 million), of which the government will cover ILS 300 million (USD 75 million) and the rest will be invested by producers.

Source: Kimhi, Rubin, 2006.

Reduction of labour cost for agriculture

About 70 000 workers are hired in the agricultural sector, of which 23 000-26 000 are foreign workers, mostly from Thailand, who are granted labour permits for agriculture only (Chapter 1). In 2003, government introduced an annual "request impost" and "employment fee" each amounting to ILS 1 000 (USD 249) per worker. The employment fee is lower compared to other sectors, for example it is at 25% of that in the construction sector, which implies that agricultural sector receives an implicit subsidy of ILS 85 million annually (USD 20 million). The government is planning to reduce the number of working permits allocated to the agricultural sector to 18 900 by 2015. As compensation, farmers will be offered investment support over 5-6 years (grants up to 40% of investment) for replacing labour with machinery starting from 2009. The budgetary expenditures for these investments amount to ILS 250 million (USD 62 million) during 2009-14. Additional ILS 30 million (USD 7 million) will be provided for research and development to improve mechanisation during 2010-16. Government supports also the employment of 1 500 Israeli workers instead of foreign workers in the agricultural sector with ILS 30 000 per worker over three years; with total budgetary expenditures amounting to ILS 45 million (USD 11 million) in 2010-16.

Water support

Water is the other scarce resource in addition to land used by agriculture in Israel. Water resources are owned by the state and the government allocates water for agricultural use through a quota system (see Section 3.2 on managing water resources). Farmers are charged rates lower than the full cost of water. Lower water rates for agriculture are compensated partly through cross-subsidisation by charging higher rates from households and partly through government support for operation, maintenance and fixed capital costs paid to the

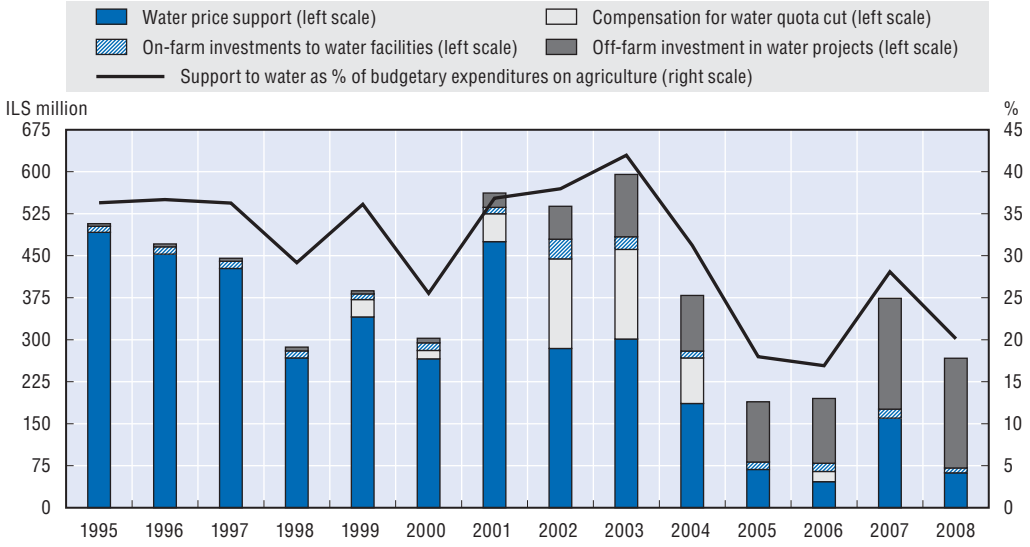
National Water Company (Mekorot) from MARD. In 2006, an agreement was signed between farmers and the government to further increase water prices for agriculture to fully cover the average cost of supplying fresh water to agriculture by 2015. During this period farmers will receive support to improve their irrigation technology on the farm.

During 1995-2008 support for water resources in agriculture varied between ILS 189-595 (USD 42-168 million) accounting for on average one-third of total annual agricultural budgetary support. The current overall support for water resources in agriculture includes the following elements (Figure 2.5):

- Water price support: agriculture's share of budgetary expenditure provided for supplying freshwater to farms (*i.e.* through the National Water Carrier, NWC). It includes mainly the operation and maintenance costs and fixed capital costs of National Water Company (Mekorot) and other water suppliers, including the costs arising from the supply of water into the NWC from the recently opened and planned seawater desalinisation plants. This support will be phased out by 2015.
- Compensation for water quota reductions: budgetary expenditure provided as compensation for the reduction in the freshwater quota allocated to farmers.
- Support to farmers to invest in irrigation technology as agreed between the farmers and the government during the period of 2007-15 over which the charge to farmers for freshwater will be gradually increased to cover average supply costs (*i.e.* operation, maintenance and capital costs).
- Investments in water facilities: this includes budgetary support for on-farm irrigation facilities and infrastructure, such as drip irrigation systems.
- Investments in off-farm water projects, mainly infrastructure investments related to waste-water treatment.

Figure 2.5. **Budgetary support related to water used in agriculture, 1995-2008**

As % of total budgetary support to agriculture



Note: The various categories of support for water are those defined with the *PSE/GSSE database*. Extraction levy concession is not shown in the figure.

Source: OECD, *PSE/CSE database for Israel*, 2009.

- Research and development, information and advisory services for irrigators: support is provided to agriculture in terms of developing the research and development for new irrigation technologies (*e.g.* sub-surface drip irrigation), as well as the dissemination and use of farm advisory services to help improve irrigators water management practices (OECD, 2009d; Plan Bleu, 2007a) (not shown in Figure 2.5 as it is not separated from the overall MARD budget for research and development and farm advisory services).
- Extraction levy concession: to reflect the scarcity value of surface water and groundwater, farmers pay an extraction levy since 2000; the levy is lower for agriculture compared to industry and household water consumers, which results in an implicit subsidy for farmers on average of ILS 90 million (USD 20 million) annually during 2000-08 (not shown in Figure 2.5 as it is implicit transfer and not actual budgetary transfer).

Debt restructuring and write-offs

Before the mid-1980s regional co-operatives (secondary level co-operatives) (Box 1.2) were engaged in providing financial and other services for their members: *kibbutzim* and *moshavim*. Farmland in Israel is nationally owned and farmers cannot use it as collateral. The fact that farm products were marketed through these regional co-operatives created an institutional guarantee for loan repayments and replaced collateral for loans drawn by co-operative agriculture. In addition, mutual guarantees were used: *moshavim* and *kibbutzim* were guarantors to the loans taken out by their regional co-operatives.

During this time, the supportive and protective government policy towards agriculture created the impression that farm debt was secure and farms would not be allowed to fail. This encouraged banks to lend to agriculture without applying the standard screening measures of creditworthiness and repayment capacity. This combination of soft-budget constraints and moral hazard led to over-borrowing and was at the root of the Israeli farm crisis that erupted in the late 1980s (Lerman, 2008).

Furthermore, regional co-operatives transferred credit to their members regardless of their ability to repay loans on the terms received. In addition, members of the co-operatives, who mutually guaranteed loans taken by the regional co-operatives, did not have the appropriate control over the actions of the officers responsible for running their financial affairs. A major consequence arising from this weak control and easy credit situation was the overall poor economic performance of both *kibbutzim* and *moshavim* as well as regional co-operatives (Kislev, 2000).

The debt crisis was triggered by the anti-inflationary government policy in 1985. Inflation was reduced from an annual rate of over 500% to about 20% in 1985. Consequently, the real rate of interest on agricultural debt, which had been negative since the early 1970s, increased up to 20% in 1985. Before the crisis, farmers were taking out cheap loans to repay debt. After the crisis, new credit could only be raised at interest rates of 100% and even more. Under these conditions the farm sector could not continue to service its debt. According to various estimates the volume of debt had reached ILS 5.7-6.5 billion (USD 3.6-4.1 billion) by 1988 (Kimhi, 2008, Lerman and Sedik, 2009).

To rescue the agricultural co-operatives and the commercial bank lenders, the government convinced the commercial banks to reach an agreement with the farmers on debt restructuring. The banks had no alternatives but to go along with the agreements because the debt of the farm sector was backed mostly by mutual guarantees. In 1988-89 agreements were concluded for the *kibbutzim* and *moshavim* sectors that wrote off part of

the outstanding debt and rescheduled the remaining debt for 15-20 years, with positive, but low real interest rates. However, the implementation of these initial debt restructuring agreements was minimal because farmers expected to obtain better terms in the future (Kimhi, 2008).

In 1992, two separate debt settlements were reached for the *kibbutzim* and *moshavim* sectors. The core of the two settlements were similar: determining the level of debt, as of 31 December 1991 that was directly linked to agricultural activity; assessing the repayment potential of farms and rescheduling the part of the debt deemed repayable; and forgiving the remaining debt. The Debt Settlement Administration was created whose responsibility was to oversee the implementation of the agreements (Box 2.3) (Kimhi, 2008).

Box 2.3. **Debt restructuring and write-offs in *moshavim* and *kibbutzim***

***Moshavim* sector**

In 1992, the Knesset approved The Arrangement for Family-Based Agricultural Sector Law (known also as Gal Law) to resolve the debt situation of the family farm sector (*moshavim*) through financial rehabilitation measures. The Law required partial debt forgiveness by the *moshavim's* bank creditors, partial repayment of *moshavim* debt using the proceeds of certain required asset sales by the *moshavim*, and the restructuring of the remaining *moshavim* debt at below market interest rates (MOF, 1999). The outstanding debt as of 31 December 1991 stood at ILS 4.8 billion (according to the values of 31 December 1991) (USD 2.1 billion) (MARD, 2009).

The Law concerned 18 regional co-operatives, 477 agricultural co-operatives (the majority of which were *moshavim*), 29 085 family farms in *moshavim* and 352 individual farmers in the private sector. There were only 20 agricultural co-operatives that were not affected by the debt crisis.

By 2009, all the debts of *moshavim* and farmers who own lands in *moshavim* had been settled. The mutual guarantees have been cancelled. The debts of 354 agricultural co-operatives are paid, which amounts to 75% of the total number of co-operatives. The debt of the rest of the co-operatives is to be paid until 2015 (ILS 150 million, USD 37 million). There are still 8-10 co-operatives for which the current arrangement is problematic and there will likely be a corrective arrangement (MARD, 2009).

***Kibbutzim* sector**

Agreements establishing the main rescue and recovery programme for *kibbutzim* were signed by the *kibbutzim*, the government and the seven banks crediting the *kibbutzim* in 1989. The agreements were different from those reached for the *moshavim* sector as they had no specific legislative basis. The volume of overdue debt was also larger in the *kibbutzim* sector. The plan provided for a reduction in the *kibbutzim's* outstanding indebtedness by ILS 4 billion (USD 2.1 billion), of which 40% was to be paid by the government and the reminder was to be written off by the banks. A further ILS 8 billion (USD 4.2 billion) of the *kibbutzim's* outstanding loans from the banks were to be restructured (MOF, 1999).

The agreement was implemented slowly because of the complexity of the problems including the establishment of the long-term ability of the *kibbutzim* to pay the debts; the transfer of the indirect debt from the central and regional *kibbutzim* organisations to each *kibbutz* and its enterprises; and the formulation of the needed additional sources of funding. As of 1991, the total outstanding debt of *kibbutzim* sector stood at ILS 20.3 billion (USD 8.9 billion).

Box 2.3. **Debt restructuring and write-offs in *moshavim* and *kibbutzim*** *(cont.)*

By early 1995, it became clear that the 1989 debt reduction agreement for *kibbutzim* was inadequate and some of the *kibbutzim* were not able to meet the conditions. In 1996, a supplementary agreement was signed by the *kibbutzim*, the government and the seven relevant banks. The principles of the agreement included the following:

- ILS 5 billion (USD 1.7 billion) indebtedness of the *kibbutzim* and the corporations they own was to be written off (in addition to amounts provided for in the 1989 agreement) by their bank creditors.
- A further ILS 0.85 billion (USD 0.3 billion) of debt was to be written off by the banks, provided the *kibbutzim* pay their debts regularly in the first three years following the signing of the agreement.
- The *kibbutzim* would surrender to the government their rights to use 27% of their land leased from the government.
- The government would pay the banks between 25% and 35% of the aggregate sum of the indebtedness to be written off (MOF, 1999).

In April 1999, a further agreement between the *kibbutzim*, the government and the seven banks was signed, and approved by the Knesset Finance Committee. Under the terms of this agreement, the banks forgave in addition ILS 4 billion (USD 1 billion) of *kibbutzim* debt, where 35% will be paid to the banks by the government in five annual payments linked to the CPI with the addition of annual interest rate of 1.5%, with the remaining 65% written off by the banks. In exchange the *kibbutzim* surrendered 30 000 *dunam* (3 000 ha) of land to the government which the government then sold, the proceeds of which were distributed between the government (35%) and the banks (65%) (MOF, 1999).

In 2007, *kibbutzim* reached a new agreement with the government. The agreement included write-off the *kibbutzim* debt totalling ILS 18.4 billion (USD 4.5 billion) and the rescheduling of the repayment of an additional ILS 9 billion (USD 2.2 billion). The state bore the main cost of the arrangement, with the banks shouldering the rest. In exchange, the *kibbutzim* transferred 20 000 *dunams* (2 000 ha) of land to the state with an estimated real estate value of ILS 1.5 billion (USD 0.4 billion). In addition, the *kibbutzim* committed to transfer 25% of their Tnuva shares (largest dairy products manufacturer in Israel that was co-operatively owned by a large number of *moshavim* and *kibbutzim*) to the state and banks. In accordance to the *kibbutzim* debt arrangement, all *kibbutzim* shall complete the repayment of all remaining debts by 2013 (MARD 2009).

After signing the settlement agreements twenty years ago, the regional co-operatives which provided financial intermediation services in *moshavim* sector ceased to operate and their assets were sold to private investors. In the *kibbutzim* sector the secondary co-operatives continued to function, but on a modest scale and no longer as financial intermediaries. *Kibbutzim* and individual farmers in *moshavim* have to turn to the commercial banks directly and as they cannot use land as collateral, credit is now available only when sound economic performance is demonstrated (Lerman, 2008).

Source: MOF, 1999; MARD, 2009; Lerman, 2008.

On-farm services

Extension services played a vital role in the early days of agricultural development in Israel. Over the years, agriculture was developed through a rapid transfer of practical information from research to the farmer. As a result, agricultural extension and research have become an integral part of Israel's agricultural infrastructure.

The Agricultural Extension Service (AES) is a unit within MARD. It covers all agricultural branches: flowers; vegetables; deciduous and subtropical fruits; citrus; field crops; poultry, dairy and beef; sheep and goats; bees; crop protection; irrigation and fertilisation; farm machinery; farm management; landscape and gardening.

AES is responsible for formulating the branch-wide technical policy; providing technical support to regional extension specialists; advising various units of MARD; and maintaining ties with research and technology generation. AES is also active in conducting its own field experiment research programme to assist the transfer of know-how from science to farmers and to the agricultural input industry. This system is well developed in Israel, and ensures close co-operation between scientists, farmers and industry.

AES employs 160 people and has five regional offices. One extension officer provides services to 100-150 farmers. Around half of the working time is used for extension services and the other half on field research activities. Extension services are provided to farmers in various ways: direct contacts between extension officers and individual farmers; advisory services to farmer groups and farmer clubs; courses, workshops and conferences; professional tours and visits to demonstration farms and regional research stations; various publications; use of information technology services.

Extension services are predominately free to farmers. Farmers have to pay only for professional publications and entry fees to seminars and courses. The government finances 88% of AES with the remainder (12%) coming from farmer organisations. Average annual budgetary support for extension services amounted to ILS 50 million (USD 12 million) during 1995-2008. However, as from 2010 MARD plans to limit free extension services up to three free extension officer's (*e.g.* agronomist) visits to the farm per year. The funding of the fourth visit, if requested by the farmer, will be shared by MARD and the farmer; the cost of possible additional visits will be fully paid by the farmer.

Income support measures

Income support is provided to poultry, egg and wheat producers in Israel. Poultry and egg producers are supported under the Galilee Law, while wheat producers benefit from the income support programme for rain-fed crops. In addition, every seventh year all agricultural producers are eligible to receive compensation for income losses if they observe the Sabbatical year, when Jewish owned land in Israel is given rest.

The Galilee Law

According to the Galilee Law 1988, a special subsidy is paid to poultry producers (table eggs and poultry meat) in the Merom Hagalil area, which includes all agricultural settlements in the strip along the Lebanese and Syrian borders extending for some 20 kilometres from the border. The intention of the Law is to promote the development of the Galilee area. The subsidy is paid primarily because production conditions in that area are different from other parts of the country and to support the stable agricultural settlements in this unique periphery. In 2008, an amendment to the Law was adopted with the requirement that owners must reside in the area in order to meet the eligibility criteria for the support. The subsidy has been paid to producers since 1989.

Until 1993, the subsidy was given as a fixed rate per kilogram, which was linked to the living cost index. Starting from 1994, the subsidy was calculated as a percentage of the production cost. Initially, the calculation of costs was prepared by the Israeli Farmers Federation and approved by MARD and MOF. Later, the regulations enacted under the framework of the Galilee Law determined the detailed procedure for the calculations subject to approval by MARD and MOF.

The subsidy for table eggs is 17% of the production cost, up to a maximum amount of 500 000 eggs per grower. This rate will be reduced gradually over the coming years as part of a comprehensive agreement reached by MARD, MOF and the PB to reform the egg-laying branch that started to be implemented in 2009. The annual average budgetary cost of this support for egg producers amounted to ILS 40 million during 1996-2008 (USD 10 million).

Support for poultry meat amounts to 13% of production costs, up to a maximum amount of 50 tonnes per grower on a family farm (*moshav*) and 500 tonnes per grower on a co-operative farm (*kibbutz*). No support is provided for the production exceeding the upper limit (for the rates of support and production costs see Annex 2.A1). Since 1999, broiler producers entitled to support under the Galilee Law can choose whether to continue production or not. Producers who opted for leaving the broiler sector are entitled to the subsidy based on their historical production level; however they should remain residents of the area. Budgetary expenditure for broiler producers in the framework of the Galilee Law amounted to ILS 47 million in 2008 (USD 13 million). As much as 88% of this support was provided according to historical production level to those farmers who are not active in poultry production any longer.

Compensation to broiler producers due to structural reform

The reform of the poultry meat sector commenced in 1994 with the main purpose of increasing the efficiency and product quality of farm production by shifting production into modern and more efficient units so as to enable a move from the marketing of frozen meat to fresh and chilled meat. The other major objective was to reduce the planning system for the broiler industry and eventually liberalise poultry production. Under the reform framework, poultry producers were given the opportunity to increase their production unit or to leave the industry. Government support involved two aspects: providing safety-nets to producers who choose to continue production and enlarge the farm; and retirement compensation for those who choose to leave the industry.

The safety-net system operated for the three years 1994-96, during which the government paid producers the difference between the average market price and 90% of the costs of production every month. Farmers who choose to leave the sector were entitled to retirement compensation. The highest retirement compensation (ILS 1.8 per kg, USD 0.6 per kg) was paid to small farms. The rest of the growers who decided to quit received reduced retirement compensation (ILS 0.45 per kg, USD 0.15 per kg). Most of the producers who retired during the first three years fell under the high compensation category (about 10% of total broiler production).

At the same time the quota system for poultry meat was loosened, with producers allowed to increase their production by 20% per farm. Later the quota ceiling was removed, with the system only determining the number of growers. This restriction was removed from the beginning of 2007. As a result of the reform, the number of producers decreased drastically: from 2 000 active producers in 1994 to 500 in 2009. The retirement compensation scheme continued over the later years of the reform, although producers who left during this period received the lower compensation rate as small-scale farmers who were eligible for the higher rate already quit the sector.

Budgetary expenditure amounted to ILS 34 million (USD 11 million) during 1995-96 after which it decreased to around ILS 1 million (USD 0.2 million) per year. No support has been given to broiler producers under this programme since 2005.

Support for rain-fed grain growers

In order to encourage the preservation and proper maintenance of open landscape MARD has supported the cultivation of rain-fed (*i.e.* un-irrigated) crops since 1989. Only wheat and small amount of barley are cultivated as rain-fed crops in Israel. The support is designed to ensure income stability for the farmers corresponding to the amount of land they cultivate. To establish the payment rate, Israel is divided into four different cultivation regions. For each region economists from MARD together with field instructors determined an accepted production costs calculation.

The support serves as a safety net for field crops, and covers the gap between the sale price of local wheat (announced for purchases to the emergency stocks in May based on Kansas market price adjusted to quality and transportation costs) and 82% of the production cost determined for that specific cultivation region. This difference is then multiplied with the production volume of the region to derive the amount of support determined for the specific region. This fixed sum of support allocated to the area annually is divided by the number of *dunams* (1 *dunam* equals 0.1 hectare) cultivated in the region every year. Due to the rise in world wheat prices from 2004 onwards, support has only been paid to producers in the southern region, which is south of the drought-line where the annual average precipitation is less than 150 mm.

In 2009, this support scheme was replaced by an income insurance framework for rain-fed grain growers. MARD will subsidise the premiums at rates varying from 40% to 80% according to the variation in yields in each region. The programme will be operated by insurance companies. Government expenditure in funding the premiums for the new income insurance will amount to some ILS 9 million (USD 2 million) per year, for a total area of 0.9 to 1.2 million *dunams*.

Support in case of Sabbatical year (Shmita)

In the Sabbatical year, according to Judaism, Jewish owned land within the Land of Israel should be given rest. The Sabbatical year recurs every seven years. An arrangement called "sale permit" allows continuing cultivation of most of the crops, so that 85% of the population can be supplied with agricultural products. The religious orthodox community that constitutes about 15% of the population does not wish to consume Israeli agricultural produce during a Sabbatical year in accordance with their religion. According to *Halacha* (Jewish law) it is possible to carry out various arrangements to allow the religious orthodox public also to consume local agricultural production. These arrangements may cause market failures, for example: part of the crops are transferred to animal consumption, part of the crops is sold at low prices without correlation to the local market price, planting of plants and fruit trees are postponed, use stored crops from a previous year for supplies in a Sabbatical year.

The objective of support given during the Sabbatical year is to preserve cultivated agricultural lands and to give farmers who stop working on their land an option to make living during the Sabbatical year. Support is given to the following farmers and bodies all across Israel: farmers who shut down their farms during a Sabbatical year; fruit tree nurseries that suffered losses; bodies who store agricultural produce from a sixth year; wheat growers in Israel as well as farmers from the non-Jewish sector who constructed greenhouses for vegetable cultivation and farmers in the Jewish sector who invested in hydroponic cultivation. The Chief Rabbinate is responsible for handling the sale permits

and the Treasure of the Rabbinical Court (*Otzar Beit Din*) provides the safety net and marketing of produce under Jewish law. The last Sabbatical year occurred in 2007/08 and budgetary support for this purpose amounted to ILS 75 million (USD 21 million), to be paid from 2008 until the end of 2009.

Preferential tax policies

In general, the agricultural sector is not subject to any preferential tax policies. The only concessions providing support to farmers are those associated with investment grants provided under the Law of Encouragement of Investments in Agriculture as described above. The other exemption relates to fresh fruit and vegetables that are exempt from value added tax since the implementation of the VAT Law in 1976.

Environmental measures

Since the foundation of the state of Israel in 1948, the country has faced significant environmental challenges, particularly concerning water management and land reclamation. More recently, intensive agricultural practices have raised concerns about ecological damage. During the past decade, MARD has initiated various reforms and processes to allow for the sustainable conservation of natural resources and environmentally friendly agricultural and economic activities in rural areas. The most significant were enacted as part of the wider reform programmes for the dairy and egg laying sectors (Box 2.2). The overall environmental objectives of the government are to protect open landscape, water sources and natural resources; reduce the use of pesticides; and preserve and develop rural areas (Chapter 3). MARD gives financial support for two programmes specifically designed for preserving open areas: maintaining cattle, sheep and goats on pasture, and support to herders by the Grazing Authority. MARD also supports a programme aimed at soil conservation.

Maintaining cattle, sheep and goats on pasture

MARD encourages the keeping of sheep, goats and cattle for meat production on pasture in order to maintain an open landscape. The programme started with support for beef herds in 1997; sheep and goats were added to the programme in 2005. The support is provided mostly in peripheral regions and in areas for which there is no alternative agricultural use. The amount of meat produced from these herds is equivalent to 17% of total fresh meat consumption in Israel and 5% of total meat consumption (including imported frozen meat).

Until 2003, support was provided as a fixed rate per animal. In 2004, a new system was introduced that provides a payment per land area grazed by the herd, taking into account the number of animals relative to vegetation on the land (the regions of Israel are divided into four different categories of pasture richness). Herd owners have to follow appropriate production practices and environmental criteria. The total budget designated for this programme amounted to ILS 15 million (USD 4 million) in 2008. The total supported area amounted to 1.22 million *dunams*: 1.16 million *dunams* for cattle production and 60 000 *dunams* for sheep and goat production.

Support to herders by the Grazing Authority

The members of the Grazing Authority are MARD, ILA and the Settlement Division of JNF. The overall objective of the support programme is to maintain grazing areas, preserve open landscape and Israel's land reserves. Support is provided for establishing

infrastructure in grazing areas (*e.g.* fences, pipes, folds) and for improving the pasture vegetation by stripping, perfusion and fertilisation. The Grazing Authority determines the nationwide support policy and divides the annual budget between 10 different regions based on the number of growers, the number of animals and the size of the developed and undeveloped grazing areas in each region. To participate in the support programme, a farmer has to hold a regularised contract with the ILA (ensuring yearly payments of land leasing and grazing fees), a veterinary permit for a herd in pasture and an Internal Revenue Service permit for the size of the herd in pasture. Support is paid per *dunam*. Annual expenditures have ranged between ILS 2 and ILS 3 million (USD 0.5 and USD 0.7 million) during 1995-2008.

Soil conservation

The soil conservation programme is contributing to the broader goal of MARD to develop sustainable agriculture. It is implemented by the Soil Conservation and Drainage Department in MARD. The main purpose of the programme is to encourage the implementation of soil conservation actions in cultivated agricultural lands. Support to soil conservation programme includes three items:

1. Support for the acquisition of machinery and equipment designed for soil conservation. For example, no-till seeding machines in crop field and orchards, tools for partial ploughing of the cultivated area and cultivation tools that cause a minor disturbance of the soil layers. The support rate for 2008 was 40% of the actual purchase cost. Budgetary expenditures to this part of the programme amounted to ILS 400 000 (USD 111 000) in 2008.
2. Support for managing land through soil and water conserving cultivation practices. This is intended to minimise runoff and erosion of the cultivated agricultural land, which consequently decreases the cost for building and maintaining infrastructures and reduces pollution of rivers and water sources due to erosion, pesticides and fertilisers. The payment rate is ILS 25 (USD 7) per *dunam* in the case of crops or orchards, and ILS 20 (USD 6) per *dunam* for enhancing organic matter. Budgetary support for the land management amounted to ILS 3.5 million (USD 1 million) in 2008.
3. Support for land conservation and agricultural drainage facilities is aimed to encourage farmers to minimise soil erosion and drain the rainfall excess from their fields. Budgetary support for land conservation and agricultural drainage facilities amounted to ILS 1.8 million in 2008 (USD 0.5 million).

Agricultural insurance system

The Fund for Natural Damages in Agriculture (KANAT) was established in 1967. Half of the shares of KANAT are owned by the government and the other half by marketing and production boards. Although KANAT is state owned company, it is run like a commercial enterprise. The idea behind the creation of the Fund was that the government and farmers would share the responsibility of providing insurance coverage. Farmers are not obliged to insure their crops by law, but it is highly recommended by the boards as well as by MARD. To lower the rates of insurance premiums, KANAT issues collective policies for each insured branch that are signed by the relevant board. In cases of damage, KANAT works directly with the individually affected farmer, by receiving damage notices, inspecting the properties, assessing the damage and determining compensation on the basis of the relevant insurance contract. Indemnities are paid either directly to the affected farmer or to the board with a specified list of producers.

Premiums are charged in various forms, depending on the crop in question. In principle, KANAT charges uniform rates for all producers of a given crop in a given area. However, it operates a system of no-claim bonus, based on the individual record of each insured farmer. A positive record, namely minimum or no claims by an individual farmer, is usually an outcome of the farmer's investing in protecting and/or damage preventing means.

Insurance against natural damages

The main insurance programme against natural damages covers mostly seasonal damage to yields. Due to continuous budgetary constraints, the rate of subsidies for the premiums provided by the government to this programme decreased over the years. In 2008, government support covered 35% of the premiums paid by farmers. During 2003-07, the annual average budgetary expenditures were relatively stable at around ILS 26 million (USD 6 million). In 2008, compensation payments under the natural damage insurance scheme increased due to compensation for damage caused by a severe frost.

Multi-risk insurance

Until 2000, the government covered financial losses resulting from natural disasters (country-wide catastrophes) according to the Natural Disasters Law 1989. Under the Law, the government had to declare a state of national catastrophe. However, the government did not have any mechanism for assessing losses due to natural catastrophes. In addition, the administrative process to declare a state of natural disaster was complex and resulted in a long delay in assessing the damages and compensating producers.

As a result, KANAT launched a new multi-risk insurance programme in 2000. This programme covers all kinds of fruit crops against unusual natural damages that cause not only seasonal damage, mostly to the yields, but also multi-annual damage to the trees that affect future yields. The multi-risk insurance programme is available only to farmers who are insured under the traditional natural damages programme. Governmental support to the premiums of this programme amounts to 80% because until a few years ago these damages were covered under the Natural Disasters Law and excluded farmers' participation. Since its establishment the average annual budgetary expenditure on multi-risk insurance has been around ILS 42 million (USD 9 million).

This insurance coverage offers the following advantages to the Israeli farmer:

- Farmers have a properly regulated insurance that secures compensation of 70% to 95% of the insured yield.
- Insurance contracts determine the expected timing and the amount of compensation to the farmer.
- There is no longer a need for the government to declare a natural catastrophe. Farmers can be compensated without the need of government declaration.
- The insurance can serve as an appropriate guarantee for loans.

The Natural Disasters Law was amended in 2006 to include compensation from the national budget only for uninsurable damages caused to infrastructure, for example, erosion damage to agricultural soils and rehabilitation of riverbeds.

Rural public services infrastructure

Research and development

Agricultural research in Israel is well developed. Intensive production systems in Israel are the result of close co-operation and interaction between scientists, extension advisors, farmers and agriculture-related industries. Israel's agriculture is supported by both basic and applied research.

National priorities for research are set every year by a National Steering Committee for agricultural research and development, headed by the MARD Chief Scientist. For each section/branch, there is an experts' panel that decides on priorities and monitors the achievements of the research activities. Major tasks of the Chief Scientist are to identify agricultural problems in which the knowledge gap exists, to determine research goals aimed to bridge such gaps, to fund research activity and to monitor research performance. Financial support is given for research programmes within MARD as well as to universities and other research centres.

The main research areas of national interest that are recommended for government financing are:

- Development of new high quality varieties of fruits and vegetables for export, and processes for extending the shelf life of fresh produce exported by sea which is less expensive than air.
- More efficient use of water for irrigation and exploiting low quality water, in general, and recycled waste water, in particular.
- Instituting quality management procedures for fresh and processed agricultural produce, and ensuring production under strict food safety regulations, *e.g.* reduction in the use of pesticides and herbicides.
- Long-term development of sustainable agriculture while protecting the environment and conserving natural resources (land and water).
- Strengthening of agriculture in the peripheral areas and in national priority areas in the Negev and the Galilee through the development of crops suitable for such areas, more efficient use of means of production, activation of the regional research and development system.
- Reducing the dependency of agriculture on foreign workers through labour-saving technologies.
- Rural development.
- Development of scientific infrastructure and biotechnologies for future products.

Agricultural research is funded primarily by the public sector (85%) of which MARD provides the major share. From 2001, average annual government spending on agricultural research and development is about ILS 218 million (USD 51 million). Other sources of public funding include bi-national and international funds. The private sector funds the other 15% of agricultural research, mainly in the framework of the agricultural input industry (*e.g.* fertilisers, seeds, irrigation equipment, pesticides). It is also supported by the office of Chief Scientist in MOITAL. The farming sector funds research through the production and marketing boards and the farmers organisations.

The vast majority of the applied agricultural research in Israel is carried out by the Agricultural Research Organisation (ARO), which is attached to MARD. ARO is involved in solving current problems in agricultural production for the benefit of farmers and consumers with the introduction of new products, process and equipments, as well as carrying out basic and applied research projects for agriculture in the future. Research in agriculture is also carried out by several universities and some regional research institutes.

Activities in applied research are also carried out at the Regional Research and Development Centres. These were established in order to meet the unique climate and soil conditions, as well as other needs, of each particular region. The regional centres, reflecting government policy to develop the nation's agriculture, are located mainly in peripheral areas in the north and south of the country – in the Jordan Valley, the Negev desert and Arava.

The leading bi-national fund involved in agricultural research is the United States-Israel Bi-national Agricultural Research and Development Fund (BARD) that is active mainly in basic research. BARD is a competitive funding programme for mutually beneficial, mission oriented strategic and applied research of agricultural problems, jointly conducted by Israeli and American scientists. Other bi-national funds include the Joint Dutch-Israeli Agricultural Science and Technology programme, and bi-national programmes with Queensland (Australia) and Canada. Israel also participates in research and development programmes of the EU.

Public stockholding

MARD is responsible for maintaining an emergency reserve of wheat for human consumption and an emergency reserve of fodder grains. Each year MARD ensures the absorption of all domestic wheat production into emergency stocks at an agreed price derived from the price of imported wheat. Domestic wheat production can supply a maximum of 25% of total wheat consumption in especially favourable (rainy) years.

The reserves are maintained by private storehouse holders that are selected through a public tender for a period up to 3 years. The reserves are purchased by the storehouse holders and are actually owned by them. The government covers only the storage and financing costs. The fodder grains reserve is fully based on imported cereals. MARD inspects the quantity and quality of the reserves. Annual average budgetary expenditure on these programmes is about ILS 40 million (USD 11 million).

Inspection services

The government dedicates a lot of resources to maintain plant and animal health as well as to food and feed safety. Gaining market access for Israeli exports of fresh products (mainly fruit and vegetables) is a priority for the government. The Plant Protection and Inspection Service (PPIS) and Veterinary Service in MARD are the main bodies responsible for inspection services. In addition, the Chief Rabbinate is responsible for enforcing the Kosher Meat Import Law (1994) in Israel and abroad in the case of imports (Box 2.4).

The main role of PPIS is to provide phytosanitary protection to Israeli agriculture by preventing the entry of injurious pests from neighbouring countries and by agricultural import; introducing environmentally friendly pest control methods; controlling the use of pesticides; and ascertaining the safety of fresh produce and feed. The development of organic production standards and inspection is also a task of PPIS.

Box 2.4. **Kosher food**

Kosher (also *kashrut*, *kashrus* or *kashruth*) refers to food that meets Jewish dietary law. In Hebrew, *kashrus* means suitable and/or pure, thus qualifying for consumption. The laws of *kashrus* include a comprehensive system of permitted and forbidden foods.

The only types of meat that may be eaten are cattle and game that have cloven hooves and chew the cud. If an animal species fulfils only one of these conditions (for example the pig, which has split hooves but does not chew the cud, or the camel, which chews the cud but does not have split hooves) then its meat may not be eaten. Examples of kosher animals are bulls, cows, sheep, lambs, goats, veal, and springbok. The birds that are traditionally considered kosher are the goose, duck, chicken and turkey. Only fish with fins and scales may be eaten, for instance, tuna, salmon and herring. Shellfish such as shrimps, crabs, mussels, and lobsters are forbidden. All products that grow in the soil or on plants, bushes, or trees are kosher.

Kosher animals must be slaughtered by a Schochet, a Rabbi who is specially trained for ritual slaughter. Since Jewish Law prohibits causing any pain to animals, the slaughtering has to be carried out in a way that ensures unconsciousness is instantaneous and death occurs almost immediately. The meat of the slaughtered animal is soaked in water for a half hour. To draw out the blood, the soaked meat is then placed on special salting tables where it is salted with coarse salt on both sides for one hour. Only the forequarter of a kosher slaughtered animal can be considered as kosher meat, the rest of the meat is considered as non-kosher.

All kosher milk products must derive from kosher animals. In addition, the milk of impure cattle and game (*e.g.* donkey milk) is prohibited. Dairy products may not contain non-kosher additives, and they may not include meat products or derivatives (for example, many types of cheese are manufactured with animal fats). Additionally, a number of pre-processed foods contain small portions of milk products, such as whey. According to kosher regulations, such tiny additives do not have to be declared on the packaging but may nevertheless render the product non-kosher. This applies especially to bread.

Under Israeli law, the sole authority for determining whether food can be labelled and sold as kosher is the Council of the Chief Rabbinate in Israel. Israeli law does not require imports to be kosher, except for meat, poultry and their products. However, as over 60% of the Jewish population, over 5.5 million people, maintain some degree of kosher observance at home and as major supermarket chains, most independent retailers and almost all institutional purchasers (*i.e.* hospitals, schools, army) are required to obtain kosher certification for all products they buy, the market for products without kosher certification is limited.

Source: MARD, 2009; GATT, 1994; WTO, 2006; Kosher Food Certification Organisation, 2009; USDA, 2005.

PPIS actively promotes Integrated Pest Management (IPM). The protection of all crops in the country is based on the guiding principle of IPM as required by both the domestic and export markets. IPM focuses on the reduction of chemical pest control and protection of the environment (Chapter 3). IPM for the Mediterranean fruit fly has been in operation since the beginning of the 1960s. It has been expanding in recent years in order to stop the spread of the fruit fly as a result of climatic change. PPMB is responsible for implementing the programme, with financial support provided by MARD: the expenditure was ILS 12 million (USD 3 million) in 2008. The rest of the funding is provided through a tax collected by PPMB from growers. All citrus growers participate in the Mediterranean fruit fly disinfestations project, while the participation of other orchards is only partial.

The main tasks of the Veterinary Service are to prevent, control and eradicate animal diseases and zoonoses. It formulates and enforces national strategies and action plans for protecting animal resources and public from epidemic/enzootic and infectious diseases, including zoonotic diseases. This includes the formulation and enforcement of systems for animal identification and registration, vaccination, monitoring and control of animal movements and quarantine. Veterinary Service is also responsible for animal welfare; supervision of meat inspection and veterinary control of slaughterhouses and abattoirs for local and export markets, and of processing of animal products for food intended for export; licensing food industries; and research and development in veterinary science and medicine.

The Control of Plants and Animals Unit ("Pitzuach") in MARD is responsible for implementing the agricultural agreements between Israel and the Palestinian Authority to ensure the protection of public, animal and plant health, and to prevent the smuggling of agricultural goods. The unit was formed in 1994 following the agricultural agreements signed between Israel and the Palestinian Authority. The annual expenditure on the supervision and control of cross-border movement of plant and animal products is ILS 11-18 million (USD 3-5 million) annually.

Total budgetary expenditure on inspection services during 2006-08 averaged ILS 87 million (USD 22 million) annually, accounting for around 7% of the total budgetary expenditures on agriculture.

Agricultural production infrastructure

The major support to production infrastructure investments relates to the waste-water treatment that started in 2001. Private sector enterprises may apply for one-time support to establish plants for returning waste-water to agricultural use. The grant covers 40%-60% of investment costs. The main purpose of the grant is to assist enterprises establish waste-water treatment plants so that the cost of the water will not exceed the tariff of treated waste-water supplied by the National Water Company (Mekorot). Budgetary costs on this programme amounted to ILS 100-198 million (USD 22-55 million) during 2003-08.

The government also supports the adaptation of irrigation systems to use reclaimed water, including: pumping and transporting the water to farms so that it is not mixed with drinking water and storing (ponding) the water from winter to summer (Kislev, 2001). Starting in the 1980s over 200 reservoirs were constructed, initially for storm water collection, but are now largely used to store recycled wastewater.

Market information

Two units of MARD are responsible for providing market information. The Agricultural Produce Marketing Department is responsible for collecting domestic price data. Wholesale prices are observed in three big wholesale markets in Tzrifin (central region), Jerusalem and Haifa. The review of prices is not based on statistical sample of distributers, but on randomly selected wholesale prices and is not representing weighted averages as the quantities distributed by wholesalers are not available. The price data is published daily on the MARD website and is also sent to subscribers.

The Department of Market Research is responsible for collecting information and conducting market research to provide information about Israel's export markets of fresh horticultural produce. The information is targeted to two major user groups: decision

makers in the public sector and growers and exporters. In 2008, the budget of the Department was about ILS 880 000 (USD 245 000). Until 2005, the production and marketing boards contributed to the budget, but since then it is fully financed by MARD.

Marketing and promotion

Until 2002, budgetary support for marketing and promotion was quite substantial, with annual expenditure of between ILS 20-70 million (USD 5-22 million). A large proportion of this support was given to various production and marketing boards. The other important support item was Exports Promotion Fund (Section 2.3). Total support for marketing and promotion programmes decreased below ILS 5 million (USD 1 million) after 2004.

Rural development programmes

The structure of rural communities has changed considerably since the mid-1980s, driven to a large extent by the farm debt crisis in the late 1980s and drastic changes in farmland protection policies in the 1990s (Chapter 1). These changes included the removal of some of the institutional restrictions on the allocation of farmland for residential use by non-farmers. This resulted in a large increase in the residents of rural settlements who are neither farmers nor members of the agricultural co-operative. The government also facilitated the release of agricultural land for new, previously prohibited uses and opened development opportunities for non-farming commercial, industrial and recreational enterprises in rural areas (Sofer and Applebaum, 2006).

The objective of rural development programmes in Israel are to strengthen rural community, re-design and restructure the Israeli rural settlement (*kibbutz* and *moshav*), develop and diversify its economic activities, and strengthen infrastructures while preserving open areas and protecting environment.

The means used by MARD for development rural areas are:

- Regional and settlement plans for rural development.
- Promotion of sustainable planning.
- Legal anchors for rural development.
- Training and instruction of officials serving the rural settlement.
- Capacity building for occupational retraining for non-agricultural activities.

In August 2006, MARD restructured its rural development programme by placing greater emphasis on promotion of rural tourism and some other rural related activities. Accordingly, budgetary spending on rural development programmes increased including training for farmers and support for rural agricultural tourism.

The decline in profitability of agriculture during the 1990s made it difficult to make a living from a farm and led to structural changes which gradually altered the set of economic branches that the village inhabitants made their living from. Consequently, public support in training the farmer for non-agricultural employment became an important and significant addition to agricultural extension services. Training is provided for the development of new businesses in the village, with an emphasis on rural tourism, which sometimes supplement agriculture and which are compatible with the rural character. Assistance is also provided for the regional councils to train local leaders. The training is essential due to the changes in the employment of the residents and the need for the absorption of new inhabitants within the settlements and the rural area.

The development of "tourism villages", former agricultural villages that have undergone a process of transformation and focus today on agro-tourism, was a project that has been administered by the Government Tourism Office for several years. The purpose is to consolidate agro-tourism within the rural area and settlements (Box 1.3).

The purpose of environmental and scenic development initiatives is to encourage tourism-related development that is suitable for agriculture and the rural area. These initiatives include regional and settlement-wide visitors' centres, attraction sites, hiking routes, agricultural and rural community heritage museums. MARD supports only those initiatives which are open to the public. This support is intended to create motivation for the development of the rural area and settlements while retaining the principles of sustainable development, and preserving the rural area and preventing its uncontrolled development (MARD, 2009).

Regional and settlement plans for rural development

Regional and settlement plans for rural development are one of the most important tools for developing rural areas and most of the rural development budget is allocated for this purpose. The master and outline plans designed by National Planning and Building Board constitute the statutory foundation for building rights and the development possibilities in settlements and in the regional-rural space. The management of open spaces and their varied layout including settlement, agriculture, infrastructure facilities, tourism, service systems, and roads and railways are all influenced by the national planning policy implemented by regional and local councils, namely local planning and building committees.

The changes that Israeli society and economy have undergone in the last decade require the adaptation of the planning policy for the rural sector. MARD seeks to outline the future directions of development in conformity with the spirit of the changes that have taken place in the rural space in recent years. Updated and appropriate plans help to remove statutory barriers from regional and rural development while allowing for sustainable development that preserves the characteristics of the rural settlement, integrating agriculture into it.

The reform of the Planning and Building Law, which was approved in the framework of the "Budgetary Arrangements Law" 2006, authorises the local planning and building committee to approve detailed plans within the committee's jurisdiction, on the basis of a valid updated outline plan. Consequently, the outline plan will grant the local planning and building committee the status and authority to approve detailed plans. This speeds up the procedure and enables the development plans, which rely on individual construction programmes, to be carried out more rapidly.

The Regional Councils' Centre initiated the promotion of master plans for sustainable development in the regional councils by pooling the budgets of different ministries, including MARD, Ministry of Environment Protection and Ministry of the Interior. The process is professionally guided by the Heschel Center and the Neaman Institute in Technion – Israel Institute of Technology.

The regional councils that joined the process have chosen planning teams under the professional direction of all those participating in the funding. These teams have been promoting the master plans for sustainable development in co-operation with the residents and farmers living in the regional council's jurisdiction. A significant number of regional councils in the southern and central parts of the country are currently seeking to join these plans.

Overall budgetary outlays on agro-food policies

Aggregate budgetary expenditure to support agriculture in 1995-2008 accounted for 0.5% of total government budgetary expenditure. During recent years the share of agricultural support in total government budgetary expenditure has fallen to 0.4%. The nominal level of expenditure on agriculture has fluctuated year-to-year. Fluctuations were mainly caused by changes in water price support. The composition of aggregate budgetary expenditure has broadly remained unchanged (Table 2.1).

Table 2.1. **Composition of budgetary support to agriculture, 1995-2008**

As % of total budgetary support to agriculture

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
On-farm support														
Water support	35	35	35	27	35	34	40	37	40	29	17	16	23	12
Investments	12	13	11	14	11	13	10	14	10	12	15	15	13	9
Galilee law	4	5	6	6	6	6	4	5	5	6	8	7	6	8
Insurance	7	6	8	7	7	6	5	6	4	6	6	6	5	13
Extension	3	4	4	5	5	4	4	4	3	4	4	4	3	4
Other	10	3	2	2	4	4	4	3	4	4	4	6	3	6
Off-farm support														
R&D	10	12	13	17	17	17	16	15	15	19	21	17	16	17
Inspection	3	4	5	7	7	5	5	5	5	6	6	8	7	7
Infrastructure	3	4	2	2	2	1	4	7	10	10	15	19	22	21
Marketing	5	5	4	3	2	4	4	2	1	1	1	0	0	0
Other	7	8	10	9	5	5	3	4	2	4	5	4	3	3
Total (ILS million, nominal terms)	**1 397**	**1 284**	**1 228**	**983**	**1 072**	**1 186**	**1 525**	**1 418**	**1 418**	**1 213**	**1 051**	**1 153**	**1 332**	**1 327**
Total (ILS million, in 2008 prices)	**1 884**	**1 647**	**1 504**	**1 150**	**1 198**	**1 309**	**1 660**	**1 489**	**1 496**	**1 280**	**1 100**	**1 186**	**1 373**	**1 327**

Notes: Water support includes water price support, compensation for water quota cut, support according to the agreement between farmers and the government from 2006 and implicit subsidy arising from lower extraction levy concession for farmers.
Total (ILS million, in 2008 prices) is derived using GDP deflator.
Source: OECD, *PSE/CSE database*, 2009.

The main component of the budgetary expenditures on agriculture is water price support that offsets the costs of water suppliers to supply water at significantly reduced rates to agricultural producers. This support also includes compensation for water quota cut for farmers. In 1995-2004, the share of water price support accounted to 35% of total support provided to agriculture, during 2005-08, the share has decreased to 17%.

As described earlier, agricultural research in Israel is well developed. Accordingly, government spending on agricultural research and development is relatively high and is the second largest form of budgetary expenditure on agriculture. Throughout the period of 1995-2008 the share of research and development in total expenditure on agriculture amounted to 16% on average.

Investment support that is provided to farmers under the Law on Encouragement of Investments in Agriculture has been the third largest budgetary expenditure, amounting on average to 12% during 1995-2008. Investment support includes expenditure provided as part of the dairy sector reform, which accounts for a significant share of total investment support from 2001 onwards. This support excludes tax concessions provided under the Law on Encouragement of Investments in Agriculture.

Support for infrastructure has increased since 2000 and mostly includes investment in water projects, specifically grants to assist the establishment of plants for returning waste water for agricultural use. In 2007 and 2008, spending on infrastructure increased to more than 20% of aggregate budgetary expenditure on agriculture.

2.3. Trade policies affecting agro-food trade flows and agricultural commodity prices

Overall reforms of the trade system

In the mid-1980s, the government commenced a series of market oriented reforms that reduced the government's role in the economy. As part of this broader reform, the government implemented a unilateral trade liberalisation over 1991-98 that brought a radical change in the trade system. Key elements of the trade reform included: abolishing state trading and extending rights to a larger number of firms to engage in foreign trade and gradual reduction of import tariffs, except for agricultural products.

Prior to the conclusion of the URAA, trade policy for agricultural and food products remained complicated and protective. Although tariffs were set at relatively low levels, imports were limited by quantitative restrictions. While the government gave up its import monopoly position for grains, oils, eggs and meat, these products, along with almost all other agricultural products, were subject to licensing requirements which in effect gave the government total control over imports. The major trade reform for agriculture was the abolition of the export monopoly held by the Citrus Marketing Board of Israel (WTO, 1999).

The conclusion of the URAA marked the start towards liberalisation of agro-food imports. The major change was the increase in transparency of agricultural trade policy. Quantitative restrictions to trade were abolished and replaced by tariffs (ceiling binding). This resulted in a significant increase in tariffs for agricultural products, with MFN applied tariffs increasing more than 2.5 times between 1993 and 1999 (Tovias, 2008). Prior to the URAA, Israel had bound a low number of tariff lines: around 500 tariffs out of some 10 000. As part of its URAA commitment, Israel undertook to bind its entire tariff schedule. A rather complicated tariff structure remains in place for the agricultural sector, with import tariffs applied at *ad valorem*, specific, combined or alternative rates.

During the period 1999-2008, Israel continued trade liberalisation reforms, but at a somewhat slower pace compared to previous years (WTO, 2006).

Main objectives of agro-food trade policy

Agro-food trade policy is designed to contribute to the roles that agricultural sector is to fulfil in Israel's economy. The most important objectives include:

- Expanding exports to earn foreign currency and providing additional income for farmers.
- Providing a source of income for settlements in the periphery as a means for implementing the policy of population dispersal.
- Achieving self-sufficiency in agricultural products that are produced in Israel.

Tariff and non-tariff import policy measures

State trading

Historically, the government had a significant role in trading agricultural products. The Government Trade Administration, under MOITAL, was the sole agency authorised to import meat, wheat and coarse grains. In 1989, the state monopoly on imports of wheat

and coarse grains was removed, with trade opened up to the private sector. The government monopoly on the importation of meat was removed in 1994. The government is still engaged in maintaining emergency stocks of wheat and feed stocks (Section 2.2).

Import licences

Prior to the URAA, import licenses were normally not granted for a significant number of agricultural products, unless there was a marked shortage of domestic production. Among those products were: meat, milk and milk products, eggs, vegetables, fruit, peanuts and olive oil. For products like edible offal, fats, cereals, oilseeds and other prepared or preserved food products, the import licenses were granted when health, labelling, phytosanitary or veterinary requirements were met (GATT, 1994).

Under the terms of the URAA, the restrictive licensing system was abolished. The Free Import Order (most recent updates entered into force in December 2008) deals with the importation of goods subject to import certification requirements and/or standards to ensure the safety and security of consumers and the public as a whole. With the adoption of the Free Import Order, Israel introduced more transparency into the import licensing procedures and removed bureaucratic barriers to trade. According to the Free Import Order, a certificate and laboratory tests are required to prove that food safety conditions are met for imports of almost all agricultural and food products (HS 1-24).

Import licenses are maintained for the purpose of tariff rate quota (TRQ) administration; hence import licensing applies only to the products imported through such quotas (WTO, 2006). In addition, the government maintains a licensing mechanism on imports from ten non-WTO members that have no diplomatic relations with Israel or that prohibit imports from Israel into their markets (Afghanistan, Algeria, Iran, Iraq, Lebanon, Libya, the Democratic People's Republic of Korea, Sudan, Syria, and Yemen). Licenses are granted for imports from these countries on an *ad hoc* basis, under exceptional circumstances (*e.g.* economic necessity), and with authorisation by the Director General of the MOITAL, except for Iran, Lebanon and Syria.

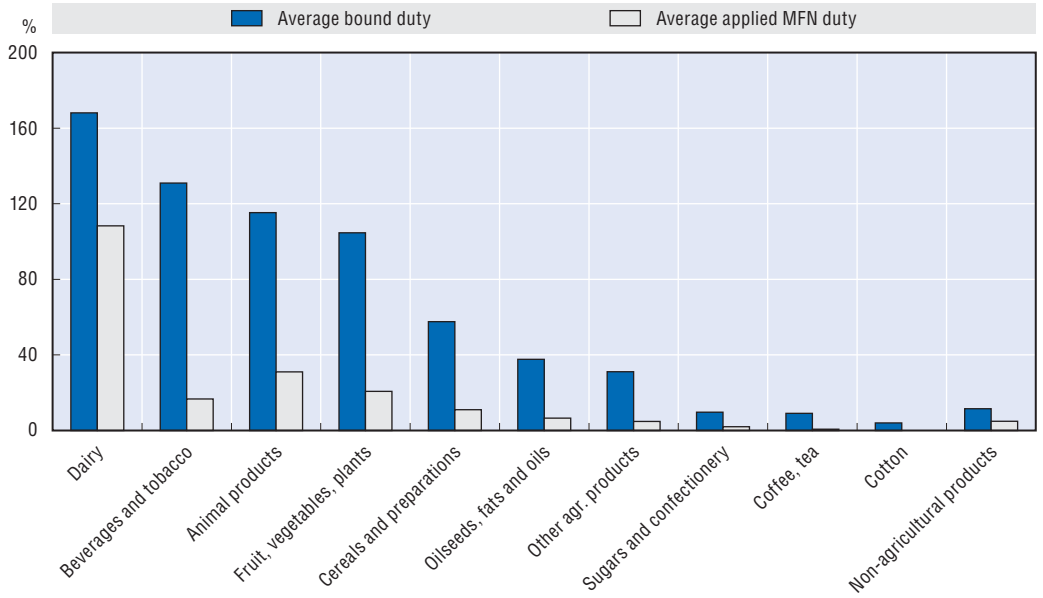
Import licenses are issued by MARD, the Ministry of Health and the Ministry of Finance for sanitary, phytosanitary health and fiscal reasons, or in order to ensure correct classification. An importer applying for an import license must be an Israeli citizen or a company duly registered in Israel. An import licence is normally issued within 14 days; in most cases, it is issued in less than seven days (WTO, 2006).

Import tariffs

In 1993, before the completion of the URAA, the simple average tariff rate was 7%. After the URAA, non-tariff measures were replaced with tariffs, including many non-*ad valorem* tariffs, which caused a significant increase in tariff rates. Israel has bound all agricultural tariff lines, with bound rates ranging from 0%-560%. Although applied MFN tariffs are significantly lower compared to bound rates, Israeli farmers benefit from relatively high tariff protection (Figure 2.6). The maximum bound rate on industrial tariffs is 30%.

The highest tariffs are applied to dairy products: the average applied MFN duty rate for dairy products is 108%. Animal products as well as fruit and vegetables are also highly protected, the average applied MFN duty rate amounts to 31% for animal products and 21% for fruit and vegetables. Tariff rates are very high for fresh and chilled meat, but almost zero for frozen meat. The lowest tariff rates (between 0% and 2%) apply to coffee, tea, sugars and confectionary and cotton. The tariff rate on cereals, the main import article of

Figure 2.6. **Average bound and applied MFN tariffs by product groups, 2006**



Note: All simple averages are based on pre-aggregated HS six digit averages. Pre-aggregation means that duties at the tariff line level are first averaged to six-digit subheadings. Subsequent calculations are based on these pre-aggregated averages. To the extent possible, non-*ad valorem* duties are converted into *ad valorem* equivalents.

Source: WTO, 2008.

Israel, is 11%. In 2006, the share of duty-free tariff lines accounted to 42%; the share of tariff lines with tariff rates between 5%-15% accounted to 27%; the share of tariff lines with duties between 15%-50% accounted to 18% (Annex 2.A1) (WTO, 2008).

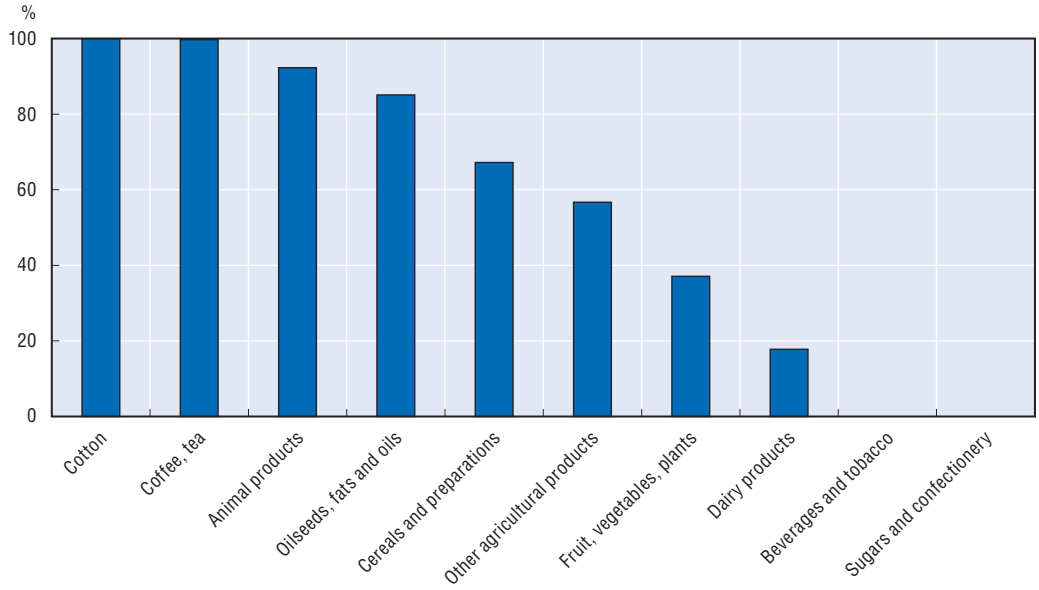
Israel has negotiated free trade agreements with most of its main trading partners (see below). For several product groups, the share of imports entering Israel duty free is therefore relatively high: 92% of animal products, 85% of oilseeds, fats and oils, 67% of cereals and preparations. However, the share of duty free imports is lower for dairy products (18%) and fruit and vegetables (37%) (Figure 2.7 and Annex 2.A1).

In general, Israel applies mostly *ad valorem* duties. However, many non-*ad valorem* duties are applied for agricultural products (Annex 2.A1). Non-*ad valorem* tariffs comprise of specific, compound or alternative rates. In 2007, non-*ad valorem* duties were applied to 27% of agricultural tariff lines (188 tariff lines out of 690 at 6-digit level according to WTO definition of agricultural products). Non-*ad valorem* duties on one or more tariff lines are applied within almost all agricultural product groups.

In 1996, the government introduced seasonal tariffs on selected fruit and vegetables. Lower seasonal tariffs are applied to 21 fruit and vegetables in periods outside their harvest seasons, although they are not much lower than in-season tariffs. Seasonal tariffs are also non-*ad valorem* type, generally specific, with relatively high *ad valorem* equivalents in most cases. The duration of the out-of season period varies from product to product. During the past five years no changes were made in seasonal tariffs (Annex 2.A1).

The extensive use of non-*ad valorem* and seasonal tariffs makes the tariff system less transparent. Monitoring the progress of liberalisation and tariff reduction is complicated. Trade weighted average tariffs can provide an indication of the actual protection level for agricultural products, although they do not take into account tariffs which are so high that they prevent trade occurring. Imports of dairy products are subject to the highest tariffs,

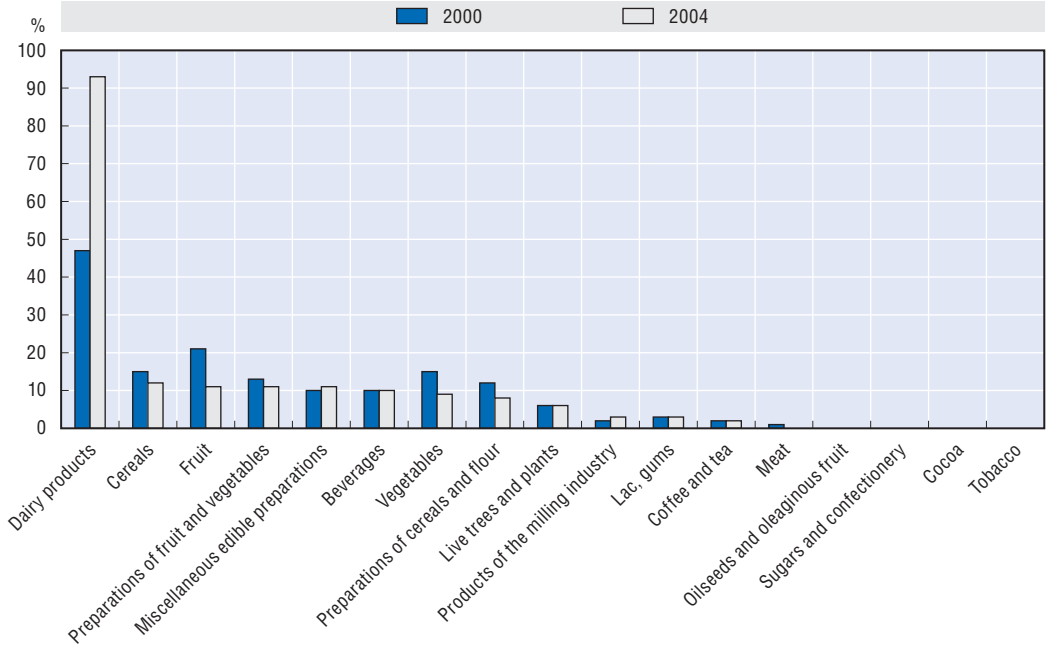
Figure 2.7. **Percentage of imports by product groups that enters Israel duty-free, 2006**



Source: WTO, 2008.

with the trade weighted average tariff on dairy products increasing between 2000 and 2004 from 47% to 93% (Figure 2.8). Trade weighted average tariffs on other products ranged between 0% and 12% in 2004.

Figure 2.8. **Trade weighted average tariff rates (%) on agricultural imports including all items, 2000 and 2004**



Note: Trade weighted average tariff rates are measured as HS six-digit MFN tariff averages weighted with HS six-digit import flows.

Source: WTO Integrated Data Base (IDB).

In accordance with the Trade Levies Law of 1991, the government collects a levy on a number of imported goods. The levy is called the "safeguard levy" but it does not have the same meaning as under the WTO Agreement on Safeguards or under Article XIX of the GATT. The levy may be imposed by the Minister of Industry, Trade and Labour on imports and exports of goods and services, on the possession of goods or on the provision of services, in a wide range of circumstances. It can be used to regulate production, demand or consumption of agricultural products, to protect local production against substantial injury caused by imports; or to restrict the export of raw materials produced in Israel, in order to prevent shortages in the local market. The Israeli customs book has a separate column indicating the items on which the levy applies. Five items, mainly types of oil and oilcake, were subject to the levy until recently. The Trade Levies Law has been amended in 2008 to enable the imposition of safeguard measures in accordance with the WTO Agreement on Safeguards and Article XIX of the GATT.

A purchase tax is levied on both domestically produced and imported manufactured goods. For agro-food products only alcoholic beverages and tobacco are subject to the purchase tax. The tax is calculated as a certain percentage of the wholesale price. While the purchase tax on domestically manufactured goods is charged on the wholesale price, the purchase tax on imports is collected from the importer at the port and is calculated according to the value of the goods for customs plus a certain percentage called TAMA (added percentage quota or import increment) which raises the value of the imported product to its wholesale price base.

In addition, a value-added-tax (VAT) of 15.5% applies to both domestically produced and imported goods. The VAT on imports is levied on the CIF landed cost plus purchase tax (purchase tax is added only to alcoholic beverages and tobacco in the case of agro-food products). VAT is recovered by the importer upon resale of the goods and is ultimately paid by the consumer (USDA, 2007a). Only fresh fruit and vegetables, from both domestic and imported sources, are exempt from VAT (MARD, 2009).

A wharfage fee is also charged on trade through maritime ports. Israel's port authorities charge importers 1.02% of the CIF value for using the port facilities whereas exporters, using the same services, face a charge of just 0.2% on the FOB value (WTO, 2006).

Tariff rate quotas

Tariff rate quotas (TRQ) were introduced as an outcome of the URAA. TRQs were established on walnuts, wheat and meslin, edible fats and oils, sweet corn, citrus juices, and live bovine, meat offal and production of bovine origin (Annex 2.A1). Additionally, all Israel's trade agreements, except for the agreement with EFTA, provide for preferential TRQs on agricultural goods (WTO, 1999).

The TRQ system is administered through designated committees, which are comprised of government officials in MARD for agricultural products and fresh food, and MOITAL for processed food. At the end of each calendar year, both ministries announce the opening of the TRQs on their websites and in two newspapers. The announcement includes information on source countries, HS codes, and quota volumes. Importers must submit their requests for an import license within four weeks; there are no restrictions on eligibility. Importers who failed to use their quotas in previous years may be excluded. All import licenses issued by MOITAL and most licenses issued by MARD are valid from 1 January to 31 July. The validity of some licences issued by MARD is shorter. In these cases,

importers may submit requests throughout the year. In August, the ministries publish another notice, inviting importers to submit requests for the quantities not utilised in the first seven months of the year. These licenses are valid from 1 September to 25 December (WTO, 2006).

In accordance with Israel's URAA commitments, TRQ levels were increased until 2004. Since 2004, the quota levels have remained unchanged. However, in-quota tariff rates have decreased for wheat, walnuts and citrus juice between 2005 and 2008 (Annex 2.A1). In general, TRQs were overfilled during 1999-2008, as for many products the in-quota and out-of-quota tariff rates were the same.

Other restrictions on imports

Sanitary and phytosanitary measures

Sanitary and phytosanitary (SPS) controls are imposed on live animals and animal and plant products whether domestically produced or imported. Existing SPS measures are in accordance with the WTO Agreement on Sanitary and Phytosanitary Measures. PPIS and the Veterinary Service are the national enquiry points and the notification authorities with respect to the SPS Agreement. They are also in charge of ensuring compliance with SPS measures (WTO, 2006).

The list of certificates required to prove that food safety conditions are met for imports of different agricultural and food products includes:

- Certificate from the MARD Plant Protection and Inspection Service.
- Certificate from the MARD Veterinary Service.
- Certificate from the MARD Foreign Trade Centre.
- Certificate from the MARD Fodder Quality Section.
- Certificate from the Ministry of Health Pharmaceutical Department.
- Certificate from the Ministry of Health National Food Service and certificate of release from transit stations.
- Kosher certificate from the Chief Rabbinical Council.

The legislation covering phytosanitary controls was recently revised and came into effect in mid-2009. At that point, import permits previously issued by PPIS were annulled. A requirement for obtaining a new import permit is that the product must be subject to a pest risk analysis (MARD, 2009).

Standards

The policy of the government is to adopt international standards wherever possible, and to implement mandatory standards related only to safety, health, and the environment (USDA, 2007a). The Standards Institution of Israel (SII), a non-governmental organisation established in 1953, is responsible for elaborating and implementing voluntary standards. SII is largely a self-financing institution, but receives support (2.5% to 5% of its budget) from the government for its standardisation activities. The Israeli Standards Law of 1953 empowers the SII as the authority for the development of voluntary standards, compliance testing, and certification of quality assurance systems and products manufactured in or imported into Israel. The Commissioner of Standardisation (within MOITAL) is in charge of standards enforcement, changing the status of standards from voluntary (as created by SII) to mandatory, enforcing mandatory standards as well as

approval of testing laboratories. Depending on the type of standard, other agencies such as the Ministries of Health, Communication, MARD, the Ministry of National Infrastructure and MOITAL are involved in enforcing standards (WTO, 2006).

SII has published 182 standards concerning food products: 160 of them were fully or partially mandatory, but most of them were equivalent to international standards (WTO, 2006).

On the background of Israel's general wish to encourage the movement of international goods, the government passed decision of "Improvement of Terms of Trade Standardisation" in 2007. The decision determines that at least 65% of Israeli's mandatory standards will be international or regional standards by 30 June 2010. This means that at least 110 mandatory standards will undergo revision by adoption of international or regional standards (USDA, 2007a).

Kosher certificate

When importing food products into Israel, a kosher certificate from a Chief Rabbinate of Israel may be required to assure compliance with *Kashrut*, Israeli dietary laws. The Kosher certificate is not an import requirement as such, but its refusal can effectively block sales to the larger part of the Israeli market. A number of Rabbis located abroad have been approved by the Chief Rabbinate to issue kosher certificates. Companies seeking certification must pay the costs of rabbinical inspection to determine that the ingredients and manufacture of the products satisfy religious standards. According to the authorities, the fee charged is based on the cost of sending the inspector to the premises of the manufacturer (including transportation, accommodation, and a predetermined per diem fee).

While kosher certificate is voluntary for food products in general, it is obligatory for meat and meat products. In 1994, Israel adopted a Kosher Meat Import Law that regulates meat imports and actually prohibits the importation of non-kosher meat and meat products (Box 2.4). The Government allows limited sales of non-kosher meat domestically, however, non-kosher slaughtering is not allowed in Israel and all non-kosher meat sold in Israel is a by-product of the slaughtering process of kosher animals.

Export policy measures

State trading

The organisation of the agricultural export sector in Israel has changed dramatically since 1991. Before the reforms, two organisations were responsible for all horticultural exports from Israel: the Citrus Marketing Board of Israel (CMBI) exported all citrus fruits while AGREXCO (a company 50/50 owned by growers and the government) exported all other fruits and vegetables. The other products exported only by production and marketing boards included groundnuts, ornamental plants, eggs, and poultry. The responsible boards were Israel Groundnuts Production and Marketing Board, Plant Production and Marketing Board and Poultry Board.

Reforms in the organisation of agricultural exports were introduced gradually. Changes commenced in 1991 with a comprehensive reform of the citrus sector, including the abolition of the single-desk exporter and the privatisation of exports operations. AGREXCO and a few commercial companies took over citrus exports. CMBI continued to exist and perform some regulatory functions, generic promotion and research and development but it ceased selling operations (Box 2.5). From 1994, exports were opened up to competition by

Box 2.5. **Citrus Marketing Board of Israel**

Until 1991, fresh citrus fruits were exported exclusively by the Citrus Marketing Board of Israel (CMBI). In 1991, the CMBI was reformed because of the poor performance of the industry as well as the Board. The aim of the reform was to abolish the monopoly and establish competition between exporting companies in order to increase the efficiency of the citrus export marketing channel and increase the income of citrus growers (Goetz *et al.*, 2008). The reform resulted in a deregulated domestic market and liberalised export sector (Scrimgeour and Sheppard, 1998). The reformed CMBI was funded by a levy collected per tonne on citrus exports. However, the reforms did not minimise barriers to entry into exporting and did not lay down explicit guidelines for the determination of export licenses (Scrimgeour and Sheppard, 1998).

Government involvement was retained in the areas of promotion, phytosanitary issues and contractual issues. Government granted some funds for promotion and the control of Mediterranean fruit fly, and is involved in phytosanitary regulation. With regard to contractual issues, the government established minimum price agreement for oranges to protect growers against the abuse of market power by exporting companies for two seasons starting in 1993/94 (in the early 1990s, post-reform, there were only four companies involved in citrus exporting). According to the agreement, exporters qualified for a government subsidy if they signed a written standardised contract with growers, guaranteeing minimum grower price and stating the timetable of payments and conditions triggering additional payments to the growers. The minimum price agreement was extended to include grapefruit over most of 1994/95 export season and part of 1995/96 (Goetz *et al.*, 2008). All minimum prices for fruit and vegetables were eliminated in 2004.

In 2004, CMBI was united with three other boards to form the Plant Production and Marketing Board (PPMB) to save cost and reduce the heavy financial burden they impose on producers. PPMB is financed by a levy collected from farmers. Half of the members of the Board of Directors are farmers, while other members are from ministries, traders and exporters.

The activities of the PPMB remain similar to the CMBI:

- Issuing export licenses and monitoring exporters.
- Developing a strategy for the citrus industry.
- Advertising and promotion; managing the Board's trade marks (Jaffa brand, generic advertisement of "Produce of Israel").
- Research and development.
- Pest control (Mediterranean Fruit Fly).
- Industry's relations in Israel and abroad.

Source: Goetz *et al.*, 2008; Scrimgeour and Sheppard, 1998; Finkelshtein and Kachel, 2006.

granting export licenses to private firms while marketing and production boards either ceased export operations or began competing with private firms (Finkelshtein, 2006). Exports were completely liberalised by the end of the 1990s (Section 1.3).

Export licenses

Export licenses are issued by MARD. The export activity is subject to compliance with the standards required by PPIS or the Veterinary Service. Licenses are issued free of charge. The licensing system is maintained for the following purposes:

- Data collection (amounts, destination, total expected revenue).

- Monitoring the exporter's facilities to ensure meeting quality requirements for fresh exported fruits and vegetables.
- Examination of the exporter's financial solvency.
- Ensuring respect of intellectual property rights, and compliance with national laws and international rules (MARD, 2009).

Export subsidies

Until 2004, export subsidies were provided for a number of agricultural products (cut flowers, vegetables, citrus and other fruit, goose liver and cotton). Under the terms of the URAA, Israel was required to reduce agricultural export subsidies by 24% over the period of 1995-2004. Export subsidies actually granted by the government were much lower compared to commitment levels (Annex 2.A1). In 1998 and 1999, export subsidies were provided only to cut flowers. Export subsidies were not provided in 2000, while in 2001 and 2002, the subsidies amounted to around ILS 21 million (USD 5 million) and ILS 28 million (USD 6 million) respectively. Outlays totalled ILS 17 million (USD 4 million) in 2003 and ILS 3 million (USD 0.7 million) in 2004. More than 60% of the subsidies were granted to cut flowers in 2001 and 2004; in 2002 and 2003 cut flowers received around 40% of export subsidies. Export subsidies were not provided in 2005-08.

Taxes

Israel has not imposed any export duties, taxes or other charges during the period under review. It does not maintain any minimum export prices. Exporters can benefit from duty and tax drawbacks on imported inputs, raw materials, and capital goods. Exporters can choose between a tax percentage method, and a credit method with an annual projection of imports. In addition, exporters pay less than importers for the use of ports and stevedores: importers pay 1.02% of the c.i.f. cost of imports into Israel; exporters pay 0.2% of the f.o.b. value of exports. Exports are exempt from the VAT (WTO, 2006).

Export finance, insurance and guarantees

Israel abolished its public export credit programme in 1994; no government-supported export financing has been available since then (WTO, 2006).

The Israel Export Insurance Corp. Ltd. (ASHRA, formerly IFTRIC), a state-owned company instituted in 1957, offers a wide range of insurance instruments to Israeli exporters. Its income consists entirely of premiums, with no transfers from the Government since 1994. ASHRA insures investments and medium- and long-term export credit transactions (one to ten years) against political and commercial risk, mostly in developing countries. It covers up to 95% of losses for political risk; coverage for commercial risk was expanded to a maximum of 90% in 2004. ASHRA does not face competition from private insurance companies, since it generally insures the most risky operations. ASHRA also guarantees loans granted by domestic commercial banks to Israeli exporters with relation to medium and long term export. Before 2001, ASHRA offered both short-term, and medium and long-term guarantees. Since the privatisation of the short-term division in 2001, it has been insuring only medium and long-term transactions (WTO, 2006).

Export promotion

Until the mid-1990s, government supported exports of fresh agricultural products through export promotion fund and provided support to encourage exporters to adjust production management and post-harvest activities to meet sanitary and phytosanitary requirements of the destination country. From the mid-1990s, support for exports has been provided on an *ad hoc* basis to provide solutions to specific problems stemming from the world market situation, and through the Exports Promotion Fund (EPF) for fresh agricultural production. EPF provides assistance to exporters for participating in exhibitions, advertising, developing catalogues and sending samples for exports. Budgetary support for EPF was quite substantial during 1995 to 2001, amounting to ILS 7-24 million (USD 2-8 million) annually. Since 2002, the support provided through EPF decreased to levels between ILS 1.3 to 3.5 million (USD 0.3-0.8 million).

Trade relations

WTO

Israel is the member of the WTO since 21 April 1995 and was a contracting party to the GATT since 1962. Israel considers itself as a developing country in the WTO context and thereby enjoys for example lower reduction requirement for domestic support in agriculture.

Israel's URAA commitments included the conversion of agricultural import restrictions into tariffs. Israel also undertook to bind its entire tariff schedule and reduce these bound rates over ten years to reach a maximum level of 560% in agricultural sector and 30% in the industrial sector. Bound duties on agricultural products were reduced by an average of 21% over a period of ten years beginning in 1995. Israel also committed to limit domestic support and export subsidies for agricultural products. Domestic support was reduced by 12% in value terms over a ten year period, and export subsidies cut by 24% in value and 13% in volume (GATT, 1994).

Bilateral trade agreements

Israel has been active in negotiating bilateral trade agreements with its main trading partners to promote trade, facilitate market access and neutralise non-tariff barriers (Annex Table 2.A1.9). For non-agricultural products, imports from the two largest trade partners – the United States (US) and the European Union (EU) – are almost 100% duty free. For agricultural products, 99% of trade enters duty free from the US and 32% from the EU in 2006 (WTO, 2008).

The first Co-operation Agreement between the EU and Israel was signed in 1975. An expanded Association Agreement was signed in 1995 and entered into force in 2000. It includes free trade arrangements for industrial goods and trade concessions for agricultural products. An additional agreement deepening mutual trade concessions for agricultural products, in the form of larger reductions or eliminations of tariffs either within TRQs or for unlimited quantities, entered into force in 2004.

In 2008, further agricultural trade liberalisation negotiations took place between the EU and Israel. The new agreement entered into force in January 2010. Substantial progress was made towards full liberalisation of trade in fresh as well as processed agricultural products, for both parties. Regarding more sensitive agricultural products such as sugar and fruit and vegetables, improved market access was achieved for both sides by means of increasing existing duty free TRQs, extending the period during which the out of season

tariff applies and by creating new TRQs, such as for goose liver, yogurts, sheep meat, lemons, oranges, mandarins, grapes, melons, kiwi, apricots, cherries, peaches, olives, preserved strawberries, and soya oil. In addition, in the absence of a standstill clause for agricultural products, Israel agreed to bind the applied tariff rates to a maximum below the MFN bound rates for around 200 tariff lines.

For processed agricultural products, 95% liberalisation of trade for both parties has been achieved. For fresh products this share is smaller at 80%. For the remaining sensitive products, some additional preferences have been exchanged in the form of TRQs or reduced duties (confectionery products, biscuits, vermouth, grape spirits and starch based glues).

Israel is part of the Euro-Mediterranean Partnership, which involves extending free trade across the Mediterranean region through a network of bilateral agreements between the EU and individual Mediterranean partners, with the ultimate aim of creating a Euro-Mediterranean Free Trade Area by 2010.

Israel's free trade agreement with the US, the Agreement on Trade in Agriculture Products (ATAP), was first signed in 1996. The agreement divides agricultural imports from the US into three product categories:

1. Products enjoying free access to the Israeli market with no duty, no fees, no levies and no quotas.
2. Products subject to TRQs under which tariffs are generally zero for limited quantities. On imports beyond the TRQ quantity, importers pay 10% less than the MFN tariff.
3. Products subject to levies for which US exporters enjoy special preferential rates compared to the MFN tariffs. The discount for the US products ranges from 10% to as much as 60% of the MFN rate.

The 2004 extension of ATAP is a five-year agreement applied from 2004 to 2008. Under the new ATAP, around 90% of US agricultural exports to Israel enter duty free with no limitations, 5% enter through TRQs, and the remaining 5% under a preferential tariff rate. Israeli agricultural exports to the US enter duty free with the exception of over-quota imports of sensitive items (*e.g.* sugar, dairy, meat, cheeses, peanuts, chocolate, raw cotton, and un-manufactured tobacco). The new agreement maintains liberalised access to the US market by granting zero in-quota tariff rates to a specified portion of imports of some of these products from Israel.

A free trade agreement between Israel and Mercosur was signed at the end of 2007. According to the agreement, Israel will eliminate duties on many agricultural products upon the entry into force of the agreement. In the case of several sensitive products, TRQs will be applied subject to zero in-quota tariff rate or step-wise reduction of MFN rate. These products include meat, dairy products, some fruit and vegetables, roses, cereals and flour (wheat and maize) and their products. The agreement will enter into force after the ratification in each country. By the end of 2008, the agreement had been ratified only by the Uruguayan parliament.

2.4. Evaluation of support to agriculture

This section presents a quantitative evaluation of support provided to Israeli agriculture through domestic and trade policies discussed in detail in the previous sections of this chapter. The evaluation is based on the indicators of agricultural support developed by the OECD, including the Producer Support Estimate (PSE), Consumer Support Estimate (CSE), General

Services Support Estimate (GSSE) and Total Support Estimate (TSE). While Box 2.6 provides basic definitions, a detailed description of the PSE methodology applied by the OECD (the "PSE Manual"), as well as comprehensive *PSE databases* for OECD countries and a number of non-OECD countries including Israel, are available from *www.oecd.org/agr/support/psecse*.

Box 2.6. **OECD indicators of support to agriculture**

Nominal indicators used in this report

Producer Support Estimate (PSE): The annual monetary value of gross transfers from consumers and taxpayers to agricultural producers, measured at the farm gate level, arising from policy measures that support agriculture, regardless of their nature, objectives or impacts on farm production or income. It includes market price support, budgetary payments and budget revenue foregone, *i.e.* gross transfers from consumers and taxpayers to agricultural producers arising from policy measures based on: current output, input use, area planted/animal numbers/receipts/incomes (current, non-current), and non-commodity criteria.

Market Price Support (MPS): The annual monetary value of gross transfers from consumers and taxpayers to agricultural producers arising from policy measures that create a gap between domestic market prices and border prices of a specific agricultural commodity, measured at the farm gate level. MPS is also available by commodity.

Producer Single Commodity Transfers (producer SCT): The annual monetary value of gross transfers from consumers and taxpayers to agricultural producers, measured at the farm gate 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 payment. This includes broader policies where transfers are specified on a per-commodity basis. Producer SCT is also available by commodity.

Consumer Single Commodity Transfers (consumer SCT): The annual monetary value of gross transfers from (to) consumers of agricultural commodities, measured at the farm gate level, arising from policies linked to the production of a single commodity. Consumer SCT is also available by commodity.

Consumer Support Estimate (CSE): The annual monetary value of gross transfers from (to) consumers of agricultural commodities, measured at the farm gate level, arising from policy measures that support agriculture, regardless of their nature, objectives or impacts on consumption of farm products. If negative, the CSE measures the burden (implicit tax) on consumers through market price support (higher prices), that more than offsets consumer subsidies that lower prices to consumers.

General Services Support Estimate (GSSE): The annual monetary value of gross transfers to general services provided to agricultural producers collectively (such as research, development, training, inspection, marketing and promotion), arising from policy measures that support agriculture regardless of their nature, objectives and impacts on farm production, income, or consumption. The GSSE does not include any payments to individual producers.

Total Support Estimate (TSE): The annual monetary value of all gross transfers from taxpayers and consumers arising from policy measures that support agriculture, net of the associated budgetary receipts, regardless of their objectives and impacts on farm production and income, or consumption of farm products.

Ratio indicators and percentage indicators

Percentage PSE (%PSE): PSE transfers as a share of gross farm receipts (including support in the denominator).

Percentage SCT (%SCT): Is the commodity SCT expressed as a share of gross farm receipts for the specific commodity (including support in the denominator).

Share of SCT in total PSE (%): Share of Single Commodity Transfers in the total PSE. This indicator is also calculated by commodity.

Box 2.6. **OECD indicators of support to agriculture** *(cont.)*

Producer Nominal Protection Coefficient (producer NPC): The ratio between the average price received by producers (at farm gate), including payments per tonne of current output, and the border price (measured at farm gate). The Producer NPC is also available by commodity.

Producer Nominal Assistance Coefficient (producer NAC): The ratio between the value of gross farm receipts including support and gross farm receipts (at farm gate) valued at border prices (measured at farm gate).

Percentage CSE (%CSE): CSE transfers as a share of consumption expenditure on agricultural commodities (at farm gate prices), net of taxpayer transfers to consumers. The %CSE measures the implicit tax (or subsidy, if CSE is positive) placed on consumers by agricultural price policies.

Consumer Nominal Protection Coefficient (consumer NPC): The ratio between the average price paid by consumers (at farm gate) and the border price (measured at farm gate). The Consumer NPC is also available by commodity.

Consumer Nominal Assistance Coefficient (consumer NAC): The ratio between the value of consumption expenditure on agricultural commodities (at farm gate) and that valued at border prices.

Percentage TSE (%TSE): TSE transfers as a percentage of GDP.

Percentage GSSE (%GSSE): Share of expenditures on general services in the Total Support Estimate (TSE).

The methodology applied in this study is fully consistent with that used for OECD countries and for a number of non-OECD countries as presented in OECD reports that monitor and evaluate agricultural policies (OECD, 2008c; OECD, 2009a). Box 2.7 provides basic information on how this methodology has been applied in the case of Israel.

Box 2.7. **Israel's PSEs: what and how?**

Period covered: 1995-2008

Products covered: Wheat, cotton, groundnuts, tomatoes, pepper, potatoes, oranges, grapefruit, apple, grapes, bananas, avocados, milk, beef and veal, sheepmeat, poultry meat and eggs. These 17 commodities account for 53%-59% of the total value of gross agricultural output (GAO) in Israel during the period covered by the study. The 12 crop products account for around 40% of the value of total crop production throughout the whole period, but only for 35% in 2008. The 6 livestock products represent on average 79% of the value of total livestock production during 1995-2007 and 84% in 2008.

The above list includes 9 fruit and vegetable commodities. Individual shares of remaining fruit and vegetables in the total value of GAO are small, but the sum of these shares is quite important at around 20%. As agricultural and trade policies for fruit and vegetables are very similar across various commodities, it was assumed that the ratio of MPS to the value of production for these remaining fruit and vegetables is the same as the average for the 9 fruit and vegetable commodities for which MPS is calculated explicitly. After this "extrapolation" procedure, the commodity coverage increased to 77% of the total value of GAO on average during 1995-2007 and to 82% in 2008.

Market Price Support

Producer prices: Average prices at the entrance to the wholesale market, slaughterhouse or industrial plant. The data originates from the Central Bureau of Statistics of Israel. Producer price of milk is a weighted average of the target price for milk supplied within the milk production quota and of the lower price for milk supplied above the quota. The data was provided by the Israel Dairy Board.

Box 2.7. **Israel's PSEs: what and how?** *(cont.)*

External reference prices: Import unit values registered at the Israeli border are used for importable crops: wheat and apples. Export unit values at the Israeli border are used for all exportable crops. As bananas are traded in very limited quantities, the unit value of French imports from all sources, derived from the *Comtrade Database*, has been used as a reference price.

For livestock products imported quantities were either small or trade data were not sufficiently consistent across the period under study to allow for the calculations of import unit values. Therefore, the following world market prices were used: milk: EU f.o.b. export price of butter, 82% butterfat, northern Europe and EU f.o.b. export price of SMP, non fat dry milk, extra grade, northern Europe adjusted for the transportation costs from the EU to Israel; beef and veal: Brazilian producer price of fat beef on bones at carcass weight adjusted for the transportation costs of fresh meat from Brazil to the EU; poultry meat: extra EU export unit value adjusted for the transportation costs from the EU to Israel; eggs: Extra EU export unit value adjusted for transportation costs from the EU to Israel; sheepmeat: average applied MFN import tariff was used to calculate the price gap.

Marketing margins: The marketing margin indicates processing, handling and transportation costs for a given commodity. The data were provided by MARD. Margins for crop products reflect the spread between the value of a product at the entrance to the wholesale market and the border, expressed as a percentage of the farm gate price. While it is assumed that the percentage margin remained at the same level over the whole period, its equivalent in absolute terms varied depending on the level of farm gate price in a given year. The absolute value of the margin in a given year was subtracted from the border reference price for crop products. In the case of milk, processing margin of butter and SMP from one tonne of raw milk in four major exporters (Australia, New Zealand, European Union and United States) was used in making the adjustments. As the reference price for beef was expressed at the farm gate level, the adjustment was only made for transportation costs based on the difference of EU CIF import and Brazilian FOB export prices of fresh boneless bovine meat. The margin to adjust farm gate price of poultry meat includes transportation from farm gate to slaughterhouse and slaughtering costs. For eggs, no margin is applied, as imported eggs are at the same processing level as locally produced eggs. For sheepmeat no adjustment was made as average applied MFN import tariffs were used to calculate the price gap.

Quality adjustments: No quality adjustments were applied.

Price gap estimates: For all the above mentioned products relevant data have been collected and price gaps calculated. For eight exportable products (groundnuts, tomatoes, pepper, oranges, grapefruits, grapes, avocados and potatoes), no export subsidies nor other market price policies either supporting or taxing producers have been identified. Consequently, in line with the OECD methodology, and as applied for other countries, the price gaps for these products have been set to zero. Price gap was assumed to be zero also for importable apples, as the price difference between farm gate price and reference price was negative, but no policies taxing producers were identified.

Budgetary support

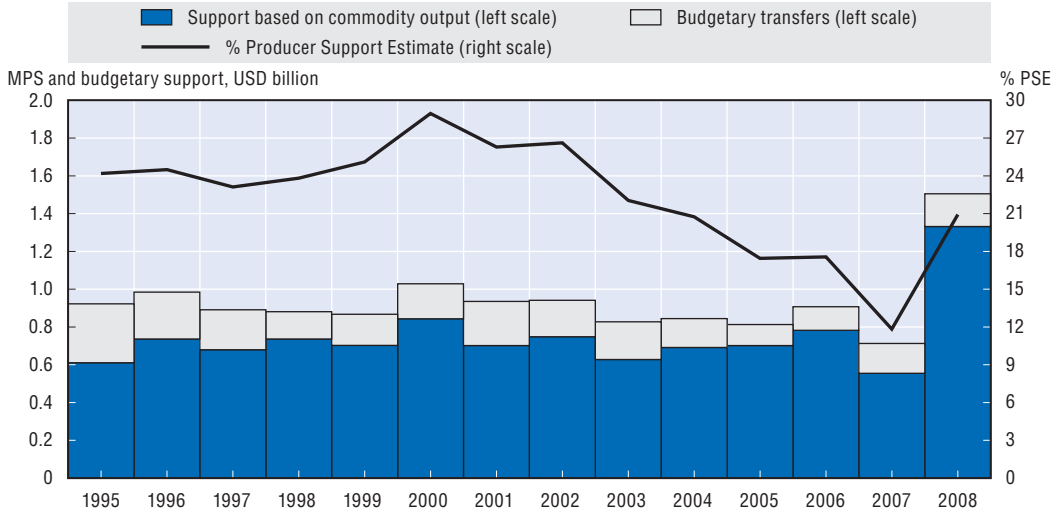
Budgetary information for the period 1995-2008 originates from the MARD. The subsidy arising from debt restructuring and write-offs is not taken into account in the PSE calculations, as it concerns debts that accumulated up to 1989/99, *i.e.* before the period covered by the report. The implicit subsidy arising from the overdue debt restructured and repaid with preferential interest rates during the period under the review is included. The subsidy arising from the water extraction levy concession is also included.

Aggregate results

Producer Support Estimate

As measured by the percentage PSE (%PSE), the level of support to agricultural producers in Israel fluctuated within a range of 12% and 29% during 1995-2008. Support to producers decreased from 24% of gross farm receipts in 1995-97 to 17% in 2006-08 (Figure 2.9, Table 2.2).

Figure 2.9. **Level and composition of the PSE, 1995-2008**



Source: OECD, *PSE/CSE database*, 2009.

Changes in the level of producer support in Israel are driven by a combination of factors. In addition to progress in policy reform, the fall is partly due to world price increases in 2006-08 which reduced the gap between domestic and world prices. Higher growth rates in GAO than in PSE also contributed to the reduction in %PSE during 1995-2008.

In comparison with selected OECD and non-OECD countries, the level of producer support in Israel is below the OECD average (23%) and below the EU27 (27%), the main trade partner of Israel (Figure 2.10). Support to producers in Israel is considerably higher than that in the United States (10%), the other important trade partner. However, it remains well below that in Japan, Korea and EFTA countries (Iceland, Switzerland and Norway).

Composition of producer support by policy category

MPS is the main component of producer support in Israel (Figure 2.9). The level of MPS remained stable during 1995 to 2006, but decreased in 2007 below the previous levels. In 2008, MPS nearly doubled due to the appreciation of the local currency and a strong increase in producer prices (Box 2.8). The increase in producer prices was partly driven by an increase in target prices for selected commodities, in particular for milk which increased by 18% in 2008. Budgetary support to the agricultural sector was relatively high in 1995-97, but then declined and remained relatively stable until 2007. It increased slightly in 2008 mainly due to one-off payments related to compensation for damage caused by frost and support provided to producers who temporarily shut down their farms during the Sabbatical year in 2008 (Section 2.2).

Table 2.2. **Israel: estimates of support to Israeli agriculture**

ILS million

	1995-97	2006-08	2006	2007	2008p
Total value of production (at farm gate)	**11 651**	**23 859**	**22 419**	**24 049**	**25 109**
of which share of MPS commodities (%)	*72*	*77*	*76*	*77*	*80*
Total value of consumption (at farm gate)	**9 263**	**16 766**	**15 904**	**16 010**	**18 384**
Producer Support Estimate (PSE)	**2 997**	**4 123**	**4 043**	**2 928**	**5 398**
Support based on commodity output	2 177	3 514	3 485	2 278	4 779
Market Price Support	*2 112*	*3 459*	*3 437*	*2 229*	*4 713*
Payments based on output	*65*	*55*	*48*	*49*	*67*
Payments based on input use	660	431	425	526	341
Based on variable input use	*457*	*211*	*179*	*301*	*153*
with input constraints	*0*	*0*	*0*	*0*	*0*
Based on fixed capital formation	*154*	*155*	*169*	*172*	*125*
with input constraints	*0*	*0*	*0*	*0*	*0*
Based on on-farm services	*48*	*65*	*77*	*54*	*62*
with input constraints	*0*	*0*	*0*	*0*	*0*
Payments based on current A/An/R/I,[1] production required	102	142	93	93	240
Based on Receipts/Income	*97*	*121*	*74*	*75*	*213*
Based on Area planted/Animal numbers	*2*	*14*	*12*	*12*	*18*
with input constraints	*0*	*0*	*0*	*0*	*0*
Payments based on non-current A/An/R/I, production required	0	0	0	0	0
Payments based on non-current A/An/R/I, production not required	56	32	28	30	37
With variable payment rates	*0*	*32*	*28*	*30*	*37*
with commodity exceptions	*0*	*0*	*0*	*0*	*0*
With fixed payment rates	*56*	*0*	*0*	*0*	*0*
with commodity exceptions	*0*	*0*	*0*	*0*	*0*
Payments based on non-commodity criteria	0	0	0	0	0
Based on long-term resource retirement	*0*	*0*	*0*	*0*	*0*
Based on a specific non-commodity output	*0*	*0*	*0*	*0*	*0*
Based on other non-commodity criteria	*0*	*0*	*0*	*0*	*0*
Miscellaneous payments	2	4	11	0	0
Percentage PSE	**24**	**17**	**18**	**12**	**21**
Producer NPC	**1.25**	**1.16**	**1.19**	**1.10**	**1.19**
Producer NAC	**1.31**	**1.20**	**1.21**	**1.13**	**1.26**
General Services Support Estimate (GSSE)	**418**	**607**	**547**	**633**	**641**
Research and development	152	210	198	211	221
Agricultural schools	3	2	2	1	2
Inspection services	56	87	87	87	88
Infrastructure	40	265	215	295	285
Marketing and promotion	59	3	2	4	4
Public stockholding	108	40	43	35	42
Miscellaneous	0	0	0	0	0
GSSE as a share of TSE (%)	**12.3**	**12.8**	**11.9**	**17.8**	**10.6**
Consumer Support Estimate (CSE)	**–2 708**	**–3 075**	**–3 897**	**–2 068**	**–3 260**
Transfers to producers from consumers	–2 268	–3 008	–3 367	–1 904	–3 753
Other transfers from consumers	–460	–39	–540	–142	565
Transfers to consumers from taxpayers	0	0	0	0	0
Excess feed cost	20	–28	10	–22	–72
Percentage CSE	**–29**	**–18**	**–25**	**–13**	**–18**
Consumer NPC	**1.41**	**1.23**	**1.33**	**1.15**	**1.21**
Consumer NAC	**1.41**	**1.23**	**1.32**	**1.15**	**1.22**
Total Support Estimate (TSE)	**3 416**	**4 730**	**4 590**	**3 561**	**6 039**
Transfers from consumers	2 727	3 047	3 907	2 046	3 187
Transfers from taxpayers	1 148	1 722	1 223	1 657	2 287
Budget revenues	–460	–39	–540	–142	565
Percentage TSE (expressed as share of GDP)	1.03	0.70	0.72	0.53	0.85
GDP deflator (1995-97 = 100)	100	136	136	136	136

p: provisional. NPC: Nominal Protection Coefficient. NAC: Nominal Assistance Coefficient.

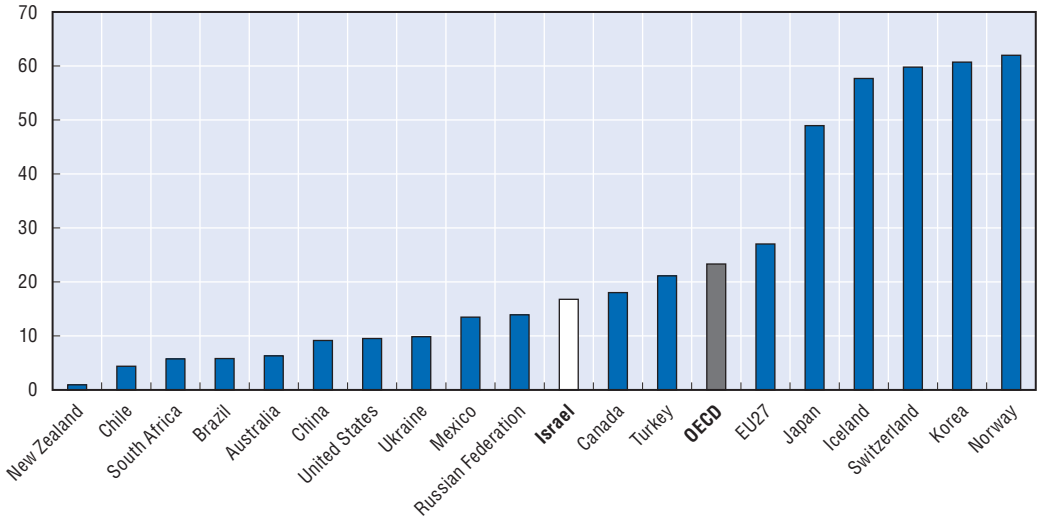
1. A (area planted), An (animal numbers), R (receipts), I (income).

Note: MPS commodities for Israel are: wheat, cotton, groundnuts, tomatoes, peppers, potatoes, avocados, bananas, oranges, grapefruit, grapes, apples milk, beef and veal, sheepmeat, poultry and eggs. Market Price Support is net of producer levies and Excess Feed Cost.

Source: OECD, *PSE/CSE database*, 2009.

Figure 2.10. **Producer Support Estimate by country, 2006-08**

As per cent of gross farm receipts

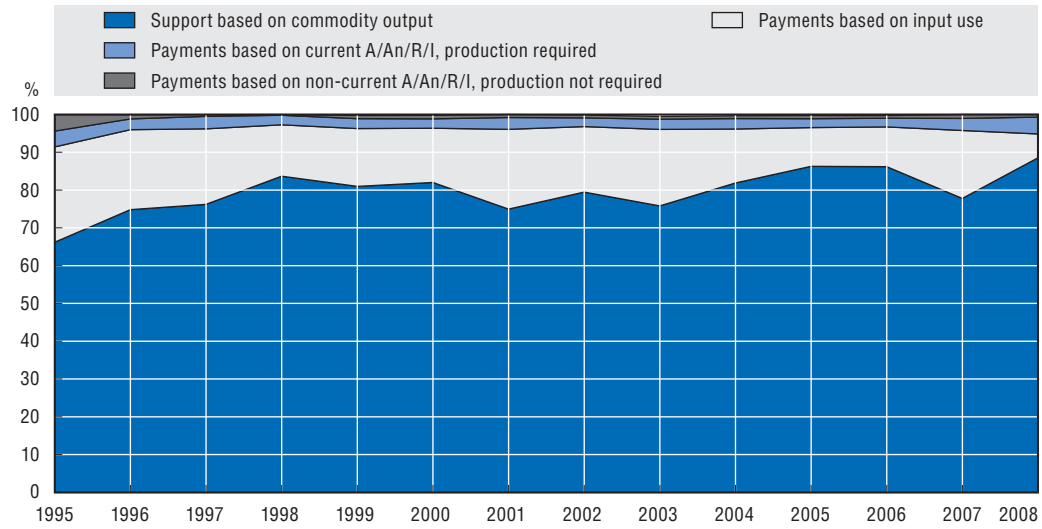


Note: PSEs for Brazil, Chile, China, the Russian Federation, South Africa and Ukraine are calculated for 2005-07.
Source: OECD, *PSE/CSE database*, 2009.

A considerable share of producer support is directly linked to commodity output and payments based on input use – the most distortive forms of assistance (Figure 2.11). The share of support based on commodity output has increased from 72% in 1995-97 to 84% in 2006-08. The share of payments based on input use has declined from 22% in 1995-97 to 12% in 2006-08. Payments based on input use include water subsidies (variable input use) and investment grants (fixed capital formation).

Figure 2.11. **Composition of Producer Support Estimate, 1995-2008**

Percentage share in PSE

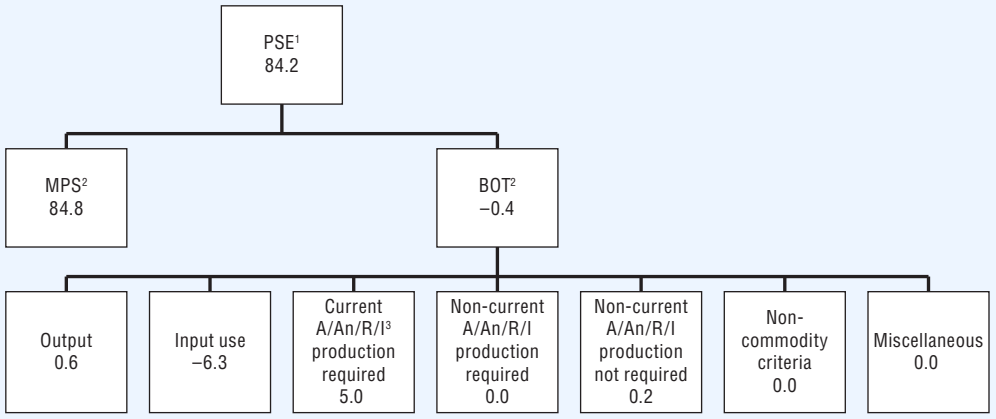


Note: A (area planted)/An (animal numbers)/R (revenue), I (income).
Source: OECD, *PSE/CSE database*, 2009.

Box 2.8. **Change in Producer Support Estimate in 2007/08**

There was a sharp increase in the level of producer support measured by the %PSE from 12% in 2007 to 21% in 2008. This box is intended to better explain the reasons for this change, using disaggregation analysis. Figure 2.12 shows that this growth was almost totally driven by the increase in MPS while budgetary transfers decreased marginally. In turn, Figure 2.13 (left panel) indicates that the change in MPS resulted from a significant increase in the average unit MPS (*i.e.* the gap between domestic and border prices measured at the farm gate), but also from the increase in the quantity of livestock production. Then, the average unit MPS increased due to the increase in domestic producer prices (13%), particularly for livestock products, that outweighed the increase in border prices in national currency. The increase in domestic producer prices was partly driven by an increase in target prices fixed by the government, in particular for milk which increased by 18% in 2008. The increase in border prices expressed in US dollars was considerably higher (24%), however, it was partly offset by a significant appreciation of the national currency *vis-à-vis* the US dollar (14%) (Figure 2.13, right panel).

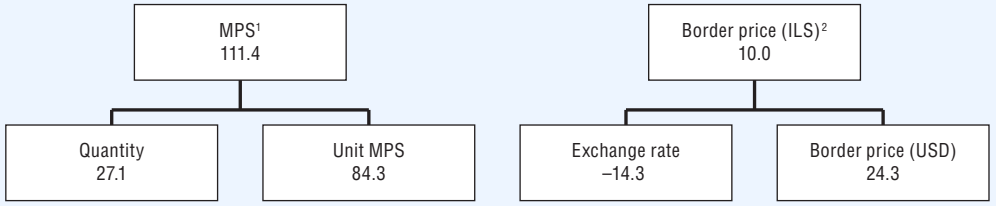
Figure 2.12. **Contribution to the change in Producer Support Estimate, 2007 to 2008**



1. Per cent change in national currency.
2. Contribution of Market Price Support and Budgetary and Other Transfers (BOT) to per cent change of PSE in national currency.
3. A (area planted) / An (animal numbers) / R (revenue) / I (income).

Source: OECD, *PSE/CSE database*, 2009.

Figure 2.13. **Contribution to the change in Market Price Support and border price, 2007 to 2008**



1. Per cent change in total MPS is the average of per cent changes in MPS for individual commodities in national currency, weighted by the shares of individual commodity MPS in total MPS in the previous year.
2. Border price at farm gate, *i.e.* price excluding marketing margins between border/wholesale market and farm gate. Per cent change in border price is the average of per cent changes in border prices for individual commodities in national currency, weighted by the shares of individual commodity MPS in total MPS in the previous year.

Source: OECD, *PSE/CSE database*, 2009.

The composition of PSE shows that, in contrast to trends observed in most OECD countries, its structure has been increasingly distortive during the period under study. This mostly reflects continued high border protection for agricultural commodities, pushing domestic prices above international levels and resulting in high market price support. Furthermore, payments based on variable or fixed input use are known for low transfer efficiency,[2] as only a small fraction of these transfers ends up as farmers' income. This particularly concerns water price support that is provided to the agricultural sector.

Commodity profile of producer support

The composition of support also reflects producers' flexibility in determining production decisions. For example, a payment designated for one specific commodity implies that in order to receive the payment a farmer must produce that commodity. In contrast, payments may be provided to a group of commodities or simply to any commodity without distinction. In such cases, producers who benefit from support have more freedom in defining their production mix and are more strongly guided by market signals (OECD, 2008c). Producer Single Commodity Transfers (SCT) is an indicator which measures to what extent agricultural policies are commodity specific. It sums up commodity specific transfers, such as market price support and payments linked to the production of a given commodity. It shows that for Israel the share of SCT in total PSE increased from 74% in 1995-97 to 87% in 2006-08. It is similar to the level in Korea, Japan and Iceland, but much higher than the OECD average (55% in 2006-08). Hence, it can be concluded that agricultural policies in Israel are focused on specific commodities which limits the flexibility of farmers in their production decisions.

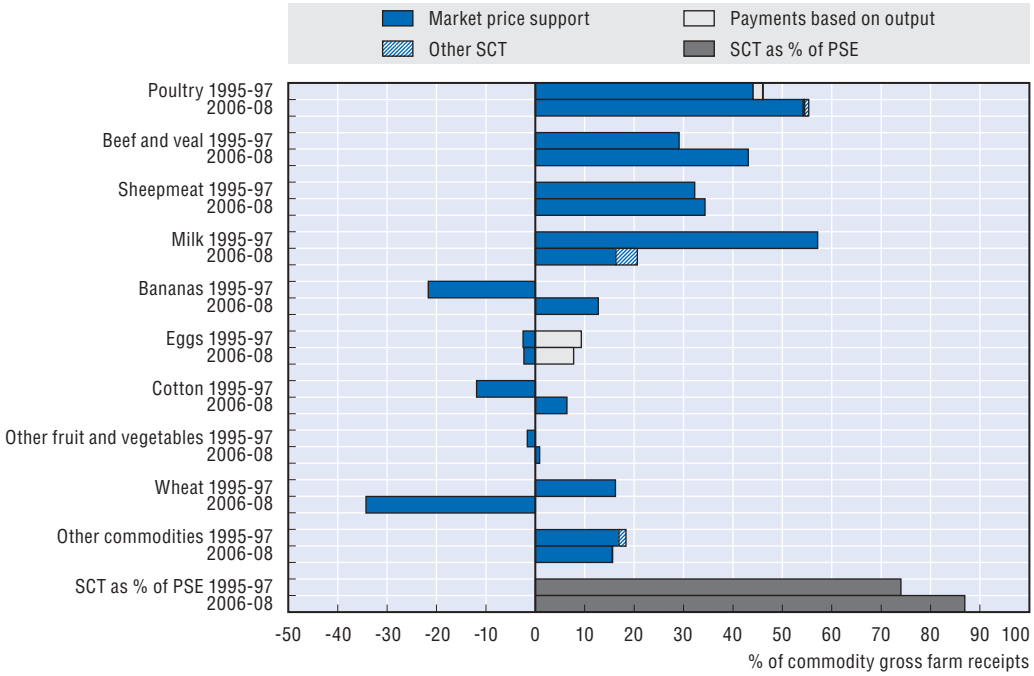
Producer SCT as a share of commodity gross farm receipts (%SCT) are highest for livestock products (Figure 2.14). Producers of eggs and milk are regulated with guaranteed (target) prices and benefit from income and investment support. The milk sector is also highly protected against international competition. While farm gate prices for poultry producers are no longer regulated, the %SCT remains high due to high border protection. This is also true for other livestock products, as well as for bananas. Producer SCTs are close to zero for the other fruit and vegetables, as MPS is assumed to be zero for exportable commodities (Box 2.7).

Producer SCT as a share of commodity gross farm receipts (%SCT) has increased in particular for poultry, beef and veal and sheepmeat over the period under review, indicating the limited nature of reforms to date in these sectors. The producer SCT has most significantly decreased for milk (from 57% to 16%), reflecting an important reform effort undertaken in the dairy sector. Until 2006, %SCT for wheat producers was positive, accounting on average for 16% of commodity gross farm receipts. A negative %SCT for 2007-08 was due to a small increase in government-set domestic farm gate prices in comparison with the rapid increase in world wheat prices.

Consumer Support Estimate

The Consumer Support Estimate (CSE) is a related indicator measuring the cost to consumers arising from policies that support agricultural producers by raising domestic prices. When the CSE is negative, it indicates an implicit tax on consumers. In the OECD methodology, the consumer is understood as the first buyer of these products. In the absence of policies that provide transfers to consumers to off-set the cost of higher prices (*e.g.* food subsidies), CSE generally mirrors the developments in MPS (Table 2.2). The

Figure 2.14. **Producer SCT by commodity, 1995-97 and 2006-08**



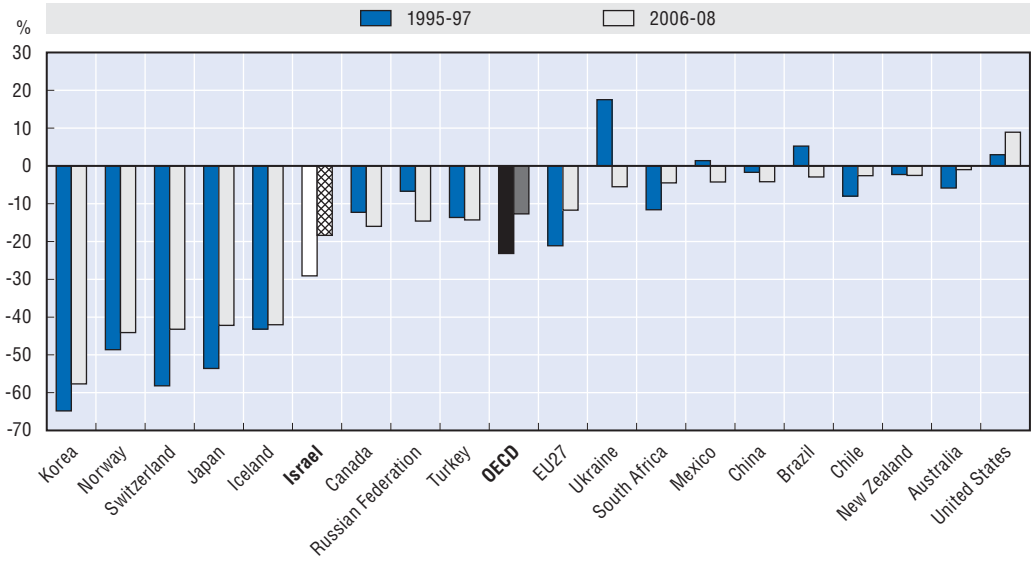
Note: Producer SCTs are zero for potatoes, peppers, tomatoes, avocados, grapes, grapefruit and oranges as MPS is assumed to be zero for exportable commodities and there are no other payments based on output for these commodities.

Source: OECD, *PSE/CSE database*, 2009.

implicit taxation of Israeli consumers has decreased over the period under review: from 29% in 1995-97 to 18% in 2006-08. However, it is higher than the average taxation of consumers in OECD countries which was 13% in 2006-08 (Figure 2.15).

Figure 2.15. **Consumer Support Estimate**

In per cent of consumption expenditure at farm gate



Note: CSEs for Brazil, Chile, China, the Russian Federation, South Africa and Ukraine are calculated for 2005-07.

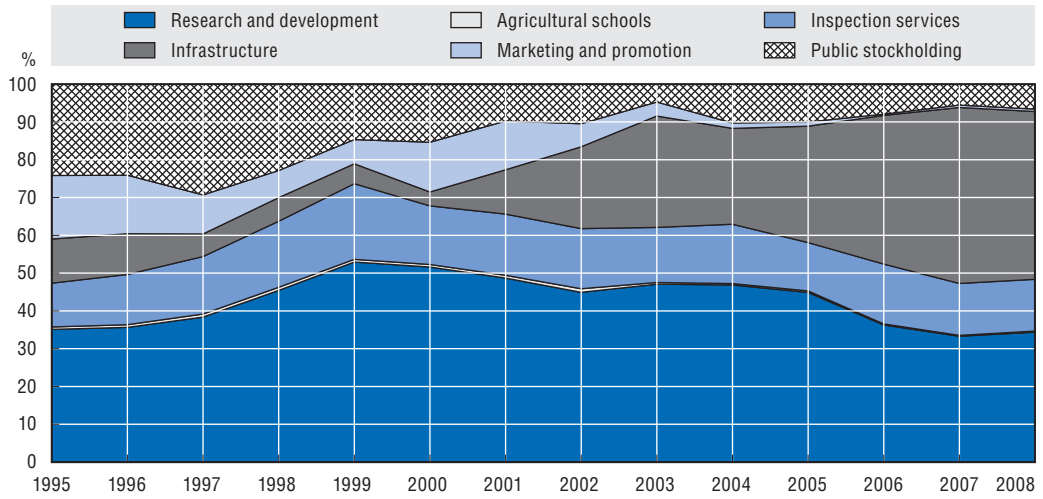
Source: OECD, *PSE/CSE database*, 2009.

General services

During the period under review, the budgetary expenditures on general services have slightly increased in nominal terms (Table 2.2). However, the composition of General Services Estimate (GSSE) has changed significantly (Figure 2.16). The share of infrastructure related investments in GSSE increased from 9% in 1995-97 to 43% in 2006-08. The share of public stockholding as well as marketing and promotion activities in budgetary expenditures on general services decreased substantially over the period under review. Israel stands out compared to OECD average in terms of expenditures on research and development which accounted for 35% of GSSE in 2006-08. The OECD average was 10% during the same period. However, the GSSE as a share of Total Support Estimate (TSE) was just 11% on average in Israel during 1995-2008, while the OECD average has increased from 13% in 1995-97 to 21% in 2006-08.

Figure 2.16. **Composition of General Services Support Estimate, 1995-2008**

Percentage of GSSE



Source: OECD, *PSE/CSE database*, 2009.

Total Support Estimate

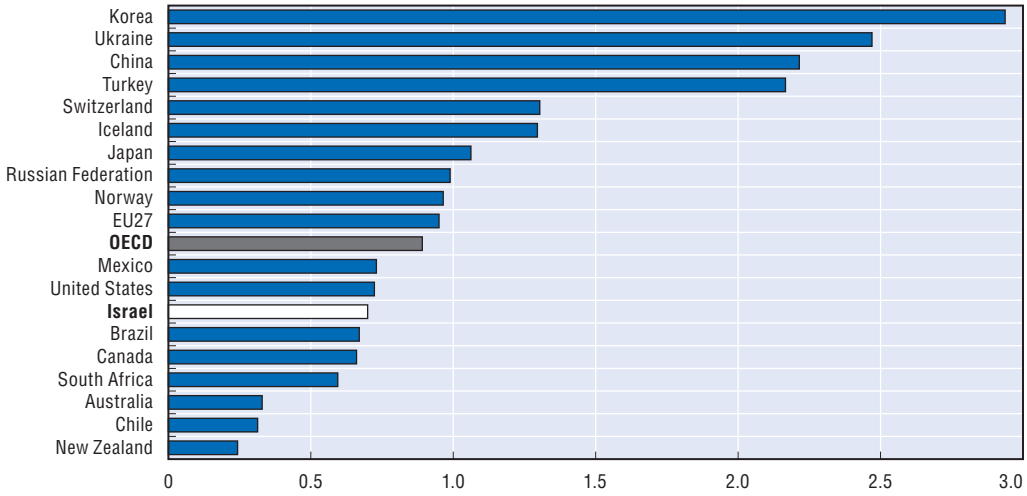
The Total Support Estimate (TSE) is the broadest indicator of support, representing the sum of transfers to agricultural producers (PSE), expenditure on general services supporting agricultural production (GSSE), and direct budgetary transfers to consumers (zero in the case of Israel). The aggregate TSE for Israel averaged USD 0.9 billion in 2006-07 and increased to USD 1.7 billion in 2008.

Expressed as a percentage of GDP, the %TSE indicates the cost that support to the agricultural sector places on the overall economy. During 1995-2002, the %TSE fluctuated between 0.9% and 1.1%, but decreased to 0.5%-0.8% in 2003-07. The decrease in %TSE was driven mainly by the higher growth rates of GDP relative to the TSE over the period under review. In 2008, the %TSE increased again to 0.8% (Table 2.2). The burden on the Israeli economy arising from agricultural support policies was lower than the OECD average in 2006-08 (Figure 2.17). The %TSE for Israel is close to the level of the United States and Brazil.

The composition of TSE for Israel indicates that MPS, considered as one of the most distorting form of assistance, remains a dominant way of supporting the farming sector throughout the period under study. Its share has increased constantly over the period

Figure 2.17. **Total Support Estimate in Israel and selected countries, 2006-08 average**

As per cent of GDP

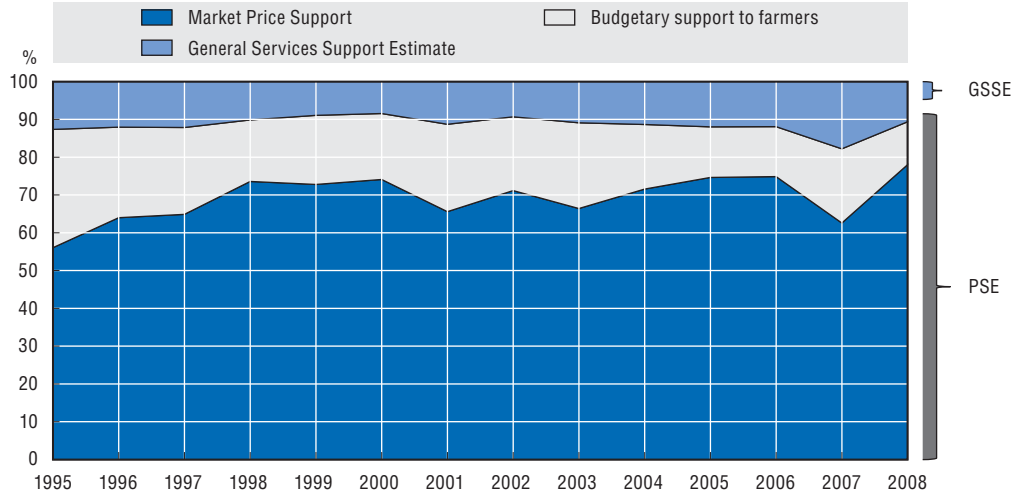


Note: TSEs for Brazil, Chile, China, the Russian Federation, South Africa and Ukraine are calculated for 2005-07.

Source: OECD, *PSE/CSE database*, 2009.

under review, reaching 78% in 2008 (Figure 2.18). The share of GSSE has been stable at around 11%, while the share of budgetary support to farmers has decreased from 31% in 1995 to 11% in 2008.

Figure 2.18. **Composition of the TSE, 1995-2008**



Source: OECD, *PSE/CSE database*, 2009.

Notes

1. Throughout the report conversion of ILS to USD was done according to the average exchange rate of a given year. For 2009, average exchange rate from January to September was used.
2. "Income transfer efficiency" captures the share of support that actually raises the net incomes of farm households. In an ideal world, this share would be 100%; *i.e.* the amount raised from taxpayers or consumers would equal the amount available for redistribution, and all the money would reach and be retained by the farmer (OECD, 2002).

ANNEX 2.A1

Policy Tables

Table 2.A1.1. **Main laws and regulations related to agriculture**

Title	Implemented
Laws	
Improvement of agricultural produce law (animals)	1952
Control of export of plants and plant products law	1954
Seed law	1956
Control on exports of animals and animal products law	1957
Control of products and services law	1957
Plant protection law	1957
Production and marketing of groundnuts law	1959
Water law	1959
Poultry board law	1963
Inspection of products and services law	1964
Planning and building law	1965
Business licensing law	1968
Plant board law	1973
Encouragement of investment in agriculture law	1980
Exemption article in the restrictive trade practices law	1988
Galilee law	1988
Compensation for natural disaster victims law (compensation for damages to agricultural infrastructures)	1989
Trade levies law	1991
The arrangement for family-based agricultural sector law (Gal law)	1992
Milk market planning law	1992
Kosher meat import law	1994
Animal protection law	1995
Supervision of prices and services law	1996
Organic law	2005
Free import order	2006
Regulations	
The rabies ordinance	1934
Control of products and services order (milk manufacturing)	1967
Control of products and services order (wine grapes marketing regulation)	1967
Control of products and services order (regulation of receiving grapes in wineries)	1968
Control of products and services order (manufacturing and trade of fodder)	1971
Fruit board order (establishment of Olives Board)	1976
Control of products and services order (honey manufacturing and sales)	1977
Bee protection ordinance	1983
Animal diseases ordinance	1985
Milk order	1967

Source: MARD, 2009.

Table 2.A1.2. **Domestic and trade policies applied in Israel**

Policy measure	Objective	Products covered	Design	Reforms since 1990
		Domestic policies		
Price support measures				
Production quotas	Regulate production.	Milk, eggs	Quota is determined based on consumption forecast. The division of annual quota to monthly quotas is aimed at encouraging farmers to reduce seasonality of supply. Milk quotas can be traded since 2007. Israeli Dairy Board and Poultry Board are implementing quota systems.	Removed from vegetables in the end-1980s, from poultry production in 2007.
Administered prices	Bolster revenues of agricultural producers through price supports.	Milk, eggs, wheat	*Milk and Eggs:* Guaranteed price targets, based on average production costs (plus a profit margin in the case of milk). Milk produced over the quota is purchased at significantly lower prices. *Wheat:* Minimum prices for local wheat are fixed annually in May based on Kansas market price adjusted for quality and transportation costs, subject to further adjustment during the year in light of the international price.	Administrative prices for fruit, potatoes, tomatoes, onions, cucumbers and poultry were dropped in 2004.
Surplus removal	Achieve stability in the domestic market.	Fruit and vegetables	Government provided support to destroy product surpluses in order to prevent prices falling below certain levels.	Abolished in 2004.
Consumer price controls	Control consumer prices of food.	Dairy products, eggs, bread	According to the Law on the Supervision of Prices of Goods and Services, approval from MOF and MARD is required before the prices can be increased.	Other products abolished in 1990s.
Reduction of input costs				
Investment grants	Improve competitiveness and introduce advanced technologies.	All	Law for Encouragement of Investment in Agriculture 1980. Investment grant is provided to cover 20% of investment costs. Investment grant is accompanied with tax concessions on income tax as well as with the right to use accelerated depreciation rate.	1999-2007 investment support to carry out dairy sector reform; from 2009 egg sector reform.
Reduction of labour cost for agriculture	Reduce labour cost for farmers.	All	Labour permits are allocated to farmers by MOITAL based on recommendations from MARD to allow employing foreign workers.	2009 an agreement to reduce permits to 18 900 by 2015.
Preferential water rates	Reduce water cost for farmers.	All	Farmers are supported through rates lower than the real cost of water. Support includes mainly the operation and maintenance costs and fixed capital costs of National Water Company (Mekorot) and other water suppliers.	1991 block tariff rate introduced in water pricing. Agreement in 2006 to increase freshwater charges to agriculture by 2015 to cover average costs of supply.
Debt write-offs and rescheduling	Rescue agricultural co-operatives.	All	The Arrangement for Family-Based Agricultural Sector Law (known also as Gal Law) was adopted to resolve the debt situation of the family farm sector and several agreements were reached to forgive and reschedule the debt in *kibbutzim* sector.	
On-farm services				
Extension service	Transfer know-how from research to farmers.	All	Extension service is free for farmers. It covers all agricultural branches and all regions. One extension officer provides services to 100-150 farmers.	
Income support measures				
Support to poultry sector in Galilee	Provide income support for producers in Galilee.	Egg and poultry	Galilee Law 1988. The subsidy for table eggs is 17% of the production cost, up to a maximum amount of 500 000 eggs per grower. Support for poultry meat amounts to 13% of production costs, up to a maximum amount of 50 tonnes per grower on a family farm (*moshav*) and 500 tonnes per grower on a co-operative farm (*kibbutz*). No support is provided for the production exceeding the upper limit.	Until 1993 the support was fixed rate per kg.
Compensation of broiler producers following structural reform	Reduce the planning system for the broiler industry.	Poultry	During 1994-96 the government paid producers the difference between the average market price and 90% of the costs of production every month. Farmers who choose to leave the sector were entitled to retirement compensation. At the same time the quota system for poultry meat was loosened.	
Support for rain-fed grain producers	Encourage the preservation and maintenance of open landscape.	Wheat	The support serves as a safety net for field crops, and covers the gap between the sale price of local wheat (announced for purchases to the emergency stocks in May based on Kansas market price adjusted to quality and transportation costs) and 82% of the production cost.	In 2009, it was replaced by an income insurance framework.

Table 2.A1.2. **Domestic and trade policies applied in Israel** *(cont.)*

Policy measure	Objective	Products covered	Design	Reforms since 1990
Support in case of Sabbatical year	Preserve cultivated agricultural lands and to give income support to farmers who stop working on their land.	All	Support is given to farmers who shut down their farms during a Sabbatical year; fruit tree nurseries that suffered losses; bodies who store agricultural produce from a sixth year; wheat growers in Israel as well as farmers from the non-Jewish sector who constructed greenhouses for vegetable cultivation.	
Insurance scheme	Reduce variability in income due to adverse weather conditions.	All	Fund for Natural Damages in Agriculture (KANAT) was established in 1967. Currently two insurance programmes are operating: insurance against variability in yields due to natural damages, and multi-risk insurance, that covers also multi-annual damage to the trees that affect future yields.	In 2000, multi-risk insurance programme was introduced.
Environmental measures				
Cattle, sheep and goats on pasture	Maintain open landscape and provide income support.	Beef, sheep and goats	The programme started with support for beef herds in 1997; sheep and goats were added to the programme in 2005. The support is provided mostly in peripheral regions and in areas for which there is no alternative agricultural use. Payment is provided per land area grazed by the herd.	In 2004, payment per animal was changed to area payment.
Grazing Authority	Maintain grazing areas, preserve open landscape and Israel's land reserves.	Beef	Support is provided for establishing infrastructure in grazing areas (*e.g.* fences, pipes, folds) and for improving the pasture vegetation by stripping, perfusion and fertilisation.	
Soil conservation	Develop sustainable agriculture.	All	Support is provided for the acquisition of machinery and equipment designed for soil conservation; for managing land through soil and water conserving cultivation practices; and for land conservation and agricultural drainage facilities to encourage farmers to minimise soil erosion and drain the rainfall excess from their fields.	
Rural public services infrastructure				
Research and development	Solve problems in agricultural production for the benefit of farmers and consumers.	All	Agricultural research is funded primarily by the public sector (85%) of which MARD provides the major share. The vast majority of the applied agricultural research in Israel is carried out by the Agricultural Research Organisation (ARO), which is attached to MARD.	
Public stockholding	Maintain an emergency reserve of cereals for human and animal consumption.	All	The reserves are maintained by private storehouse holders that are selected through a public tender for a period up to 3 years. The reserves are purchased by the storehouse holders and are actually owned by them. The government covers only the storage and financing costs.	
Inspection services	Maintain plant and animal health and food and feed safety.	All	The Plant Protection and Inspection Service (PPIS) and Veterinary Service in MARD are the main bodies responsible for inspection services. In addition, the Chief Rabbinate is responsible for enforcing the Kosher Meat Import Law (1994).	
Infrastructure	Improve agricultural production infrastructure.	All	Investments related to the waste-water treatment. The government also supports the adaptation of irrigation systems to use reclaimed water, including: pumping and transporting the water to farms so that it is not mixed with drinking water and storing (ponding) the water from winter to summer.	
Market information	Increase transparency of the markets.	All	Two units of MARD are responsible for providing market information.	
Marketing and promotion	Promote exports.	All	Support is provided through Exports Promotion Fund. Fund provides assistance to exporters for participating in exhibitions, advertising, developing catalogues and sending samples for exports.	
Trade policy measures				
Import policy measures				
State trading	Retain state control over imports of wheat, grains and meat.	Meat, wheat, coarse grains	The Government Trade Administration, under MOITAL, was the sole agency authorised to import meat, wheat and coarse grains.	Abolished for wheat and coarse grains in 1989 and for meat in 1994.

Table 2.A1.2. **Domestic and trade policies applied in Israel** *(cont.)*

Policy measure	Objective	Products covered	Design	Reforms since 1990
Import licences	Control imports of agro-food products.	All	Import licensing applies only to the products imported through tariff rate quotas (TRQs). In addition, the government maintains a licensing mechanism on imports from twelve non-WTO members that have no diplomatic relations with Israel or that prohibit imports from Israel into their markets.	In 1995, restrictive licensing system abolished.
Import tariffs	Protect domestic producers.	All	Bound rates range between 0%-560%. Highest applied MFN tariffs are applied to livestock products (31%) and fruits and vegetables (21%). Tariff rates are very high for fresh and chilled meat, but almost zero for frozen meat. For several product groups, the share of imports entering Israel duty free is relatively high: 92% of animal products, 85% of oilseeds, fats and oils, because of free trade agreements. However, these are mainly for products for which MFN tariffs are already low, with the agreements generally limiting import competition for the more sensitive products.	In 1995, all tariff lines bound and *tariffication*.
Tariff rate quotas	Allow preferential access for certain commodities.	Wheat, edible fats and oils, corn, citrus juice, beef	In addition to general WTO quotas, all Israel's trade agreements (except EFTA) provide for preferential TRQs on agricultural goods. In accordance with Israel's URAA commitments, TRQ levels were increased until 2004. Since 2004, the quota levels remained unchanged. However, in-quota tariff rates have decreased for wheat, walnuts and citrus juice between 2005 and 2008. In general, TRQs were overfilled during 1999-2008, as for many products the in-quota and out-of-quota tariff rates were the same.	Introduced in 1995.
Sanitary and phytosanitary measures	Ensure food safety.	All	Sanitary and phytosanitary (SPS) controls are imposed on live animals and animal and plant products whether domestically produced or imported. Existing SPS measures are in accordance with the WTO Agreement on Sanitary and Phytosanitary Measures. A Certificate is required in imports to prove that food safety conditions are met.	
Standards	Assure appropriate level of quality of commodities.	All	The policy of the government is to adopt international standards wherever possible, and to implement mandatory standards related only to safety, health, and the environment.	
Kosher certificate	Ensure compliance with Israeli dietary laws.	Meat (all)	When importing food products into Israel, a kosher certificate from a Chief Rabbinate of Israel may be required to assure compliance with *Kashrut*, Israeli dietary laws. The Kosher certificate is not an import requirement as such, but its refusal can effectively block sales to the larger part of the Israeli market. However, kosher certificate is obligatory in importing meat.	Kosher Meat Import Law introduced in 1994.
Export policy measures				
State trading	Control exports of agro-food products.	Horticultural products	Marketing and production boards and AGREXCO were responsible for horticultural exports until the 1990s.	Abolished in 1990s.
Export licenses	Monitoring exporters.	Fruit and vegetables	The licensing system is maintained for data collection; monitoring the exporter's facilities to ensure meeting quality requirements for fresh exported fruits and vegetables; examination of the exporter's financial solvency; ensuring respect of intellectual property rights, and compliance with national laws and international rules.	
Export subsidies	Support exporters.	Cut flowers, fruit and vegetables, goose liver, cotton	Under the terms of the URAA, Israel was required to reduce agricultural export subsidies by 24% over the period of 1995-2004. Export subsidies actually granted by the government were much lower compared to commitment levels.	Not applied since 2004.
Export finance, insurance and guarantees	Facilitate exports.	All	Israel abolished its public export credit programme in 1994; no government-supported export financing has been available since then. The Israel Export Insurance Corp. Ltd., a state-owned company, offers a wide range of insurance instruments to Israeli exporters.	Export credit programme abolished in 1994.
Export promotion	Promote exports.	All	From the mid-1990s, support for exports has been provided on an *ad hoc* basis to provide solutions to specific problems stemming from the world market situation, and through the Exports Promotion Fund (EPF) for fresh agricultural production.	

Source: OECD, 2009.

Table 2.A1.3. **Prices of milk products subject to consumer price controls in Israel, 2008**

Milk product	Brand name	Fat (%)	Package	Size	Retail price (ILS)	Consumer price incl. VAT (ILS)
1 Fresh milk		3.0	Plastic bag	1 litre	3.85	4.96
2 Fresh milk		1.0	Plastic bag	1 litre	3.59	4.65
3 Fresh milk		3.0	Carton (tetra pack)	1 litre	4.6	6.16
4 Fresh milk		1.0	Carton (tetra pack)	1 litre	4.33	5.8
5 Fermented milk	Eshel	4.5	Cup	200 cc	1.11	1.53
6 Fermented milk	Gil	3.0	Cup	200 cc	1.03	1.41
7 Sour cream		15.0	Cup	200 cc	1.59	2.15
8 Fresh cream		38.0	Carton (tetra pack)	250 cc	3.95	5.3
9 UHT cream		38.0	Carton	250 cc	4.94	6.62
10 Butter				100 grammes	2.37	3.18
11 Hard cheese (EDAM like)	Emek			1 kg	32.62	44.04
12 Hard cheese (EMENTAL like)	Tal-Ha'Emek			1 kg	36.6	49.76
13 Semi hard cheese	Gilboa			1 kg	30.68	41.71

Note: VAT is at 15.5%.
Source: MARD, 2009.

Table 2.A1.4. **Production costs and Galilee Law subsidy for eggs and broilers, 1990-2007**

	Broilers			Eggs		
	Subsidy	Average production cost	Subsidy rate	Subsidy	Average production cost	Subsidy rate
	ILS/kg	ILS/kg	%	ILS/egg	ILS/egg	%
1990	0.83	–	–	–	–	–
1991	0.97	–	–	–	–	–
1992	1.08	–	–	–	–	–
1993	0.58	3.64	16	–	–	–
1994	0.55	3.78	14.5	–	–	–
1995	0.50	3.87	13	–	–	–
1996	0.58	4.49	13	–	–	–
1997	0.61	4.71	13	0.0555	0.3265	17
1998	0.54	4.19	13	0.0429	0.2525	17
1999	0.55	4.26	13	0.0451	0.2651	17
2000	0.57	4.36	13	0.0458	0.2696	17
2001	0.58	4.45	13	0.0466	0.2744	17
2002	0.61	4.71	13	0.0485	0.2854	17
2003	0.64	4.96	13	0.0514	0.3021	17
2004	0.68	5.20	13	0.0537	0.3157	17
2005	0.66	5.09	13	0.0525	0.3088	17
2006	0.68	5.20	13	0.0529	0.3110	17
2007	0.74	5.72	13	0.0577	0.3396	17

–: not available.
Source: MARD, 2009.

Table 2.A1.5. **Tariffs by product groups, 2006**

	Final bound duties				MFN applied duties			Imports	
	Average bound duty in %	Duty-free in %	Max. in %	Binding in %	Average applied MFN duty in %	Duty-free in %	Max. in %	Share in %	Duty-free in %
Dairy	168	0.0	247	95	108	5.8	212	0.1	17.8
Beverages and tobacco	131	1.3	255	98	17	17.5	97	0.0	0.0
Animal products	115	8.5	190	96	31	33.0	190	0.7	92.3
Fruit, vegetables, plants	105	0.0	560	100	21	18.0	284	0.5	37.1
Cereals and preparations	58	0.6	255	100	11	41.8	129	1.4	67.2
Oilseeds, fats and oils	38	2.0	128	100	7	61.9	86	0.8	85.1
Other agr. products	31	7.3	170	98	5	67.8	105	0.2	56.7
Sugars and confectionery	10	0.0	35	100	2	80.6	16	0.0	0.0
Coffee, tea	9	0.0	25	100	1	87.5	12	0.1	99.7
Cotton	4	20.0	5	100	0	100.0	0	0.0	100.0

Note: All simple averages are based on pre-aggregated HS six digit averages. Pre-aggregation means that duties at the tariff line level are first averaged to six-digit subheadings. Subsequent calculations are based on these pre-aggregated averages. To the extent possible, non-*ad valorem* duties are converted into *ad valorem* equivalents.
Source: WTO, 2008.

Table 2.A1.6. **Bound and applied MFN tariffs on main agricultural products, 2002 and 2008**

		Bound MFN in %	Applied MFN 2002 in %	Non-*ad valorem* 2002	Applied MFN 2008 in %	Non-*ad valorem* tariffs 2008
1029	Bovine animals, live	128		1.6 ILS/kg		1.15 ILS per kg
1039	Swine, live	85	30			
104109	Sheep, live	170	58.3			6.22 ILS per kg but not more than 170%
104209	Goat, live	170	87.5			
10591	Fowls, live	170		8.4 ILS/unit max. 185%		8.4 ILS per unit but not more than 150%
201	Bovine meat, fresh	190	190		190	
202	Bovine meat, frozen	128	0		0	
2031	Swine meat, fresh	128	30		30	
2032	Swine meat, frozen	128	20		20	
2042	Sheep meat, fresh or chilled	50		50		
2043	Frozen sheep meat carcases	50		50		
20711	Poultry meat, fresh	170		5-6 ILS/kg max. 191%		5-6 ILS per kg but not more than 170%
20712	Poultry meat, frozen	170				5-6 ILS per kg but not more than 170%
401	Milk and cream	153	172		153	
407	Eggs	170		0.3 ILS/unit max. 191%, 0.75-3.6 ILS/unit max. 50%		0.3 ILS per unit but not more than 170%, 3.6 ILS per unit but not more than 50%
60240	Roses	136	10		10	
60310	Fresh cut flowers	136	20		20	
7019	Potatoes	230	115	1.58-1.88 ILS/kg max. 250%		1.59 ILS per kg but not more than 234% 1.79 ILS per kg but not more than 230%
702	Tomatoes	272	47.5	1.89-2.53 ILS/kg max. 301%		0.89-1.20 ILS/kg max. 272%
70310	Onions	298	47.5	0.84-1.26 ILS/kg max. 324%		0.76-1.09 ILS per kg but not more than 298%
70320	Garlic	340	47.5	10.08 ILS/kg max. 370%		7.09-11.44 ILS per kg but not more than 340%
70700	Cucumbers	170	47.5	2.04 ILS/kg max. 185%		0.96 ILS per kg but not more than 170%
70960	Sweet peppers	93	47.5	2.03-3.03 ILS/kg max. 101.5%		1.34-1.80 ILS per kg but not more than 93%
8030	Bananas	136	36.3	2.17 ILS/kg max. 148%, 20% + 0.54 ILS/kg		0.99 ILS per kg but not more than 136%
8051	Oranges	162	36.3	1.56 ILS/kg max. 176%		0.72 ILS per kg but not more than 162%
8054	Grapefruit	162	36.3	1.38 ILS/kg max. 176%		0.64 ILS per kg but not more than 162%
8061	Table grapes	349	47.5	1-3.66 ILS/kg max. 379.5%,		1.71-3.18 ILS per kg but not more than 349%
8081	Apples	553	47.5	3.66 ILS/kg max. 602.5%		1.85 ILS per kg but not more than 553%
1001	Wheat	128	50		50	
1003	Barley		0		0	
1206	Sunflower seeds	114		20% + 1.11 ILS/kg, 3.7 ILS/kg max. 139%		1.92 per kg but not more than 114%

Source: WTO Integrated Data Base, MARD, 2009.

Table 2.A1.7. **Seasonal tariffs in Israel, 2008**

Product	Period	Tariff	Period	Tariff
1 Potatoes, fresh or chilled (7019000)	July-April	ILS 1.79/kg but not more than 230%	May-June	ILS 1.52/kg but not more than 230%
2 Tomatoes, fresh or chilled (702)	November-May	ILS 1.19/kg but not more than 272%	June-October	ILS 0.89/kg but not more than 272%
3 Fresh or chilled onions and shallots (070310)	January-April	ILS 1.09/kg but not more than 298%	May-December	ILS 0.76/kg but not more than 298%
4 Fresh or chilled cauliflowers (70410)	September-February	ILS 1.06/kg but not more than 128%	March-August	ILS 0.80/kg but not more than 128%
5 Carrots and turnips (07061000)	June-November	ILS 1.39/kg but not more than 213%	December-May	ILS 1.06/kg but not more than 213.0%
6 Aubergines (07093000)	November-April	ILS 0.54/kg but not more than 89%	May-October	ILS 0.46 /kg but not more than 89%
7 Marrow (07099030)	November-April	ILS 0.78/kg but not more than 128%	May-October	ILS 0.53/kg but not more than 128%
8 Fresh figs (08042010)	May-November	ILS 2.42/kg but not more than 102%	December-April	ILS 1.52/kg but not more than 102%
9 Fresh mangoes, guavas, and mangosteens (08045000)	June-December	ILS 1.97/kg but not more than 85%	January-May	ILS 1.252/kg but not more than 102%
10 Watermelons (08071100)	October-May	ILS 0.46/kg but not more than 102%	June-September	ILS 0.44/kg but not more than 102%
11 Melons (08071900)	October-May	ILS 1.22/kg but not more than 102%	June-September	ILS 0.67/kg but not more than 102%
12 Apricots (08091000)	April-August	ILS 1.54/kg but not more than 89%	September-March	ILS 0.97/kg but not more than 89%
13 Cherries (08092000)	April-July	ILS 3.70/kg but not more than 81%	August-March	ILS 1.74/kg but not more than 81%
14 Peaches, including nectarine (08093000)	April-November	ILS 1.33/kg but not more than 89%	December-March	ILS 0.84/kg but not more than 89%
15 Plums and sloes (08094000)	May-November	ILS 1.13/kg but not more than 102%	December-April	ILS 0.71/kg but not more than 102%
16 Strawberries (08101000)	October-May	ILS 4.22/kg but not more than 94%	June-September	ILS 1.38/kg but not more than 94%
17 Kiwifruit (08105000)	September-June	ILS 3.43/kg but not more than 94%	July-August	ILS 1.63/kg but not more than 94%
18 Persimon (08109010)	August-February	ILS 1.33/kg but not more than 94%	March-July	ILS 0.92/kg but not more than 94%
19 Lychee (08109020)	June-September	ILS 5.53/kg but not more than 94%	October-May	ILS 3.48/kg but not more than 94%
20 Loquat (08109030)	March-July	ILS 4.86/kg but not more than 94%	August-February	ILS 3.41/kg but not more than 94%
21 Ginger, other than spices in form of powder or granules (09101090)	October-February	ILS 6/kg	March-September	15%

Note: Corresponding HS code is provided in parenthesis.
Source: MARD, 2009.

Table 2.A1.8. **Tariff quotas on imports (WTO quotas), 1999-2008**

Item (code HS)	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	Final bound rates In-quota rate (Out-of-quota rate)	Applied rate (2005) In-quota rate (Out-of-quota rate)	Applied rate (2008) In-quota rate (Out-of-quota rate)
Wheat and meslin (1001)													
Quota level ('000 tonnes)	450	450	450	450	450	450	450	450	450	450	85%	0% and 50%	0%
Actual imports ('000 tonnes)	1 669	1 552	708	661	1 241	1 317	1 435	1 330	1 226	1 527	–128%	(0% and 50%)	(0% and 50%)
Sweet corn (2005.8000)													
Quota level (tonnes)	275	290	300	320	350	350	350	350	350	350	20%	12%,	12%
Actual imports (tonnes)	300	588	1 319	152	1 590	2 058	1 301	1 348	3 203	2 292	–128%	(12% and 12% but not less than ILS 1.6 per kg)	(12% and 12% but not less than ILS 1.61 per kg)
Walnuts (0802.31 and 0802.32)													
Quota level (tonnes)	135	142	147	156	163	170	170	170	170	170	18% and 20%	18% and 20%	12%
Actual imports (tonnes)	2 685	2 885	425	2 857	3 726	3 203	3 513	2 297	3 948	3 997	–87%	(21.2% and 22%)	12%
Prunes (0813.20)													
Quota level (tonnes)	600	600	600	600	600	600	600	600	600	600	10%	ILS 1 to 4 per kg but not more than 10%	ILS 1 to 4 per kg but not more than 10%
Actual imports	1 050	1 678	586	1 993	1 986	2 447	1 321	1 658	2 041	2 112	–102%	(ILS 1 per kg but not more than 30% and ILS 2 or 4 per kg but not more than 102%)	(ILS 1 per kg but not more than 30% and ILS 2 or 4 per kg but not more than 102%)
Orange juice (2009.10) Grapefruit juice (2009.20) Other citrus juice concentrated (2009.30)													
Quota level (tonnes)	130	136	140	148	154	160	160	160	160	160	26%	0-45%	25%
Actual imports (tonnes)	6 195	8 922	13 417	9 995	21 225	22 447	24 446	24 404	27 855	32 129	–120%	0-45%	0-45%
Edible fats and oils (1516.1110)													
Quota level (tonnes)	600	630	650	690	720	750	750	750	750	750	ILS 0.8 per kg but not less than 12%	ILS 0.8 per kg but not less than 12%	ILS 0.8 per kg but not less than 12%
Actual imports (tonnes)	0	0	1	5	0	3.4	0	0	0	0	–85%	(ILS 0.18 per kg but not more than 28%)	(ILS 0.18 per kg but not more than 28%)

Table 2.A1.8. **Tariff quotas on imports (WTO quotas), 1999-2008** *(cont.)*

Item (code HS)	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	Final bound rates In-quota rate (Out-of-quota rate)	Applied rate (2005) In-quota rate (Out-of-quota rate)	Applied rate (2008) In-quota rate (Out-of-quota rate)
Bovine, live and meat (0102.10, 0102.90, 0201-0202, 0206.10, 0206.20 and 1601-03)													
Quota level (tonnes)	37 250	37 250	37 250	37 250	37 250	37 250	37 250	37 250	37 250	37 250	15% 50%, 120%	0%, 50% or ILS 1.15 per kg	0%, 50% or ILS 1.15 per kg
Actual imports (head) (0102)	17 891	60 209	85 661	72 711	48 219	41 680	70 589	111 693	66 148	81 627	(43%, 128%, 111%, 187%, 190%)	(0%, ILS 1.15 per kg)	(0%, ILS 1.15 per kg)
Actual imports (tonnes) (0201, 0202, 1601, 1602, 1603, 02061000, 02062000)	57 535	150 088	72 808	58 986	67 329	65 107	66 139	83 205	77 144	102 852		0%-12%, 50%, 190%, 2% + ILS 2.9, 12% + ILS 9.75, 12% + ILS 4.9 per kg but not more than 50%	0%-12%, 50%, 190%, 12% + ILS 2.9, 12% + ILS 9.75, 12% + ILS 4.9 per kg but not more than 50%
Sheep and goats, fresh (0204)													
Quota level (tonnes)	440	480	480	480	480	480	480	480	480	480	100%	50%	50%
Actual imports (tonnes)	2 038	1 716	1 029	793	930	752	813	1 107	1 257	2 003	–89.50%	50%	50%
Milk and cream < 1.5% (0402.10)													
Quota level (tonnes)	1 200	1 200	1 200	1 200	1 200	1 200	1 200	1 200	1 200	1 200	85%	85%	85%
Actual imports (tonnes)	2 064	3 276	3 496	1 776	1 930	2 531	3 218	3 294	5 076	6 406	–162%	(0%, 85% and 162%)	(0%, 85% and 162%)
Milk and cream >1.5% (0402.20)													
Quota level (tonnes)	92	100	100	100	100	100	100	100	100	100	215%	–	–
Actual imports (tonnes)	2 799	1 438	2 322	2 889	3 900	3 626	4 096	3 538	3 132	2 677	–212%	(0% and 212%)	(0% and 212%)
Processed cheese (0406.30)													
Quota level (tonnes)	62	68	68	68	68	68	68	68	68	68	150%	50%	50%
Actual imports	93	124	55	240	524	1 098	739	288	297	175	–215%	(50% and ILS 14.5 per kg but not more than 214%)	(50% and ILS 14.6 per kg but not more than 214%)
Other cheese (0406.90)													
Quota level (tonnes)	990	1 080	1 080	1 080	1 080	1 080	1 080	1 080	1 080	1 080	250%	50%	50%
Actual imports	964	782	1 079	1 108	1 847	2 339	2 181	1,890	1 676	1 581	–179%	(ILS 4 or 13 per kg but not more than 179% and ILS 16 per kg but not more than 170%)	(ILS 4.03 or 13 per kg but not more than 179% and ILS 16 per kg but not more than 170%)

Source: WTO, 2006.

Table 2.A1.9. **Actual subsidised exports and export subsidies commitments, 1995-2008**

Product (HS code)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Cut flowers (0603.1000)														
Subsidised exports														
Outlays (USD million)			4	1	1	0	3	2	2	0	0	0	0	0
Quantity (million units)			415	116	244	0	354	526	430	430	0	0	0	0
Annual commitment levels														
Outlays (USD million)	12	12	11	11	11	10	10	10	10	9	9	9	9	9
Quantity (million units)	783	772	761	750	739	727	716	705	694	683	683	683	683	683
Vegetables (0701-09)														
Subsidised exports														
Outlays (USD million)			1	0	0	0	1	1	1	0	0	0	0	0
Quantity ('000 tonnes)			18	0	0	0	40	78	80	78	0	0	1	0
Annual commitment levels														
Outlays (USD million)	9	9	9	8	8	8	8	8	7	7	7	7	7	7
Quantity ('000 tonnes)	91	89	88	87	86	84	83	82	80	79	79	79	79	79
Citrus fruit (0805)														
Subsidised exports														
Outlays (USD million)			1	0	0	0	1	0	0	0	0	0	0	0
Quantity ('000 tonnes)			20	0	0	0	50	60	38	38	0	0	0	0
Annual commitment levels														
Outlays (USD million)	18	17	17	16	16	16	15	15	14	14	14	14	14	14
Quantity ('000 tonnes)	424	418	412	406	401	394	388	382	376	370	370	370	370	370
Other fruit (0803, 04, 06-10)														
Subsidised exports														
Outlays (USD million)			0	0	0	0	1	2	1	0	1	0	1	1
Quantity ('000 tonnes)			0	0	0	0	35	36	15	0	7	0	8	4
Annual commitment levels														
Outlays (USD million)	6	5	5	5	5	5	5	5	5	4	4	4	4	4
Quantity ('000 tonnes)	55	54	53	52	52	51	50	49	48	48	48	48	48	48
Goose liver														
Subsidised exports														
Outlays (USD million)			0	0	0	0	0	0	0	0	0	0	0	0
Quantity ('000 tonnes)			0	0	0	0	0	0	0	0	0	0	0	0
Annual commitment levels														
Outlays (USD million)	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Quantity ('000 tonnes)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cotton														
Subsidised exports														
Outlays (USD million)			0	0	0	0	0	1	0	0	0	0	0	0
Quantity ('000 tonnes)			0	0	0	0	0	1	0	0	0	0	0	0
Annual commitment levels														
Outlays (USD million)	9	9	9	9	9	8	8	8	8	7	7	7	7	7
Quantity ('000 tonnes)	47	46	46	45	44	44	43	42	42	41	41	41	41	41
Total														
Subsidised exports														
Outlays (USD million)			6	1	1	0	5	6	4	1	1	0	1	1
Quantity ('000 tonnes)			. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .
Annual commitment levels														
Outlays (USD million)			52	51	49	48	47	45	44	43	43	43	43	43
Quantity ('000 tonnes)			. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .

. .: not available.
Source: WTO, 2006.

Table 2.A1.10. **Israel's free trade agreements**

Country	Date of agreement
European Union	1975 Co-operation Agreement, 1995 Association Agreement, additional concessions to agricultural products in 2004 and 2008.
United States	1985 Free Trade Agreement, 1996 Agreement on Trade in Agriculture Products, extended in 2004.
EFTA (Norway, Switzerland, Iceland and Lichtenstein)	1992, bilateral agricultural agreements between the individual EFTA countries and Israel have been concluded in 1992 with Norway, Switzerland and Iceland.
Palestinian Authority	1995, part of the Oslo Agreements (1993-94) and contains chapters relating to agricultural trade between the Palestinian Authority and Israel.
Canada	1996, expansion of concessions to trade in agricultural products was negotiated in 2003.
Turkey	1996, includes concessions on agricultural products.
Jordan	1996, as part of the peace agreement between the two countries, includes concessions on agricultural products.
Mexico	2000, includes concessions on agricultural products.
Mercosur (Argentina, Brazil, Paraguay, Uruguay)	2007 (not yet in force), includes concessions on agricultural products.

Source: MARD, 2009.

Chapter 3

The Environmental Performance of Agriculture*

Chapter 3 of this report examines the key trends and policies relevant to the environmental performance of Israeli agriculture since the early 1990s. Section 3.1 sets the scene by providing an overview of the agri-environmental context and related policy objectives, policy instruments, and institutional and legal framework, with Section 3.2 examining the management of water resources, the dominant environmental issue in Israeli agriculture. This is followed by discussion of recent trends and policies in: Section 3.3, covering the control of water pollution; Section 3.4, concerning combating land degradation and desertification; Section 3.5, examining the protection of biodiversity and cultural landscapes related to agriculture; Section 3.6, reviewing the reduction of air pollution; and, Section 3.7 addressing the consequences of climate change and climate variability for Israeli agriculture. Finally, Section 3.8 summarises the key achievements in improving the environmental performance of Israeli agriculture and explores the challenges and approaches that might strengthen its future environmental performance.

* This review is not intended to cover the territories known as the Golan Heights, the Gaza Strip or West Bank. However, for technical reasons, this review sometimes uses Israel's official statistics, which include data relating to the Golan Heights, East Jerusalem and Israeli settlements in the West Bank.

3.1. Overview of the agri-environmental context

The variety of physical conditions in Israel give rise to large spatial and temporal variation in rainfall and temperature, ranging from the arid to semi-arid central/southern region to the cooler and wet northern Mediterranean region. This has resulted in a rich and varied biodiversity (flora, fauna, habitats, and ecosystems) and a diverse agricultural system of cultivated crops and reared livestock (CBD, 2005; Nemtzov, 2002).

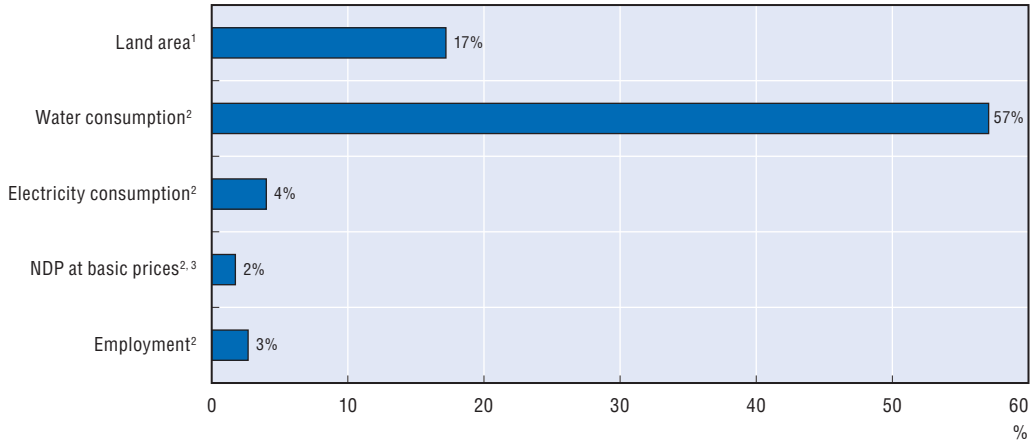
Over recent decades the high rate of population growth, coupled with rapid economic development and limited space and natural resources, has generated great pressure on already scarce land and water resources (MEP, 2007a). The challenge for the Israeli agricultural sector is to expand production and play a part in rural and economic development, while protecting land and water resources, reducing pollution, and contributing to biodiversity and landscape (open spaces) amenity conservation.

Recent agri-environmental trends

Agriculture's contribution to the economy is small but its impact on the environment is significant.[1] The dominant role of agriculture's use of national water (57%) and land (17%[2]) resources, contrasts with its low share in NDP (2%) and employment (3%) (Figure 3.1). Despite the small and declining share of primary agriculture in the Israeli economy, production has grown substantially contributing to expansion of the agri-food chain and growth in agri-technology exports (Section 1.2, Chapter 1) (Feitelson, 1999; Kimhi, 2004).

Figure 3.1. **Overview of Israeli natural resource and agricultural profile**

Share of primary agriculture in national total



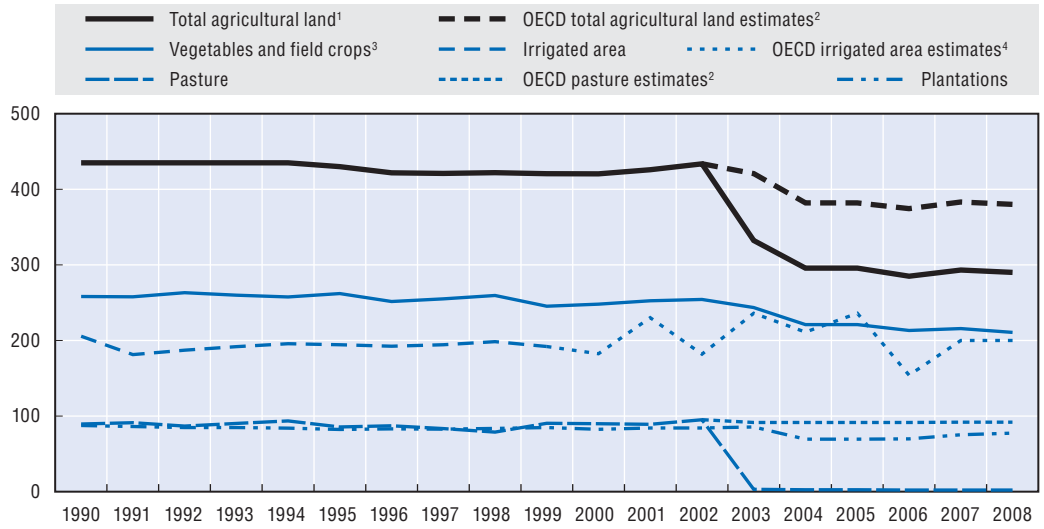
1. Average 2006-08 (OECD estimate).
2. Average 2006-08.
3. Net Domestic Product at basic prices equals GDP at market prices after deduction for consumption of fixed capital and net taxes on products.

Source: CBS, 2006; CBS, 2008a; CBS, 2008b; CBS, 2009c; and MARD, 2009.

The growth in agricultural production since the early 1990s has been achieved by improving the productivity of fixed and variable inputs, including water (Figure 1.14, Chapter 1). During the same period the yield of agricultural production also rose as the area farmed remained virtually unchanged up to 2000 (Figure 3.2). From 2000 up to the present, however, the area farmed has decreased under further pressure from rapid population growth and urbanisation (Kimhi, 2004; Tal, 2007).

Figure 3.2. **Agricultural land area trends in Israel**

'000 hectares



Note: From 2003, CBS data collection methods were changed. Therefore, comparisons with previous years cannot be made.

1. Excluding missing data for the categories of flowers and garden plants, and other uses.
2. OECD estimates for years 2003 to 2008.
3. Including potatoes and melons.
4. OECD estimates for years 2000 to 2008.

Source: CBS, 2009c; and OECD Secretariat estimates, 2009.

These developments have led to a ***varying mix of environmental costs and benefits***. Agriculture's embrace of technological innovation has given rise, on the one hand, to more technically efficient use of water, pesticides and fertilisers per unit of output and, for example, recycling of effluent, but on the other hand pollution of water and air, land degradation and pressure on biodiversity (MEP, 2008b; Tal, 2007). At the same time the rapid expansion of the economy and urban population, has intensified competition across all economic sectors, including agriculture, for scarce land and water resources (Feitelson, 1999).

The dominant environmental issue for the agricultural sector concerns availability of water resources and water management, in particular, for irrigated agriculture, which accounts for about 60% of the total agricultural land area, with the remainder rainfed farmland (Section 3.2) (MARD, 2009).[3] Water management in agriculture is concerned not only with irrigation but also water pollution, notably salinity and run-off from pesticides and nutrients (inorganic fertilisers and livestock manure) (Section 3.3).

Combating land degradation and desertification is also important in the arid areas of the country, notably the southern Negev desert (Section 3.4). Biodiversity has been adversely impacted by agriculture through land degradation, overexploitation of water resources, and

water and air pollution, while the transfer of land from agricultural to urban use is giving rise to concerns about protecting open spaces (cultural landscapes) (Section 3.5). Agriculture also gives rise to air pollution, mainly ammonia emissions from livestock and fertiliser application, and the depletion of ozone by the methyl bromide pesticide (Section 3.6). Apprehension over the future impacts of climate change and climate variability for farming systems is an overarching economic, environmental and social issue (Section 3.7).

Environmental policy objectives

Environmental issues have only become more important in agricultural policy making since around 2000. In the early period of Israel's statehood the focus was on ensuring food security, giving precedence from around the 1960s onwards to programmes centred on increasing farm production and exports (Feitelson, 1999). Over the 1990s with growing environmental awareness among the public and policy makers (Maruani and Amit-Cohen, 2009), agriculture was progressively included in broader environmental policies (*e.g.* national water quality standards). In parallel, Israel was also increasingly entering into commitments under International Environmental Agreements, some with implications for agriculture (OECD, 2009d).

A ***nationwide multi-year Plan for Sustainable Agricultural Development*** (PSAD) was adopted in 2002, and seeks to balance environmental concerns with expanding agricultural production. The following principles and objectives guide environmentally sustainable agricultural policy (MARD, 2009; MEP, 2008b):

1. efficient use of natural resources and materials, including ensuring the maximum use of runoff water and collection of rainwater;
2. utilisation of recycled effluent and marginal water sources;
3. reduction of degradable and non-degradable farm wastes; and agriculture related hazards and environmental damage, especially from nutrients and pesticides;
4. utilisation of urban waste, sewage sludge and plant wastes, including the encouragement of village and regional level facilities to treat agricultural waste;
5. prevention of land degradation and conservation of soils, including combating desertification;
6. preservation of agricultural open space, and maintaining the culture and landscape values of agriculture, including the balance between nature and agriculture; and
7. promotion of recognised sustainable development practices both on-farm and also in the activities of the Ministry of Agriculture and Rural Development (MARD).

The overarching objectives for the PSAD have been translated into a number of specific agri-environmental measures (Section 2.2, Chapter 2). Most importantly these include programmes aimed at protecting open landscapes – maintaining cattle sheep and goats on pasture and a measure providing support to herders by the Grazing Authority (Section 3.5) – and various soil conservation measures (Section 3.4). Other agri-environmental programmes include, for example, Integrated Pest Management and encouraging the adoption of environmentally beneficial farm practices. About a third of the Ministry of Agriculture research and development (R&D) budget is now devoted to environmental issues, with the focus on: water management; pest management; climate change; conservation of open spaces; biodiversity and gene banks; and improving efficiency of agricultural energy use.

Some broader based ***agricultural policies***, such as policy reforms in the dairy (1999-2007) and geese sectors (2000), have had as part of the policy reforms package measures addressing environmental concerns (Section 3.3). This has encompassed measures and farm practices aimed at lowering water pollution, especially in aquifers, and reducing air pollution, mainly greenhouse gas emissions.

In 2006, the MARD also restructured its ***Rural Development Programme*** (RDP), with greater emphasis on environmental protection and rural tourism (Section 2.2, Chapter 2). The RDP, together with the PSAD, also place emphasis in rural areas for environmental protection and conservation of open spaces and cultural landscapes (MARD, 2009; MEP, 2008b).

The Government's 2003 ***Strategic Plan for Sustainable Development*** has provided the basis for an economy-wide vision for sustainable development toward 2020, and takes an intra-ministerial approach to foster sustainable development. This has implications for the agricultural sector as it requires all Ministries, including MARD, to develop their policy strategies according to sixteen principles (Box 3.1), which form the common basis for sustainable development (OECD, 2009d). The inter-ministerial general committee of directors, which has defined these principles, has also identified several cross cutting issues of relevance to agriculture, including those concerning: water resources and pollution; air pollution; land degradation and desertification; biodiversity; and climate change. Most important among these issues are environmental measures included as part of water policy reforms, such as those aimed at increasing the use of recycled effluent in agriculture (Section 3.2).

Linked to domestic environmental and sustainable development policies are Israel's commitments under various ***international environmental agreements*** with implications for agriculture. These include commitments under the: *Barcelona Agreement* (to reduce waste

Box 3.1. **Principles for sustainable development strategies across all Israeli ministries**

1. Integrated resource management.
2. Mainstreaming of sustainable development principles into action plans and policy.
3. Polluter pays.
4. User pays.
5. Eco-efficiency.
6. Sustainable consumption.
7. Intergenerational and intragenerational equity.
8. Accountability and transparency.
9. Valuation of environmental resources.
10. Waste treatment or reduction at source.
11. Precautionary principle.
12. Public participation.
13. Expanding the resource base.
14. Cross-boundary perspectives.
15. Advancement of knowledge as a resource.
16. Impact reduction from environmental risks.

disposal into the Mediterranean); *Montreal Protocol* (to limit ozone depleting emissions); *UN Convention to Combat Desertification*; *Convention on Biological Diversity* (biodiversity conservation); *Bonn Convention* (protection of migratory bird species); *Ramsar Convention* (protection of wetlands); and the *UN Framework Convention on Climate Change*.[4]

Environmental policy instruments

Israel uses a mix of different policy instruments to achieve its environmental policy objectives in agriculture, including a combination of economic instruments (support and taxes), regulatory requirements (specific rules and penalties), and advisory and institutional measures (research and development, and use of farm educational, advisory and extension services).

Traditionally environmental policy at the broad national economy level has been implemented by using a ***command and control strategy***, such as imposing regulations and legal penalties on polluters. In more recent years economic instruments and market based incentives have been increasingly introduced to achieve environmental and sustainable development goals in agriculture. Policy makers are beginning to use economic tools where polluters impose costs on society or recover costs where producers use natural resources (*e.g.* water). Moreover, the use of taxes, charges, and support is subject to environmental effectiveness and economic efficiency considerations (OECD, 2009d).

The budgetary expenditure on ***agri-environmental measures*** amounted to nearly ILS 30 million (USD 9 million) in 2008, just over 2% of total agricultural budgetary expenditure, covering measures for livestock graziers to maintain open spaces and soil conservation measures. But agri-environmental expenditure more broadly defined is higher, such as where the environmental measures that are part of the livestock reform programme policy package are included (Section 3.3), although it is difficult to disaggregate these data.

Agri-environmental payments are varied across the MARD's development regions, which are defined according to national priorities for agricultural production, environmental considerations and settlement dispersal (Section 2.1, Chapter 2). The Negev desert and Lake Kinneret regions receive the highest regional rates of agri-environmental payments. In the newly (2009) created ecological region near to the most densely populated areas of Tel Aviv and Haifa, farmers are eligible for environmental investment grants up to 25% of the investment costs, such as for wood chopping facilities in orchards, and equipment for compost and biogas production (Section 2.2, Chapter 2).

Institutional and legal framework governing the environment in agriculture

The ***institutional framework*** that administers agri-environmental and related policies is largely under the responsibility of the MARD and Ministry of Environmental Protection (MEP) (Section 2.1, Chapter 2). In recognition of the need for an integrated system of water management, the national *Water Authority* was established in January 2007, which is responsible to the Minister of National Infrastructure (Section 3.2, and OECD, 2009d). Other Ministries also have responsibilities which touch on environmental management in agriculture including: promoting efficient use of water and energy (Ministry of Industry, Trade and Labour); and monitoring and establishing drinking water quality standards (Ministry of Health).

The Jewish National Fund (JNF, Section 2.1, Chapter 2), owned by the World Zionist Organization with an annual budget for land rentals and international donations of ILS 650 million (USD 180 million) annually, also has an important role in the area of agriculture and environment. Among the top priorities of the JNF is supporting Jewish agriculture in marginal and national border areas, overseeing forestry in Israel, paying for the construction of recycled effluent water reservoirs, and investing in agricultural research.

Data collection and monitoring relevant to agri-environmental issues is a collective effort of the MARD, MEP and the Central Bureau of Statistics (CBS, 2006). These activities are supported by the Hebrew University of Jerusalem and the Jerusalem Institute for Israel Studies, in an effort to establish a set of sustainable development indicators.

At the ***regional level*** the MARD and MEP are co-ordinating with 53 regional councils to promote the *Strategic Plan for Sustainable Development*, with technical support from the Israel Institute of Technology – Technion and the Herschel Centre. The co-ordination and support provided by the Ministries is important in achieving agricultural and rural development goals for preserving cultural heritage and landscape amenity, in part to encourage rural tourism (MARD, 2009). A number of independent bodies, of relevance to environmental management in agriculture, are under the guidance of the MEP (OECD, 2009d), including: the *Nature and National Parks Authority*, responsible for protecting biodiversity and cultural heritage; and management of water basins by the *Yarkon* and *Kishon River Authorities* (Maruani and Amit-Cohen, 2009).

With regard to land and water resources the ***legal framework*** for agriculture in Israel differs markedly from most OECD countries, as over 90% of agricultural land and all water resources are State owned (MARD, 2009). Farmland is administered by the *Israel Land Administration*, which leases land to farmers over varying periods, although this has no direct consequences for the environmental management of agricultural land (Section 1.4, Chapter 1). Water resources are allocated by the *Water Authority* to urban, industrial and agricultural users, with water recently allocated to meet environmental objectives. Under the 1959 *Water Law*, the MARD allocates to farmers the total amount of water designated to agriculture by the *Water Authority* (Section 3.2).

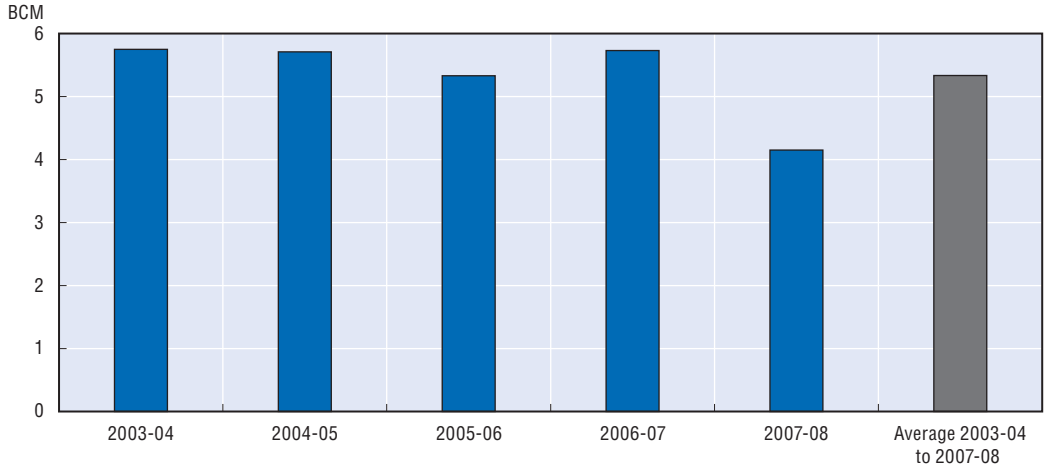
3.2. Managing water resources[5]

Israel is currently facing the worst water crisis in the State's 60 year history. The country's geo-climatic location, rapidly expanding population, growing economy, and transnational boundary water agreements, are placing enormous demands on limited water resources (MEP, 2008b; OECD, 2009e).[6] This situation has been exacerbated by almost five years of consecutive drought from 2003/04 to 2007/08 (Figure 3.3), not only heightening concern for water consumers across the economy, including agriculture, but also in meeting environmental needs to maintain ecosystems.

Despite this serious situation, improvements in technology and management of water resources in agriculture, together with water policy reforms have enabled the agricultural sector to substantially increase its efficiency of water use (Figure 3.5). The greater use of recycled effluent and the more recent development of seawater desalinisation plants is also easing the economy-wide stress on natural freshwater resources. But given that agriculture remains the major water user and the demand for water continues to increase from other users as well as to meet environmental needs, pressure on scarce water resources remains.

Figure 3.3. **Annual rainfall in Israel: 2003 to 2008**

Billion cubic metres (BCM)



Source: CBS, 2009.

Water supply and demand balance and the agricultural sector[7]

Israel's physical water balance is extremely precarious, with the rate of renewable freshwater (surface water, groundwater, and brackish water from saline aquifers) abstraction being consistently greater than replenishment since the 1970s, except in a few years of above average rainfall (Fishhendler, 2008; Lawhon and Schwartz, 2006; Rosenthal *et al.*, 2009). The recent drought has further destabilised the fragility of the Israeli water system (Figure 3.3), though the impacts from overexploitation of water resources were felt during earlier drought periods, for example, between 1984 and 1986 and from 1989 to 1991 (Fischhendler, 2008). These droughts highlight the very high variation in annual water replenishment, which is further aggravated by greater within season variability. Appropriate water management and water policies are thus a considerable challenge (OECD, 2009e).

Of the total long term average annual availability of renewable water, about 95% is already exploited, approximately 50% by agriculture and 45% by other water consumers (OECD, 2009e; World Bank, 2006). Freshwater sources are mainly supplemented in the national water system by recycled effluents and desalinated water (Table 3.1). Nationally, average water consumption is less than 300 m^3/year/capita (m^3/y/c) (Table 3.2), compared to the international norm of around 1 700 m^3/y/c below which a region/country is under increasing water stress. This implies Israel is one of the world's most severely water stressed countries (OECD, 2009f).

The main sources of renewable freshwater are Lake Kinneret (Sea of Galilee), and the coastal and mountain aquifers (including the Yarkon-Tanninim and eastern mountain range aquifers), which together account for over 80% of renewable freshwater supplies. Lake Kinneret is Israel's only natural freshwater lake and provides a significant share of national water requirements (Box 3.2). Smaller regional basins and aquifers, notably the western Galilee aquifer, account for the other 20% of freshwater supplies.

Given the stress on renewable freshwater resources to supply agriculture and other uses, the ***government has invested in four main initiatives to develop water supplies***, including (Tal, 2006):[8]

1. development of an integrated National Water Carrier system;

Table 3.1. **Water demand[1] by sectors, 2008**

Million cubic metres per year

Sector	Total	Freshwater		Recycled effluent and marginal water[2]		Saline[3]	
		Total	Share (%)	Total	Share (%)	Total	Share (%)
Agriculture	1 127	532	47	435	39	160	14
Industrial	146	101	69	2	1	44	30
Urban	758	755	99	1	0	3	0
Total	2 032	1 388	68	437	22	207	10
Palestinian Authority	60	60	100				
Jordan	55	55	100				
Grand total	**2 147**	**1 503**	**70**	**437**	**20**	**207**	**10**

1. The definition in the original data is "allotment" except for the urban sector, in which the definition is "consumption".
2. Marginal water includes stored flood water and other minor water sources.
3. Saline water covers water from desalinated seawater and desalinated brackish water.

Source: Water Authority, 2009.

Table 3.2. **Population and water use: recent trends and projections[1]**

Million cubic metres per year (Mm^3/y)

		1980	1990	2000	2004	2005	2015	2025
Population	Million	3.9	4.8	6.4	6.9	7.0	8.1	9.5
Total water use[2]	Mm^3/y	1 679	1 804	1 924	1 954	1 961	2 330	2 690
Urban	Mm^3/y	368	482	662	712	715	917	1 107
Agriculture	Mm^3/y	1 212	1 216	1 137	1 129	1 127	1 235	1 395
Industrial	Mm^3/y	100	106	124	113	120	129	139
Environmental	Mm^3/y			25	25	25	50	50
Total per capita supply	m^3/y	428	374	302	285	281	286	284
Urban per capita supply	m^3/y	94	100	104	104	102	113	116

1. Projections of water demand are based on the following assumptions: 1.5% annual population growth; 113 m^3/y in 2015 and 116 m^3/y in 2025 as per capita urban demand; 1% industrial freshwater annual growth; 560 Mm^3/y fresh water and 200 Mm^3/y saline water for irrigation by 2025; 40% in 2010, 50% in 2020 and 60% in 2040 of urban and industrial water recycled and directed to irrigation; and 50 Mm^3/y environmental water demand by 2015.
2. Excludes water for Jordan and Palestinian Authority, see Table 3.1.

Source: OECD, 2009e.

2. recycled effluent water, mainly from treated sewage and industrial wastewater;

3. water harvesting through a network of rain-fed reservoirs; and most recently;

4. desalination of seawater and brackish (saline) groundwater.

National Water Carrier (NWC): The largest mobilisation of natural water resources began in 1964 with the operation of the NWC, a north to south water conveyance system, which transfers water from Lake Kinneret and the relatively humid northern region to the semi-arid and arid southern region (OECD, 2009e; Tal, 2006). This undertaking led to a major increase in the area under cultivation in semi-arid regions, and facilitated the maintenance of a balanced national water pumping system taking into account changes in hydro-geological conditions (World Bank, 2006). But the NWC has also exacerbated salinity problems, and to a lesser extent raised water turbidity levels (*i.e.* clouding of water through soil sediments) (Tal, 2006). Efforts are being made, however, to reduce salinity and turbidity levels in the reservoirs of the NWC system (Tal, 2006) (Section 3.3).

Box 3.2. **Management of Lake Kinneret (the Sea of Galilee)**

Lake Kinneret is Israel's major source of natural freshwater, situated at –230 metres below sea level (MSL) in the Kinneret basin in the North-East of the country fed by the Jordan river and its tributaries, with a total volume of 4 300 Million cubic metres (Mm^3). Depending on the annual rainfall the inflow is between 200-700 Mm^3, with an average of around 650 Mm^3. About 400 Mm^3 is pumped out of the Lake annually into the National Water Carrier conveyance system, while the pumping rate from the Lake has varied from 99 Mm^3 (2001) to 524 Mm^3 (2004).

Growing variability of rainfall poses a major challenge in managing water pumped from the Lake. Management of the Lake is entrusted to the Kinneret River and Drainage Authority, funded by the Water Authority, and established in 1969. Management involves determining annually the volume of water that can be pumped for national and regional uses with a lower limit (so called Red Line) of –213 MSL and a limit of –215 MSL (so called Black Line) below which the pumps of the national aquifer cannot operate, and at which salinity levels and other phenomena will severely damage the Lake. In both 2001 and 2008 the water level in the Lake came close to Black Line limit, and the Water Authority predicts the water level in 2009 will again fall close to this limit. This has important implications in terms of annual freshwater allocation for agriculture and other users.

A further management challenge of the Lake concerns ***controlling pollution*** both from natural and anthropogenic sources. The Kinneret Authority has established an extensive monitoring system of the Lake and its watershed, as well as the groundwater discharging into the Lake. The rising salinity levels in Lake Kinneret are of particular concern (Figure 3.11) from both higher evaporation levels and saline inflows from marine water. Nutrient and pesticide leaching from agriculture and other activities (*e.g.* tourism) in the Kinneret watershed also contributes to lake pollution. Measures are being taken to curb these Lake pollutants, including programmes concerning agriculture (Section 3.3).

Source: OECD, 2009d; Plan Bleu, 2007a; Rosenthal *et al.*, 2009; World Bank, 2006.

Recycled effluent (Box 3.3): Treated domestic effluents (sewage and industrial waste water) provided about a third of water supplies for irrigated agriculture and contributed around a fifth of national water supplies in 2008 (Table 3.1). Israel has among the highest rates internationally of recycling municipal sewage, at over 70% compared to less than 5% in the United States, for example (Tal, 2006). This largely reflects the greater pressure on water resources in Israel compared to many countries. Typically most effluents for agriculture are supplied by nearby towns, often from non-mechanised plants, while larger municipal facilities frequently transport effluent longer distances. For example, recycled effluent from Tel Aviv is transported 100 km to the Negev desert for agricultural use (Tal, 2006).

Water harvesting and reservoirs: Starting in the 1980s a network of almost 200 reservoirs has been established, providing nearly 7% of the total water in Israel, mainly located in drier southern regions (Tal, 2006). Initially these reservoirs were mainly supplied by sporadic flood waters diverted from rivers, with the aim to replenish groundwater, although often reservoirs have been directly connected to irrigation systems. More recently, reservoirs have been constructed to store treated wastewater before its use in agriculture, requiring operational management to avoid pollutant discharges from reservoirs to irrigated land (Tal, 2006).

Box 3.3. **The use of recycled effluent water in agriculture: costs and benefits for Israel**

Since the early 1960s Israel has embarked on an ambitious plan to recycle effluent water (REW, mainly from sewage but also industrial wastewater) for use largely by agriculture but also some other water users. ***The share of effluent recycled by Israel, about 70%, is now possibly the highest globally.*** Given that other countries are beginning to examine the greater use of recycling effluent in view of the growing pressure on freshwater resources, Israel's experience over many decades is one that can provide lessons on the costs and benefits of using REW in agriculture.

A key objective in Israel's *Plan for Sustainable Agricultural Development* is to increase agricultural use of REW, but use REW to bring water to desert agriculture and as a solution to disposal of urban and industrial wastewater (Section 3.1). In pursuit of these objectives the government has developed a ***policy framework*** to: provide financial support for treating, storing and supplying REW to agriculture (Section 3.2); establish regulatory arrangements to address human health and environmental concerns associated with REW (Section 3.3); develop research to improve the quality and farming practices in using REW; and organise farmer education and advisory services in the use of REW. The JNF has also provided funding to establish a national network of reservoirs to hold REW.

REW now contributes about a third of the water supplies for irrigated agriculture, with this share expected to grow substantially over the coming decade (Tables 3.1 and 3.3). REW is supplied to farms from nearby urban areas, but in some cases transported over distances in excess of 100 km. Support for use of REW by agriculture is mainly provided by: lowering the REW price relative to freshwater to encourage substitution on farm; offering grants that cover 40%-60% of the investment costs of treating, storing and supplying REW to agriculture; and support for the on-farm costs associated with adapting irrigation systems to using REW. This support has increased in absolute terms and as a share of both overall water support to agriculture (Figure 3.10) and also in total agricultural budgetary support.

A benefit of developing the supply of REW for agriculture and other users has been to address the growing pressure on freshwater resources. It is also viewed by the government as a low cost and beneficial way of disposing of sewage that might otherwise be treated to a lower standard and lead to environmental pollution. With Israel's rapidly growing urban centres, REW use has had the advantage of helping to address the problem of sewage disposal. Farmers also see REW beneficial in terms of: overcoming limited freshwater allocations; providing a lower cost source of water compared to freshwater; and improving crop yields and reducing fertiliser costs due to the high levels of nutrients in REW. Also REW is viewed as a way of "greening the desert" and helping to establish agriculture in marginal and national border regions.

The expanding use of REW has made a significant contribution to water and sewage management in Israel, but it has raised a number of issues in terms of the ***economic, agronomic, environmental and human health costs of using REW in agriculture***. The support provided for REW raises economic issues as to whom should bear the full costs of recycling, the urban/industrial producers of the effluent or agricultural users of REW the beneficiaries of effluent treatment, which would result in savings if these costs were not financed by the government. The main agronomic difficulties associated with using REW have mainly concerned the high concentration of pollutants in REW, even after treatment, damaging to soils and crop growth, in particular, high levels of salinity and excess boron (Section 3.3). High salinity of REW has also led to environmental costs, especially REW leaching from irrigated agriculture leading to growing salinity of aquifers (Section 3.3). Aquifers have also been affected by the leaching of nutrients from irrigated agriculture, in part, resulting from the high concentrations of nutrients in REW.

REW is mostly used to irrigate non-edible crops, but there are concerns with its use for food crop cultivation, although research on these links is still required. Pathogens and micro-organisms in REW can be passed through the soil into plant root systems and contaminate fruit, salmonella is an example. Also REW containing residual hormones from the dairy and meat industry, flushed birth control pills and similar chemicals might be causing endocrine disruption in males. Recent research, but as yet inconclusive and still in progress, has made the possible link between the drop in male fertility in Israel over the past decade with the presence of endocrine disrupting chemicals found in REW and leached from agriculture into aquifers used for drinking water.

Box 3.3. **The use of recycled effluent water in agriculture: costs and benefits for Israel** *(cont.)*

In its effort to address the environmental and health costs of using REW in agriculture, the government has implemented and revised ***health and environmental REW treatment standards*** (MEP, 2005; MEP, 2007b). A considerable research effort has been undertaken to address the problems associated with using REW, both for farmers, but also in terms of health and environmental costs. One such success story has been the use of soil aquifer treatment to ensure greater purification of REW (Box 3.5). For Israel to move toward more sustainable use of REW, however, will further require: examining the stringency of treatment standards; investing in treatment infrastructure; and developing research, especially the concerns related to the possible links between use of REW in agriculture and endocrine disruption in the male population.

Source: Fine *et al.*, 2006; Gal *et al.*, 2009; Haruvy *et al.*, 2008; Kislev, 2001; Lawhon and Schwartz, 2006; Scott *et al.*, 2004; Tal 2006, 2007 and 2009.

Desalination: Israel has augmented its water supplies through small to medium size desalinisation plants to process brackish groundwater and seawater for domestic supply, and agricultural use (Dreizin *et al.*, 2008; Tal, 2006; World Bank, 2006). By the 1990s, following multi-year droughts and over exploitation of water resources, and taking the view that low cost alternative water supply options had been exhausted, the government agreed to a plan to construct large scale seawater desalination plants and integrate these into the NWC system.

The government decision to expand desalinisation is due to a combination of factors, including: the plan to exchange the current use of freshwater by agriculture for treated wastewater; the general reduction (in terms of US dollars) in the costs of the desalinisation process, from USD 102 cents/m^3 (ILS 1.20/m^3) in 1985 to USD 78 cents/m^3 (ILS 2.81/m^3) by 2008; and the goal to close the growing gap between supply and demand for water so as to assure a 90% water supply reliability to all consumers (Dreizin *et al.*, 2008; Tal, 2006; World Bank, 2006).

It should be noted, however, that prior to embarking on the process of expanding seawater desalinisation the Ministry of Finance raised economic concerns with increasing desalinisation plant capacity. It viewed this strategy as a last resort action, only to be agreed after water pricing reforms lowered agricultural water demand (Dreizin *et al.*, 2008).

Desalination of seawater has also raised environmental concerns, including: the loss of public coastal open spaces; the cumulative impact of brine discharges into the sea; and additional greenhouse gas emissions associated with powering the plants, especially as most of Israel's energy supplies are derived from coal. In addition, there have been agronomic problems with using desalinated water in agriculture, as the desalinisation process removes ions that are essential to plant growth (*e.g.* calcium, magnesium) while concentration of boron is highly toxic to many crops (Yermiyahu *et al.*, 2007).

The first of the large scale desalination plants, the Ashkelon plant, started operating in 2005, and by 2008 desalination capacity provided (plus desalinated brackish inland water) 10% of the country's total freshwater resources (Table 3.1), with plans to further expand capacity and increase the share to 30% by 2020 (Dreizin *et al.*, 2008; OECD, 2009d). One of the proposed projects to expand seawater desalinisation capacity is the Red-Dead Sea Conveyor. The project, if completed, would convey seawater from the Red Sea (Gulf of Eilat) to the Dead Sea in an effort to protect the Dead Sea ecosystem and enhance water supplies for Israel, but in particular, increase water supplies for the Palestinian Authority and Jordan.[9]

The new Ashkelon plant, however, has led to the reduction of salinity (chloride and sodium) levels in recycled effluent water used by agriculture. In addition, efforts have been made to reduce boron levels in desalinated seawater, as excessive boron can damage plant growth. Use of desalinated water for domestic and industrial use could also lead to a further 15%-20% reduction in agriculture's use of recycled effluent from current requirements because at present there is a need to use additional water to rinse salt concentrations from the crop root zones (Dreizin *et al.*, 2008; Tal, 2006).

The expanding use of desalinated and recycled water from sewage effluents is easing pressure on the use of freshwater resources, including in agriculture. The share of these alternative water sources in total water use has been increasing and is expected to grow further up to 2025, especially with the major expansion in seawater desalinisation plant capacity (Table 3.3).

Table 3.3. **National water sources: desalinisation and recycled effluents**

	Water from desalinisation of seawater[1]	Water from recycled effluents	Total water use[2]	Share of desalinated and recycled effluent water in total water use
	A	B	C	(A+B)/C
	Million cubic metres/year	Million cubic metres/year	Million cubic metres/year	%
2000	0	280	1 924	15
2005	120	340	1 961	23
2008	207	437	2 032	32
2010	365	510	2 435	36
2015	600	565	2 330	50
2025	775	665	2 690	54

1. In addition to desalinisation of seawater, there is also desalinisation of brackish (inland) saline water projected to be 35 Mm^3 (2010); 70 Mm^3 (2015) and 90 Mm^3 (2025).
2. Total water use equals: desalinated water plus recycled effluent plus freshwater (see Table 3.1).

Source: Water Authority, 2009.

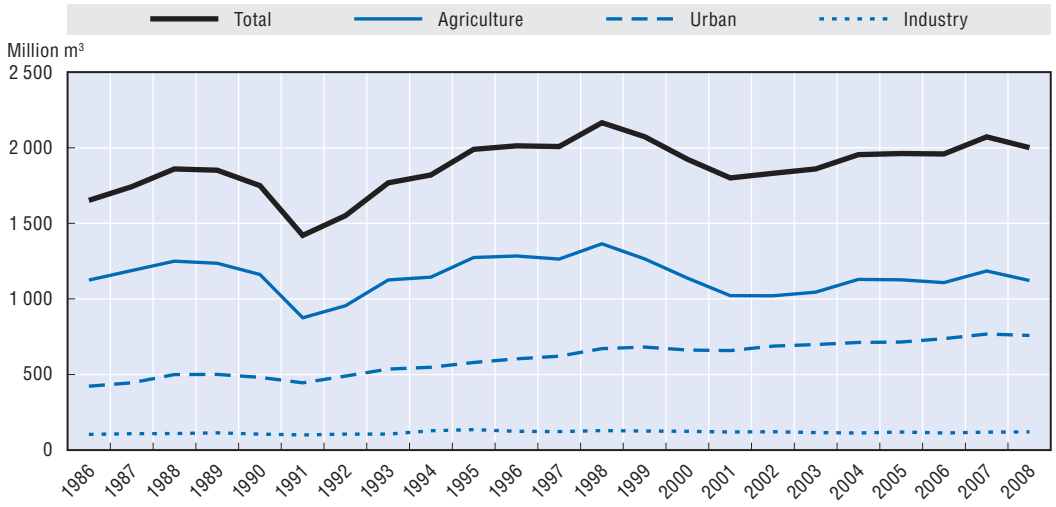
Agricultural water use and water use efficiency

Agriculture's use of water decreased almost continuously from the mid-1990s to the early 2000s but has subsequently stabilised up to 2008 (Figure 3.4). But the quantity of water used by agriculture is projected by the Water Authority to rise by 2025, although at a lower rate than the increase in urban and industrial demand. As a consequence the share of agriculture in total water use, which fell from over 70% in 1980 to 55% by 2008, is projected to decline to a share of 52% by 2025 (Tables 3.1 and 3.2). A further development, induced by government water quota policies, has been the decline in use by agriculture of freshwater resources compared to an increase in the sector's use of recycled effluent and desalinated water.

A notable feature of Israeli agriculture has been its capacity to increase the ***efficiency of water use in agriculture***. Efficiency has been improved in physical (technical) terms of water use per tonne of output (or hectare irrigated) (Figure 3.5), in terms of economic water use efficiency (value of output per unit of water used, Figure 3.9), and through reducing the sector's use of fresh drinking quality water while increasing use of recycled water (Table 3.3).

Figure 3.4. **Water use by sector**

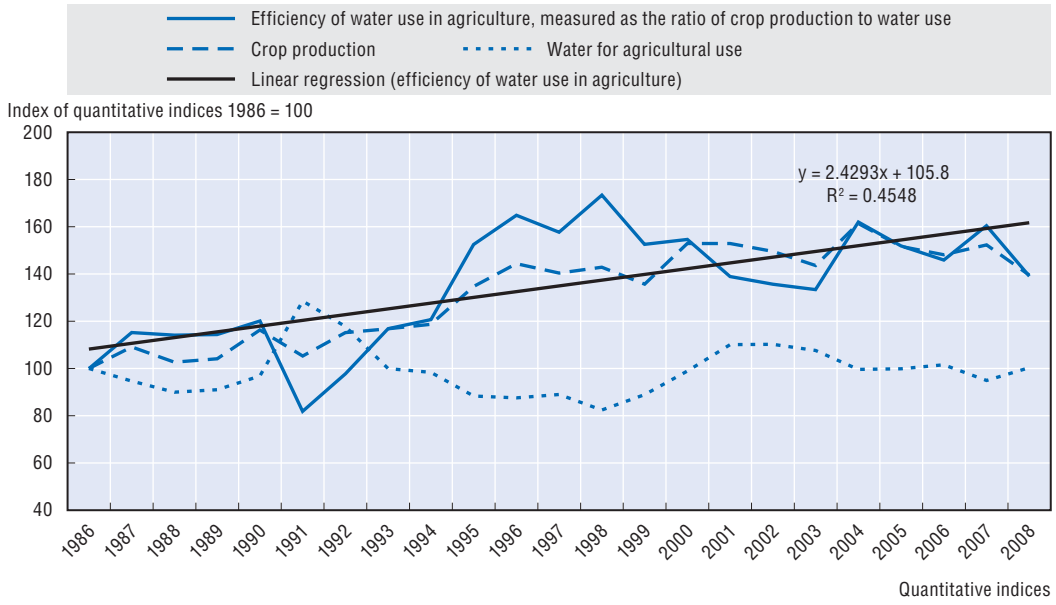
Million cubic metres



Source: OECD, 2009e.

Figure 3.5. **Technical efficiency of agriculture's water use**

Quantitative indices: crop production and water use



Source: MARD, 2009.

Over the period from 1950 to present (2009) there have been ***three main phases in the physical (technical) efficiency of water use by agriculture***, including (Fuchs, 2007):[10]

1. *1950 to the late 1980s:* Over this period the annual rate of water use (water use per hectare) for irrigation steadily declined from around 9 megalitres/ha (ml/ha) to 5 ml/ha, mainly from improved management practices and uptake of technologies such as drip irrigation.

2. *Late 1980s to the late 1990s:* Over this decade the annual rate of water use rose from 5 ml/ha to nearly 7 ml/ha, largely explained by an abrupt rise and share of recycled effluent water used in agriculture, especially related to the opening of the water carrier from the Dan regional recycled effluent water project. The high salt content of the effluent prompted a higher water application rate to prevent the accumulation of salts and other harmful chemicals in the soil (Box 3.3).
3. *Late 1990s to the present (2009):* During this decade the annual rate of water use again declined from 7 ml/ha to about 5 ml/ha, this is partly explained by the: sharp increase in the water price paid by farmers (Figure 3.7); change in cropping patterns toward higher value crops requiring less water; investment in research projects started in the latter part of the 1980s to lower the use and improve the quality of effluent water; and also the introduction of new irrigation technologies and irrigation management practices. The current rate of Israeli water use in irrigated agriculture of around 5 ml/ha compares to the OECD 2002-04 average of 7.5 ml/ha (OECD, 2010c).

As a result of these improvements in agricultural water use efficiency Israel is now a world leader in the management and technologies related to irrigation in arid environments (World Bank, 2006). The invention and development of ***drip irrigation*** in Israel from the 1960s, has been the key innovation behind the rise in technical water use efficiency, as well as shifting to other pressurised irrigation systems (*i.e.* sprinklers, micro-sprinklers, micro-jets) with flood irrigation no longer used by farmers (Box 3.4).

The amelioration in irrigation water use technical efficiency, has been in contrast to the reduction in the total area irrigated from 191 000 ha in 1990-92 to 185 000 thousand ha by 2006-08, although as a share of the total agricultural land area (including pasture) rose from 44% to 49% over this period (Figure 3.2).[11] But little pasture is irrigated and irrigated land as a share of arable (field and horticultural crops) and permanent (orchards and plantations) crop area was around 64% in 2006-08. The shares of the main crops on irrigated land are (2008): vegetables, 37%; fruit trees, 36%; field crops, 25%; and flowers, 2%.

Institutional framework and water rights

Under the 1959 *Water Law* ownership of water in Israel is public, and its utilisation is controlled by the newly created (2007) *Water Authority* (WA) (Margoninsky, 2009). The WA centralises under one administration responsibilities for the entire water system, including: pumping to sewage treatment and reclamation plants; guaranteeing water supply to an assured quality; ensuring regional integration of the water system, taking into account regional economic development and social objectives; setting water tariffs; restructuring water pricing so as to reflect the costs of water supply, including its scarcity value; promoting water conservation; and, establishing the policy framework to control and protect Israel's water resources under the *Water Law* (OECD, 2009d). Permits for irrigators using reclaimed effluents and the control of freshwater quality are the responsibility of the Ministry of Health (OECD, 2009d).

The public ownership of water resources extends to the water that may be drawn from a well under a farmer's property, even if it is intended solely for the owner's use. In this case the water can be drawn from a well or aquifer with a water production licence. While the right to water ownership is *de facto* expropriated under the *Water Law*, the right to receive and use water is private, including by agriculture. Thus, once the water is allocated it is brought to the farm through the private sector (World Bank, 2006). The water supplied to agriculture is mainly provided by the National Water Company, Mekorot, and Agricultural Water Associations.

Box 3.4. **Development of drip irrigation in Israel**

Efficient water management has been a key to much of Israel's success in agriculture in arid, semi-arid and dry sub-humid zones. The most conspicuous technology in this regard is drip irrigation. This technology attempts to increase water use efficiency through lowering runoff and evaporation losses and reducing leaching of water and contaminants below the root zone. The success of drip irrigation lies in the provision of optimum conditions for plant uptake of water and nutrients (UNCCD, 2006). Drip systems also facilitate the more efficient agronomic use of saline, brackish and marginal water.

Developed in Israel during the 1960s, and initially marketed in 1965 by the *kibbutz* based Netafim Corporation, drip irrigation held limited interest and was not without problems, such as pipe clogging and breakage (Tal, 2006). This changed in the 1980s with further refinements to drip systems, including developments towards the next generation of drip technology including, for example, computerised systems, fertigation by applying fertilisers directly to the plant roots, and pressurised drippers which enable stable distribution of water (MITL, 2008).

A more recent development has been sub-surface drip irrigation (SDI), with about 5%-10% of the irrigated area now under SDI systems. These systems are positioned within the soil to: conserve water; control weeds; minimise runoff and evaporation (reducing evaporation by up to 20%); increase longevity of piping and emitters; ease use of heavy equipment in the field; and prevent human contact with low-quality water. Additional motivation for SDI comes in the form of savings of the extensive labour involved with seasonal installation and collection of surface drip system piping (UNCCD, 2006). SDI provides the opportunity to manipulate root distribution and soil conditions in arid climates in order to better manage environmental variables including nutrients, salinity, oxygen and temperature.

In Israel over half the irrigated area is now under drip irrigation, and has played a major role in improving water use efficiency. Drip irrigation technology forms a major part of Israeli water technology exports which totalled ILS 5.0 billion (USD 1.4 billion) in 2008, double the amount in 2005 according to the Israel Export and International Co-operation Institute (Box 1.1, Chapter 1). It is projected that Israeli exports of water technologies will reach ILS 36 billion (USD 10 billion at 2008 exchange rate) by 2017 (Barak 2008), with Israeli companies controlling about 50% of the global market in drip irrigation technology (MITL, 2008).

Source: Barak, 2008; MITL, 2008; Tal, 2006; UNCCD, 2006.

Policy instruments to manage water resources: quotas, pricing and support

The major focus of Israeli water policy is to: improve water efficiency by greater use of economic tools and market based instruments (such as raising water prices); enforce regulatory instruments (water allocation and quotas); support research and development, education and technologies; and lower overall support for water in agriculture (Feitelson, 2005; MEP, 2008b; OECD, 2009d; Tal, 2006). Regulatory instruments also extend to bans on daytime irrigation, and there have been a few cases where municipalities were fined by the WA for not complying with this regulation (UNCCD, 2006).

Water allocation and quotas

The overarching *Water Law* recognises the problem of water scarcity by developing a legal framework for ***water allocation*** for production (extraction) and for utilisation and consumption. The criterion for water production and utilisation is the sustainability of the

water resource, with the role of the WA to ensure the long run security and quality of water supplies (Kislev, 2001). Toward this end the WA issues annual licences (which can be revoked) for production (extraction) by suppliers, which depend on local hydro-geological circumstances. An extraction levy has been implemented to avoid unsustainable use of aquifers (see below).

The WA criteria for allocating water to users combine economic, environmental and social objectives. The WA seeks to achieve economic efficiency by maximising the overall economic welfare from using water mainly by raising water charges paid by farmers, and from 2004, through an amendment to the *Water Law*. Environmental effectiveness is sought by allocating water to meet the needs of ecosystems (Kislev, 2001). Two policy instruments are in place to achieve the economic and environmental goals, water quotas and pricing, with nearly all farmers connected to water metres. In terms of its social objectives the WA ensures that all farms are allocated water, while allocating water to marginal farming areas, especially along the country's frontiers, is another important social objective.

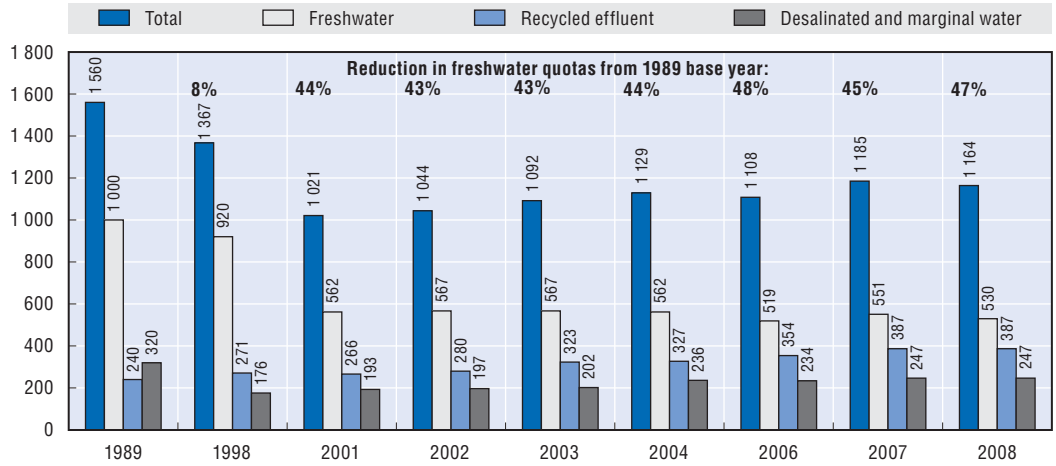
In prescribed *Rationing Areas*, which in practical terms applies to virtually the whole country, where water demand exceeds supply, water allocation is made in the following descending order of priority: *i)* domestic use; *ii)* industrial use; *iii)* agricultural use; and *iv)* other uses (including the environment). From the period since the creation of the Israeli State, however, the water supply system has primarily been developed in order to provide water for agriculture which is the major user (Feitelson *et al*., 2007; Feitelson, 2005; Fischhendler, 2008; Kislev, 2001; and World Bank, 2006. This reflects in the early days of statehood the need to increase food security and later the power of farming interests, but also that about 40% of water supplied to agriculture was (and still remains) by suppliers other than the National Water Company (Mekorot), in particular, Agricultural Water Associations (OECD, 2009e).

A base "historic" ***quota level*** is allocated according to each farm's (or in most cases allocated to the *Moshavim*): location; land area; total land suitable for irrigation; cropping patterns; and soil types (MARD, 2009; World Bank, 2006). While in principle these "historic" quotas are reallocated every year, in practice they changed little up to the early 1990s. However, from 1993 a flexibility element was introduced. At the beginning of the winter (around October) the WA first allocates around 75% of the agricultural water quota, then depending on the rainfall over the winter months, the remainder is allocated accordingly by March/April (Feitelson *et al*., 2007; World Bank, 2006).

Following a severe drought in 1999 the then Water Commissioner (now replaced by the WA) decided on a major reduction in the freshwater quota for agriculture by 44% from the 1989 level (set as the base year for the reduction) with little change in freshwater quota levels up to 2008 (Figure 3.6). In the period before 1989, however, there had been a gradual reduction of the freshwater allocation to agriculture and more sudden reductions in periods of drought (MARD, 2009; World Bank, 2006). The quota reduction (in drought situations) was made on the basis of the farmer's crop mix and the increasing supplies of recycled effluent water provided to agriculture, with the lowest cuts (0%-40%) made for orchards, flowers, perennial and glasshouse crops, and the largest cuts in quota (40%-100%) imposed on vegetable, cotton and field crops.

From 2008 a further refinement was made to the system of allocating water to agriculture, in terms of type of water source: freshwater, recycled effluent, and desalinated and other marginal and alternative water sources. By 2008 some 46% of water allocated for agriculture was from freshwater sources compared to 67% in 1998 (Figure 3.6).

Figure 3.6. **Total annual agricultural water quota and division according to types of water**



Source: MARD, 2009.

Reductions in the water allocation for agriculture since 1999 have been compensated by payments to agriculture for the quota cuts. These payments peaked in 2002 and 2003 at around ILS 160 million (USD 35 million) (Section 2.2, Chapter 2). The further reduction in the agricultural freshwater quota from 530 Mm^3 in 2008 to 350 Mm^3 by 2015, will be compensated but only when farmers can show evidence that they have made investments in water saving and efficient technologies and practices.

Trading in water quotas was historically illegal, but from 2008 the government agreed to allow holders of water allocations to sell up to 30% of their permanent ("historic") or temporary allocations by transferring the actual transaction via the National Water Carrier (NWC) only to other farmers (Axelrad and Feinerman 2009). This opens the possibility for some water trading, and is similar to the policy of the WA in trading freshwater for recycled effluent with farmers. It is possible that following further reforms of the water pricing regime for agriculture after 2015, that water trading may become more widespread, albeit only between farmers. Water trading might also help toward reducing the illegal sales of unused agricultural water quota, which are estimated to be in excess of 20 million m^3/year (Lictman, 2007).

Water prices

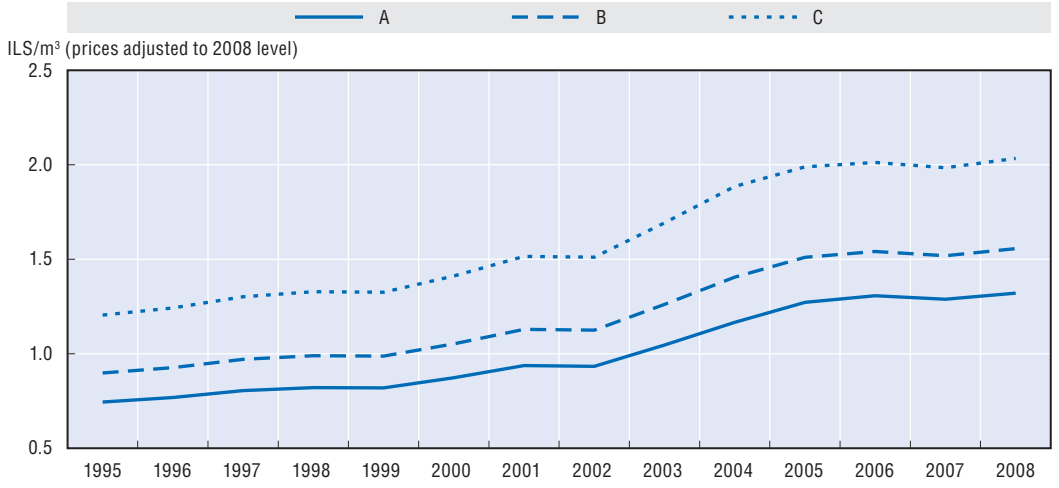
There has been a ***long run increase in real water prices paid by farmers and other water consumers***, covering three broad phases in the national water economy from the early 1950s to the present including (Kislev, 2001; Margoninsky, 2006; World Bank, 2006):

1. the local supply phase up to the early 1960s when irrigation was not widely practised;
2. a second phase involving the opening of the NWC in 1964 which increased supply to meet growing national demand for water and led to the introduction of irrigation into the south; and
3. the third phase from the late 1990s to the present when demand has in most years outstripped supply, leading to an increase in real water prices and an expansion of water supplies through greater use of recycled effluent and the construction of seawater desalinisation plants.

Agricultural freshwater prices are determined by the WA, and its three tier block price structure is the same for all farmers. This tiered block rate tariff structure, introduced in 1991, varies according to the share of the quota that is used by the farmer, while the price for water rises considerably for water used above quota (Figure 3.7, Table 3.4). The move from a single to tiered block pricing regime for water supplied to agriculture was initiated by the government with the twin objectives to support smaller family farms and raise the economic efficiency of agricultural water use. A recent study concluded that the switch from a single to a tiered block pricing system probably lowered aggregate agricultural water use by 7%, and has allowed small family farms to pay a lower average price compared to larger farms, which usually consume more of their quota (Bar-Shira *et al*., 2006).

Figure 3.7. **Real prices paid for freshwater supplies to agriculture**

ILS/m^3prices adjusted to 2008 level



Notes:
Rate A – Consumption less than 50% of the quota.
Rate B – Consumption between 50%-80% of the quota.
Rate C – Consumption between 80%-100% of the quota. Farmers pay 150% of the A rate for consumption beyond the quota, see Table 3.4.
Source: MARD, 2009.

Economic efficiency is facilitated since each farmer can freely adjust water consumption within the three price tiers, with the marginal price paid by each farmer tending to reflect the marginal value of water on that farm, unless the quota is not fully used (Kislev, 2001; OECD, 2009e). Tiered block rate pricing, however, has given the WA more power to vary support to agriculture through altering the water price to farmers, even though this was not the intention of the 1959 *Water Law* (Kislev, 2001).

As well as the three tier pricing structure for freshwater, ***water prices also vary according to the type of water supplied to farms***, *i.e.* freshwater, recycled effluent water, and water extracted from surface water or groundwater (Table 3.4). The differences in water prices in Table 3.4 reflect not only the quality and cost of supplying the water, but also the government's goal to encourage use of different water types.

The ***use of recycled effluent by agriculture*** is considered by the government to bring a number of economic, environmental and social benefits, although it use also involves costs (Box 3.3). Hence, prices for recycled water used by agriculture are lower than freshwater to encourage farmers to increase the substitution of freshwater for recycled water (Table 3.4).

Table 3.4. **Water supply costs, charges and levies for different water consumers and sources, 2008**

	Prices per cubic metre (2008 prices)		% share of price that covers operational, maintenance and fixed capital costs
	ILS	USD	
Average water supply costs for:			
Natural freshwater[1]	1.73	0.48	n.a.
Desalinated seawater[2]	2.81	0.78	n.a.
Recycled effluent[3]	1.54	0.43	n.a.
Average water charges for:			
Agriculture *freshwater*[4]	1.33	0.37	70[9]
0% to 50% of water quota (rate A)			
50% to 80% of water quota (rate B)	1.56	0.44	82[9]
80% to 100% of water quota (rate C)	2.05	0.57	108[9]
Mean price 0% to 100%	1.54	0.43	81[9]
+100% of water quota	2.04	0.57	108[9]
Agriculture *recycled effluent*[5, 6]	0.79	0.22	51
Industry *freshwater*[5]	2.78	0.78	147[9]
Households *freshwater*[5, 7]	2.85	0.79	150[9]
Water extraction levy for:[8]			
Agriculture	0.21-0.67	0.06-0.19	n.a.
Industry and households	0.63-0.77	0.18-0.22	n.a.

n.a.: not applicable.

1. Average cost of Mekorot according to a cost survey for 2006 for the Water Authority, plus a 4.8% adjustment for 2008.
2. Average costs of desalinated water for 2008 from all desalination facilities, but excluding connection costs to the main water system.
3. Weighted average cost for the Dan Region and all other Mekorot facilities according to a Mekorot cost survey for 2006 plus a 4.8% adjustment for 2008.
4. Prices according to Water Authority tariffs for 2008, see also Figure 3.7.
5. Prices according to Water Authority tariffs for 2008.
6. The cost of upgrading, pumping, transporting and ponding recycled effluent.
7. This is the average household charge, as domestic consumers pay a tiered block rate depending on their level of consumption. Municipalities purchase drinking water at a city gate charge of ILS 2.46/m^3 (USD 0.70/m^3).
8. Agriculture, and other water consumers, pay an extraction levy, which in part covers some of the opportunity costs (or resource scarcity value) of using water. The lower levy charge is for surface water and the higher rate for groundwater.
9. Percentages relate to weighted average costs for freshwater (85%) and desalinated water (15%).

Source: Water Authority, personal communication, 2009.

The costs of adapting irrigation systems to using recycled water, however, are not negligible, including: upgrading sewage treatment plants; pumping and transporting the water to farms so that it is not mixed with drinking water; and storing (ponding) the water from winter to summer (Kislev, 2001).

Despite the fact that costs vary in supplying water to different regions of the country and in summer compared to winter months, there are no ***regional or seasonal variations in the water prices*** paid by agriculture or other water consumers (excluding the extraction levy see below). Hence, farmers in the south and mountain areas pay less of the cost of supply than those located in the more water abundant north, who effectively cross subsidise those in the south. There is also an implicit subsidy by not charging for the higher costs of pumping in summer months (Kislev, 2001; World Bank, 2006).

The absence of a regional water pricing system has been justified by the government to: achieve social equity through a one nation tariff structure for water; encourage the relocation of population and capital in the more peripheral areas of the country; and make the "desert bloom" in terms of supporting agriculture in the arid southern region (World Bank, 2006).

This is viewed by some commentators as introducing further distortions to the water system and leading to the over use of water in marginal areas (Kartin, 2000; Kislev, 2001, World Bank, 2006).

To reflect the scarcity value of surface water and groundwater and not just the cost of supply, the government imposed (from 1999 and amended in 2007) a water ***extraction levy on water consumers***. The WA determines the levy rate on the basis of location and hydrological status. The levy is lower for agriculture compared to industry and household water consumers (Table 3.4) (Plan Bleu, 2007a; World Bank, 2006). The levy also varies regionally to reflect differences in regional water scarcity. For example, the levy is lower for farmers in the north near Lake Kinneret as they can only use freshwater to avoid possible lake pollution from using recycled water (OECD, 2009d).

Essentially the levy is being used as a policy tool to: prevent overexploitation of aquifers by farmers and others extracting groundwater; ensure environmental flows in rivers; correct for market failures, such as environmental externalities; and supplement other policy instruments being used by the government to manage water resources, including quotas and water pricing (Kislev, 2001). As the farm sector pays the levy at a lower rate than industrial and household consumers (Table 3.4), this provides an implicit subsidy to agriculture (Figure 3.10).

The use of the extraction levy is a start by Israel of a process to recover the opportunity (or resource scarcity) costs of water use in agriculture rather than by other users. There are few OECD countries where this policy instrument has been adopted. Water pricing in Israel has yet, however, to reflect the externality costs of using water in agriculture (*e.g.* release of pollutants from irrigation, and damage to ecosystems), although these costs are rarely reflected in the agricultural water charges of OECD countries (OECD, 2010c).

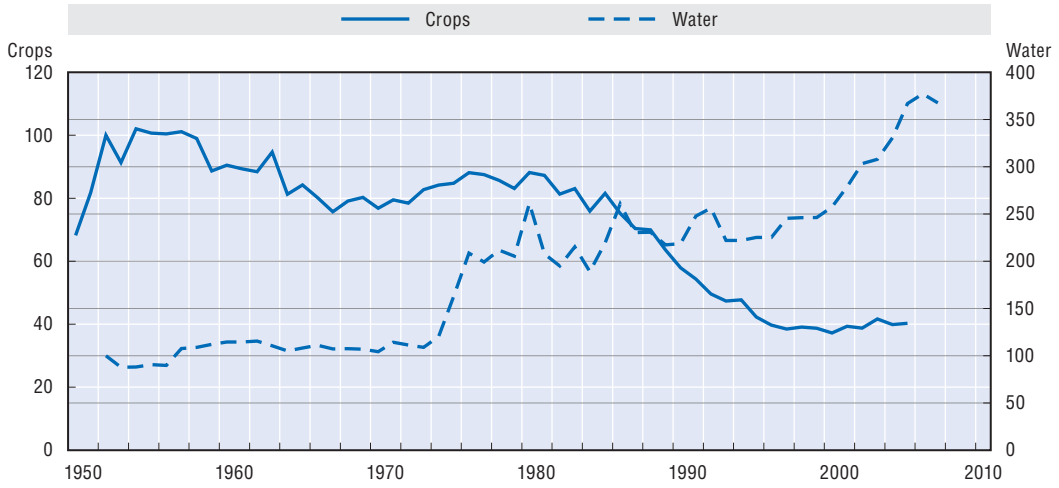
Overall domestic household water consumers cross subsidise agricultural water consumers (Table 3.4). Even so, over 80% of the operation and maintenance costs and fixed capital costs for water supplies are recovered from the agricultural sector, which is a substantial increase compared to the 1970s. This is comparable, if not higher in many cases, with cost recovery rates for water supplies for many OECD countries where irrigated agriculture is significant (OECD, 2010c).

The rise in average real agricultural water prices, coupled with the long run downward trend in prices received by farmers for irrigated crops has led to a decline in the agricultural terms of trade for crop irrigators (Figure 3.8) (Kislev, 2001; OECD, 2009d; Tal, 2007). Because of these developments and improvements in productivity, the overall value of irrigated agricultural output per cubic metres of water applied has increased and total agricultural water use reduced since the late 1990s[12] (Figure 3.9). Higher water prices have provided an incentive for farmers to lower water use, by changing crop mixes and raising productivity through improved management and technological innovation (OECD, 2009e).

Rising real water prices have in part reflected the relatively energy intensive nature of the Israeli water transport system, compared to some other major irrigated areas of the world which rely more on dams and gravity to transport water (*e.g.* large parts of California). In terms of the NWC, the national water company Mekorot pumps water from Lake Kinneret (230 metres below sea level) raised almost 400 metres in the surrounding mountains, and then moves the water southwards (Kislev, 2001). The recent increase in use of desalinated seawater is also an energy intensive form of water supply (Section 3.2).

Figure 3.8. **Price indexes for agricultural freshwater and irrigated crop products**

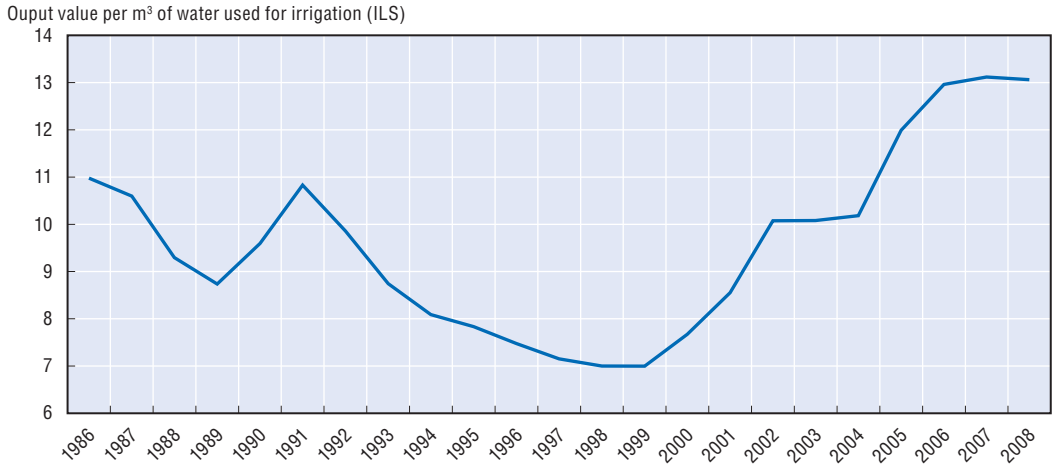
Deflated by the Consumer Price Index, 1952 = 100



Source: Kislev (2001 and personal communication with the author).

Figure 3.9. **Agricultural output value and irrigation**

ILS per cubic metre

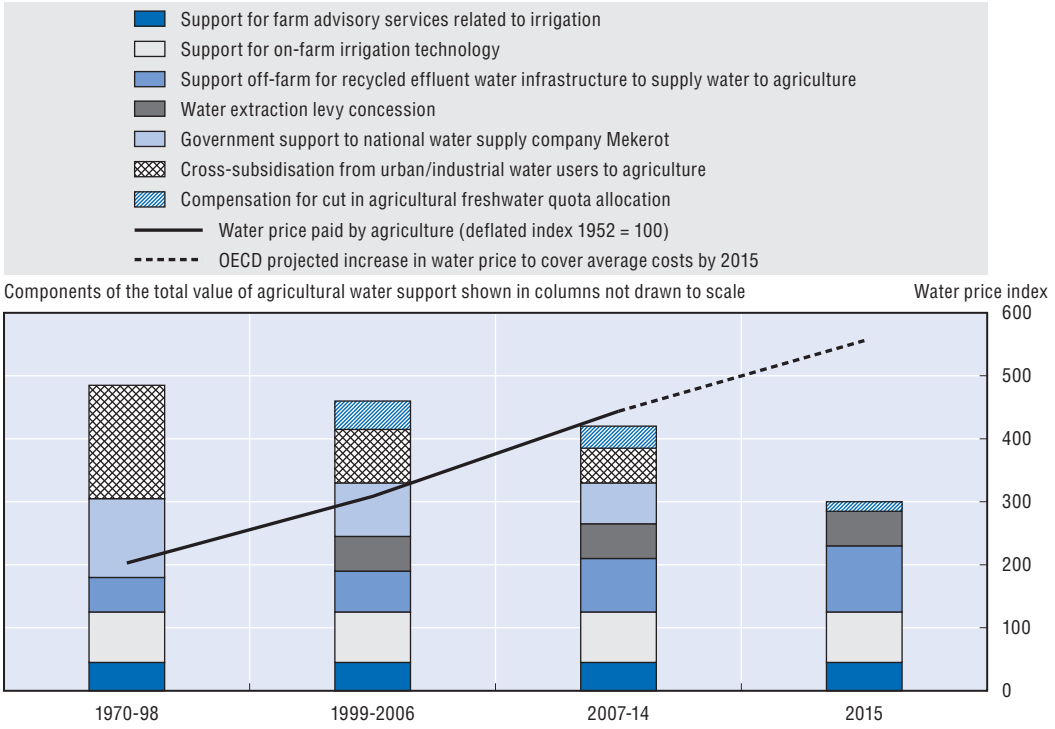


Source: OECD, 2009e.

Water support[13]

Changes in water quota allocations and water charges paid by farmers, have led to a long term overall lowering of policy support for water supplied to agriculture beginning from the early-1970s (Figure 3.10). As a consequence of water policy reforms and increasing pressure on government budgetary expenditure, however, support for water to agriculture has decreased more rapidly since about 2000, although annual fluctuations in support levels have reflected compensation for changing costs of water supplies to agriculture as a result of droughts and higher energy prices (Figure 2.5, Chapter 2).

Figure 3.10. **Evolution of water support received and water prices paid by agriculture: 1970-2015**



Source: OECD Secretariat 2009 and for water prices: 1970-2007 see Kislev (2001) and Figure 3.8, and 2009-15 OECD projection.

The evolution of government support related to water resources for agriculture from 1970 to 2015 can be defined in terms of four main phases (Figure 3.10):

1. **1970-98:** From the early 1970s support for water resources was at its height but was gradually reduced over this period, while at the same time the real price of water for agriculture gradually rose up to the late 1990s (Figure 3.8). The principal components of support for water resources in agriculture over the 30 years of this phase included both *government support to Mekerot* (national water supply company) to cover part of the operation and maintenance and fixed capital costs of supplying freshwater and also the *cross subsidisation of freshwater charges for agriculture* from charging higher rates to urban and industrial water users (Table 3.4).

   A mainstay of support to water resources for agriculture (throughout all four phases from 1970 and planned through to 2015) has been the provision of *on-farm investment grants* for installing drip irrigation and other water efficient technologies and also support for *research and development* (R&D) on new irrigation technologies and enhanced water management systems, together with *on-farm extension and advisory services* to help improve water management practices by irrigators. Beginning in the 1980s support was also provided for *off-farm water infrastructure*, in the early stages for the construction of reservoirs to collect stormwater but later for developing the supply of recycled effluent for agriculture by providing support to cover the costs for treating, transporting and storing recycled water in agricultural areas (Box 3.3).

2. **1999-2006:** At the beginning of this phase two new policy measures were introduced affecting water support to agriculture, including compensation for the cut in the water allocation to agriculture and also the introduction of the water extraction levy (described above). *Compensation to agriculture for cuts in the water allocation* since 1999, peaked in 2002 and 2003 at around ILS 160 million (USD 35 million) but subsequently were reduced up to 2008 (Figure 2.5, Chapter 2). Although farmers have being paying the *water extraction levy* since 2000, as the levy is charged at a lower rate for agriculture compared to industrial and household consumers (Table 3.4), this has provided an implicit subsidy to agriculture of on average ILS 90 million (USD 20 million at average 2000-08 exchange rate) annually between 2000-08.

   The other components of support for water provided in the first phase were continued over this phase (*i.e.* R&D and on- farm technology and farm advisory support), but government support to Mekerot was progressively reduced to 15%-20% of its operating and capital costs (from 40% in the early 1990s) (World Bank, 2006), and cross subsidisation of agricultural water charges was gradually lowered as water charges to farmers rose (Figures 3.7 and 3.8).

3. **2007-14:** This phase will be marked by the *agreement between the government and farmers in 2006 to further increase water charges paid by farmers* so they eventually cover the average cost of water production by 2015 (operation and maintenance and fixed capital costs). The agreement to move toward charging farmers the average cost of water production implies the gradual elimination of government support to Mekerot and the ending of urban/ industrial cross subsidisation of water for agriculture. Government support to Mekerot will only be provided over this period on condition farmers invest in water saving technologies and infrastructure so that they can adjust to the rise in water charges by 2015.

   There will also be a further reduction in the agricultural freshwater quota from 530 Mm^3 in 2008 to 350 Mm^3 by 2015, which will be compensated but only on condition that when farmers show evidence that they have made investments in water saving and efficient technologies. Support for expanding the use of recycled effluent water by agriculture, however, will be increased, including ILS 950 million (USD 265 million at 2008 exchange rate) planned expenditure over 2008-12.

4. **2015:** It is the government's objective that by this year the agricultural sector will pay the average cost of water production delivery. The expectation is that support by 2015, however, will further increase to develop the use of recycled effluent water by agriculture, and continue for R&D, on-farm technology and farm advisory support related to water resources. But compensation for the further reduction in agricultural freshwater allocation can be expected to be lowered.

Overall the government's water policy reforms have led to reduced support provided to agriculture for water resources, paralleled by rising real water prices charged by Mekerot for supplies to farmers (Figures 3.7, Figure 3.8 and 3.10). As already discussed in this section the combined effect of lowering support and raising water charges to farmers has had a positive impact on raising water use efficiency in agriculture (Figure 3.5). This is being achieved without negative consequences on farm output, as the production of irrigated crops (Figure 3.5) and agricultural output value per cubic metre of water used for irrigation have both increased (Figure 3.9).

3.3. Controlling water pollution

Overview of recent trends and policy responses

Pollution of water from agricultural activities is a long standing problem in Israel. Salinity of water arising from irrigation practices, and pesticide and nutrient run-off from cropping and livestock activities are the main forms of water pollution. Other forms of agricultural pollution occur from soil sediments in water and air, as well as abattoir and plastic wastes.[14] While agriculture is an important source of water pollution other sources also contribute to the problem, notably from industrial activities and urban sewage disposal.

The issue of water quality is inextricably linked to water resources, as the pressure on water resources has led to deterioration in quality. In general the quality of surface water, groundwater and coastal waters have been impaired from agricultural activities. Almost all rivers are polluted with only limited sections open to use for recreational purposes, although for some rivers water quality has improved (CBS, 2006; Maruani and Amit-Cohen, 2009; OECD, 2009e; Rosenthal *et al.*, 2009).

A complex set of policies are used to protect the nation's streams, rivers, lakes, groundwater, and coastal areas, which are enforced by a multitude of institutions, authorities and organisations (Maruani and Amit-Cohen, 2009; OECD, 2009e). The main thrust of ***policy measures and tools*** to address water pollution, in particular of agricultural origin, include:

1. enforcing regulations to deter agricultural and other polluters;
2. developing riparian buffers on agricultural land to reduce pollutant run-off;
3. integrating environmental pollution control measures as a central part of broader livestock sector policy reforms;
4. promoting integrated pest management and organic farming systems to reduce the use of chemical inputs in agriculture;
5. upgrading sewage treatment both to expand the availability of recycled effluent water for agriculture and to lower effluent pollution of water and pollution from using sewage sludge as a fertiliser; and
6. improving monitoring of surface water, groundwater and coastal pollution originating from agricultural activities, including soil mapping to understand the assimilative capacity of the land.

The overarching ***policy framework*** for improving water quality is the 1959 *Water Law,* which initially had few provisions that addressed water quality, but an amendment in 1971 prohibited point and non-point (agricultural) sources of water pollution (Maruani and Amit-Cohen, 2009; World Bank, 2006). A further amendment to the *Water Law* was made in 1991, which led to the recognition of the need for environmental protection of water, as well as public health.

Most recently the *Plan for Sustainable Agricultural Development* (2002) has the objective to lower water pollution from agriculture (Section 3.1), while the *Strategic Plan for Sustainable Development* (2003) includes among its principles for sustainable development the application of the polluter pays principle (Box 3.1). Farmers must also obtain permits for waste treatment and disposal to prevent coastal pollution, including meeting Israel's commitments under the *Barcelona Convention* to reduce pollution of the Mediterranean (OECD, 2009d). However, there is little information on the extent and trends of agricultural pollution of the Mediterranean.

The ***institutional responsibilities*** for managing water quality of relevance to agriculture at the national level mainly involve the: Ministry of Environmental Protection (MEP), which is concerned with controlling pollution from recycled effluent, in particular, the standards achieved in wastewater treatment plants; the Ministry of Health which is entrusted with managing the quality of drinking water; and the Ministries of Infrastructure and the Interior which are responsible for implementing aspects of the *Water Law* as it relates to water pollution (Margoninsky, 2009; OECD, 2009e; World Bank, 2006).

There are also many other sub-national agencies and organisations which function under the control of the central government Ministries with specific responsibilities to manage water pollution. Of particular relevance to agriculture are the multiple River Authorities, which operate between the MEP and local government, to restore riparian ecosystems (CBS, 2006; Maruani and Amit-Cohen, 2009).

Salinity and irrigation

Decades of irrigation, fertilisation, industrialisation and urbanisation activities have led to a continuous rise in the salinity levels in Lake Kinneret (Box 3.2) and most of the nation's major aquifers, especially the coastal aquifer (Table 3.5, Figure 3.11) (OECD, 2009e; Rosenthal *et al*., 2009).[15] The critical state of the coastal aquifer shows that less than half the water samples extracted from the aquifer were classified as very good in 2003/04, although the share was much higher in other lakes and aquifers (Table 3.6, Figure 3.11) (OECD, 2009e; Plan Bleu, 2007a).

Four sources are the main origin of increasing salinity levels in aquifers, in particular the coastal aquifer, including (CBS, 2006; Kislev, 2001):

1. overpumping of aquifers by irrigators and other water extractors leading to the infiltration of seawater and saline (brackish) water from the sea, as well as saline leakages from the clay beneath the aquifer (in the coastal aquifer overpumping exceeding replenishment rates has led to water levels reduced by 6-10 metres disturbing the balance of water flows between the aquifer and the sea increasing chloride concentrations);
2. infiltration of saline water from the growing use of recycled effluent in irrigation, while the use of fertilisers in irrigated agriculture further increases the salinisation process;
3. recharge of water from Lake Kinneret into the coastal aquifer also contributes to higher saline levels in aquifers, as it is ten times more saline than the initial salinity of aquifers; and
4. discharge of untreated municipal and industrial wastewater into aquifers.

Table 3.5. **Mean chloride and nitrate concentrations**

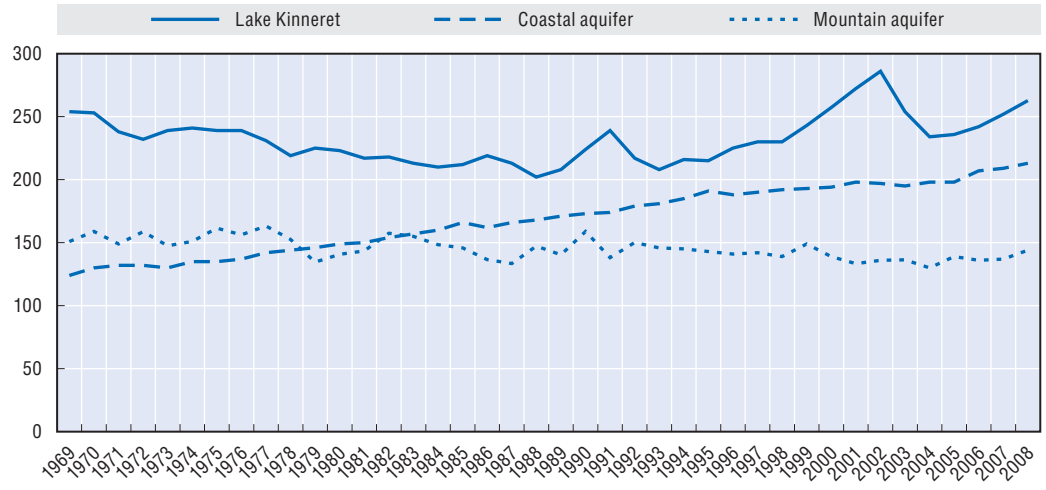
Milligrams per litre

	1980		1990		2000		2004		2007	
	Chloride	Nitrate	Chloride	Nitrate	Chloride	Nitrate	Chloride	Nitrate	Chloride	Nitrate
Lake Kinneret	230		225		255		235		250	
Coastal Aquifer	149	45	173	50	194	62	198	60	209	63
Yarkon-Tanninim	141	19	159	22	139	27	138	18	137	19
W. Galilee (coastal)	331	42	328	41	331	52	338	51	320	51
Carmel	507	32	507	27	558	34	560	32	544	32
W. Galilee (mountain)	148	18	155	21	156	26	154	29	140	27

Source: The Israel Authority for Water and Sewage, November 2008.

Figure 3.11. **Average salinity (concentration of chlorides) in aquifers and Lake Kinneret**

Milligrams of chloride per litre



Source: CBS, 2008b.

Table 3.6. **Classification by quality of extracted water in 2003-04**

	Very good	Passable		Bad
Range of chlorides, milligrams/litre	< 250	< 250	250-600	> 600
Range of nitrates, milligrams/litre	< 45	45-70	< 45	> 70
Kinnereth Basin (%)	100			
Coastal Aquifer (%)	47	39		14
Yarkon-Tanninim (%)	89	10		1
Western Galilee (%)	82	2		16
Carmel (%)	20	64		16
Eastern Mountain (%)	35	65		–
Negev and Arava (%)	6	31		63

Source: OECD, 2009e derived from the Hydrological Service, 2005.

Some researchers project that the pressures described here could continue even if drastic measures are undertaken now to address the problem, because the effects of past damage will continue to cause salinisation. In the case of the coastal aquifer it might only be suitable for irrigation and industrial purposes in future but not for domestic households (CBS, 2006). Moreover, the deterioration of water quality from salinity due to these anthropogenic factors has triggered natural causes of salinisation, further exacerbating the salinity levels of aquifers and lakes (Rosenthal *et al.*, 2009).

Given the serious salinity problems in coastal aquifers, the Water Authority authorised the national water company Mekerot in 2009 to begin an ILS 500 million (USD 139 million at 2008 exchange rate) programme to reduce salinisation in the coastal aquifer. The programme plans to pump out and desalinate up to 40 million m^3 of saline water.

Israel has had considerable success in increasing the supply of recycled effluent water for use in irrigation, and this has been a key element in the overall water strategy to gradually replace freshwater with recycled water in agriculture (Box 3.3, Section 3.2). But the quality of recycled effluent in agriculture has raised public and environmental health concerns, not only in Israel but more generally, including both for rural water supplies and

the transmission of pathogens through irrigated crops into the food chain (Lawhon and Schwartz, 2006; Scott *et al*., 2004; Tal, 2007). Recycled effluents are significantly more saline than the water originally used in the households and industry from which it was collected, and even after treatment to reduce salinity the water can be polluted by other undesirable chemical and biological pollutants (Kislev, 2001).

In response to public health and environmental concerns from using recycled water in agriculture, since the 1970s sewage treatment facilities have been improved and regulatory standards for effluent treatment made stricter (Tal, 2006; Tal, 2007).[16] Despite the greater stringency of regulatory measures to limit the discharge of effluent into streams and rivers, salinity still remains at relatively high levels and not within the established standards for irrigation and drinking water (Tables 3.5 and 3.6) (Lawhon and Schwartz, 2006).

To address this situation the government approved more stringent requirements for sewage treatment in 2000 and again in 2005, not only to limit salinity but also other pollutants (*e.g.* heavy metals, nutrients). These new measures have the objective to treat 100% of the nation's recycled effluent coming from large cities (for small urban centres the requirements are less stringent) to a level that will allow unrestricted irrigation on all crops, while minimising risks to crops, soils, water bodies and human health (Tal, 2006; UNCCD, 2006).

The new standards for effluent treatment will take 10 years to phase-in and are expected to become mandatory starting in 2010. It is estimated that the economic cost of the upgrade in effluent quality standards will reach ILS 990 million (USD 220 million) (at 2005 prices) (Tal, 2006; UNCCD, 2006). But meeting the new standards will be easier for the large municipal effluent treatment plants, than non-mechanised smaller plants that produce a quarter of the country's effluents (Tal, 2006).

In many cases the new standards differ between those required for agriculture and those set for effluent discharge into surface water. The ammonia standard, for example, is set at 20 mg/litre for agricultural sewage reuse, but concern about the eutrophication of surface water has led to a more stringent requirement of 1.5 mg/litre for discharge into surface water (Tal, 2006). Moreover, the permitted national standard for chlorides in drinking water is 600 mg/litre, compared to the World Health Organisation standard of 250 mg/litre, although most Israeli drinking water does not exceed the international standard (CBS, 2008a).

Upgrading all irrigation water to "unrestricted" quality brings with it additional economic costs (Fine *et al*., 2006; Haruvy *et al*., 2008). A study by Fine *et al*. (2006) has estimated that upgrading all recycled effluents in Israel to "unrestricted irrigation quality" (*i.e.* suitable for use on all irrigated crops) would cost an additional ILS 315 million (USD 69 million) annually (at 2003 prices) above the treatment costs to the sanitary level required for each crop. This additional cost stems from the fact that most effluent is used to irrigate non-edible crops (*e.g.* fodder and industrial crops) for which partial pathogen removal is adequate (to protect underlying aquifers). Fine *et al*. (2006) suggest that upgrading effluent for all crops to the sanitary standards required for the most sensitive crops (*e.g.* fruit and vegetables) would be inefficient and costly, and it might be better that only freshwater is used for the cultivation of these crops. A broader economy wide cost-benefit analysis of upgrading effluent standards, however, found an annual net benefit to the economy of ILS 540 million (USD 120 million in 2005 prices) (MEP, 2005).

Nutrients: inorganic fertilisers, livestock manure and sewage sludge

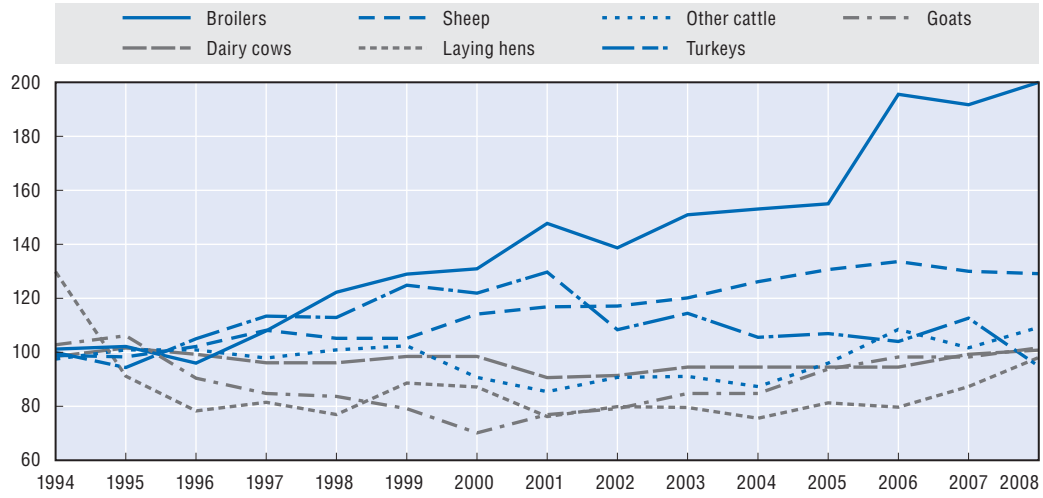
Excess nutrient release from agriculture are imposing significant environmental harm. These include: nitrate and phosphorus pollution of water bodies, which also leads to soil salinisation (see above); impacts on ecosystems (Section 3.5); and air pollution through ammonia losses (Section 3.6). Most nutrient pollution results from application of inorganic fertilisers and sewage sludge on fields and irrigated crops, as well as the disposal of livestock manure wastes (CBS, 2006; MEP, 2008b). Even so, the quantities of composted sewage sludge or livestock manure that can be applied in fields by farmers is based on crop nutrient uptake, sludge or manure nutrient concentration and irrigation water quality. The permits to dispose of sewage sludge and other wastes on fields are provided by the MEP, based on agronomic recommendations (not regulations) from the extension service of the Ministry of Agriculture.

It is likely that agricultural national nitrogen (N) and phosphorus (P) surpluses have increased since 1990, which is probably exerting an increasing pressure on water bodies and the air through ammonia emissions. This is largely explained by an overall rise in livestock numbers, leading to higher quantities of manure and ammonia releases (Figure 3.12). At the same time while agricultural inorganic fertiliser use rose rapidly in the early 1990s, since the mid to late 1990s (leaving aside annual fluctuations) fertiliser use has decreased (Figure 3.13). The decline in the use of inorganic fertilisers has mainly resulted from improved management of fertilisers, reflected in improved efficiency of fertiliser use, as crop production output has been rising since 1990 (Figure 3.13). Fertiliser use has also decreased because of the greater use of recycled effluent water which also contains plant nutrients.

Long run mean values of nitrate concentrations have increased in nearly all major water bodies across the country from 1980 to 2007 (Table 3.5). However, N and P pollutant loadings in major streams decreased, between 1994 and 2003, by 54% and 84% respectively. But these samples from water monitoring sites represent all sources of N and P, including

Figure 3.12. **Index of national livestock numbers**

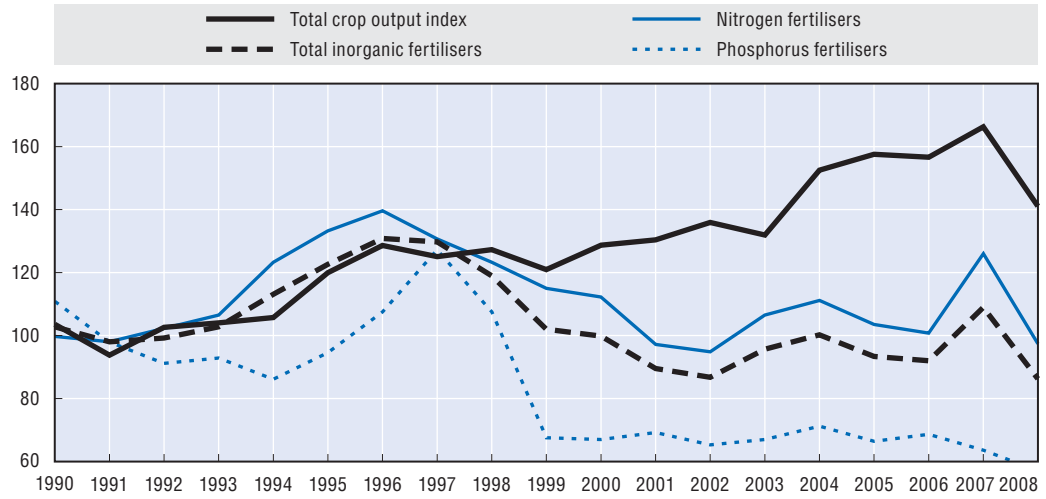
Index 100 = average 1994-96



Source: CBS, 2008b.

Figure 3.13. **The quantity of inorganic fertiliser use and crop output**

Index 100 = average 1990-92



Source: CBS, 2008b; CBS, 2008c.

urban, industrial, natural sources, as well as agriculture. Israel does not yet monitor nutrient pollution of water bodies in predominantly agricultural regions, unlike many OECD countries (OECD, 2009g).[17]

While recent trends suggest a reduction in nitrate pollution, overall concentration levels remain high for 2007, especially in the coastal aquifer at 63 milligrams/litre (Table 3.5). Some other aquifers had more than 14% of their water samples measured above the Israeli nitrate drinking water standards of 70 milligrams/litre in 2003/04, while in the Negev and Arava this was above 60% of the water samples (OECD, 2009g) (Table 3.6). Evidence also indicates that concentration levels in predominantly agricultural areas in the centre of the country are at 70 milligrams/litre and that agriculture is a major source of nitrate pollution in the coastal aquifer and Lake Kinneret (CBS, 2006; Fishman *et al.*, 2009; Lawhon and Schwartz, 2006). One of the main reasons for high nitrate concentration in Israel has resulted from land cultivation practices in the 1940s and 1950s, which exposed natural organic matter in soils to oxidation.

New technologies and regional co-operation are being promoted to improve the collection and treatment of organic wastes (mainly livestock manure and sewage sludge), especially as a result of the livestock reform programmes (discussed below). High priority is also being given to mapping the carrying capacity of most of Israel's soil types in order to prevent damage to soil and water sources from applying organic wastes to agricultural land.

In the case of irrigation, producers are encouraged to increase the uptake of controlled fertilisation practices, through pressurised irrigation methods that ensure minimal discharge of nutrients into the soil and maximum utilisation by the plant. For the greenhouse sector, which makes intensive use of chemical inputs, encouragement has been given to divert greenhouse drainage water to cultivate dates and other crops that can tolerate the wastewater. The uptake of these farm practices to improve efficiency of nutrient use has been supported through the government farm advisory services provided for farmers.

One of the methods being used in Israel to filter, absorb or otherwise eliminate nitrogen and organic matter in recycled effluent is ***soil aquifer treatment***. This is an innovative and unique technology that has been implemented at the Dan wastewater-treatment plant, and produces a high-quality product suitable for irrigating most crops (Box 3.5).

Box 3.5. **Soil Aquifer Treatment**

To ensure a high level of purification of recycled effluent water applied to irrigated food crops, a unique technology was developed locally – Soil Aquifer Treatment (SAT) – and applied at the Dan reclamation facility. After treatment the high quality effluent is applied to sand infiltration fields, where they are recharged into the aquifer by alternate regimes of flooding and drying. As the water seeps into the ground, it undergoes physical, biological and chemical processes that significantly improve its quality.

The long retention time in the aquifer produces a very high quality treated effluent. This recycled effluent is suitable for all agricultural crops with no restrictions or risk to public health (pathogen free). During 2004, the facility treated 122 million cubic metres (Mm^3) of effluent annually, and with the backup of the coastal aquifer returned 140 Mm^3 of reclaimed water to the Negev. This system treats polluted water from the central coastal region and supplies the recycled effluent for agricultural irrigation in southern arid areas.

Source: MEP, 2008b.

By the end of the 1990s the livestock sector (dairy and poultry sectors) faced two main challenges: opening markets to international competition; and the need to enforce environmental regulations to reduce pollution (Box 2.3, Chapter 2). A ***livestock reform package***, starting in 1999 for the dairy sector, but later for the geese (2000) and egg layer sectors (2008), includes the following measures related to environmental provisions (OECD, 2009d):[18]

1. *Dairy sector programme* (1999 to 2007): support of 50%-65% of the investment costs to meet environmental standards was provided to dairy farms (*e.g.* construction of manure storage facilities, installation of drainage systems to reduce pollution from dairy cow wastes, and construction of biogas facilities, Section 3.7). Over the reform period a total of ILS 493 million (USD 120 million) was approved under the environmental element of the reform programme (26% of the total reform expenditure costs) covering investments in: on-farm environmental infrastructure (ILS 362.5 million-USD 90 million); upgrading and constructing new regional manure treatment facilities (ILS 110.5 million-USD 25 million, with more than 25 small plants upgraded); and upgrading and constructing new effluent treatment plants, especially in the Negev desert (ILS 20 million-USD 5 million) (Israeli Dairy Board, 2007).

   By the end of the programme in 2007, 98% of dairy farms had prepared nutrient management improvement plans, and 89% had completed the required environmental investments (Figure 2.4, Chapter 2). Where farmers have infringed the regulations controlling farm pollution they have been fined. The number of dairy farms presented with finable warnings for infringing environmental regulations also declined over the time of the programme, with 26% of dairy producers presented with warnings in 2006 down to 4% in 2007, and no warnings since 2008.

2. *Geese fattening farms programme* (2000): all these farms were closed and banned by the government, because of the environmental pollution they were causing, but mainly in response to pressure on the government from the animal welfare lobby.
3. *Egg laying sector programme* (2008 to 2012): this programme is operating in the same way as applied to the dairy sector, by supporting producers to cover a share of the investment costs to meet environmental standards (Section 2.2, Chapter 2).

The livestock reform programmes, in particular the dairy reforms, have resulted in the reduction of environmental emissions into both water and air, provided benefits in terms of generating biogas, and involved nearly all dairy farms in improved environmental management and investment (Wachs and Tal, 2009). This has been achieved through a mix of regulatory measures to enforce how livestock waste is managed and disposed, together with payments to farmers to help toward covering the costs of the necessary environmental investment. But the reforms have ignored the differences in climatic regions across the country, for, example, in the arid Arava region where the potential of livestock polluting watersheds is low, while feedlots for beef production have not been addressed by environmental measures (Wachs and Tal, 2009).

Of total annual organic waste production, largely derived from livestock manure and ***sewage sludge***, between a third to a half is currently recovered for use by the agricultural sector, with the rest disposed in landfills and water bodies (CBS, 2006; Kan *et al*., 2008). A study by Kan *et al*. (2008) estimated recovery rates could be raised to nearly 90% for livestock manure and 75% for sewage sludge, subject to compliance with environmental regulations. The authors suggest this could be achieved by imposing a tax on sewage sludge disposal in landfill sites and improving information and advisory services to farmers to show the benefits of recycling manure.

From 2007, two essential changes have been made to the *Prevention of Water Pollution (Usage of Sewage Sludge) Regulations* concerning the use of sewage sludge as a fertiliser in agriculture (World Bank 2006). First, the quality level required for recycled sewage sludge was upgraded to meet higher environmental standards (*i.e.* rising maximum permitted values for pollutants in treated sludge). Second, a "*land-filling fee*", in addition to the current fixed "*catching fee*", was implemented at the entrance to landfill sites. The landfill fee was ILS 24/tonne (USD 6/tonne) in 2007 and is proposed to be increased incrementally to ILS 120/tonne (USD 34/tonne, using 2008 exchange rate) by 2011.

Pesticides: integrated pest management and organic agriculture

The only currently available information on agricultural pesticide use is a survey made jointly by the MEP and CBS in 1998. The survey revealed that 73% of pesticides (in terms of active ingredients) were used on orchards and a further 13% on field crops. The intensity of pesticide use was highest in the northern Galilee-Golan region (mainly due to the high incidence of orchards in the area) reaching 0.69 kg/litre/ha compared to the national average of 0.11 kg/litre/ha. About 42% of the total active ingredients were fungicides, 29% herbicides, 25% insecticides, and 5% other pesticides.

The Israeli Water Authority monitoring of pesticides is collected at only a third of the monitoring sites in coastal aquifers. One or more pesticides were detected in around 35% of these monitoring sites in 2007/08, although none had pesticides concentrations exceeding Israeli drinking water standards.

Excess use of pesticides has caused large-scale bird fatalities in the Beth-She'an valley over a long period. In an effort to lower use of pesticides and bird fatalities a joint initiative – started by the MEP, MARD, Tel Aviv University, and the Society for the Protection of Nature – sought to eradicate rodent infestations in the valley by natural biological means using barn owls (*Tyto alba*) and kestrels (*Falco tinnunculus*) instead of applying pesticides (Box 3.6).

Box 3.6. **Use of bio-controls in Israel to reduce pesticide use: owls and kestrels**

Excessive use of pesticides (rodenticides) in the late 1970s and again in the late 1990s to control the explosion of rodent populations damaging crops in the Beit-Sheaan valley in Israel, caused large-scale bird fatalities (Haim *et al.*, 2007; MEP, 2008b). This area of Israel is an important migration route for over 500 million birds twice yearly, and birds of prey (notably storks and herons) have been killed by secondary poisoning from rodenticides used to control voles and other rodents (Charter and Leshem, 2008).

In the 1980s a conservation plan was developed that reduced the use of rodenticides by using birds of prey, barn owls (*Tyto alba*) and common kestrels (*Falco tinnunculus*), as part of a biological pest control plan. After initial trials and set-backs the scheme has resulted in an estimated 1 000 nest boxes for barn owls, divided between 7 main regions across Israel. The project was also expanded to include nesting boxes for common kestrels, with now around 600 nesting boxes. This has the advantage that barn owls hunt rodents at night and kestrels during the day.

To further expand the project a national biological pest control project was started in 2007. Most of the funding, for nest boxes, is provided by farmers, but limited funds have been made available by the Ministries of Agriculture and Environment, supported technically by Tel Aviv University and the Society for the Protection of Nature, which encompasses educational campaigns and advice for farmers. Israel, with funding from the United States, has also been co-operating with Jordanian and Palestinian farmers since 2002 to extend this bio-control practice (Charter and Leshem, 2008).

Source: Charter and Leshem, 2008; Haim, *et al.*, 2007; MEP, 2008b.

Integrated Pest Management (IPM), through practices such as improved pest monitoring and pesticide use application, has been used in Israel since the early 1960s to help eradicate the Mediterranean fruit fly (Section 2.2, Chapter 2). The uptake of IPM is estimated to have reduced national insecticide use by 30% between 1997 and 2003, while farmers' incomes have risen. Around 65% of citrus groves have adopted IPM and its use is becoming more widespread in the production of other horticultural crops (Moser *et al.*, 2007), with around 90% of strawberries, 80% of other fruit (*e.g.* avocado, mango) and 50% of peppers under IPM (according to MARD).

Adoption of IPM is being encouraged by the government's Plant Protection and Inspection Service (PPIS) and the Farm Extension Service, to reduce crop losses and pesticide use and meet consumer requirements in both domestic and export markets (Section 2.2, Chapter 2). The PPIS largely uses advisory services to promote the adoption of IPM, although support is provided for IPM under the Mediterranean fruit fly eradication programme, with expenditure of ILS 12 million (USD 3 million) in 2008. The Mediterranean fruit fly programme

has involved using the Sterile Insect Technique which leads to the release of sterilised males to suppress the fruitfly as an alternative to the use of organo-phosphorus pesticides.

There is further evidence that during the 1990s the use of pesticides begun to decline, in response to wider adoption of IPM and the need to meet European Union pesticide residue standards, a key export market for Israeli horticultural products (Tal, 2007). Also important in reducing reliance on pesticides has been the heightened Israeli public awareness about the health and environmental benefits of lowering pesticide risks, as well as domestic policies aimed at reducing pesticide use and risks (see below).

Consideration of consumer preferences in export markets (mainly the EU) has also limited the growth in the adoption of ***genetically modified (GM) organisms*** (Prainsack and Firestine, 2006). There is no commercial cultivation of GM crops in Israel. However, in 2005 the government established the National Committee for Transgenic Plants (NCTP) to oversee experiments in cultivating GM crops. Farmers that wish to conduct GM crop experiments require a permit from the NCTP.

Israel has been experimenting with organic agriculture since the 1940s, but it contributes only a very small share in total agricultural production or in consumer food expenditure (Tal, 2007). While the organic agriculture industry is growing rapidly, with the area under organic production doubling from 2000 to 2007 (to 5 500 hectares) and an increasing number of producers, organic agriculture accounted for only around 1.5% of the total agricultural area by 2007. This is lower than the OECD average of 2% (2002-04) and the EU15 average (4%) (CBS, 2006; OECD, 2009g).

Much of the growth in organic production has been from horticultural production, mainly tomatoes, peppers, potatoes, carrots, mangoes, avocados and red grapefruit. About 75% of organic production is destined for export, mostly (90%) to the European Union, accounting for nearly 2% of the total Israeli agricultural export value. Organic growers receive no government support, with the organic market largely influenced by changes in domestic consumer preferences and export market opportunities (CBS, 2006). The government does provide research and development assistance and advisory services for organic growers. In 2006 a national organic standard logo for consumers was introduced, and grower inspection and organic accreditation is managed through three private inspection bodies under the audit and supervision of the Plant Protection and Inspection Service, within the Ministry of Agriculture.

Policy approaches to reducing the human health (both consumers, farmers handling pesticides, and rural communities close to pesticide spraying) and environmental risks (both terrestrial and aquatic habitats) associated with pesticide use have centred on (MARD, 2009; OECD, 2009h; World Bank, 2006):

1. testing, regulating and registering pesticides prior to their release on the market, including the banning of some products (*e.g.* acute rodenticides);
2. providing mainly advisory, and some limited support, for adoption of IPM;
3. limiting the spaying of pesticides near water courses, with limits set on aerial spraying in terms of the proximity to water sources, wind velocity and direction;
4. regulating the cleaning of pesticide spraying equipment and disposal of pesticide containers;
5. establishing standards for maximum permissible levels of pesticides in food products; and
6. developing a monitoring system to measure the presence of pesticides in soil, water and the air, as well as their impacts on biodiversity.

Overall, an accurate environmental assessment of the use of pesticides by the agricultural sector is hampered by a lack of data. There is little information on the volumes and types of pesticides used by farmers, largely because of the failure to reach agreement with the pesticide industry to release this information, which is currently available in many OECD countries. Also the government has yet to develop a monitoring system to track concentrations of pesticides in rivers, lakes, aquifers and coastal waters.[19] Such monitoring information is crucial to assess the effectiveness and efficiency of government policy initiatives to reduce the risks of pesticides in the environment.

3.4. Combating land degradation and desertification

Various forms of land and soil degradation processes associated with agricultural activities are significant in Israel, especially as large areas of agriculture operate within dryland or semi-arid and arid environments. Soil erosion (water and wind), desertification and soil contamination from industrial contamination, are the main land degradation issues (MARD, 2007). The extent of soil acidification and other forms of soil degradation are unclear, although the government is establishing a monitoring system of key physical parameters related to soil conservation (*e.g.* rainfall, soil erosion and water flows).

For all forms of land degradation, however, there is a lack of monitoring and information on their spatial range, temporal change, and knowledge of agriculture's role in exacerbating or ameliorating these land degradation processes. Technically over 95% of Israel, including the dry-sub-humid centre and the Galilee region, are drylands and becoming drier under the influence of climate change. According to a MARD (2007) report about 40% of the area used for field crops, as well as 10% of orchards are subject to severe erosion, which places Israel among a small number of OECD countries with similarly high shares of agricultural land having moderate to severe erosion risk (OECD, 2009g).

A study by Portnov and Safriel (2004) indicates that in dry-humid areas of the country soil salinisation is a problem due to irrigation, and in some areas where farmland has been abandoned this has led to bush encroachment and woodland fires causing soil erosion. In semi-arid regions there are indications of sheet soil erosion on irrigated land, and highly intensified gully erosion in regions under cropping and grazing systems. The problem of soil silting of reservoirs from soil erosion, however, is reported to be only a minor problem (OECD, 2009e).

Overgrazing by goats, especially in the southern Negev region, has been detrimental to ecosystems in this region and caused land degradation (Portnov and Safriel, 2004; UNCCD, 2006). But grazing pressure from goats has fluctuated, with a decline in numbers from 1990 to 2000, but subsequently numbers have increased up to 2008 (Figure 3.12). Managed systems of grazing, however, have been shown to cause little land degradation (Wachs and Tal, 2009) and support floral biodiversity (Section 1.5).

Under the *Plant Protection (Damage from Goats) Regulation*, the Grazing Authority, together with the MEP, MARD and Green Patrol, regulates stocking densities of goats, and a grazing fee per head of livestock per month is paid to the MARD. The MARD also provides payments for improving the vegetative capacity of grazing land (sheep, goats and cattle) subject to environmental criteria, with a total annual budget of on average ILS 9 million (USD 2.6 million) (MARD, 2009) (Section 2.2, Chapter 2).[20]

Prevention of ***soil erosion and conservation of soils*** is a major policy objective under the *Plan for Sustainable Agricultural Development* (Section 3.1). A soil conservation programme, planned over 10 years (2007 to 2016), has the objective to bring 100 000 ha of field cropland

(almost 50% of the current total field cropland area) under soil conservation practices by 2016 (MARD, 2007). The annual budget for soil conservation in 2008 was ILS 5.7 million (USD 1.6 million), or under 1% of total agricultural budgetary expenditure, to support three main programmes (Section 2.2, Chapter 2):

1. *Managing land through soil and water conservation practices* (ILS 3.5 million-USD 1 million): The payment rate is ILS 25 (USD 7) per *dunam* in the case of crops or orchards, and ILS 20 (USD 6) per *dunam* for enhancing soil organic matter. These payments are to finance farm practices that minimise pollutant runoff and erosion of cultivated land, which is intended to reduce costs from the pollution of water bodies from soil, pesticide and fertiliser run-off. Farmers are also provided educational and advisory support to establish the adoption of soil conservation practices.
2. *Developing land conservation and agricultural drainage facilities* (ILS 1.8 million-USD 0.5 million): This support is aimed at encouraging farmers to minimise soil erosion and drain excess rainfall from their fields.
3. *Acquiring machinery and equipment designed for soil conservation* (ILS 400 000-USD 114 000): For example, support (40% of the purchase cost) for no-till seeding machines for field crops and orchards, and support for equipment for partial ploughing of the cultivated area that only cause minor disturbance of soil layers.

The MARD (2007) has estimated that the soil conservation programme could generate substantial national direct and indirect economic benefits. The estimated direct economic benefits may amount to ILS 45 million (USD 13 million), mainly from: lowering soil loss; reducing canal and drainage maintenance costs from less soil sediments; increasing soil water retention and groundwater recharge; and minimising flood damage costs. The indirect national benefits include, for example, increasing soil carbon sequestration through soil organic matter retention, improving soil structure, and addressing desertification.

In 2004, the MEP published an initial list of threshold values for ***soil contamination***, but only during recent years has it begun to examine the soil contamination problem in Israel. In the 228 sites that were suspected of contamination, the following contaminant distribution was found: 36% of the sites suffer from oil and fuel pollution; 26% from chemicals and organic matter pollutants; and 55% from heavy metal contamination. Soil contamination is attributed mostly to industrial causes and, while there are regulatory mechanisms for the prevention of soil contamination, their enforcement does not apply to agriculture.

Israel is undertaking measures to ***combat desertification*** in recognition of its obligations under the *UN Convention to Combat Desertification* (UNCCD). The main thrust of Israeli policies to address desertification in semi-arid and arid regions and of relevance to agriculture include (UNCCD, 2006):

1. Developing a long-term strategic plan, *National Master Plan 35*, that balances urban and agricultural growth with conservation objectives.
2. Improving water management, such as upgrading effluent recycling for agriculture, operation of new desalinisation facilities and implementation of water conservation policies to prevent unsustainable exploitation of water resources (Section 3.2).
3. Continuing implementation of a broad-based afforestation programme involving the planting of tree clusters, with a range of forest types defined by their ecological capacity and landscape values. Simultaneously, there is some limited use of agro-forestry to combat desertification and for pollutant run-off containment.

4. Undertaking research and development (R&D) programmes to address desertification, including identifying crops suited to arid lands, and involving environmental orientated R&D aimed at improving farm productivity while protecting biodiversity. For example, the MARD's Volcani Institute of Agricultural Research and satellite stations have an annual budget of around ILS 70 million (USD 20 million) for applied research (about a third of the annual MARD R&D budget), much of it aimed toward developing sustainable agricultural initiatives in arid areas (UNCCD, 2006).

Concern has been raised that if the present pace of urban expansion in the Negev continues into the future, agriculture will inevitably be forced to the fringes of the Negev, which could further exacerbate desertification through induced soil erosion and salinisation in the region (Portnov and Safriel, 2004; UNCCD, 2006). According to Portnov and Safriel (2004) this might justify a development path for the Negev region based on urban expansion accompanied by compact pockets of intensive greenhouse agriculture, such as already exists in the Arava region.

3.5. Protecting biodiversity and open spaces (landscapes)

Israel is characterised by a rich ***biodiversity*** of crop and livestock genetic resources, wild species and ecosystems (CBD, 2005; CBS, 2006; Nemtzov, 2002; OECD, 2009d; Orenstein, 2004). The high biological diversity is attributed to Israel's geographic location connecting Africa and Eurasia, its varied climatic zones from mountain to Mediterranean and arid environments, and being in a region with a long agricultural history giving rise to a rich crop and livestock genetic resource base. Agriculture has also contributed in providing ***open spaces*** or ***landscapes***.

Yet biodiversity, as well as open spaces and landscapes, is endangered from accelerated economic development and urbanisation, and also pressure from some agricultural practices, such as the misuse of pesticides and nutrients and the impact of salinity from irrigated land on ecosystems (CBD, 2005; CBS, 2006; OECD, 2009d; Orenstein, 2004). But assessing the effects of agricultural activities and policies on biodiversity and landscapes is seriously limited by a lack of information and data, although information exists in terms of protected areas (*e.g.* national parks) and the numbers of threatened flora and fauna species (Table 3.7). A national biodiversity monitoring system, however, is now under construction.

Within the broader context of the *National Biodiversity Strategic Action Plan* efforts are underway to seek a better balance between agriculture, biodiversity and landscape conservation, as outlined under the *Plan for Sustainable Agricultural Development*. Israel is also

Table 3.7. **Total number of wildlife species existing, endangered, or extinct, 2002**

Group	Total number of species	Endangered or critically endangered		Regionally extinct	
		Number	%	Number	%
Amphibians	7	4	57	1	14
Fish	32	6	19	1	3
Reptiles	103	20	19	3	3
Mammals	104	37	36	9	9
Birds	206	23	11	15	7

Note: Out of the 15 birds regionally extinct, 11 are not nesting in Israel anymore. Out of the 9 mammals regionally extinct, 4 of them are under conservation programmes.
Source: Orenstein, 2004; and personal communication with the Ministry of Environmental Protection.

co-ordinating its biodiversity conservation efforts under related international environmental agreements, including the *Convention on Biological Diversity*, the *Bonn Convention* (to protect migratory bird species), the *UN Convention to Combat Desertification*, the *Ramsar Convention* (to protect wetlands) and the *Kyoto Protocol* (Section 3.1).

Biodiversity

The Israeli flora includes the ***genetic resources of several important field crops***, such as wheat, barley, flax and other plants, that were initially domesticated in the Near East over many millennium (Barazani *et al.*, 2008; CBD, 2005). With threats to the genetic variability of plant material, including from agriculture, industry and other pressures, the need to protect Israel's genetic crop diversity has become a national priority, with an estimated 46 species of Israeli flora already extinct (Barazani *et al.*, 2008).

The Israeli Plant Gene Bank (IGB) has been entrusted with the conservation of plant genetic resources and their wild relatives, as well as the approximately 400 rare endangered endemic species that have been reported in the literature (Barazani *et al.*, 2008). Plans have been drafted by the IGB to expand its plant collection, improve plant conservation and research, and develop a database, although financial constraints have slowed this process (UNCCD, 2006). Some 200 wild relatives of crop plants have been targeted by the IGB for *ex situ* conservation in botanical gardens. The *ex situ* collections include over 100 species accessions held in universities as part of the IGB's decentralised genebank. For some plant species *in situ* conservation is being undertaken, such as for garlic (*Allium sativum*) and wild emmer wheat (*Triticum dicoccum*) in the eastern Galilee (UNCCD, 2006).

Conservation of ***livestock genetic resources***, *ex situ* or *in situ*, is not as well developed in Israel as for crops, and information on the state and trends of livestock genetic diversity are incomplete or not collected (Wachs and Tal, 2009). But an endemic beef herd is being reared *in situ* in a nature reserve to maintain genetic diversity.

Surveys of the complete numbers of ***wild flora and fauna species*** were made in 1975, 1987 and 2002, with an indication of the share of species endangered and extinct (Table 3.7). The impacts of farming, both beneficial and harmful, on the nation's wild species are poorly monitored except for birds.

Migratory birds use Israel as one of their main routes between Europe and Africa (Nature and National Parks Authority, 2005). About 500 million birds of over 300 species (including 21 globally threatened species) migrate over Israel twice annually. Some of them, mainly Cranes (*Grus grus*), Pelicans (*Pelecanus*) and Storks (*Cigonia cigonia*), rest on route in Israel, including in fish ponds and wetlands on agricultural land (*e.g.* the Hula Lake, see below). There is an annual water-bird population count, including monitoring the numbers using fish ponds and wetlands on farmland. Trends in two of the bird species noted above, from 1998 to 2008, show a highly variable picture, but populations of Storks appear to be increasing but Pelicans decreasing (excluding a small rise over the past few years).[21]

Protection of wild species has typically been through the creation of national parks and nature reserves (but also applies to nature assets outside the parks and reserves). Currently there are no specific agri-environmental policies for the conservation of wildlife on farmland. Even so, a number of initiatives are being developed, for example, a two year pilot project to pay farmers, through an auction system, to maintain farmland for

biodiversity conservation. Some agricultural policies, however, act indirectly to lessen the impact of farming practices on wildlife, in particular:

1. Support for farmers suffering lost of yield in fish ponds impacted by migratory birds, and encouraging the use of barn owls and kestrels as bio-controls to reduce pesticide use. Agriculture is also subject to other forms of damage and losses from wildlife, such as damage to irrigation equipment by mammals and birds, and losses to field crops and orchards from small rodents and birds. In addition, to support for some losses, farm advisory, bio-control, IPM and other methods are being used to address these wildlife-agriculture conflicts (Nemtzov, 2002).
2. Livestock reform and IPM programmes have lowered environmental pressure from excess nutrients and pesticide (Ramsar, 2008) (Section 3.3).
3. Programmes aimed at reducing the environmental impacts of over grazing on fragile pasture land (see discussion below on open spaces). There is also research in Israel that shows that managed grazing regimes in the Negev desert has helped to support floral diversity (Hadar *et al.*, 2000; Osem *et al.*, 2002; Perevolotsky, 2006; Sternberg *et al.*, 2000; and Wachs and Tal, 2009).
4. Local and sporadic field research projects which has been undertaken to determine the impact of agricultural activities on wild flora (Davidson, 2004; UNCCD, 2006).

A significant area of wetlands and other ***ecosystems*** have been damaged from agricultural pesticide and nutrient run-off, and lost to agricultural development, however, there is little systematic information or research on these impacts. Since the 1950s it is estimated that Israel has drained over 90% of wetlands for agricultural development. The remnant wetlands are under serious threat from future construction of recycled effluent water reservoirs as wetland sites are often the lowest cost site to construct the reservoirs, although the JNF is beginning to reconsider where it constructs reservoirs.[22] Nevertheless, part of the original Hula Lake, which had been drained for agricultural purposes, has been flooded and some migratory birds have returned to nest (Nature and National Parks Authority, 2005; Orenstein, 2004). There are also MARD farm advisory programmes that instruct farmers on how to protect wetlands and riparian ecosystems on their land (Ramsar, 2008).

Agriculture, notably in arid environments, can have mixed impacts on habitats and wild species. A study of the Arava Valley (an arid environment), for example, showed that the development of intensive farming increased water and food resources to the benefit of the red fox (*Vulpes vulpes*), but to the detriment of native species such as gerbils (*Gerbillus gerbillus*) which were forced out to remaining habitats close to surrounding farms (Shapira *et al.*, 2008). In addition, the increasing trend towards holding sheep and goats in feedlots may be detrimental to floral biodiversity in the Negev, rather than under situations where livestock grazing stocking densities are managed (Wachs and Tal, 2009).

Open spaces (landscapes)

A major objective under the *Plan for Sustainable Agricultural Development* concerns the preservation of agricultural open space and maintaining the cultural and landscape values associated with agriculture (Section 3.1). Open spaces are defined by the following criteria (CBD, 2005):

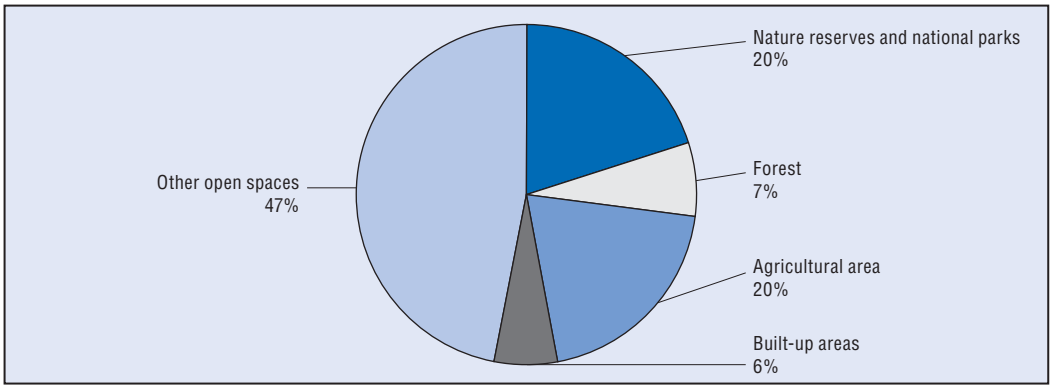
1. Vulnerability: based on features such as flora, fauna and natural ecosystems.

2. Continuity: based on the ability of large and connected areas to support ecosystem functions.
3. Functionality: based on national planning and social considerations, including the ability of open areas to serve as buffers between urban areas and to provide ecosystem services and rural tourism opportunities, such as leisure and recreational possibilities.

The integration of these criteria provides the basis for open space sensitivity maps which delineate the value of open spaces across the country. About 90% of the total national land area can be defined as open spaces, essentially land with no construction or development, although some of this land overlaps with military exercise zones (Tal, 2008). More importantly around 60% of the total land area is formally designated as open spaces, with agriculture, nature reserves and forests provided statutory protection through planning laws and other legislation (Tal, 2008).

Farmland constituted around 20% of Israel's open spaces in 2008, compared to 27% in 2002 reflecting, in particular, the expansion of urban areas (Figure 3.14). A major share of farmland, particularly in the central region, is left unmanaged, even without having its function redefined. According to one estimate (BOI, 2004), about 18% of total farmland in the Negev is unmanaged, although there is no clear explanation why land is being untended or time series data to assess trends of unmanaged agricultural land. This land, especially if it is close to residential or industrial areas, is exposed to illegal use which may reduce its value as visual landscape. Urban and industrial expansion requiring additional land from agriculture threaten to put pressure on the benefits of open spaces as visual landscapes in the future.

Figure 3.14. **Composition of open spaces in Israel, 2008**



Source: Ministry of Environmental Protection.

At the beginning of the 2000s, a number of factors begun to alter the course of government policy concerning open spaces, especially related to agricultural land (Tal, 2008):

1. A new national Masterplan No. 35 was approved in 2005 guaranteeing the protection of continuous corridors of open spaces.
2. Public activism begun to provide political support to protect open spaces.
3. There was increasing recognition of the economic value and ecosystem services provided by open spaces. A number of studies have pointed out that land markets in Israel fail to take account of the ecosystem services and amenity value provided by

open spaces on farmland and other open spaces (Tal, 2008). A study by Fleischer and Tsur (2009) found that the extent of market under supply of farmland is substantial (in view of the high value tourists attach to travelling through farmed landscapes), while pressure to convert farmland to urban and industrial uses is high. Taking into account the amenity value of some farmland, an appropriate policy response could be through a tourist tax which may provide a stream of revenue with which to finance the conservation of open spaces on farmland (Box 1.3, Chapter 1).

According to Kan *et al.* (2009), the net social benefit of protecting farmland could be further enhanced by encouraging intra-agricultural land allocation among different crops. The authors contend this would favour a regional approach rather than a national programme to protect agricultural landscapes. This is because their study suggests that in many regions the public's preferred agricultural landscape is fairly similar to the currently observed landscape which may result from the public's adaptation to the local surroundings.

In order to protect open spaces from urban and industrial development and encourage the ***conservation of open spaces and cultural landscapes in agricultural areas*** the MARD provides support to farmers through three programmes amounting to ILS 27 million in 2008 (USD 7.7 million) or over 2% of the total agricultural budgetary expenditure (Section 2.2, Chapter 2):

1. *Maintaining cattle, sheep and goats on pasture* (ILS 15 million in 2008-USD 4 million): support is provided for sheep, goat and cattle rearing for meat production on pasture, mostly in marginal agricultural regions and in areas for which there is no alternative agricultural use. The programme started with support for beef herds in 1997; sheep and goats were added to the programme in 2005. From 2004 the programme provides a per hectare grazed payment, taking into account livestock density relative to land vegetation cover, with the regions of Israel divided into four categories according to pasture richness. Herd owners have to follow appropriate production practices and environmental criteria, and the area supported under the programme amounted to about 60% of the total agricultural land area in 2008.
2. *Support for rain-fed grain growers* (ILS 10 million in 2008-USD 3 million): support for the cultivation of rain-fed crops (since 1989), mainly wheat and barley. As well as encouraging conservation of open spaces the support is designed to ensure farm income stability according to the area of land cultivated. Payment rates vary across four cultivation regions, and due to the rise in world wheat prices from 2004 onwards, support was only paid to producers south of the drought-line where the annual average precipitation is less than 150 mm. From 2009, this support scheme was replaced by an income insurance framework, with premium rates varying from 40% to 80% according to the variation in yields in each region, and will operate across about 25% of the total agricultural land area.
3. *Support to herders* (ILS 2 million in 2008-USD 0.6 million paid through the Grazing Authority): support is provided for establishing infrastructure in grazing areas (*e.g.* fences, drainage) and for improving pasture vegetation, to maintain grazing areas, preserve open landscape and Israel's land reserves. The Grazing Authority determines support payments across 10 regions based on the number of livestock producers, type of livestock, and the extent to which pasture has been improved in each region.

While Israel's open space policies have began to evolve since the late 1990s, especially in agriculture, there are nevertheless a number areas which raise concern:

1. To date conservation of open spaces on agricultural land is essentially being achieved through production support policies. As economic studies indicate a willingness of the public to pay for visual amenity and ecosystem services provided by farmland, this suggests it might be appropriate to consider more targeted policy approaches, for example, a tax on tourism.
2. Illegal activities in the rural sector has led to rural *kibbutzim* and *moshavim* selling farmland for development purposes (*e.g.* housing, industrial development) (Tal, 2008). According to Tal (2008) there has been widespread non-compliance with the law in selling agricultural land for urban and commercial development and poor enforcement of planning regulations.
3. Unauthorised construction in the Negev desert, associated with the Bedouin building boom. This has led to the loss of open spaces and haphazard development (Tal, 2008).
4. In an effort to develop Jewish settlements in the Negev in the late 1990s the Jewish population was encouraged to establish private ranches on national land (Tal, 2008).

The future growth in population will continue to exert pressure on open spaces and agricultural land. This pressure will need to be reconciled with meeting agricultural interests and the increasing public demand to protect rural landscapes in terms of their amenity value and the ecosystem services they can offer.

3.6. Reducing air pollution

The main national sources of ***air pollution*** are the transport, energy and industrial sectors, and to a lesser extent agriculture. Agricultural air pollution (apart from greenhouses gas emissions, Section 3.7) mainly occurs from the release of ammonia from livestock manure, inorganic fertiliser storage and application, and emissions from the use of methyl bromide, an ozone depleting pesticide.

Ammonia emissions

Agriculture is probably the major national source of ammonia emissions, from livestock and use of fertilisers, but there is no national inventory of ammonia emissions. Across OECD countries over 90% of ammonia originates from agriculture. For most OECD countries livestock manure management accounts for over 90% of agricultural ammonia emissions, with the remainder originating from inorganic fertiliser application (OECD, 2009g). This is therefore likely to also be the case in Israel. Ammonia emissions can be damaging to soils and contribute to eutrophication in receiving ecosystems.

Given the near continuous increase in the overall national livestock inventory from 1990 to 2008 (Figure 3.12), partly offset by the decline in inorganic fertiliser use since the mid-1990s (Figure 3.13), it seems likely that ammonia emissions have increased. But in the absence of a national monitoring system for ammonia emissions, these trends cannot be verified. There are no policies addressing the reduction of ammonia emissions directly, but the policy reforms in the livestock sector, especially the dairy sector (1999 to 2007), have probably led to a lower rate of emissions release through improved manure storage and fertiliser application practices, especially as dairy cow numbers changed little over the period from 1994 to 2008 (Figure 3.12).

Methyl bromide use and ozone depletion

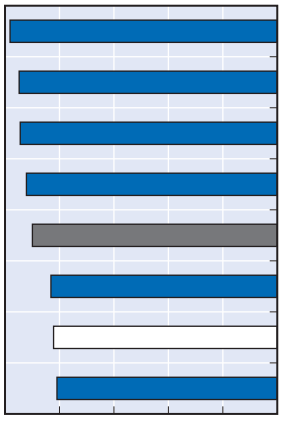
Methyl bromide is a fumigant used in the agri-food sector to control soil insects, mites, etc., in open fields and greenhouses, as well as in the storage of food commodities. While methyl bromide is a low cost fumigant it can be harmful to human health and soil biodiversity and is also an ozone depleting substance, being one of the most destructive ozone depleting substances (OECD, 2009g). The stratosphere ozone layers provide protection from harmful ultraviolet rays, which can be detrimental to human health and the environment.

As a signatory to the *Montreal Protocol* in 1992, Israel is committed to lowering emissions and production of ozone depleting substances, and has made substantial progress in this regard by reducing methyl bromide use by 82% between 1991 (the base period used under the *Protocol*) and 2007 (Figure 3.15). The reduction in methyl bromide use, however, has been less than that for nearly all other OECD countries, but greater than many non-OECD countries with Israeli use declining from around 2 150 tonnes (ozone depletion potential, ODP) in the early 1990s down to about 360 tonnes by 2008. Israel is a major global producer and user of methyl bromide, its use accounting for 5% of the world total in 2007 (Table 3.8).

Israel, in common with other OECD countries, is committed under the *Protocol* to phased reduction of methyl bromide use leading to a complete phase out by 2005, except for *Critical Use Exemptions* (CUEs) that may be approved by the Parties to the Protocol (Table 3.9). While Israel is moving closer to achieving a complete phase out, by 2008 this has not yet been achieved, in common with many other OECD countries (Table 3.9). But Israel expects to reduce methyl bromide use by 90% from the 1991 base year by 2010, and full phase out is expected by 2011 (Plant Protection and Inspection Services, 2007).

Figure 3.15. **OECD and Israeli methyl bromide use: 1991 to 2007**

Percentage change in tonnes of ozone depleting potential, 1991 to 2007



	Tonnes of ozone depletion potential (ODP tonnes)							Change (%)
	1991[1]	2002	2003	2004	2005	2006	2007	1991 to 2007
EU27	11 530	4 184	2 953	2 873	1 405	846	212	–98
New Zealand	81	26	13	10	18	16	4	–95
Australia	422	194	109	123	70	33	24	–94
Japan	3 664	1 770	858	1 019	357	293	288	–92
OECD[2]	31 167	9 297	8 027	10 422	6 237	5 101	3 132	–90
United States	15 317	3 051	4 053	6 353	4 353	3 885	2 581	–83
Israel[3]	**2 148**	**1 032**	**644**	**643**	**649**	**525**	**383**	–82
Canada	120	58	35	35	32	25	23	–81

1. 1991 base period for non-Article 5 countries under the Montreal Protocol and 1995-98 for Article 5 countries.
2. OECD excludes Korea, Mexico and Turkey.
3. Data for 2008 and 2009 are not yet available for some OECD countries. For Israel methyl bromide use was 360 ODP tonnes in 2008 and projected to decrease to 228 ODP tonnes by 2010, a nearly 90% reduction from 1991.

Source: Plant Protection and Inspection Services, MARD for Israel; OECD, 2009g; data retrieved from the UNEP website under "Data Reporting", "Data Access" at: *http://ozone.unep.org/Data_Reporting/Data_Access/*.

Table 3.8. **World and Israeli methyl bromide use: 1991-2007**

		1991	2002	2003	2004	2005	2006	2007	% change 1991-2007
World use of ozone depleting potential products (tonnes)		894 252	162 680	170 546	126 290	92 464	84 902	61 769	–93
World total methyl bromide use (ODP tonnes)		38 664	18 154	15 801	17 372	12 579	9 874	7 316	–81
Share of methyl bromide use in total ODP use (%)	OECD	3	6	5	8	7	6	5	
	Israel	**0.2**	**0.6**	**0.4**	**0.5**	**0.7**	**0.6**	**0.6**	
Share of methyl bromide use in world total methyl bromide use (%)	OECD	81	51	51	60	50	52	43	
	Israel	**6**	**6**	**4**	**4**	**5**	**5**	**5**	

Source: Plant Protection and Inspection Services, MARD for Israel; OECD, 2009g; data retrieved from the UNEP website under "Data Reporting", "Data Access" at: *http://ozone.unep.org/Data_Reporting/Data_Access/*.

Table 3.9. **Methyl bromide use in OECD countries and Israel: progress toward the phase out schedule under the *Montreal Protocol*[1]**

	Consumption baseline 1991 (ODP tonnes)	1999	2001	2003	2005	2006	2007	2008
		Agreed percentage reduction levels from 1991 base year						
		25	50	70	100	100	100	100
		Actual percentage reduction levels from 1991 base year						
Australia	422	28	54	74	83	92	94	96
Canada	120	38	57	71	73	79	81	84
Japan	3 664	25	53	77	90	92	92	n.a.
New Zealand	81	51	87	85	78	80	95	n.a.
United States	15 317	44	58	74	72	75	83	n.a.
OECD[2]	31 167	38	58	74	80	84	90	n.a.
EU27	11 530	35	60	74	88	93	98	n.a.
Israel	**2 148**	**28**	**50**	**70**	**70**	**76**	**82**	**83**

n.a.: not available.
1. 1991 base period for non-Article 5 countries under the Montreal Protocol.
2. OECD excludes Korea, Mexico and Turkey which are Article 5 countries under the Montreal Protocol.
Source: Plant Protection and Inspection Services, MARD for Israel; OECD, 2009g; data retrieved from the UNEP website under "Data Reporting", "Data Access" at: *http://ozone.unep.org/Data_Reporting/Data_Access/*.

The basic strategy for the long term reduction of methyl bromide consumption in Israel relies on a multi-disciplinary approach. This consists of the development of legal, environmental, agricultural research and extension, improving farmers awareness and education, and linking together relevant public and private stakeholders (Plant Protection and Inspection Services, 2007). More specifically reductions in methyl bromide use are through the implementation of Integrated Pest Management, together with, for example, thermal disinfection, and use of controlled atmosphere in greenhouses (OECD, 2009h).

In view of the technical difficulties to meet the phase-out schedule for methyl bromide and finding alternatives, in particular in the horticultural sector, the *Montreal Protocol* allows the Parties to apply for CUEs when there are no technically or economically feasible alternatives, in addition to the existing exemption for use in quarantine and pre-shipment purposes (OECD, 2009g). The CUEs are intended to give farmers, fumigators and other users of methyl bromide additional time to develop substitutes. The OECD and Israel's agreed CUEs under the *Montreal Protocol* to 2007 are shown in Table 3.10. The share of total CUEs agreed for 2007 in the 1991 base period values varied between OECD countries, but averaged for OECD 13% but for Israel was 20% (Table 3.10).

Table 3.10. **Critical Use Exemptions (CUEs) for methyl bromide agreed under the *Montreal Protocol* for OECD countries and Israel**

	CUEs agreed	Methyl bromide use	2007 CUEs total compared to 1991
	2007[1]	1991	
	ODP tonnes	ODP tonnes	%
Australia	29	422	7
Japan	382	3 664	10
United States	3 089	15 317	20
OECD	3 956	31 167	13
EU27	414	11 530	4
Israel	**428**	**2 148**	**20**

1. Critical Use Exemptions for methyl bromide use have been granted to the Parties under the Montreal Protocol.
Source: Plant Protection and Inspection Services, MARD for Israel; data retrieved from the UNEP website under "Data Reporting", "Data Access" at: *http://ozone.unep.org/Data_Reporting/Data_Access/*.

3.7. Responding to climate change and climate variability

Agriculture's link to climate change is complex, as agricultural activities are both a contributor to greenhouse gas (GHG) emissions and a carbon sink (sequestration), the extent depending on which crop and livestock husbandry practices and management systems farmers adopt. Moreover, certain agricultural biomass feedstocks and waste materials (*e.g.* manure) have the potential to provide a carbon neutral source of renewable energy. Equally while farming contributes to climate change, agricultural production is also impacted by climate change (OECD, 2009g).

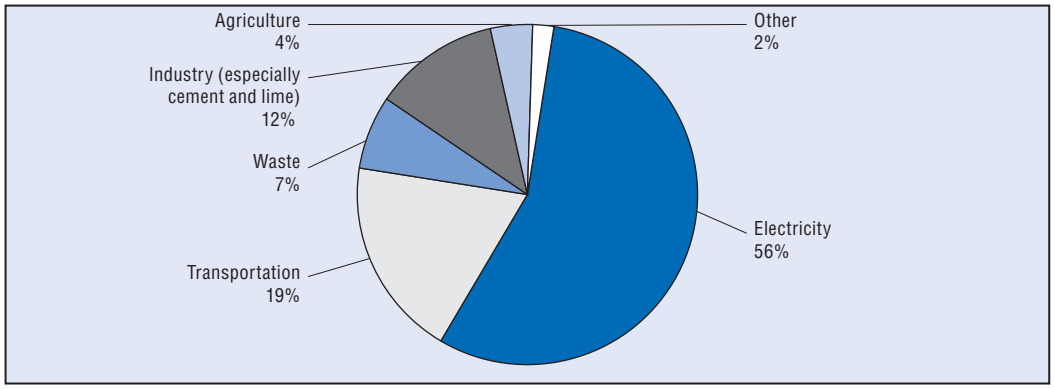
While Israel ratified the *Kyoto Protocol* in 2004 it is not subject to any agreed limitations on GHG emissions as it is classified as a developing country under the *Protocol*. With regard to agriculture there is no specific policy framework to address climate change mitigation and adaptation in agriculture. Instead, a range of agricultural policies act indirectly to contribute to national climate change policy goals, usually providing co-benefits toward several other environmental objectives. For example, improved manure handling as part of the dairy reform policy to help reduce water pollution, also leads to lower methane GHG emissions. Similarly policies geared to improving the efficiency of water use in agriculture should also contribute to the adaptation of agriculture to climate change as water resource availability is projected to decline and become more variable (*i.e.* greater number of floods and droughts), although this will depend on the extent to which overall agricultural production increases.

Agricultural greenhouse gas emissions

Agriculture's share in total Israeli greenhouse gas (GHG) emissions is relatively small at 4% in 2006 (Figure 3.16). The main sources of agricultural emissions, are from methane (CH_4, mainly livestock enteric fermentation) and nitrous oxide (N_2O, largely from application of inorganic fertilisers) (Wachs and Tal, 2009). Carbon dioxide (CO_2) emissions (principally from energy combustion in farming) account for a minor share of total agricultural GHG emissions measured in CO_2 equivalents (UNFCCC, 2000).

There was little change in total agricultural GHG emissions over the period from the early/mid 1990s to 2006. This reflects an increase in GHG emissions from rising numbers of

Figure 3.16. **Distribution of greenhouse gas emissions by sector, 2006**



Source: Ministry of Environmental Protection, see the website under "Environmental Topics", "Air Quality", "Climate Change" at: *www.sviva.gov.il/bin/en.jsp*.

livestock (Figure 3.12), largely offset by reductions in GHG emissions resulting from the (CBS, 2006; Palatnik and Shechter, 2008; UNFCCC, 2000):

1. decline in inorganic fertiliser use since the late 1990s (Figure 3.13), associated with improved fertiliser management and increased use of wastewater;
2. increase in manure recycling and advanced waste-treatment methods, and establishing regional manure collection and recycling sites, resulting from the livestock reform programme;
3. improvements in cooling systems and management of dairy farms leading to an annual reduction in dairy cow GHG emissions equivalent to about 1% of total agricultural GHG emissions; and,
4. implementation of a new programme of methane gas collection from landfills.

Many of these emission mitigation actions in the agriculture sector reflect those that were recommended in the Israeli submission to the UNFCCC (2000) (Table 3.11). The UNFCCC has recommended further actions to reduce GHG emissions from agriculture, including wider use of minimum tillage and an increase in crop coverage (Table 3.11).

Table 3.11. **UNFCCC recommendations for reducing greenhouse gas emissions in Israeli agriculture**

Alternative	CO_2 reduction tonne/year	Technology	Cost USD/kW	% of sector's emissions	% of total emissions	Remarks
10% increase in crop coverage	Decrease of emissions by 0.5 million tonnes	Existing	Depends on agriculture policy		0.8	Serves other national aims: preserving open space, green lands
10% decrease in crop coverage	Increase of emissions by 0.5 million tonnes					
Minimal tillage 25% of land	2 million tonnes over 10 years	Existing	Usually saves expenses for farmers		0.3	
Improved feeding to cattle	8 000 tonnes methane, 0.2 million tonnes CO_2	Existing		0.3		
Improved manure handling	2 500 tonnes methane, 0.1 million tonnes CO_2	Existing		0.16		Better product, less odours
Improved fertiliser application	1 200 tonnes N_2O, 0.4 million tonnes CO_2	Existing, requires improvements		0.6		Less water pollution

Source: UNFCCC, 2000.

Carbon sequestration and renewable energy in agriculture

There are no current estimates of ***carbon sequestration*** resulting from agricultural activities in Israel. Circumstantial evidence would suggest that programmes seeking to increase agro-forestry have contributed to increasing carbon capture. Changes in the area under permanent pasture also increase carbon sequestration, but as there has been little change in the area under pasture since 1990 (Figure 3.2), this would suggest the carbon balance of agricultural soils has also remained unchanged.

There is considerable technical potential in Israel for producing ***renewable energy*** from agricultural biomass feedstocks and waste materials, but there has been little development to date of renewable energy produced from agricultural feedstocks (UNFCCC, 2000; USDA, 2007c). The economic feasibility of developing this source of renewable energy, however, is uncertain without financial support.

As a co-benefit of the livestock reform programme, however, the first ***biogas*** plant, with investment support from the government, started to produce electricity in 2007 (about 2 to 2.4 Megawatt hours), using manure from dairy and poultry farms as feedstock (USDA, 2007c). By 2008 some 10% of the national dairy herd produced 4.2 million m^3 of biogas and the government is planning to fund three additional regional biogas plants by 2011. With completion of these additional facilities, it is estimated that about a third of Israel's cows will contribute to the production of biogas (Israeli Dairy Board, 2007).

There have been a number of impediments in Israel to renewable energy development, including the dominance of coal as a major energy source in the national economy (Plan Bleu, 2007b). Among the more important of the impediments relevant to agriculture, include the low levels of public R&D on renewable energy, and the economics of developing renewable energy from agricultural feedstocks remain uncertain without government support, with the notable exception of biogas.

Climate change and agriculture: projections and challenges

The most recent climate change models project the following impacts of climate change on temperatures, rainfall, and water supplies over the 21st century to 2100 in Israel (Brown and Crawford, 2009; Mariotti *et al.*, 2008; Parry *et al.*, 2007; Plan Bleu, 2008; Snir, 2006):

1. an increase in temperature of 3-5 °C by 2100, with greater temperature variability;
2. a 10%-30% reduction in current annual average rainfall;
3. a tendency towards more extreme events/years, leading to a greater incidence and severity of drought and flood events; and
4. a decline in freshwater supplies by 60% from current levels by 2100, due to a lack of water recharge, and sedimentation and salinisation of reservoirs.

The climate change projections for Israel are subject to two main uncertainties. First, incomplete knowledge of climate change science; and second, the unknown evolution of future Israeli economic activity and the country's capacity to develop strategies to adapt to climate change (Plan Bleu, 2008). It would seem from recent events that Israeli agriculture is already experiencing the impacts of climate change. This includes a five year period of drought (Figure 3.3), an increase in the incidence of extreme summer/winter temperatures, as well as more flood and drought events (Snir, 2006).

Recent studies based on modelling the aggregate impacts of climate change projections on Israeli agriculture, suggest the following:

1. Over the period up to 2020 climate change could be beneficial to agriculture, due to the ability of Israel to supply international markets earlier in the season (Fleischer *et al.*, 2008), although this result is contested in some models (Kan *et al.*, 2006).
2. Climate change over the long run to 2100 would be detrimental to net farm revenues (Fleischer *et al.*, 2008; Haim *et al.*, 2008; Kan *et al.*, 2006).

The critical challenge for Israel is how the projected 700 Mm^3/y increase in total water consumption by 2025 (from the current level of around 2 000 Mm^3/y), can be reconciled with the expectation that climate change and climate variability will lead to a reduction in water resource availability (Table 3.2) (Yehoshua and Shechter, 2003). For agriculture, possibilities exist to improve the efficiency in water use. While irrigated agriculture is expected to increase its total use of water from 2005 to 2025 by almost 270 Mm^3/y, its overall share in total water consumption is projected to decline, while use of recycled effluent water and desalinated seawater by agriculture should increase compared to a reduction in the use of freshwater.

3.8. Challenges in improving the environmental performance of Israeli agriculture

There remain significant challenges for policy makers to improve the environmental performance of Israeli agriculture, but considerable progress has been made since the early 1990s. A key achievement has been the reform of water policies as they affect agriculture, especially raising the real price of water charges to farmers so they reflect an increasing share of the full costs of supplying water to agriculture (Figure 3.10). These reforms will continue with the government agreement in 2006 to further raise water charges paid by farmers so they cover the average cost of water production by 2015. As part of this reform has also been the success in reducing the use of scarce freshwater resources by agriculture, while increasing the supply of recycled effluent water available to the sector.

Other areas of environmental progress in agriculture have been the inclusion of environmental provisions as part of the dairy sector reform, in particular, upgrading of manure waste and effluent treatment, and development of biogas. Use of pesticides is being curbed through wider adoption of Integrated Pesticide Management, greater use of bio-controls and expansion of organic farming. Soil degradation and desertification in agriculture is being better managed through programmes to improve soil conservation, drainage and proving support for low/no-tillage equipment. Many of these measures have also had beneficial impacts for the conservation of biodiversity. In addition, a concerted effort has been made to reduce methyl bromide use in agriculture.

Despite these achievements, challenges remain to further improve the environmental performance of agriculture. A key challenge for Israeli agriculture will be reconciling the growing pressures of climate change and population on already scarce land and water resources with greater public expectation that agriculture should improve its environmental performance.

Building on the achievements to date in enhancing environmental performance in agriculture, ***Israel could further strengthen policy approaches in***:

- ***Managing water resources:*** As agriculture consumes around 55% of water resources and in view of projected climate change impacts, the measures that could be undertaken to make additional improvements in water use efficiency, include:
  - meeting the agreement conditions between the government and farmers in 2006 to further increase water to cover average costs of water production delivery by 2015;
  - examining who should bear the costs of recycling effluent water (REW) supplied from urban and industrial processes to agriculture, in view of the growing support for REW;
  - ensuring that regional and seasonal variation in the cost of supplying recycled effluent water is reflected in water charges to farmers;
  - exploring the possibilities of trading water quotas between different agricultural producers and over the medium term with other water users, including use for environmental needs.
  - eliminating the water extraction levy concession to better deliver the sustainable use of groundwater; and
  - improving hydrological information to better guide policy makers in the allocation of rights to use groundwater.
- ***Controlling water pollution:*** Pollution of water from agricultural activities is a long standing problem, and approaches to improve the control of pollution from agriculture might include:
  - streamlining the highly complex policy and institutional framework governing the control of water pollution from agriculture and other sectors of the economy;
  - extending measures and enforcement of current regulations to deter pollution across all agricultural sub-sectors and not just parts of the livestock sector; and
  - upgrading effluent treatment both to expand the availability of recycled effluent water for agriculture and to lower effluent pollution of water.
- ***Combating land degradation and desertification:*** To supplement existing policy measures to address various forms of land and soil degradation processes associated with agricultural activities the following could be considered:
  - encouraging greater uptake of conservation or minimum tillage practices; and
  - examining the potential to further develop managed grazing systems in semi-arid areas, especially those practised by some nomadic Bedouin herders in the Negev desert.
- ***Protecting biodiversity and open spaces (landscapes):*** Biodiversity and farmed open spaces are endangered from accelerated urbanisation and certain agricultural practices, which for agriculture could be addressed by undertaking the following measures:
  - establishing a set of targeted agri-environmental policy measures, such as payments for ecosystem services, that directly provide incentives toward conservation of biodiversity and open space related to agriculture;
  - developing programmes for the *ex situ* (*e.g.* sperm banks) and *in situ* conservation of livestock genetic resources to the level attained for plant genetic conservation; and
  - enforcing planning regulations for farmland valued for biodiversity and open space qualities to prevent its unauthorised sale and development for urban and commercial development.

- ***Reducing air pollution:*** Agricultural air pollution mainly occurs from the release of ammonia from livestock and fertiliser use, and ozone depleting emissions from using methyl bromide. Efforts to further reduce these emissions might encompass:
  - extending knowledge of the extent and impacts of ammonia emissions from agriculture on soils and eutrophication of water bodies; and
  - making a more concerted effort to meet Israel's commitment under the *Montreal Protocol* to completely abandon production and use of methyl bromide by agriculture, particularly by reinforcing wider adoption of Integrated Pest Management.
- ***Responding to climate change and climate variability:*** Climate change policy approaches that could help toward mitigating agricultural greenhouse gas emissions and contribute to the adaptation of agriculture to climate change, might involve:
  - preparing a targeted policy framework to address climate change mitigation and adaptation policies encompassing all agricultural sub-sectors;
  - undertaking cost-benefit analysis of different climate change strategies in agriculture; and
  - analysing the potential economic and environmental benefits of using agricultural wastes to generate renewable energy, as already achieved for biogas generated from dairy cows.

Policies toward addressing environmental issues in agriculture appear to have evolved over the past decade in a piecemeal and uncoordinated manner. If the future challenges to improve the environmental performance are to be addressed this will require ***developing a more integrated and coherent policy approach***, including greater involvement of all relevant stakeholders, that could be achieved by considering:

- moving toward greater policy integration and coherence across agricultural, environmental, water and energy policies which could provide environmental co-benefits, including through greater use of market based approaches and payments for ecosystem services by agriculture; and
- ensuring greater integration of urban and industrial planning regulations with agricultural policies that are seeking to protect biodiversity and open spaces related to agriculture.

In establishing a more integrated and coherent agri-environmental policy framework it will be important to ***improve environmental monitoring and policy evaluation***. Current deficiencies in the data available to policy makers should be addressed, so that information is available to undertake an evidence-based environmental and economic evaluation of policies. To address data and monitoring gaps related to agri-environmental linkages it is suggested effort could be made to:

- improving data sets for monitoring, especially related to: water pollution; land degradation; biodiversity; open spaces; and a full inventory of greenhouse gas emissions and sequestration; and
- monitoring and evaluation of the economic efficiency and environmental effectiveness of agri-environmental policies, and cost-benefit analysis of measures before their introduction.

Notes

1. Agriculture refers here and elsewhere in the chapter to the primary agricultural sector, and not the agro-food chain (*i.e.* including related upstream and downstream sectors) or agro-forestry, unless otherwise stated.
2. Agricultural land includes the area under arable crops, permanent crops, pasture and farm buildings.

3. For a more detailed description of the main environmental issues of concern to agriculture, outlined in this and the subsequent paragraph see the Ministry of Environmental Protection website under "Environmental Topics""Agro-ecology" at: *www.sviva.gov.il/bin/en.jsp?enPage=e_home*.

4. Israel is not included in the Annex A group of developed countries that agreed to make emission cuts under the *Kyoto Protocol* (Section 3.7).

5. There is an extensive literature (in Hebrew and English) on the management of water resources in Israel, for a selection of the key English references drawn on in this section, the reader is guided to the following: Feitelson (2005); Fischhendler (2008); Kislev (2001); Margoninsky (2009); Margoninsky (2006); Mizrahi (2004); OECD (2009e); and the World Bank (2006).

6. Israel has a transboundary agreement with Jordan for 55 million m^3 per year (OECD, 2009d). Transboundary issues related to water resources and agriculture are outside the scope of this report, but for literature (in English) covering the issue of water between Israel and the Palestinian Authority see for example: Deconinck (2004); Friends of the Earth Middle East (2008); Jarrar and Awayes (2004); Water Authority (2009); and World Bank (2009).

7. There are various terms used in the literature for different types of water, but for the purposes of this document the following terms have been used: *Freshwater* – renewable natural water from either surface water (rivers and lakes) or groundwater (wells and aquifers), sometimes referred to as drinking or potable water; *Recycled effluent* – includes treated sewage, industrial and other wastewater, sometimes referred to as wastewater and recycled sewage; *Saline water* – including desalinated seawater and desalinated brackish, sometimes termed desalinated water; *Marginal water* – this includes all other sources of water, in particular, stored flood water.

8. Other, more minor, initiatives have also been developed to expand water supplies, such as artificially induced rainfall through cloud seeding (World Bank, 2006), while further initiatives are being researched and developed, for example, gathering dew.

9. For a review of the economic and environmental costs and benefits of the Red-Dead Sea Conveyor see: Becker and Katz (2006); Douglas (2008); The Jerusalem Institute for Israel Studies (2006); Lipchin (2006); Qdais (2008); and Tal (2006). Recent reports suggest Jordan is prepared to begin the project on its own, although the World Bank expects a further 2 years is required to complete a feasibility study of the project.

10. Comparing the physical efficiency of irrigation water use in terms of megalitres/hectare irrigated needs to be treated cautiously for Israel, in view of: multicropping on the same hectare irrigated; irrigation in intensive greenhouses; water quality as more water is required the lower the quality of the water (*e.g.* saline, brackish); different climatic zones requiring different quantities of water; and recent changes in the system of data collection for the area irrigated.

11. Because of a break in the statistical series for the total agricultural land and total irrigated area, the data from 2000 to 2008 in the text and Figure 3.2 are OECD estimates.

12. The decrease in output per m^3 irrigated in the period prior to the late 1990s was, in part, due to increased supplies of recycled effluent water, as noted previously in this section.

13. This section focuses on the historical and future trends in support for water supplied to agriculture, with a description of recent budgetary outlays outlined in Section 2.2 of Chapter 2.

14. Pollution (including pollution of water and air, visual blights and nuisance odours) from abattoir and plastic wastes arising from agricultural activities are not considered in this report, for further information see the Ministry of Environmental Protection website under "Environmental Topics" "Agro-ecology" at: *www.sviva.gov.il/bin/en.jsp?enPage=e_home*.

15. The salinity in Lake Kinneret does not accumulate but instead fluctuates annually with the salt transported from the lake into the water system.

16. In 1970 an outbreak of cholera occurred in Jerusalem involving some 200 clinical cases. Evidence suggested that the outbreak was closely linked to the consumption of vegetables produced on land illegally irrigated with untreated effluent. This incident provoked the government to introduce more stringent regulations concerning use of recycled effluent for irrigation (Fattal *et al*., 2004; and Margoninsky, 2009).

17. The notable exception to water monitoring is Lake Kinneret, which has been the subject of intensive studies and monitoring for over 40 years (Box 3.2). However, while the water monitoring information on Lake Kinneret is comprehensive, it is not necessarily sufficient to examine the interactions between the lake's water management and water quality (Gal *et al*., 2009).

18. Additional details of the environmental components of the livestock reform programmes are provided on the Ministry of Environmental Protection website under "Environmental Topics" "Agro-ecology" at: *www.sviva.gov.il/bin/en.jsp?enPage=e_home*.

19. The only source in English providing some information on the use of pesticides (but no time series data nor information on concentrations in water bodies) is available on the Ministry of Environmental Protection website under "Environmental Topics" "Agro-ecology" at: *www.sviva.gov.il/bin/en.jsp?enPage=e_home*.

20. An important issue in the Negev region is the environmental and economic impacts of nomadic herders (typically Bedouin) in the region. This issue is outside the scope of this report, but see for example, Abu Rabia *et al.*, 2008; Portnov and Safriel, 2004; UNCCD, 2006; and Wachs and Tal, 2009.

21. Data on bird populations are collected by the Nature and National Parks Authority, see the website (only in Hebrew) at: *www.parks.org.il/BuildaGate5/portals/parks/imagesFILES/Advanced1217319418.pdf*, and also Labinger and Alon (2007), and Nature and National Parks Authority (2005).

22. Personal communication with Professor Alon Tal, Ben Gurion University of the Negev.

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OECD Review of Agricultural Policies

ISRAEL

Israel's agriculture is unique amongst developed countries in that land and water resources are nearly all state-owned and that agricultural production is dominated by co-operative communities. Since the late 1980s, agriculture has benefited from: a stable macroeconomic climate; policy reforms; high levels of investment in R&D; a developed education system; high-performing extension services; and accumulated farm management expertise. Israel is a world leader in agricultural technology, particularly in farming in arid conditions. Israeli agriculture thus relies on an "induced", rather than "natural", comparative advantage, one built on knowledge and technological progress.

This *Review* measures support provided to Israeli agriculture and evaluates the effectiveness of current agricultural policy measures. Israel has made progress in removing policies that distort trade and resource allocation, and support to agriculture is lower than the OECD average. However, the government still plays an important role in farming. This is reflected by its involvement in the allocation of key factors of production – land, water and foreign workers – and by high border protection, subsidisation of water and capital and measures securing profitability for milk and egg producers. The report suggests further agricultural policy reforms to reduce costs for consumers and taxpayers, and to improve the efficiency of current policy measures.

A special focus of the report is the environmental performance of Israeli agriculture. This is already an issue with scarce land and water resources, accentuated by the overarching issue of climate change. The *Review* examines agriculture's performance with respect to water resources and pollution, soils, biodiversity, air emissions and climate change. It concludes that strengthening policy coherence, especially in improving the management of water resources in agriculture, is important.

The data used for the calculation of the level of agricultural support (PSE/CSE) in Israel and complete documentation of definitions and sources are available at: ***www.oecd.org/agr/support***.

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