



Australian Government
**Department of Agriculture
and Water Resources**
ABARES

What Indonesia wants

Analysis of Indonesia's food demand to 2050

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and Brian Moir

Research by the Australian Bureau of Agricultural
and Resource Economics and Sciences

Research report No. 15.9
November 2015



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Cataloguing data

This publication (and any material sourced from it) should be attributed as Gunning-Trant, C, Sheng, Y, Hamshere, P, Gleeson, T & Moir, B 2015, *What Indonesia wants: Analysis of Indonesia's food demand to 2050*, ABARES research report no 15.9, Canberra, November. CC BY 3.0.

ISSN 978-1-74323-227-9

ISBN 1447-8358

ABARES project 43433

Internet

What Indonesia wants: Analysis of Indonesia's food demand to 2050 is available at <http://agriculture.gov.au/abares/publications>.

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Acknowledgements

The authors thank Jammie Penm, Sally Thorpe, Matthew Hyde, Dean Mansfield, Matthew Miller, and David Cui of ABARES for their insights and contributions to this report.

Foreword

Indonesia's role in South East Asia continues to strengthen with its rapid economic growth and increasing regional and global integration. Indonesia's economy differs significantly from Australia's and there are likely to be major and mutual benefits from a deepening of the trade and investment relationship. Australia's agricultural sector is well poised geographically and strategically to benefit from Indonesia's market potential. The 2015 Agricultural Competitiveness White Paper demonstrates the Australian Government's commitment to strengthening the sector and to developing stronger relationships with overseas markets. Australia's engagement in the negotiations for the Regional Comprehensive Economic Partnership (RCEP), in which Indonesia is a party, is a current example of that commitment. These and future trade agreements will build enhanced opportunities for Australian agricultural exports.

This report, which is part of the *What Asia wants* series, analyses future food consumption and trade trends in Indonesia over the long term. Previous reports in this series are *What Asia wants*, *What China wants* and *What India wants*.

Karen Schneider
Executive Director
November 2015

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Summary

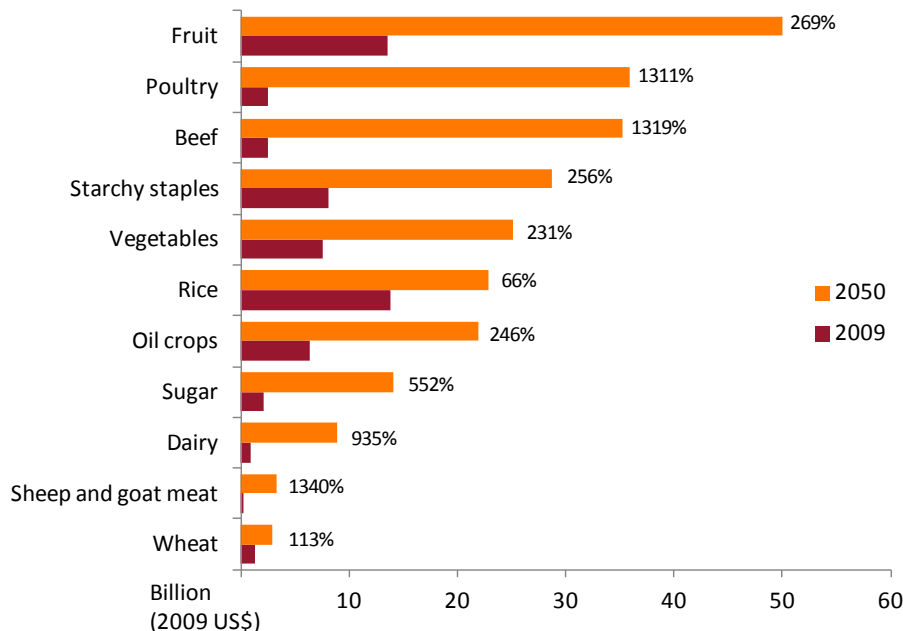
Indonesia has emerged as a growing and important market for Australian agricultural commodities. In 2014, Australia was the second-largest exporter of agricultural products to Indonesia, behind the United States, supplying around US\$2.6 billion of agricultural commodities.

Over the next few decades, sustained economic growth, population increases and continued urbanisation are expected to change Indonesia's demand for food. Not only will total food consumption increase but diets are expected to become more diverse. The value of agrifood consumption in Indonesia is projected to quadruple between 2009 and 2050.

At the same time, the Indonesian agrifood sector faces challenges to increase its production and productivity growth. The Indonesian Government's commitment to agricultural investment will be required to mitigate or overcome the persistent challenges of a limited land supply, an agricultural sector characterised by smallholdings, a deteriorating resource base, and ongoing competition between production of cash crops and food crops.

The rise in the real value of food consumption in Indonesia will be characterised by a move to more diverse diets, with higher intake of meat, dairy products, fruit and vegetables. Between 2009 and 2050, the real value of beef consumption is projected to rise more than 14 times, dairy ten times, and fruit and vegetables three times (Figure S1). These increases are driven mainly by greater quantities demanded.

Figure S1 Agrifood consumption in Indonesia



Note: Starchy staples include pulses, potatoes, yams and cassava.
Source: ABARES model output

For many commodities, the value of consumption in 2050 is projected to rise from a very low base. Average per person consumption is currently low because of high rates of poverty. For example, on a per person basis, Indonesian consumption of meat in 2009 was between 70 per cent and 80 per cent less than that of Japan, the Republic of Korea, China and many other ASEAN

nations. As per person income rises, there is significant potential for food consumption to increase in Indonesia.

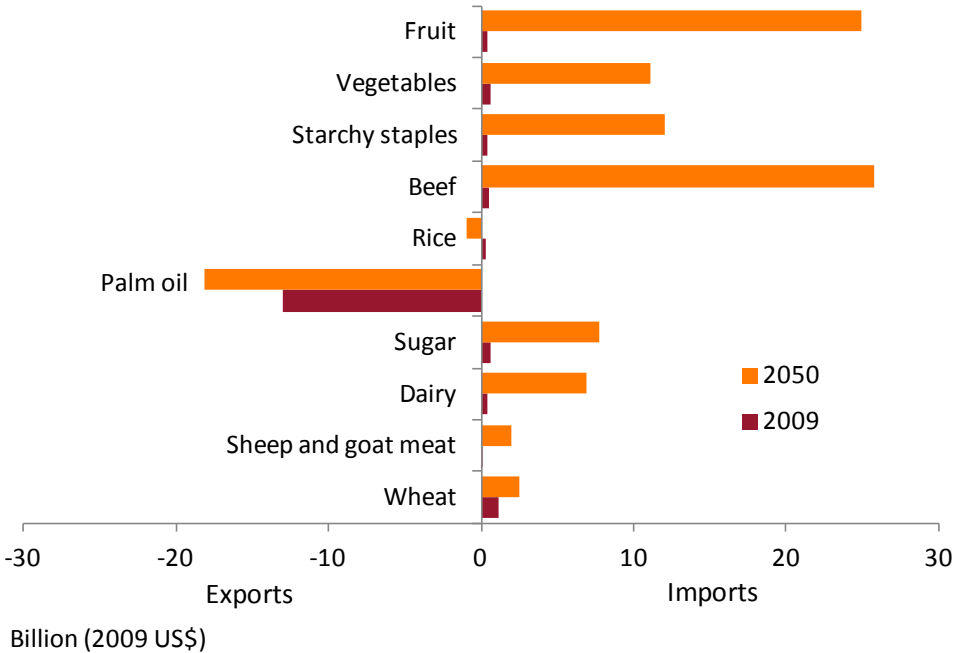
The upward trend in agrifood demand is most pronounced among urban households because of expected higher income growth and continued urbanisation to 2050. In rural households, a declining rural population and relatively lower incomes will result in slower food consumption growth than urban households.

The real value of Indonesia's agrifood production is projected to more than double from US\$81 billion in 2009 to almost US\$173 billion in 2050 (in 2009 US dollars). This increase is driven by projected higher production of beef (up 209 per cent), poultry (187 per cent), starchy staples (115 per cent), vegetables (92 per cent), fruit (78 per cent) and rice and palm oil (up 77 per cent each).

Indonesia has a comparative advantage in the production of non-food, cash crops, such as natural rubber, copra, palm kernels, coffee, cocoa and spices. In Indonesia the production of these cash crops competes with food crops for resources, despite Indonesia's policies that support food production and food self-sufficiency. The production of non-food, cash crops is also likely to increase over the projection period, although modelling of these crops is outside the scope of this analysis.

Under the assumption of no major policy changes to 2050, food imports are projected to be an increasingly important component of Indonesia's food supply towards 2050. The real value of agrifood imports is projected to rise more than 20 times from 2009, to US\$152 billion (in 2009 US dollars) in 2050. In 2050, imports of beef are projected to reach US\$26 billion (in 2009 US dollars), compared with US\$0.5 billion in 2009 (Figure S2). Imports of dairy products are projected to be US\$7 billion in 2050, compared with US\$0.4 billion in 2009. For fruit and vegetables, the value of imports is expected to increase by almost US\$25 billion and US\$11 billion (in 2009 US dollars), respectively, between 2009 and 2050.

Figure S2 Trade of selected agrifood commodities, Indonesia



Source: ABARES model output

Because of their geographic proximity, Australia and Indonesia are well placed to benefit from advancing bilateral agricultural trade. Indonesia is already an important market for Australian wheat, sugar, live cattle, beef, skim milk powder, and horticultural products such as grapes and citrus. Stronger projected demand for these commodities and others in Indonesia will create further opportunities for Australian exporters.

1 Introduction

World demand for agrifood products is expected to increase significantly over the period to 2050, with the real value of Asian agrifood demand expected to double (Linehan et al. 2012a). The rise in the global population, per person incomes and rates of urbanisation, especially in developing countries, are driving this increase. In Indonesia, projected strong population and economic growth over the coming decades are expected to result in a marked increase in total food consumption.

Indonesia is becoming an increasingly important export destination for many Australian agricultural commodities. In 2014, Australia was the second-largest exporter of agricultural products to Indonesia, behind the United States. Australia supplied around US\$2.6 billion of agricultural commodities (excluding tobacco and its products), compared with US\$680 million in 2000 (in 2014 US dollars).

The objective in this report, the fourth in the *What Asia wants* series, is to build upon existing ABARES analysis of global food consumption and production by examining the factors likely to influence the future pattern of Indonesia's food consumption, with particular attention to household consumption trends across urban and rural consumers.

For this analysis, an updated version of the ABARES agrifood model (Linehan et al. 2012b) was developed. The model is a partial equilibrium economic model of global agricultural production, consumption and trade with a base year of 2009. The agrifood products in the model include both primary and lightly transformed agricultural products, such as flour and meat. Uses of agrifood products include direct food use, feed use and industrial use. Highly processed food items, such as beverages and packaged foods, are not included, nor are non-food agricultural commodities and cash crops, such as natural rubber, copra, palm kernels, coffee, cocoa and spices. In this report, Indonesia's targeted consumer subsidy for rice, Raskin, is built into the model baseline.

Chapter 2 of this report examines the factors expected to influence Indonesia's food demand trends to 2050 and presents the income and population assumptions used in the analysis. Chapter 3 discusses some of the production constraints and challenges with which Indonesia will have to contend over the longer term in order to increase its agricultural output. Chapter 4 briefly outlines Indonesia's principal agricultural policies supporting food security. Chapter 5 discusses projected consumption, production and trade trends to 2050 in a business-as-usual policy environment, as well as in a lower economic growth scenario. Chapter 6 summarises the main findings of the analysis.

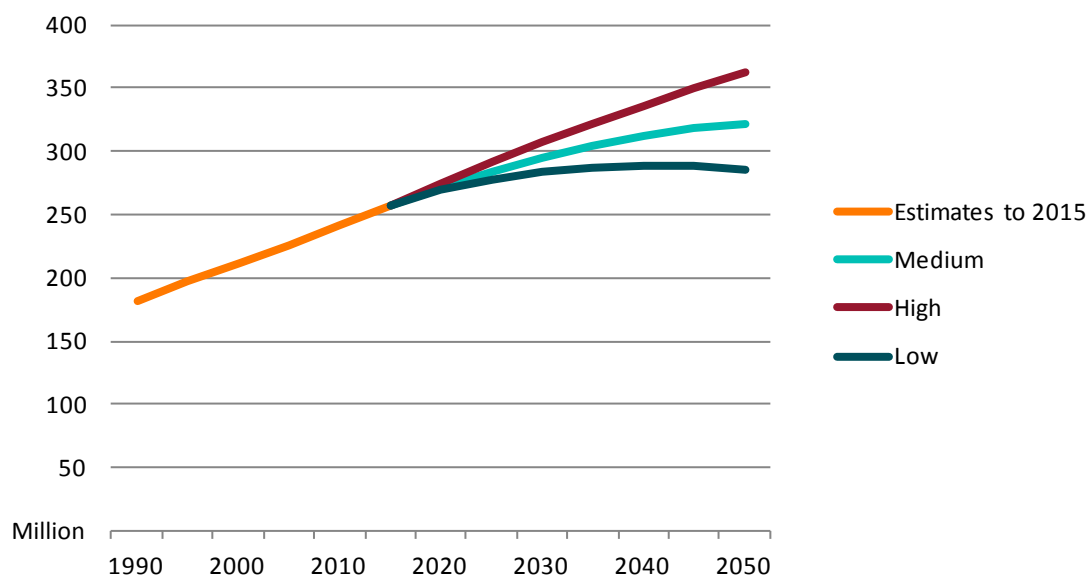
2 Drivers of food demand

Food consumption at the national level relates to the size of the population and the amount of food consumed by each person. Changes in per person food consumption, as well as in the mix of foods consumed, are largely influenced by growth in household incomes and by factors such as the age structure of the population, lifestyle, and the proportion of the population living in urban and rural areas. This chapter discusses the contribution of these factors to the expected increase in Indonesian food demand to 2050.

Population

Indonesia's population grew from just over 180 million in 1990 to more than 257 million in 2015, an average growth rate of 1.4 per cent a year (Figure 1). Under the medium-variant projection of the United Nations the population is expected to grow by an average of 0.6 per cent a year between 2010 and 2050 (United Nations Population Division 2015). At this rate, the population would grow by some 65 million to reach 322 million in 2050.

Figure 1 Indonesia's population



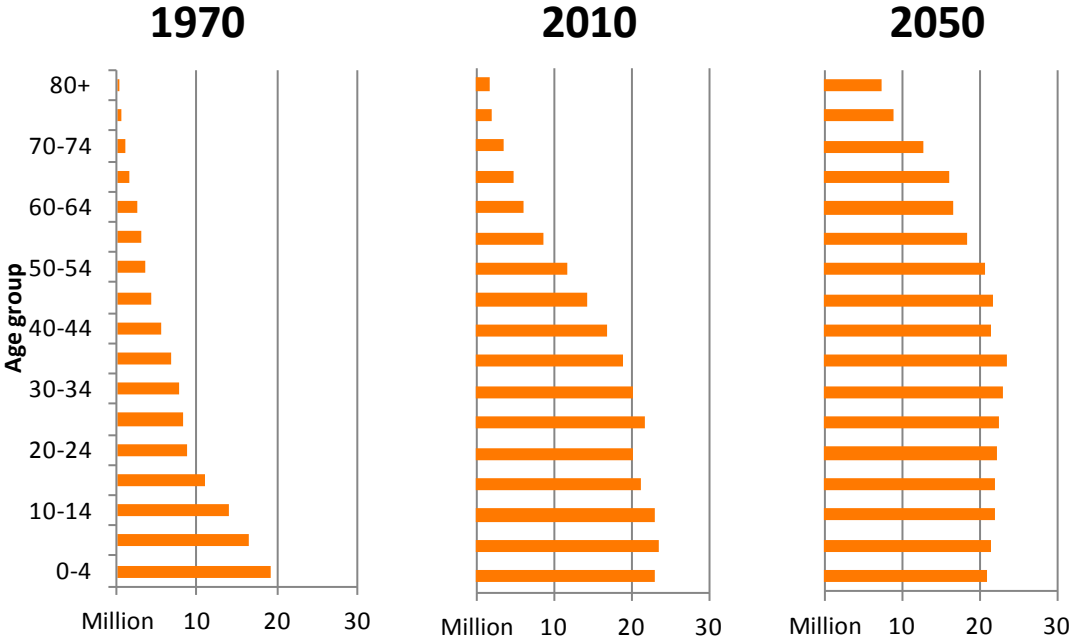
Source: 'World population prospects, the 2015 revision', United Nations Population Division (United Nations Population Division 2015)

Indonesia's population growth during much of the past half century was partly the result of a significant decline in mortality rates. Between 1950–55 and 2005–10 Indonesia's crude death rate declined from 21 per 1 000 people to 7 per 1 000 people. Between 1950–55 and 1970 the crude birth rate was high, above 40 births per 1 000 people. However, it began to decline in about 1970, reaching 21 births per 1 000 people by 2005–10.

The declining birth and death rates in the four decades to 2010 resulted in a significant shift in the age distribution of the population (Figure 2). In 1970, 67 per cent of the population was aged under 30; by 2010 this group constituted 55 per cent of the population. By 2050 it is projected to be only 41 per cent. Conversely, the proportion of the over-50s in the population was 11 per cent in 1970 and 16 per cent in 2010, and is projected to increase to 31 per cent by 2050.

Compared with other Asian countries, Indonesia's population is relatively young (Elias & Noone 2011). The proportion of people of working age (15 to 64) in the population is forecast to remain above 65 per cent beyond 2045 (United Nations Population Division 2015) and the absolute number of people of working age is also expected to continue to increase.

Figure 2 Population distribution by age, Indonesia



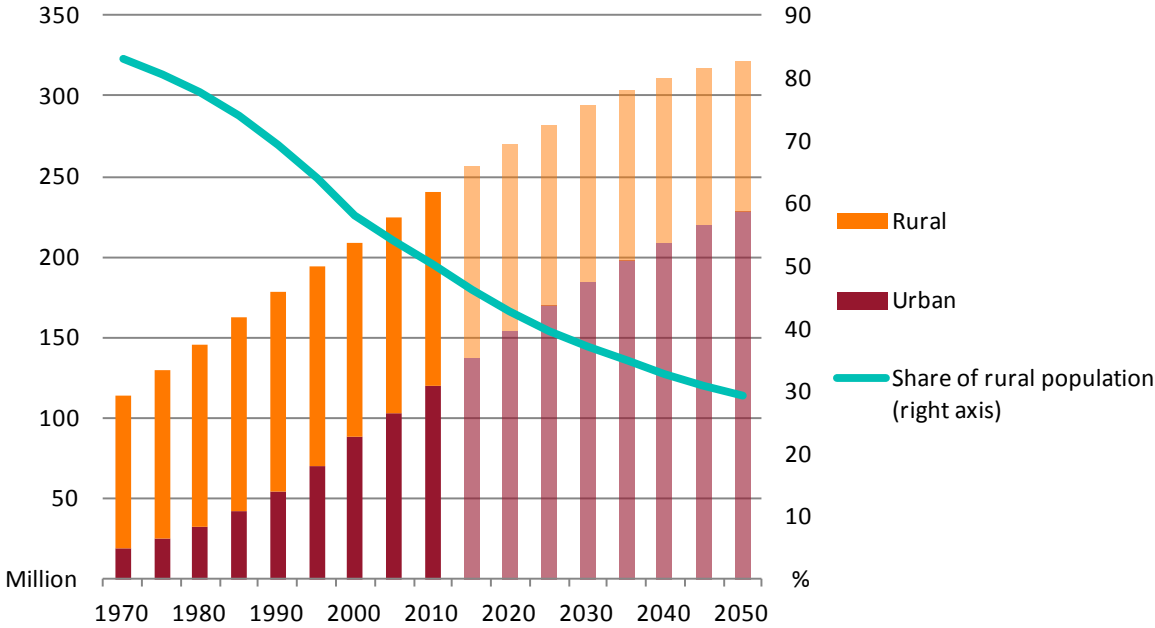
Source: 'World population prospects, the 2015 revision', United Nations Population Division (United Nations Population Division 2015)

The changing age structure is likely to have an effect on patterns of food demand. Nutritional requirements increase as children age to maturity and decline as adults age. Older people generally consume less food and typically prefer more traditional foods.

Urbanisation is an important determinant of consumer demand for food. Urban dwellers typically have higher incomes than their rural counterparts, and different dietary and shopping patterns. Over the four decades from 1970 to 2010, Indonesia's urban population expanded by an average of 4.5 per cent a year (Figure 3). The rural population grew more slowly than the urban population, reaching a peak in 1995. Since 2010 the total number of urban residents has exceeded rural residents.

Jakarta is by far Indonesia's largest city, with a population of just over 10 million (United Nations Population Division 2014). Jakarta has four times the population of the second-largest city, Surabaya. However, most other cities are growing at faster rates than Jakarta. In 2050, 71 per cent of Indonesia's population is projected to live in urban areas, compared with 54 per cent in 2015 (United Nations Population Division 2014).

Figure 3 Urban and rural population, Indonesia

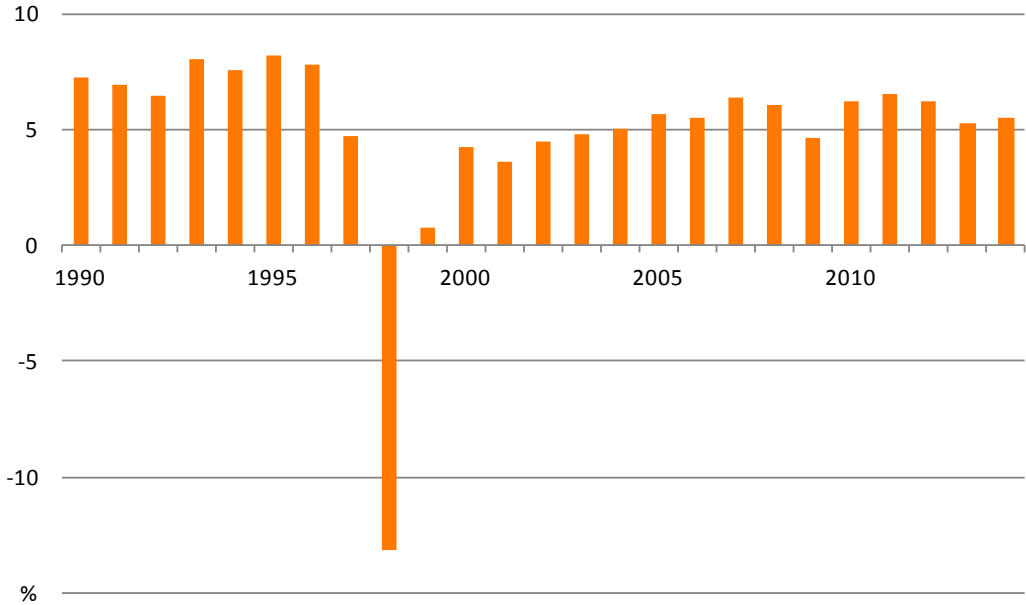


Source: 'World urbanisation prospects, the 2014 revision', United Nations Population Division (United Nations Population Division 2014)

Incomes

The Indonesian economy has grown consistently over the past two decades, apart from the Asian financial crisis of 1998 (Figure 4). Indonesian GDP, in constant prices, almost tripled between 1990 and 2012 (IMF 2015). Average incomes per person, in constant prices, doubled over the same period.

Figure 4 GDP growth in Indonesia



Source: 'World Economic Outlook Database', International Monetary Fund (IMF 2015)

Indonesia's economic growth has not been shared equally across the population. Although the middle class (defined as those with daily expenditure of between US\$2 and US\$20 in 2005 purchasing power parity terms) expanded from around 25 per cent of the population in 2000 to 57 per cent in 2010, income inequality has increased (Afif 2014; Indonesian Central Bureau of Statistics 2015a). Income growth and income inequality both have important implications for food consumption. The expansion of the middle class has been a significant factor behind the increase in Indonesia's total food consumption. However the rise in inequality implies there remains a considerable proportion of the population with low incomes and limited capacity to buy food.

In the baseline projections presented in this report, Indonesian GDP is assumed to grow according to OECD (2012a) projections (Table 1). Between 2011 and 2030, real GDP growth is assumed to increase at an average of 5.3 per cent a year, before weakening between 2030 and 2050 to average 3.4 per cent a year. Urban incomes are assumed to continue to grow faster than rural incomes over the period to 2050, averaging 5.6 per cent and 2.1 per cent a year, respectively. An alternative scenario of lower economic growth is also examined, based on World Bank (2015) projections (see Chapter 5, Table 7).

Table 1 Indonesia GDP growth, 2009 to 2050

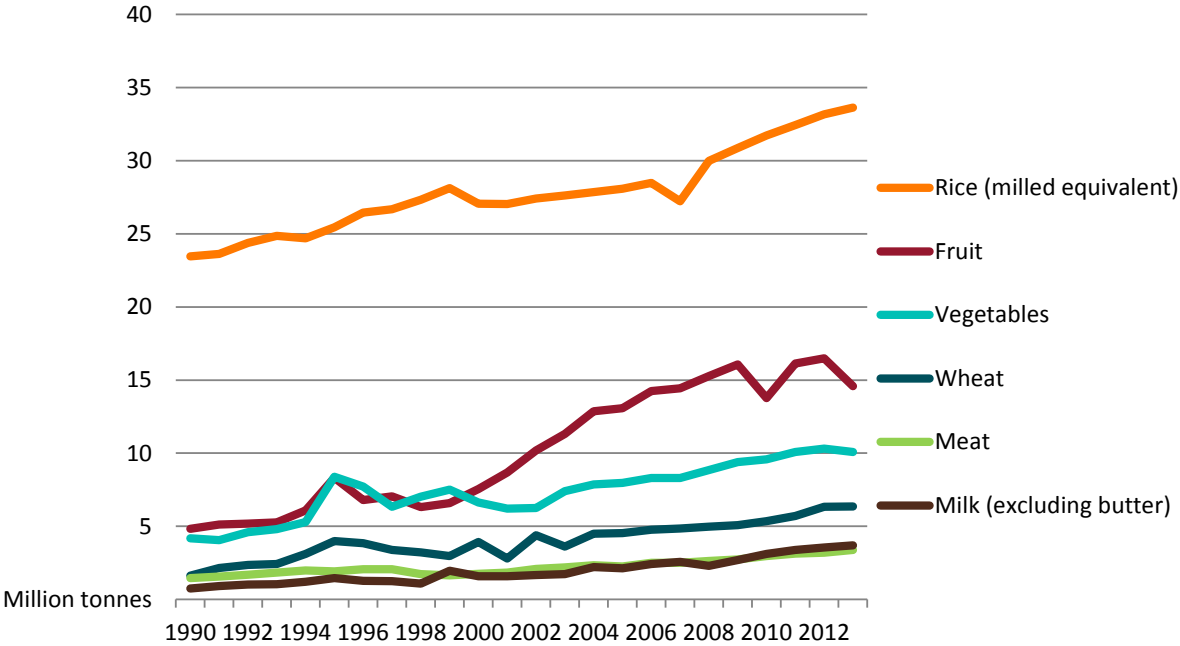
	1991-2010	2011-2020	2021-30	2031-40	2041-50
Average annual growth (%)	4.4	5.3	5.3	3.4	3.4

Source: 'Looking to 2060: A global vision of long-term growth', Economics Department Policy Notes, no. 15, Organisation for Economic Co-operation and Development (OECD 2012a)

Food consumption

Total food consumption in Indonesia has increased in response to rising incomes and population. Between 1990 and 2013, total consumption of wheat, fruit and milk each increased by more than 200 per cent (Figure 5). Consumption of vegetables more than doubled over the same period and meat consumption almost doubled. Consumption of rice—a staple food in Indonesian diets—increased by only 32 per cent.

Figure 5 Consumption of selected foods, Indonesia

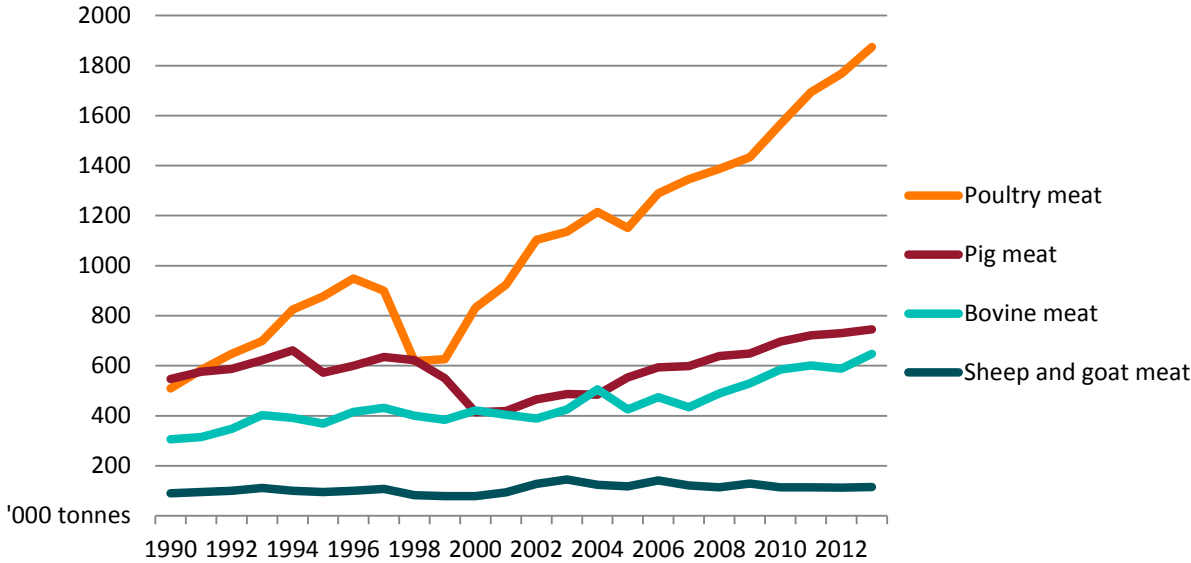


Source: 'FAOSTAT', Food and Agriculture Organization of the United Nations (FAO 2015)

Between 1990 and 2013 the average calorie intake per person in Indonesia increased by 19 per cent. The contribution of starchy roots and pulses to individuals' calorie intake declined, while the contribution of fruit and vegetables, meat and fish increased. Average per person consumption of milk and other dairy products more than doubled but remained of limited significance.

Poultry is the major source of meat in Indonesia, accounting for over half the total meat consumed in 2013 (Figure 6). Pig meat constituted almost a quarter of total meat consumption in 2013, consumed by non-Muslim people. Consumption of beef, which ranks third, has been increasing more slowly than chicken meat consumption because it is relatively more expensive (FAO 2015). Sheep and goat meat accounted for less than 5 per cent of total meat consumption.

Figure 6 Total consumption of meats, Indonesia



Source: 'FAOSTAT', Food and Agriculture Organization of the United Nations (FAO 2015)

On a per person basis, Indonesia's consumption of many food groups is relatively low. This is because a high portion of its population lives at or near the poverty line. Per person consumption of meat in 2011 was between 70 per cent and 80 per cent less than that of Japan, the Republic of Korea, China and many other ASEAN nations (Table 2). For dairy it was around 80 per cent less than that of Japan, 56 per cent less than China, 47 per cent less than the Republic of Korea, and lower than other ASEAN countries. For fruit and vegetables it was between 30 per cent and 65 per cent less than that of Japan and the Republic of Korea, 74 per cent less than China, and lower than other ASEAN countries. These relatively low per person consumption levels underline the potential for sizable increases in per person food consumption as incomes rise.

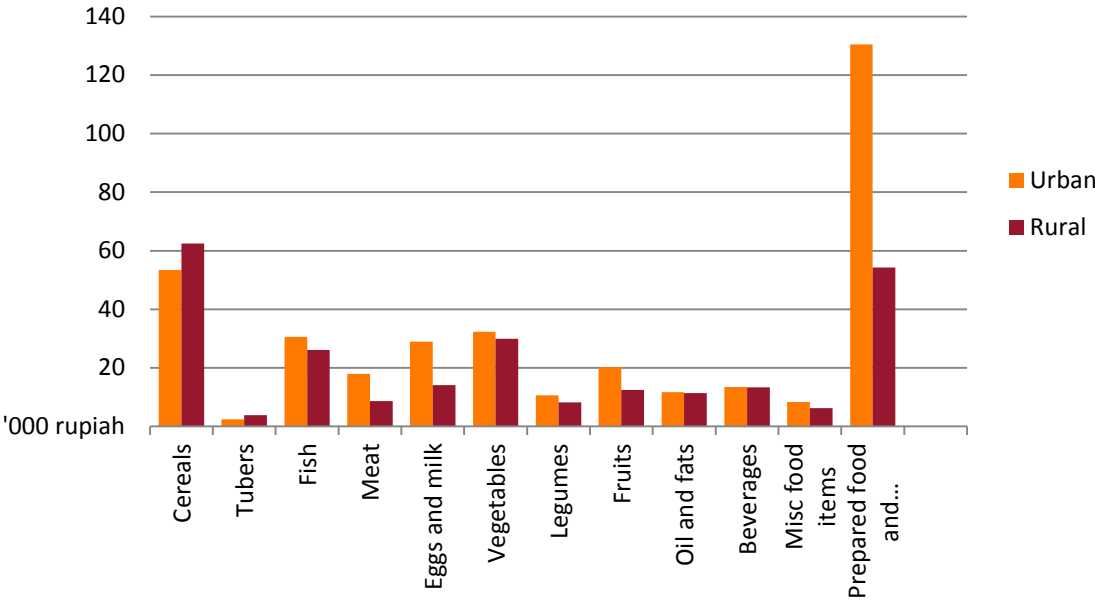
Table 2 International comparison of annual per person food consumption, 2011

Country	Meats kg	Dairy kg	Fruit and vegetables kg	Cereals kg
Japan	48.8	71.3	152.4	104.4
Republic of Korea	62.2	26.4	288.8	151.5
China	57.7	31.5	417.8	151.5
Malaysia	53.3	32.2	113.1	146.6
Philippines	34.5	14.5	179.6	157.7
Vietnam	57.6	15.1	144.5	167.0
Indonesia	12.9	13.9	107.5	190.6

Source: 'FAOSTAT', Food and Agriculture Organization of the United Nations (FAO 2015)

Diets of urban residents are usually different from their rural counterparts. In 2013, Indonesia's urban residents spent an average of 414 000 rupiah a month on food, compared with 299 000 rupiah by rural residents (Indonesian Central Bureau of Statistics 2015b). Urban residents spent more than rural residents on meat, fish, eggs, fruit and prepared (cooked and packaged) foods. Rural residents spent more on cereals and tubers (Figure 7), with 24 per cent of their food budget devoted to cereals alone, compared with only 15 per cent for urban residents.

Figure 7 Expenditure on food items, urban and rural residents, 2013, Indonesia



Source: Indonesian Central Bureau of Statistics 2015b

Food marketing in Indonesia is also changing. In the 1980s, supermarkets occupied only a small niche in food retailing. By the mid-1990s they were still confined to the urban upper income sector. Supermarkets only began to spread quickly in Indonesia after 1998. By 2007 they accounted for about 30 per cent of overall retail food expenditure (World Bank 2007).

The development of supermarkets is typically associated with closer vertical coordination along value chains as the supermarkets maintain close relationships with their suppliers. This often involves contractual arrangements with farmers or, in the case of food imports, with suppliers in other countries. Asian supermarket chains have developed direct relationships with suppliers of fresh horticultural and dairy produce in the United States, New Zealand and Australia (Glover 2011).

3 Production constraints in Indonesian agriculture

The agriculture sector is a key component of the Indonesian economy, contributing about 14 per cent of Indonesia's GDP in 2014 (Statistics Indonesia 2015). Thirty per cent of Indonesia's land area is used for agricultural purposes and the sector employs 41 million people or 35 per cent of the nation's work force. The sector is a strong contributor to Indonesia's trade, with agricultural exports accounting for 24 per cent of the value of total merchandise exports in 2012 (World Bank 2014).

Indonesia's agriculture is generally characterised by fertile volcanic soils and abundant renewable water resources. High population density has resulted in a sector dominated by smallholdings. Agricultural land area per person in Indonesia is low at just 0.22 hectares. This is equivalent to a third of the world average (World Bank 2014). Challenges to agricultural production and productivity growth include the availability and quality of natural resources, insecure land tenure, underemployment of labour and lack of infrastructure.

Resource constraints

Land availability

Indonesia is the world's largest nation archipelago made up of 17 508 islands, of which just over a third are inhabited. Java is the most densely populated island, accommodating more than half of Indonesia's population (57 per cent in 2013) on only 7 per cent of the total land area (Map 1).

Map 1 Map of Indonesia



Source: 'GeoNetwork', Food and Agriculture Organization of the United Nations (FAO 2012)

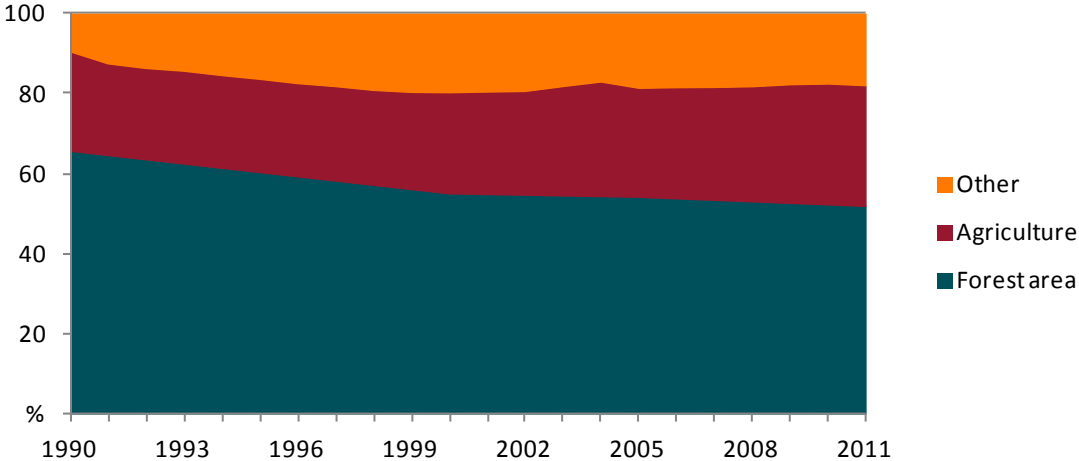
About 30 per cent of Indonesia's land area (545 000 square kilometres) is classified as agricultural land (World Bank 2014). Of this, 43 per cent or 235 000 square kilometres is considered arable, that is, land under annual crops or any fallow or pasture land used for annual crops within any five-year period. The remaining agricultural land is either devoted to plantation crops (such as oil palm, coconut, rubber, coffee and sugar cane) or permanent pasture (natural or seeded grassland that remains unploughed for many years).

The islands of Java, Bali and large parts of Sumatra are home to irrigated lowland rice-paddy terraces and upland rain fed farming. The average size of farms producing rice and other food crops, such as maize, peanuts and cassava, ranges from 0.3 hectares on Java to 1.4 hectares elsewhere (OECD 2013). Java produces around half of Indonesia's rice. Expansion of the lowland rice area in Java is limited because of increasing competition for land with other crops and non-agricultural uses, such as industry uses, housing and roads (FAO 2005).

The plantation and industrial crops sector, dominated by oil palm, coconut and natural rubber, makes up 15 per cent of total crop area. Large private and state-owned farms are involved in these perennial crops—mainly in Kalimantan and Sumatra and mainly for producing oil palm and natural rubber—but there are also many smallholders. The average farm size in this sector is 2 600 hectares (OECD 2013).

Until 2010, growth in agricultural production relied largely on converting forested areas into agricultural land, particularly to oil palm plantations. In the past two decades, millions of hectares were cleared for this purpose. Just over half of Indonesia's total land was classified as forest area in 2011, compared with 65 per cent in 1990 (Figure 8). Driving this trend has been the growing global demand for edible oils and the price competitiveness of palm oil relative to alternatives such as soybean oil (Rabobank 2013). Much of the deforestation is concentrated in Sumatra and Kalimantan.

Figure 8 Land use in Indonesia



Note: Share of total land area.
 Source: 'World Development indicators', World Bank Group (World Bank 2014)

Many less populated islands remain densely forested and are home to forest and coastal communities that sustain themselves through agriculture, hunting, foraging and fishing (USAID n.d.). Indonesia's Ministry of Forestry estimates of bush, shrub grass and barren land across Indonesia total 22 million hectares—around half of which is located in Kalimantan and Papua. McKinsey Global Institute (2012) estimates almost 7 million hectares of this land (much of which used to be in agricultural production but has since been abandoned) could be developed for agricultural production. Alexandratos and Bruinsma (2012) project that, between 2009 and 2050, total arable land in Indonesia will increase by 7.5 per cent—an assumption used in the modelling in this report.

Land degradation

Indonesia is regularly described as being a highly fertile country, but land quality varies across the archipelago. The central islands have more fertile soils and hence are densely populated. Agricultural land in Java, in particular, has benefited from high levels of mineral fertiliser application, soil and water erosion control programmes, and relatively good soil (FAO 2005). In contrast, the soils of the outer, less populated islands are characterised by highly weathered, acidic soils that require higher fertiliser inputs to achieve the high crop yields obtained in Java and the other central islands. Actual fertiliser use in the outer islands is generally lower than on Java, resulting in soil nutrient depletion in the upland crop areas (FAO 2005).

Erosion and associated problems of nutrient depletion are minimal on Java because of the system of flat terracing and well-maintained irrigation schemes. However, in the lower-potential rain fed uplands, where crops such as maize and cassava are produced on sloping hillsides, erosion problems and nutrient depletion are more prevalent. Where deforestation has occurred to make way for plantation crops, loss of forest cover has led to watershed degradation, silting of waterways, flooding, soil erosion and decline in soil quality and soil productivity (World Bank 2009).

Land tenure

Land parcels in Indonesia are highly fragmented, particularly on smallholder farms. As land is passed down the generations, it tends to become divided into smaller parcels (McKinsey Global Institute 2013). While the law requires that all land rights be registered, most of these inherited parcels are unregistered; less than 25 per cent of rural land parcel holders have been registered in the 40 years since land registration began (OECD 2012b). Additionally, a large share of land off Java is communal rather than privately titled. Land rights of these communities are often not formally recognised, increasing the risk of conflict.

The implications of the land tenure arrangements are that, for large investors, gaining access to land is a long and unclear process. As a result, only limited land rights are granted, which compromises the extent to which production can increase (OECD 2012b). For smallholders, unclear land tenure or nonexistence of certificated land registration compounds the difficulties of gaining access to credit from financial institutions. This discourages investment in productivity-enhancing technology and biases farmers' choices away from longer-term activities, such as tree crops (World Bank 2010).

Fertiliser use

The Indonesian Government maintains a ceiling price on fertiliser which, depending on fertiliser type, is between 50 per cent and 75 per cent lower than the market price (Sudaryanto 2014). Lower fertiliser prices are intended to encourage increased crop production, particularly of rice. The government provides a subsidy to fertiliser manufacturers to compensate them for selling fertiliser below market prices. Despite the subsidy payment, the incentives for fertiliser manufacturers to increase production and compete with one another are limited by government regulation of production quantities, prices and locations where fertiliser can be sold (Osorio et al. 2011).

The use of fertiliser is unevenly distributed across the archipelago. Among food crops, the highest application rates per hectare are for rice, followed by maize and soybeans. The lowest are for peanut and cassava. The subsidy and resulting increase in fertiliser use led to more than a doubling of rice production between 1970 and 2000. Over that period, total annual fertiliser

use increased from 635 000 tonnes to 5.9 million tonnes, more than half of which was used to increase rice production (FAO 2005).

Fertilisers remain underused on plantation crops. Large areas of plantation crops are owned and managed by smallholder farmers. For many, the lack of knowledge about appropriate fertilisation technology, and the lack of reliable and timely access to the right fertilisers at village level, lead to inadequate and unbalanced application (FAO 2005).

Apart from the budgetary burden, subsidising domestic fertiliser prices results in inefficient fertiliser use at the farm level. Studies in West Java report rice farmers applying levels of fertilisers higher than the recommended rates, with some soil tests showing nutrient reserves had built up to high levels, negatively affecting yields (FAO 2005, Osorio et al. 2011).

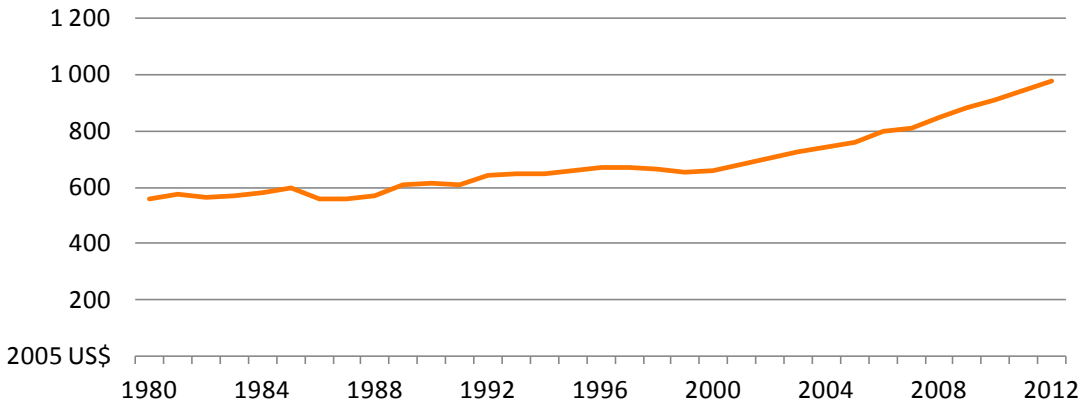
Farm labour and mechanisation

Indonesian agriculture is dominated by abundant labour in relation to available agricultural land, contributing to the issue of small-scale production. The agriculture, forestry and fishing sector employs around 40 million people or 35 per cent of the workforce (15 years and over), and is the main source of employment in rural areas (Indonesian Central Bureau of Statistics 2015c, McKinsey 2012). The proportion of landless and land-poor agricultural households is especially high on Java. Of more than 17 million households on Java characterised as farmer or agricultural labourer households, 39 per cent neither lease nor own any crop land, and another 44 per cent lease or own less than 0.5 hectares (USAID n.d.).

Tradition is one obstacle to agricultural development in Indonesia (Shahaf 2009). In many cases farmers grow the same crops as previous generations, using the same such methods and tools. Sometimes two or three generations work the same farm.

Traditionally, particularly in Java, harvesting is undertaken primarily by manual labour (Yamauchi 2014). Machines are rarely used. However, outside Java, the emergence of larger scale farmers had led to operations scaling up through mechanisation. This has contributed to a rise in farm labour productivity since 2000 (Figure 9).

Figure 9 Agriculture value added per farm worker, Indonesia



Source: 'World Development indicators', World Bank Group (World Bank 2014)

Currently tractors are used for land preparation activities, such as primary and secondary tillage, while seeding and planting activities continue to be done manually. Threshers are used in more developed areas where agricultural labour has become scarce as a result of competitive wages in other industries.

Wage growth in recent years may have led to the introduction of labour saving practices among relatively large farmers, such as renting more land and acquiring machinery (Yamauchi 2014). In contrast, small farmers have not significantly changed their behaviours.

Infrastructure

As the world's largest archipelago, Indonesia's insufficient and poor quality infrastructure is a major challenge for connectivity between the islands. High transport costs also undermine the competitiveness of agricultural industries and associated supply chains (Rabobank 2013, OECD 2012b). With most transport developments concentrated in Java, access to markets for the rest of Indonesia is poor.

Ninety per cent of freight and 80 per cent of passenger traffic in Indonesia moves by road. However, roads are heavily congested and their quality in urban and provincial areas is poor (The Canadian Trade Commissioner Service 2011). Because connectivity with markets is compromised by an inadequate road system, returns to agricultural producers are often discounted because of spoilage incurred during transport (Global Business Guide Indonesia 2012).

Indonesia has around 300 ports spread throughout the archipelago. Inter-island shipping, consisting of ferry and cargo shipping services, accounts for around 60 per cent of total seaborne cargo in the country (World Bank 2013). Seaports in Indonesia are outdated and investment in port facilities has not matched the rapid growth of traffic moving through them. As a result, inefficiencies in the shipping system, such as bottlenecks and delays in cargo handling, are common. Vessels also often leave the main port, Tanjung Priok, before they are fully loaded to keep to published schedules (The Canadian Trade Commissioner Service 2011).

Current infrastructure does not support internal trade well and challenges Indonesia's ability to provide its own food to its own people. Developing an efficient transport and logistics system would not only increase the competitiveness of Indonesia's external trade but would also provide easier and cheaper access for local agricultural products to domestic markets with reduced losses through spoilage. Until this is achieved, Indonesian supply chains will continue to be uncompetitive, inefficient and looking to other markets to satisfy agrifood demand, particularly in urban centres.

Water availability

While Indonesia's water supplies may be sufficient for current agricultural production, deterioration of the existing irrigation infrastructure and investment constraints to improve or develop new infrastructure may limit Indonesia's future water availability given rapid urbanisation and food demands.

Growing municipal water needs and the needs of the agriculture sector to increase production to meet the demands of urban consumers is likely to result in water shortages in coming decades. The McKinsey Global Institute projects that by 2030 water supplies will fall short of demand by around 18 per cent (McKinsey 2012). Significant investment is required to improve water productivity and reduce water transmission losses through rehabilitating old and damaged irrigation infrastructure. Up to half of Indonesia's piped water supply is estimated to be lost in transmission (McKinsey 2012).

Feed availability

Increasing demand for meat protein has stimulated the establishment of large scale commercial poultry farms and beef cattle feedlots. Data from the Indonesian Feed Millers Association show

the poultry industry consumes 83 per cent of Indonesia's animal feed, the aquaculture industry consumes 11 per cent and cattle and pig industries the remaining 6 per cent (USDA–FAS 2014).

On average, Indonesia's livestock feed is composed of maize (50 per cent), soybean meal (15 to 20 per cent), rice bran (15 per cent), wheat pollard (8 per cent), fish meal (5 per cent), maize gluten meal (3 per cent) and crude palm oil (2 per cent) (USDA–FAS 2014). While most maize is sourced domestically, inconsistent seasonal supplies and storage challenges, such as high moisture content and aflatoxin levels, are major factors that are leading feed millers to import increasing quantities of maize. Canola meal is being used increasingly in poultry diets as a cost competitive alternative to soybean meal. However, its use is restricted to less than full replacement of soybean meal because of canola's lower energy and protein content and the presence of antinutritional factors, such as lower amino acid digestibility than in soybean meal (Khajali and Slominski 2012). Apart from maize and agri-industrial by-products, such as rice bran, copra meal and palm kernel meal, other feed ingredients are largely imported (Table 3).

In food crop producing areas, fibrous agricultural residues have become the main feed source for ruminant animals raised by small scale livestock producers. Rice straw is fed as a base roughage but additional good quality feedstuff or concentrates—such as leaves and stalks of cassava; leaves of maize and sugarcane; leaves, stems and peelings of banana; rice bran; pods and peelings of cacao; and the fronds, pressed fibre and palm kernel cake from oil palm—are required to gain higher production performance (Djajanegara 1999). Such feeds are available in various locations, but their unequal distribution and high prices at the farm level limit their use by smallholder farmers. Lack of storage and labour shortages during harvest time also restrict the collection of rice straw. These limitations, as well as the seasonal nature of these feedstuffs, affect continuity of supply and therefore the productivity potential of smallholder livestock producers.

Table 3 Indonesian animal feed, sources of primary ingredients

Feed ingredient	Local share (%)	Imported share (%)
Maize	90–95	5–10
Fish meal	5–10	90–95
Meat and bone meal (MBM)	0	100
Soybean meal	0	100
Rapeseed meal	0	100
Maize gluten meal	0	100
Feed additive	0	100
Rice bran	100	0
Copra meal	100	0
Palm kernel meal	100	0
Crude palm oil (CPO)	100	0

Source: Indonesia grain and feed annual report 2014, United States Department of Agriculture (USDA–FAS 2014)

Productivity

There has been significant growth in the volume of total agricultural output in Indonesia over the past 50 years, although the rate of growth has varied markedly over the decades. The contribution of increased total factor productivity (TFP) to total agricultural output growth (including food crops and non-food cash crops) was strong during the 1960s and 1970s, as new

technologies and improved crop varieties were widely adopted during the 'green revolution' (Table 4) (Fuglie 2010, 2012). In the 1980s, land and labour use expanded, enabling total agricultural output to grow, but TFP growth slowed. During the 1990s, average agricultural output growth declined to less than 2 per cent a year as the 'green revolution' crop varieties had already been widely adopted and no newer, higher yielding varieties were suitable or available. However, TFP growth was stronger than the previous decade.

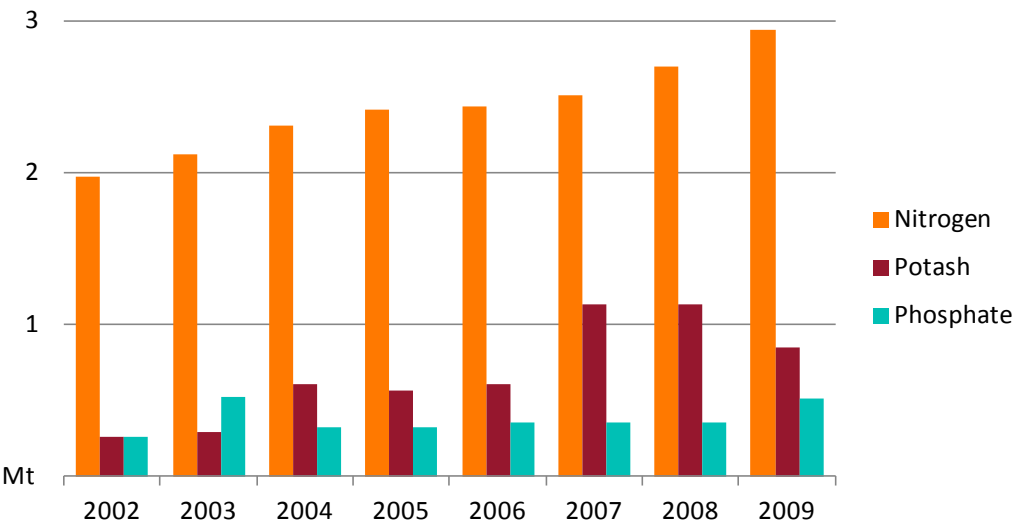
Table 4 Average annual food and non-food agricultural output and total factor productivity growth, Indonesia

Years	Agricultural output	Agricultural TFP
	%	%
1961–1970	2.71	1.75
1971–1980	3.34	1.40
1981–1990	4.64	0.59
1991–2000	1.87	0.99
2001–2009	4.86	3.68

Note: Agricultural output measured in volume.
Source: Fuglie 2012

Between 2001 and 2009, strong output and TFP growth resumed for a number of reasons. Newly available crop land achieved by the clearing of forested areas supported the expansion and diversification of agriculture into higher value, non-staple commodities, such as tropical perennials, horticulture and livestock. At the same time, the relatively low price of fertilisers and chemicals available to producers led to a 50 per cent increase in their use between 2002 and 2009 (Figure 10), resulting in a marked improvement in crop yields compared with the previous decade (OECD–FAO 2014). Improved literacy and education of the farm labour force also contributed to productivity growth (OECD 2012b).

Figure 10 Total fertilizer use in Indonesia, by type



Note: 2001 data not available.
Source: 'FAOSTAT', Food and Agriculture Organization of the United Nations (FAO 2015)

TFP estimates do not exist for the period since 2010. While yield growth is not as robust a measure of technical change as TFP, yield trends can provide a partial indication of changes in productivity. Average annual yield growth between 2011 and 2013 was lower than in the

periods 2001–05 and 2006–10 across a range of food and non-food crops (Table 5). A number of factors explain this slowdown. The rate of conversion of forest land to cropping slowed significantly, reducing the rate of agricultural output growth achieved through additional agricultural land (OECD 2012b). In addition, the sustained overuse of fertilizers and chemicals throughout the 2000s has led to decreasing returns to scale for these intermediate inputs. As a result, any future increase in the productivity of food and non-food crops is unlikely to be achieved through the application of chemicals or fertilisers.

Table 5 Average annual yield growth of food and non-food cash crops, Indonesia

Commodity	Unit	1991-95	1996-00	2001-05	2006-10	2011-13
Food crops						
Rice	%	0.2	0.3	0.8	1.9	0.9
Maize	%	1.2	4.2	4.6	5.2	3.0
Cassava	%	-0.6	1.5	5.0	4.9	3.6
Mung beans	%	-0.3	-6.7	4.4	2.3	-0.2
Soybeans	%	0.4	1.7	1.1	1.1	1.2
Groundnuts	%	-3.4	5.8	1.5	1.6	0.2
Vegetables ^a	%	9.3	-0.8	3.5	-1.7	-6.8
Cash crops						
Rubber	%	na	-0.1	4.5	5.8	4.8
Crude palm oil	%	na	-7.2	10.8	-0.6	1.2
Palm kernel	%	na	-10.4	12.0	0.8	-1.0
Cocoa	%	na	0.5	14.3	2.1	-3.0
Coffee	%	na	2.4	1.4	6.2	3.7
Tea	%	na	0.2	3.0	-0.5	-1.1

^a Vegetable data available to 2012.

Source: 'FAOSTAT', Food and Agriculture Organization of the United Nations, (FAO 2015)

With reduced scope for expansion in agricultural production through both conversion of forest land and increased use of fertilisers and chemicals, future agricultural productivity growth is likely to be achieved through the more efficient use of inputs. The dominance of smallholdings remains a constraint to achieving higher agricultural productivity growth in future, as small plots impede the implementation of more productive practices. This is compounded by inefficient fertiliser use, limited mechanisation and an inadequate supply of other important inputs such as high-yielding seeds, irrigation systems, extension services and access to credit. Addressing these issues will be key to future productivity trends.

4 Indonesian agricultural and food policies

The objectives of Indonesia's agricultural policy, as stated by the Indonesian Ministry of Agriculture in 2010, are to:

- 1) achieve food self-sufficiency
- 2) enhance diversification of production and consumption
- 3) raise the competitiveness and value added of production and
- 4) increase farmers' welfare (OECD 2012b).

To achieve its objectives, the Indonesian Government intervenes in the farm sector with multiple policy instruments. The government also implements policies to protect consumers from fluctuations in prices of key food products, such as wheat, rice and vegetable oils, and to insulate domestic producers from foreign competition. Food for consumers is subsidised, which effectively maintains the price of food within a narrow price band. Producers benefit from tariffs applied to imported food, which keep the price of domestically produced food competitive with imports. Additionally, producers are directly supported by government food purchases at guaranteed prices and subsidies on farm inputs, such as fertiliser, seed and farm equipment.

Policies to support agricultural production

Reference prices and import restrictions

The Indonesian Government sets reference prices for rice, sugar and beef, which it aims to maintain through various policy instruments.

On average, around 70 per cent of domestic rice production is consumed within the farming household (OECD 2012b). The remainder is sold through either private or government-run channels, such as Indonesia's National Food Logistics Agency, known as Badan Urusan Logistik (BULOG). BULOG purchases a limited amount of rice at the reference price to fulfil two objectives:

- 1) stockholding for emergency purposes and
- 2) redistribution as part of the consumer subsidy programme, Raskin (discussed below) (OECD 2012b).

In 2010, BULOG procured around 6 per cent of total domestic rice production, equivalent to around 20 per cent of all marketed rice (OECD 2012b).

For sugar, the government supports the producer price by imposing legal requirements on domestic sugar millers, who control the domestic sugar market. Sugar millers are required to purchase 75 per cent of their sugar cane requirements from domestic sugar cane growers and to pay growers a government-determined price.

The Indonesian rice and sugar industries are also protected by import restrictions. Companies that import rice and sugar are required to support the domestic industry by buying domestically produced product if the mill price falls below the reference price.

For beef and live cattle imports, the Indonesian Government sets a reference price which it aims to achieve by managing import volumes through an import permit system. Since 2014 the reference price has been 76 000 rupiah (A\$7.20) a kilogram. Under the system, import permits are not issued if domestic beef prices fall below the reference price (ABARES 2013). Weight restrictions on cattle imports also usually apply, limiting imports to young, lighter cattle destined for feedlots.

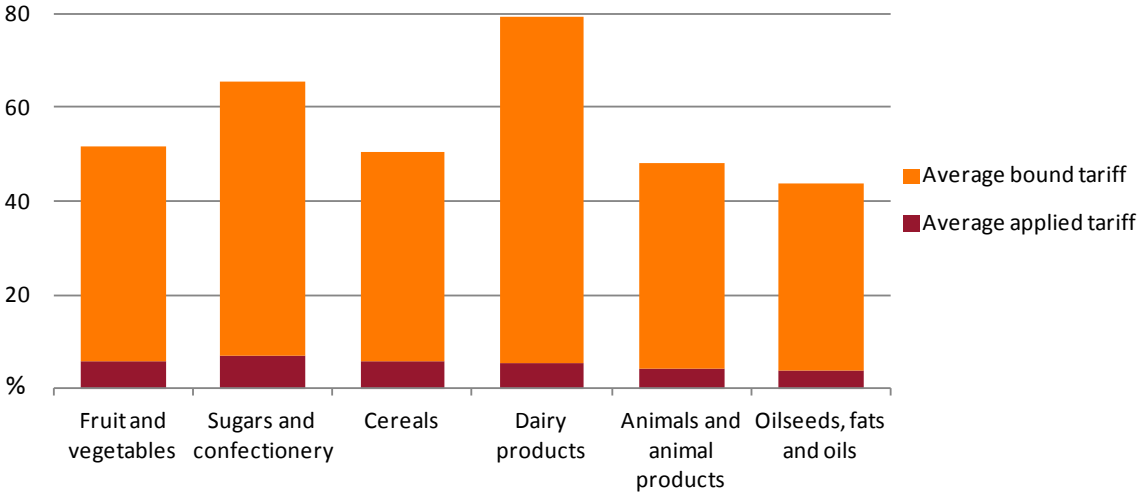
The Indonesian Government also restricts imports of other commodities such as soybeans, maize, horticulture, certain processed foods, and animals and animal products (including fresh, chilled and frozen meat and eggs). Importing these commodities is generally not permitted if the Ministry of Trade considers it will cause injury to the domestic industry (WTO 2013). Companies seeking to import these commodities are required to gain approval from the Indonesian Ministry of Trade (OECD 2012b).

Tariffs

Tariffs are applied to most imported food products in Indonesia. However, they are relatively low and are not a major policy instrument used to protect domestic industries. The average applied agricultural tariff was 5.3 per cent in 2010 (OECD 2012b). Around 85 per cent of agricultural imports are subject to tariffs between zero and 5 per cent, with almost 66 per cent entering duty free. All agricultural tariffs are ad valorem except for rice and sugar, which have specific tariffs (OECD 2012b).

While applied tariffs are low, bound tariff rates, or the ceiling rate that can be applied under World Trade Organisation rules, remain high (Figure 11). On average, the bound rate on agricultural products is 47 per cent (OECD 2012b). The highest bound tariff is 210 per cent for milk powders, although the applied rate is just 5 per cent. Rice has a bound tariff of 160 per cent and an applied specific rate of 450 rupiah a kilogram (equivalent to an ad valorem tariff of 10 per cent when using the average export price for 15 per cent broken rice from Thailand in 2010) (OECD 2012b).

Figure 11 Average bound and applied tariffs by product groups



Source: 'OECD Review of Agricultural Policies: Indonesia 2012', Organisation for Economic Co-operation and Development (OECD 2012b)

Input subsidies

The Indonesian Government supports farmers by subsidising inputs such as fertiliser, seeds and ad hoc products, including power tools and rice milling units. Fertiliser support is the largest component of budgetary support for agriculture, accounting for 37 per cent in 2008–09 (OECD 2012b). Not all farmers receive input subsidies because eligibility requirements apply in many cases. For example, subsidised fertiliser is only available to farmers producing on less than 2 hectares.

Policies to support consumers

Price intervention

The Indonesian Government intervenes in the domestic market for wheat flour, maize and cooking oil when it considers retail prices too high for the poor. It does this using a broad range of measures, from simply asking manufacturers and wholesalers to be socially responsible with their pricing, to purchasing these products and distributing them directly to poor households (OECD 2012b). Another policy often used is the 'government covered value tax', under which the government waives the existing 10 per cent value added tax on the final price of certain food items. For example, the government has used this policy to reduce the price of non-branded cooking oil since 2007. In 2010 this policy cost the Indonesian Government around 250 billion rupiah (A\$29.9 million).

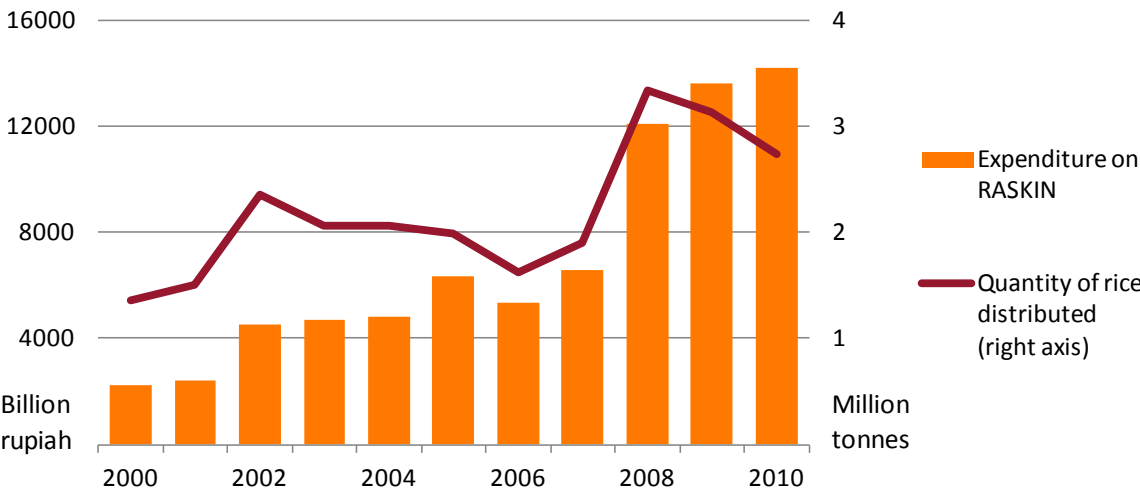
Food subsidies

The Indonesian Government operates a targeted rice subsidy programme, known as Raskin, to combat food insecurity. The programme's objective is to make available a set quantity of rice (procured by BULOG) at a subsidised price to Indonesia's poorest households on a monthly basis. Raskin's intention is to provide rice to those on official lists of households living under or near the national poverty line (World Bank 2012b). The poverty line in 2014 was around 318 500 rupiah per person a month in urban areas and 286 100 rupiah per person a month in rural areas (Indonesian Central Bureau of Statistics 2015a). Those with incomes within 20 per cent of the poverty line are defined as being 'near the poverty line' (World Bank 2012b).

Despite the objectives of Raskin to target the most vulnerable, since allocations of Raskin rice to households are decided by local authorities, poor and non-poor households alike benefit from the programme. In 2010, around 17.5 million households received Raskin rice (OECD 2012b), at a cost of around 14 trillion rupiah (A\$1.7 billion) to the Indonesian Government (Figure 12). Between 2005 and 2010, the subsidised price was 1 600 rupiah (A\$0.19) a kilogram, representing about 20 to 25 per cent of the average market price (World Bank 2012a).

The quantity of rice per household, the subsidised price, the number of months a year that rice is distributed, and the classification of the poorest households have all been altered over the period of the programme. For example, monthly allocations per household have been set as low as 10 kilograms and as high as 20 kilograms over the programme period, although households rarely benefit from the full amount of the allocation (OECD 2012b, World Bank 2012a).

Figure 12 Raskin rice distribution and budgetary cost



Source: 'OECD Review of Agricultural Policies: Indonesia 2012', Organisation for Economic Co-operation and Development (OECD 2012b)

Implications of agricultural and food policies

Public expenditure on Indonesian agriculture has increased under its current policy settings. In 2009, public spending was around 61.5 trillion rupiah (A\$7.5 billion). This was equivalent to 5.6 per cent of total government expenditure, compared with 2.7 per cent in 2001 (World Bank 2011). The fertiliser subsidy and Raskin have been the biggest drivers of increased spending over this period.

In addition to the direct budget cost of Indonesia's agricultural and food policies, there have also been allocative effects. Indonesian policies tend to focus on rice, maize and sugar, leading to increased production of these commodities and improved availability from domestic sources. However, expansion of these crops has come at the expense of horticulture and other commodities in which Indonesia has a comparative advantage, such as natural rubber, cocoa and spices (World Bank 2011).

The administration of some support programmes, the fertiliser subsidy in particular, is inefficient (Sudaryanto 2014). As discussed in Chapter 3, subsidising fertiliser companies in an environment where quantities, prices and distribution channels are regulated reduces incentives for these companies to effectively compete. This inefficiency has resulted in the under-production of fertiliser, leading to shortages. At the same time, the artificially low price has led to an over-reliance on fertiliser by producers to increase yield, rather than using other methods such as improved seeds (World Bank 2011).

5 Simulation results

Baseline assumptions

The objective in this analysis is to identify and quantify projected changes in Indonesian demand for a range of agrifood commodities over the longer term across urban and rural households. An updated version of the ABARES agrifood model (Linehan et al. 2012a) is used to investigate these potential trends. The model has been modified to include Indonesia's consumer subsidy policy (Raskin) and a re-aggregation of some country and commodity groups to allow more detailed analysis.

Indonesia has a comparative advantage in the production of many cash crops and non-food agricultural commodities that are not included in the ABARES agrifood model, such as natural rubber, copra, palm kernels, coffee, cocoa and spices (FAO 2013). In Indonesia, the production of these commodities competes with food commodities for resources despite a policy environment targeted at food production and food self-sufficiency.

Given Indonesia's limited supply of arable land, and the quality and availability of its water supply, the capacity of the domestic agricultural sector to meet the growing demand for food in Indonesia will depend heavily on improvements in productivity. Total factor productivity (TFP) growth in Indonesian agriculture is estimated to have averaged 1.54 per cent a year since 1961. It is expected that yield growth in Indonesia will not decline from this average annual rate in the future because the potential for productivity growth remains significant. However, nor is it expected to continue at the relatively high rates estimated for the period 2001 to 2009, which were made possible from the expansion of agriculture into higher-value, non-staple commodities on newly deforested land, and a significant increase in the use of chemical fertilisers (see Chapter 4).

Productivity growth since 2010 is estimated to have slowed from the decade 2001–2009. The Indonesian Government's policy initiative 'Reducing Emissions from Deforestation and Forest Degradation' (REDD) in 2010 and declaration of a two-year Forest Moratorium in 2011 have slowed the rate of forest conversion to crop land (OECD 2012b). In addition, agricultural production continues to be constrained by the issues outlined in Chapter 4 (including decreasing returns to scale for chemical inputs, lack of widespread mechanisation and, deteriorating resource base). With ongoing competition between the production of food crops and non-food cash crops (in which Indonesia has a comparative advantage), and little prospects in the foreseeable future for major policy changes on food consumption and production, TFP growth for food crops in Indonesia is assumed to average 1.54 per cent a year between 2009 and 2050. This is close to the forecast by Ludena et al. (2007) of 1.52 per cent a year to 2040 (FAO 2013, USDA–FAS 2014).

Growth rates for TFP for individual commodities have in the past shown similar patterns to growth in yields. Assumptions of TFP growth rates for individual commodities are therefore derived by apportioning the assumed rate for the whole of agriculture by historical growth in the yields of each commodity (Table 6).

Table 6 Average annual TFP growth rate by industry in Indonesia, 2009 to 2050

Industry	%
Rice	2.14
Maize	3.37
Coarse grains	3.35
Other cereals	2.39
Oilseeds	3.88
Vegetables	2.32
Fruit	3.03
Beef	0.32
Sheep and goat meat	1.44
Poultry	1.44
Eggs	1.35
Dairy	2.15
All Agriculture	1.54

Source: ABARES model assumption

In the reference case, no change to Indonesia's market support policies is assumed over the projection period. On the production side, these include the principal forms of market support of state trading, input subsidies and import restrictions. Additionally, the Indonesian Government's minimum support prices for rice and wheat are maintained in real terms, as are other ad hoc interventions on a range of agricultural commodities.

The government support received by consumers through the consumer subsidy policy, Raskin, is also maintained in real terms over the projection period (discussed in Chapter 4).

The baseline projections determined in the agrifood model for Indonesia are also dependent on a set of assumptions discussed in Chapters 2 and 3. To summarise:

- population growth is assumed to average 0.7 per cent a year between 2010 and 2050
- the proportion of the population in urban areas is assumed to increase from 50 per cent in 2009 to 72 per cent by 2050
- average annual GDP growth in Indonesia is assumed to average 5.3 per cent a year between 2010 and 2030, before weakening between 2030 and 2050 to average 3.4 per cent a year (Table 1)
- average annual income growth is assumed to be 5.6 per cent a year in urban areas and 2.1 per cent a year in rural areas

agricultural productivity in Indonesia is assumed to continue to increase according to the growth estimates provided in Table 6.

The population is divided into two income strata—urban income and rural income households. Across these two household types the income growth assumptions to 2050 for urban and rural areas are based on historical income data from the Indonesian Central Bureau of Statistics (2011). These data demonstrate that not only is average urban income higher than average rural income but, with urbanisation, average income growth in urban areas has also been higher than

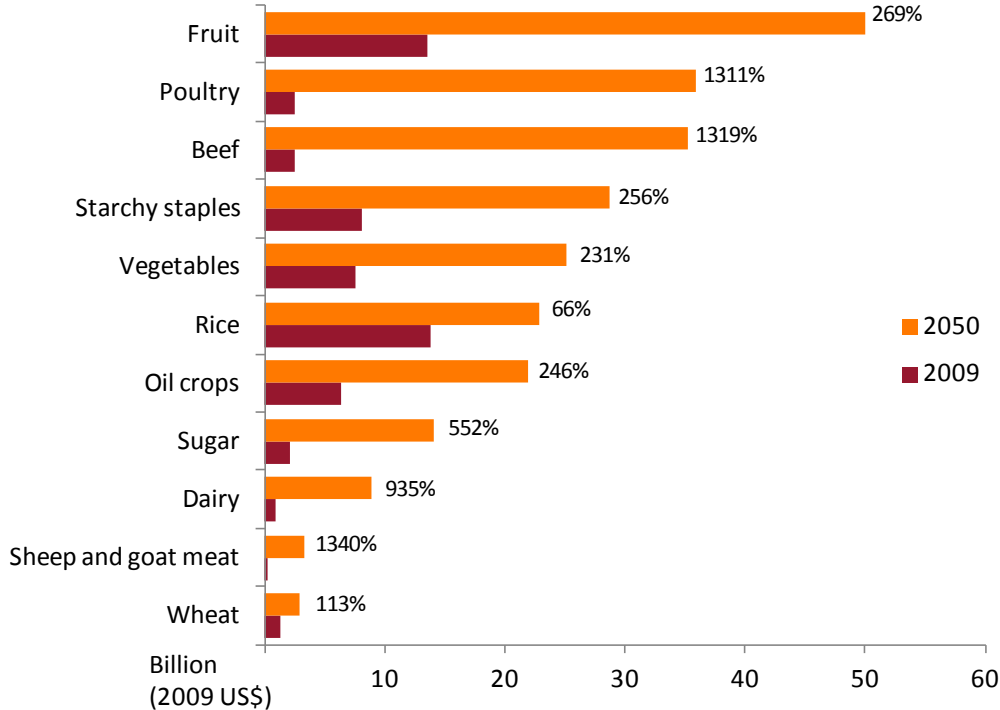
in rural areas. This has been the result of a relatively faster rate of economic development and higher wages, which have stemmed from the growth in the manufacturing and services sectors prevalent in urban areas. The model assumes this trend in income growth will continue to 2050. Indonesian household food consumption data in the base year of the model are from the Indonesian Central Bureau of Statistics (2014) and Widarjono (2012). These data were used as the basis in the model to project food consumption across urban and rural households to 2050.

In the model, total and per person Indonesian food consumption, and total urban and rural food consumption, is apparent consumption, which reflects the total use of agrifood products (food, feed and industrial use). In contrast, per person urban and rural consumption is direct food consumption only; it excludes feed use and industrial use of agrifood products to better reflect changes in diets.

Consumption

The real value of total food consumption in Indonesia (including food, feed and industrial use) is projected to quadruple between 2009 and 2050 to US\$327 billion (in 2009 US dollars). The largest increases are for meat, dairy products, fruit and vegetables, as real incomes increase (Figure 13). Together these commodities account for two-thirds of the projected rise in the real value of food consumption.

Figure 13 Consumption of selected agricultural commodities, Indonesia



Note: Starchy staples include pulses, yams, potatoes and cassava.
Source: ABARES model output

Between 2009 and 2050, the real value of Indonesian beef consumption is projected to rise more than 14 times to US\$35 billion (in 2009 US dollars); dairy products ten times to almost US\$9 billion; and fruit and vegetables more than three times to US\$50 billion and US\$25 billion, respectively. For many commodities, the value of consumption in 2050 is projected to rise from a very low base, reflecting high poverty rates and a large rural population in 2009. By 2050, 72 per cent of the population is projected to live in urban centres, with higher incomes than the

rural cohort. It is this expected transition of the population and income growth that drive the magnitude of projected consumption growth for many commodities. Despite these large increases, Indonesia's per person food consumption in 2050 is projected to remain below that of China for many commodities (Hamshere et al. 2014).

For cereals, oil crops and starchy staples (pulses, potatoes, yams and cassava), consumption is also projected to increase. Between 2009 and 2050, the real value of rice consumption is projected to rise by 66 per cent to nearly US\$23 billion (in 2009 US dollars); maize by 182 per cent to US\$8 billion; oil crops by 246 per cent to US\$22 billion; and starchy staples by 256 per cent to almost US\$29 billion. Over this period, the real value of sugar consumption is projected to rise more than six times to US\$14 billion (in 2009 US dollars).

The projected rise in consumption of cereals, oil crops and starchy staples is driven by a number of factors. First, cereals and starchy staples (such as cassava) are relatively affordable foods, particularly for low and middle income consumers whose populations are projected to rise. Although both cereals and starchy staples will remain important components of Indonesian diets to 2050, their relative contribution will decline as diets become more diversified with greater amounts of meats, dairy products and fruit and vegetables—the continuation of a trend that began around 1990 (Figure 5).

The projected rise in consumption of cereals, oil crops and starchy staples is also driven by feed requirements, which will increase as the demand for meat protein rises to 2050. As discussed in Chapter 3, about 50 per cent of domestic maize production is used as feed. Rice bran also comprises about 15 per cent of total Indonesian feed consumption. Soybean meal comprises between 15 per cent and 20 per cent of total livestock feed, all of which is imported. Rapeseed meal can be used as a partial substitute for soybeans and it, too, is entirely imported. In 2050, it is projected that feed use will account for around 42 per cent of total maize consumption, 43 per cent of total oil crop consumption and 44 per cent of total starchy staple consumption, a larger proportion of which will need to be imported compared with 2009.

Urban and rural consumption

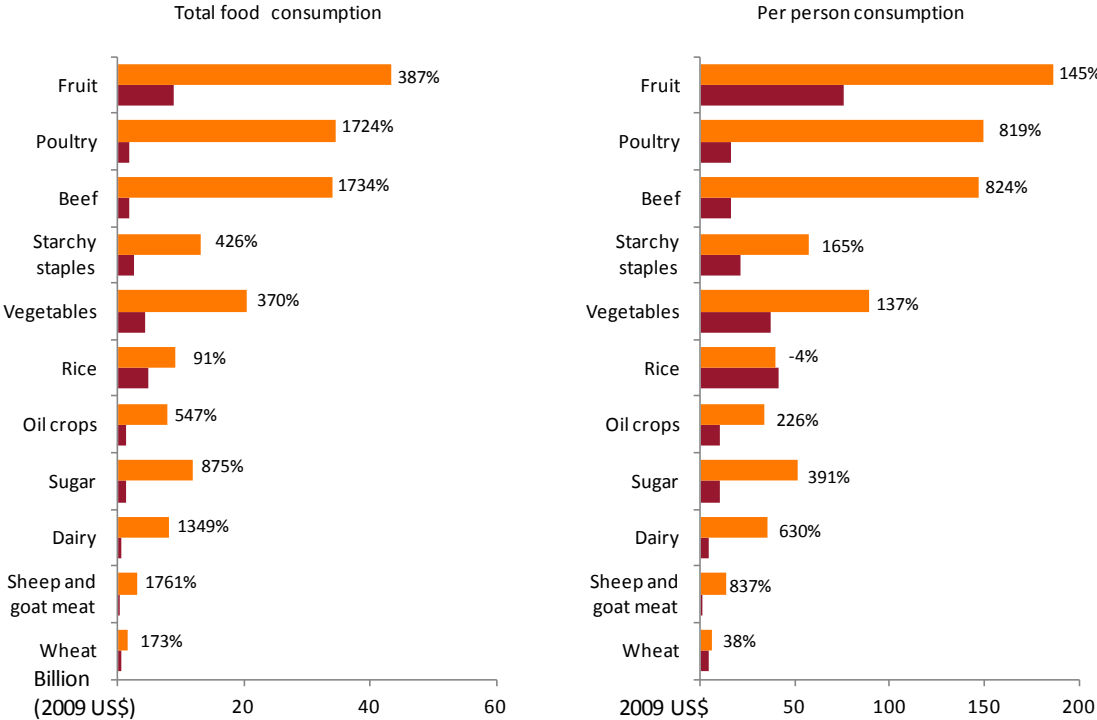
In 2050, 71 per cent of Indonesia's population is projected to live in urban areas, compared with 54 per cent in 2015 (United Nations Population Division 2014). By 2050, Indonesian consumers are projected to have more diverse diets, with greater consumption of meat, dairy products, fruit and vegetables.

In this section the results for total urban and rural consumption reflect apparent consumption. However, per person rural and urban consumption is direct food consumption only. Feed use and industrial use of the agrifood products are excluded in the per person results in order to better understand the projected change in diets.

High value commodities

Urban consumers account for most of the growth in consumption of meat, dairy products, fruit and vegetables over the projection period because of rising urban populations and incomes. Between 2009 and 2050, the real value of urban beef consumption is projected to rise more than 18 times to US\$34 billion (in 2009 US dollars). Consumption of dairy products is projected to rise by more than 14 times to more than US\$8 billion, and fruit and vegetables more than four times to US\$43 billion and almost US\$21 billion, respectively (Figure 14).

Figure 14 Urban consumption of selected agricultural commodities, Indonesia

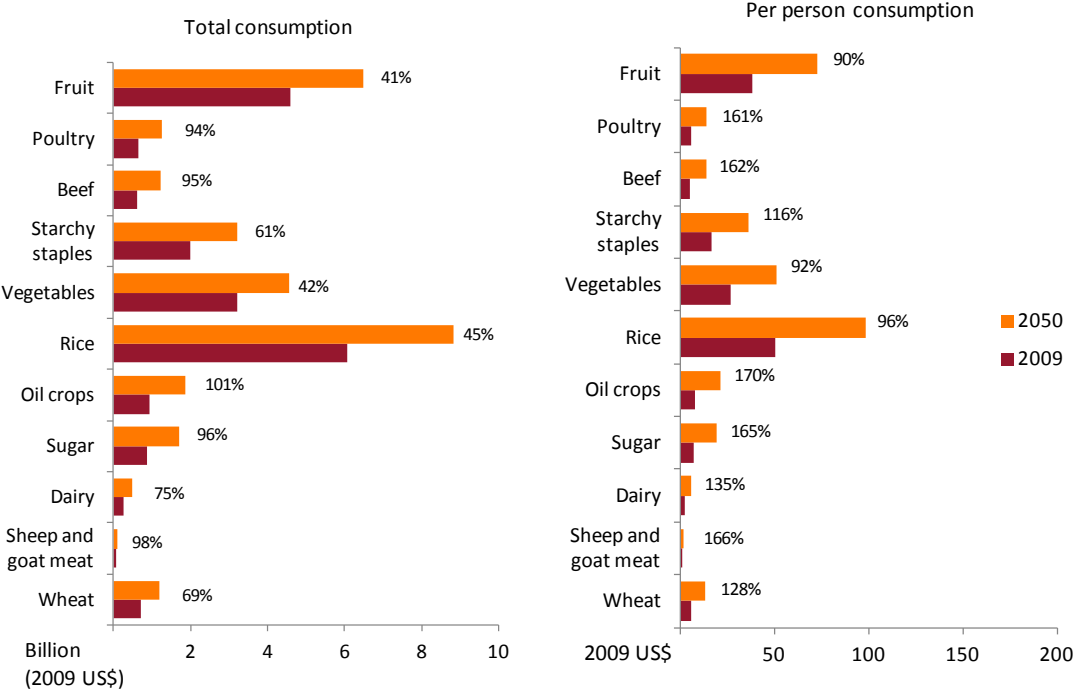


Source: ABARES model output

In per person terms, the value of urban beef consumption is projected to rise more than nine times between 2009 and 2050; dairy more than seven times; and fruit and vegetables to more than double. However, consumption of rice is projected to fall by 4 per cent. While these increases are large, Indonesia's urban per person consumption in 2050 is still projected to be lower than that of China in the same year for many commodities, including vegetables (73 per cent lower), oilseeds (12 per cent), dairy products (41 per cent) and sheep and goat meat (24 per cent). In contrast, Indonesia's urban per person consumption is projected to be higher than China's for beef (52 per cent higher), sugar (400 per cent), cereals (23 per cent) and starchy staples (14 times higher) (Hamshere et al. 2014). For beef, higher Indonesian per person consumption relative to China in 2050 reflects the dominance of beef in Indonesian diets by that time, compared with China where pig meat consumption is significant. Similarly, the projected rise in per person consumption of starches in Indonesia mainly reflects higher consumption of cassava, a culturally important food crop.

For rural consumers, total growth in consumption of meat, dairy products, fruit and vegetables is lower than for urban households. This can be attributed to relatively lower rural incomes and a decline in the absolute size of the rural population. Between 2009 and 2050, total rural beef consumption is projected to rise by 95 per cent to more than US\$1 billion (in 2009 US dollars); dairy products by 75 per cent to US\$0.5 billion; fruit by 41 per cent to almost US\$7 billion; and vegetables by 42 per cent to almost US\$5 billion (Figure 15).

Figure 15 Rural consumption of selected agricultural commodities, Indonesia



Source: ABARES model output

Between 2009 and 2050, rural per person consumption of each of the agrifood commodity groups is projected to change by a similar magnitude as urban consumption. In value terms, rural per person consumption of beef is projected to rise by 162 per cent; dairy products by 135 per cent; fruit by 90 per cent; and vegetables by 92 per cent. Similar increases are projected for rice (96 per cent), wheat (128 per cent) and starchy staples (116 per cent).

Again, despite these significant increases, rural per person consumption in Indonesia is projected to be lower than that of China in 2050 for all products except sugar, which is projected to be 117 per cent higher. For all other commodity groups, rural per person consumption is projected to be lower than in China, including sheep and goat meat (85 per cent lower); dairy (54 per cent); starches (32 per cent); cereals (56 per cent); and vegetables (86 per cent).

For both rural and urban consumers, the rise in the real value of total food consumption in 2050 is principally the result of an increase in the quantity consumed rather than a projected significant rise in the real price. This is especially pronounced in urban households. For example, between 2009 and 2050, beef consumption by urban households is projected to rise by more than 15 times, and sheep and goat meat by 13 times. In contrast, rural beef consumption over this period is projected to rise by 64 per cent, and sheep and goat meat by 44 per cent.

Projected consumption growth of cereals and starchy staples between 2009 and 2050 is most pronounced in urban areas. Rising urban consumption of these commodities is largely the result of population growth. Urban consumption of wheat is projected to rise by 173 per cent to around US\$2 billion (in 2009 US dollars); rice by 91 per cent to US\$9 billion; and starchy staples (which includes pulses, potatoes, yams and cassava) by 426 per cent to US\$13 billion.

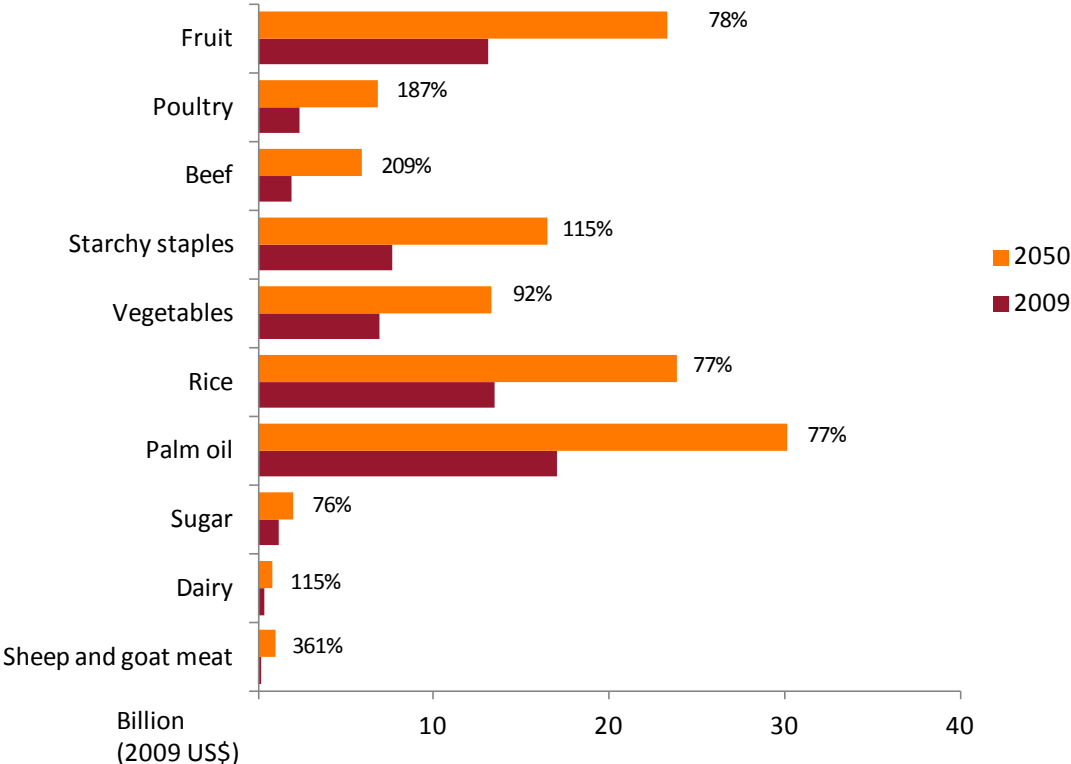
Rural consumption of cereals and starchy staples is projected to rise despite a falling rural population. As incomes rise towards 2050, the relatively affordable prices of these commodities will drive rural consumption. Between 2009 and 2050, rural consumption of wheat is projected

to rise by 69 per cent to US\$1 billion (in 2009 US dollars); rice by 45 per cent to almost US\$9 billion; and starchy staples by 61 per cent to US\$3 billion.

Production and trade

The real value of Indonesia's total agrifood production (which includes production for food, feed and industrial use) is projected to more than double from US\$81 billion in 2009 to US\$173 billion in 2050 (in 2009 US dollars). This increase is driven by a higher value of production (in 2009 US dollars) of beef (up 209 per cent); poultry (187 per cent); starchy staples (115 per cent); vegetables (92 per cent); fruit (78 per cent); and rice and palm oil (up 77 per cent each) (Figure 16). The value of maize production, divided almost equally between feed and food use, is projected to increase by 78 per cent.

Figure 16 Production of selected agricultural commodities, Indonesia



Source: ABARES model output

For some agricultural products, such as rice and beef, rising production partly reflects domestic policies that favour their production. For example, the real value of rice production between 2009 and 2050 is projected to rise by 77 per cent because of the assumption that producers continue to receive a minimum support price and input subsidies. Indonesia is projected to switch from being an importer to an exporter of rice by 2050. The real value of Indonesia's rice exports in 2050 is projected to be around US\$0.9 billion (in 2009 US dollars).

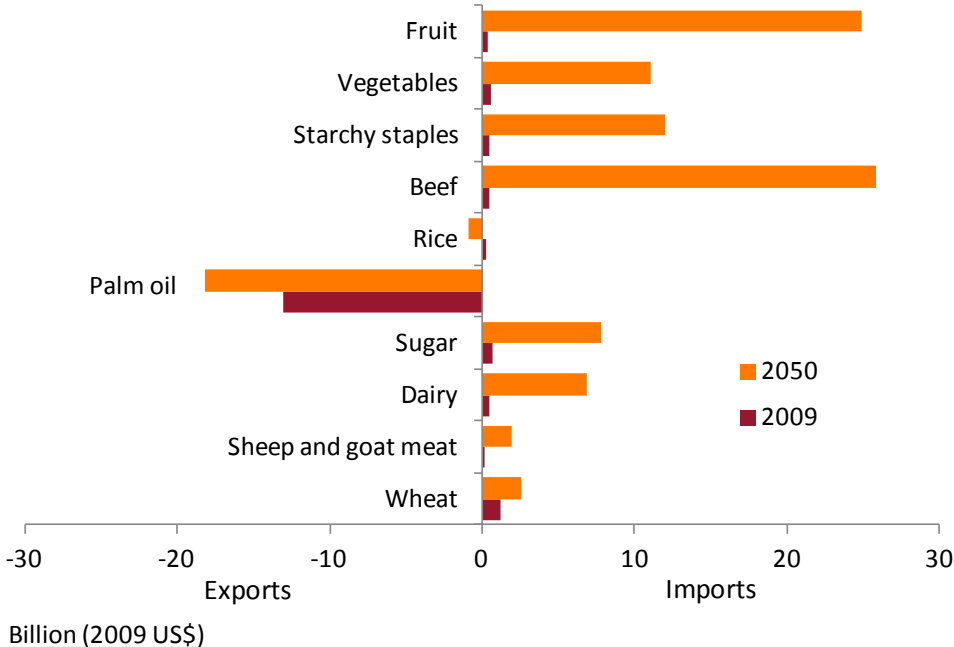
The real value of Indonesia's palm oil production is projected to rise significantly, in line with strong export demand and Indonesia's comparative advantage in its production. Between 2009 and 2050, Indonesia's production of palm oil is projected to rise by US\$13 billion to US\$30 billion, an increase of 77 per cent. Over this period, palm oil exports are projected to rise by 40 per cent to US\$18 billion.

Imports

For some agricultural commodities, such as rice and palm oil, the rise in consumption by 2050 is projected to be met largely by a rise in domestic production. However, for most agrifood commodities, production is projected to increase at a slower rate than consumption. As a result, food and feed imports will be an increasingly important component of Indonesia's food supply towards 2050. The real value of Indonesia's total agrifood imports is projected to rise more than 20 times from 2009 to US\$152 billion (in 2009 US dollar terms) in 2050.

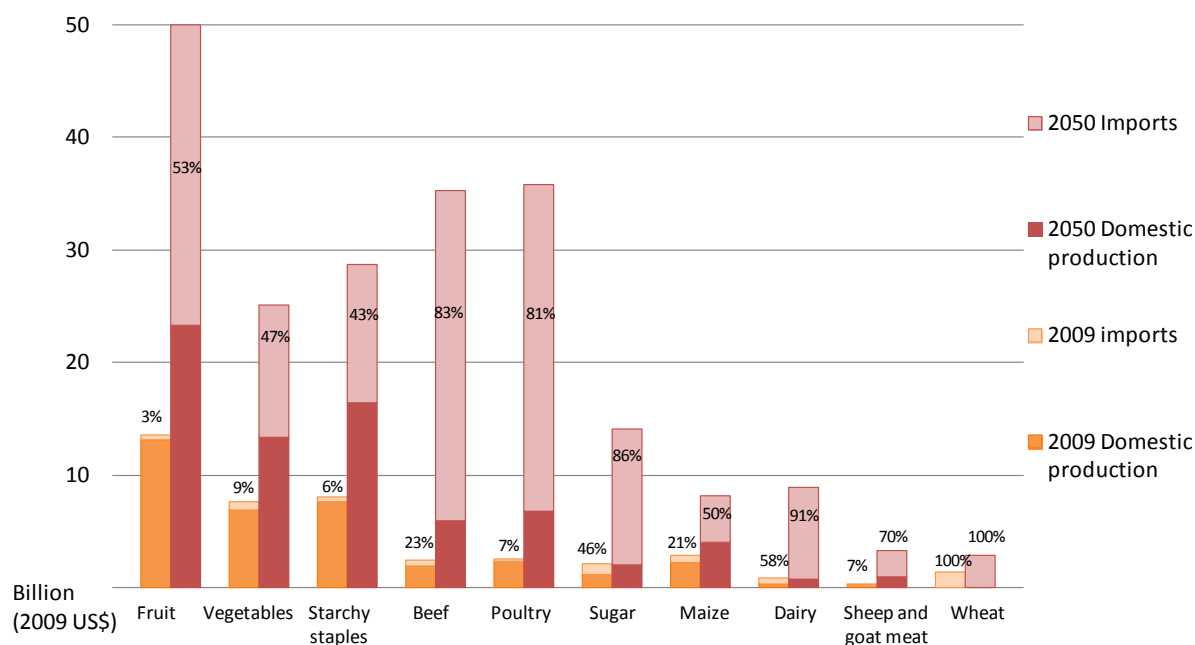
By 2050, Indonesia is projected to import a wide range of horticultural products. Given rising domestic demand, the real value of Indonesia's fruit and vegetable imports is projected to rise to US\$25 billion and US\$11 billion in 2050, respectively (in 2009 US dollars; Figure 17). On this basis, the share of imports in total Indonesian fruit consumption will rise from 3 per cent in 2009 to 53 per cent in 2050 (Figure 18). For vegetables it will rise from 9 per cent in 2009 to 47 per cent in 2050.

Figure 17 Trade of selected agricultural commodities, Indonesia



Source: ABARES model output

Figure 18 Import share of total consumption, Indonesia



Source: ABARES model output

Lower-income growth scenario

The baseline projections for Indonesian agrifood consumption, production and trade to 2050 are reliant on the underlying assumptions presented at the beginning of this chapter. Chief among these are the OECD (2012a) assumptions for Indonesian GDP growth to 2050 presented in Chapter 2 (Table 1 and Table 7). If Indonesia were to realise a lower level of income growth, agrifood demand growth would be expected to be lower. The World Bank projects that Indonesian GDP growth in each decade to 2050 will be markedly lower than the OECD's projections (World Bank 2015, Table 7). This scenario examines the potential effect on Indonesian agrifood consumption and import demand if GDP, and hence income, growth were slower over the projection period, as suggested by the World Bank. All other variables from the reference scenario are held constant.

Table 7 Indonesia GDP growth projections, 2010 to 2050

Period	Baseline 1991-2010	2011-2020	2021-30	2031-40	2041-50
OECD average annual growth (%)	4.40	5.30	5.30	3.40	3.40
World Bank average annual growth (%)	4.40	3.50	3.50	2.25	2.25

Source: OECD 2012a, World Bank 2015

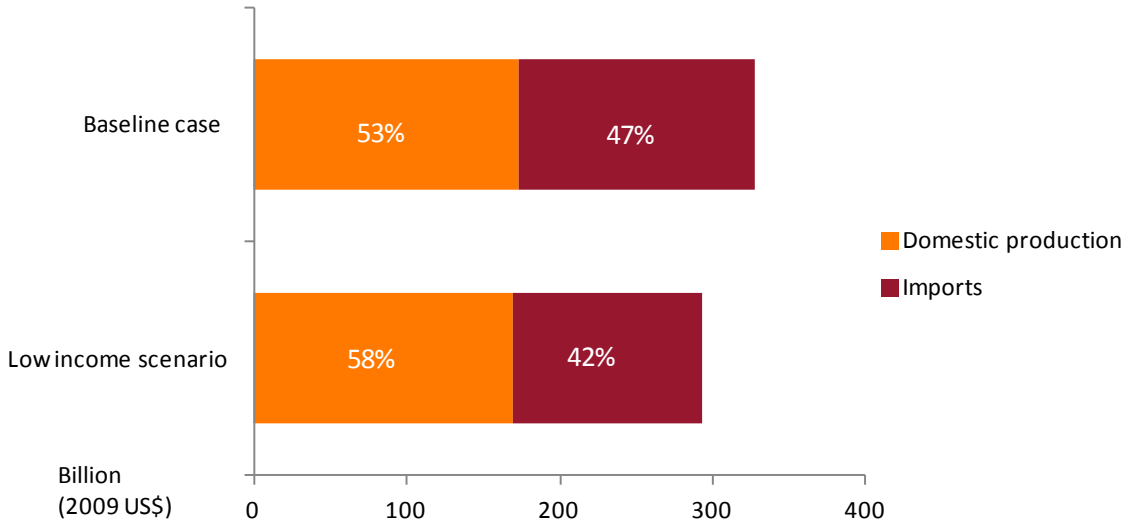
Results

In this scenario, lower economic and income growth throughout the projection period results in GDP in 2050 that is 44 per cent lower than the reference case. Because agrifood consumption is sensitive to changes in income, the total value of agrifood consumption in 2050 (in 2009 US dollars) is 10 per cent less than in the reference case (Figure 19). Weaker economic growth most

strongly affects urban areas, where average annual income growth in the reference case was assumed to be more than double that of rural areas. As a result, demand for high-value products, such as meat and dairy products declines significantly. Many of these products are imported. In 2050, the total projected value of beef consumption (in 2009 US dollars) is 17 per cent lower than in the reference case, and poultry and milk products are each 14 per cent lower. The real value of consumption for many domestically produced products, such as starches and maize, also declines but by no more than 10 per cent for any single commodity.

Weaker consumption growth leads to lower import growth over the projection period, particularly for high-value commodities. The total value of imports in 2050 is 16 per cent lower in this scenario compared with the reference case, with the import share of total consumption 5 percentage points lower than the reference case, at 42 per cent (Figure 19). Beef imports are projected to be 20 per cent lower than the reference scenario; sheep and goat meat 26 per cent lower; and dairy products 16 per cent lower. Fruit and vegetable imports are 12 per cent and 19 per cent lower, respectively.

Figure 19 Agrifood consumption in 2050 under lower income growth assumption



Source: ABARES model output

6 Conclusion

Continued strong income and population growth, combined with greater urbanisation, are driving Indonesia's increasing demand for not only more food but for a wider variety of foods. This demand growth is projected to be met by increases in both domestic production and imports.

Assuming no major changes to Indonesia's existing agricultural policies to 2050, the real value of food consumption in Indonesia is projected to increase more than four times between 2009 and 2050. The increase will be characterised by a move towards more diverse diets, with higher intake of meat, dairy products, fruit and vegetables. Between 2009 and 2050, the real value of beef consumption is projected to rise more than 14 times, dairy tenfold, and fruit and vegetables to more than triple. These projected increases are from a relatively low base and are driven by a rise in the quantities consumed, rather than any significant projected rise in real prices. To support this rise in demand, imports of many agrifood commodities are projected to increase to 2050.

The contribution of meat, dairy products, fruit and vegetables in Indonesian diets will increase more quickly than cereals and staples to 2050. While cereals and starchy staples will remain important components of Indonesian diets, their relative contribution will decline—the continuation of a trend that began around 1990.

The upward trend in food demand is most pronounced among urban households, whose income growth is assumed to be more than double that of rural households. A declining rural population and relatively lower incomes will result in slower growth in food consumption compared with the urban population.

For most agricultural commodities, assuming no significant change to historical TFP growth for total agriculture, production is projected to increase at a slower rate than consumption. As a result, food imports will be an important component of Indonesia's food and feed supply towards 2050. The real value of Indonesia's agrifood imports is projected to rise more than 20 times from 2009 to US\$152 billion (in 2009 US dollar terms) in 2050.

The projected significant increases in consumption and import demand for food in Indonesia are based on the assumption of relatively strong income growth to 2050. Under a lower growth scenario, consumption of protein-based food products, such as meat and dairy products, is projected to be around 14 to 17 per cent lower than the reference case at 2050. While consumption of domestically produced products is also projected to be lower in 2050 in the lower-income-growth scenario, the declines are less significant compared with the baseline case.

While not included in the modelling in this report, there is scope for increased production of non-food agricultural commodities and cash crops in Indonesia, in which it has a comparative advantage. These include natural rubber, copra, palm kernels, coffee, cocoa and spices. Indonesia's current policies on food self-sufficiency favour investment in food industries rather than the non-food and cash crops industries. This has the effect of allocating resources away from their most efficient use.

Because of their geographic proximity, Australia and Indonesia are well placed to benefit from advancing bilateral agricultural trade. Indonesia is an important market for Australian wheat, sugar, live cattle, beef, skim milk powder, and horticultural products, such as grapes and citrus.

Stronger demand for these commodities and others in Indonesia will create further opportunities for Australian exporters.

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