

Chapter 2. The policy context

The chapter examines the key issues that have shaped the development of India's agricultural sector over the last two decades. A brief overview is provided on the political, demographic, macroeconomic and social characteristics of the country. The chapter then evaluates the performance of agriculture in terms of production, productivity and trade; discusses its social impacts in terms of employment, incomes and food consumption; outlines its environmental consequences; and finally analyses structural changes in the sector, including in upstream and downstream sectors.

2.1. Introduction

India is a country of enormous diversity: geographic, economic and ethnic. It has made remarkable economic and social progress since the start of liberalisation reforms in the early 1990s. India is now among the fastest-growing G20 economies and its strong performance has lifted more than 160 million people out of extreme poverty over the last 25 years. Despite the declining contribution of agriculture¹ to India's GDP, the sector continues to have a pivotal role in the economy as it remains the first source of employment and thus a key driver of growth and poverty reduction. Spearheaded by the 'green revolution' in the 1960s-70s, the agricultural sector overcame productivity stagnation and food grain production improved. This period was followed by the 'White Revolution', which transformed Indian milk production and marketing. In comparison, over the last decade, the sector's overall performance in terms of growth on a sustainable basis has been much more modest. The main objective of the chapter is to provide a deeper understanding of the current constraints on agricultural productivity growth – the central challenge facing agriculture in India – by examining the key issues that have shaped the development of the sector and that have conditioned policy responses over the last two decades.

The following sections thus provide a brief overview of the political, demographic, macroeconomic, and social characteristics of the country. The chapter then evaluates agriculture's performance in terms of production, productivity and trade; discusses socio-economic impacts in terms of employment, incomes and food consumption; outlines environmental consequences; and finally analyses structural changes in the agricultural sector, including in agriculture's upstream and downstream sectors.

2.2. The big picture: Overall performance of the Indian economy

India is the seventh largest country by land area (2.97 million km²) and the second most populous after China with over 1.3 billion people, accounting for 18% of the world's population. Its territory spreads over the distance of 3 214 km from north to south and 2 933 km from east to west, while its coastline is 7 517 km long. The country is a federation composed of 29 states and 7 Union Territories (UTs) (Box 2.1). Table 2.1 provides a selected configuration of India's North, East, North-east, West-central, and South regions (National Portal of India, 2016).

Table 2.1. Selected configuration of main regions in India

Region	States and Union Territories (UTs)
North	Delhi (UT), Chandigarh (UT), Haryana, Himachal Pradesh, Jammu and Kashmir, Punjab, Uttarakhand, Uttar Pradesh
East	Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, Tripura
North-east	Bihar, Jharkhand, Odisha, West Bengal
West-central	Chhattisgarh, Goa, Gujarat, Dadra and Nagar Haveli (UT), Daman and Diu (UT), Madhya Pradesh, Maharashtra, Rajasthan
South	Andaman and Nicobar Islands (UT), Andhra Pradesh, Karnataka, Kerala, Lakshadweep (UT), Puducherry (UT), Tamil Nadu, Telengana

Note: This regional configuration has been selected for the purpose of the current study.

Source: Own tabulation based on National Portal of India (2016).

Box 2.1. Overview of the political and administrative system

India is a federal parliamentary democratic republic in which the President is the head of state and the Prime Minister is the head of government. There is a bicameral legislature consisting of an Upper House (*Rajya Sabha*), which represents the states, and a Lower House (*Lok Sabha*), which represents the people of India as a whole. The administrative structure is divided between the union government in Delhi (also called central government) and state governments, with significant autonomy granted to states. State executive branches are headed by governors appointed by the central government.

Indian states were organised during the post-independence period, based on linguistic and ethnic considerations. Several regions were considered unique in these respects – together with the size of population and area, administrative importance, and strategic location – and therefore could not fit within the states category or merged with them; these were thus designated as “Union Territories”. Unlike states, which have their own elected governments, UTs are ruled directly by the union government (hence the name “Union Territory”). In general, the President appoints an administrator or lieutenant-governor for each UT. The current 7 UTs represent less than 2% of India’s surface. The states and UTs are further subdivided into districts, followed by smaller administrative divisions. The Constitution provides for an independent judiciary which is headed by the Supreme Court.

The Constitution defines the organisation, powers and limitations of both central and state governments. It also provides a classification of their areas of responsibility, grouped under three broad dimensions: the Union List, the State List, and the Concurrent List which includes the topics that are subject to joint governance. The constitutionally assigned responsibilities of the central government are those related to monetary and financial policies, international trade, and those having implications for more than one state due to economies of scale or spillovers (including defence, communications, atomic energy, oil and mining, inter-state trade). The major subjects assigned to states comprise public order, public health, agriculture, irrigation, land tenure, fisheries, and industries. The Concurrent list includes areas such as education, transportation, or social security.

Source: National Portal of India (2016).

Macroeconomic performance: an economy of many parts

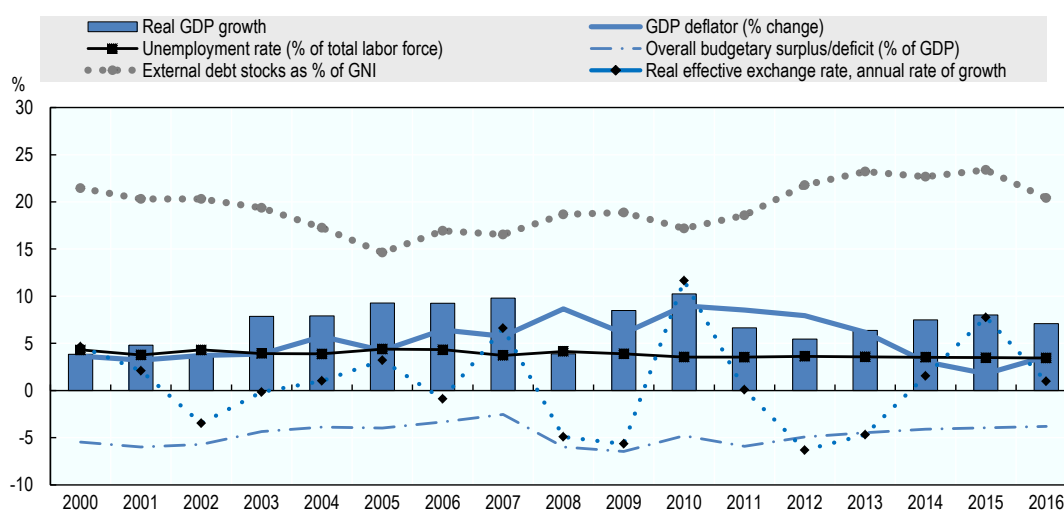
The economic reforms initiated in the 1980s and accelerated in the early 1990s – under the pressure of a balance of payments crisis largely driven by fiscal expansion – were a stepping stone in achieving a rapid rate of economic growth. Key components of the reforms included: liberalising measures (significant tariff reductions, elimination of all quantitative restrictions starting with non-consumer goods, relaxation of foreign direct investment policy); abolition of industrial licensing; exchange rate policy and introduction of current account convertibility; as well as fiscal consolidation which led to greater efficiency in resources allocation (Panagariya, 2004; OECD, 2014).

During the liberalisation period of the 1990s, fewer direct interventions were made in the agricultural sector. Import licensing was liberalised on sugar and cotton and state trading monopoly given up on edible oils. The reduction of protection to industry, and the accompanying depreciation in the exchange rate, tilted relative prices in agriculture’s

favour and supported agricultural exports. Spillover effects of liberalisation were also expressed through changes in the demand side of agricultural markets. Diversification of diets resulting from urbanisation, rise in per capita incomes, and increased female participation in the workforce enhanced demand for higher value and processed agricultural products, stimulating the emergence of organised retail in India. The liberalisation process was continued in the 2000s and quantitative restrictions on imports were eliminated on all goods, except where necessary to protect human, animal or plant life or health. Peak tariffs were reduced on non-agricultural products, albeit with a few exceptions (Singh, 2011).

India's GDP per capita more than doubled over the last two decades and the economy is currently the tenth largest in the world by nominal GDP. Having recorded GDP growth of less than 5% prior to 2003, the Indian economy registered since 2013 four consecutive years of growth above 6% and recently became one of the fastest-growing G20 economies (Figure 2.1) (Government of India, 2016; OECD, 2014, 2017a; IMF WEO, 2018; WB WDI, 2018).

Figure 2.1. India: Selected macroeconomic indicators, 2000-16



Source: World Bank (2018), *World Development Indicators*; IMF (2018), *World Economic Outlook Database*; Bank for International Settlements (2018).

The rapid growth in the economy in 2003-07 enabled a sharp fall in its overall budgetary deficit, from 4.3% of GDP in 2003 to 2.5% in 2007. However, relatively little was done during this time to widen the tax base and thus the country's fiscal capacity remains limited. India currently has one of the narrowest tax bases in the G20 and among BRIICS² economies, with total tax revenues amounting in 2015 to about 17% of its GDP. As exemption thresholds for income taxes have been consistently raised, an estimated 5.5% of people in the working age group currently pay taxes, with the individual income tax representing 2.1% of GDP. The cyclical nature of the improvement in the budget over these years was exposed by the speed of fiscal deterioration in 2008 as the economy slowed in the aftermath of the global economic crisis. The pace of fiscal consolidation has proven slow and the wide fiscal deficit thus remains a key macroeconomic challenge, resulting in limited policy space to adopt countercyclical policies (Government of India, 2016; OECD, 2014, 2017a; IMF WEO, 2018; WB WDI, 2018).

Fiscal federalism has been evolving in India along three broad directions in recent years: first toward greater transparency, second toward rationalisation and simplification of transfers, and finally a relative shift towards untied transfers. India's system of fiscal transfers includes devolution of taxes from the central divisible pool as well as a number of grants. The implementation in 2014-16 of the 14th Finance Commission's (FFC) recommendations has marked a shift in the fiscal architecture by enhancing the fiscal autonomy of states. The FFC has radically boosted the share of the states in the central divisible tax pool from 32% to 42%, which resulted in a substantial increase of untied transfers from centre to states³. However, to ensure that its fiscal space is secured, the central government sought a commensurate reduction in tied Central Assistance to States (CAS) – known as “plan transfers” – and in the number of Centrally Sponsored Schemes (CSS) financed by CAS (Kotia and Chowdhury, 2016; World Bank, 2016).

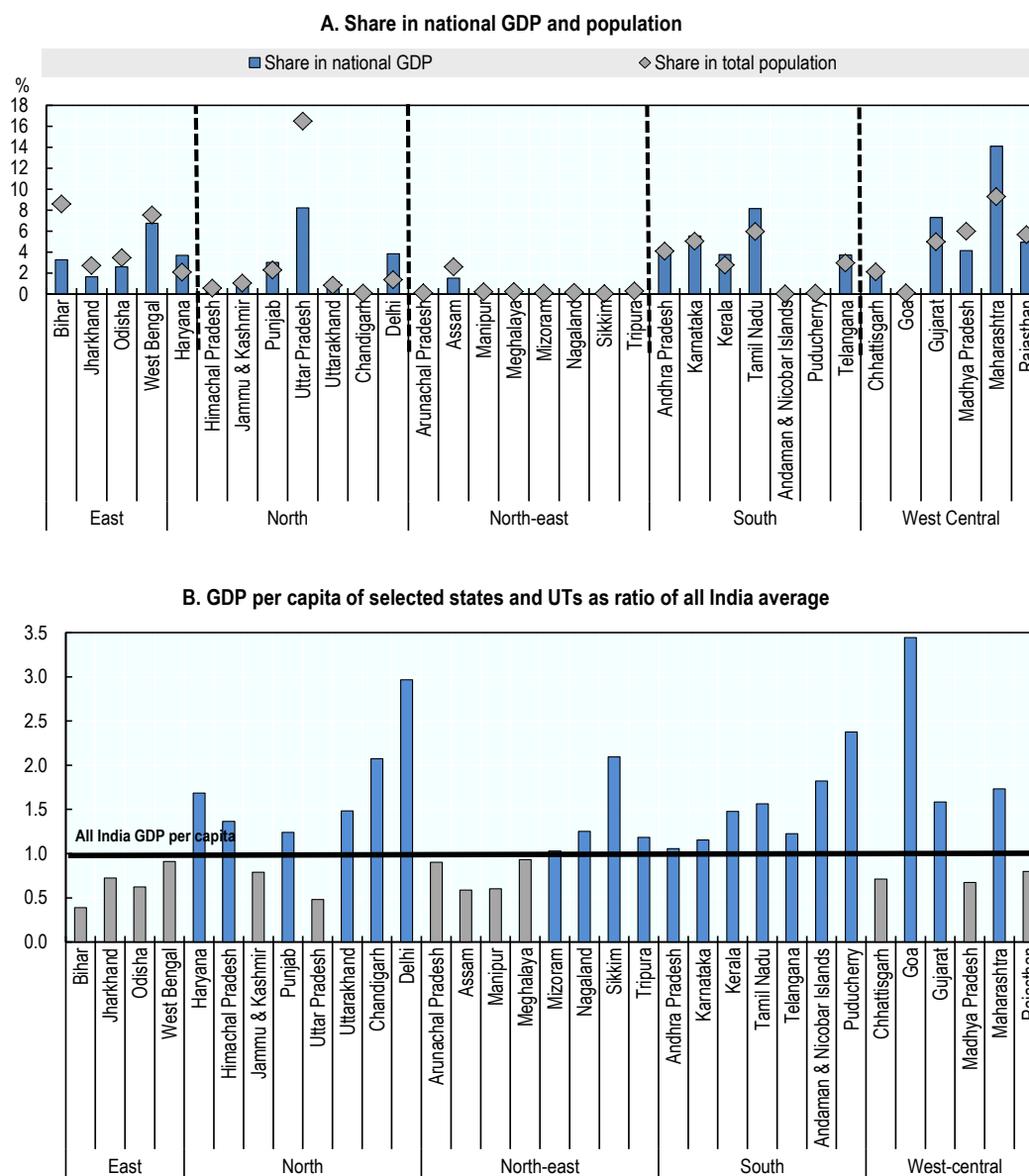
Unemployment is currently at 3.6%⁴ (Figure 2.1). However, this low number hides significant degrees of informal employment – which is as high as 87% of total employment – and under-employment⁵. The resulting strong segmentation of the labour market, with many workers left outside the reach of social protection schemes and labour market regulations, is an important source of income inequality. Moreover, the rate of employment creation has been too low to prevent a decline in the employment to working-age population ratio, partly because of low female participation. The central government has recently taken steps to make labour regulations friendlier to job creation by reducing several burdensome administrative requirements and strengthening transparency (OECD, 2017a). In this sense, as part of labour laws reforms, the Code on Wages Bill 2017 was introduced in the *Lok Sabha* in August 2017, seeking to streamline four existing Laws, namely: the Minimum Wages Act, 1948; the Payment of Wages Act, 1936; the Payment of Bonus Act, 1965; and the Equal Remuneration Act, 1976. The Codification of the Labour Laws aims to remove the multiplicity of definitions and authorities and lead to ease of compliance without compromising wage and social security (Ministry of Labour and Employment, 2017).

Inflation was high in 2007-13, ranging between 5% and 10%. It has since then dropped to 4% in 2016 and is expected to average 4.2% in 2017-21, in part due to relatively low global commodity prices. Food inflation has a significant impact on cumulative inflation in India, as food and beverage products account for 46% in the consumer price index. Indeed, with annual food inflation exceeding non-food inflation by about 3.5 percentage points on average since the 2007-08 global crisis, its direct contribution to annual cumulative inflation was of around 1.75 percentage points (Anand et al., 2016; IMF, 2015; OECD, 2014, 2017a; Ministry of Labour and Employment, 2016; EIU, 2017).

India applies a floating exchange rate regime, allowing the Indian Rupee (INR) value against other currencies to adjust to changing market conditions. In nominal terms, the INR depreciated from INR 46 per USD in 2010 to INR 67 per USD in 2016; its real value has however been steadily appreciating due to the persistent inflation differential between India and its main trading partners (Figure 2.1). This means that Indian produced goods are becoming more expensive relative to its competitors. Therefore, further appreciation of the real effective exchange rate may affect the competitiveness of the economy, including the agricultural sector (World Bank, 2016).

India's demographic and economic configuration is very heterogeneous, with large regional disparities across states and UTs. Southern and western states are the country's economic powerhouse, while the large majority of northern and eastern states lag behind (with the notable exception of the national capital region, UT of Chandigarh, Haryana, Himachal Pradesh, Sikkim, Uttarakhand, and Punjab). In 2014, the GDP per capita in the poorest state, Bihar, was just 15% of the level of UT of Delhi, one of the richest territories (Figure 2.2) (OGD Platform India, 2017; NITI Aayog, 2017a).

Figure 2.2. Economic configuration of selected states and UTs, 2014-15

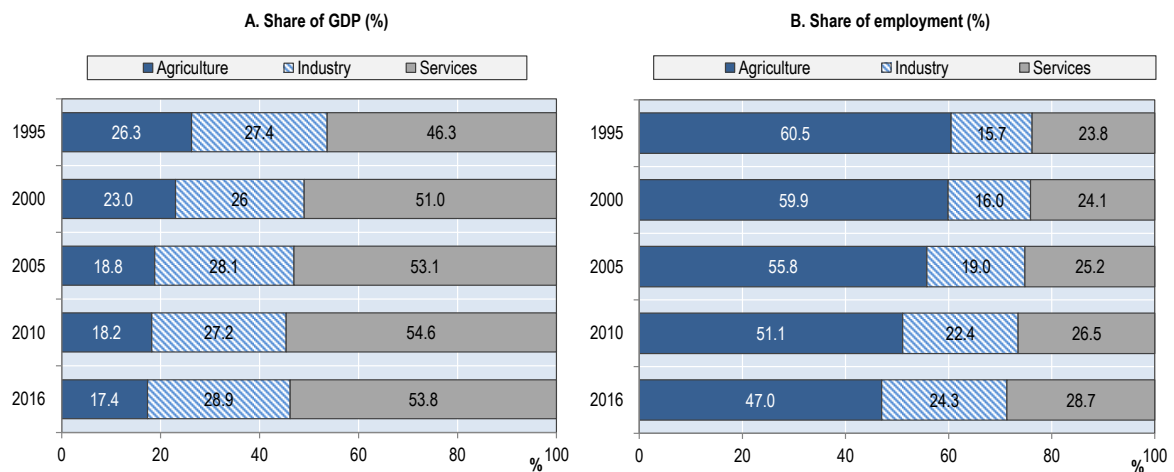


Source: OGD Platform India (2017); NITI Aayog (2017a).

Changing structure of the economy

The contribution of the agricultural sector to GDP has continued to decline over the last two decades, while that of other sectors – particularly services – has been increasing (Figure 2.3). This pushed down agriculture’s share in GDP from 26.3% in 1995 to about 17.4% in 2016⁶. Agriculture remains nevertheless a major source of employment, accounting for about 47% of the total national workforce⁷ (Ministry of Labour and Employment, 2016; MAFW, 2017a; OGD Platform India, 2018; World Bank WDI, 2018).

Figure 2.3. Economy structure, 1995-2016

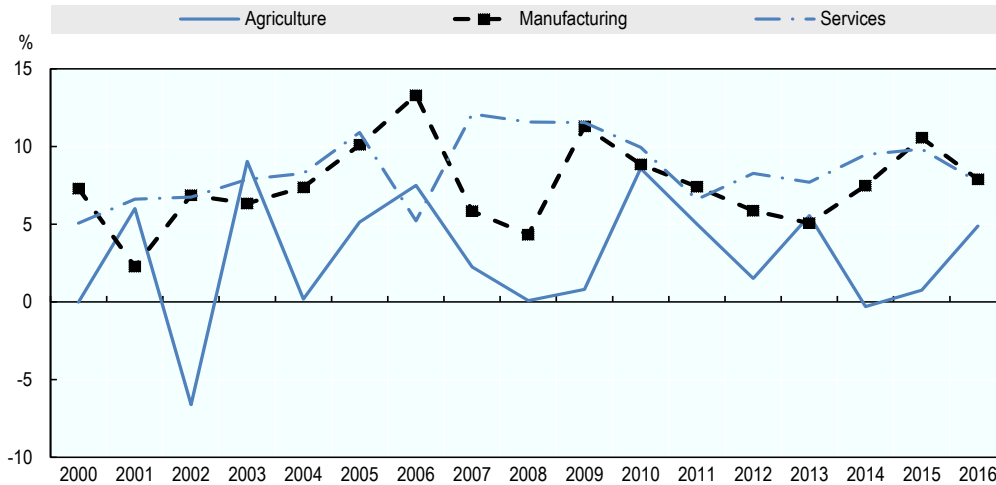


Note: For time comparison purposes, available data on agriculture value added includes the primary sector, forestry, hunting, and fishing.

Source: Ministry of Labour and Employment (2016); Ministry of Agriculture and Farmers’ Welfare (MAFW) (2017a); OGD Platform India (2018); World Bank WDI (2018).

Production has been shifting away from agriculture, but mostly into services rather than manufacturing. Services led economic growth over the last 15 years and played a more important role in India’s economic development than in most other major emerging economies (Figure 2.4). Despite the important product market reforms in the early 1990s (as discussed above) the share of manufacturing in GDP has remained stagnant and low in the past decades (13% of GDP in 2014-16), unlike in other Asian economies such as Indonesia (23.7%) or China (31.8%). Productivity of the manufacturing sector is also low: measured in value added in PPP per hour worked, manufacturing productivity in China and Indonesia is approximately 2.9 and 5.2 times higher than in India (OECD, 2014; World Bank WDI, 2018).

Figure 2.4. Annual percentage growth by sector value added, 2000-16

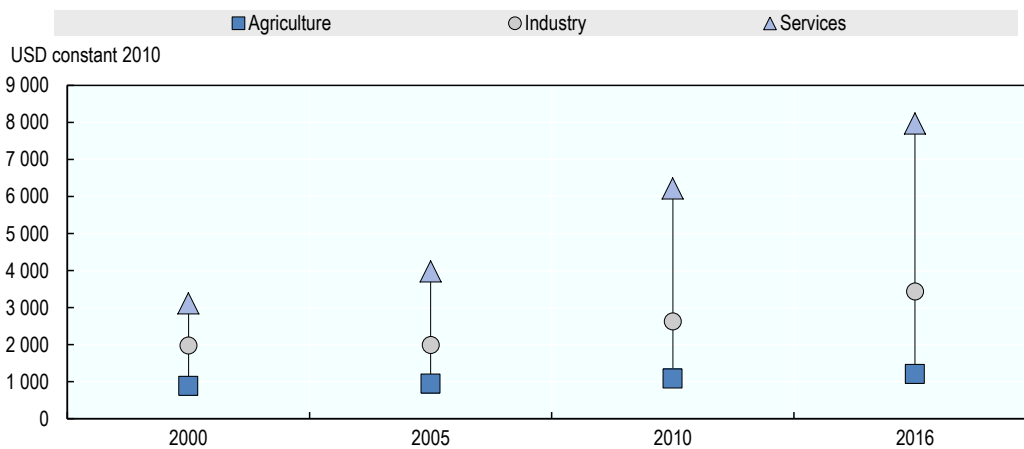


Source: OGD Platform India (2017); WB WDI (2018).

Variations in worker productivity and wage rates have been an important factor influencing labour movements across the different sectors of the economy. Productivity per worker is almost four times higher in services and two times higher in manufacturing than in agriculture (Figure 2.5). While this has prompted rural labour to move away from agriculture, the transition is progressing at a very slow pace. This largely reflects the poor technical skills and education status of the rural workforce, as well as a limited capacity of the non-farm sector to ensure sufficient employment opportunities to incoming workers (OECD, 2017a).

Figure 2.5. Labour productivity by sector, 2000-16

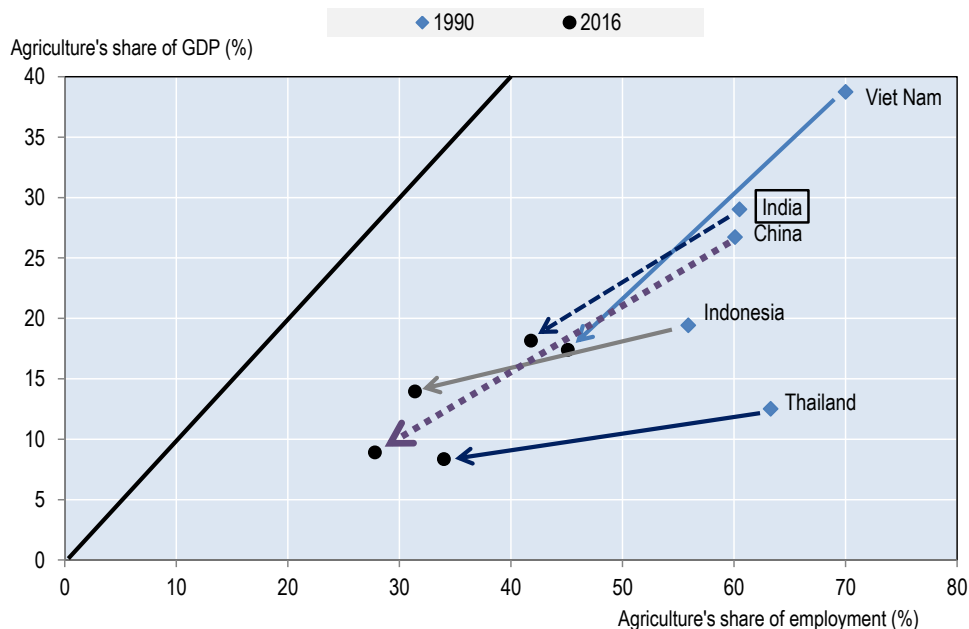
Value added per worker (USD constant 2010)



Source: World Bank WDI (2018).

The structural transformation in India has thus been atypical, with the fast growth of the services sector not preceded by any remarkable growth of manufacturing and no notable transformation in the occupational structure of the economy accompanying the relative growth of the different sub-sectors. The transformation has also been less prominent in 1990-2014 than in other Asian economies such as China or Viet Nam (Figure 2.6) (Rada and von Arnim, 2012; World Bank WDI, 2018).

Figure 2.6. Evolution of agriculture's share in GDP and in employment in selected Asian countries, 1990-2016



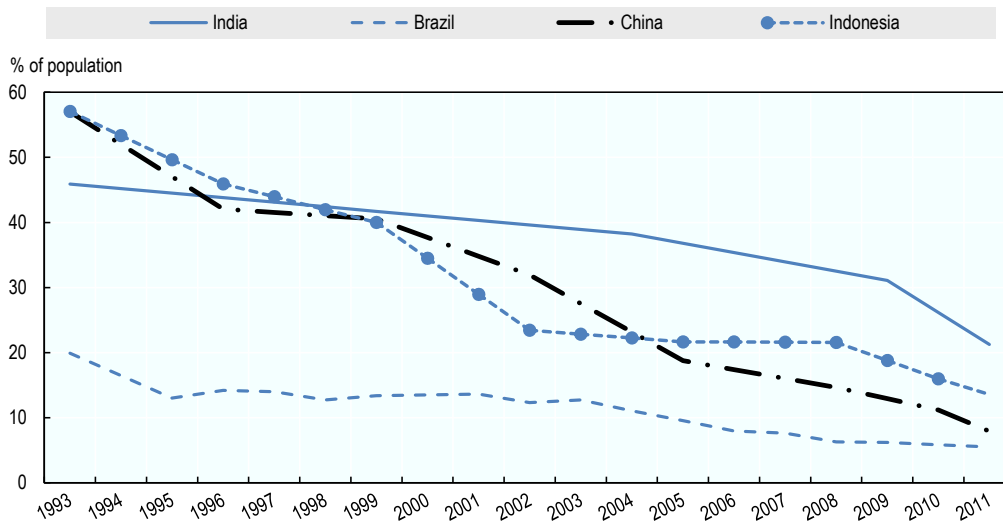
Note: For time and cross-country comparison purposes, available data on agriculture value added includes the primary sector, forestry, hunting, and fishing.

Source: World Bank WDI (2018).

Demographic and socio-economic aspects

Economic growth helped diminish the poverty incidence from 45.9% in 1993 to 21.2% in 2011, as measured by the World Bank definition of absolute poverty of USD 1.90 at PPP/day/person (Figure 2.7). If a broader definition of poverty is applied – USD 3.10 at PPP/person/day – poverty rates declined from 79.6% in 1993 to 58% in 2011. These rates show that even if progress in poverty reduction has been significant, one-fourth of the total population, currently just above the absolute poverty line, remains vulnerable to falling back into absolute poverty. As in most developing countries, poverty incidence is much higher in rural than in urban areas: at the national poverty threshold⁸, the rural poverty rate of 26% in 2011-12 was almost twice the rate in urban areas, despite a faster decline since the mid-2000s (OECD, 2017a).

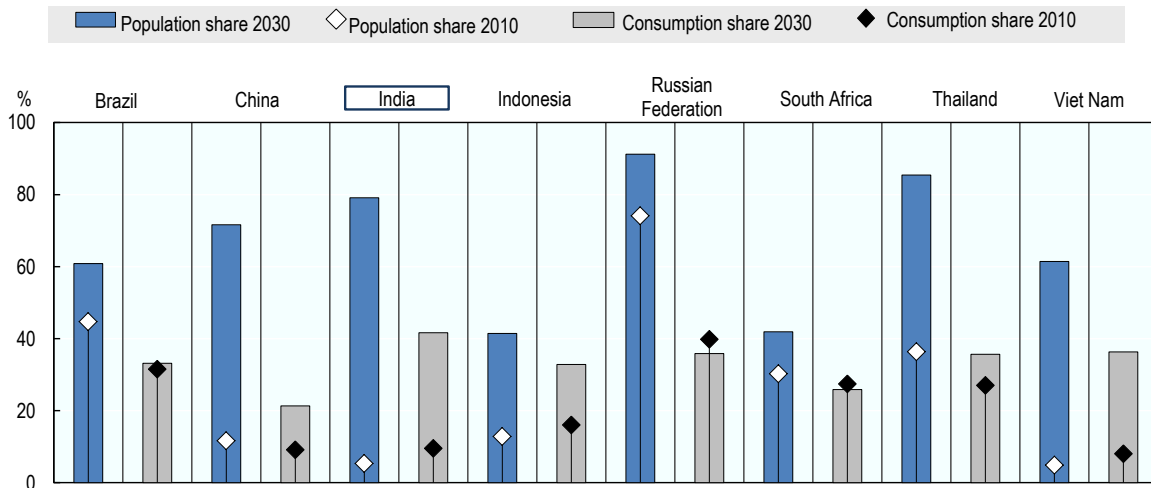
Figure 2.7. Poverty headcount ratio at USD 1.90/day (2011 PPP), 1993-2011



Note: For the years data are not available, population was estimated by linear interpolation and extrapolation.
Source: OECD (2017a) based on World Bank WDI.

Moreover, the rapid economic growth has not been sufficiently inclusive: income inequality is high, spatial inequalities are large, and regional development remains unbalanced. Income inequality has been rising: according to the Gini index of regional GDP per capita,⁹ India's regional disparities are large compared with the OECD average (0.28 versus 0.16 in 2013), as is the case in many other emerging economies. Although the regional Gini index for India is broadly at par with China, the share of the population living in low-income regions in India is much higher. Not only are regional disparities pronounced, they have also increased since the 1990s: states with a low GDP in 2000 have tended to grow less rapidly than those with a higher GDP per capita (OECD, 2017a).

The share of the middle class population has been rising rapidly, supported by the strong economic growth. A wide range of factors can be used to identify "middle class" – including income, socio-economic status, aspirations, material deprivation or multidimensional approaches, with different definitions yielding different sizes, income shares, or characteristics of the middle class population. For instance, according to Brookings Institution estimates available for more than 130 economies¹⁰, if India continues on its growth path, its middle class could reach more than two thirds of the population towards the end of the following decade (Figure 2.8). With the average household income set to triple by 2025 compared to its current level, India would also consolidate its position among the largest consumer economies (Brookings Institution, 2015).

Figure 2.8. Middle class population and consumption in key emerging economies, 2010-30

Note: Middle class population and consumption as a share of total population and GDP in each of the selected countries. Middle class variables estimate and provide forecasts of the number of people living in households earning or spending between USD 10 and USD 100 per person per day (USD 2005 PPP), and the consumption expenditure of this group. There is no standard definition of India's middle class. India's National Council of Applied Economic Research (NCAER) defines the middle class as households with a disposable income of 200 000 to 1 000 000 rupees (USD 4 380 to USD 21 890) a year in real 2000 terms. *Source:* Brookings Institution (2015), *Development, Aid and Governance Indicators* (DAGI).

The level of urbanisation increased from 27.8% in 2001 to 31.1% in 2011. In the early 2010s, the fastest growing states tended to be those with a large urban population and at present, the richest states are also the most urbanised. While the overall share of urban population remains low compared to countries at a similar level of development, demographic change will be an important factor driving the Indian economy in the long run. India's population is projected to continue growing for several decades to 1.4 billion in 2022 and 1.7 billion in 2030, thus exceeding China's population. Moreover, in 2020, the estimated average age of India's population at around 29 years is expected to be among the lowest in the world. The percentage of the population living in urban areas is also estimated to reach 41% by 2030, putting pressure on the already heavily burdened urban infrastructure. Rural-urban linkages have been less dynamic than in other economies in the region, such as China or Indonesia, both in terms of temporary and permanent migration (Box 2.2) (Denis and Zérah, 2014; UN, 2015).

Access to core public services is highly unequal and spatially concentrated. Public services are essential for improving working conditions and economic opportunities for the rural population, including farm workers. India's population coverage for water provision, sanitation and electricity has improved but remains low compared to other major emerging economies. While almost 20% of the Indian population has no access to electricity, some states have nonetheless succeeded in achieving near universal provision, including Gujarat, Karnataka and Maharashtra. Despite government efforts aimed at improving public services in rural areas, such as the National Health Mission or the *Pradhan Mantri Sahaj Bijli Har Ghar Yojana-Saubhagya* ("Easy access to power for every house") scheme, deficiency in core public services remains much higher in rural than urban areas, with a particularly marked rural/urban divide for electricity, sanitation and drinking water (OPHI, 2015; OECD, 2017a).

Box 2.2. Rural-urban linkages

Labour migration flows in India include permanent, semi-permanent, and seasonal migrants. Net rural to urban migration is estimated to have accounted for 21% of urban population growth in 1991-2001 and for 22% in 2001-11. Residential migrations within the rural environment continue to be by far the most important flow. Internal migrants have been mostly moving over short distances, within their own district (62.6% in late 2000s), then between districts of the same state (24.1%), and only 13.3% attempted long distance migration to another state. Inter-state labour mobility averaged 5-6 million people per year between 2001 and 2011, yielding an inter-state migrant population of about 60 million.

Small towns and peri-urban areas¹ have become the key intermediary point in the convergence of rural population to urban areas. Most rural workers migrate from rural to urban only for temporary periods, particularly in lean periods of agricultural-related work. The rural-urban linkages are characterised by a growing role of small towns in services provision, such as education, health or financial services. A total of 32 million individuals, accounting for 4.3% of India's rural population, live in households where one or more workers commute from rural to urban areas. Scheduled tribes (STs) and scheduled castes (SCs)² – population groups explicitly protected in India's Constitution due to their historical socio-economic background – are over-represented in short-term migration flows.

1. There are two different sets of criteria to define an urban locality: Statutory Towns (ST) and Census Towns (CT). STs generally include government-designated municipalities. CTs comprise all settlements that fulfil the following three conditions: (i) the population must be 5 000 or more, (ii) the density must be at least of 400 persons per km², and (iii) 75% of the male workforce should be employed outside the agricultural sector. The population of all settlements which are not classified as urban is included in the total rural population.

2. The caste system is a system of social stratification in India. Hindu society is stratified into four hierarchical classes or varnas (the Brahmins, Kshatriyas, Vaishyas, and Shudras), with a large sub-population of untouchables excluded from this system entirely (Dalits). Within each of these classes, and among the untouchables, are thousands of castes or jatis. The term "Scheduled Tribes" refers to specific indigenous peoples whose status is acknowledged to some formal degree by national legislation, and are also considered as socially disadvantaged. "Scheduled Caste" is the official name given to the lowest caste, considered 'untouchable' in orthodox Hindu scriptures and practice, and officially regarded as socially disadvantaged. SCs and STs comprise about 16.6% and 8.6%, respectively, of India's population.

Source: Denis and Zerah (2014); Government of India (GoI) (2017a).

Competitiveness and structural challenges

Economic growth is projected to remain robust, at around 7.3% a year in 2016-21. These projections are supported by increased political certainty; several market-oriented reforms initiated by the government elected in 2014; improved business confidence; lower commodity import prices; sustained private consumption; and services sectors growth (EIU, 2017; IMF, 2015; OECD, 2014, 2017a).

More recently, important steps have been taken to make India a less fragmented domestic market. For instance, the Government of India introduced the Goods and Services Tax (GST), which came into force on 1 July 2017. The GST replaces various taxes on goods and services levied previously by the central government and states¹¹ by a single tax on value added. This has the potential to reduce tax cascading, facilitate a common

national market, encourage voluntary tax compliance, reduce tax collection costs, support investment, and improve competitiveness. The GST, unlike the previous system, will allow the supplier at each stage to set-off the taxes paid at preceding levels in the supply chain and ease inter-state movement of goods. Nonetheless, challenges remain in terms of its implementation stemming from the different tax rates applied across product categories, exclusion of certain products, and other administrative complexities related to registration and payment (Government of India, 2017a; OECD, 2017a). Moreover, inter-state regulatory requirements can still involve detailed documentation such as permits, waybills, tax invoices, and delivery notes which lead to delays and increases in the transaction cost. These not only create barriers to inter-state trade but also inefficiencies in supply chains (IMF, 2015).

India's trade openness, measured as the ratio of traded goods and services to GDP, has increased from 15% in 1990 to 40% in 2016. The latter is close to the ratio in other economies with large domestic markets such as China (37%) or Indonesia (37%). With a share of 37%, services constitute the bulk of exports. In turn, agro-food products represent 13% of exports and 7% of imports. Export growth has been decelerating from 7.8% in 2013 to 4.5% in 2016 as India's dynamic services export sector was also hit by the appreciation in the real effective exchange rate (IMF, 2015; World Bank WDI, 2018).

The country has also experienced a significant acceleration of its integration into global value chains (GVCs) over the last two decades with the foreign content of its exports more than doubling from less than 10% in 1995 to nearly 21% in 2014, which now puts it at the second highest rate among BRIICS economies after China. The increased participation in GVCs was led by services: 59.4% of the total value of India's exports reflects services content in 2014. Middle East and North Africa (MENA) economies constitute the main export market destination of India's products (30%), followed by Asia-Pacific (27%). India's main supplier of intermediate and final goods remains the Asia-Pacific region (38%), followed by MENA (29%) (IMF, 2015; World Bank WDI, 2018; CEPII, 2018; OECD-WTO TiVA, 2017).

Overall, India's competitiveness is ranked 40th out of 137 countries classified by the World Economic Forum in 2017-18, consolidating its position after advancing 16 places in 2016-17. It also compares rather favourably with other countries classified as factor-driven economies¹², but rather poorly when compared with other key emerging Asian economies such as China, Malaysia, and Thailand. While the large market size constitutes an advantage, and important progress has been made in terms of fostering innovation, goods market efficiency, and business sophistication, there are remaining challenges as regards the low labour market efficiency, cumbersome regulatory procedures, low quality of infrastructure, low technological readiness, barriers to FDI, and underperforming higher education and training (Box 2.3) (OECD, 2017a; WEF, 2018).

Box 2.3. Key structural challenges for the Indian economy

Labour market efficiency: Although direct labour costs are relatively low, labour regulations are complex and stringent, for the manufacturing sector in particular. Employment protection legislation (EPL) is particularly restrictive compared to both OECD countries and other emerging economies. There is also uncertainty regarding enforcement since many labour laws are old and responsibilities are often shared across state jurisdictions. Implementation of recent reforms aiming to make labour regulations friendlier to job creation can be heterogeneous at the state level. This partly explains the significant degree of informality and the low formal job creation, as well as the low quality of jobs.

Cumbersome regulatory procedures, including in the services sector: The OECD Product Market Regulation (PMR) indicators show that in 2013 India scored poorly in terms of barriers to entrepreneurship and investment. These scores reflect the complex regulations and burdensome administrative procedures for firms, which impede growth, keep prices high and create opportunities for corruption. There have been initiatives to simplify and improve government administration across various states and UTs, including through ICT tools, to increase transparency. However, such efforts encounter many implementation challenges at local levels. India also tends to have more restrictive regulation than most other countries covered by the OECD Services Trade Restrictiveness Indices (STRI): the general regulatory framework imposes a number of burdensome administrative procedures and time consuming licensing and permit requirements. The particularly restrictive sectors are among the ones potentially supporting the *Make in India initiative*, namely communications services, professional services, financial services and distribution.

Low quality of infrastructure and low technological readiness: This concerns roads, ports and airports, as well as electric power transmission and distribution. India ranks 66st out of 137 economies covered by the WEF Global Competitiveness Report as regards the quality of infrastructure and 100th with respect to the electricity and telephony infrastructure. Land acquisition laws induce significant delays in the implementation of infrastructure projects. In addition, India remains one of the least digitally connected countries in the world (120th out of 148); only one in five Indians access the Internet on a regular basis.

Barriers to FDI: The OECD FDI Regulatory Restrictiveness Index 2016 series – measuring statutory restrictions on FDI in 62 economies – reveals that while India is considerably more open to FDI than China, barriers to FDI are much higher than in most OECD economies. FDI inflows remain low as a share of investment, depriving India of a valuable source of financing and technology transfer.

Underperforming higher education and training: Adult literacy, as well as secondary and tertiary enrolment rates place India behind all major emerging economies. Even people with higher education or vocational training (VET) are often ill-equipped and require significant on-the-job training.

Source: Benz, Khanna and Nordás (2017); IMF (2015); OECD (2014, 2015a, 2015b, 2017a, 2017b); WEF (2018).

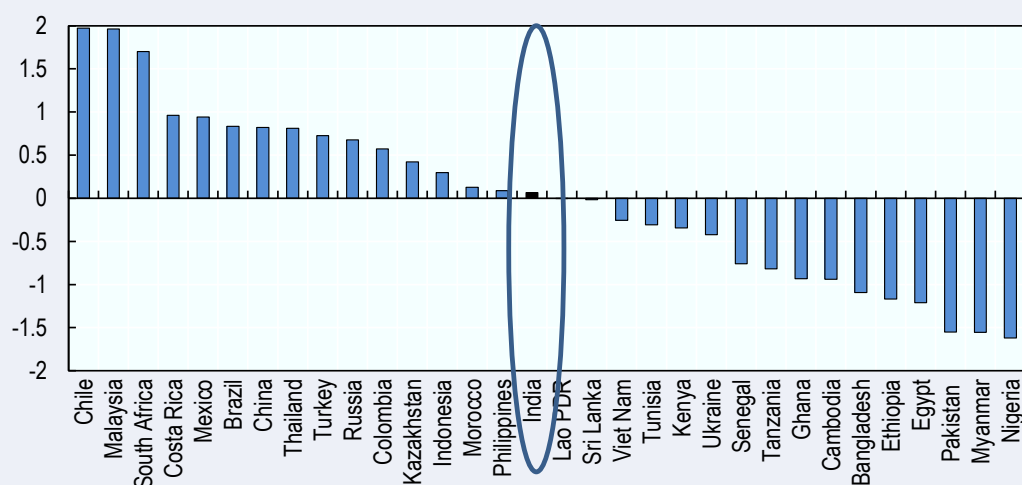
While India's economic growth remains strong, the supply-side bottlenecks and structural challenges discussed above will constrain medium to long-term growth, hinder job creation and also weaken the enabling environment for agricultural development (Box 2.4).

Box 2.4. Agriculture Growth Enabling Index

A country's enabling environment is defined as the multifaceted settings within which the agricultural sector and economy more broadly operates, comprising non-distorting and stable policies, adequate provision of public goods, good governance through laws and regulations that are conducive to private-sector economic activity while addressing market failures, and strong and effective institutions through which government measures and actions are operationalised. Collectively, these factors play an important role in ensuring a favourable environment for innovation at the farm level and by other businesses in agricultural value chains, by shaping incentives for investment and sustainable use of natural resources, and by building economic capacities.

To assess agriculture's enabling environment in a given country and to compare it with other countries, the OECD in co-operation with IFPRI constructed a preliminary Agricultural Growth Enabling Index (AGEI). The Index has been further developed by the OECD Secretariat to include sustainability components and to cover a wider range of countries. The Index assembles a wide array of information to provide cross-country comparisons or single-country evaluations. The AGEI assembles existing indicators and indices for measuring the determinants of agricultural growth and competitiveness. It has been applied to 32 developing and emerging economies, including India. Relative scores on the AGEI overall are shown in Figure 2.9. The overall AGEI score for India is slightly above average, ranking 16 out of 32 countries covered in 2015.

Further decomposition can be made both across and within the four key blocks of the AGEI (governance quality, investments in and availability of capital, effectiveness of market operations, and agriculture/sustainability). India performs relatively well on governance and markets, but below average on capital and agriculture/sustainability. Within governance, India performs well on political stability, but somewhat poorer on institutions and macro stabilisation. For capital, India performs slightly above average on human capital, as captured by health/education indicators, but much poorer on infrastructure. For markets, India scores above average on financial markets and trade facilitation, but poorly on goods and labour markets. For agriculture/sustainability, India scores particularly low on various sub-components, including: capital intensification, measured by the capital stock per person employed in agriculture, land market rights and access, land availability per person employed in agriculture, pressure on water, as well as on agricultural R&D; on the other hand, it appears to score above average with respect to farm finance.

Figure 2.9. Agricultural Growth Enabling Index, 2015

Note: The index is comprised of four blocks with 40% of the weight on agriculture/sustainability factors and 20% each on broader economy-wide governance, capital and market operation. The indicators selected measure circumstances within each country in the early 2010s. To account for the differences in averages of scores of the 32 countries and the variances of these scores across the index and its blocks, this figure shows the normalised score of each country on the AGEI index and on each component. Specifically, for the AGEI and each of its four blocks the average for the 32 countries has been subtracted from each country value and the resulting country value divided by the standard deviation for the series, to create series with zero mean and unit standard error. For example, a value of 2 means that the observation for a given country is 2 standard deviations above the average (which is zero) for the 32 countries.

Source: OECD estimates.

2.3. Agriculture in the Indian economy

Climatic conditions

India has great geographic diversity and a variety of climate regimes. The agriculture sector spreads over six major climatic subtypes, ranging from arid desert in the west, alpine tundra and glaciers in the north, and humid tropical regions supporting rainforests in the south-west and the island territories. The northern region of the country possesses continental climate with alternating severe summers and cold winters. Peninsular India has a more moderate but arid climate. The coastal regions receive abundant rains and have unvarying warmth. The north-east also receives abundant rainfall but has a more contrasting seasonal temperature (Ministry of Environment, Forest and Climate Change, 2015).

The Indian monsoon with its summer (south-west) and winter (north-east) stages is the dominant climatic influence on the subcontinent. The south-west monsoon is the most important feature of India's climate as nearly 75% of the annual rainfall of the country is received during this season (June-September). The north-east monsoon brings rain mainly to the south-east parts of the country. Variation in the onset, withdrawal and amount of rainfall during the monsoon season affects the water resources, agricultural production, and ecosystems of the country (Ministry of Environment, Forest and Climate Change, 2015).

Trends in agricultural output

The annual average growth in agricultural output¹³ has been of approximately 3.6% since 2011 (Figure 2.10). Driven by the technological improvements of the green revolution in the 1960s-70s, the agricultural sector was able to overcome productivity stagnation and the production of cereals increased at a very fast rate until the early 1990s, increasing the net availability of food grains. The green revolution was followed by the white revolution, which completely transformed milk production and marketing in India (Box 2.5) (Gulati, Saini and Jain, 2013; OECD/FAO, 2014; MAFW, 2017a; FAOSTAT, 2018; WB WDI, 2018).

Since 1995, output growth has nevertheless been highly volatile reflecting periods of erratic climatic conditions, particularly as regards monsoons (Figure 2.10). This performance contrasts sharply with that of the agricultural sectors in China or Viet Nam, which has been more dynamic. The sector follows nevertheless similar trends to other countries in the region such as Indonesia, Malaysia and Thailand (Figure 2.11) (Gulati, Saini and Jain, 2013; MAFW, 2017a; FAOSTAT, 2018).

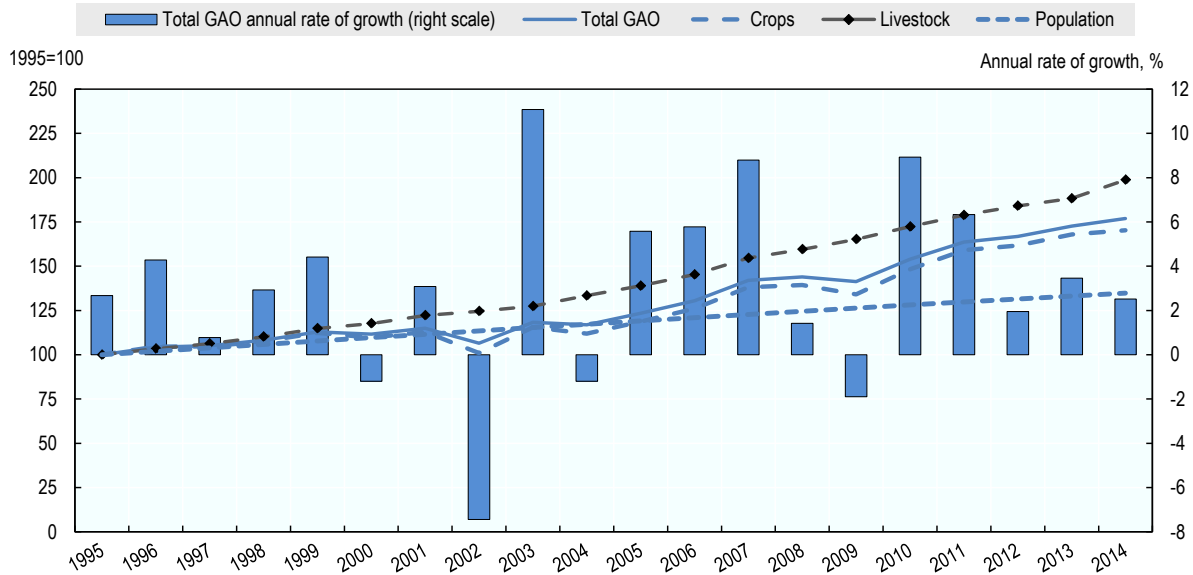
Box 2.5. The green and white revolutions

The ‘green revolution’ began with the introduction of semi-dwarfed, high-yielding varieties of wheat in 1967 and rice in 1968. Favourable policies in the form of price and procurement support as well as input subsidies encouraged farmers to adopt the new varieties. The Green Revolution spread largely in areas with favourable agro-climatic conditions, i.e. irrigated areas where wheat and paddy were mainly grown. Another notable feature was the adoption of double-cropping. Major irrigation facilities, such as dams, were built while simple irrigation techniques, like the digging of tube wells for extracting groundwater, were also adopted on a massive scale. During the 1990s, there was a shift from investments in capital assets, such as irrigation, power and rural infrastructure, to subsidies on inputs like power, water and fertiliser and to minimum support prices.

In the 1950s and 1960s, India relied heavily on milk imports, while dairy farmers had only a few animals and were struggling to get this highly perishable product to markets in urban centres. Against this background, the Indian government set out to “flood India with milk” and launched Operation Flood in 1970. This aimed to increase milk production, connect milk producers and consumers, and thus raise the income of dairy farmers. Operation Flood addressed three different levels: i) at the farm-level, dairy farmers were organised into co-operatives. Co-operatives were provided with advanced technologies, such as modern animal breeds that produced more milk; ii) at the district level, co-operative unions were formed, which owned and operated milk processing plants as well as storage and transport equipment. The unions also provided animal health services; iii) at the state level, state federations conducted and co-ordinated the nation-wide marketing of milk. Today, India is the largest producer of fresh buffalo and goat milk and the second largest producer after the United States of fresh cow milk.

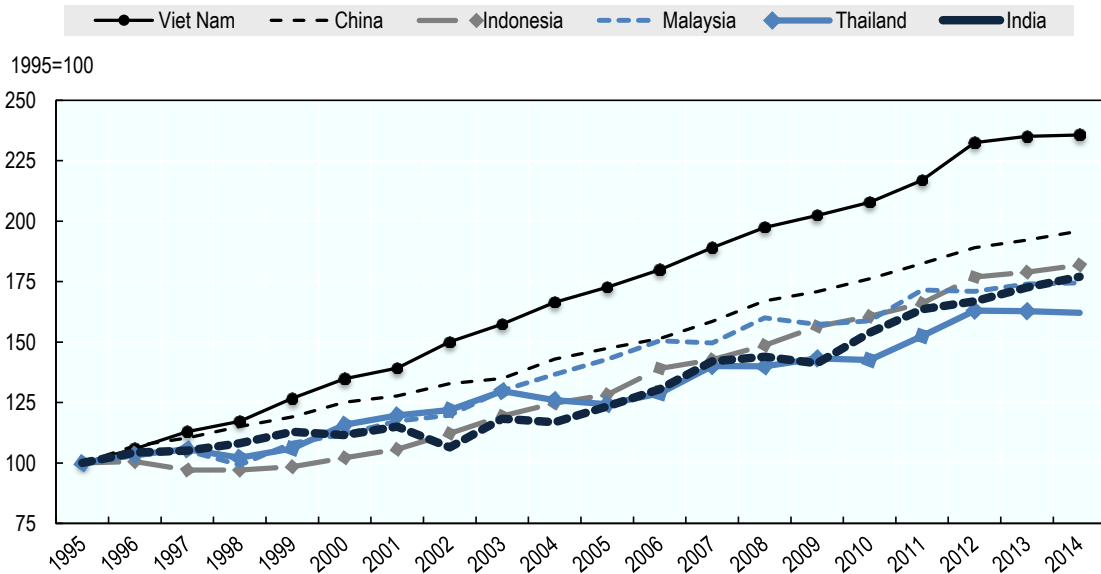
Source: OECD/FAO (2014).

Figure 2.10. Growth in agricultural output in India, 1995-2014



Note: FAO indices based on the 2004-06 period have been recalculated taking 1995 as base year.
Source: MAFW (2017a); FAOSTAT (2018).

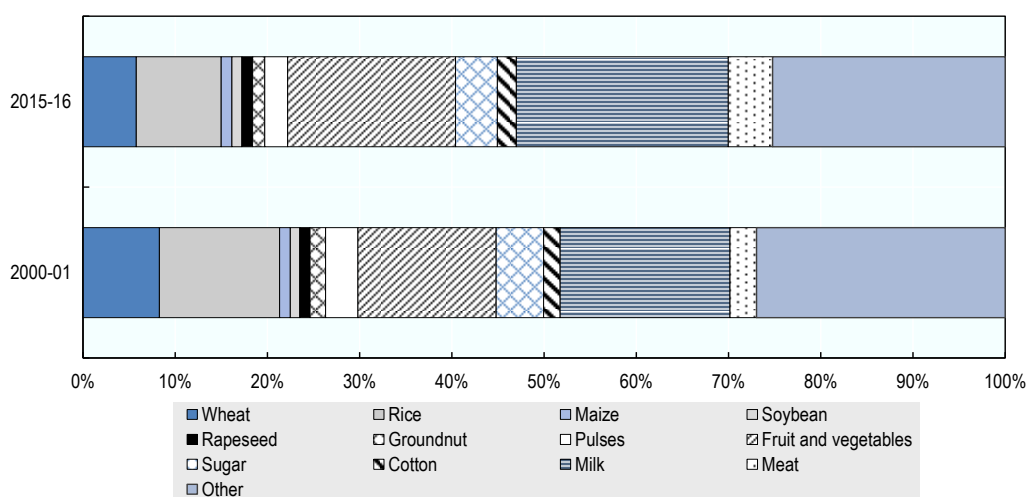
Figure 2.11. Growth in gross agricultural output in selected Asian countries, 1995-2014



Note: The FAO indices of agricultural production show the relative level of the aggregate volume of agricultural production for each year in comparison with the base period 2004-06. They are based on the sum of price-weighted quantities of different agricultural commodities produced after deductions of quantities used as seed and feed weighted in a similar manner. In this figure, indices based on the 2004-06 period have been recalculated taking 1995 as base year.
Source: FAOSTAT (2018).

The differential rates of growth in the two main sub-sectors (Figure 2.10) show that Indian agriculture is continuing to steadily diversify towards livestock and away from grain crops. Livestock output growth has been faster and less volatile compared to the crop sector. While grains and milk remain dominant, there has been a gradual change in the composition of production to other crops – such as sugarcane, cotton, fruit and vegetables – as well as certain meat sub-sectors (Figure 2.12). In contrast to grains, where policy intervention has been extensive on the supply side (Chapter 3), the expansion of high-value crops and livestock was primarily led by growth in consumer demand and changing diet preferences associated with rising incomes, urbanisation, and demographics dynamic (Gulati, 2009; Gulati et al., 2016).

Figure 2.12. Changes in the composition of the value of agricultural production, 2000-16



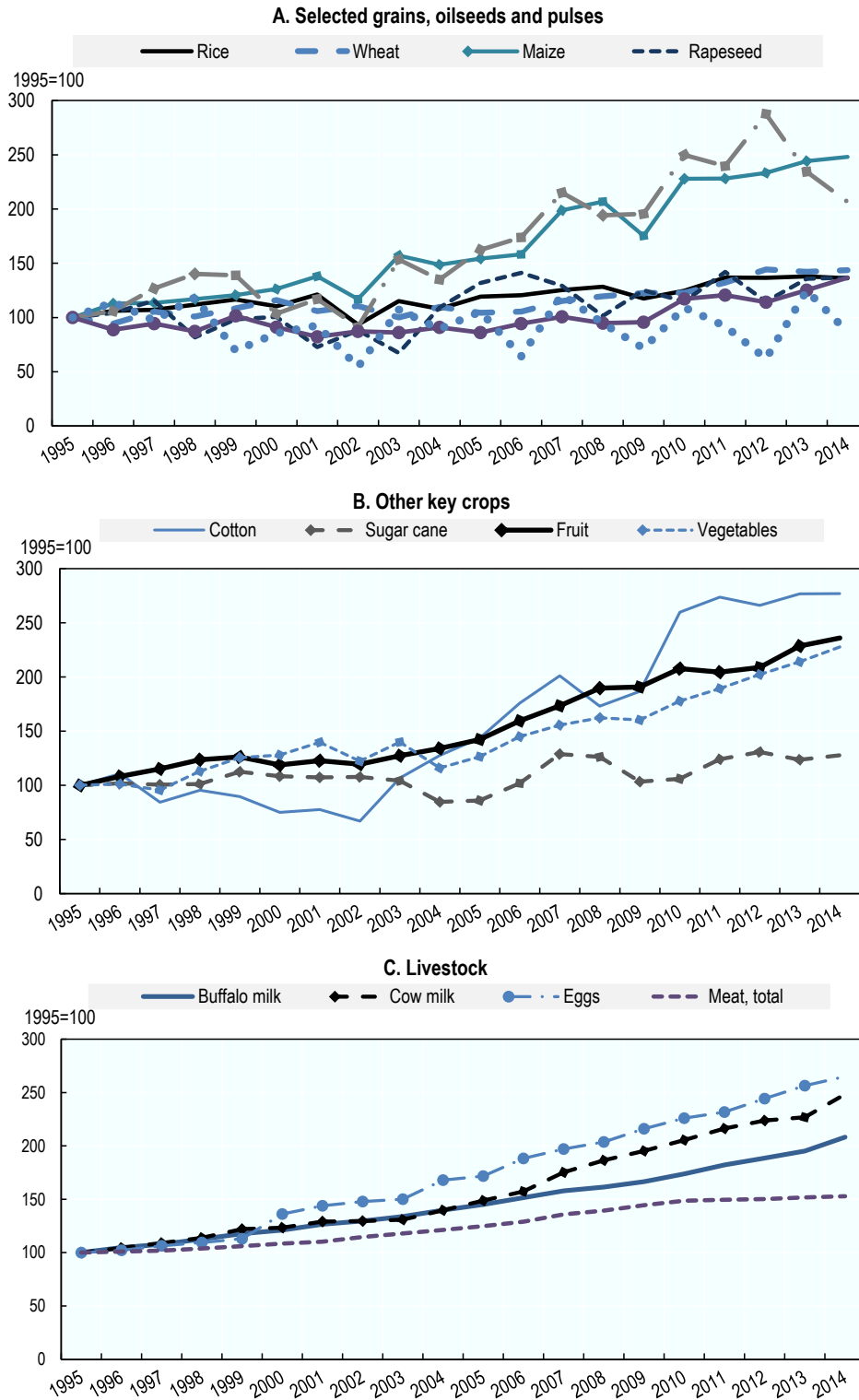
Note: 'Meat' includes here bovine meat, sheep meat, and poultry.

Source: MAFW (2017a); Ministry of Statistics and Programme Implementation (MOSPI) (2016a).

Output trends in cereals and oilseeds

Beyond the green revolution, growth in rice and wheat output slowed, with annual production increasing since 2000 by only 1.9% and 2.5% annually (Figure 2.13). Oilseeds production is dominated by soybeans, accounting in some years for close to half of the total oilseeds produced. Groundnuts and rapeseed make up most of the rest of India's oilseed production. Soybeans production expanded much faster than groundnuts and rapeseed, which experienced significant year-to-year fluctuations. Production of pulses remained stable until mid-2000s, but picked up slowly afterwards, largely in response to focussed efforts in the National Food Security Missions from 2007 and the Accelerated Pulse Production Program launched in 2010-11 (Chapter 3). Chickpeas, a *rabi*¹⁴ crop, constitutes over 40% of the total pulses output. Pulses production remains insufficient to cater to domestic demand, making India a major importer of pulses (MAFW, 2016a, 2017a; MOSPI, 2017; FAOSTAT, 2018).

Figure 2.13. Output trends for key crops and livestock, 1995-2014



Source: FAOSTAT (2018).

Dynamic change in the composition of output: fruit and vegetables...

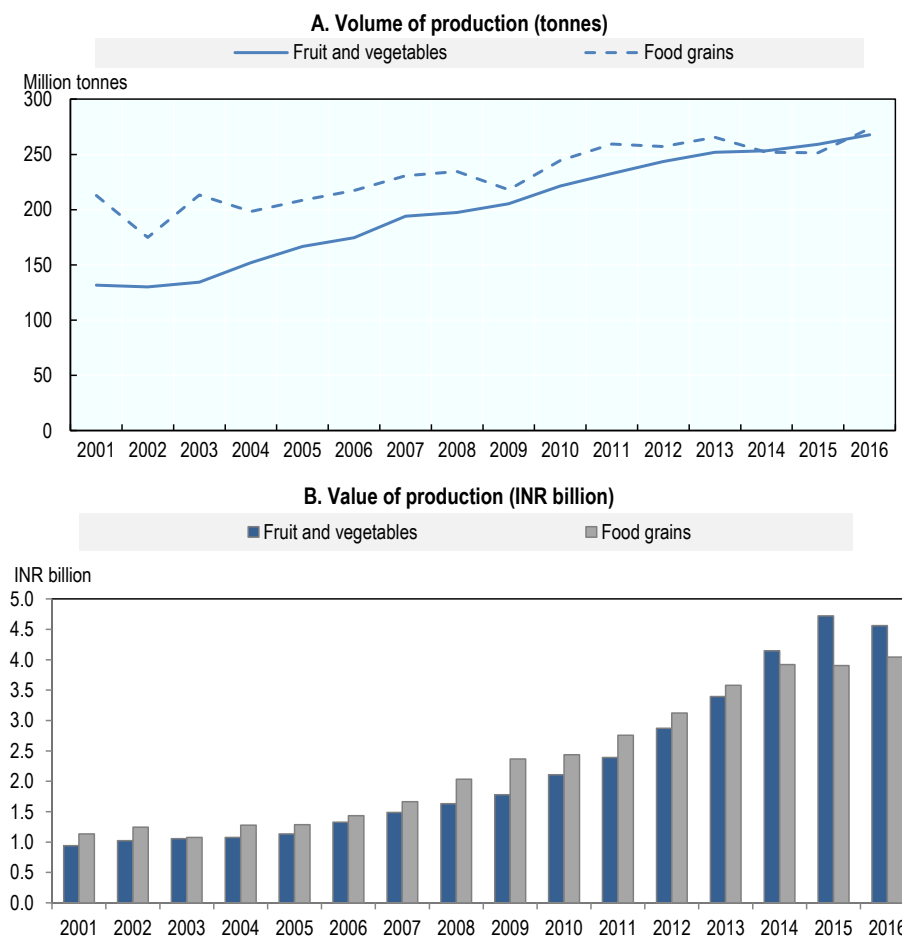
Among crops, cotton and fruit and vegetables are by far the outstanding performers in terms of output growth over the last two decades. The cotton sector expansion was driven by the 2002 introduction and subsequent rapid adoption of Bt (*Bacillus thuringiensis*) technology, with output almost tripling in 2001-15 (the gene revolution). As a result, India today has the largest area under Bt cotton (greater than that in China).

Fruit and vegetables production has also surged, growing at 4.3% per year since 2001 and making India the second largest global producer after China. These are primarily destined for the domestic market and such output growth reflects the evolving pattern in domestic consumer preferences. India is first in the production of fruits such as mango, banana, papaya, or pomegranate. The country is also second to China in the production of many vegetables, including potato, tomato, onion, eggplant, cabbage, or cauliflower. India currently grows 41% of world's mangoes, 23% of bananas, and 10% of onions. With the advantage of diverse agro-climatic zones, some crops can be harvested in shorter durations compared to food grains and have better access to irrigation. Moreover, fruit and vegetables production overtook food grains production in terms of both volume and value in 2014-15 (Figure 2.14) and has been much less volatile than other crops (Figure 2.13) (Gulati, 2009; Gulati et al., 2016; MAFW, 2017a; MOSPI, 2017; FAOSTAT, 2018).

...as well as livestock products

Milk production has almost tripled since 1995, continuing the developments of the white revolution. India is unique among the major milk producers because more than half of its production is from buffalo, rather than cattle. India has one sixth of the world's cattle and about half of the world's buffalo population. The bulk of milk production is destined to domestic consumption. Moreover, about half of the milk produced represents self-consumption, while the rest is marketed through both formal and informal channels (Gulati, 2009; Gulati et al., 2016; MAFW, 2016a; MOSPI, 2016a; FAOSTAT, 2018).

Meat production has been gradually increasing at 2.5% per year since 2000, driven by both bovine meat and poultry sectors expansion. The bovine meat supply is primarily destined for exports (section 2.6) and based on adult male buffalos as well as unproductive and least milk productive female buffalos. Sale of cattle for meat production is frequently used as an income smoothing mechanism, especially among small farmers. Poultry is also one of the fastest growing segments in Indian agriculture, with the production of eggs and broilers rising at a rate of 6% to 10% per year over the last two decades. The poultry sector was spearheaded by developments in high yielding layer and broiler varieties, together with improved practices of disease control. While relatively small-scale producers account for the bulk of production, integrated large-scale producers represent a growing share of the sector in some regions (Chatterjee and Rajukumar, 2015; Landes et al., 2016; MAFW, 2017a; MOSPI, 2017; FAOSTAT, 2018).

Figure 2.14. Fruit and vegetables production overtaking food grains in volume and value

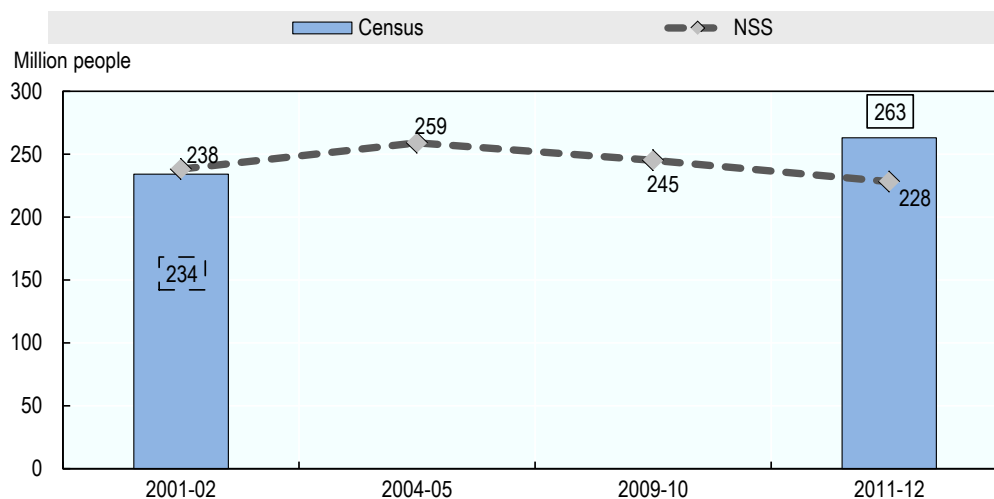
Source: MAFW (2017b), *Horticulture at a Glance Statistics*; MOSPI (2017).

Farm employment and off-farm rural job opportunities

Available official statistics can diverge in terms of the evolution of the absolute number of people employed in the farm sector. While the National Sample Survey (NSS) notes an absolute decline in the size of India's agricultural workforce between in 2004-12 by 33.3 million, evidence from the latest Census of India points that, on the contrary, the sector does not seem to have started shedding labour in absolute terms: the overall number of workers engaged in agriculture – including cultivators¹⁵ and agricultural labourers¹⁶ – would have increased from 234.1 million in 2001 to 263 million in 2011 (Figure 2.15). According to the Census, while the 2001-11 period saw a decline in the number of cultivators (from 127.3 million to 118.7 million) the number of agricultural labourers increased by 35% (from 106.8 million to 144.3 million). According to the NSS results, self-employed workers in agriculture (which roughly correspond to cultivators) represented 147 million in 2011-12, almost 30 million more than the Census estimate for cultivators. In turn, the NSS estimated casual employees in agriculture – corresponding to agricultural labourers – at 76 million, which amounts to 68 million less persons than the Census estimate. Since 2011, the Ministry of Labour through its Labour Bureau has been declaring labour statistics every year and according to that in 2015-16, out of the total

469 million labour force, about 220 million people (47%) are employed in agriculture¹⁷ (Census India, 2011; Ministry of Labour and Employment, 2016; Thomas and Jayesh, 2016).

Figure 2.15. Evolution of absolute farm employment, 2001-02 to 2011-12



Note: Census data are for 2001 and 2011.

Source: National Sample Survey Office (NSSO), Employment and unemployment survey, various rounds (1999-2012); India Census (2001, 2011).

Different factors are behind this significant divergence between the Census and NSSO datasets. These include definitional differences that may have led to a different classification of worker categories, the slow structural transformation of large parts of the rural areas – which meant that many workers divided working days during a year between farm and non-farm jobs – as well as the limited capacity to accurately account for short-term migration. The discrepancy between the two databases is higher in several states across the central, eastern, and northern parts of the country; discrepancies are lower in southern and western states (Thomas and Jayesh, 2016).

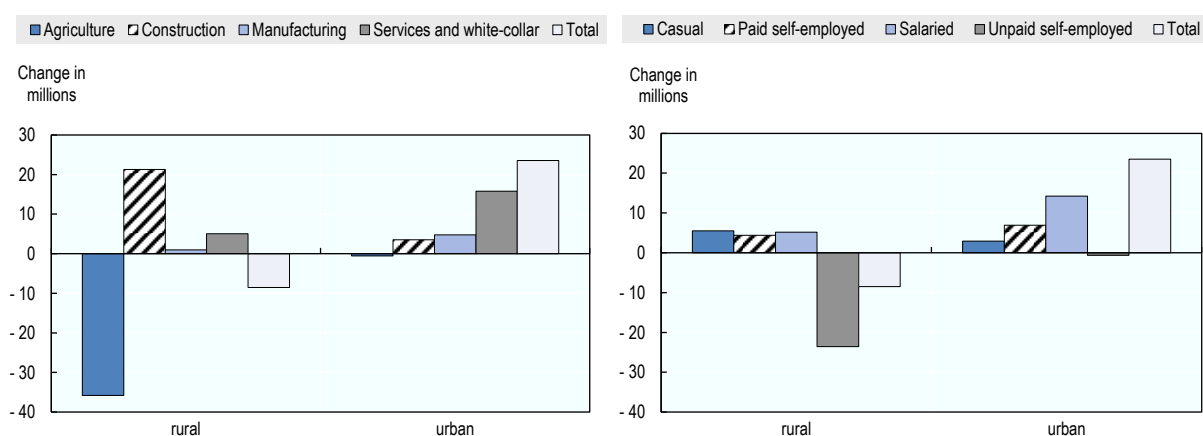
The noteworthy agricultural labour market development for which both NSS and Census estimates concur is that, over the past two decades, there has been a decline in the population of self-employed workers (cultivators) and an increase in the population of casual workers (agricultural labourers). With lower realisation of market prices for several commodities and falling profitability in farming due to increasing farm operating costs, many small and marginal farmers have had to sell their landholdings and became either agricultural labourers or seek alternative employment in the non-farm sector. At the same time, in parallel to the estimated decrease in the number of cultivators, the average size of operational landholdings has been declining over the last decades. This links back to the existing challenges relating to the registration of land records – which often make the official and up-to-date transfer of ownership cumbersome and slow – as well as the restrictive land leasing laws across many states that have forced tenancy to be informal (see section below on land tenure) (Chand and Srivastava, 2014; OECD, 2017a).

Based on the NSS estimates, the share of farm employment in total employment decreased from 61% in 1990 to 47% in 2014 with a contribution of about 17% to the country's GDP. The decline in the sector's share in employment has therefore not kept

pace with the changes in inter-sectoral share in output (section 2.1). This can be partly attributed to the lack of sufficient non-farm employment opportunities in rural areas able to absorb a larger proportion of the workforce from agriculture. Indeed, job creation has taken place largely in urban and peri-urban areas and most of the jobs created in cities are salaried, often offering better conditions than self-employed activities and casual work (Figure 2.16) (Himanshu et al., 2013; Labour Bureau, 2015; OECD, 2017a).

A low level of education and skills continues to hinder the ability to move out of the low-productivity agriculture sector to better-paid non-farm activities. An estimated 40.8% of farmers are illiterate, compared to an illiteracy rate of 15.9% in urban areas (MOSPI, 2013; Chand and Srivastava, 2014; Imbert and Papp, 2014; OECD, 2017a; Sharma and Chandrasekhar, 2014; Srivastava, 2016).

Figure 2.16. Job creation in rural and urban areas by sector and status, 2005-12



Note: A regular salaried/wage employee is a person working in other's farm or non-farm enterprises (both household and non-household) and getting in return salary or wages on a regular basis (and not based on daily or periodic renewal of work contract). The category of salaried/wage employees includes not only salary and wage earners getting time wage but also those getting piece wage or salary and paid apprentices, both full-time and part-time. A person casually engaged in other's farm or non-farm enterprises (both household and non-household) and getting in return wages according to the terms of the daily or periodic work contract is treated as casual wage labour. Unpaid self-employed workers are auxiliary workers ('helpers') who assist the main family workers in an unpaid capacity.

Source: OECD (2017a) based on NSSO, Employment and unemployment survey, rounds No. 61 and 68.

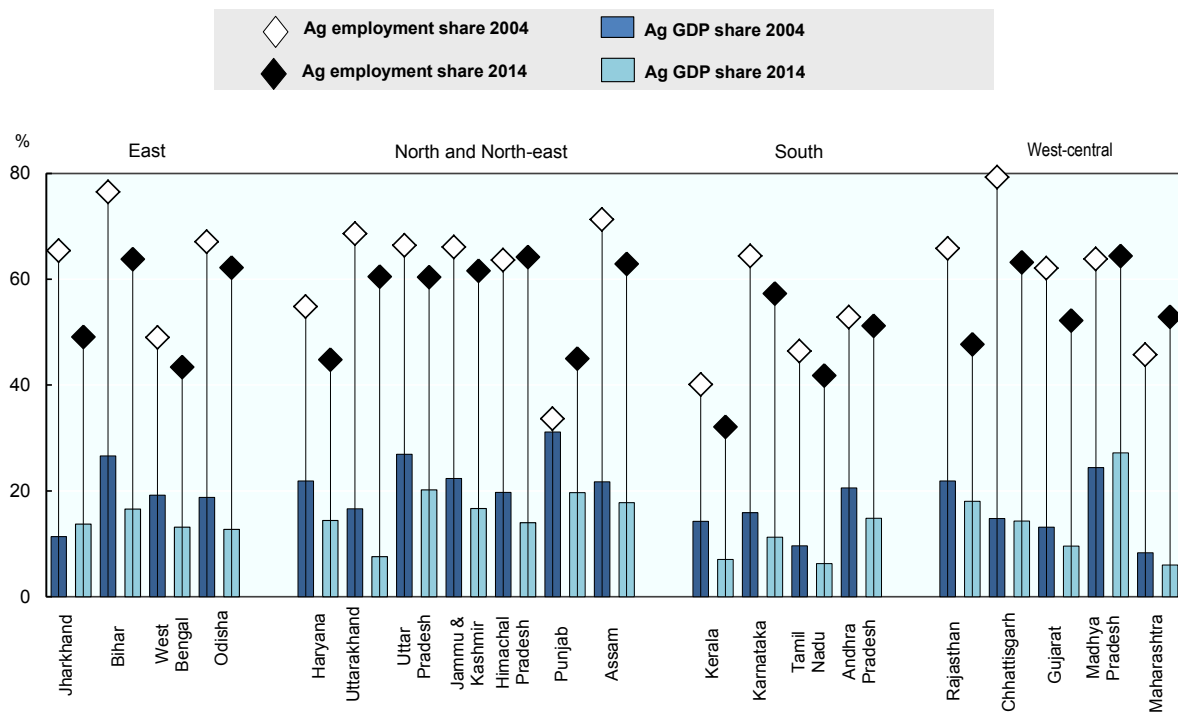
Women represent about 33% of cultivators and 47% of agricultural labourers. However, the participation of women in the sector is generally limited to less skilled jobs when compared to the workforce constituted by men, with many women engaged as unpaid subsistence workers. An estimated 52-75% of Indian women engaged in agriculture are illiterate, an education barrier that prevents them from occupying higher skilled jobs or moving to the non-farm sector (Sanghi et al., 2015).

Spatial heterogeneity: performance at the sub-national level

State-level structural transformation processes are taking place at different paces. While in states such as Uttar Pradesh and Madhya Pradesh agriculture contributes more than 20% to state-level value-added, in other states like Maharashtra, Tamil Nadu, Kerala, Uttarakhand and Gujarat agriculture contributes to less than 10% (Figure 2.17). Very high shares of agriculture in the labour force are recorded not only in the poorer states of

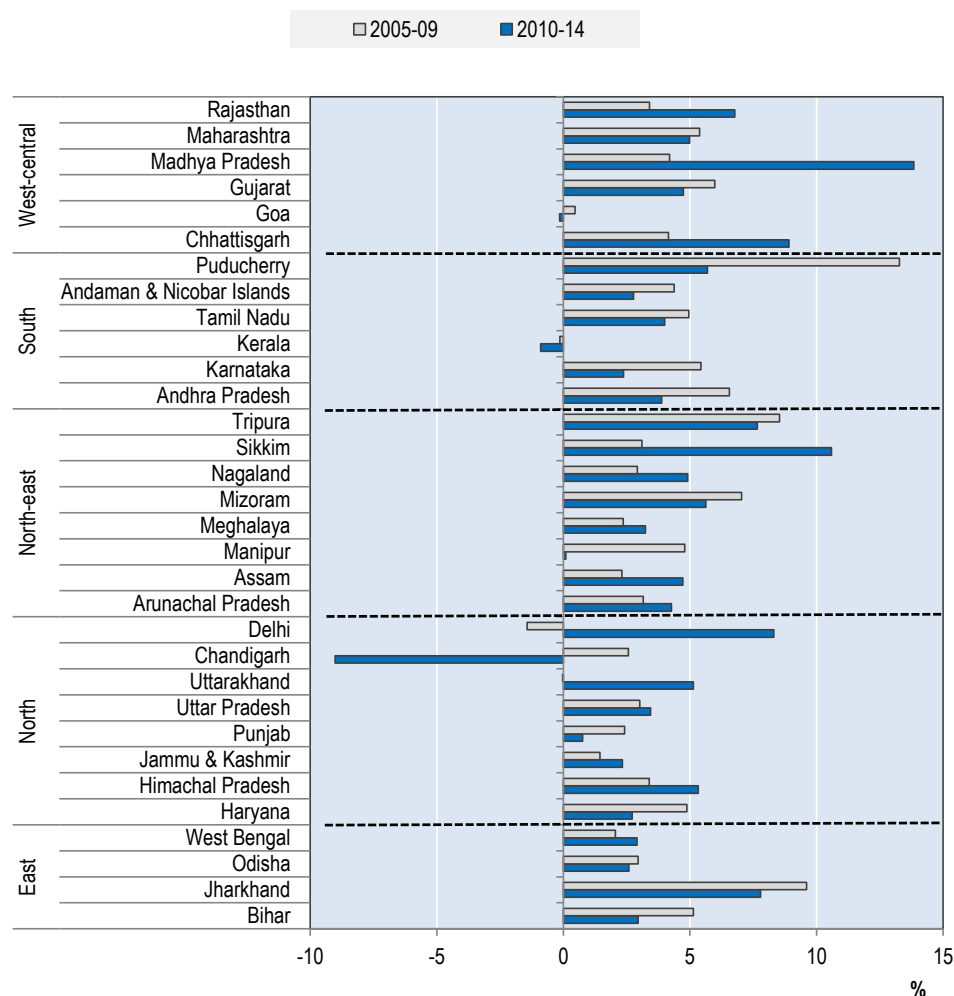
Bihar, Uttar Pradesh, Odisha, Rajasthan and Madhya Pradesh (above 60%), but also in the middle income states of Himachal Pradesh and Andhra Pradesh (above 50%) (OGD Platform India, 2017; NITI Aayog, 2017a).

Figure 2.17. Share of agriculture in GDP and employment in selected states, 2004-14



Source: OGD Platform India (2017); NITI Aayog (2017a).

The sector's growth pattern at state level has been highly uneven. At one end of the spectrum, there are states like Rajasthan, Jharkhand or Madhya Pradesh that have been showing strong agricultural growth since 2010, with an average annual growth between 7% and 14%. At the other end there are states like Uttar Pradesh or West Bengal that have been only growing at 1-2.5% per year (Figure 2.18). Diversification of agriculture away from grains to other commodities occurred in all regions, but once again following very different patterns. Cereal shares range from a low of 2.8% in Kerala's value of production to 16% in Madhya Pradesh; livestock shares vary from 20% in Maharashtra to 25% in Kerala, while the share of horticulture varies from 6% in Punjab to 37% in West Bengal (Government of India, 2015a; MAFW, 2016a).

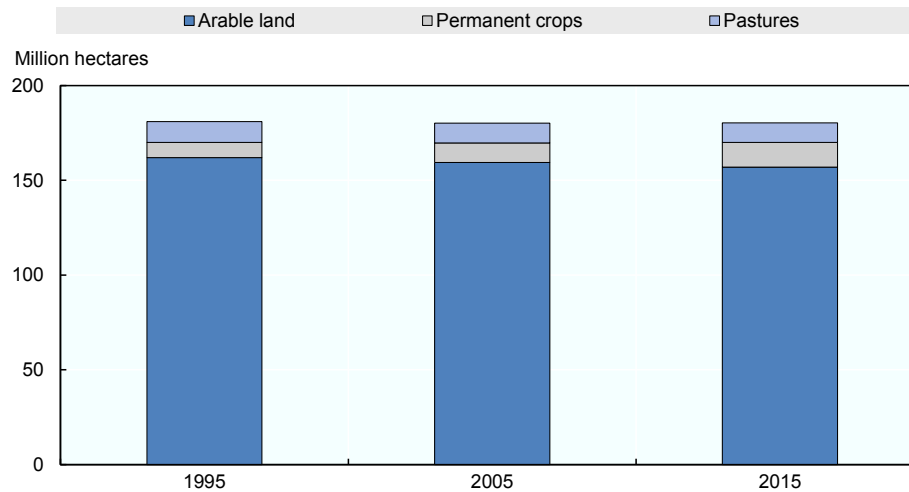
Figure 2.18. Mixed agricultural state performance: Average growth, 2005-14

Source: MAFW (2016a).

Input use and sustainability performance

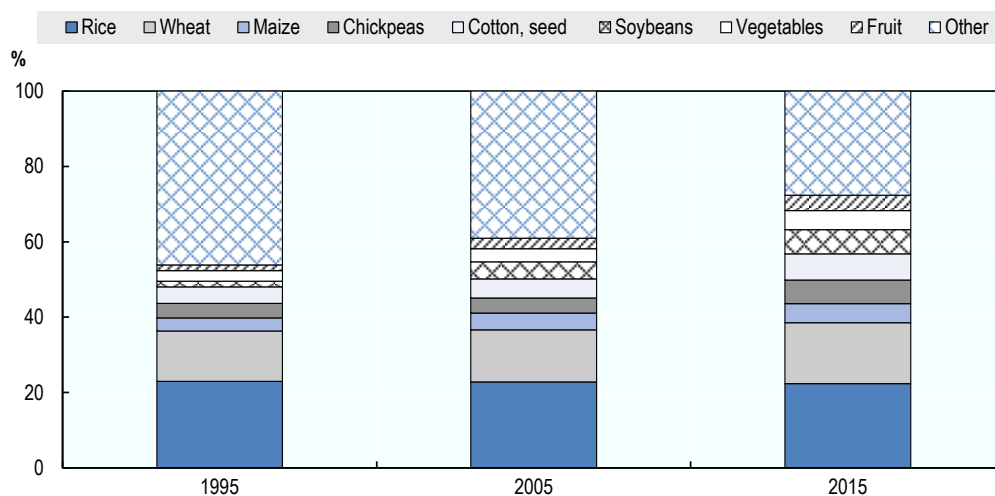
Land

India has the second largest agricultural land area in the world after the United States: this covers 180 million ha, representing about 55% of its total land area. However, at just 0.15 ha per capita agricultural land is very scarce. Agricultural land consists of 157 million ha of arable land, 13 million ha of permanent crops and 10 million ha of pastures and meadows. The arable land area remained relatively stable over the last two decades, highlighting that virtually all of the increase in production resulted from yield gains and multi-cropping rather than expansion of the cultivated area (Figure 2.19). Multi-cropped area currently represents 30% of overall agricultural land (54.5 million ha) (MAFW, 2017c; FAOSTAT, 2018).

Figure 2.19. Agricultural land, 1995-2015

Source: MAFW (2017c), *Land Use Statistics*; FAOSTAT (2018).

The allocation of harvested area by commodity shows that the largest shares are accounted for by rice (22%), wheat (16%), and cotton (7%). The shares of maize, soybeans, cotton, and chickpeas cultivated areas all increased in 1995-2015. In addition, the shares of fruit and vegetables more than doubled over the same period, but are still relatively small at 4-5% each (Figure 2.20) (MAFW, 2017c; FAOSTAT, 2018). Grazing intensity is very high in India: a cattle population of 467 million grazes on the 10 million ha of pastures, implying an average of almost 47 cattle heads per ha of land (MAFW, 2017c).

Figure 2.20. Composition of the harvested area, by crop, 1995-2015

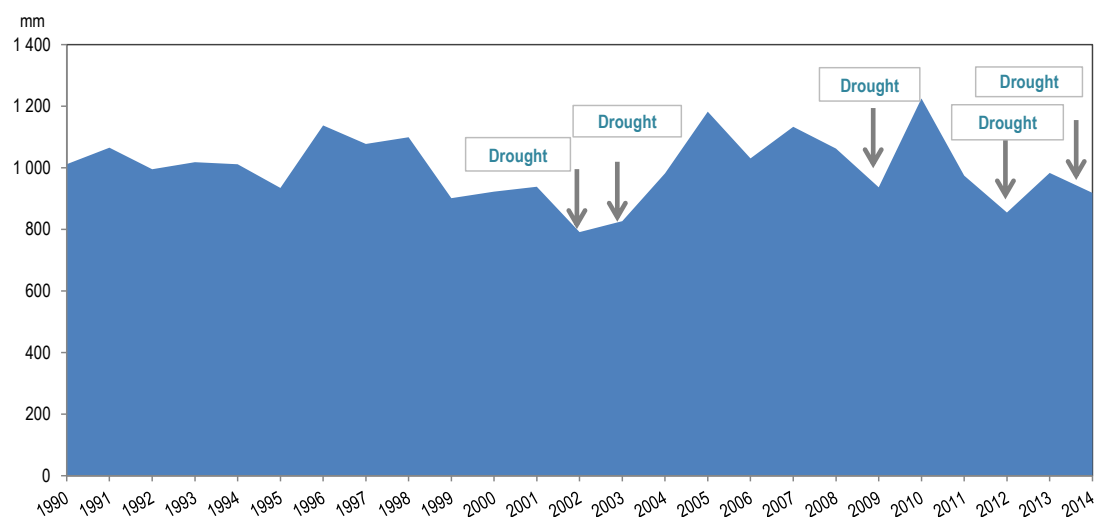
Source: MAFW (2017c), *Land Use Statistics*; FAOSTAT (2018).

Any potential future increase in arable land appears to be limited. On the one hand, India has been implementing one of the largest reforestation and community forestry programmes ever undertaken, which has restricted the conversion of forests to cropland. Deforestation rates in India have thus declined since 1980, largely due to the implementation of the 1980 Forest Conservation Act and the 1988 Joint Forest Management legislation (Ministry of Environment, 2015). Forests currently constitute the second largest land use category in India after agriculture (24.2% of the total area). On the other hand, both agricultural land and forest areas are under pressure from urban and industrial development: the share of the area under non-agricultural use increased from 6.8% of total area in 1995 to 8.2% in 2014 (MAFW, 2017c).

Water use

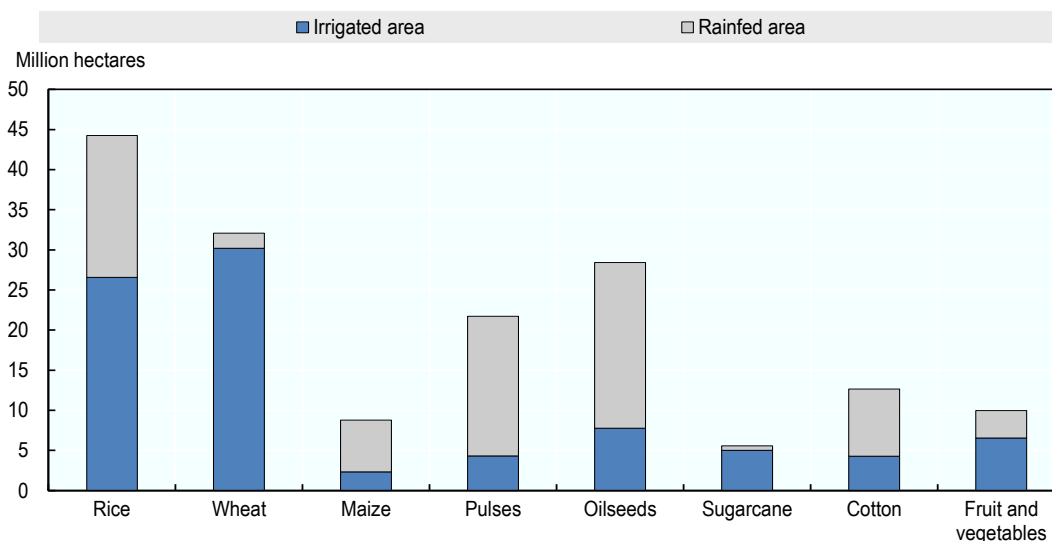
While India hosts 18% of the world's population, the country has only 4% of the world's renewable water resources. 70% to 80% of precipitation in India is received through the monsoon during the four summer months (June, July, August and September). While the average annual rainfall of the country is about 1 170 mm, there is a huge temporal and spatial variation in rainfall and water availability (Figure 2.21): average rainfall in the North-east region can be as high as 10 000 mm per year, but some parts of Western Rajasthan receive annual rainfall of about only 100 mm. The north-eastern region of the country receives heavy precipitation, in comparison with the north-western, western and southern parts. Whereas the lower rainfall areas (less than 750 mm annual rainfall) account for 33% of the cropped area, the medium rainfall zone (750 mm to 1 125 mm) covers 35%, the high rainfall zone (1 125 mm to 2 000 mm) covers 24%, and the very high rainfall zone (more than 2 000 mm) accounts for the remaining 8% (Government of India, 2015).

Figure 2.21. Average annual precipitation pattern, 1990-2014



Source: Indian Institute of Tropical Meteorology (2016).

Over half of the total cropped area is rainfed. Rice, maize, pulses, oilseeds and cotton are the most dependent on precipitation (Figure 2.22) and thus among the most vulnerable crops, facing an increasingly erratic pattern of precipitation (MAFW, 2017c). The significant output drops observed in 2002, 2004 and 2009 (Figure 2.10) are directly linked to droughts (Gulati, Saini and Jain, 2013; Government of India, 2015a).

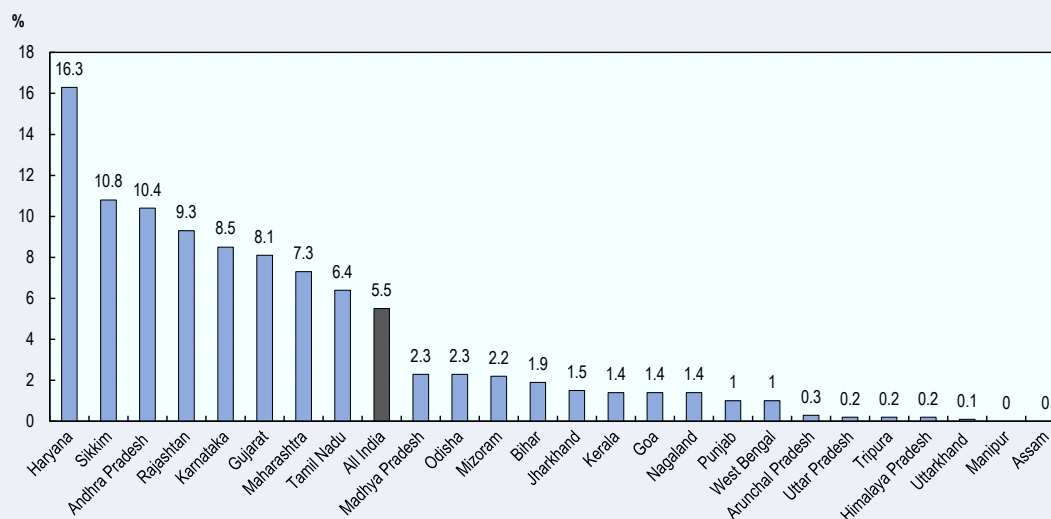
Figure 2.22. Irrigated area under different crops, 2014-15

Source: MAFW (2017c), *Land Use Statistics*.

India's agriculture sector accounts for nearly 90% of water use. 66 million ha of total arable land are currently irrigated, while two-thirds of India's vast irrigation system is based on groundwater. 60% of the total irrigated area is dedicated to rice and wheat. Sugarcane and fruit and vegetables are also mainly irrigated, but such systems face high levels of inefficiency: for those relying on surface water sources, efficiency¹⁸ is estimated at only 35-40%, while for those relying on groundwater sources this is estimated at 65-75% (Government of India, 2015). The area under micro-irrigation systems – such as sprinkler or drip irrigation – has been growing, but currently stands at only 7.7 million ha, representing about 5.5% of the cropped area (Box 2.6; Figure 2.23). This is much less than in other countries such as China (10%), Brazil (52%), United States (55%), or Israel (90%) (Irrigation Association of India, 2016).

Box 2.6. Micro irrigation developments in India

The Government of India launched in 2006 the Centrally Sponsored Scheme “Micro irrigation” with the objective of increasing the coverage of area under micro irrigation and encouraging a more efficient use of water resources. These objectives were subsequently upgraded through the National Mission on Micro Irrigation (NMMI) during 2010-14 and the National Mission for Sustainable Agriculture (NMSA) in 2014-15. The area covered under micro irrigation systems has grown since 2006 by 9.7% annually. The states with the largest area under micro irrigation include: Rajasthan (1.68 million ha), Maharashtra (1.27 million ha), Andhra Pradesh (1.16 million ha), Karnataka (0.85 million ha), Gujarat (0.83 million ha) and Haryana (0.57 million ha) (Figure 2.23). The majority of the area covered under micro irrigation systems in 2016-17 comes under sprinkler irrigation (53.9%), followed by drip irrigation (46.1%).

Figure 2.23. Micro irrigation coverage (share of net sown area by state), 2015

Note: The figure provides the combined share for the states of Andhra Pradesh and Telengana. The state of Telengana was separated from Andhra Pradesh in 2014 and became an independent state.

Source: Irrigation Association of India (2016).

The 2014 NMMI impact study conducted a survey of 5 892 beneficiaries of NMMI across 13 states, identifying several key advantages of this technology compared to conventional water use systems:

- Micro irrigation technology ensures water use efficiency as much as 50-90%, achieved through a reduction of use losses, run-off, and evaporation losses. The saved water can be used to increase the area under irrigation or for the recovery of degraded/waste land.
- Due to the smaller power units needed as a result of lower water requirement and thus lower number of hours of irrigation, significant electricity savings were estimated (30.5%, on average).
- The overall irrigation operational cost registered on average a reduction of 32%.
- On average, 30.4% of surveyed farmers were able to introduce new crops due to the use of micro irrigation systems.

As a result of the controlled and targeted application of water, soil moisture could be maintained at optimum levels, improving land productivity. In the case of onions, drip irrigation was associated with 15-25% higher bulb yield, while for sugarcane yields were estimated to go up by 40%.

Source: Planning Commission (2014); Irrigation Association of India (2016); Ganguly, Gulati and von Braun (2017).

Fertiliser use

India is the second largest consumer of fertilisers in the world after China, with about 26.8 million tonnes used by the agriculture sector in 2015-16. At an estimated 131 kg/ha¹⁹ the rate of fertilisers applied per ha in 2015-16 is almost twice that applied in 1990-92 (72 kg/ha). Average intensity of fertiliser use in India remains nevertheless much lower than in other countries in the region²⁰ such as China (319 kg/ha), Korea (262 kg/ha), Japan (230 kg/ha), Malaysia (208 kg/ha), or Viet Nam (206 kg/ha) (MAFW, 2017c; FAOSTAT, 2018).

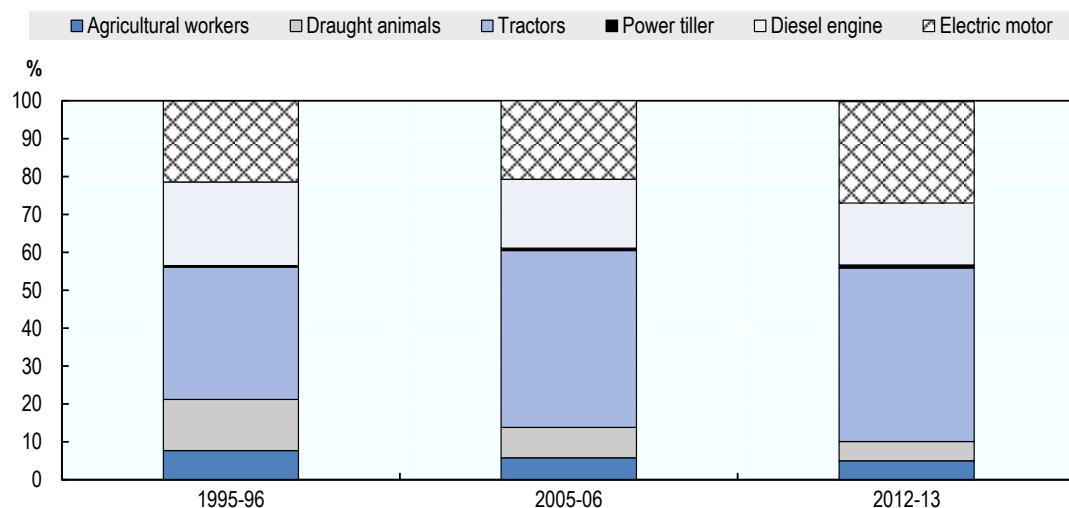
Fertiliser use also appears highly skewed across regions, with wide inter-state and inter-district variations. Average intensity of fertiliser use has generally been higher in states such as Punjab, Haryana and Andhra Pradesh with a consumption of over 200 kg/ha, while other states like Odisha, Kerala, Madhya Pradesh, Jharkhand, Chhattisgarh and Rajasthan have had a consumption of less than 100 kg/ha (Sharma and Thaker, 2011; Government of India, 2015, 2017a).

Both the use intensity and patterns have been influenced by fertiliser subsidies, a key component of India's agricultural policy over the last decades (Chapter 3). On the one hand, the allocation of nearly 70% of annual subsidies to urea has led to an unbalanced application pattern of nitrogenous, phosphate and potash (NPK) fertilisers when compared to actual soil and crop nutrient requirements across various regions (Government of India, 2015). On the other hand, in some areas, a comparison between urea subsidy allocations with estimates of the actual use derived from surveys reveals that a large share of urea is likely being diverted for industrial use or smuggled across border to neighbouring Bangladesh and Nepal (Government of India, 2017a).

Farm mechanisation

Two of the major impediments to adoption of mechanisation in India have been land fragmentation, with a majority of marginal and small landholdings hampering the utilisation of agricultural machinery, and an inadequate access to formal sources of finance for long-term credit. To address these challenges, models of farm machinery available on rent made such equipment more effective and affordable for farmers. Estimates suggest that informal farm equipment rental represents roughly 35% of the farm machinery market in India, showing the scope for organising the market as well as expanding services to less mechanised regions. As part of the 2014 Sub-Mission on Agricultural Mechanisation (SMAM) guidelines, the Government of India introduced Custom Hiring Centres (CHCs)²¹ at the village level; 711 CHCs were set up in 2014-16. Private players are also entering the market by opening rental hubs in states such as Karnataka, Maharashtra and Gujarat (Ganguly et al., 2017).

Over 90% of farm power is currently from mechanical sources, with tractors and power tillers providing the bulk (47%) (Figure 2.24). The use of tractors and tillers has increased five-fold in the last four decades and the share of agricultural workers and draught animals in overall farm power availability decreased from 21% in 1995-96 to 10% in 2012-13 (Government of India, 2015a).

Figure 2.24. Availability of farm power by resource category, 1995-2013

Source: Government of India (2015a), “State of Indian Agriculture”.

The level of mechanisation varies substantially by region. States in the north, such as Punjab, Haryana and Uttar Pradesh, have a greater level of mechanisation due to the highly productive land in the region as well as a declining labour force. The western and southern states have lower levels of mechanisation due to the smaller and more fragmented land holdings prevalent in these regions. In north-eastern states, the level of mechanisation is extremely low. Factors like hilly topography, high transportation costs and financial constraints have hindered the development of a farm equipment sector within these states (Dhiman and Dhiman, 2015).

Agro-environmental impacts: land degradation, water stress and greenhouse gas

Land degradation is prevalent throughout the country: 37% of the total land area (about 120.4 million ha) is affected by various types of degradation²²; 25% of India's total land is undergoing desertification. Degradation has mainly resulted from deforestation, excessive and unbalanced use of chemical fertilisers, poor irrigation and water management techniques, excessive tillage, over-grazing, improper management of industrial effluents and wastes, poor forest management, surface mining, and urban expansion (Indian Council of Agricultural Research, 2010). In 11 states and UTs, more than 50% of land is affected by some form of degradation. Mizoram, Nagaland, Tripura (East), Himachal Pradesh (North), Madhya Pradesh (West-central), and Kerala (South), are in the top of this list, with 60% of their surface experiencing degradation (Bhattacharyya et al., 2015).

India also faces a severe water crisis due to a widening gap between water supply and demand, as well as poor water resources management, and changing precipitation patterns induced by climate change. Total water demand is expected to increase by 32% by 2050 due to population growth, urbanisation and industrialisation. As 80% of the sewage generated – commonly used for field irrigation and fertilisation – currently goes untreated, the discharge of untreated sewage into water bodies has become a common source of water pollution. Groundwater depletion has also contributed to the deterioration of water quality. India is thus subject to multiple categories of water risk, including risks

associated with shortage, excess, weather variability, and poor quality of water (Annex 2.A) (Amarasinghe et al., 2008; Government of India, 2015a; OECD, 2017c).

The existing policy framework lacks a clear incentive structure for efficient and sustainable water use. Low or absent water charging for surface water used in irrigation and energy subsidies for groundwater pumping (Chapter 3) have been driving severe depletion of resources. Issues related to intra- and inter-state water sharing and lack of adequate enforcement and monitoring of existing water policies undermine water governance and policy co-ordination. Moreover, the lack of sustainable financing for water infrastructure results in poor maintenance of existing infrastructure and limits further investment (OECD, 2017c).

The continuous rise of tube well irrigation – particularly suited to the fragmented landholding pattern characterising the sector – has led to an overexploitation of water reserves. Decline in groundwater levels is observed mostly in northern north western and southern of the country in the states of Rajasthan, West Bengal, Andhra Pradesh Karnataka, western Uttar Pradesh, Punjab and Haryana. Groundwater development stress²³ reached an average of 133% in Haryana and 172% in Punjab (Box 2.7). In the states of Andhra Pradesh, Gujarat, Madhya Pradesh and Rajasthan, the water table has been falling every year during 2014-16 (CGWB, 2014; OECD, 2017c).

Box 2.7. Water risk hotspots for agriculture: North-west India

Water hotspots are defined as localised agriculture productive regions subject to acute water risks. Agriculture water risks at hotspot locations can cause three layers of impacts. First, water risks will have a direct negative impact on agriculture production. Second, these production effects may have broader market implications both domestically and potentially internationally. Third, broader food security and associated indirect effects may also occur. In India, agriculture water scarcity issues are forecasted to become most prevalent in the cereal producing regions of the North and North-west (particularly in the states of Punjab and Haryana), while flooding risks are foreseen for the more production diversified South-east region.

Punjab and Haryana are two leading producers of rice and wheat: the two states account for only 3% of the national territory, but produce 15% of its rice and 30% of its wheat. They also represent 38% of the country's rice procurement and 62% of the wheat procurement. The two states belong to the Indo-Gangetic Belt, a fertile region with important groundwater and surface water resources, supplied by the snowmelt water of the Himalaya and annual monsoon rains. However, the climate is characterised by high inter-seasonal and inter-annual variability in precipitation, which makes them particularly exposed to drought. Agriculture in this region depends on groundwater resources. Double cropping, first during the summer monsoon and then during the dry winter season, further intensifies water needs for production. In 2010, the water level fell below a depth of 15 m in 75% of Punjab's surface area, while it was the case for only 14% of the area in 2000. As of 2016, 51% of the local administrative units (blocks) in Haryana and 75% in Punjab are considered as over-exploited with respect to water use.

Due to its semi-arid climate, the Indo-Gangetic plain is also naturally exposed to salinity risks. Intensive groundwater pumping amplifies the phenomena, limiting irrigation sources for farmers. Salinity limits water uptake capacity of plants, and dramatically decreases yields for most of the crops. Almost 0.5 million ha are already affected by salinity in Haryana, and this is expected to rise in the coming decades, following the

patterns of groundwater depletion. By 2023, in some central districts of Punjab, water tables are expected to sink below 50 m. In addition, the mobilisation of deeper and more saline water through tube well irrigation affects the quality of shallow waters. Due to intensive pumping, there is evidence of pollutant breakthrough and water leakage to the deep reservoirs of the multi layered aquifer.

Increased temperatures will affect storage efficiency of surface water reservoirs and open irrigation canals, thus the capacity of these systems to conserve and deliver water without loss. Besides, the Indus basin and the Ganges basin are broadly supplied by snowmelt water. Since melting mountain glaciers are declining in the long term, rivers flows will be affected during the summer as early as 2050. Finally, even if precipitation will increase in total, it will be more variable and concentrated in time during a shorter monsoon. As a result, groundwater recharge could drop if storage capacities are not improved.

Possible increases in the cost to pump deeper groundwater may exacerbate farmers' losses resulting from lower average yields and output levels. Low-cost wells equipped with surface-mounted centrifugal pumps are not powerful enough to lift water below 8 m. Therefore, farmers would have to invest in deep tube wells equipped with electric submersible pumps and cover the associated high costs. Indebtedness and water access restrictions caused by depleting groundwater have had dramatic consequences for rural development: on average, villages where aquifers have fallen below 8 m suffer from a 10% increase in poverty rate.

Source: OECD (2017c).

Accounting for 18% of total greenhouse gas (GHG) emissions in India, agricultural production is the second major emitter of GHGs after the energy sector (71%). Although the share in total GHGs has decreased from 23% in 1990, the amount of agricultural GHGs has increased by 21% over the last two decades. The majority of agricultural GHG emissions occur at the primary production stage, and are generated through livestock rearing (enteric fermentation and manure management) (59% of agricultural GHGs), the use of chemical fertilisers and their associated impacts on soils (21%), paddy rice cultivation (18.3%), as well as residue management practices (1.7%). GHG emissions per kg of product were greater for livestock products than for crops, with the exception of rice (IARI, 2014; Ministry of Environment, Forest and Climate Change, 2015).

Agricultural land tenure system and farm structure

Land tenure key highlights

The Indian system for governing land tenure, both in terms of legislation and institutional framework, is complex. This is due not only to the country's large surface, but also to the various pre-independence political, economic and social influences. At the time of independence, India inherited a feudal agrarian structure in which land rights were concentrated in the hands of a limited number of landlords (*zamindars*), while tenants did not have any right or security of tenure. The government thus enacted in the years following independence a series of land reforms intended to improve both equity in land distribution and efficiency in agricultural production. Land reform legislation introduced as of the 1950s consisted of four main areas for action (USAID, 2011):

- abolition of intermediaries who were rent collectors under the pre-independence land revenue system

- tenancy regulation to improve the contractual terms faced by tenants, including crop shares and security of tenure
- a ceiling on landholdings²⁴ with a view to redistributing surplus land to the landless
- efforts to consolidate disparate landholdings: pursuant to the Land Acquisition Act of 1894, the government could use compulsory acquisition authority to purchase privately held land if such land was required for a public purpose, including the distribution of land to the landless poor.

The socio-economic impacts of the land reform components appear to be mixed. On the one hand, such reforms did succeed in reallocating land – 8.5 million ha under tenancy and ceiling laws alone post-independence – from large holders to the landless and land poor. However, as the landless were allocated on average very small parcels of agricultural land, many of these holdings became economically unviable. On the other hand, some land reform components – and land ceiling legislation in particular – seem to have had a negative and significant effect on agricultural labour productivity in India (Ghatak and Roy, 2007; Deininger et al., 2017).

Moreover, land acquired under the Land Acquisition Act has often resulted in inadequate compensation to the owners or occupiers of the land. The 1894 Land Acquisition Act was replaced by the Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, passed by the *Lok Sabha* and the *Rajya Sabha* in 2013, intending to reduce involuntary displacement, provide greater compensation and an improved legal process to those whose land is taken. The Act introduced the ‘consent’ clause with land to only be acquired with approval of the 70% of the landowners²⁵ for private-public partnership projects and 80% for private entities projects. The Act also defines the method by which the market value of the land shall be calculated, as well as the amounts of compensation and subsistence allowance in case of resettlements. Due to identified bottlenecks in implementation, in 2015, the *Lok Sabha* also passed the Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement (Amendment) Bill 2015. The Bill exempts five types of projects from the consent provision: defence; rural infrastructure; affordable housing; industrial corridor; and private-public partnership infrastructure projects where the government owns the land. While the bill was passed in *Lok Sabha*, it still needs approval from the *Rajya Sabha* (Government of India, 2015b).

Rural land markets do not function efficiently as a result of several factors. These include poor land records that make it difficult to officially transfer ownership, tenancy and land ceiling laws leading to concealment of ownership status and impediments to transactions, limited mobility of potential buyers, lack of brokerage services, and limited flow of information about buying and selling opportunities. Given the limited reach of the formal banking sector, particularly in remote rural areas, another factor is the difficulty of financing land purchases. India’s property market also lacks transparency, as both sellers and buyers tend to declare lower values than in the actual transaction to avoid steep stamp duties of around 5-12% of transaction values, capital gain taxes, and income tax clearances (OECD, 2009).

The land recordkeeping system lacks a mechanism of proper periodical revision of records due to financial and institutional constraints. India’s land recordkeeping system includes national and state laws covering a deeds registration system for any form of land transfer, as well as state-level laws establishing cadastral-based records of land rights for revenue purposes. From state to state, the cadastral systems are managed by agencies with

varying institutional capacities and financial allocations. The records maintained by the deeds and cadastral systems can be in many cases inconsistent as their periodical revisions are not co-ordinated. More significantly, the land records maintained do not constitute land titles, but only ‘evidence of title’²⁶. This makes the land transfer system costly and slow: to register a land sale transaction in India, the parties must complete six procedures, a process which takes an average of 45 days and costs an average of 7.5% of the value of the property. This often leads to a large number of unrecorded transactions and an overall system of land registration and record keeping providing an inaccurate picture of landholdings on the ground (OECD, 2009).

The Government of India launched in 2008 the Centrally Sponsored Scheme National Land Records Modernisation Programme (NLRMP) with the aim to modernise management of land records by: building an integrated land information management system; minimise scope of land disputes; enhance transparency in the land records maintenance system; and facilitate a subsequent move towards guaranteed conclusive titles to immovable properties in the country. The scheme is currently part of the Digital India initiative (Digital India Land Records Modernization Programme, DILRMP). The central government’s Department of Land Resources, in the Ministry of Rural Development, also drafted a National Land Utilization Policy in 2013, which emphasised the need to conduct a detailed and comprehensive survey and documentation of the existing land area. As of mid-2018, 23 states/UTs have completed the computerisation of land records in more than 75% of their respective villages (USAID, 2011; MOA, 2014; Government of India, 2017a; Ministry of Rural Development, 2018).

Restrictive land leasing laws have forced tenancy to be informal, insecure and inefficient. There is significant variation in the adoption and implementation of land and tenancy reforms across states and over time. State tenancy laws were enacted in the 1960s-70s, with most state governments having either legally banned or imposed some type of restrictions on agricultural land leasing. Tenancy is completely prohibited in some states but completely free in others: for instance, Punjab and Haryana have not prohibited tenancy whereas Karnataka has a near-complete ban on tenancy (specific features of tenancy laws across states are provided in Annex Table 2.B.2) (Deshpande, 2005; USAID, 2011).

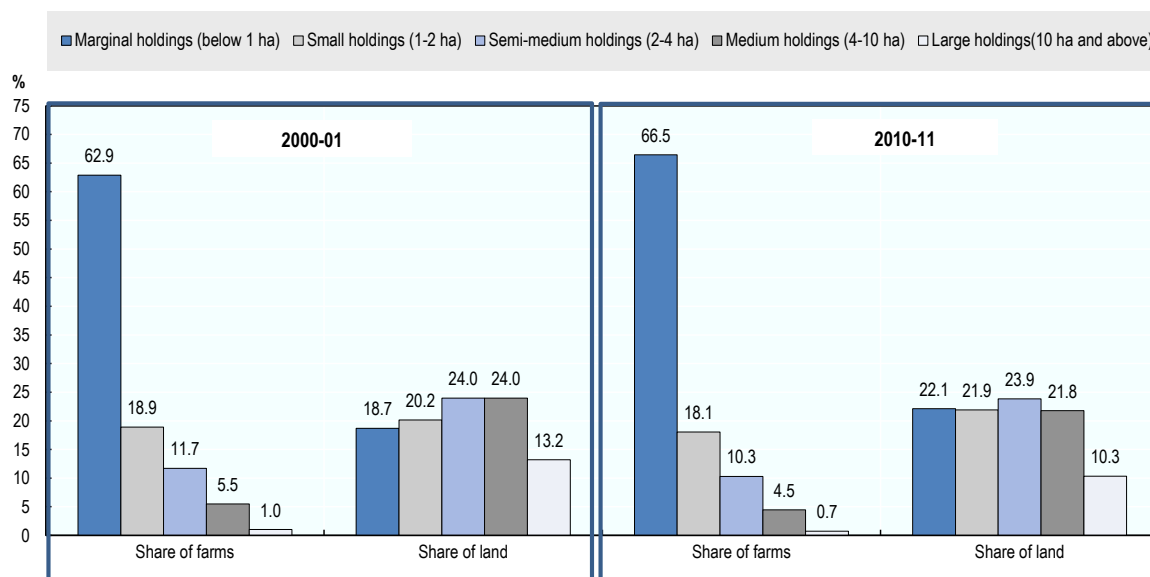
In 2016, the central government rolled out a Model Agricultural Land Leasing Act with the objective to relax the restrictive tenancy laws across states, ensure complete security of land ownership for landowners and security of tenure for tenants for the agreed lease period. State governments would enact the Land Leasing Act as they see appropriate; if and when adopted by a state, it would overrule any other existing act and would be effective from the date of notification by the respective state. It would in general permit and facilitate the leasing of agricultural land while protecting fully the land rights of the owners. As per the Model Act, the land owner could legally enter into a lease contract with the tenant for use of his/her agricultural land for agriculture and allied activities over a specified period, based on an agreement with terms and conditions mutually agreed by the owner and the tenant²⁷. The Act would provide for recognition of farmers who cultivate on leased land, which would ultimately facilitate their access to institutional credit (NITI Aayog, 2016). An additional Model Land Cultivators License Act has been put forward by the Union Budget 2018-19, proposing to provide lessee cultivators with a licence, without compromising on the legal rights of the landholder. The licence would enable these farmers to avail the benefits of farm credit, crop insurance, and compensation in the event of a natural calamity (Ministry of Finance, 2018).

Several states already took the lead in reforming tenancy laws. For instance, in 2016, Rajasthan provided statutory support to land records, effectively guaranteeing land and property ownership. Rajasthan also passed a Land Pooling Bill that eases aggregation of small land holdings and should facilitate the development of adequate infrastructure. Gujarat eliminated the requirement of a social impact assessment and consent clauses for certain types of development projects. Maharashtra allowed the sale of certain publicly owned lands that were previously slated only for leasing and allowed mid-size plots to be divided (OECD, 2017a).

Agricultural land holdings

Agricultural census estimates show that the sector continues to be dominated by a large number of marginal and small-scale operators: 85% of the operational holdings in India are of less than 2 ha and represent 45% of the total cropped area. In turn, only 5% of farmers operate on holdings larger than 4 ha, but they occupy nearly 32% of the overall cropped area (Figure 2.25). This also implies that the national average operational holding size has been showing a steady decline, from 1.33 ha in 2000-01 to an estimated 1.15 ha in 2010-11 (Agricultural Census India, 2016).

Figure 2.25. Distribution of operational holdings and agricultural area, by land size classes, 2000-11



Note: The basic statistical unit for data collection is ‘operational holding’. The concept of agricultural operational holdings does not include those holdings which are not operating any agricultural land and are engaged exclusively in livestock activities and fishing etc.

Source: Agricultural Census India (2016).

As in the case of farm employment, there are discrepancies between official data on landholdings available from Agricultural Censuses versus NSS Surveys on Land and Livestock Holdings (LHS). The later reports an average landholding area of 0.91 ha for the same recent period as the census. There are several reasons for this, starting with those stemming from the use of different definitions as well as differences in the data collection process. The census refers exclusively to cropped land and does not cover

operational holdings that are engaged exclusively in livestock activities and fishing, while the LHS includes all agricultural activities (Kumar, 2016).

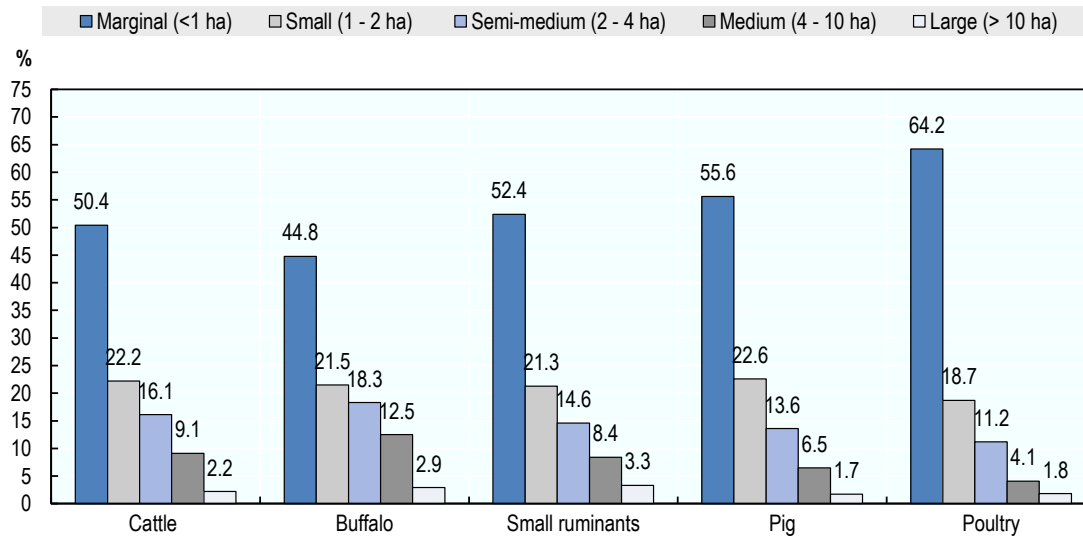
The agricultural census identifies operational holdings²⁸ primarily based on land records within states,²⁹ while LHS data are collected through a sample survey of rural households. The structural issues arising from the land tenure system can complicate the exact identification of plots as well as their characteristics under the different surveys. For instance, many land registrations can be done under a fictitious name, so as to avoid household landholdings from coming under the purview of land ceiling legislation. Consequently, a single holding may often be recorded as distinct units under different landholders. Households, including absentee landowners, may be shown operating agricultural holdings in land records, while they might not be engaged in farming anymore (Kumar, 2016).

Both the agricultural census and the LHS do coincide in the increase in the area under the marginal and small holding category, as well as the increase in the number of marginal and small farmers. This increase is largely explained by population growth, subdivision upon inheritance,³⁰ the structural issues in the land legal framework and land markets, as well as the insufficient non-farm alternative employment opportunities. The restrictions on land leasing and related uncertainties have reduced the occupational mobility of many landowners who could take up employment outside agriculture and yet are forced to stay due to the fear of losing the land if they lease out and migrate. Moreover, fragmented parcels enable owners to sell or mortgage discrete portions of their total holdings at any one time. Cumbersome and lengthy procedures in the land transfer market together with the land ceiling regulations also dissuade consolidation (Vyas, 2007; USAID, 2011).

According to the Census, nearly half of the total number of marginal farmers (below 1 ha) are located in three states: Uttar Pradesh (23%), Bihar (16%) and Andhra Pradesh (9%). These three states, together with Tamil Nadu (8%) and Kerala (8%), account for nearly two thirds of the marginal farmers in the country. On the other hand, each of the following states – Punjab, Haryana, Himachal Pradesh, Gujarat, and Jammu and Kashmir – have less than 1% of the country's marginal farmers (MOSPI, 2013; Agricultural Census India, 2016).

The proportion of socially disadvantaged groups such as Scheduled Castes (SCs) and Scheduled Tribes (STs) is higher among marginal and small farmers than that of medium and large farmers. Around 22% of marginal and small farmers are from SCs compared to 7.8% among medium and large farmers; 15.6% of small farmers belong to STs compared to 14.9% among medium and large farmers (MOSPI, 2013; Agricultural Census India, 2016).

Marginal and small farmers own most livestock. Marginal farmers (less than 1 ha) own more than 50% of all cattle, small ruminants, pigs, and poultry, and almost 45% of India's buffaloes (Figure 2.26). These characteristics of Indian dairy farming translate into low productivity, with milk production per head of cattle 5 to 7 times lower than in the United States or Japan (MOSPI, 2016b).

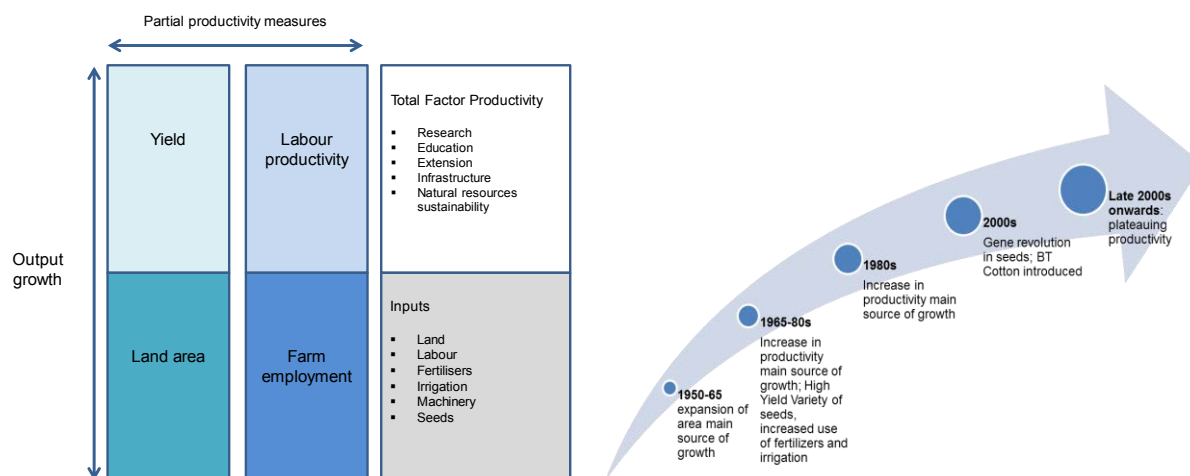
Figure 2.26. Livestock ownership by land holding size, 2013

Source: MOSPI (2016b).

2.4. Productivity trends

As discussed in the previous sections, India has experienced considerable changes in the crop mix and production since the onset of the green revolution. In the pre-green revolution period, output growth was mainly driven by the expansion of the agricultural area. The beginning of the green revolution in the mid-1960s raised agricultural land productivity through improved seed varieties and technologies. This was accompanied by an expansion of extension services and an increase in the use of fertilisers, pesticides, and irrigation. In the 1980s-90s, these yield-enhancing technologies were expanded to additional crops and regions (further details on the policy setting in Chapter 3). Over the last decade however, the sector's overall performance in terms of growth on a sustainable basis has been much more modest. The following sub-sections provide an overview of agricultural productivity trends, components and drivers (Figure 2.27).

Figure 2.27. Understanding agricultural productivity drivers

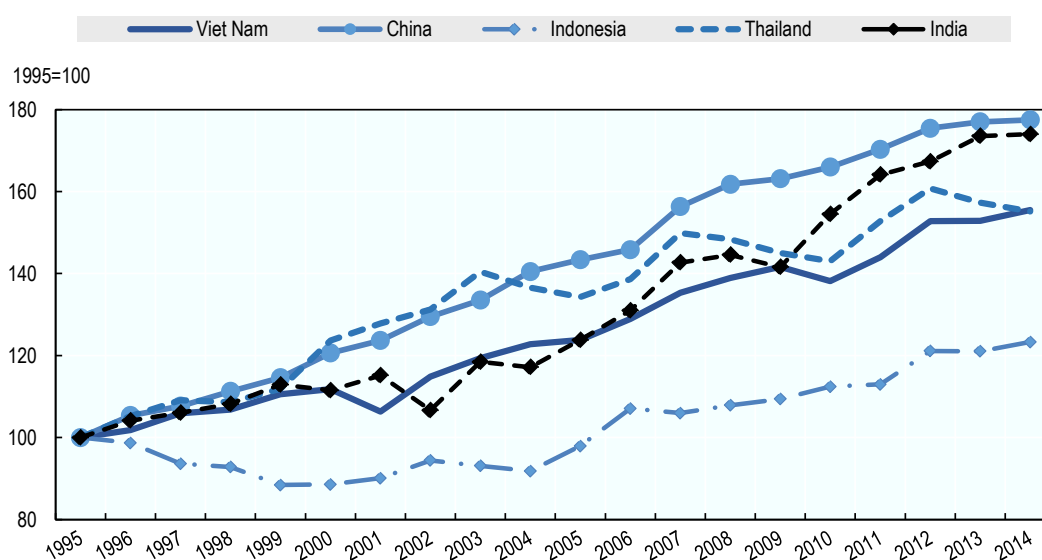


Source: Own tabulation based on literature review.

Land productivity: yields for key crops

In India, overall land productivity increased by 74% in 1995-2014, slightly less than in China but more than in Viet Nam, Thailand, and Indonesia (Figure 2.28). In recent years however, increases in nutrient input use have exceeded land productivity growth, suggesting diminishing marginal contributions of nutrient input to yield growth and reaching the limits of current technology (Fuglie and Rada, 2018; FAOSTAT, 2018).

Figure 2.28. Growth in land productivity in selected Asia countries, 1995-2014

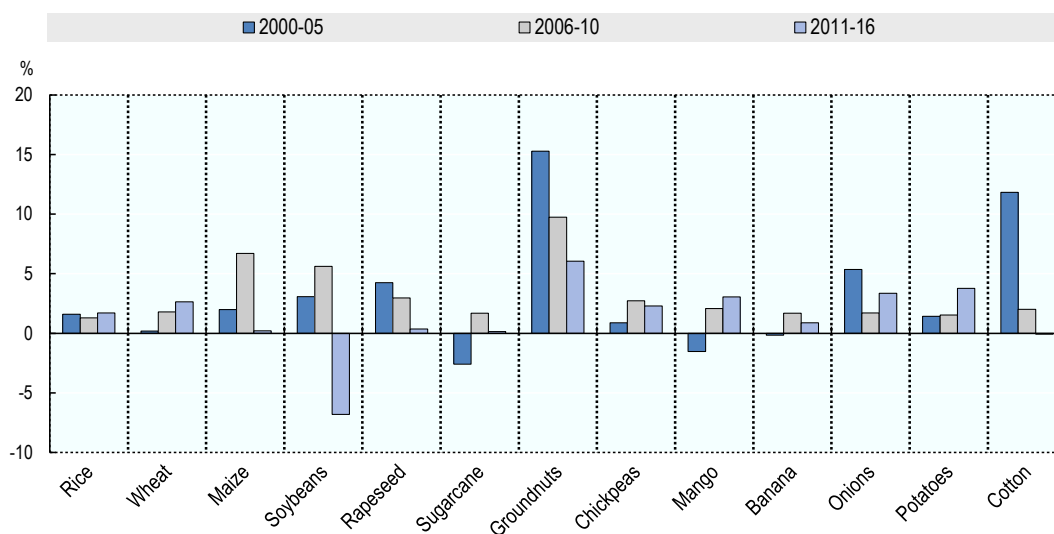


Note: Data used for time and cross-country comparison purposes.

Source: Own tabulation based on Fuglie and Rada (2018), *International Agricultural Productivity Dataset*, ERS, USDA.

A mapping of yield trends in India in 2011-16 highlights that land productivity has stagnated for many of the key commodities. Annual yield growth has been under 2% in recent years for key grains (including rice, wheat and maize) as well as for soybeans, rapeseed, sugarcane, chickpeas, and cotton (Figure 2.29). This counters a decade of increasing yields between 2000 and 2010 driven by technological innovation. The development and adoption of hybrid maize varieties, high-yield variety groundnut seeds, and Bt cotton in the early 2000s had a significant impact on their respective yield trends and the expansion of these sub-sectors. Farm-level analysis also highlights the importance of increased input quantity and quality in raising yields until the end of 2000s: in the case of cotton, for instance, the use of fertilisers and pesticides, or increased adoption of hybrid seeds, appear to have contributed significantly to the yield increase in addition to Bt cotton (Grüere and Sun, 2012; FAOSTAT, 2018).

Figure 2.29. Average yearly yield growth for key crops, 2000-16



Source: FAOSTAT (2018).

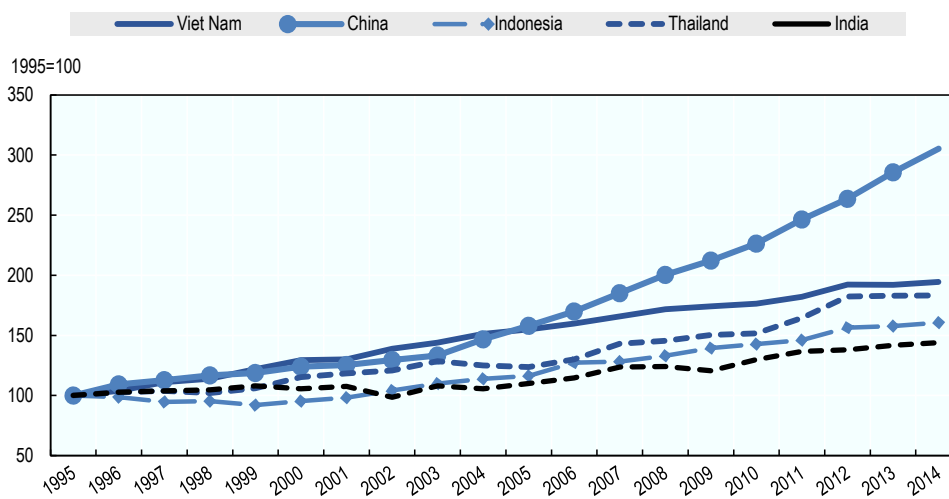
In addition to yield stagnation, significant gaps remain in yield potential. Average yields of most key crops in India are still low compared to the highest yields achieved worldwide and, in some cases, even world averages. For instance, current wheat and rice yields are approximately 3 times lower than the highest global yields, while yields for key fruit and vegetables – including mango, banana, onion or potato – are between 2 to 7 times lower than highest yields achieved worldwide. Therefore, vast untapped potential exists in yields for most crops and states; considering that the frontiers of expansion of cultivated area are practically attained in India, future output growth must come from increase in yield (FAOSTAT, 2018).

Labour productivity

Farm labour productivity growth in India has been lagging over the last decade behind that of other Asian economies such as China, Viet Nam, Indonesia, and Thailand (Figure 2.30) (Fuglie and Rada, 2018). As in the case of land productivity, average annual growth has also been considerably slowing in recent years. These trends are directly linked to the slower growth of agricultural output versus the evolution of farm

employment, with labour moving out of the sector at a very sluggish pace. Real agricultural value added per worker in India is one third of that in China (Figure 2.31) (Fuglie and Rada, 2015). The low levels of labour productivity in agriculture can be attributed to the continuous fragmentation of landholdings and underemployment in the sector, with many agricultural workers actually dividing their time between farm and non-farm jobs (sections 2.3 and 2.5). Larger farms benefit from scale effects associated with mechanisation and less labour use per hectare (Rada and Schimmelpfennig, 2015).

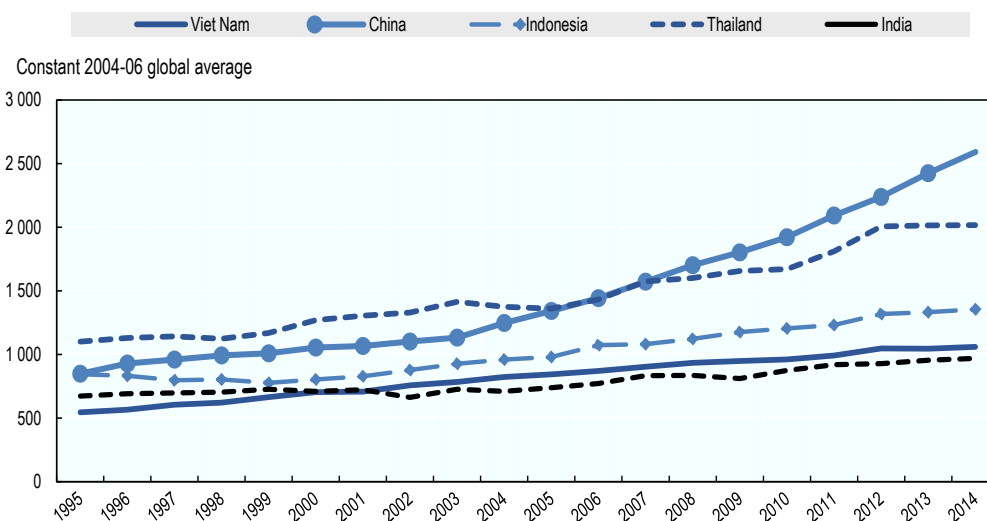
Figure 2.30. Growth in labour productivity in selected Asian countries, 1995-2014



Note: Labour productivity is measured as total agricultural output (constant 2004-06 global-average prices) divided by the total number of economically active persons in the sector in a given year.

Source: Own tabulation based on Fuglie and Rada (2018), *International Agricultural Productivity Dataset*, ERS, USDA.

Figure 2.31. Agriculture value added per worker in selected Asian countries, 1995-2014



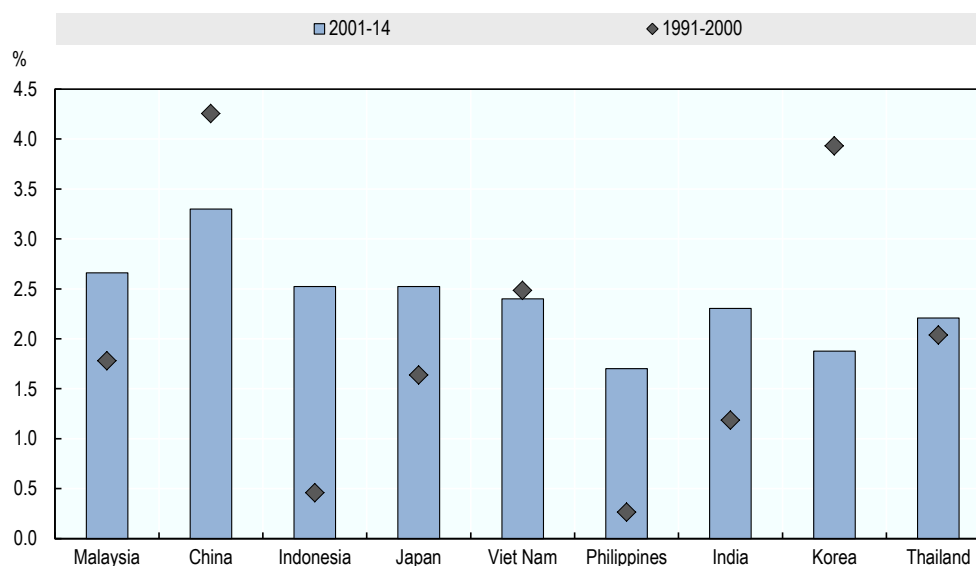
Source: Own tabulation based on Fuglie and Rada (2018), *International Agricultural Productivity Dataset*, ERS, USDA.

Total factor productivity

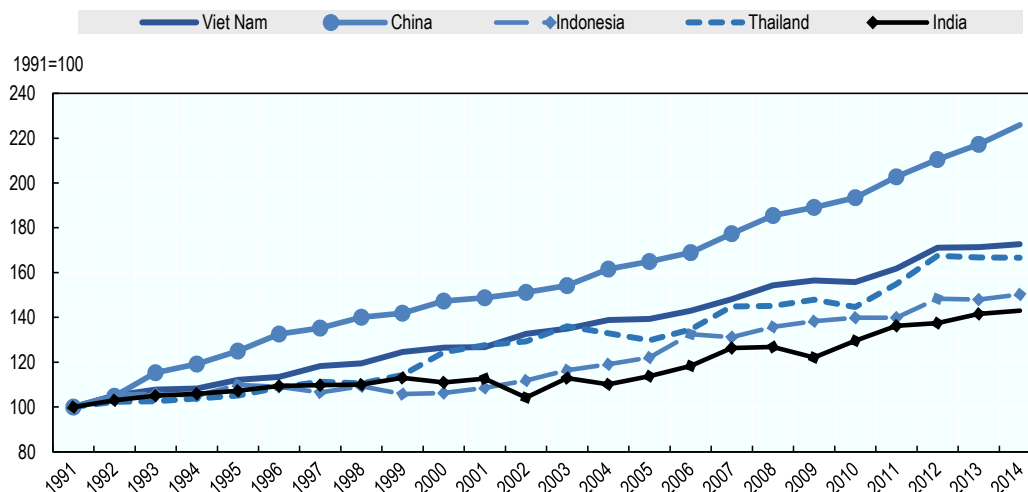
Improvements in Total Factor Productivity (TFP) have also been an important source of output growth. TFP represents the share of output increase not explained by the amount of inputs used in agricultural production; it accounts for effects in total output growth relative to the growth in total inputs used in production, such as fertilisers, land, or irrigation. TFP thus captures the effects of technological change, skills, or infrastructure, as well as the increase in efficiency with which inputs are utilised in production.

India's TFP growth since 2001 has been robust, reversing the early 1990s slowdown (Figure 2.32). However, TFP growth levels are behind those in China, Viet Nam, Thailand or Indonesia (Figure 2.33) (Fuglie and Rada, 2017). Technological progress has been the main and consistent driver of TFP growth over the past two decades. Main components of technological progress in India included the use of improved seeds, as well as better infrastructure coverage and quality (irrigation, road density, electricity supply). In turn, efficiency³¹ stagnated over the long run and shows even a declining trend in recent years, indicating that the gap between realised and potential productivity levels has widened. It also means that farmers have not been efficiently applying existing technologies in production due to suboptimal investment in public extension services (Chapter 3). This has been accompanied by a deterioration of farmland infrastructure, particularly the existing water conservation systems, which constrained the farmers from applying best production techniques (Rada and Schimmelpfennig, 2015).

Figure 2.32. Average annual growth rate in Agricultural Total Factor Productivity, 1991-2014

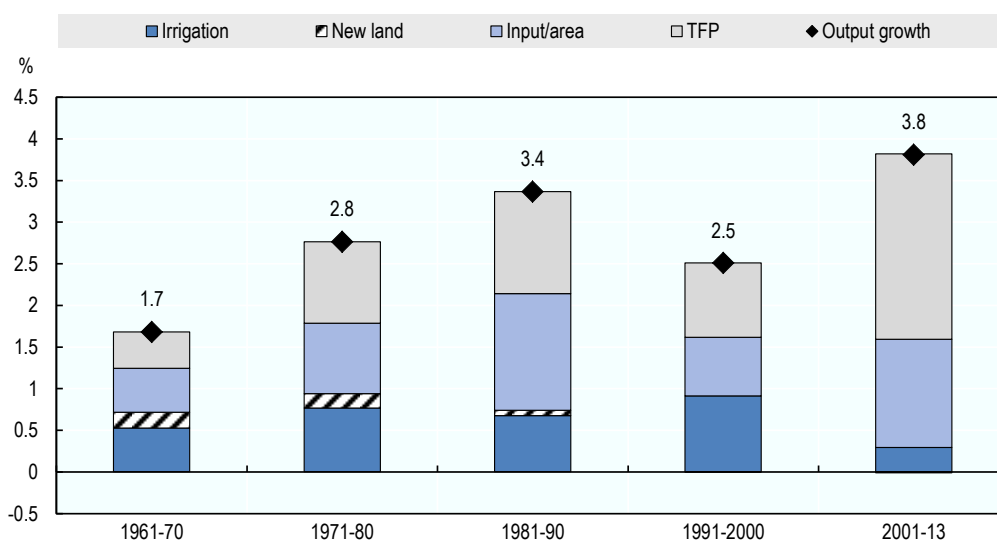


Source: Fuglie and Rada (2018), *International Agricultural Productivity Dataset*, ERS, USDA.

Figure 2.33. Growth in total factor productivity in selected Asian countries, 1991-2014

Note: TFP growth rate is calculated as the difference between output and input growth rates.
 Source: Fuglie and Rada (2018), *International Agricultural Productivity Dataset*, ERS, USDA.

Among individual inputs, irrigation was an important driver of growth in the earlier decades, but it expanded much more slowly in the 2000s and so did its contribution to output increase. Growth in inputs other than land and irrigation – such as chemical fertilisers – has also been an important source of output increase throughout the last decades. TFP growth was nevertheless by far the most important driver of output growth in 2001-13 (Figure 2.34) (Fuglie and Rada, 2018). TFP for grains shows little improvement over the most recent period, implying that the overall agricultural TFP has been mainly driven by high-value horticulture and livestock sub-sectors (World Bank, 2014a).

Figure 2.34. Contribution of inputs and TFP to output growth, 1961-2013

Source: Fuglie and Rada (2018), *International Agricultural Productivity Dataset*, ERS, USDA.

India's TFP growth rate has varied not only over time and crops, but also by regions and states. TFP growth was faster in those regions that complemented traditional crops with specialty and horticultural crop production as well as livestock (such as the western, southern, and eastern regions of India). In comparison, TFP has been increasing at a slower pace in regions specialising in grains and animal products (northern India) as well as in the regions unable to benefit from the higher returns from high-value commodity production (central and north-eastern India) (Rada and Schimmelpfennig, 2015).

Agriculture performance in face of climate change

India is already highly exposed to natural catastrophes: 59% of the land is vulnerable to earthquakes, 8.5% to cyclones, and 5% is prone to river basin floods. Droughts also severely impacted agricultural output in early 2000s, mid-2000s and recent years. Further changes in temperatures, precipitation, and carbon dioxide concentration are foreseen in India. Thus by mid-century, impact of climate change would be felt as an increase in the average surface temperature by 2 to 4 degrees C, changes in rainfall (distribution and frequency) during both monsoon and non-monsoon months, as well as an increase in the frequency and intensity of both droughts and floods. A shift towards wetter forest types in the north-eastern region and drier forest types in the north-western region is predicted, which will alter ecosystems (Ranuzzi and Srivastava, 2012).

As described above, the agricultural sector is exposed to existing stresses such as the widening gap between water supply and demand, land degradation, and air pollution; climate change will therefore make already sensitive systems even more vulnerable. Indian agriculture is doubly exposed in face of climate change. First, due to the large share of the agricultural land area which is rainfed, it is highly vulnerable to climate change impacts on the monsoon pattern. Second, due to the large share of small and marginal farmers, which currently have a lower capacity to cope with climate change impacts on agriculture, challenges will arise in adapting to new cultivation cycles, technologies and infrastructure (Ranuzzi and Srivastava, 2012).

Due to higher temperatures, increased rainfall variability and decreasing access to freshwater for irrigation, land productivity of most crops in India is projected to be lowered by 10% to 40% by the end of the century, relative to a scenario with no water or climatic shocks (Shrivastava, 2016). Cereals such as rice, wheat, and maize, as well as cotton, sugarcane and vegetables will be particularly affected. Because of moisture deficit and heat, irrigated rice yields are projected to fall in absolute terms by about 16% in Haryana and Punjab by 2050. The increase of mean temperatures and the intensification of monsoon rains will also favour the development of pests and parasites: the north-west region is projected to suffer from the highest yield deviation in the country for rainfed rice by 2080, with a relative decline ranging from 7% to 22% (Soora et al., 2013). *Kharif* crops grown during monsoon periods are more likely to be exposed to rainfall variability and droughts, while *rabi* crops sown in winter are expected to be more particularly sensitive to low temperature stress (CRIDA, 2013). Under different irrigation stresses and climate change scenarios, with no adaptation or mitigation, the production of sugarcane, cotton and vegetables is projected to fall by 2050 by between 15% and 25% relative to a scenario with no water stress or climatic shocks (OECD, 2017c).

While the livestock sector is a major contributor to GHG emissions in India (section 2.4), it will also be affected by the projected increases in temperature. These may cause distress to dairy animals and thus impact milk production. For instance, a 10% to 25% loss in milk production is forecasted in Haryana by mid-century. High producing

crossbred cows and buffaloes will be impacted more than indigenous cattle. Heat stress due to high ambient temperature accompanied with excess humidity during summer months will also have adverse effects on the reproductive performance of most farm animals (Government of Haryana, 2011).

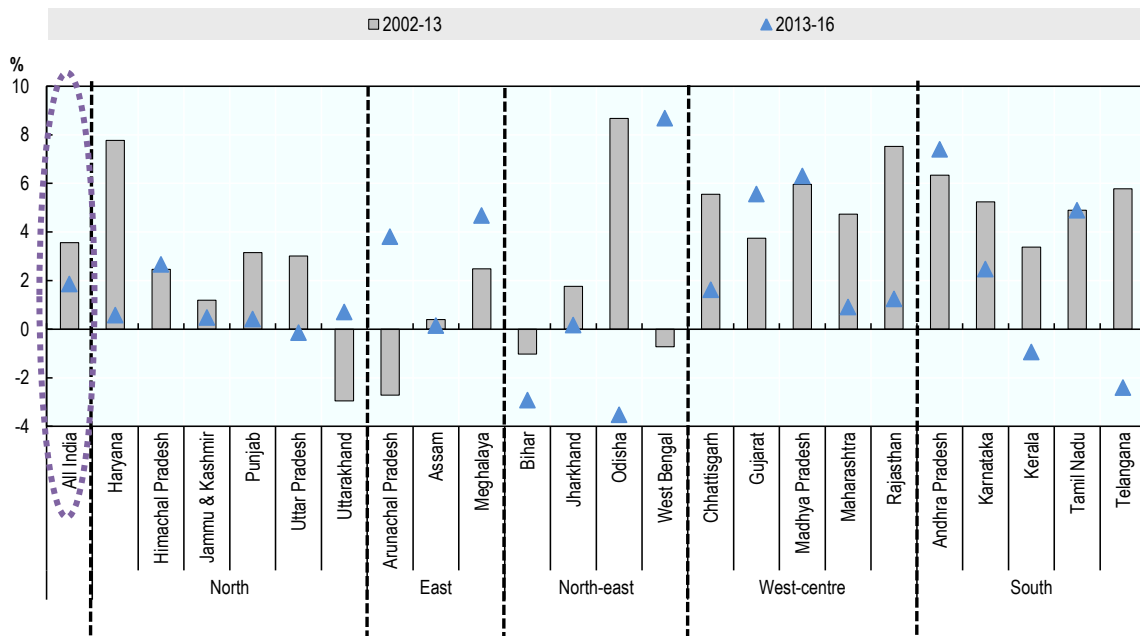
In the scenario of climate damages – driven by higher temperatures, increased rainfall variability and frequency of extreme weather events – India stands to lose more than other regions and major agricultural producers. Yields losses for wheat and rice could be almost twice as high in India when compared to other economies in South-east Asia, China, or average worldwide estimated impacts. India is also among the economies to suffer the highest impacts on trade, with exports estimated to contract more than imports (-6% and -4%, respectively, relative to worldwide average impacts of about -2%). Production costs are forecasted to increase much more in India than those of its trading partners, affecting its overall competitiveness (Delink et al., 2017).

2.5. Rural socio-economic aspects

Farmer incomes and rural poverty

Farm incomes are currently at less than one-third of those of non-agricultural households, highlighting once again the significant productivity differences between sectors³² (NITI Aayog, 2017b). Farmer incomes³³ grew at 3.7% in the 1990s, but this trend slowed in the early 2000s and the average all-India annual real growth was of 3.5% during 2002-13. Latest all-India available estimates would indicate that between 2013 and 2016, real farmer incomes increased by only 2% per year³⁴ (Government of India, 2017b) (Figure 2.35). The Government of India recently announced an objective to double farmers' income by 2022 (NITI Aayog, 2017b).

There is a wide variation in farmer income growth magnitudes between regions as well as between individual states. In 2002-13, incomes grew at more than 7% in states such as Odisha, Haryana, Rajasthan, Andhra Pradesh and Madhya Pradesh compared to states like Uttarakhand, Arunachal Pradesh, Bihar or West Bengal where incomes even decreased in real terms (Figure 2.35). However, not all strong performers from 2002-13 continued on this path in 2013-16, highlighting thus the volatility in farmer incomes evolution. In Haryana, Rajasthan and Maharashtra, farmer incomes increased at a lower rate than the all-India average and appear to have even been decreasing in Odisha. While incomes continued their decrease in Bihar in 2013-16, they appear to have increased by over 8% annually in West Bengal. Gujarat, Madhya Pradesh, Andhra Pradesh and Tamil Nadu are the most consistent performers, with farmer income growth well above the all-India average in both 2002-13 and 2013-16 (Gulati et al., 2014; Birthal et al., 2014; Government of India, 2017b).

Figure 2.35. Evolution of real farmer incomes in selected states, annual growth, 2002-16

Note: Estimates for 2013-16 are derived by the Government of India Doubling of Farmers' Income (DFI) Committee.

Source: Government of India (2017b) based on NSSO unit level data, 59th and 70th Rounds.

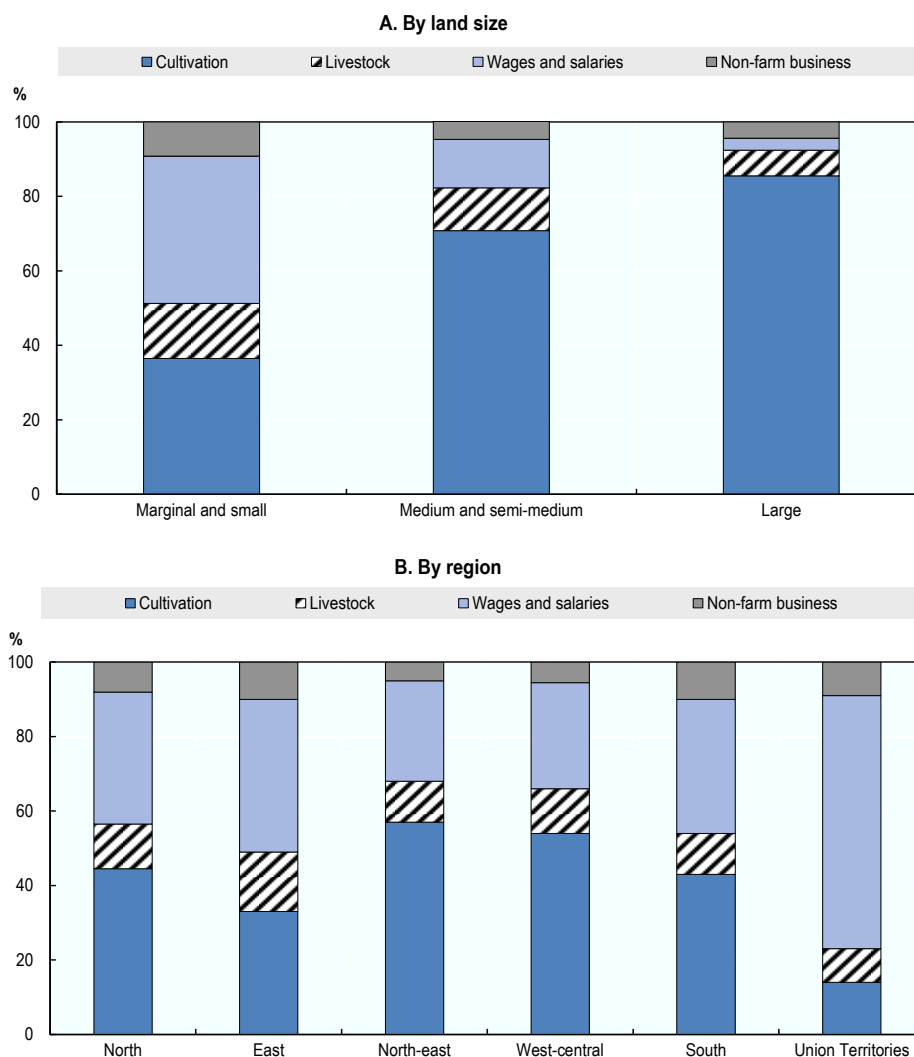
The evolution of farm incomes has been influenced by both “pull” and “push” factors. The implementation of the 2005 rural public employment programme Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) scheme acted as “push factor” by providing at least 100 days of wage employment in a financial year to every household whose adult members volunteered to perform unskilled manual work. This scheme set an upward pressure on farm wages. On the other hand, overall economic growth creating employment opportunities outside the farm and in particular, the development of the construction sector in some rural areas, have been a factor behind labour “pull” out of agriculture and farm incomes increase (Gulati et al., 2014; Birthal et al., 2014).

For persons employed in agriculture, growth of income from animal husbandry and livestock has been higher than the one from cultivation across a wide range of selected states in 2002-12. At an all-India level, income from livestock increased in 2002-12 by 14.7% annually, income from cultivation by 3.8%, wages and salaries by 1.5%, while income from non-farm business sources by 0.5% (Government of India, 2017b).

The relative contribution of the different agricultural household income components is linked to the farm size. The share of income from cultivation increases with the size of the landholdings. At the lower end of the spectrum of land size (marginal and small farmers, owning land size of less than 2 hectares) wages and salaries constitute the principal source of income. In turn, for medium and semi-medium farmers (owning land size in the range of 2 to 10 hectares) and large farmers (owning land size of more than 10 hectares), income derived from cultivation represents the highest share of the overall farmer income. The share of income from livestock declines with farm size (Figure 2.36A) (Government of India, 2017b).

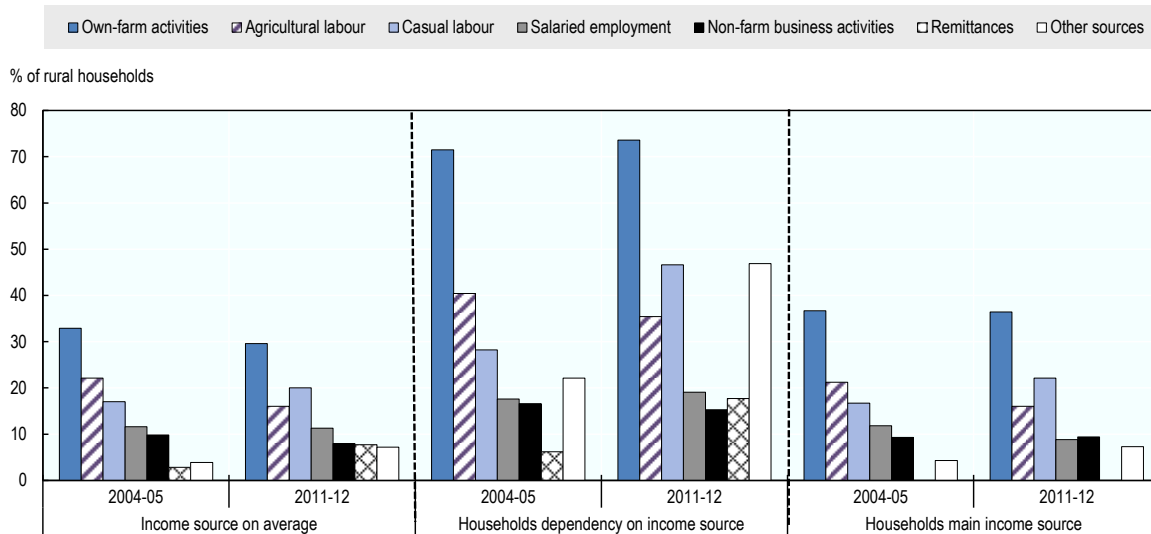
The sources of income differ also across regions and states. The share of cultivation in income ranges on average between 33% and 64%, barring in the UTs for which the average share is approximately 14% (Figure 2.36B) (Government of India, 2017b).

Figure 2.36. Main sources of income, 2012-13



Source: Government of India (2017b) based on NSSO unit level data, 59th and 70th Rounds.

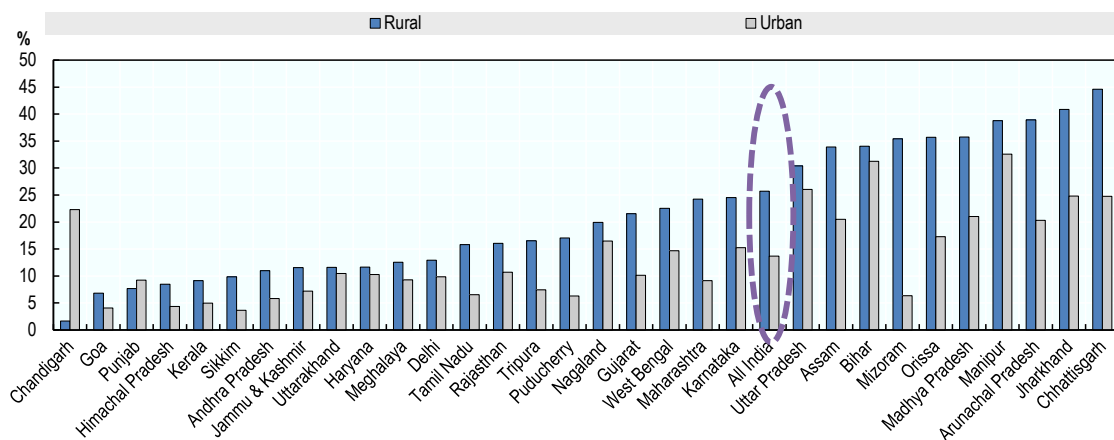
There has been significant change in rural household income sources over the past decade, with a reduction in the share of agriculture in total household revenue. This matches the increasing participation of rural households in the non-farm sector. The share of income an average rural household earned from own farm activities (including cultivation, livestock and lease rent) decreased from 32.9% in 2004-05 to 29.6% in 2011-12 and the share of income earned through paid work on other farms declined from 22.1% to 16% over the same period (Figure 2.37). Only 1.8% of all rural households derived most of their income from self-employment in livestock farming. Milk production remains nevertheless a secondary occupation to crop cultivation for about 69% of India's agricultural households. Non-farm sources (wage, salary, non-farm business activities etc.) contribute about 40% on average to a rural household's income (MOSPI, 2016b; Ranganathan et al., 2016).

Figure 2.37. Rural income diversification dynamics, 2004-12

Note: Own-farm activities include incomes from cultivation, livestock and lease of agricultural property. Agricultural labour income considers agricultural wages which are obtained from work on other farms. Non-farm business activities include income from manufacturing, hotels and restaurants, construction, mining and quarrying, repairing, and other services.

Source: Ranganathan et al. (2016) based on the *India Human Development Survey (IDHS)*.

Low farm incomes lead to high poverty rates among farmers. Rural poverty is both widespread and severe, largely reflecting very low farm labour productivity and insufficient non-farm employment opportunities. According to the national definition of the poverty line, the poverty incidence for rural households is high, 25.7% in 2012, compared to the nationwide average for the urban population of 13.7% (Figure 2.38). There are large differences in rural poverty incidence across states, varying from above 40% (Jharkhand and Chhattisgarh) to under 10% (Kerala, Himachal Pradesh, Punjab, Goa) (OECD, 2017a).

Figure 2.38. Rural and urban poverty rates across selected states, 2011-12

Note: Poverty is calculated by using the Tendulkar methodology, which defines poverty not in terms of annual income, but in terms of consumption or spending per individual over a certain period for a basket of essential goods.

Source: OECD (2017a) based on Reserve Bank of India data.

Food consumption

Consistent with overall economic growth, the share of consumer spending on food has declined in both urban and rural areas: the proportion of expenditure on food items across all income groups has declined by about 10 percentage points in the rural areas and by about 16 percentage points in the urban areas from the end of 1990s to 2010. In 2011-12, food constituted 52.9% of rural households' expenditure and 42.6% for urban households. Income-induced dietary diversification has resulted in consumers moving away first from cereals such as *jowar* and *bajra* to superior grains such as wheat and rice and more recently from cereals to higher value food products such as milk, egg, meat, fruit and vegetables. There is also a rise in consumption of processed food, with 83-85% of food products being consumed at some degree of processing (Minten and Reardon, 2010; MOSPI, 2014).

Despite the changing diet over the years, the overall calorie intake has registered only a modest increase from an average 2 333 kcal per day in 2000-02 to 2 450 kcal per day in 2010-13 (Chapter 4). A decline in calorie intake from cereals has nevertheless been offset by increased intake from animal-based food products and fruit and vegetables. Over the same period, the contribution from cereals and pulses to protein intake declined by 7%, while the contribution of animal products and fruit and vegetables increased by 25% and 29%, respectively. The share of energy intake contributed by cereals is about 57% for rural India and 48% for urban India. The contribution of cereals varies across the major states from 42% (Punjab) to 70% (Odisha) in the rural sector and from 39% (Haryana) to 60% (Odisha and Bihar) in the urban sector (Census India, 2014; MOSPI, 2014).

Food consumption patterns also differ across India's regions and are influenced by religious and cultural factors. Food expenditure shows a more diversified diet across the eastern, southern and western coasts. Rice consumption is higher in the eastern, southern and coastal parts of India whereas wheat consumption is more prevalent in the northern, western and central regions. Vegetable consumption is greater in southern, eastern and north-eastern parts of the country. The states where the majority of the population is vegetarian are Rajasthan (74.9%), followed by Haryana (69.3%), Punjab (66.8%), and Gujarat (61%). In states such as Punjab and Kerala, religious beliefs and cultural movements have played an important role in keeping meat consumption low. Aside cereals, protein rich crops such as pulses meet the needs of a large segment of the population that, to a varying extent, eschew animal-based products, such as meat, eggs or fish. Overall, 37.7% of Indian households are estimated to be vegetarian in 2011-12, down from 43.3% in 1993-94 and 41.8% in 2004-05, showing that non-vegetarian diets are increasing. Meanwhile, India still has more vegetarians than the whole of the rest of the world put together (Gupta and Mishra, 2014; MOSPI, 2014; Gulati, 2016).

As far as meat consumption regions are concerned, meat is mainly consumed in the southern, north-eastern and north-western parts. Seven states in North-east India had the highest share of non-vegetarians in 2011-12 (97%), followed by West Bengal (95%) and Kerala (92%). This has largely been driven by poultry consumption, with the proportion of households consuming poultry increasing from 8% in 1993-94 to 38% in 2011-12. The increase of chicken meat consumption is due to its widespread availability, lower fat content, versatility, and relatively low cost in comparison to other meat products (Gupta and Mishra, 2014; Gulati, 2016).

2.6. Structural change beyond the farm gate

Input markets

Seeds and fertilisers

Farmers have access to seeds through formal and informal systems. Central and state-level public agencies, together with the private sector, currently play a role in the formal industry. Several channels are part of the formal system: traditional input dealers, the Primary Agricultural Credit Societies (PACS)³⁵, state seed stores (located mainly at the district level), agricultural universities (offering direct retail of breeder and foundation seed to selected farmers), Rural Business/Service Hubs (RBH) outlets, and *mandi* (wholesale market) traders. The major share (over 80%) of the formal seed market is supplied by the private sector (56% through traditional retail and 24% through RBHs). The informal sector consists of seed saved on-farm and that obtained from the trading and exchange sub-systems within the community. The formal system is expanding rapidly, with about 39% of operational holdings using certified seeds and 9.8% hybrid seeds in 2011-12. However, 60% of food crops in India are still sown from seed stocks selected and saved by farmers (World Bank, 2014a; MAFW, 2016b).

The establishment of the National Seeds Corporation (NSC) in 1963 marked the beginning of the formal seed sector. The seed industry had been dominated by the public sector until 1988, when the liberalisation of seed policy through the New Policy on Seed Development (NPSD) opened the door for private domestic and multinational seed companies in the import of seeds and technologies, as well as in research and development investment. The laws and policies thereafter encouraged private participation and seed production increased four-fold in 1991-11. The growth drivers in this period were the rapid development and adoption of innovations (improved varieties, hybrids and proprietary technologies) and more dynamic seed markets (especially for Bt cotton, single-cross maize hybrids, hybrid rice, and vegetables). The private sector currently comprises several multinational corporations, joint venture companies and domestic research-based seed companies, which are all involved in producing, processing and marketing both public and private varieties. However, the main focus of private seed companies has been on the high-value low-volume hybrid seeds such as fruit and vegetables, while the public sector seed corporations still dominate the market for low-value high-volume seeds of cereals, pulses and oilseeds (Majunatha et al., 2013).

The distribution of fertilisers takes place through private channel sale points (77% of the market or approximately 211 750 units) as well as through co-operatives and other institutional agencies (23% of the distribution points). Some quantities are also made available through manufacturers³⁶ own outlets. Co-operatives are the main institutional agency in the country handling fertilisers, comprising at present 29 state level marketing federations (called Apex Co-operative Marketing Federations), 171 district level marketing societies, and about 66 200 village level co-operative societies (PACS). The other institutional agencies engaged in the distribution of fertilisers are the State Agro-Industries Development Corporations, Commodity Federations and State Departments of Agriculture. They operate both through their own sale depots as well as through private dealer networks. The co-operative structure differs from state to state and administrative units at different levels (district/sub-district/village) can perform distinct functions across states (Sharma and Thaker, 2011).

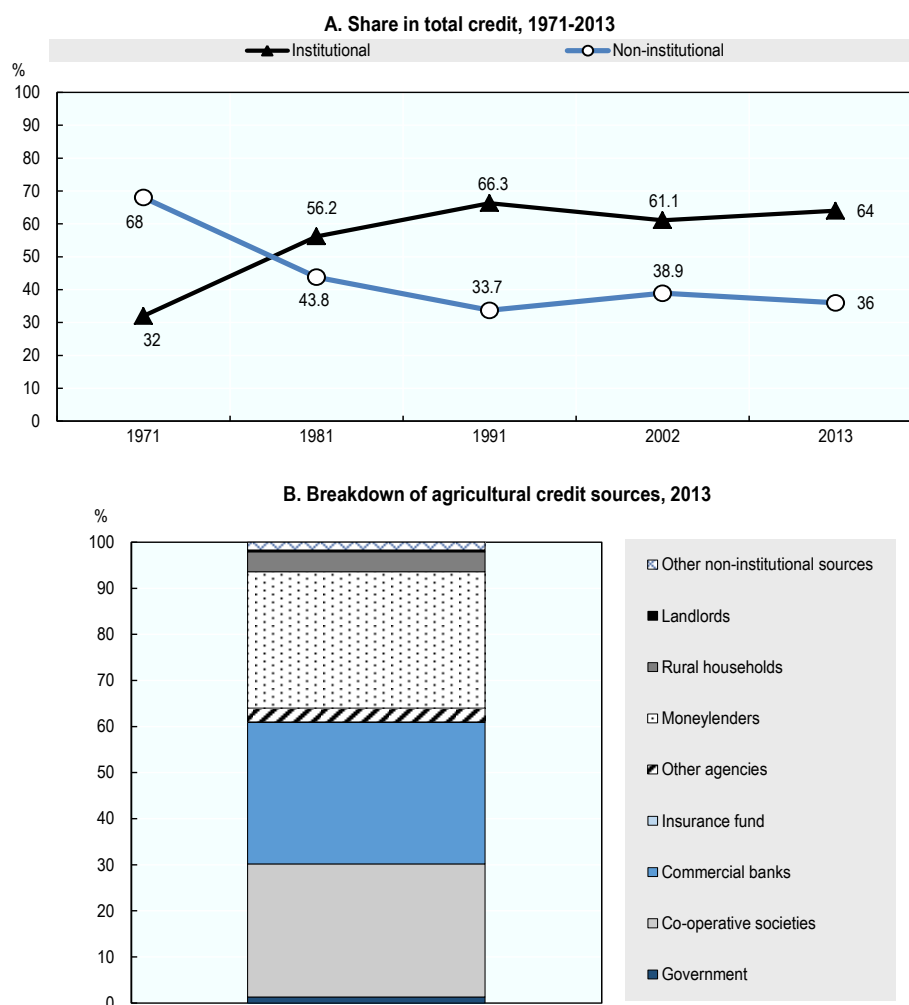
The Government of India's longstanding policies and regulations with respect to fertiliser prices (Chapter 3) have a direct impact on access to and use of fertilisers. While the average use intensity of fertilisers has risen steadily at an all-India level (section 2.2), the domestic production of fertilisers has not increased to meet these growing requirements mainly due to raw materials limitations. India depends entirely on imports for potassic (K) resources and imports 90% of phosphatic (P) inputs used in the production of fertilisers. Urea (N) is the only fertiliser for which the requirement is largely (around 80%) met through domestic resources (Majunatha et al., 2013). 50% of urea is under the Department of Fertilizers' movement control order – that is setting the amount of imports and the point of sale – compared with 20% for fertilisers based on K and P. Only three agencies are allowed to import urea into India, while there are no specific import controls on K and P-derived fertilisers. The entire process – from the time the Department of Fertilizers decides to import to the time urea reaches consumer centres – takes about 60-70 days; such delays can exacerbate shortages, and are particularly costly during peak demand periods (Government of India, 2016).

Access to financial services

While the rural banking system in India made significant achievements in increasing the amount of loans granted to the agricultural sector, several qualitative aspects of the credit delivery system have been neglected. Rural areas currently dispose of a range of financial service providers, including formal sector financial institutions at one end of the spectrum, informal providers (mostly moneylenders) at the other end, and in between a number of semi-formal/microfinance providers. In terms of size and coverage of operations, formal sector financial institutions dominate the rural finance landscape. The Government of India policies supported branch expansion of public sector commercial banks in rural areas, particularly in the 1970s and 1980s. India currently has over 32 000 rural branches of commercial banks (mostly public sector commercial banks) and regional rural banks (RRBs), some 14 000 co-operative bank branches, 98 000 PACS providing financial services, thousands of mutual fund sellers, several non-bank finance companies (NBFCs), and a large post office network with 154 000 outlets that are required to focus on deposit mobilisation and money transfers. Agriculture is also one of the priority sectors for lending³⁷, with a requirement that at least 18% of adjusted net bank credit (ANBC) is directed to the agricultural sector. More specifically, within the 18%, a sub-target of 8% of ANBC or Credit Equivalent Amount of Off-Balance Sheet Exposure – whichever is higher – is reserved for small and marginal Farmers (Reserve Bank of India, 2015).

This hides nevertheless a notable inter-state variation in access to formal credit: in 2013, Andhra Pradesh had the lowest share from the formal sector at 31%, while Kerala and Maharashtra had the highest at about 83%. There are also big differences across socio-economic groups, with 87% of marginal farmers not having access to credit from a formal source. This is exacerbated by the inability of small borrowers to provide collateral, coupled with volatile incomes and erratic expenditure patterns, as well as difficulties in contract design and enforcement. In addition, the transaction costs of rural lending are high, mainly due to small loan size, the high frequency of transactions, the large geographical spread, the heterogeneity of borrowers, and low education levels. Non-institutional agencies still account for as much as 36% of the total outstanding loans of cultivator households in 2012-13, an increase from 34% in 1990-91 (Figure 2.39) (Hoda and Terway, 2015; Rajeev, 2015).

Figure 2.39. Agricultural credit by source, 1971-2013



Source: Hoda and Terway (2015) based on various issues of *All India Debt & Investment Surveys*, National Sample Survey Office (NSSO).

The range of financial products of rural financial institutions remains limited and inadequate in relation to long-term farm investment needs. Direct lending to farmers by institutional agencies (co-operative banks, commercial banks and regional rural banks) takes the form of either short-term or long-term credit³⁸. The banking sector has focused disproportionately on basic financial products, such as short-term credit, also motivated by interest rate subsidies on this type of credit³⁹ (Chapter 3). Long-term credit for the sector constituted only 57.6% of private capital formation in 2012-13, with significant fluctuations since the 1970s. Small and marginal farmers are particularly dependent on short-term credit (Hoda and Terway, 2015).

To compensate for the relative lack of success of formal banks in reaching the rural poor, new microfinance approaches were developed. These include the “Self-Help Groups (SHGs) - Bank Linkage”, initiated by the National Bank for Agriculture and Rural Development (NABARD) to target the poorest segments of the rural population. However, outreach, volume of lending, and average loan size remain limited, with disbursements accounting for only 2% of the formal sector credit in rural areas (Rajeev, 2015).

The level of indebtedness rose sharply in both urban and rural areas in 2002-13: about 31.4% of rural households and 22.4% of urban households were in debt, up from 26.5% and 17.8% respectively in 2002. There is a higher level of indebtedness among cultivators (35%) than non-cultivators (25.6%). Recovery of loans in the agricultural sector is poor. The reasons behind this phenomenon lie mainly in the low level of income generation especially on small-sized farms, diversion of loans to unproductive purposes, inadequacy of the loans leading to their diversion, and wilful default in expectation of a waiver (MOSPI, 2016c). Indeed, the poor debt recovery has led many state governments to announce several waves of agricultural debt write-offs in recent years (Chapter 3). Although India's banks are recapitalised by the government for the full amount of loans written off under such programmes, district-level data suggest that banks shifted credit to observably less risky regions as a result of such programmes (Giné and Kanz, 2014).

Marketing channels for farm output

Marketing infrastructure

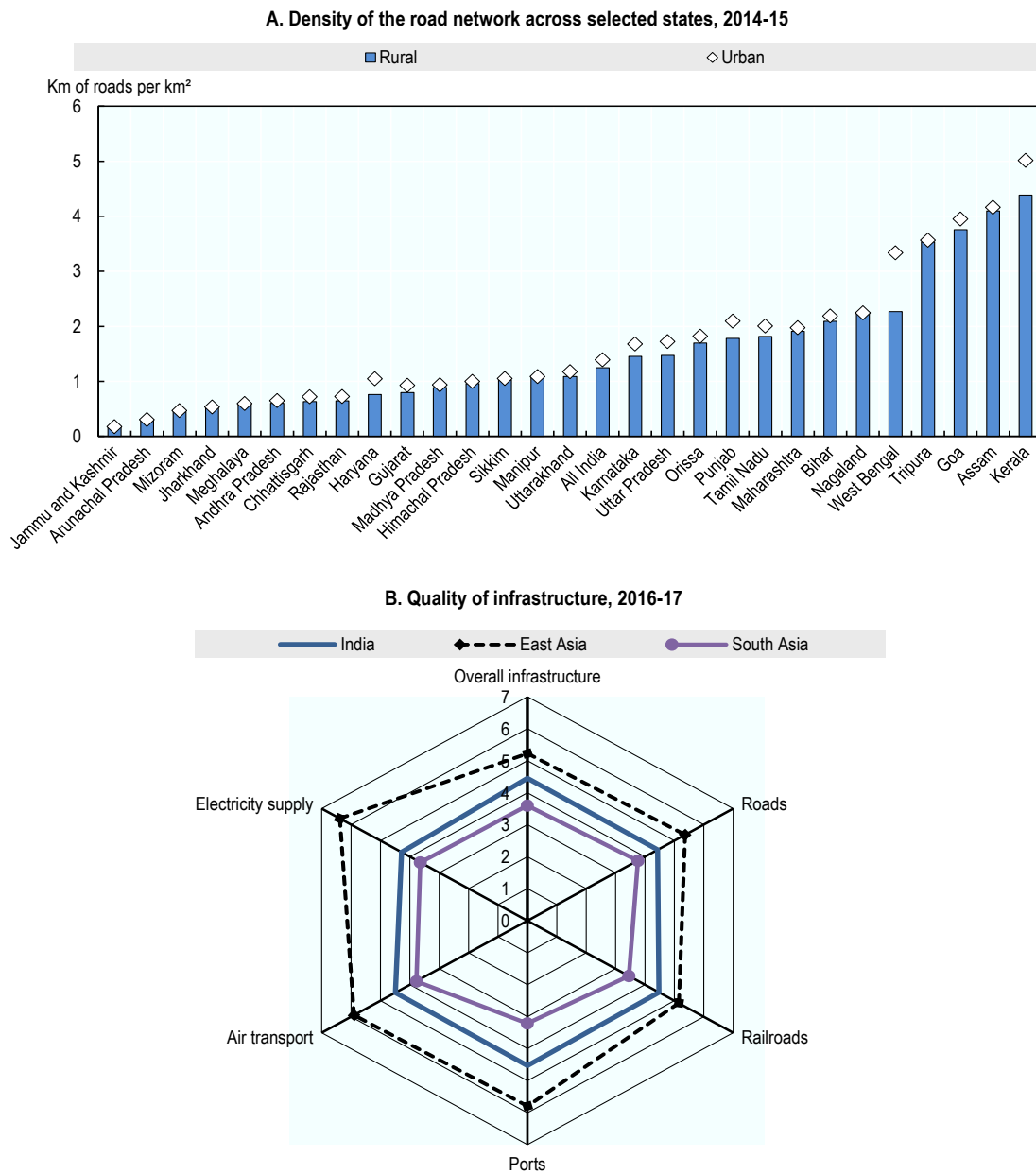
Current infrastructure deficiencies in India – concerning transport connectivity, cold chain and storage infrastructure, logistics, and energy supply – can be disruptive for agricultural supply chains, particularly when connecting small-scale producers to other market actors. These gaps lead to delays and uncertainties in supply chains and drive up transaction costs, resulting in higher prices for inputs and higher wholesale and retail prices for food.

Road transport infrastructure coverage in India has expanded considerably since independence. The average all-India rural road density is of 1.5 km/km² in 2014-15, ranging from 0.17 in Jammu and Kashmir to 4.38 km/km² in Kerala (Figure 2.40A). The fully centrally-sponsored scheme *Pradhan Mantri Gram Sadak Yojana* (PMGSY), introduced by the Government of India in 2000, made a significant contribution to providing all-weather road connectivity to every rural habitation with a minimum population of 500 in the plains and 250-plus in hill states, tribal districts and desert areas (Government of India, 2016; OECD, 2017a).

Meanwhile, the most acute strains on India's physical infrastructure lie in the quality of roads, railroads, ports, airports, as well as electricity supply. While India's quality of roads, railroads, ports, air transport, and electricity supply is better than South Asia peers, it lags considerably behind the average of East Asian economies (Figure 2.40B). About 40% of the road network is currently not paved and so far, only 14 states have developed policies for maintenance of rural roads (OECD, 2017a; WEF, 2017).

In the absence of appropriate rail and waterway networks, freight is highly concentrated in road transport, which dominates the freight market (over 65% of goods in terms of tonnage are transported by road, while 21% are transported by rail). Moreover, seven long-haul corridors account for about half of the total freight, even though national highways along these corridors are less than 0.5% of the Indian road network. This makes the current infrastructure over-stretched, with most of the national highway network and rail links along the North-South and East-West corridors congested: the average distance travelled by a truck in India is estimated to be around 250-300 km per day, compared to a world average of 400 km per day (World Bank, 2014b).

Figure 2.40. Physical infrastructure in India



Note: Panel B: The index is on a scale of 0 (lowest performance) to 7 (highest performance).

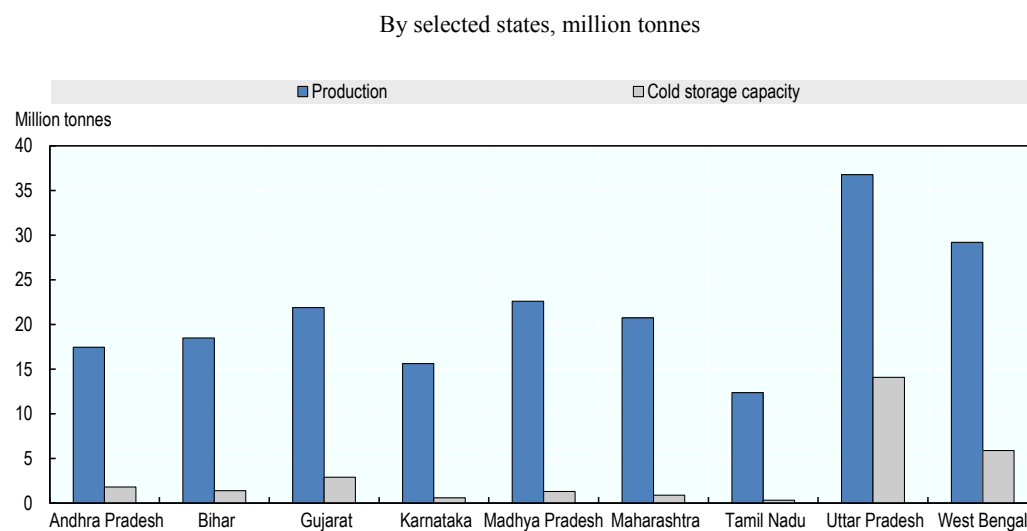
Source: Panel A: OECD (2017a) based on Ministry of Road Transport and Highways; Panel B: WEF (2017), Global Competitiveness Indicators.

In addition, the trucking industry in India is largely fragmented and in the hands of small truck operators. Estimates suggest that nearly 75% of truck owners in India own between 1 and 5 trucks, while 15% own between 6 and 20 trucks. Trucks overloading is often an outcome of a truck fleet dominated by very small operators. Moreover, the cost of refrigerated transport can be up to three times higher than transport of non-perishable goods (World Bank, 2014b).

Aside road transport and freight services quality, inter-state checkpoints⁴⁰ and other checks during transit add to delays and uncertainties in the supply chain and push up total costs. There is also substantial variance in the number of checkpoints across states. Haryana, for example, has managed to eliminate domestic checkpoints, replacing them with widespread mobile squads; in contrast, Uttar Pradesh is reported to maintain over 100 checkpoints. Karnataka and other states have implemented e-permits that have cut the time spent at checkpoints, while Gujarat has moved to a fully electronic inter-state check-post system (World Bank, 2014b).

The private sector currently accounts of only 14.9% of the all-India available storage capacity in warehouses, slightly above co-operatives (11.9%) but well behind the public sector (73.2%). Cold storage units are estimated to exist in only 9% of wholesale markets while grading facilities exist in less than one third of the markets. For instance, in the case of fruit and vegetables, only 12% of output is covered by cold storage capacity at an all-India level, with notable differences between states such as Uttar Pradesh (capacity for 14% of output) and Tamil Nadu (0.32%) (Figure 2.41). Moreover, the functioning of available cold storage units is impacted by problems in electric power transmission and distribution losses, which represent 18.5% of total electric power output and are much higher than in other economies in Asia such as Indonesia (10%) or China (6%) (WB WDI, 2018). There is also a mismatch between storage and transport capacity, as refrigerated transport capacity represents only 12% of the all-India cold storage capacity.

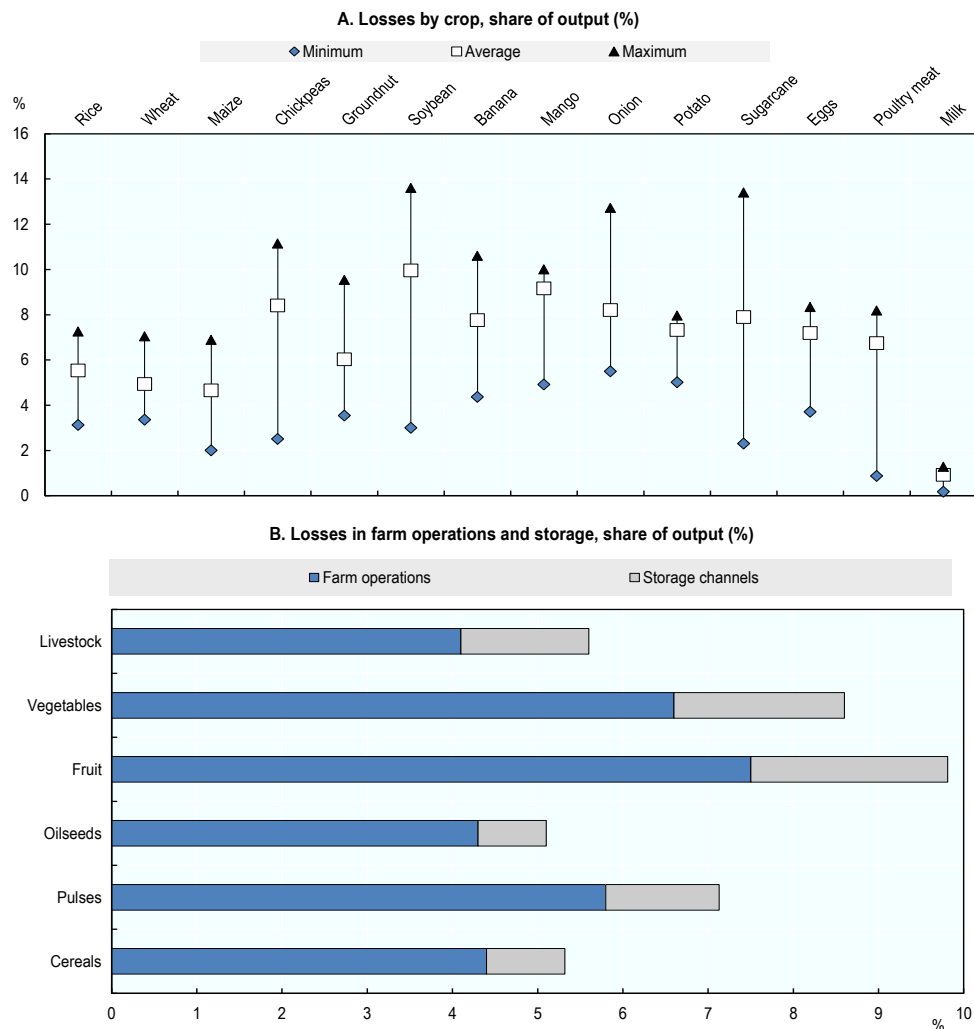
Figure 2.41. Production of fruit and vegetables versus overall cold storage capacity



Source: MAFW (2017), *Horticulture at a Glance*.

Transport inefficiencies between production and processing areas, together with the limited capacity in storage infrastructure, also increase post-harvest losses and hinder the development of efficient agro-marketing chains. Estimates indicate that while reductions in annual post-harvest losses have been registered for fruit and vegetables, these still remain high (between 4% and 16%, depending on the state). In turn, an increase in annual output losses has been recorded for cereals, pulses, oilseeds, dairy (Figure 2.42) (ICAR, 2012; World Bank, 2014a; MOFPI, 2015; Gulati and Saini, 2016; Government of India, 2017c).

Figure 2.42. Average state-level post-harvest losses and wastage intervals, by product category, 2015



Note: Post-harvest losses are recorded as a share of total output in selected states. The figure accounts for milk marketed through formal channels. Almost half of India's milk production is consumed by the household in which it is produced and is not marketed, while about 33% of milk production is channelled to consumers through the small and informal sector (Chapter 3).

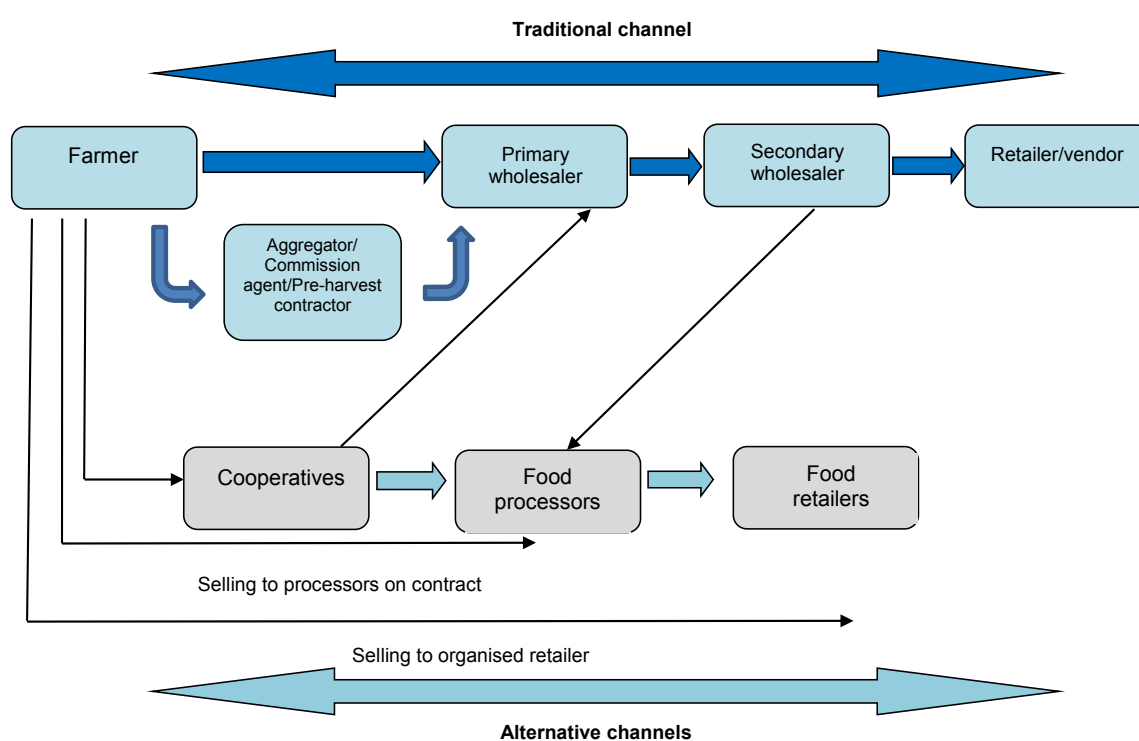
Source: MOFPI (2015).

Multiple challenges still remain with respect to infrastructure development, including funding constraints, land acquisition issues, delays related to identification and award of projects, and policy failures in transport infrastructure maintenance. To improve the situation, the Union Budget 2017-18 foresees ambitious programmes in transportation, telecommunications, and energy supply. Total government spending on physical infrastructure has been increasing from 4.1% of GDP in 2006-07 to 4.5% in 2011-12 and 5.1% in 2016-17⁴¹. The budget allocation for the transportation sector as a whole constitutes 60% of the overall infrastructure allocation in 2017-18. The infrastructure system – the aggregation, transport, storage and distribution – requires integrating operational capacities so as to serve as a conduit to the market and not function in isolation (Government of India, 2017a, 2017b).

Agricultural output markets

The traditional agro-marketing system stretches from farmers to aggregators, wholesalers, processors and retailers (Figure 2.43). This marketing channel includes both primary and secondary wholesale markets. Primary wholesale markets are located very close to production areas, allowing farmers to participate in transactions, in addition to other agents such as aggregators and contractors. Secondary wholesale markets, where transactions take place between different traders and market intermediaries, are usually located in or near large cities and commercial centres (MOA, 2013; World Bank, 2014a).

Figure 2.43. Agricultural output marketing channels



Source: Adapted from MOA (2013) and Ghesh (2013).

Agricultural output markets function under a large set of regulations, including controls on private storage, processing, distribution, and market infrastructure development (Chapter 3). Inter-state barriers, such as the complex tax system prior to the implementation of the GST reform (Chapter 3) and the existence of state border checkpoints, have led to fragmentation of the national agricultural market. At the level of government-regulated primary and secondary wholesale markets, the complex licensing arrangements – initially set up so as to control the behaviour of market participants – has led to market arrangements characterised by multiple middlemen and multiple commissions, charges and levies: these all contribute to placing downward pressure on farmers' prices (Chapter 3). For instance, in the case of fruit and vegetables, the lengthy supply chain can lead to aggregators, market traders, wholesalers etc. accounting for between 30% to 50% of the retail consumer price (Boston Consulting Group, 2012).

Alternative marketing arrangements for linking farmers to markets

Alternative arrangements for linking farmers to markets have been developing given the inefficient and weak functioning of many output markets. In many cases, this has helped bypass some of the traditional intermediaries and thus reduce sourcing costs and wastage levels. Such initiatives include co-operatives and contract farming (Figure 2.41) (Patnaik, 2011; World Bank, 2014a).

For instance, in the dairy sector, the network of co-operatives has been a key driver of development since the onset of the White Revolution and currently accounts for approximately 60% of processed fluid milk. The first co-operative was established by producers in 1946 in Anand, Gujarat in order to sell directly to consumers. The “Anand Model” continues to function as a three-tiered approach which includes (1) village-level dairy co-operative societies that collect milk with quality-based payments to members; (2) District Co-operative Milk Producers’ Unions (DCMPUs) that process, market, and provide technical support for the village-level societies; and (3) State Co-operative Milk Marketing Federations that provide a range of marketing, feed distribution, and administrative functions. The village-level societies collect milk daily from members, with the milk chilled, aggregated, and transported to a co-operative plant owned by a DCMPU. Members receive an immediate payment based on the fat content of their milk, and a later payment based on the overall earnings of the district and state unions. Most district unions also provide a range of inputs and services to village societies, including feed, veterinary care, artificial insemination services, as well as training. The dairy co-operatives network includes 22 State Milk Marketing Federations, 183 district milk producer unions, and nearly 156 000 village-level co-operative societies with a total membership of about 15.1 million dairy farmers (Landes et al., 2017).

Contract farming has been developing as another alternative marketing channel for producers. As an example, within the last decade, many poultry meat processors have vertically integrated their operations⁴² with farmers, particularly in southern and western India (which accounts for 70% of total chicken meat production). Integrators own all the hatcheries, feed mills, and slaughter facilities, and enter into a contract with multiple smaller farmers (a large integrator may have as many as 20 000 contracted farms). This has provided farmers with lower transaction costs, guaranteed markets, faster turnaround, more transparent pricing, and better allocation of risks, while contracting firms had the advantage of more secure supplies and reasonable control over quality and other specifications. Some integrators also provide credit and extension services (GAIN FAS, 2016).

Direct procurement from farmers can be done only in states that have amended their Agricultural Produce Marketing Committee (APMC) Act to permit buyers to purchase directly from producers, in line with the Model Act 2003 proposed by the central government (Chapter 3). Moreover, contract farming arrangements are largely dependent on the legal enforceability of contractual provisions – with many being often verbal and informal in nature – as well as the ability of small farmers to form clusters that can create a scale effect and enhance their bargaining position (Gulati, 2009). According to the Doing Business indicators, India is only halfway in reaching worldwide best practice in the ease of enforcing contracts, with the efficiency, cost and time associated to resolving a commercial dispute lagging significantly behind other major Asian agricultural producers such as China, Thailand or Viet Nam. In addition, in many sectors – including fruit and vegetables – organised processing and retail establishments often have strict

requirements regarding the produce, which means they would more often procure from small and medium farmers rather than marginal ones (Minten and Reardon, 2010).

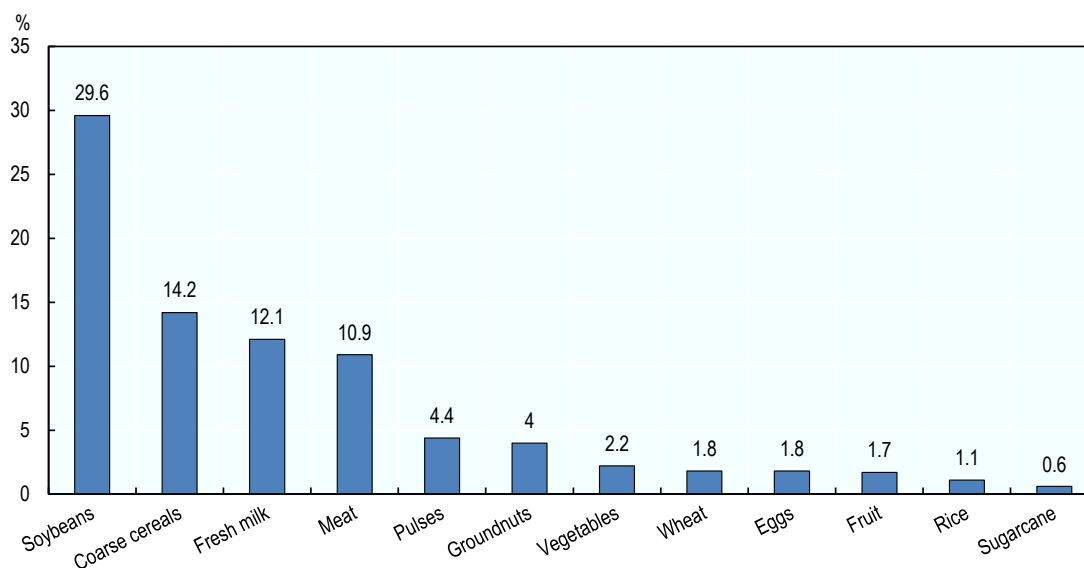
Agro-food industry: food processing and retail

Changing demographics, increased urbanisation, lifestyle changes, evolving preferences for branded items, as well as a modernising retail sector are driving demand for processed food. The food processing sector grew rapidly in the past five years, with investments increasing by 20% annually. The central government has made efforts since the mid-1990s to attract private investment in the food processing industry by giving it ‘priority sector status’ and providing fiscal incentives⁴³. Meanwhile, India’s food processing mainly involves primary processing which accounts for 80% of the sector. Six traditional sectors – grains, oils and fats, sugar, dairy, tea and coffee – dominate the food processing industry with 80-85% of total processing output, employment, and factories (World Bank, 2014a).

Despite significant increases over the recent period, the shares of high-value sectors in food processing – such as fruit and vegetables and meat products – remains small (less than 5% and 8% of total value of output) compared to cereal-based products (21%) and oilseeds (18%) (Figure 2.44). A significant challenge for both the organised and unorganised sectors is the amount of agro-food output damaged or lost each year due to insufficient and inadequate cold storage (as highlighted in Figure 2.44), as well as post-harvest and further processing facilities. In the case of milk production, only 22% of cities and towns are catered by organised milk distribution networks and only 15% of milk marketed is packed (World Bank, 2014a).

Figure 2.44. Extent of food processing

Share of domestic output by selected commodity (%)



Source: Institute of Economic Growth (2014).

Major constraints to the growth of the Indian food processing industry include the absence of adequate connectivity infrastructure, inadequacy of information and marketing linkages, lack of electricity supply, and the absence of cold chain systems. The food processing sector currently has a dualistic structure: a relatively small (in number of units) but capital-intensive organised segment coexists with a widespread (in number of small units and workers) labour-intensive and mostly rural unorganised segment. The food-processing operations employed nearly 8 million people in 2008–09, with the organised sector accounting for 21%; the difference in productivity between the organised and unorganised sectors remains significant, as the former alone contributes 81% of the industry gross output. The bulk of employment in the processing sectors is generated by grain mill products, sugar refining, dairy sector, oils and fats, and bakery products. Depending on the scale of the operation, the organised Indian food processing sector can be divided into: large Indian companies, wholly-owned subsidiaries of foreign companies or joint ventures, and medium-sized domestic food processing companies with a local or regional presence (Gulati, 2009; World Bank, 2014a; Gulati et al., 2016).

The Indian retail sector has also undergone marked changes in the past years, largely driven by an improved business environment and FDI liberalisation. As in the case of food processing however, food retail is also characterised by a dualistic structure, with the market being divided between organised and unorganised retailers.⁴⁴ India's food retail industry remains largely dominated by unorganised retailers like *kirana* (mom-and-pop stores), grocers and provision stores which accounted for 92% of the sector in 2015. The emergence of larger chains and stores began mid-2000s in large cities and the sector has since grown to over 3 500 modern retail outlets across India – nevertheless, such retailers still accounted for only 8% of the sector in 2015 (Gulati et al., 2016).

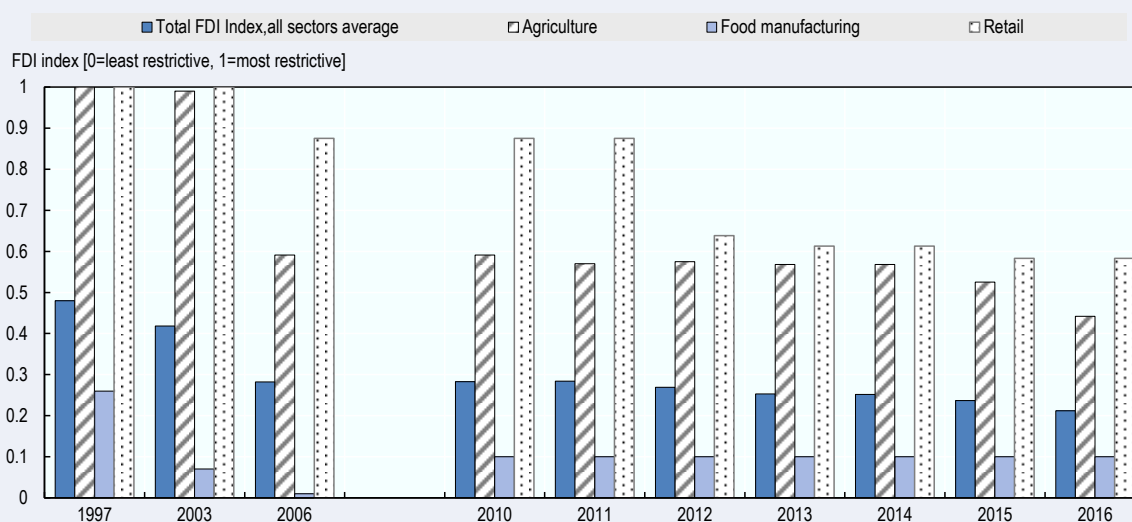
The organisation of the retail sector is also quite different from other Asian countries, such as Thailand (where modern retail represents 45% of the sector versus 55% for traditional retail), Malaysia (43% versus 57%), the Philippines (28% versus 72%), Viet Nam (25% versus 75%), and Indonesia (16% versus 84%). Compared to these other emerging economies, the development of organised private retailers has been driven by domestic capital investment, rather than by FDI-driven retail expansion. Owing to remaining FDI restrictions, particularly in the multi-brand segment,⁴⁵ the retail sector is currently biased towards domestic retailers (Box 2.9). It is also only at an early stage in its penetration of small cities and even rural towns and areas. Given the current scale of organised retail establishments and operations, their most important procurement avenue remains from wholesale markets through brokers and other intermediaries. Larger investors in the modern retail sector are more likely to be involved in peri-urban collection centres, where traditional market channels are bypassed, particularly for some fruit and vegetables (Minten and Reardon, 2010; MOFPI, EY and CII, 2017).

Box 2.8. FDI policies in wholesale and retail

The cumulative FDI equity inflows between April 2000 and June 2017 totalled USD 342.4 billion, of which USD 43.5 billion were invested in 2016-17 alone. Services have attracted the highest FDI in India in 2000-17, accounting for almost 18% of the total FDI inflows. Food processing (2.28%), agricultural services (0.6%) and retail trading (0.30%) are also among the important FDI recipients.

During the liberalisation period of the 1990s, the Government of India introduced various reforms relaxing the regulations governing foreign investments. Further on, since 1999, the FDI regime in India continued to be progressively liberalised with many restrictions on foreign investments being removed and procedures being simplified, as reflected by the OECD FDI Restrictiveness Index over the 1997-2016 period (Figure 2.45). For instance, in the case of the approval route, this can now be requested by the investor through the online single window Foreign Investment Facilitation Portal, which replaced in 2017 the Foreign Investment Promotion Board so as to simplify and speed the process.

Figure 2.45. OECD FDI Restrictiveness Index: Agriculture and retail, 1997-2016



Note: The FDI Regulatory Restrictiveness Index (FDI Index) measures statutory restrictions on foreign direct investment across 22 economic sectors and gauges the restrictiveness of a country's FDI rules by looking at the four main types of restrictions on FDI: 1) Foreign equity limitations; 2) Discriminatory screening or approval mechanisms; 3) Restrictions on the employment of foreigners as key personnel; and 4) Other operational restrictions, e.g. restrictions on branching and on capital repatriation or on land ownership by foreign-owned enterprises. The overall restrictiveness index is the average of sectoral scores.

Source: OECD (2017b), *FDI Regulatory Restrictiveness Index database*.

Nonetheless, significant restrictions are still prevalent, particularly in the primary sector and retail:

Agriculture: 100% FDI is permitted under the automatic route only for the following activities: (i) floriculture, horticulture, apiculture and cultivation of vegetables and mushrooms under controlled conditions (i.e. where climatic and related conditions are controlled artificially); (ii) development and production of seeds and planting material;

(iii) services related to agro and allied sectors. 100% FDI is also allowed through the automatic route in the plantation of tea and coffee, rubber, cardamom, palm oil and olive oil.

Food processing: 100% FDI is permitted for the manufacturing sector under the automatic route. A manufacturer is also permitted to sell its products manufactured in India through wholesale, retail or e-commerce activities. Further, notwithstanding the FDI provisions applicable to the retail trading sector, 100% FDI under the approval route is permitted for food products manufactured or produced in India. To increase investment in food processing infrastructure the Ministry of Food Processing Industries (MOFPI) has been implementing a number of central sector schemes, including the *Scheme for Mega Food Parks*, which also provides various fiscal incentives in terms of reduction and exemption of taxes.

Retail: Since January 2018, up to 100% FDI is permitted via automatic route for companies looking to undertake *Single Brand Retail Trading* (SBRT) in India. FDI in SBRT has shown consistent growth in India, with various global conglomerates having set-up operations in the country. Where FDI in SBRT exceeds 51%, mandatory local sourcing norms would be applicable on an annual basis, after the first five years: at least 30% of the value of goods purchased should be from India (preferably from MSMEs, artisans, craftsmen or village/cottage industries).

In 2012, the Government of India also relaxed several conditions with respect to FDI in *Multi-Brand Retail Trading* (MBRT). FDI up to 51% is permitted under the government approval route, with at least 50% of the first tranche of investment required to be invested in 'back-end infrastructure' (quality control, distribution, packaging, warehousing, design improvement, logistics) within 3 years. Entities having FDI, and engaged in MBRT activities, would not be permitted to engage in trading via e-commerce. There are also local sourcing norms for investing in MBRT: at least 30% of the value of procurement should be sourced from Indian MSMEs that have a total investment in plant of machinery not exceeding USD 2 million (sourcing from agricultural and farmers co-operatives would fall in this category). In the first instance, the local sourcing requirement should be met as an average of 5 years and thereafter annually. Additional circumstances include state government discretion, as the FDI policy on MBRT is only enabling in nature, and retail outlets can be set-up exclusively in states or UTs that have agreed to this policy and in cities with a population exceeding 1 million (or other cities agreed by State Governments).

Source: MOFPI, EY and CII (2017); OECD (2017b).

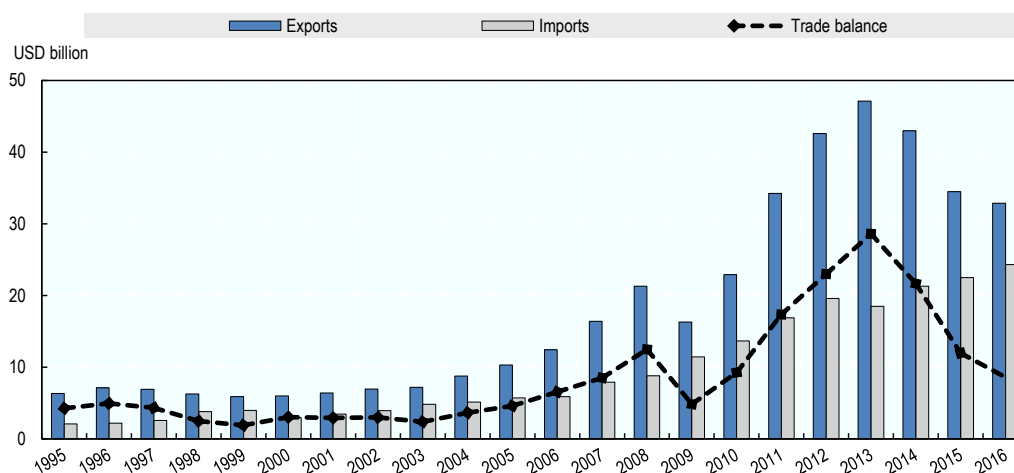
Aside existing FDI restrictions, many structural challenges relating to the establishment of retail businesses affect domestic and foreign players alike. High upfront investments in back-end infrastructure – including warehouses, logistics, and customer services – and access to capital constitute main impediments to the establishment of retail businesses. With a geographically dispersed population, the distribution structure at a pan-India level is fragmented and poor connectivity makes the cost to service stores very high. The wide geographical spread also leads to higher management costs. In addition, competition from low-cost traditional channels sets important pressure on margins, with the organised retail sector not only operating at lower costs but also having lower margin expectations. Scale and profitability thus deter most entrepreneurs from entering the market (MOFPI, EY and CII, 2017).

Existing restrictions in the services sector – another key input to the domestic agro-food processing and retail sectors – set an additional constraint for product development, supply chain management, production process support, distribution and marketing of agro-food products. In services sectors such as distribution or logistics, India tends to have more restrictive regulation than most other countries covered by the OECD Services Trade Restrictiveness Indices (STRI), mainly driven by a general regulatory framework imposing a number of burdensome administrative procedures and time consuming licensing and permit requirements. India is characterised by a distribution services STRI of 0.44,⁴⁶ second only to Indonesia among BRIICS, and a logistics storage and warehouse STRI, second after the Russian Federation within BRIICS economies (Benz, Khanna and Nordås, 2017).

Agro-food trade flows and participation in global value chains

India has consistently been a net exporter of agro-food⁴⁷ products during the last two decades. Agro-food exports grew at an annual average rate of 11%, from USD 6.3 billion in 1995 to USD 47.1 billion in 2013; exports then decreased to USD 32.9 billion in 2016 due to a mix of lower global commodity prices, sluggish foreign demand, increased domestic consumption, and climate events affecting the domestic production base. Agro-food imports also increased from USD 2.2 billion in 1995 to USD 24.3 billion in 2016, growing at an even higher annual average rate of 14%. With a higher growth rate of agro-food exports in 2009-13, the trade surplus widened considerably until 2013. It then started to narrow, in line with the agro-food exports decrease versus the consistent increase in imports (Figure 2.46) (UN, 2017).

Figure 2.46. Agro-food trade of India, 1995-2016



Note: Agro-food trade data include here fish and fish products.

Source: UN (2017), *UN Comtrade Database*.

Indian agriculture has increasingly been integrated with world markets: agro-food trade as a share of agricultural GDP was just 5% in 1990, when economic reforms started, but reached 16% in 2016 (Table 2.2). It is still low as compared to the share of India's total merchandise exports and imports as a per cent of India's GDP, which increased from 14.7% to 42% over the same period. Agro-food exports constitute 13% of India's total exports, while agro-food imports are 7% of total imports (UN, 2017).

Table 2.2. Agro-food sector's integration with international markets, 1995-2016

		1995	2005	2010	2015	2016
Coverage degree of imports by exports	%	306	181	168	153	135
Share of agro-food trade in total trade						
Exports	%	20	10	10	13	13
Imports	%	6	4	4	6	7
Ratio of agro-food exports to agricultural GDP	%	7	7	8	10	9
Ratio of agro-food imports to agricultural GDP	%	2	4	5	7	7
Ratio of total exports to total GDP	%	9	12	13	13	12
Ratio of total imports to total GDP	%	10	17	21	19	16

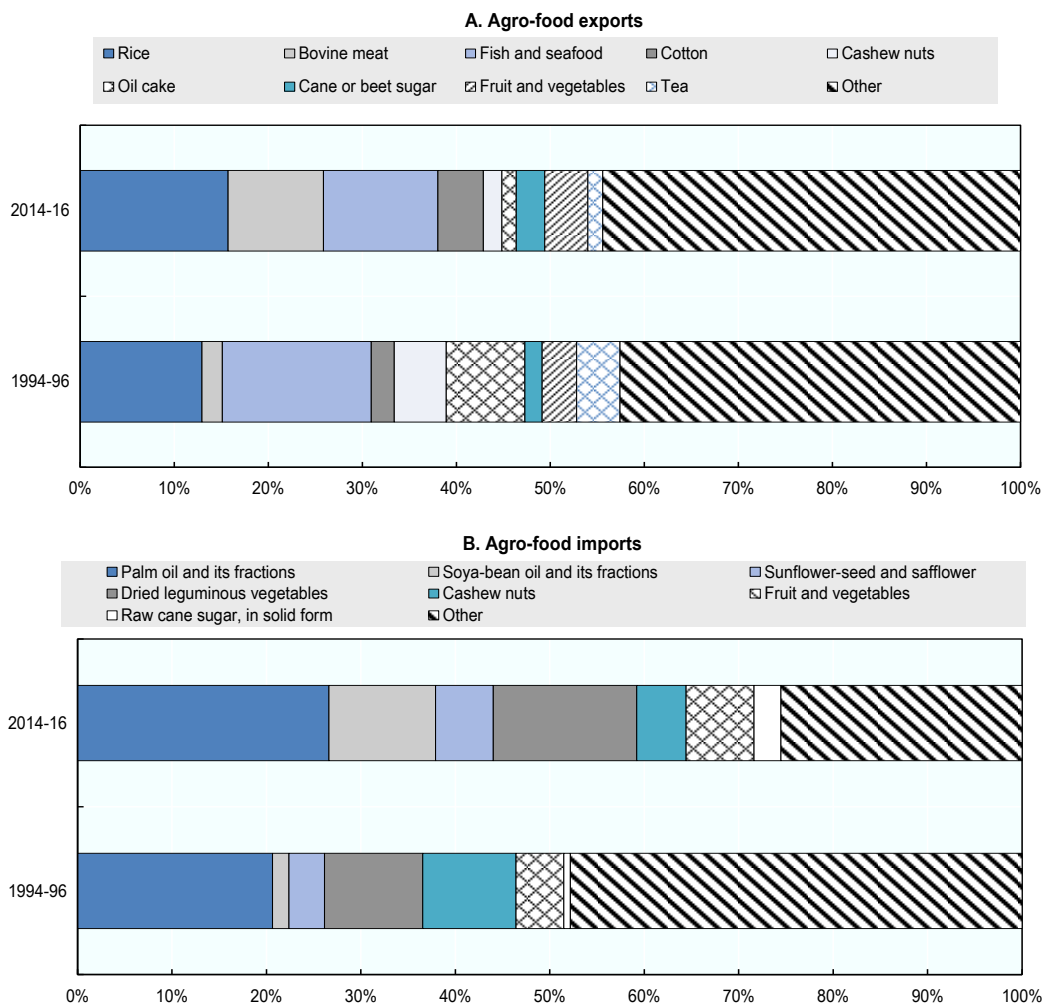
Source: UN (2017), *UN Comtrade Database*.

India's share in total global exports of agro-food products has increased from 0.8% in 1990 to 2% in 2016 and is higher than the share that India has in global merchandise exports (1.7%). The composition of agro-food exports has evolved over the last two decades. The share of rice, bovine meat, cotton, and sugar in total agro-food exports increased over this period (Figure 2.47). In 2012, India emerged as the world's largest exporter of rice and bovine meat, which consists of boneless meat from buffalo⁴⁸ only (called *carabeef*). A strong global demand for bovine meat, particularly in low- and middle-income developing countries, and the development of private, export-oriented slaughter and packing facilities in several Indian states have been key drivers of India's emergence as a major bovine meat exporter (Landes et al., 2016). It is also the world's second largest exporter of sugar and cotton, in spite of the national fibre policy allowing only cotton surplus to domestic consumption to be exported. Other dynamic sectors, such as fruit and vegetables, have also been expanding, with the share of this group increasing from 4.2% in 1994-96 to 5.2% in 2014-16, signalling a movement towards high-value exports in line with global demand (Figure 2.47) (Gulati et al., 2016; UN, 2017).

The composition of agro-food imports has remained unchanged over the last two decades, with pulses and edible oils accounting for more than half of the total (Figure 2.47). The share of pulses has increased from 9% in 2001-02 to 13% in 2014-16 while edible oils have increased their share from 46% to 52% in the same period. More than 60% of edible oil imports consist of palm oil, while soybean and sunflower seed oil account for smaller shares. Fruits and nuts (including cashew nuts) accounted for 11% of total agro-food imports in 2014-16 (Gulati et al., 2013; Gulati et al., 2016; UN, 2017).

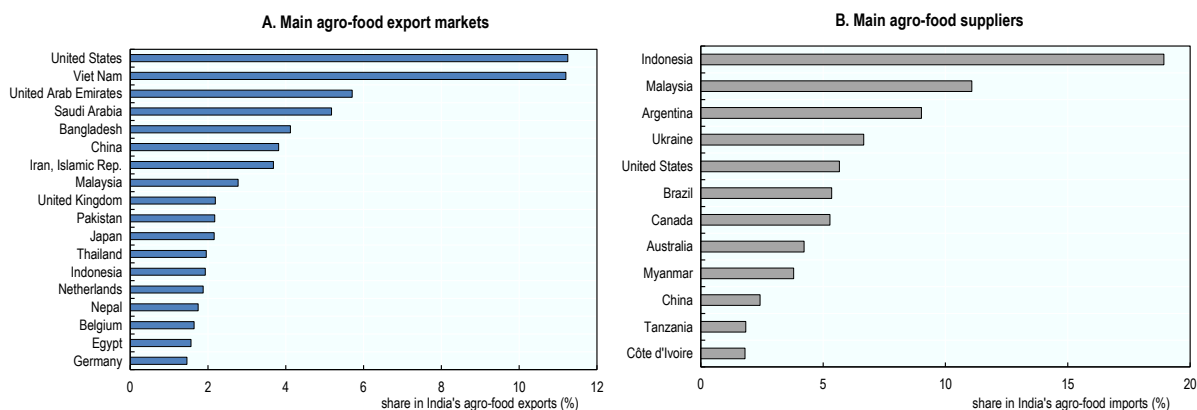
The United States, Viet Nam and United Arab Emirates were the main export markets for India's agro-food products in 2014-16. Other MENA and South Asian economies such as Saudi Arabia or Bangladesh are also important destinations, particularly for cereals. Within Asia, ASEAN's agro-food trade with India increased, with Indonesia and Malaysia becoming India's top suppliers of agro-food products, largely due to vegetable oils imports. Agro-food trade with Europe and Central Asia has been much less dynamic, although Ukraine remains a key source of wheat imports (Figure 2.48) (Gulati et al., 2013; UN, 2017).

Figure 2.47. Composition of agro-food trade, 1994-2016



Source: UN (2017), UN Comtrade Database.

Figure 2.48. Main export markets and suppliers of agro-food products, 2014-16

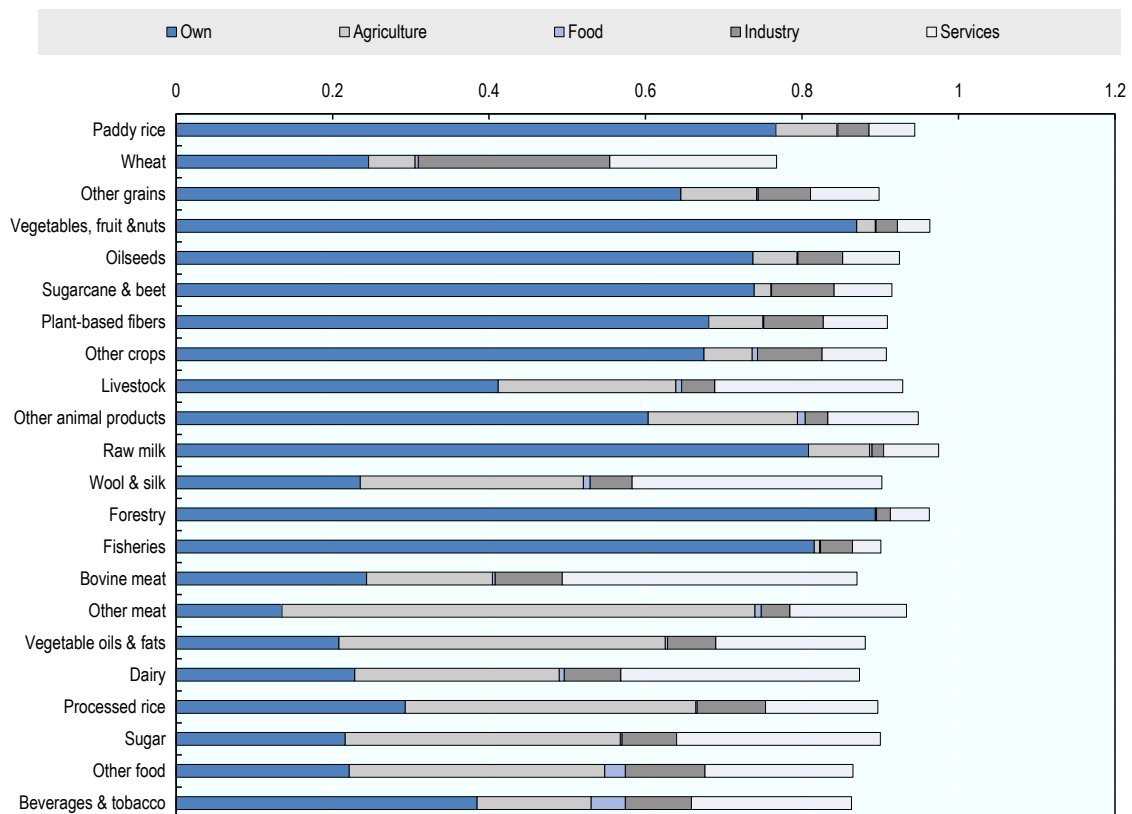


Source: UN (2017), UN Comtrade Database.

India's participation in agricultural global value chains (GVCs) is weaker than its engagement in manufacturing or services sectors GVCs. The foreign content in India's exports has increased significantly over the last two decades in sectors such as industrial raw materials, chemicals, machinery or electronics, in the ranges of 28.6% to 56.6% of exports across these sectors in 2011. However, the foreign value added content is only 4.1% in the case of the agriculture sector exports, highlighting a much more limited access to competitively-priced foreign inputs. Similarly, the share of domestic agro-food value added driven by foreign final demand (10%) is lower than most manufacturing sectors (ranging between 20% and 63%) or mining (39.9%) (OECD-WTO TiVA, 2017).

For agriculture, due to the primary nature of production, the majority of domestic value added is generated in the sector itself – that is, from the land, labour and capital employed (Figure 2.49). The high share of value added derived within agriculture itself points to the importance of productivity growth in the agricultural sector as a means to enhance value added in the overall agro-food sector. The high shares of industry and services in the value of agro-food exports highlight as well the importance of accessing competitively-priced inputs – including services such as business, transport, and logistics – for the international competitiveness of various sub-sectors. The services sector appears to play a key role for all agro-food exports in India, with services content in total exports ranging between 15 to 38% by agro-food sector (Greenville et al., 2017a, 2017b).

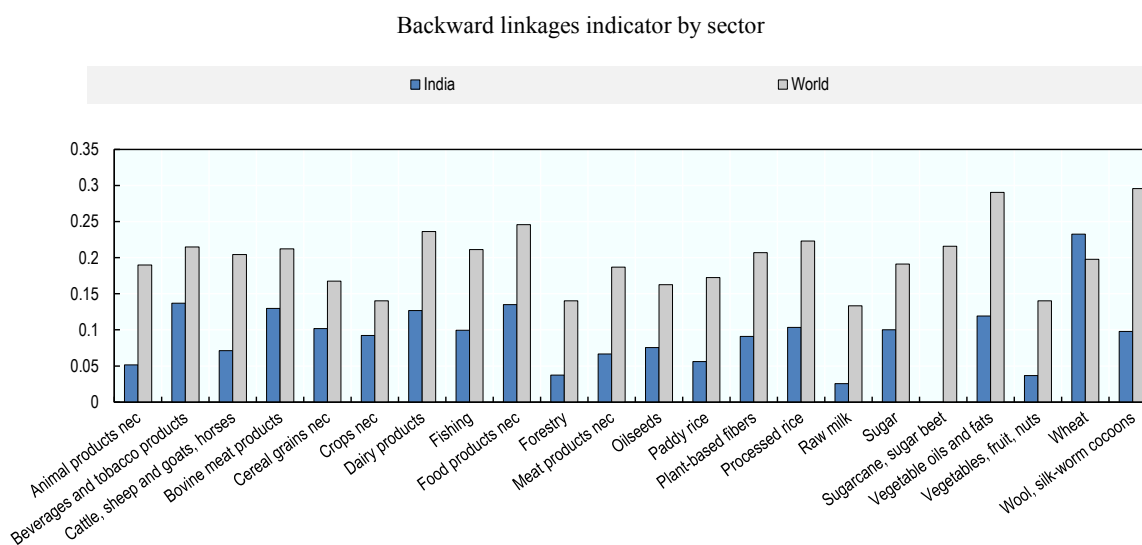
Figure 2.49. Domestic value added in India's agro-food exports by source, 2011



Source: OECD estimates based on the dataset in Greenville et al. (2017a, 2017b).

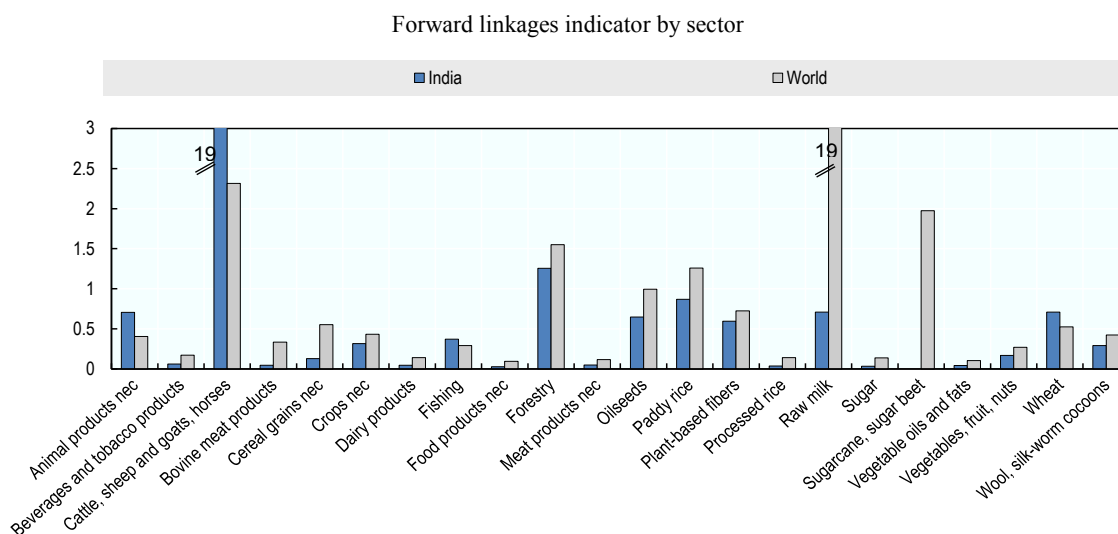
The specific pattern of India’s GVC integration can be analysed through estimates of the engagement in the form of buying from (backward linkages⁴⁹) and selling (forward linkages⁵⁰) to GVCs. In terms of sourcing inputs from value chains (buying from GVCs), India’s strongest linkages are in sectors such as wheat, beverages and tobacco products, or dairy products, but overall the sector has low backward integration (Figure 2.50). With the exception of wheat, India’s GVC engagement on the demand side is below the world average across all the selected sectors. India’s participation in GVCs is much stronger on the supply side of GVCs (forward linkages), with Indian inputs being used in other countries’ exports, particularly in live animals, animal products, and wheat, all above world averages (Figure 2.51) (Greenville et al., 2017a, 2017b).

Figure 2.50. Buying inputs within GVCs, 2011



Source: OECD estimates based on the dataset in Greenville et al. (2017a, 2017b).

Figure 2.51. Selling inputs to GVCs, 2011



Source: OECD estimates based on the dataset of Greenville et al. (2017a, 2017b).

Overall, the agro-food GVCs integration pattern mirrors the structural challenges and marketing inefficiencies encountered at the level of domestic agro-food supply chains. The low participation in agro-food GVCs – either through direct exporting of intermediates and final products, or through indirect exporting of agricultural value added through other downstream domestic sectors – has also limited the potential labour returns stemming from the sector’s participation in agro-food GVCs in India (Greenville et al., 2017a, 2017b).

2.7. Summary: Key highlights

The Indian economy, including its agricultural sector, has undergone significant transformations and realised a number of notable achievements over the last decades. The green revolution (in cereal production, late 1960s-early 1980s) was succeeded by the white revolution (in milk production, starting in the 1970s), the gene revolution (in cotton production, early 2000s) and the more recent diversification of production towards pulses, fruit and vegetables, as well as meat and meat products, largely in response to evolving demand patterns driven by rising incomes and urbanisation. Since the early 1990s, India’s agricultural exports have also steadily grown and diversified. India emerged as a major exporter of agriculture and allied products such as rice, meat and meat products, cotton, oilcakes, vegetable extracts, fish and fish products, and several others (including wheat in some years). Given the fact that India is already a significant producer of fruit and vegetables, the next revolution is likely to emerge in the fruit and vegetables sector (both fresh and processed segments). However, this will not occur in a scenario of low storage and processing capacities, significant post-harvest losses, and weak marketing connectivity.

The diversity of natural regions and climatic conditions in India allow for the cultivation of a wide range of crops and undergoing various livestock activities. However, at just 0.15 ha per capita, agricultural land is very scarce. Moreover, land degradation is increasingly prevalent throughout the country: 37% of the total land area (about 120.4 million ha) appears to be affected by various types of degradation. India also faces a severe water crisis due to a widening gap between water supply and demand, as well as poor water resources management and changing precipitation patterns induced by climate change. Total water demand is expected to increase by 32% by 2050 driven by population growth, urbanisation and further industrialisation. Environmental pressures are rapidly intensifying: by mid-century, the impact of climate change would be felt as an increase in the average surface temperature, changes in rainfall during both monsoon and non-monsoon months, as well as an increase in the frequency and intensity of both droughts and floods.

Agriculture accounts for as much as 17% of GDP and 47% of the total national labour force. The slow pace of India’s structural transformation is reflected in the large gap in productivity between agricultural and non-agricultural workers. Agricultural labour productivity growth remains a key challenge and lags behind other economies in the region. Farm incomes are currently at less than one-third of those of non-agricultural households and there is a wide variation in farm income growth between regions as well as between individual states. Land productivity has been increasing over the last two decades; however, a mapping of yield trends in India in 2011-14 highlights that land productivity stagnated for several key commodities.

The sector is dominated by a large number of marginal and small-scale operators: 85% of the operational holdings in India are of less than 2 ha and represent 45% of the total

cropped area. In turn, only 5% of farmers operate on holdings larger than 4 ha, but they occupy nearly 32% of all arable land. There is continuing fragmentation of the already very small farms, with the national average operational holding size showing a steady decline, from 1.33 ha in 2000-01 to an estimated 1.15 ha in 2010-11. Mixed crop-livestock farming systems predominate among smallholders.

Land tenure governance in India is very complex, both in terms of legislation and organisational framework. Rural land markets do not function efficiently as a result of several factors, including poor land records, tenancy and land ceiling laws leading to concealment of ownership status and impediments to transactions, limited mobility of potential buyers, lack of brokerage services and limited flow of information about buying and selling opportunities. Restrictive land leasing laws have forced tenancy to be informal, insecure and inefficient.

Gaps in physical infrastructure and logistics disrupt agro-food supply chains and drive up transaction costs, particularly for small and marginal farmers. Limited connectivity and storage infrastructure increase post-harvest losses and impacts farmers' incomes as well as their incentives to produce. This remains a key challenge to address in order to link farmers to markets, encourage private sector participation in the supply chains and tap the potential for the production and export of fruit and vegetables, as well as meat and meat products. Alternative marketing channels are nevertheless emerging (such as contract farming in poultry), in addition to an evolving food processing industry and an improved business environment for the retail sector. The food processing industry has nonetheless a dualistic structure, with a relatively small (in number of units) but capital intensive organised segment coexisting with a pervasive, mostly rural, and more labour-intensive unorganised segment.

Notes

¹ In this chapter, "agriculture" broadly covers crops and livestock. However, where it is not possible to separate the data, "agriculture" will cover cultivation of crops, livestock production as well as forestry, hunting, and fishing.

² BRIICS economies include Brazil, the Russian Federation, India, Indonesia, the People's Republic of China (hereafter "China") and South Africa.

³ The FFC also recommended a change in the formula for distribution of devolved resources to compensate states with higher rates of in-migration and poor fiscal capacity (ability to raise own revenues). Some states thus saw their shares increase (e.g. Chhattisgarh, Madhya Pradesh), while others (e.g. Bihar, Rajasthan) saw their shares reduced.

⁴ The unemployment rate measures at both urban and rural levels the number of people actively looking for a job as a percentage of the labour force. The usual employment status considers persons who are self-employed, employed either directly by the establishment on regular/casual basis/contract basis, or through a contractor on contract basis.

⁵ The informal sector is defined as unincorporated enterprises with fewer than ten workers; informal employment is defined as workers without any employment security or employer-provided social security. Under-employment concerns persons employed at less than full-time or regular jobs or at jobs inadequate with respect to their training.

⁶ For time and cross-country comparison purposes in this study, available data on agriculture value added includes the primary sector, forestry, hunting, and fishing.

⁷ National data on employment are available from the National Sample Survey Office (NSSO), the Census, and the Labour Bureau of the Ministry of Labour and Employment. Slight differences can exist between the estimates across these sources due to differences in the definitions used for compiling data. Most recent estimates (2015-16) are available from the Labour Bureau.

⁸ This is expressed in terms of monthly per capita consumption expenditure based on a mixed reference period.

⁹ The Gini index is a measure of inequality among all regions of a given country. The index takes on values between 0 and 1, with 0 interpreted as no disparity. It assigns an equal weight to each region regardless of its size. Differences in the values of the index among countries may partly reflect differences in the size of regions in each country.

¹⁰ Middle class estimates refer to the number of people living in households earning or spending between USD 10 and 100 per person per day (USD 2005 PPP).

¹¹ Domestic trade taxes were levied by the central, state, as well as local governments, and had a highly complex structure. The most important categories included: union excise duties (UED) and central sales tax (CST) levied by the centre; general sales tax (GST), entry tax and electricity duty levied by the states; and *octroi* levied by the local governments.

¹² The WEF Global Competitiveness Report separates countries into three specific stages: factor-driven, efficiency-driven, and innovation-driven, each implying a growing degree of complexity in the operation of the economy. In the factor-driven stage countries compete based on their factor endowments, primarily unskilled labour and natural resources. Companies compete on the basis of prices and sell basic products or commodities, with their low productivity reflected in low wages.

¹³ “Agricultural output” analysis in this section covers crops and livestock, but does not include forestry or fisheries.

¹⁴ The agricultural crop year in India is from July to June. The *kharif* cropping season is from July–October during the south-west monsoon (summer) and the *rabi* cropping season is from October–March (winter). The *kharif* crops include rice, maize, sorghum, pearl millet/bajra, arhar (pulses), soybean, groundnut, cotton. The *rabi* crops include wheat, barley, oats, chickpea/gram, linseed, mustard.

¹⁵ For purposes of the Census a person is classified as cultivator if he or she is engaged in cultivation of land owned or held from government or held from private persons or institutions for payment in money, kind or share. Cultivation includes effective supervision or direction in cultivation.

¹⁶ A person who works on another person’s land for wages in money or kind or share is regarded as an agricultural labourer. She or he has no risk in the cultivation, but merely works on another person’s land for wages. An agricultural labourer has no right of lease or contract on land on which he or she works.

¹⁷ While the Census and NSSO account for all workers above the age of 5, the Labour Bureau accounts for workers greater than 15 years of age. Thus, the data between Census, NSSO and Labour Bureau may not be directly comparable.

¹⁸ A scheme’s irrigation efficiency (in %) represents the share of the water pumped or diverted through the scheme inlet which is effectively used by the plants.

¹⁹ Use of fertiliser includes nitrogenous, phosphate and potash fertilisers in nutrient terms. Cropland includes arable land and perennial crops.

²⁰ Latest estimates for selected economies, as available for 2012-14 (national data and FAOSTAT, 2018).

²¹ The Government of India provides a subsidy to rural entrepreneurs willing to set up a CHC (40% of the CHC initial investment).

²² These include water and wind erosion (94.9 million ha), water logging (0.9 million ha), soil alkalinity/sodicity (3.7 million ha), soil acidity (17.9 million ha), soil salinity (2.7 million ha), and degradation from mining and industrial waste (0.3 million ha).

²³ Groundwater development stress is defined as the current annual rate of groundwater abstraction divided by the mean annual natural groundwater recharge: groundwater abstraction is the volume of groundwater removed from the aquifer by wells and other abstraction devices; groundwater recharge is the inflow of water into an aquifer, which may include ‘natural’ components (natural recharge) and anthropogenic ones (artificial recharge, induced recharge).

²⁴ Currently, the land holding limit differs across states. For instance, for irrigated land with two crops, this can range from 12 acres (4.9 ha) in West Bengal or Tamil Nadu to 18 acres (7.3 ha) in Gujarat or Rajasthan (more details in Annex Table 2.B.1). In July 2013, the Ministry of Rural Development put forth a draft of a new National Land Reform Policy (NLRP). This draft encouraged state governments to effect a downward revision of land ceiling limits if the existing ceiling is higher than 5-10 acres (2-4.1 ha) in the case of irrigated land and 10-15 acres (4.1-6.1 ha) for non-irrigated land. It does not seem to have been enacted (GoI, 2017a).

²⁵ These include agricultural workers, families dependent on water or forests on the land, tenants or artisans who work nearby the land to be purchased.

²⁶ The transfer of land or property between a buyer and a seller is recorded through a sale deed, which needs to be registered according to the current legal framework, which refers to the registration of the transaction and not the land title. The two laws that provide the basis for registration of land are the Transfer of Property Act and the Land Registration Act, which are both central legislations although in the latter the state legislatures can make an amendment. The responsibility of checking the validity of the title (or the rightful ownership of the property) is on the buyer. Any prospective buyer who wants to verify the title has to undertake a tedious process of consulting various sources such as past transactions, mortgage deeds, revenue records and encumbrance certificate as there is no centralised property title registry. Rajasthan was the first state to introduce a Guaranteed Land Title Act in 2008 which allows freehold landed property ownership.

²⁷ In addition, the law provides for removing the clause of adverse possession of land in the land laws of various states and allows automatic resumption of land after the agreed lease period, without requiring any minimum area of land to be left with the tenant even after termination of tenancy. Further, it allows the terms and conditions of lease to be determined mutually by the land owner and the tenant and facilitate all tenants, including share croppers, to access credit as well as to entitle them to recuperate any unused value of investment at the time of tenancy termination.

²⁸ The Agricultural Census defines an operational holding as “all land, which is used wholly or partly for agricultural production and is operated as one technical unit by one person alone or with others without regard to title, legal form, size or location”. The LHS defines a household operational holding as “land that was used wholly or partly for agricultural production and was operated (directed/managed) by one household member alone or with assistance of others, without regard to title, size or location.”

²⁹ With the exception of West Bengal, Odisha, and Kerala (constituting about 9% of the total operated area in the country), where these are not available, and thus a household survey is carried out.

³⁰ Different laws governing inheritance apply to different religious groups. Inheritance rights in India for Hindus, Sikhs, Buddhists and Jains were governed by the Hindu Succession Law since 1956. The Law originally entitled daughters equal rights to their father's individual property, once a male died without a will, but no rights to the joint family property (e.g. land) in contrast to sons. The Hindu Succession (Amendment) Act 2005 gives women equal entitlement to the family joint property. However, social norms and customs tend overwhelmingly to prevail, and in practice women's legal rights in their parental land tend to pass to their male siblings.

³¹ Efficiency change is a joint outcome of several factors, including knowledge about available technology, the proper use of inputs, the incentives that influence farmers' choice of technology and inputs, access to markets (for inputs and outputs), and other policies and institutions affecting input-use decisions.

³² NITI Aayog estimate for 2011-12 based on data from the NSSO for farm income per cultivator and non-farm income (NITI Aayog, 2017b).

³³ A 'farmer' corresponds to an agricultural household as defined in the Situation Assessment Survey of Agricultural Households, NSSO 70th Round. There are four components of farmers' incomes: (a) income from crop cultivation; (b) income from farming animals; (c) wages and salaries; and (d) income from non-farm business.

³⁴ Farmer income data subsequent to 2012-13 are extrapolations carried out by NITI (2017b) based on NSS estimates for 2012-13.

³⁵ PACS are co-operative credit institutions working at the village or small village (*panchayat*) level.

³⁶ Currently there are more than 57 large-sized and 64 medium- and small-sized chemical fertiliser production units in India.

³⁷ Other sectors of priority lending include include Micro, Small and Medium Enterprises; export credit; education; housing; social infrastructure; renewable energy.

³⁸ Short-term agricultural credit or crop loans enable cultivators to procure inputs such as fertiliser and seeds needed for seasonal agricultural operations, while long-term credit is for investment in fixed assets, such as irrigation pumps, tractors, agricultural machinery, plantations and those related to dairying, fishing and poultry. Short-term credit is also meant to cover the cost of hired labour as well as a part of the consumption needs of poorer farmers.

³⁹ Farmers' access to credit for inputs such as fertilisers and seeds has been facilitated by the *Kisan Credit Card* (KCC) scheme, which documents a bank customer's personal and financial details.

⁴⁰ Checkpoints have been set up to check whether permits are in order, as well as to collect taxes or control the movement of specific types of goods.

⁴¹ This includes electricity supply infrastructure, roads and bridges, railways, telecommunications, irrigation, water supply sanitation, ports, airports, oil and gas pipelines, and storage infrastructure.

⁴² They are also called "integrators".

⁴³ Some of these include a five-year tax exemption and 35% tax deduction for the same period for setting up new agro-processing industries; reduced import duty on processing machinery; no corporate taxes on profits from export sales; and automatic approval for 100% FDI in most items. Exemptions from excise duty have been given to encourage capital investment in large projects and processing firms.

⁴⁴ Organised retail refers to trading activities undertaken by licensed retailers, that is, those who are registered for sales tax, income tax, etc. These include the corporate-backed hypermarkets and retail chains, and also the privately-owned large retail businesses. Unorganised retailing, on the other hand, refers to the traditional formats of low-cost retailing, for example, the local kirana shops, owner manned general stores, paan/beedi shops, convenience stores, hand cart and pavement vendors, etc.

⁴⁵ Multi-Brand Retail Trading (MBRT) includes super-markets, hyper-markets, malls etc., while Single Brand Retail Trading (SBRT) refers to the trading of products that have been branded (during manufacture) under a single brand.

⁴⁶ 0 is the minimum score (least restrictive) and 1 is the maximum score (most restrictive). The STRI database covers 35 OECD Members (as of December 2017), Brazil, China, Colombia, Costa Rica, India, Indonesia, Lithuania, Russia, and South Africa.

⁴⁷ “Agro-food” trade includes chapters 1-24 of the Harmonised System together with a number of headings in chapters 33, 35, 38, 41, 43 and 51-53.

⁴⁸ Exports of beef as well as buffalo fresh, chilled or frozen, as carcasses, half carcasses or other cuts with bone-in, are prohibited. Exports of boneless meat of buffalo fresh, chilled, or frozen, are allowed.

⁴⁹ Backward participation rates explore the extent to which exports from a sector in a given country rely on imports from other countries.

⁵⁰ Forward participation rates explore the extent to which domestic value added from an industry in a given country (both direct and indirect through the exports of other domestic industries) form part of the value of another country’s exports.

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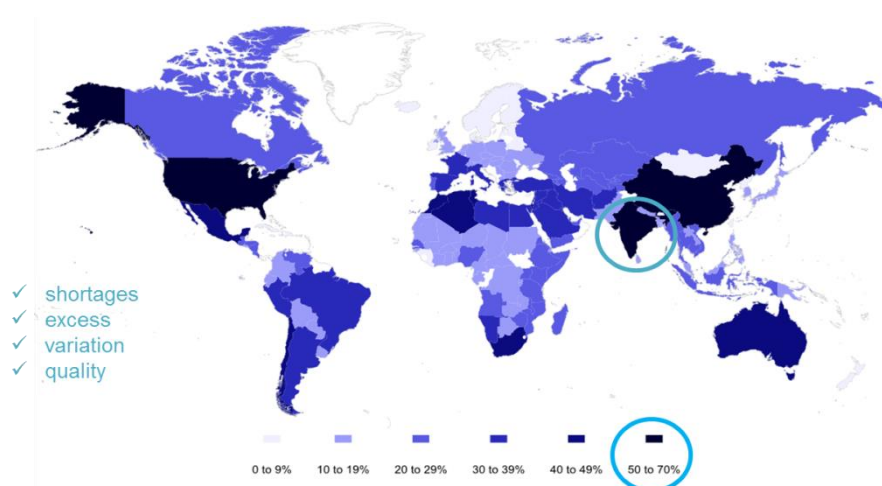
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Annex 2.A. Water risk hotspots for agriculture

Annex Figure 2.A.1. China, India and the United States expected to face the highest water risks by 2050

Frequency of observations, listing countries as subjects to high or very high future water risks



Note: 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.

Source: OECD (2017c) based on a review of 64 publications, accounting for 142 countries.

Annex 2.B. Agricultural land tenure system

Annex Table 2.B.1. Ceilings on land holdings in selected states and UTs (acres and hectares)

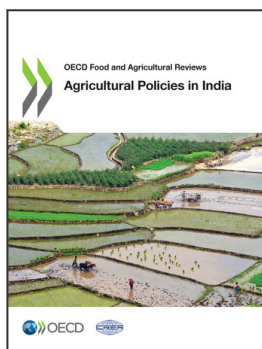
States and UTs	Irrigated land with two crops		Irrigated land with one crop		Non-irrigated land	
	acres	ha	acres	ha	acres	ha
Andhra Pradesh	10 to 18	4.1 to 7.3	15 to 27	6.1 to 10.9	35 to 54	14.2 to 21.9
Assam	17	6.9	17	6.9	17	6.9
Bihar	15 to 18	6.1 to 7.3	25	10.1	30 to 45	12.1 to 18.2
Gujarat	10 to 18	4.1 to 7.3	15 to 27	6.1 to 10.9	20 to 54	8.1 to 21.9
Haryana	18	7.3	27	10.9	54	21.9
Himachal Pradesh	10	4.1	15	6.1	30 to 70	12.1 to 28.3
Jammu & Kashmir	9 to 12.5	3.6 to 5.1	9 to 12.5	3.6 to 5.1	15 to 23	6.1 to 9.3
Karnataka	10 to 20	4.1 to 8.1	25 to 30	10.1 to 12.1	54	21.9
Kerala	12 to 15	4.9 to 6.1	12 to 15	4.9 to 6.1	12 to 15	4.9 to 6.1
Madhya Pradesh	18	7.3	27	10.9	54	21.9
Maharashtra	18	7.3	27	10.9	54	21.9
Manipur	12	4.9	12	4.9	15	6.1
Odisha	10	4.1	15	6.1	30 to 45	12.1 to 18.2
Punjab	17	6.9	27	10.9	51	20.6
Rajasthan	18	7.3	27	10.9	54 to 175	21.9 to 70.8
Tamil Nadu	12	4.9	30	12.1	60	24.3
Sikkim	12.5	5.1	12.5	5.1	50	20.2
Tripura	10	4.1	10	4.1	30	12.1
Uttarakhand	18	7.3	27	10.9	45	18.2
Uttar Pradesh	18	7.3	27	10.9	45	19.2
West Bengal	12	4.9	12	4.9	17	6.9

Source: MAFW (2017b), *Agricultural Statistics at a Glance 2016*.

Annex Table 2.B.2. Highlights of tenancy laws in selected states

Category	States	Specific features of tenancy legislation
1	Kerala, Jammu and Kashmir, Manipur	Leasing out agricultural land is prohibited without any exception.
2	Bihar, Karnataka, Madhya Pradesh, Chattisgarh, Uttar Pradesh, Uttarakhand, Himachal Pradesh, Tripura, Telengana, Odisha	Allow leasing out only by certain categories of land owners, such as those suffering from physical or mental disability, widows, unmarried, separated or divorced women, and members of armed forces.
3	Punjab, Haryana, Gujarat, Maharashtra, Assam	Do not explicitly prohibit leasing, but the tenant (excepting in Haryana) acquires the right to purchase the leased land from the owner after a specified period of creation of tenancy. In Gujarat and Maharashtra, tenancy of a tenant belonging to SC/STs cannot be terminated. In Punjab, law does not ban leasing out, but provides that a tenant of a big land owner above ceiling is entitled to purchase his tenanted land on continuous possession for six years. Similarly, in Assam, tenants who have held land for at least three years consecutively can acquire ownership right on payment of 50 times the rate of revenue.
4	Andhra Pradesh, Tamil Nadu, Rajasthan, West Bengal	No legal ban on leasing, but there are several restrictive clauses differing by state. In West Bengal, only sharecropping is allowed and not leasing on fixed rent or fixed produce basis. In Andhra Pradesh, leasing has to be for a minimum period of six years and tenancy can be terminated only by an application to the special judicial officer on any of the specified grounds.

Source: USAID (2011).



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