INSTITUT Montaigne

[Scenarios] **India 2050:** The Challenge of Food Security

EXPLAINER - JUNE 2024

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Institut Montaigne's Explainers are analytical short-reads, setting out key facts and figures to make sense of the world we live in and how it is evolving

This paper is part of a series of short and medium-term scenarios that outline potential trajectories for certain countries, with the aim of supporting decision-making.

Foreword

How can France and Europe fully capitalize on the "Indian moment" that is shaping the 21st century? Both are key players in India's pursuit of a balanced global power dynamic, as India will remain committed to diversifying its partnerships.

India is far from being absent from our foreign policy priorities: France and India signed a strategic partnership as early as 1998, and the EU-India relationship was upgraded to the same status in 2004. Despite India's robust economic growth – 8.4% in the last quarter of 2023 – the economic relationship between Europe and India remains underwhelming. India is only the EU's tenth-largest trading partner, accounting for just 2.1% of European exports of goods.

The term "untapped potential" frequently describes our relationship with India. Yet European companies are well-positioned to meet some of India's needs. The country, despite its macroeconomic successes, still faces classic development challenges indeed. Christophe Jaffrelot and his co-authors delve into these issues in two insightful papers on India's food security and environmental concerns (water stress, air pollution, and deforestation).

These papers provide forward-looking scenarios up to 2050 – with agriculture and the environment being particularly suited to twenty-five-year horizon scenarios – , outlining concrete avenues for reflection and opportunities for French and European businesses in specific sectors.

The coming years are a prime opportunity for France to enhance its economic ties with India and establish a robust agenda for collaboration in environmental and agri-food sectors. For both France and Europe, it will be a matter of overcoming bottlenecks and points of tension (notably divergences in the context of the EU-India FTA negotiations, especially as an FTA could be beneficial to the food and environmental issues that

India wishes to address today), and of taking advantage of the many steps forward in the Europe-India agenda (solar, hydrogen, wind power, resilience of European industrial supply chains), in order to base the relationship on an encouraging and tangible dynamic.

By contributing to the debate on the conditions for India's success, each paper provides input for a revitalized France-India and Europe-India dialogue.

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Authors

Christophe Jaffrelot[1]

Dr. Christophe Jaffrelot is Senior Fellow – India at Institut Montaigne, among other research areas he covers for the institute. He is also Senior Research Fellow at CERI (Centre de recherches internationales) at Sciences Po Paris, Research Director at the CNRS (Centre national de la recherche scientifique), and Professor of Indian Politics and Sociology at the King's India Institute (London). He has been Global Scholar at Princeton University, and visiting professor at Columbia University, Yale and SAIS (Johns Hopkins). He also works at The Carnegie Endowment for International Peace as a Non Resident Scholar and chairs the British Association for South Asian Studies since 2023.

Vignesh Rajahmani

Vignesh Rajahmani is a Postdoctoral Research Dellow of Indian and Indonesian politics at the Royal Netherlands Institute of Southeast Asian and Caribbean Studies, Leiden; research affiliate at the King's India Institute, King's College London; and postdoctoral affiliate at CITAP, University of North Carolina at Chapel Hill. His interests include democracy, politics of mobilisation, political strategy development, and social media.

Hemal Thakker

Hemal Thakker is an Environment Policy Expert specializing in Energy Transition and Agriculture Policy. He also serves as an Adjunct Professor at Sciences Po. He holds a Master's degree in Environmental Policy from Sciences Po Paris. He has successfully led the International "Fossil Free Finance" Campaign and held the positions of Coordinator of the Observatory of the Indo-Pacific and Agriculture Policy Lead at the International Panel of Experts on Sustainable Food Systems (IPES-Food).

[1] Christophe Jaffrelot would like to thank Bruno Dorin, Frédéric Landy and Christophe Guilmoto for their very useful comments on an earlier version of this note.

Introduction

Since 1950, the population of India has experienced explosive growth,[2] increasing by more than one billion people. With 1.4 billion inhabitants,[3] it has become, since the beginning of 2023, the most populated country in the world according to the UN[4] – and unlike the other demographic giant, China, India continues to see its population increase. According to the United Nations,[5] this trend should continue until 2064, peaking at 1.7 billion. By the year 2050 – the time horizon that we will focus on in this paper – the Indian population should be around 1.67 billion inhabitants according to the UN.[6]

However, these projections vary due to a significant margin of uncertainty. In the so-called "high-variant" scenario, where the fertility rate is evaluated at 0.5 births per woman more than in the average variant, India's population would surpass 2 billion people by 2068. According to the "low-variant" scenario, where the total fertility rate is projected to be 0.5 births less than in the medium variant, the Indian population will begin to decline from 2047 and will fall to 1 billion people by 2100. **Regardless of the scenario, India's population will continue to grow for at least another quarter of a century**. If this demographic dynamism may be an asset, it can also be challenging. This question can be posed from

[2] *Census figures for India show that the annual population growth rate was 1.3% in 1951, rising to 2% in 1961. Over the next 30 years, from 1971 to 1991, India's annual population growth rate remained stable at 2.2% before starting to decline in the 1990s. In 2011, India's population growth rate was 1.6%.*

[3] *According to UNFPA (United Nations Population Fund), India's population in 2021 will already be 1,393.4 million, with an average population change rate of 1% per year.*

[4] *India is also one of the world's most densely populated countries, accounting for 18% of humanity, but only 2.4% of the world's land surface. Its surface area is three times smaller than China's, but its cultivated area is greater.*

[5] *C. Dotto et R. Mogul, "How India's population exploded to overtake China's and what's next", CNN, July 9 2023, https://edition.cnn.com/2023/04/28/asia/india-population-overtakes-china-graphics-intl-hnk-dst-dg/index.html#.*

[6] *UN Population Division Data Portal, https://population.un.org/dataportal/data/indicators/53,50,52,49/locations/356/start/2020/end/2050/table/pivotbylocation.*

different viewpoints (in terms of schooling for children, employment for young people, etc.). We will consider it from a more fundamental angle, that of food security, to **ask under what conditions the country can feed millions of additional people, provide them with a balanced diet in the coming years and thus fight against the mass undernutrition that prevails in today's India**. Food security has remained so precarious in India that in 2013 the Congress-led government of Manmohan Singh passed a National Security Food Act, which legally entitles up to 75% of the rural population and 50% of the urban population to receive subsidized foodgrains under the Targeted Public Distribution System.[7]

Defining "food security" is not an easy task. Indeed, what does "feeding its population" mean for a country? At first approximation, one could consider that a country guarantees its food security when it no longer depends on external inputs and when it therefore enjoys a certain food independence. But we must go further. Following the World Food Summit of 1996, the FAO proposed a generic definition that we can adopt: food security is achieved "when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life".

This definition serves as a reference today, but will need to be specified because the adjective "sufficient" can be interpreted in many ways: what level of food access is necessary to not suffer from hunger? We will therefore examine both the issue of undernutrition in India and the future of its food independence, especially since the former can persist even when the latter has been resolved.

[7] *Under this law, special provisions have been made for pregnant women and lactating mothers and children in the age group of 6 months to 14 years, by entitling them to receive nutritious meals free of cost.*

1 Chronic undernutrition despite improved production: the legacy of the Green Revolution

The issue of food in India requires addressing a significant contradiction: on the one hand, cereal production has greatly increased since the Green Revolution of the 1960s – the decade during which the last famines were recorded. The production of "foodgrains", where rice, wheat, and pulses (lentils, chickpeas, etc.) play a key role, increased by 2.5% per year from 1950 to 2007, while the population increased by 2.1% per year. As a result, India began to export rice and even wheat. But on the other hand, India continues to suffer from chronic undernutrition.[8] In 2021, the Food and Agriculture Organization (FAO), while launching its Regional Overview of Food Security and Nutrition, pointed out that "74.1% of Indians were unable to afford a healthy diet" and that South Asia at large, with 379.7 million, represented 50% of the undernourished people of the world.[9]

In 2022, the report by the FAO on food security and nutrition in the world in 2022 indicates that **the number of undernourished people in India in 2019-2021 amounted to 224.3 million, which represented 16% of a population of 1.4 billion**.

[8] *This paradox was noted as early as 2014 by Suresh Babu of the International Food Policy Research Institute, in a highly interesting interview ("Feeding a Billion: Agriculture and Food Security in India - An Interview with Suresh Babu", The National Bureau of Asian Research, February 26, 2014, https://www.nbr.org/publication/feeding-a-billion-agriculture-and-food-security-in-india/.*

[9] *"74.1% of Indians unable to afford a healthy diet: FAO report", The Wire, December 12, 2023, https://thewire.in/rights/over-74-indians-unable-to-afford-healthy-diet-un-report.*

1.1. CHRONIC AND MASSIVE UNDERNUTRITION

The trend is worrying: in 2023, India ranked 111th out of the 125 countries considered by the Global Hunger Index,[10] an index whose calculation is based on four criteria: the general undernutrition of the population, the weight of children under five, their height, and their mortality rate. India is increasingly falling in the ranking conducted every year based on this index: it was ranked 107th in 2022, 103rd in 2018, 100th in 2017, and 97th in 2016.[11] It should be noted that in 2023 the only South Asian country ranked behind India, and by a small margin, was Afghanistan, which was at the 114th position, while Sri Lanka was 60th, Nepal 69th, Bangladesh 81st, and Pakistan 102nd. Only Haiti and twelve countries in sub-Saharan Africa were ranked lower than India. While India had seen its index significantly improve from 35.5 to 29.2 between 2008 and 2015, it has almost stagnated since then to reach 28.7 in 2023.[12]

India's poor performance in terms of tackling undernourishment explains why it has moved from the 115th to the 121st global rank (out of 163 countries) from 2019 to 2022 in terms of the "Social Development Goals" defined by the United Nations in 2003, far behind all the other BRICS and even its neighbors reputed to be poorer, such as Nepal and Bangladesh.[13]

[10] *https://www.globalhungerindex.org/india.html. India, in 2022, was worse off than 14 countries, most of which were victims of open conflict.*

[11] *2018 Global Hunger Index Results – Global, Regional, and National Trends, https://www.globalhungerindex.org/results/.*

[12] *https://www.globalhungerindex.org/india.html.*

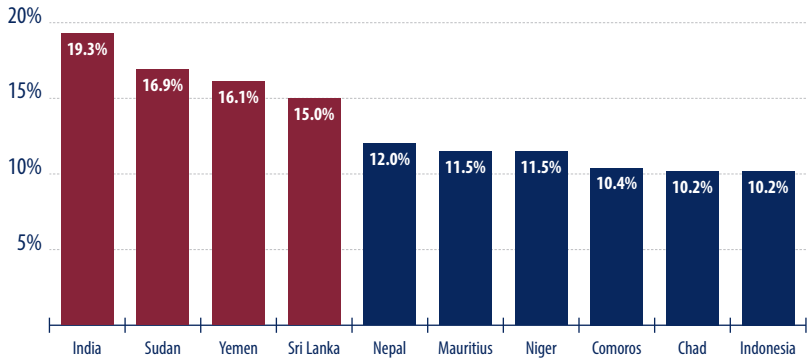
[13] *Gyan Singh, "Hunger, lack of food security behind India's 'slip' in UN's sustainable development rank", Counterview, June 13, 2021, https://www.counterview.net/2021/06/hunger-lack-of-food-security-behind.html; Kiran Pandey, "India's SDG preparedness ranking continues to decline: Report", Down to earth, 6 juin 2022, https://www.downtoearth.org.in/news/governance/india-s-sdg-preparedness-ranking-continues-to-decline-report-83158#:~:text=In%20the%202022%20Global%20Index,%2Dtrack%2C%20the%20trends%20indicated et Bharat Hiteshi, "Hunger, lack of food security behind India's 'slip' in UN's sustainable development rank", Tehelka, November 1, 2022, https://tehelka.com/india-slipping-in-global-hunger-index-2022-and-the-whole-truth/.*

This assessment is supported by the figures made available by India itself. Already in 2016, the National Nutrition Monitoring Bureau indicated that 35% of men and women living in rural areas suffered from undernutrition and that this was the case for 42% of children. These figures had never been this bad since the 1970s.[14] The latest National Family Health Survey 2019-2021 (NFHS-5) reveals, similarly, that about a third of Indian children under five years of age are underweight and show growth retardation: **36% of children under five are too short for their age, which is a sign of chronic undernutrition, 19% are too thin for their height, which is also a sign of acute undernutrition, while 32% are underweight.**

Certainly, the prevalence of stunting and underweight has decreased since 2015-16. Stunting affected 36% of the population in 2019-21, compared to 38% in 2015-16. During the same period, the prevalence of wasting (or emaciation) went from 21% in 2015-16 to 19% in 2019-21. However, progress is very slow. The average annual rate of reduction (AARR) between 2005-06 and 2019-2021 is 2.2%. If India continues at this pace, the proportion of Indian children suffering from growth retardation due to undernutrition will not fall below 10% until 2076. India will need to increase the rate of reduction to 5.5% to reach single-digit figures by 2040.

[14] *P. Mohan, "Rural India is eating less than it did 40 years ago", Scroll.in, August 26, 2016 https://scroll.in/article/814886/rural-india-is-eating-less-than-it-did-40-years-ago.*

Graph 1: Child wasting in percentage in 2017-2021



Furthermore, according to the National Family Health Survey of 2019-21, 67% of children (aged 6 to 59 months) suffer from anemia, with 29% mild, 36% moderate, and 2% severe form of anemia.[15] These figures reflect a worsening of the situation because in 2015-16 the prevalence of anemia among children in this age category was "only" 59%. Among adults, 57% of women (aged 15 to 49 years) were anemic in 2019-21, as well as a quarter of men in the same age group with a current average annual rate of reduction (AARR) of 0.4%. If this rate of reduction is maintained, India will continue to face mass anemia until the end of the century. It would need to increase to 6.50% to achieve a rate of 9.9% by 2040.

The data presented in the latest National Family Health Survey displeased the government, which led to the suspension of the director of the International Food Policy Research Institute, the agency in charge of this report. The government decided that from now on, the NFHS surveys would no longer measure anemia.

[15] *National Family Health Survey, Mumbai, International Institute for Population Sciences, 2022, p. 373 et suivantes, https://rchiips.org/nfhs/NFHS-5Reports/NFHS-5_INDIA_REPORT.pdf.*

1.2. PRIORITY TO (SOME) CEREALS: THE DANGERS OF MONOCULTURE

The reason why a considerable number of Indians suffer from undernutrition despite increased production has to do with the fact that, in terms of food, not all production is equal, and as part of the Green Revolution, priority was given to certain cereals (rice and wheat, at the expense of millets)[16] and sugarcane, at the expense of other crops, such as pulses, which are richer in protein but were less favored after the Green Revolution.[17] The Indian government has been aware of the problem for a long time. In 2007, the National Food Security Mission made pulses a priority and succeeded in increasing production from 14.2 million tons in 2006-07 to over 17 million tons in 2011-12. However, production fell back to its 2007 level between 2013 and 2016 due to repeated droughts. Although production has increased since then, India has not been able to meet the needs of its population, resulting in the import of 2.7 million tons of pulses in 2021-22.

Pulses are among the primary sources of protein for Indians, especially for vegetarians. It is mainly due to a lack of sufficient protein in the diet that India is slipping in international rankings. Rural Indians consume 194 grams of protein per day, far less than the recommended 459 grams (and urban Indians, 242 grams). This deficit is also explained by insufficient consumption of pulses, fruits and vegetables.

This underconsumption of pulses, fruits, and vegetables affects the poorest from childhood, through the "mid-day meals program". This program, which was initiated in Tamil Nadu in the 1960s before being extended to the entire country by the Indian government in the 1990s

[16] *Between 1991-92 and 2020-21, rice production increased by 64.04%, from 74.68 million tons to 122.27 million tons. Millets (such as jowar - sorghum), on the other hand, fell sharply, from 8.10 to 4.78 million tons.*

[17] *Siraj Hussain, "How Can India Become Self-Sufficient in Pulses", The Wire, February 17, 2023, https://thewire.in/agriculture/india-pulses-self-sufficient.*

under the name of National Program of Nutritional Support to Primary Education, consists of providing a free meal to children in public kindergartens and primary schools. This policy, unique in scale worldwide, both attracts poor children to school and is a means to feed them. However, the meals often make very limited room for anything other than rice and wheat, which are the two most abundant and cheapest food resources in India.

This problem is also found in the state-subsidized food distribution program, the famous Public Distribution System (PDS). Under this program, families living below the poverty line have a ration card allowing them to buy food at a price lower than the market rate. Again, the commodities thus accessible to them – often of very poor quality – make only a marginal place for pulses, fruits, and vegetables, with the monthly ration per head consisting of 3 kg of rice, 2 kg of wheat, and 1 kg of millet, all at a heavily subsidized price.

These different factors partially explain the persistence of mass chronic undernutrition despite a remarkable increase in sustainable agricultural production: producing more is not enough, it is also necessary to diversify production to offer a balanced and inexpensive diet. But the problem has other facets: producing more (and more varied commodities) is not enough if the products are not accessible to poor consumers.

2 From producer to poor consumer: issues of availability and accessibility

2.1. HOW MUCH FOOD IS AVAILABLE?

We explore here another paradox: although cereal production has greatly increased, the quantity of "foodgrains" (cereals and pulses) available per capita has decreased, going from 510.1 grams per day per person in 1991 to 507.9 grams in 2021 (see Annex 1).[18] How is this essential variable calculated? By subtracting from the total production seeds, concentrates for animals, lost products, and the balance of imports/exports, and then dividing the resulting figure by the population. While seeds only marginally reduce the product, the same cannot be said for the other three variables.

The FAO estimates that 40% of agricultural products are lost in India due to poor storage conditions, preservation, and transportation.[19] **1.3 billion tons of perishable goods (such as fruits, milk, etc.) are lost due to the lack of an efficient cold chain**. This staggering figure represents a third of the total production and amounts to between 8 and 15 billion dollars depending on market prices.[20]

Concentrates for animals (cereals, oilseeds) are becoming an increasingly important factor given the growth in poultry (uniquely fed with oilseeds) and livestock which has increased by almost 5% between 2012 and 2019.[21] This trend is explained in three ways: firstly, India has

[23] *B. Thomas, S. Shubham et KJS Satyasai, Food and nutritional security in India. The way to a robust agri-food system, Mumbai, Department of Economic Analysis and Research (DEAR) et National Bank for Agriculture and Rural Development, 2022, p. 6.*

[19] *"Warming up to decentralized cold storage solutions", Your stories, July 9, 2021, https://yourstory.com/2021/07/tan90-warming-up-decentralised-cold-storage-solutions.*

[20] *"Cold Chain Logistics: Current Challenges in India", The Times of India, November 18, 2022, https://timesofindia.indiatimes.com/blogs/voices/cold-chain-logistics-current-challenges-in-india/.*

become a major producer of milk and a big meat exporter; secondly, the Indian government's commitment to cattle protection – in the name of defending the sacred cow – promotes the growth of livestock; thirdly, while many Indians are vegetarians, a dietary transition characterized by increasing meat consumption (especially poultry) is underway. However, livestock farming, whether or not the animals are intended for slaughter (many cows are raised for milk production), competes with humans for the consumption of certain plants used in concentrates for animals. Indian farmers are suffering from a severe shortage of components of these concentrates, illustrating the intensity of this problem.[22]

Finally, **India has become a major exporting nation of agricultural products**, with revenues from these sales jumping from 33.3 billion dollars in 2016-17 to 50.2 billion in 2021-22.[23] Cereals – especially rice, but also recently wheat – top these exports. As a result, from 1991 to 2021, the availability of cereals per capita has seen significant fluctuations over time. In 1991, it was 186.2 kg, in 2001 it fell to 151.9 kg, before rising to 170.9 kg in 2011 and 185.4 kg in 2021 – below what it was in 1991. This represents a difference of –18.6% between 1991 and 2001, an increase of 12.9% between 2001 and 2011, and a slight increase of 8.5% between 2011 and 2021 (see Annex 1). These variations, and the fact that the 2021 figure is essentially equivalent to that of 1991, testify to the persistent challenge that food security represents in India.

[21] *https://dahd.nic.in/sites/default/filess/MLP.pdf.*

[22] *B. B. Choudhary et P. Sharma, "Cultivate more fodder", The Hindu, July 3, 2023, https://www.thehindubusinessline.com/opinion/cultivate-more-fodder/article67038453.ece.*

[23] *India Brand Equity Foundation, "Agriculture and Food Industry and Exports", April 2024, https://www.ibef.org/exports/agriculture-and-food-industry-india.*

2.2. MASS POVERTY IN RURAL AREAS: REVERSING A TREND

The undernutrition suffered by so many Indians is also explained by the difficulties the poorest encounter in accessing available food on the market, especially regarding access to pulses, fruits, and vegetables that could complement the cereals from the PDS. Here, the question is one of purchasing power. Mass poverty is, of course, an old phenomenon in India, which had been mitigated during the 2000s due to nearly double-digit growth rates and certain public policies. For nearly ten years now, growth has been uneven and public policies implemented no longer give the same priority to fighting poverty and undernutrition.

Before turning to the factors explaining the persistence of mass poverty in rural India, it should be acknowledged that measuring the evolution of poverty in India has become difficult. The statistical body responsible for this measurement, the National Sample Survey Office, saw its report on the subject rejected by the government in 2019. This report showed that the percentage of rural people living below the poverty line had increased, for the first time since this measure was introduced in the 1970s, from 31% to 35% of the population – that is, from 380 to 456 million people.[24] Paradoxically, governmental bodies today refer to this document, even though other alternative sources are available. The reason is that these sources – which all at least admit that the fight against poverty has been less effective since the 2010s than in the previous decade – are perceived as less reliable.[25]

[24] *S. Subramanian, "What is Happening to Rural Welfare, Poverty, and Inequality in India?", The India Forum, November 27, 2019, https://www.theindiaforum.in/article/what-happened-rural-welfare-poverty-and-inequality-india-between-2011-12-and-2017-18.*

[25] *Himanshu, "Do We Know What has Happened to Poverty since 2011-12?", The India Forum, June 16, 2022, https://www.theindiaforum.in/article/what-happened-poverty-after-2011-12; D. Maiorano, "Why the Modi government shouldn't be so quick to dismiss World Bank's Human Capital Index", The Wire, 11 octobre 2018, https://thewire.in/government/narendra-modi-govt-world-bank-human-capital-index.*

a. Structural factors

Firstly, agricultural yields are no longer increasing as rapidly as before, particularly for key crops such as rice and wheat.[26] This stagnation is partly attributed to **soil impoverishment, which the addition of fertilizers is not sufficient to offset**. The "fertilizer response ratio" calculated by the Department of Fertilizers of the Ministry of Agriculture has dropped from 13.4 in 1970 to 4.1 in 2000 and has likely continued to decline.[27] The Green Revolution, although it led to an increase in agricultural production, also partly explains the yield stagnation due to the rise of monocultures and excessive use of pesticides.

The tillers of the land are partly impoverished **because holdings are becoming increasingly smaller**, a fragmentation mainly resulting from the division of their holdings among their sons upon retirement – in 2015-16 the Agricultural Census of India revealed that 86% of Indian farmers cultivated less than 2 hectares and that 68.5% of holdings were less than 1 hectare.[28]

Moreover, agricultural land area is no longer increasing. This trend is linked to the **competition for land that industry poses to farmers, but also to soil degradation**. Already 147 million hectares are suffering from significant degradation due to various forms of erosion (wind or water) and salinization.[29]

[26] *"India's crop yields lower than US, Europe and China", The Economic Times, November 22, 2016, https://economictimes.indiatimes.com/news/economy/agriculture/indias-crop-yields-lower-than-us-europe-and-china/articleshow/55558872.cms?from=mdr.*

[27] *Jitendra, "Economic Survey 2019-20: Agriculture growth stagnant in last 6 years", Down to earth, January 31, 2020,, https://www.downtoearth.org.in/news/agriculture/economic-survey-2019-20-agriculture-growth-stagnant-in-last-6-years-69076.*

[28] *All India Report on Agriculture Census 2015-16 , New Delhi, Ministry of Agriculture and Farmers Welfare, 2020, p. 125, https://agcensus.da.gov.in/document/agcen1516/ac_1516_report_final-220221.pdf.*

[29] *Salinization is linked to rising sea levels, which penetrate more deeply into river mouths, and rising temperatures, which encourage evaporation.*

Irrigation is not optimal – which is particularly problematic in a country with only one rainy season, the monsoon – because less than 50% of cultivated land (49.9% to be exact) is irrigated.[30]

Finally, **the multiplicity of intermediaries** between the producer and the consumer – including wholesale and retail traders – increases the price of foodstuffs, or even creates shortages.

b. Cyclical factors

The increase in poverty in the Indian countryside over the past decade, can also be explained by cyclical factors that date back to the 1990s, the decade during which, as part of economic liberalization, priority was given to industry and services. This trend accelerated under the Modi government.

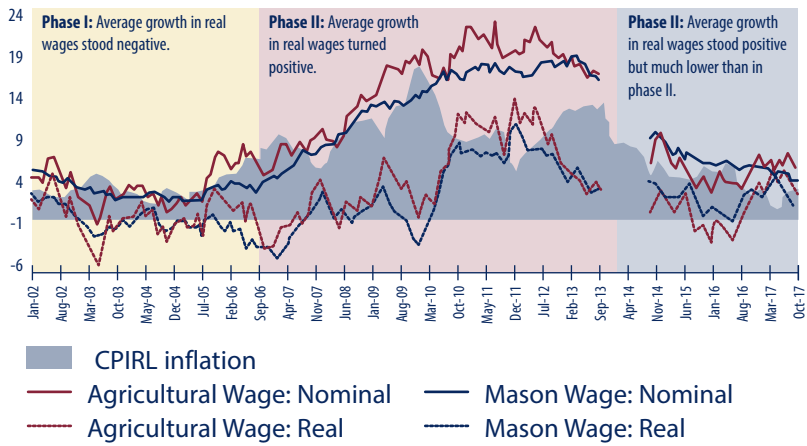
Firstly, **the State has further reduced its investments in the agricultural sector**. An expert in the field indicated that these investments had decreased by 1% per year, in real terms, during the first four years of Narendra Modi's first term that began in 2014. This decrease in public investment has particularly affected the maintenance of infrastructure as essential as irrigation canals. Government investments in agriculture have decreased, from 5.4% of the budget in 2011-2012 to 4.3% in 2020-2021. According to the Reserve Bank of India, public sector investments in agriculture accounted for about 0.4% of GDP between 2011-12 and 2017-18. This is notoriously insufficient for a sector on which 60% of the population depends directly or indirectly for their subsistence. By contrast, fertilizer subsidies had substantially increased between 2002 and 2009. During the 2010s they have decreased but remained very high.[31]

[30] *Agriculture statistics at a glance, p. 241.*

[31] *The authors are very grateful to Bruno Dorin for this piece of information.*

Secondly, **agricultural prices, set by the State, have not increased as much as the cost of inputs and food commodities**, with the inflation rate continuously rising in recent years. In 2018, agricultural prices even entered a negative zone, while the price index reached 4.8%. When agricultural prices increased on the free market (not regulated by the State), the government hastened to prevent exports and/or to favor imports in order to contain the cost of food at a reasonable level for city dwellers, among whom the large voting blocs of the ruling party, the BJP, are recruited. This arbitrage and the decline of the so-called NREGA program (see below) partly explain why farmers' and agricultural laborers' real incomes have been falling.

Graph 2: Movements in rural wages and inflation
(2002-2017)



Source: Labour Bureau, Shimla, Ministry of Labour and Employment.

Thirdly, **the Modi government has made severe cuts to the poverty alleviation program introduced by his predecessor**, Manmohan Singh, the Mahatma Gandhi National Rural Employment Guarantee Scheme, which provided for the grant of one hundred days of minimum wage to all rural Indian families suffering from unemployment. This program, which represented up to 0.6% of India's GNP under Manmohan Singh, benefited 50 million households between 2005 and 2014. Others benefited indirectly through the increase in the minimum wage that MGNREGA allowed, from 65 to 162 rupees per day. The Modi government questioned this program, which it saw as a form of welfare dependency. As a result, the number of people who benefited from 100 days of work paid at the minimum wage dropped from 470,000 in 2013-14 to 250,000 in 2014-15 and 170,000 in 2015-16.[32] The real minimum wage itself fell to 136 rupees per day in 2016-17.[33] The overall volume of the program that year represented only 0.25% of the GNP. It rose to 0.56% at the height of the COVID-19 crisis to help villagers who saw those who had gone to work in the city (and whose factories were closing) return, before falling to 0.29% in 2022-23 and 0.198% in the 2023-24 budget.[34] During the last fiscal year, only 4% of this budget remained to be spent in October 2023 so strong was the demand.[35] To this is added the fact that the wage effectively paid to MGNREGA beneficiaries, 211 rupees per month, does not keep up with inflation and does not even meet the standard set by the administration, 245 rupees, due to lack of resources.

[32] *P. Deshpande, "NDA destroying MGNREGA: has Modi forgotten 'sabka saath, sabka vikas'?" The Indian Express, February 3, 2016, https://indianexpress.com/article/blogs/mgnrega-surprising-to-see-nda-so-determined-to-destroy-it/.*

[33] *Tewari, "NREGA: each household got only 39 job days last year", The Indian Express, April 6, 2015.*

[34] *Jayati Ghosh, Nikhil Dey et alii, "Meagre Funds and Unlawfully Low Wages: How the MGNREGA is Being Squeezed", People's Action for Employment Guarantee, July 2022, https://www.im4change.org/upload/files/July%202022%20tracker%20%281%29.pdf.*

[35] *"GoI's 2023-24 NREGA allocation 'lowest ever', 0.198% of GDP; just 4% of funds remain", Counterview, October 5, 2023, https://www.counterview.net/2023/10/gois-2023-24-nrega-allocation-lowest.html.*

Fourthly, **the COVID-19 crisis marked a major turning point by accelerating a decline in industrial labor that had begun a few years earlier** – to the detriment of the countryside. In 2020, the abrupt imposition of a total lockdown led factories and workshops to suspend all their activities, casting millions of informal sector workers onto the roads, a sector that employs more than 80% of the Indian workforce. These men returned to their villages where their families had to face a double penalty: on one hand, they no longer received the money that the father, son, or brother who had gone to the city sent them monthly, but on the other hand, they had to feed these additional mouths. This re-ruralization of India continued beyond the COVID-19 crisis due to the decline of the manufacturing sector, which now represents only 15% of India's GDP. The labor force employed in agriculture increased from 41.4% of the total in 2018-19 to 44.8% in 2020-21, while that contributing to the manufacturing sector, which had begun to contract before the COVID crisis, went from 12.5% of the total in 2011-2012 to 12.1% in 2018-19 and 11% in 2020-21.

Overall, although India is capable of producing enough food for its needs, millions of Indians suffer from undernutrition due to the **priority given to cereals at the expense of other foodstuffs**, to the **lesser availability of food, and to the insolvency of a very significant part of the rural population**. Our analysis here illustrates Amartya Sen's "Capability Theory", which explains famines not only by a lack of food availability but also by social and economic factors. According to him, famines occur when vulnerable populations can no longer access available food due to a lack of means. This theory remains valid today in India where undernutrition is primarily a function of households' financial resources: millions of Indians cannot afford to buy food to meet their needs both quantitatively and qualitatively. Their meager purchasing power forces them to fall back on cereals and prevents them from consuming proteins present in pulses, fruits, and vegetables as much as they should.[36]

[36] *M. Sharma et alii, "A comparison of the Indian diet with the EAT-Lancet reference diet", BMC Public Health, 20, article number 812, 2020, https://bmcpublichealth.biomedcentral.com/articles/10.1186/s12889-020-08951-8.*

However, in the above reasoning, we have repositioned this issue within the broader context of the agricultural challenges that India must now meet, which concern yields, cultivable areas, farm size, soil depletion, and the model resulting from the Green Revolution in general. The verdict of two leading French specialists on the subject is unequivocal: India is faced with a crisis with multiple facets:

"[There is an] economic crisis, with over-indebtedness and low agricultural incomes; a social crisis, with an increase in farmer suicides and a growing agricultural proletariat due to the lack of alternative income sources (industry is losing jobs instead of creating them on a large scale); a nutritional and health crisis, with chronic undernutrition, malnutrition from excess (diabetes, overweight…), and cancer epidemics; and finally, an ecological crisis, with soil erosion and salinization, decline in biodiversity and resilience to biotic and abiotic shocks, water pollution from fertilizers, pesticides, and antibiotics, falling groundwater levels, and massive emissions of greenhouse gases…"[37]

How can India overcome the challenge of undernutrition and food security under these conditions?

[37] *F. Landy et B. Dorin, « L'État au secours de la transition agroécologique ? Le cas de l'Inde », Mouvements, 109:1, pp. 94-106.*

3 Perspectives and opportunities

The average growth rate of Indian agriculture has fluctuated between 2% and 3.5% over the past thirty years, according to economic surveys by the Indian government. During the decade from 1992 to 2002, it was 3.3%.[38] The growth rate of agriculture slowed in the following decade, from 2002 to 2012, falling to 2.12%. In the period from 2012 to 2022, it rose to 3.48%, but according to the World Bank, it is expected to fall to less than 3% by 2032 and remain at this level until the 2050s. How does this forecast break down by type of crop? And what can we learn from future scenarios to address the question at hand?

In the sections that follow, we will first focus on the trajectories that population and production curves are likely to follow until the middle of the century. But the preceding pages have shown us that food security is not just a matter of production. Therefore, we will devote the last part of this work to discussing feasible solutions in all areas.

3.2. MULTIFACETED SCENARIOS

The scenarios we present below are based on two different sources: the work of the body that succeeded the Planning Commission in India, NITI Aayog[39] and, on the other hand, statistics from three official reports: the Annual Report, 2022-23 of the Department of Agriculture and Farmer Welfare, the *Basic animal Husbandry Statistics* of the Ministry of Fisheries, Animal Husbandry & Dairying, and the *Handbook on fisheries statistics, 2022.*[40] NITI Aayog's methodology is primarily based on data from the

[38] *Agriculture statistics at a glance, New Delhi, ministère de l'Agriculture et de l'Aide sociale des agriculteurs, 2021, http://www.indiaenvironmentportal.org.in/files/file/agrcultural%20statistics%20at%20a%20glance%202021.pdf.*

[39] *Niti Aayog, Demand and supply projections towards 2033, https://www.niti.gov.in/sites/default/files/2019-07/WG-Report-issued-for-printing.pdf.*

Reserve Bank of India. However, its forecasting effort does not go beyond 2033.[41] To extend it to 2050, we applied the average annual growth rates obtained by NITI Aayog up to this date and extended the curves. To perform our own calculations on the basis of the three official sources mentioned above which provide reliable statistics on agricultural production, livestock, and fishery resources, we have proceeded differently. We calculated the "Compounded Annual Growth Rate" of each of the productions we were interested in between 2015 and 2020 and then extended the curves to 2050 by applying this growth rate. A variant of these simulations was then added to present the situation that would prevail in each case if the annual growth rate was 5% lower (see the statistical annexes for the detail of the data thus produced).

A first conclusion emerges from the mere sight of the graphs in the annex: the growth rate of agricultural production as estimated by NITI Aayog or based on our simulations seems generally higher than that of the population, as estimated by the National Commission on Population and the UN – but this impression deserves to be immediately qualified in two ways: firstly, our simulations and that of NITI Aayog diverge to a considerable extent.[42] Secondly, the growth of certain productions is likely not to be significantly higher than that of the population. To have the most accurate overall vision possible, it is appropriate to refer to each of the productions in question and to compare the estimated growth rates with that of the population.

[40] *Annual Report, 2022-23, Department of Agriculture and Farmer Welfare. https://agriwelfare.gov.in/Documents/annual_report_english_2022_23.pdf; Basic animal Husbandry Statistics, Ministry of Fisheries, Animal Husbandry & Dairying. https://dahd.nic.in/sites/default/filess/BAHS_2022-English.pdf; Handbook on fisheries statistics, 2022, Ministry of Fisheries, Animal Husbandry & Dairying, https://dof.gov.in/sites/default/files/2023-01/HandbookFisheriesStatistics19012023.pdf.*

[41] *Niti Aayog, Demand and Supply Projections towards 2033. Crops, livestock, fisheries and agricultural inputs, New Delhi, NITI Aayog, 2018, https://www.niti.gov.in/sites/default/files/2023-02/WG-Report-issued-for-printing.pdf.*

[42] *Bruno Dorin points out that Niti Aayog overestimates the contribution of technical progress to the growth of industrial agriculture ("Annex 9.1.5 : NITI Aayog projections towards 2033", in B. Dorin et alii, AgroEco2050, p. 98 and Dorin Bruno, Poisot Anne-Sophie, Vijay Kumar Thallam. Agro-industry vs agroecology? Two Contrasting Scenarios for 2050 in Andhra Pradesh, India, RySS, Cirad, FAO, 2024, hal-04351765).*

The Indian population is expected to register a 0.82% annual growth rate between 2020 and 2050 according to the forecasts of the Census of India – an indigenous source that we have privileged at the expense of international sources.[43] The report from the Census of India titled *Population Projections for India and the States, 2011-2036* covers only part of the period we are interested in, so for the years 2036-2050, we have applied the same rates of deceleration in population growth as those observed for the period 2011-2050. This leads us to estimate India's population at 1,723,380,000 people by mid-century, a figure congruent with those of the United Nations, although slightly higher.

Turning to the evolution of agricultural production, forecasts are more difficult to make, but the methodology explained above yields interesting results: per capita productions of cereals, pulses, foodgrains (a category combining cereals and pulses), vegetables, milk, meat, and eggs are likely to increase, respectively, by 2.65%, 4.9%, 2.84%, 4.65%, 4.58%, 11.57% and 5.82% as an average annually. In the scenario where the annual growth rate of these productions was 5% lower than the projections on which these figures are based, the per capita productions would increase over the period by respectively 2.52%, 4.66%, 2.69%, 4.42%, 4.36%, 10.99% and 5.53%. Apart from meat – whose dynamism reflects the phenomena noted above –, none of these food productions is therefore expected to experience growth that would significantly combat undernutrition.

The scenarios mentioned above do not take into account the possibility of a drop in production linked to a rapid deterioration of weather conditions due to an acceleration of climate change. Yet the most recent events, from prolonged drought episodes to excessive rainfall leading to catastrophic floods, make this hypothesis credible.

[43] *Census of India, Population projections for India and the states, 2011-2036, Report of the technical group on population projections, New Delhi, Ministry of Health and Family Welfare, 2020. https://main.mohfw.gov.in/sites/default/files/Population%20Projection%20Report%202011-2036%20-%20upload_compressed_0.pdf.*

Due to these extreme conditions, in 2022, wheat production fell 107 million tons against 113 million tons the previous year. It rose to 112 million tons in 2023, but is bound to drop to 105 million tons in 2024.[44] In 2023 and 2024, the decline in rice production has been even more significant. According to the Indian government, it should still drop by 8.8% below the level of the previous year in 2024.[45] This is due to the drought that affected a large part of the territory (monsoon rains being very late or insufficient) and the floods that subsequently devastated the crops. Expecting a poor harvest, the Indian government suspended exports of rice other than Basmati, the variety that brings the most revenue to the country, as early as July 2023. India, whose rice exports account for 40% of global rice exports – a performance unmatched by any country – had exported nearly 18 million tons of non-Basmati rice in 2022, with Basmati rice accounting for only 4 million tons.[46] In 2023, the government of India, by suspending exports of non-Basmati rice, has been able to sale 17.5 million tons of rice on the domestic market in order to contain price rise.[47]

The possible grim scenario of declining rice and cereal production deserves to be taken seriously, even if it is too early to assign it a probability coefficient for several reasons, all related to environmental conditions.

[44] « La production de blé de l'Inde en 2024 devrait atteindre 105 millions de tonnes, soit 6,25 % de moins que les estimations du gouvernement », Reuters, April 8, 2024 (https://www.zonebourse.com/actualite-bourse/La-production-de-ble-de-l-Inde-en-2024-devrait-atteindre-105-millions-de-tonnes-soit-6-25-de-moi-46385750/#:~:text=Actualit%C3%A9s-,La%20production%20de%20bl%C3%A9%20de%20l'Inde%20en%202024%20devrait,que%20les%20estimations%20du%20gouvernement&text=L'Inde%20devrait%20produire%20105,que%20les%20estimations%20du%20gouvernement).

[45] « Baisse de la production de blé et de riz en Inde en 2023/24, selon le gouvernement », Reuters, February 29, 2024 (https://www.zonebourse.com/actualite-bourse/Baisse-de-la-production-de-ble-et-de-riz-en-Inde-en-2023-24-selon-le-gouvernement-46065541/).

[46] R. Jadhav, "Why Indian rice export ban is so important to global trade", Reuters, July 20, 2023.

[47] E. Lombardot, « L'Afrique subsaharienne en sursis: Pourquoi l'Inde restreint ses exportations de riz ? », Intelligence économique, Setpetmber 21, 2023, https://www.portail-ie.fr/univers/enjeux-de-puissances-et-geoeconomie/2023/lafrique-subsaharienne-en-sursis-pourquoi-linde-restreint-ses-exportations-de-riz/#:~:text=L'Inde%20se%20classe%20en,40%20%25%20des%20exportations%20mondiales).

- The Sixth Assessment Report by the Intergovernmental Panel on Climate Change predicts that not only the yields from cereal crops like rice and wheat will decline significantly because of climate change, **but also that the risk of simultaneous crop failures will increase.**[48] Using some of the most reliable studies, the report said that "by 2050, the number of people at risk of hunger will increase by 20% and 11% under high- and low-emission scenarios, respectively", Sub-Saharan Africa and South Asia "being projected to be at the greatest risk, with triple the amount of South Asia's current food reserves needed to offset such an extreme event".[49]

- The **heatwaves – which have so penalized Indian agriculture in 2022 and 2023 – risk becoming the norm**. If August 2023 was the driest and hottest month across the country since 1901, the date of the first records in this area, according to the Indian Meteorological Department (IMD), between 2010 and 2019, the incidence of heatwaves in India increased by a quarter compared to the previous decade, with a corresponding increase in heat-related mortality of 27%. During the hot season in 2022, India experienced twice as many heatwave days as during the same period in 2012, the previous record year.[50] Climate change has made heatwaves 30 times more likely than it would have been otherwise in India, according to World Weather Attribution. This is due both to the increase in India's average annual temperature – by about 0.7°C between 1900 and 2018 – and to the fact that it has made heatwaves larger and more frequent.

[48] *IPCC Sixth Assessment Report. Impacts, Adaptation and Vulnerability, Chapter 5, "Food, Fibre and Other Ecosystem Products", 728, https://www.ipcc.ch/report/ar6/wg2/downloads/report/IPCC_AR6_WGII_Chapter05.pdf.*

[49] *Ibid., p. 796.*

[50] *"Global warming is killing Indians and Pakistanis", The Economist, 2 avril 2023, https://www.economist.com/asia/2023/04/02/global-warming-is-killing-indians-and-pakistanis.*

- If 147 million hectares are already suffering **significant degradation due to different forms of erosion and salinization, climate change is expected to amplify this process**, to the point that by 2050 half of the arable land should suffer from it, which will inevitably result in a decrease in productivity. Two experts in the field do not hesitate to conclude that "Growing trend in the salt-affected soils in India is becoming a threat to national food security and economic development".[51] In 2012-14, an estimate, now ten-year-old, assessed the loss of agricultural production due to salinization alone at 16.84 million tons.[52]

- **Water resources are being depleted**. The drop in groundwater levels is mainly due to the growing consumption of an ever-increasing population and, in some areas, to the introduction of water-intensive crops such as rice, sugarcane, cotton, or maize since the Green Revolution. However, the evolution of rainfall and monsoon patterns also explains why the largest part of the water supply for agriculture and the population's drinking water comes from groundwater. Approximately 89% of groundwater used in India is for irrigation, and it is this type of use that has led to a 61% reduction in groundwater levels in India between 2007 and 2017, according to a report by the Central Ground Water Board (CGWB), presented to the Lok Sabha in 2018.[53] In Punjab, Gujarat, Haryana, and Rajasthan, one must dig more than 40 meters on average to find water[54] – and to irrigate fields –, something that only large operators ready to invest in tubewells can afford.

[51] *Ibid.*

[52] *S. Mandal, R. Raju, A. Kumar, P. Kumar et P.C. Sharma, "Current Status of Research, Technology Response and Policy Needs of Salt-affected Soils in India – A Review", Journal of the Indian Society of Coastal Agricultural Research36(2): 40-53 (2018).*

[53] *Prabhash K Dutta, "Why India does not have enough water to drink," India Today, 28 juin 2019, https://www.indiatoday.in/india/story/why-india-does-not-have-enough-water-to-drink-1557669-2019-06-28.*

[54] *See the maps of the Ministry of Jal Shakti, Annual Report. 2019-20, New Delhi, Government of India, 2020, pp. 55.*

If the stagnation, or even the decline, in the production of staple crops were to be confirmed, the implications would be considerable in terms of undernutrition, but not only. One of the major consequences of such a development would concern **the rise of farmers' indebtedness which has already reached a very high level.**[55]

Another consequence would concern India's trade balance. Today, the country earns precious foreign currency from its agricultural exports. In 2022, it sold $9.66 billion worth of rice.[56] In the future, if production does not increase fast enough to feed the population, India will likely have to not only reduce its exports but also start importing essential commodities again, which will further impact its foreign trade. The country has already been importing large quantities of pulses and edible oil for decades.

Furthermore, the decrease in Indian exports contributes to reducing the supply of foodstuffs on the global market and, consequently, to increasing prices, which for rice, have jumped by 15 to 25% depending on the country following the announcement of the suspension of its exports by India. African countries are the first collateral victims of this new situation, with India exporting rice to Benin, Angola, Cameroon, Guinea, Ivory Coast, and Kenya.[57]

[55] *Sandeep Kandikuppa, "Heat and Debt: Climate Change and Poverty in Rural South Asia", The Diplomat, 26 juin 2023, https://thediplomat.com/2023/06/heat-and-debt-climate-change-and-poverty-in-rural-south-asia/.*

[56] *S. Sharma, "How India's ban on some rice exports is ricocheting around the world", Al Jazeera, 16 août 2023, https://www.aljazeera.com/economy/2023/8/16/how-indias-ban-on-some-rice-exports-is-ricocheting-around-the-world.*

[57] *The banning of rice and wheat exports has been criticized by observers of trade relations who accused the Modi government to destabilise the global trade of cereals for domestic, political reasons: "India's export bans can also be seen as irresponsible if driven not primarily by domestic food security, but rather by political reasons. Ahead of the March [sic] 2024 elections, there is a need to appease India's urban middle class by reducing mounting food prices" (J. Ma Luis Montesclaros, "India's rice export restrictions need multilateral solutions", East Asia Forum, October 18, 2023, https://www.eastasiaforum.org/2023/10/18/indias-rice-export-restrictions-need-multilateral-solutions/).*

The scenarios mentioned above all focus on the issue of food production to examine to what extent India will be able to feed its growing population. The question is not trivial. According to the most serious estimates, India will indeed need to produce 311 million tons of foodgrains by 2030 and 350 million by 2050 to meet the needs of its population.[58] To achieve this, the country must either increase productivity or expand cultivated areas – or, better yet, do both at the same time.

If the grim scenario does not materialize, India's food security appears to be guaranteed in the medium term. The decisive variable, from this point of view, is none other than climate change: if the recent droughts and floods are not structural but attributable to El Niño, India will probably be able to return to the trajectory it followed before the 2020s. Otherwise, the risks of losing self-sufficiency, already noticeable for some commodities, will pose major challenges for the world's most populous country. The demographic growth expected to continue until the middle of the century will not be an asset but a constraint.

Even if India regains good agricultural growth rates, the scenarios we have developed and the one by NITI Aayog show that malnutrition is expected to remain a chronic ailment in 21st-century India, simply because, as mentioned above, the country would need to multiply its annual average reduction rate (AARR) by two or three to significantly address this phenomenon Between 2005-06 and 2015-16 the AARR stood at 2.2% as mentioned above.[59]

However, to reduce undernutrition and anemia, the country has a few tools that do not depend solely on production levels, the variable on which we have focused in our scenarios.

[58] *Pradeep Kumar and Pradeep K. Sharma, "Soil salinity and food security in India", Frontiers in Sustainable Food Systems, vol. 4 (2020), https://www.frontiersin.org/articles/10.3389/fsufs.2020.533781/full.*

[59] *B. K. Kar, "Ensure Zero Hunger Deaths By 2040", Outlook, August 16, 2019, https://www.outlookindia.com/magazine/story/india-news-ensure-zero-hunger-deaths-by-2040/302038.*

3.3 HOW TO IMPROVE INDIA'S FOOD SECURITY?

When addressing the quest for solutions to the issues discussed earlier, five categories of thought emerge immediately: the improvement of agricultural production, the availability of products, the access to these products, markets and trade (both at the domestic and international level) and, more ambitious, the development of agroecological farming.

a. Diversify and increase production

Agricultural production can be optimized in several ways:

- India has started **to diversify its productions to escape the trap of monocultures inherited from the Green Revolution** and, in particular, to revive the cultivation of millets (with recognized nutritional virtues) and especially pulses which are produced and consumed in too small quantities to effectively combat undernutrition. Concerning the latter, the plan proposed by the committee led by Arvind Subramanian in 2015 could be revisited. One of its recommendations was for the state to offer producers a guaranteed price (Minimum Support Price) sufficiently rewarding to encourage them to invest in this crop as is the case for rice and wheat, half of the production of which is purchased by the state. In some years, such as in 2018-19, this policy was followed and bore fruit, but this financial effort is marginal today. The committee also recommended the ban on exports of pulses, which was however lifted in 2017.

- **Irrigation**, which still only concerns a minority of cultivated land (where farmers can therefore only make one to two harvests per year) can be further optimized, no longer solely (nor even primarily) by creating canals subject to high evaporation or by digging wells (as groundwater is being depleted), but by reviving traditional forms of

rainwater collection through reservoirs and wells with wide margins to maximize collection. Such initiatives have already materialized in semi-desertic states like Gujarat and Rajasthan.

- In parallel, water-intensive crops like maize, rice, and sugarcane must be partly replaced by others, such as millet, which would make the development of irrigation less necessary. **Reducing the area dedicated to export crops like rice** would also make it possible to produce the fodder needed by livestock – which might otherwise be fed with food that could be intended for human consumption.

- **The growth of livestock farming needs to be analyzed carefully**, not only for this reason but also because of its effects on climate change. Dissuasive prices could be applied in the state-managed wholesale markets.

- Most importantly, an **agrarian reform** would help reduce inequalities in rural areas. The experience of some Indian states shows that to give a plot of land to the millions of agricultural workers who form the large battalions of "landless peasants" is one of the best ways to fight against mass poverty in the countryside. It remains a politically sensitive measure because of the landowners' social capital.

- To help farmers cope with climate change, the Manual Drought Management needs to be revised again: in 2016, the Ministry of Agriculture changed the central government policy, making it much more difficult for the state governments to declare a drought.[60]

[74] *I. Kukreti, "How India made it harder to declare a drought", Scroll.in, 5 juillet 2023, https://scroll.in/article/1052002/how-india-made-it-harder-to-declare-a-drought.*

b. Improve availability

- **Upgrading the cold chain in domains where it remains underdeveloped would be very useful** to promote the conservation of some products thanks to the installation of cold rooms and the use of refrigerated trucks.

- **Limiting exports of pulses** – when they continue to take place – would improve the access of local consumers to these key commodities.

c. Facilitate access to food

- To reducing mass poverty, India could **upgrade the MGNREGA**, which had lifted millions of people out of poverty and/or given them access to more substantial food. The policy of the Modi government has reversed this trend. The budget for MGNREGA should be tripled to return to its level in 2007-08.

- The Public Distribution System (PDS), renovated as part of the National Food Security Act (2013), has the potential to **offer cheap food to the poor**. While the government, during the COVID crisis, had doubled the food ration of 800 million Indians, in 2022, the decline in production mentioned above compromised this program when the government announced that he would more than halve the quantities of wheat available in the Public Distribution System, the main instrument of food aid in India.[61] Narendra Modi suspended this decision in late 2023 because of the extreme vulnerability of the poor.[62] Yet, the government failed to apply the NFSA because

[61] *"Centre cuts wheat allocation to states under food security scheme as production falls", Scroll. in, May 5, 2022, https://scroll.in/latest/1023299/centre-cuts-wheat-allocation-to-states-under-food-security-scheme-amid-lower-production.*

[62] *M.K. Venu, "Hunger and unemployment in Modi's Amrit Kaal", The Wire, November 10, 2023, https://thewire.in/economy/modi-amrit-kaal-hunger-unemployment.*

it did not adjust the number of the PDS beneficiaries according to the population data: first, the government said it was waiting for the census, but no census was organized in 2021 (the year when it should have taken place. The Supreme Court asked the government to take steps to re-determine the number of people covered by the NFSA in June 2021, but the government said it will wait for the next census.[63]

- The PDS can be made more efficient by **adding more millet, pulses, fruits, and vegetables to the rice and wheat** which currently make up the bulk of the food rations today.

- Improving children's nutrition would also be possible through **the systematization of programs called "mid-day meals"**. This policy, initiated in southern states, has been officially extended to all the states of India after the Supreme Court directed the state governments to do so, but the number of beneficiaries is decreasing in many states of the Indian Union due to the increasing number of children attending private schools where "mid-day meals" are not practiced. This program could be extended there and pulses as well as fruits and vegetables should be added.[64]

- To restore purchasing power to the countryside while the terms of trade deteriorate in favor of cities, **increasing the "minimum support prices"** set by the government is a convenient solution, even if it means subsidizing the commodities put on the market to spare poor urban consumers.

[63] *According to some NGOs, around a hundred million people eligible for food aid do not receive it for this reason, despite the Supreme Court's express request to the government to review its policy. ("Govt of India 'excludes' 10 crore poor people from food security net despite SC directive", Counterview, February 12, 2023, https://www.google.com/search?client=safari&rls=en&q=Counterview+Govt+of+India+%27excludes%27+10+crore+poor+people+from+food+security+net+despite+SC+directive&ie=UTF-8&oe=UTF-8).*

[64] *Global child nutrition foundation, State survey of school meal programs: India 2020, https://gcnf.org/wp-content/uploads/2021/05/State-Survey-of-School-Meal-Programs-in-India-Report-with-Annexes.pdf.*

d. Reform markets and trade

- The committees managing agricultural markets, known as "Agricultural produce market committees" (APMC), were created to protect farmers against middlemen who might not buy their products at a fair price. They have recently been accused by the government of harming the efficiency of the sector. However, the three "Farm Acts" promoted by the government in 2020-21 did not provide an acceptable solution to the farmers since they deregulated the sector in favor of large agri-food firms. Farmers protested for a year near Delhi and forced the Modi government to back down.[65] These reforms would have made them more vulnerable to the whims of the free market, without much regulation or price guarantee. Nevertheless, the state could **help small farmers gain market access** and a reform is certainly needed.

- The issue of trade in agricultural products also arises at the international level. If India limits its exports of pulses, rice, and meat as recommended above, and if it lowers tariffs on imports of commodities it needs most, such as pulses, it will have to compensate for this loss of revenue. This compensation could come from **international aid** that India refuses today – particularly from the World Food Programme.

- India is faced with the famous food dilemma of finding it difficult to choose between "cheap imports to feed consumers, but at the expense of national agriculture, or protectionism that helps producers but penalizes consumers". Frédéric Landy points out that the country has not decided between these two options and acts on a case-by-case basis.[66] Today, the government of Narendra Modi

[65] *H. Singh Bal, "Mandi, Market and Modi", The Caravan, March 1, 2021, https://caravanmagazine.in/essay/farm-laws-adani-reliance.*

[66] *F. Landy, « Pourquoi l'Inde n'a (peut-être) pas besoin d'aide humanitaire en matière alimentaire », Alternatives humanitaires, November 2022, https://www.alternatives-humanitaires.org/fr/2022/11/28/pourquoi-linde-na-peut-etre-pas-besoin-daide-humanitaire-en-matiere-alimentaire/.*

tends to increase imports to lower the prices of certain foodstuffs to preserve the purchasing power of urban residents, the core of its electorate. This policy makes it difficult for farmers to get more remunerative prices and affects the trade balance.

- On the export side, following the outbreak of the war in Ukraine, Western countries (starting with the EU) have pressured the WTO for India to continue supplying the global market with agricultural products to contain the price rise and in the name of market logic. India has resisted these pressures. In 2020, the EU and India began trade negotiations aiming to conclude a free trade agreement. Already, the Minister of Commerce, Piyush Goyal, has assured farmers that he will be able to defend their interests and protect, in particular, dairy producers.[67]

e. Develop the Indian Brand of Agroecology: the long-term solution

In India like elsewhere, natural agriculture appears to be the only long-term solution to ensure food security, all the more so as one state, Andhra Pradesh, has already initiated substantial reforms to promote this alternative type of agriculture.[68]

The agroecology alternative is a response to the environmental and social consequences of the Green Revolution[69] which include: (1) the depletion of soil nutrients leading to reduced soil productivity,[70]

[67] *"Piyush Goyal assures protection of farmers and dairy sector interests in India-EU free trade agreement", The Economic Times, April 14, 2023, https://economictimes.indiatimes.com/news/economy/foreign-trade/india-to-protect-interests-of-farmers-dairy-sector-in-free-trade-agreement-with-eu-piyush-goyal/articleshow/99483473.cms?from=mdr.*

[68] *Other regional examples (like the state of Sikkim) or even local experiences (like the Patamil Project – (https://patamil.centraider.org/premices/) could also be mentioned.*

[69] *Dorin B., Landy F. 2009. Agriculture and Food in India. A Half-Century Review, from Independence to Globalization. Manohar, New Delhi, 280 p.*

[70] *Abhilash PC, Singh N. Pesticide use and application: an Indian scenario. J Hazard Mater. 2009;165(1–3):1–12.*

(2) the heightened presence of pesticide residues in food and the environment due to overuse of pesticides,[71] (3) a tendency among farmers to adopt unsustainable farming methods in pursuit of higher yields, (5) small-scale farmers being forced to sell their land to larger commercial entities because of escalating farming costs and debt, and (6) farmers abandoning agriculture[72] or even committing suicide because of unsustainable indebtedness.

As a response to this unsustainable conventional model of agriculture, many initiatives emerged from all over India, including, in the mid-1990s, in Maharashtra where Subhash Palekar pioneered the "Zero Budget Natural Farming" (ZBNF).[73] Initially, this farming technique was based on four fundamental components: *jeevamrutham* ("elixir of life", a concoction for soil comprising cow dung, urine, pulse flour, jaggery, and soil to stimulate soil micro- and macro-organisms), *beejamrutham* ("ferment of immunity", a coating for seeds using similar ingredients to protect them and stimulate their growth), *acchadana* (a constant coverage of the soil with diverse crops and crop residue mulches;), and *whapasa* ("microclimate": aerated soil humus that harnesses water vapor).[74] These techniques, in combination, aim to enhance microbial activity in soil, boost soil carbon, add nitrogen via green mulching, and improve nitrogen availability in the surface soil.[75] They also emphasize the use of natural inputs and, when possible, indigenous seed varieties.[76]

[71] *Rekha, Naik SN, Prasad R. Pesticide residue in organic and conventional food–risk analysis. J. Chem Health Saf. 2006;13:12–9. https://www.sciencedirect.com/science/article/abs/pii/S1074909805000262.*

[72] *Eliazer Nelson, A.R.L., Ravichandran, K. & Antony, U. "The impact of the Green Revolution on indigenous crops of India". J. Ethn. Food 6, 8 (2019). https://doi.org/10.1186/s42779-019-0011-9.*

[73] *S. Biswas, "Zero Budget Natural Farming in India: Aiming Back to the Basics." Int. J. Environ. Clim. Change 38–52 (2020) doi:10.9734/ijecc/2020/v10i930228*

[74] *A. Khadse, Rosset, P. M., Morales, H. & Ferguson, B. G. "Taking agroecology to scale: the Zero Budget Natural Farming peasant movement in Karnataka, India." J. Peasant Stud. 45, 192–219 (2018).*

[75] *J. Smith, Yeluripati, J., Smith, P. and Nayak, D. R. "Potential yield challenges to scale-up of zero budget natural farming" Nat. Sustain. 3, 247–252 (2020).*

[76] *Rose, S., Halstead, J., & Griffin , T. (2021), https://sites.tufts.edu/cierp/files/2022/01/CREATE_ZBNF_Rose_Halstead_Griffin.pdf.*

In 2015, the Andhra Pradesh government took significant steps to institutionalize, further innovate and scale up Zero Budget Natural Farming (ZBNF) across the state. This policy was entrusted to the Rythu Sadhikara Samstha (RySS, the "farmers empowerment corporation"), a government-backed entity tasked with implementing the "Climate Resilient Zero Budget Natural Farming" program. RySS's mandate included educating farmers and facilitating peer-to-peer knowledge exchange. The program began as an experiment involving more than 700 villages and 40,650 farmers in 2016.[77] By March 2020, the program had seen substantial growth, with 623,300 farmers participating, accounting for 10% of all the state's farmers. It covered nearly 3% of Andhra Pradesh's total net sown area, amounting to 181,600 hectares.[78] Looking forward, the state's ambition is to extend what became in 2020 the Andhra-Pradesh Community-managed Natural Farming (APCNF) to all 6 million farmer families, covering 8 million hectares of land by 2027.[79] While this model has garnered coverage and interest globally, it also sparked debates regarding the sustainability of natural farming in providing long-term food security for a populous nation such as India.[80]

This is why the "RYSS-CIRAD-FAO AgroEco2050 participative foresight project (2019-2023)"[81] was initiated to study two contrasting scenarios for Andhra Pradesh by 2050: the intensification of conventional Industrial Agriculture and food (scenario IA), and the 100% generalization

[77] *RySS. "Andhra Pradesh Zero-Budget Natural Farming (AP ZBNF). A Systemwide Transformational Programme", 2019, https://apcnf.in/about-apcnf/.*

[78] *A. Khurana and Kumar V., State of Organic and Natural Farming in India. Challenges and Possibilities, New Delhi, Centre for Science and Environment, 2020, pp. 41-42, https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwjR4ZaFq8aDAxX7Y6QEHX-6QBvwQFnoECBAQAQ&url=https%3A%2F%2Fwww.cseindia.org%2Fcontent%2Fdownloadreports%2F10346&usg=AOvVaw3RwlQoPqIMZFGz0vm6FmNA&opi=89978449.*

[79] *RySS. "Andhra Pradesh Zero-Budget Natural Farming (AP ZBNF). A Systemwide Transformational Programme", 2019, https://apcnf.in/about-apcnf/.*

[80] *B. Dorin, "Theory, Practice and Challenges of Agroecology in India." International Journal of Agricultural Sustainability, 20(2), (2022) 153-167.*

[81] *"An unprecedented participatory foresight initiative to foster the agroecological transition in India", https://www.cirad.fr/en/cirad-news/news/2023/participatory-foresight-initiative-in-india-agroeco2050.*

of agroecology with Natural Farming (scenario NF). The agro-industrial model refers to conventional farming with intensive use of chemicals, larger specialized farm sizes with economies of scale, stronger oligopolies of input suppliers and buyers. On the other hand, the agroecological model is based on women's self-help groups, natural farming principles without fertilizers (either chemical or organic) and pesticides, low water and energy requirements, small farm sizes, and indigenous knowledge with both community and scientific support.

The AgroEco2050 foresight platform worked with: (1) these two contrasting narratives or "sociotechnical regimes";[82] (2) an Indian expert group of about 30 people including scientists from different disciplines, policymakers, NGOs and farmers' representatives; (3) a macro-bioeconomic model, Agribiom-India.[83] It investigated and interlinked four dimensions of the agri-food system:

1. Land use
2. Population and employment
3. Economic growth, income and inequality
4. Yield and production of plant food calories.

By 2050, under the industrial agriculture scenario, there would be a reduction in the area of land cultivated, from 6.2 million hectares to 5.5 million hectares, with few monocultures and an emphasis on the most efficiently irrigated regions. By contrast, in the agroecological scenario, the area of cultivated land is projected to expand to 8.3 million hectares by the year-round regeneration and cultivation of 2.8 million hectares of land left fallow by industrial agriculture, especially in semi-arid zones.

[82] *Geels F. W., Schot J., 2007. Typology of sociotechnical transition pathways, Research Policy, 36:3, 399-417, https://doi.org/10.1016/j.respol.2007.01.003.*

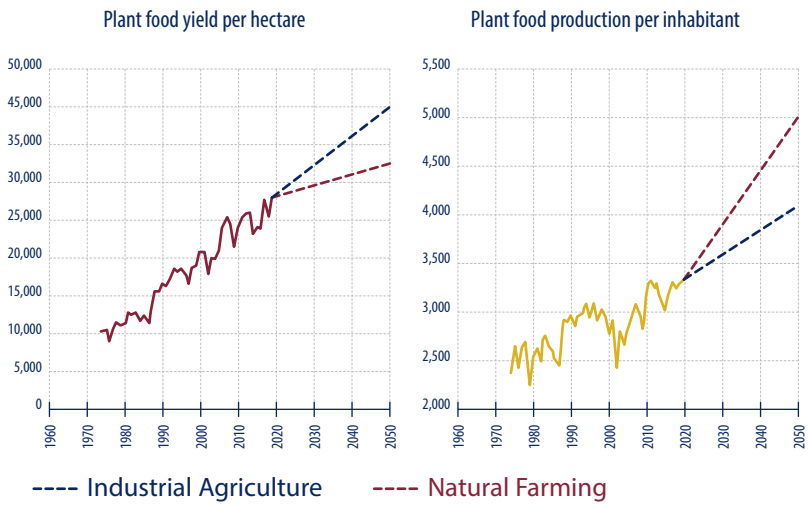
[83] *Dorin B., Joly PB., 2020. Modelling world agriculture as a learning machine? From mainstream models to Agribiom 1.0. Land Use Policy, 96, 103624, https://doi.org/10.1016/j.landusepol.2018.09.028.*

By 2050, Andhra Pradesh's population is expected to reach 59.5 million, with those aged between 20- and 63-years old numbering 35.4 million.[84] If the industrial agriculture (IA) model persists, the 2019 unemployment rate of 30% for the 20-63 age group would not change, and the farming population would halve, dropping from 9.3 million to 5.0 million. On the other hand, in the natural farming (NF) scenario, 10 million small-scale farmers would enhance their livelihoods through natural farming, which would reduce the unemployment rate in the 20-64 age demographic to 7%.

Under the natural farming scenario, the Gross Value Added (GVA) of agriculture and allied activities is expected to increase by 6% annually, surpassing the 4% annual growth recorded between 1980 and 2019. This anticipated growth is primarily due to the extensive involvement of both land and farmers in natural farming techniques, alongside significant savings in agricultural input costs such as seeds, irrigation systems, chemical fertilizers, fossil energy, financial credit, and machinery. Additionally, the market is likely to assign higher values to food products that are safe and nutritious, stemming from natural farming practices. On-farm value-added activities, which include small-scale processing and packaging, as well as the development of agrotourism, are also expected to contribute to this growth. Consequently, these improvements in the agricultural sector are projected to spur general economic growth, potentially increasing it by 6.5% per annum. This growth is anticipated to lead to broader economic benefits, including reductions in unemployment and inequality, and contribute to the overall well-being of the population.

[84] *KC S., Wurzer M., Speringer M., Lutz W., 2018. Future population and human capital in heterogeneous India, Proceedings of the National Academy of Sciences, 115:33, 8328-33, https://doi.org/10.1073/pnas.1722359115.*

Graph 3: Plant food yield and production (kcal/day) in Andhra Pradesh



Source: Dorin et al., 2023.

In the industrial agriculture (IA) scenario, the yield of a limited number of monocrops is projected to continue on its historical trajectory, despite potential adverse effects on farmers' livelihoods, environmental resources, and the health of consumers. In contrast, the natural farming (NF) approach might result in a somewhat lower increase in food yield, but it promises a production that is more nutritionally diverse – richer in both macronutrients and micronutrients, as well as fibers – and produced without the use of any chemical inputs such as fertilizers and pesticides. The per capita plant food production, when considering both yield and the extent of cultivated area, is expected to be substantially higher in an agroecological (AE) scenario, amounting to 5,008 kilocalories per day per inhabitant. This is in contrast to an industrial agriculture (IA) system, where the figure stands at 4,054 kilocalories per day per inhabitant.

Table 1: Two 2050 Andhra Pradesh narratives in figures

Indicator	2019	2050 Scenario 100% Industrial Agriculture	2050 Scenario 100% Natural Farming
Population (million capita)	**52.6** (+1.2%)*	**59.5** (+0.4%)**	**59.5** (+0.4%)**
Labour force (20-64 years)	32.5	35.4 (+0.3%)**	35.4 (+0.3%)**
Unemployment (of the 20-64 years)	10.1 (31%)^	10.6 (30%)^	2.4 (7%)^
Employment	22.4 (69%)^	24.8 (70%)^	33.0 (93%)^
• Farmers	9.3 (42%)^	5.0 (20%)^	10.0 (30%)^
• Nonfarmers	13.1 (58%)^	19.8 (80%)^	23.0 (70%)^
Cropland area (million ha)	6.2 (–0.0%)*	5.5 (–0.4%)**	8.3 (+0.9%)**
Hectare per farmer	0.67 (+0.9%)*	1.11 (+1.7%)**	0.83 (+0.7%)**
Gross Value Added (10 INR)	6.1 (+5.8%)*	36.9 (+6.0%)**	42.7 (+6.5%)**
• Farm sector	1.9 (+4%)*	5.4 (+3.5%)**	11.2 (+6%)**
• Nonfarm sector	4.2 (+7.3%)*	31.5 (+6.7%)**	31.4 (+6.7%)**
Productivity (INR/day)***	741 (+5.3%)*	4,080 (+5.7%)**	3,545 (+5.2%)**
• Cropland (per ha)	815 (+4.0%)*	2 670 (+3.9%)**	3,719 (+5.0%)**
• Farmer (per worker)	544 (+5.0%)*	2 967 (+5.6%)**	3,080 (+5.8%)**
• Nonfarmer (per worker)	880 (+4.8%)*	4 359 (+5.3%)**	3,748 (+4.8%)**
Plant food production (Gkcal/day)	193 (+2.4%)*	241 (+0.7%)**	298 (+1.4%)**
• Per hectare (kcal/day)	31,095 (+2.4%)*	43,854 (+1.1%)	36,000 (+0.5%)**
• Per farmer (kcal/day)	20,740 (+3.3%)*	48,729 (+2.8%)	29,808 (+1.2%)**
• Per capita (kcal/day)	3,669 (+1.1%)*	4,054 (+0.3%)	5,008 (+1.0%)**
Structural Path	Farmer Excluding	Farmer Excluding	Farmer Developing
Income gap between farmers and nonfarmers (INR/day)	336 (62%) µ	1,392 (47%) µ	668 (22%) µ

Source: Dorin et al., 2023 and Dorin Bruno, Poisot Anne-Sophie, Vijay Kumar Thallam, 2024 (livre à paraître). Agro-industry vs agroecology? Two Contrasting Scenarios for 2050 in Andhra Pradesh, India, FAO, Rome.

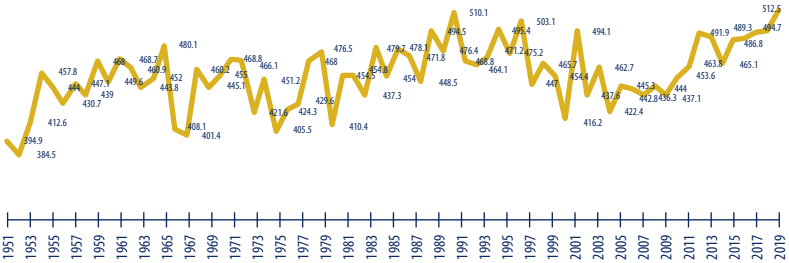
Note: Ha: hectare; INR: Indian National Rupee of 2011/12; Gkcal: giga kilocalories.
Structural path: as defined by Dorin et al. (2013).
** Growth rate per annum (p.a.) from 1980 (39 years).*
*** Growth rate per annum (p.a.) from 2019 (31 years).*
**** Constant/Real Indian rupees of 2011-12.*
^ Category share for the concerned year.
µ share in average farmer income of "average nonfarmer income less average farmers income".

Overall, compared to the industrial scenario in 2050, in the natural farming scenario, Andhra Pradesh:

- would cultivate (regenerate) 365 days/year +2.8 million hectares of land left fallow by industrial agriculture;
- would produce +1000 kcal/day/inhabitant of much healthier and more balanced food
- would see small agroecological farmers earn as much as larger industrial farmers, with zero fertilizers, zero pesticides, and significant savings in water and fossil energy;
- would employ +5 million farmers, and unemployment would drop from 30% to 7%;
- would reduce the farmer income gap with nonfarmers from 47% to 22%;
- would see the growth rate of the economy (GDP) increase from 6 to 6.5% per year;
- would green the economy and save billions in public subsidies.

Moreover, the cost of policies aimed at completely eliminating income inequality among 20-64-year-olds would be much less in the agroecological scenario than in the industrial scenario.

Annex 1: Per Capita Net Availability of Foodgrains per day (grams)



Source: Agricultural statistics at a glance 2020, New Delhi, Government of India, Ministry of Agriculture and Farmers Welfare, 2021, http://www.indiaenvironmentportal.org.in/files/file/agrcultural%20statistics%20at%20a%20glance%202021.pdf.

Annex 2: Population and food production in India (1051-1920)[85]

Population Growth and Agricultural Products Availability

Year	Population (million)	Cereals Net availability (million tonnes)	Pulses Net availability (million tonnes)	Cereals Per capita net availability per day (grams)	Pulses Per capita net availability per day (grams)	Foodgrains Per capita net availability per day (grams)
1951	363.2	44.3	8	334.2	60.7	394.9
1952	369.2	44	8	325.4	59.1	384.5
1953	375.6	48	8.6	349.9	62.7	412.6
1954	382.4	54.2	9.7	388.1	69.7	457.8
1955	389.7	53.1	10.1	372.9	71.1	444
1956	397.3	52.4	10.2	360.4	70.3	430.7
1957	405.5	55.5	10.6	375.3	71.8	447.1
1958	414	52.9	8.8	380.5	58.5	439
1959	423.1	60.8	11.6	393.4	74.9	468.3
1960	432.5	60.8	10.4	384.1	65.5	449.6
1961	442.4	64.6	11.1	399.7	69	468.7
1962	452.2	65.8	10.2	398.9	62	460.9
1963	462	64.8	10.1	384	59.8	443.8
1964	472.1	69.3	8.8	401	51	452
1965	482.5	73.7	10.8	418.5	61.6	480.1
1966	493.2	64.8	8.7	359.9	48.2	408.1
1967	504.2	66.6	7.3	361.8	39.6	401.4
1968	515.4	76.2	10.6	404.1	56.1	460.2
1969	527	76.5	9.1	397.8	47.3	445.1
1970	538.9	79.3	10.2	403.1	51.9	455
1971	551.3	84	10.3	417.6	51.2	468.8
1972	563.9	86.5	9.7	419.1	47	466.1

[85] *Sources: Annual Report, 2022-23, Department of Agriculture and Farmer Welfare. https://agriwelfare.gov.in/Documents/annual_report_english_2022_23.pdf; Basic animal Husbandry Statistics, Ministry of Fisheries, Animal Husbandry & Dairying. https://dahd.nic.in/sites/default/filess/BAHS_2022-English.pdf; Handbook on fisheries statistics, 2022, Ministry of Fisheries, Animal Husbandry & Dairying, https://dof.gov.in/sites/default/files/2023-01/HandbookFisheriesStatistics19012023.pdf.*

Population Growth and Agricultural Products Availability (continued)

Year	Population (million)	Cereals Net availability (million tonnes)	Pulses Net availability (million tonnes)	Cereals Per capita net availability per day (grams)	Pulses Per capita net availability per day (grams)	Foodgrains Per capita net availability per day (grams)
1973	576.8	80.1	8.7	350.5	41.1	421.6
1974	590	88.4	8.8	410.4	40.8	451.2
1975	603.5	80.6	8.8	365.8	39.7	405.5
1976	617.2	84.4	11.4	373.8	50.5	424.3
1977	631.3	89	10	386.3	43.3	429.6
1978	645.7	99.6	10.7	422.5	45.5	468
1979	660.3	104.1	10.8	431.8	44.7	476.5
1980	675.2	93.8	7.6	379.5	30.9	410.4
1981	688.5	104.8	9.4	417.3	37.5	454.8
1982	703.8	106.8	10.1	415.6	39.2	454.8
1983	718.9	104.4	10.4	397.8	39.5	437.3
1984	734.5	117.4	11.3	437.8	41.9	479.7
1985	750.4	113.9	10.5	415.6	38.4	454
1986	766.5	121.5	12.3	434.2	43.9	478.1
1987	782.7	124.4	10.4	435.4	36.4	471.8
1988	799.2	120.1	10.7	411.8	36.7	448.5
1989	815.8	134.7	12.5	452.6	41.9	494.5
1990	832.6	132.3	12.5	435.3	41.1	476.4
1991	851.7	145.7	12.9	468.5	41.6	510.1
1992	867.8	137.7	10.9	434.5	34.3	468.8
1993	883.9	138.1	11.7	427.9	36.2	464.1
1994	899.9	142.6	12.2	434	37.2	471.2
1995	922	154	12.7	457.6	37.8	495.4
1996	941.6	152.1	11.3	442.5	32.7	475.2
1997	959.8	163.2	13	466	37.1	503.1
1998	978.1	147.9	11.7	414.2	32.8	447
1999	996.4	156.1	13.3	429.2	36.5	465.7
2000	1,014.8	156.6	11.7	422.7	31.8	454.4
2001	1,033.2	145.6	11.3	386.2	30	416.2
2002	1,050.6	175.9	13.6	458.7	35.4	494.1
2003	1,068.2	159.3	11.3	408.5	29.1	437.6

Population Growth and Agricultural Products Availability (continued)

Year	Population (million)	Cereals Net availability (million tonnes)	Pulses Net availability (million tonnes)	Cereals Per capita net availability per day (grams)	Pulses Per capita net availability per day (grams)	Foodgrains Per capita net availability per day (grams)
2004	1,085.6	169.1	14.2	426.9	35.8	462.7
2005	1,102.8	157.3	12.7	390.9	31.5	422.4
2006	1,119.8	168.8	13.3	412.8	32.5	445.3
2007	1,136.6	169	14.7	407.4	35.5	442.8
2008	1,153.1	165.9	17.6	394.2	41.8	436.0
2009	1,169.4	173.7	15.8	407.0	37.0	444.0
2010	1,185.8	173.8	15.3	401.7	35.4	437.1
2011	1,201.9	180.1	18.9	410.6	43.0	453.6
2012	1,213.4	181.0	18.4	408.6	41.7	463.8
2013	1,228.8	194.3	19.4	433.2	43.3	491.9
2014	1,244.0	201.1	21.1	442.9	46.4	489.3
2015	1,259.1	193.6	20.1	421.4	43.8	465.1
2016	1,274.0	206.3	14.3	443.7	43	486.8
2017	1,289	204.1	20.2	434.0	54.7	488.7
2018	1,302.9	210.2	22.2	442.0	51.3	493.3
2019	1,317	215.1	19.3	447.4	47.3	494.7
2020	1,330.8	225.7	20.1	464.6	47.9	512.5

Foodgrains

Year	Population (million)	Foodgrains (in million tonnes)	Foodgrains Per Capita (in kg)	Population Growth Rate	Foodgrains Growth Rate	Foodgrains Per Capita Growth Rate	Demand (Niti Aayog Report) Foodgrains (in million tonnes)	Surplus/ Deficit Foodgrains (in million tonnes)	Surplus/ Deficit Percentage Cereals
2015	1,315.10	251.57	191.29	–	–	–	–	–	–
2016	1,330.63	275.67	207.17	1.18%	9.58%	8.30%	257.39	18.28	7%
2017	1,346.64	282.65	209.89	1.20%	2.53%	1.31%	261.77	20.88	8%
F2018	1,361.75	289.85	212.85	1.12%	2.55%	1.41%	266.22	23.63	9%
F2019	1,376.26	297.24	215.97	1.07%	2.55%	1.47%	270.75	26.48	10%

Foodgrains (continued)

Year	Population (million)	Foodgrains (in million tonnes)	Foodgrains Per Capita (in kg)	Population Growth Rate	Foodgrains Growth Rate	Foodgrains Per Capita Growth Rate	Demand (Niti Aayog Report) Foodgrains (in million tonnes)	Surplus/ Deficit Foodgrains (in million tonnes)	Surplus/ Deficit Percentage Cereals
2015	1,315.10	251.57	191.29	–	–	–	–	–	–
2016	1,330.63	275.67	207.17	1.18%	9.58%	8.30 %	257.39	18.28	7%
2017	1,346.64	282.65	209.89	1.20%	2.53%	1.31%	261.77	20.88	8%
F2018	1,361.75	289.85	212.85	1.12%	2.55%	1.41%	266.22	23.63	9%
F2019	1,376.26	297.24	215.97	1.07%	2.55%	1.47%	270.75	26.48	10%
2020	1,389.97	304.81	219.29	1.00%	2.55%	1.54%	275.36	29.45	11%
2021	1,402.81	312.62	222.85	0.92%	2.56%	1.62%	280.03	32.59	12%
F2022	1,412.32	320.73	227.10	0.68%	2.59%	1.90%	284.70	36.04	13%
F2023	1,424.83	329.05	230.94	0.89%	2.59%	1.69%	289.44	39.61	14%
F2024	1,440.84	337.59	234.30	1.12%	2.59%	1.45%	294.26	43.33	15%
F2025	1,456.64	346.35	237.77	1.10%	2.59%	1.48%	299.17	47.19	16%
F2026	1,472.27	355.34	241.36	1.07%	2.59%	1.51%	304.15	51.19	17%
F2027	1,487.58	364.56	245.07	1.04%	2.59%	1.54%	309.22	55.34	18%
2028	1,504.40	374.02	248.62	1.13%	2.59%	1.45%	314.37	59.65	19%
2029	1,520.94	383.85	252.38	1.10%	2.63%	1.51%	319.81	64.04	20%
F2030	1,537.18	394.00	256.31	1.07%	2.64%	1.56%	325.44	68.56	21%
F2031	1,553.18	404.42	260.38	1.04%	2.64%	1.59%	331.18	73.24	22%
2032	1,568.82	415.11	264.60	1.01%	2.64%	1.62%	337.01	78.10	23%
F2033	1,585.35	427.52	269.67	1.05%	2.99%	1.92%	342.74	84.79	25%
F2034	1,601.50	440.30	274.93	1.02%	2.99%	1.95%	348.56	91.75	26%
F2035	1,617.30	453.47	280.38	0.99%	2.99%	1.98%	354.48	98.99	28%
F2036	1,632.74	467.03	286.04	0.95%	2.99%	2.02%	360.50	106.53	30%
F2037	1,647.74	480.99	291.91	0.92%	2.99%	2.05%	366.62	114.36	31%
F2038	1,662.41	495.37	297.98	0.89%	2.99%	2.08%	372.85	122.52	33%
F2039	1,676.71	510.18	304.27	0.86%	2.99%	2.11%	379.19	130.99	35%
F2040	1,690.56	525.43	310.80	0.83%	2.99%	2.15%	385.63	139.81	36%
F2041	1,704.01	541.14	317.57	0.80%	2.99%	2.18%	392.18	148.96	38%
F2042	1,717.08	557.32	324.58	0.77%	2.99%	2.21%	398.84	158.48	40%
F2043	1,729.78	573.99	331.83	0.74%	2.99%	2.23%	405.62	168.37	42%
F2044	1,742.08	591.15	339.34	0.71%	2.99%	2.26%	412.51	178.64	43%

Foodgrains (continued)

Year	Population (million)	Foodgrains (in million tonnes)	Foodgrains Per Capita (in kg)	Population Growth Rate	Foodgrains Growth Rate	Foodgrains Per Capita Growth Rate	Demand (Niti Aayog Report) Foodgrains (in million tonnes)	Surplus/ Deficit Foodgrains (in million tonnes)	Surplus/ Deficit Percentage Cereals
F2045	1,754.04	608.82	347.10	0.69%	2.99%	2.29%	419.51	189.31	45%
F2046	1,765.77	627.02	355.10	0.67%	2.99%	2.31%	426.64	200.38	47%
F2047	1,777.23	645.77	363.36	0.65%	2.99%	2.33%	433.89	211.88	49%
F2048	1,788.50	665.08	371.86	0.63%	2.99%	2.34%	441.26	223.82	51%
F2049	1,799.68	684.96	380.60	0.63%	2.99%	2.35%	448.76	236.21	53%
F2050	1,810.71	705.44	389.59	0.61%	2.99%	2.36%	456.38	249.06	55%

Foodgrains (5% lower)

Year	Population (million)	Population Growth Rate	Foodgrains [5% lower] (in million tonnes)	Foodgrains Per Capita [5% lower] (in kg)	Foodgrains Growth Rate [5% lower]	Foodgrains Per Capita Growth Rate [5% lower]	Surplus/ Deficit Foodgrains (in million tonnes)	Surplus/ Deficit Percentage Cereals
2015	1,315.10	–	238.99	181.73	–	–	–	–
2016	1,330.63	1.18%	261.89	196.81	9.58%	8.30%	4.50	2%
2017	1,346.64	1.20%	268.52	199.40	2.53%	1.31%	6.75	3%
F2018	1,361.75	1.12%	275.36	202.21	2.55%	1.41%	9.14	3%
F2019	1,376.26	1.07%	282.37	205.18	2.55%	1.47%	11.62	4%
2020	1,389.97	1.00%	289.57	208.33	2.55%	1.54%	14.21	5%
2021	1,402.81	0.92%	296.99	211.71	2.56%	1.62%	16.96	6%
F2022	1,412.32	0.68%	304.70	215.74	2.59%	1.90%	20.00	7%
F2023	1,424.83	0.89%	312.60	219.40	2.59%	1.69%	23.16	8%
F2024	1,440.84	1.12%	320.71	222.59	2.59%	1.45%	26.45	9%
F2025	1,456.64	1.10%	329.04	225.89	2.59%	1.48%	29.87	10%
F2026	1,472.27	1.07%	337.57	229.29	2.59%	1.51%	33.42	11%
F2027	1,487.58	1.04%	346.33	232.82	2.59%	1.54%	37.11	12%
2028	1,504.40	1.13%	355.32	236.19	2.59%	1.45%	40.95	13%
2029	1,520.94	1.10%	364.66	239.76	2.63%	1.51%	44.85	14%

Foodgrains (5% lower) (continued)

Year	Population (million)	Population Growth Rate	Foodgrains [5% lower] (in million tonnes)	Foodgrains Per Capita [5% lower] (in kg)	Foodgrains Growth Rate [5% lower]	Foodgrains Per Capita Growth Rate [5% lower]	Surplus/ Deficit Foodgrains (in million tonnes)	Surplus/ Deficit Percentage Cereals
F2030	1,537.18	1.07%	374.30	243.50	2.64%	1.56%	48.86	15%
F2031	1,553.18	1.04%	384.20	247.36	2.64%	1.59%	53.02	16%
2032	1,568.82	1.01%	394.35	251.37	2.64%	1.62%	57.34	17%
F2033	1,585.35	1.05%	406.15	256.19	2.99%	1.92%	63.41	19%
F2034	1,601.50	1.02%	418.29	261.19	2.99%	1.95%	69.73	20%
F2035	1,617.30	0.99%	430.79	266.37	2.99%	1.98%	76.32	22%
F2036	1,632.74	0.95%	443.67	271.74	2.99%	2.02%	83.17	23%
F2037	1,647.74	0.92%	456.94	277.31	2.99%	2.05%	90.32	25%
F2038	1,662.41	0.89%	470.60	283.08	2.99%	2.08%	97.75	26%
F2039	1,676.71	0.86%	484.67	289.06	2.99%	2.11%	105.49	28%
F2040	1,690.56	0.83%	499.16	295.26	2.99%	2.15%	113.53	29%
F2041	1,704.01	0.80%	514.09	301.69	2.99%	2.18%	121.91	31%
F2042	1,717.08	0.77%	529.46	308.35	2.99%	2.21%	130.62	33%
F2043	1,729.78	0.74%	545.29	315.23	2.99%	2.23%	139.67	34%
F2044	1,742.08	0.71%	561.59	322.37	2.99%	2.26%	149.08	36%
F2045	1,754.04	0.69%	578.38	329.74	2.99%	2.29%	158.87	38%
F2046	1,765.77	0.67%	595.67	337.35	2.99%	2.31%	169.03	40%
F2047	1,777.23	0.65%	613.48	345.19	2.99%	2.33%	179.59	41%
F2048	1,788.50	0.63%	631.82	353.27	2.99%	2.34%	190.57	43%
F2049	1,799.68	0.63%	650.72	361.57	2.99%	2.35%	201.96	45%
F2050	1,810.71	0.61%	670.17	370.11	2.99%	2.36%	213.79	47%

Vegetables

Year	Population (million)	Vegetables (in million tonnes)	Vegetables Per Capita (in kg)	Population Growth Rate	Vegetables Growth Rate	Vegetables Per Capita Growth Rate	Demand (Niti Aayog Report) Vegetables (in million tonnes)	Surplus/ Deficit Vegetables (in million tonnes)	Surplus/ Deficit Percentage Cereals
2015	1,315.10	169.06	128.55	–	–	–	–	–	–
2016	1,330.63	176.18	132.40	1.18%	4.21%	3.00%	182.35	-6.17	-3%
2017	1,346.64	184.40	136.93	1.20%	4.67%	3.42%	189.98	-5.58	-3%
F2018	1,361.75	193.00	141.73	1.12%	4.67%	3.50%	197.92	-4.92	-2%
F2019	1,376.26	202.01	146.78	1.07%	4.67%	3.56%	206.20	-4.19	-2%
2020	1,389.97	211.43	152.11	1.00%	4.67%	3.63%	214.82	-3.39	-2%
2021	1,402.81	221.29	157.75	0.92%	4.66%	3.71%	224.27	-2.98	-1%
F2022	1,412.32	231.61	164.00	0.68%	4.67%	3.96%	234.11	-2.50	-1%
F2023	1,424.83	242.42	170.14	0.89%	4.67%	3.75%	244.39	-1.97	-1%
F2024	1,440.84	253.73	176.10	1.12%	4.67%	3.50%	255.11	-1.38	-1%
F2025	1,456.64	265.57	182.32	1.10%	4.67%	3.53%	266.31	-0.74	0%
F2026	1,472.27	277.96	188.80	1.07%	4.67%	3.55%	277.99	-0.04	0%
F2027	1,487.58	290.93	195.57	1.04%	4.67%	3.59%	290.19	0.73	0%
2028	1,504.40	304.50	202.41	1.13%	4.67%	3.50%	302.93	1.57	1%
2029	1,520.94	318.71	209.55	1.10%	4.67%	3.53%	316.33	2.38	1%
F2030	1,537.18	333.58	217.01	1.07%	4.67%	3.56%	330.50	03.08	1%
F2031	1,553.18	349.14	224.79	1.04%	4.67%	3.59%	345.30	3.84	1%
2032	1,568.82	365.43	232.93	1.01%	4.67%	3.62%	360.77	4.66	1%
F2033	1,585.35	382.38	241.20	1.05%	4.64%	3.55%	376.49	5.89	2%
F2034	1,601.50	400.12	249.84	1.02%	4.64%	3.58%	392.89	7.23	2%
F2035	1,617.30	418.68	258.87	0.99%	4.64%	3.62%	410.01	8.67	2%
F2036	1,632.74	438.10	268.32	0.95%	4.64%	3.65%	427.87	10.23	2%
F2037	1,647.74	458.42	278.21	0.92%	4.64%	3.69%	446.51	11.91	3%
F2038	1,662.41	479.68	288.55	0.89%	4.64%	3.72%	465.96	13.72	3%
F2039	1,676.71	501.94	299.36	0.86%	4.64%	3.75%	486.26	15.67	3%
F2040	1,690.56	525.22	310.68	0.83%	4.64%	3.78%	507.45	17.77	4%
F2041	1,704.01	549.58	322.52	0.80%	4.64%	3.81%	529.56	20.02	4%
F2042	1,717.08	575.07	334.91	0.77%	4.64%	3.84%	552.63	22.45	4%
F2043	1,729.78	601.75	347.88	0.74%	4.64%	3.87%	576.70	25.04	4%

Vegetables (continued)

Year	Population (million)	Vegetables (in million tonnes)	Vegetables Per Capita (in kg)	Population Growth Rate	Vegetables Growth Rate	Vegetables Per Capita Growth Rate	Demand (Niti Aayog Report) Vegetables (in million tonnes)	Surplus/ Deficit Vegetables (in million tonnes)	Surplus/ Deficit Percentage Cereals
F2044	1,742.08	629.66	361.44	0.71%	4.64%	3.90%	601.83	27.83	5%
F2045	1,754.04	658.87	375.63	0.69%	4.64%	3.92%	628.05	30.82	5%
F2046	1,765.77	689.43	390.44	0.67%	4.64%	3.94%	655.41	34.02	5%
F2047	1,777.23	721.41	405.92	0.65%	4.64%	3.96%	683.97	37.45	5%
F2048	1,788.50	754.88	422.07	0.63%	4.64%	3.98%	713.76	41.11	6%
F2049	1,799.68	789.89	438.91	0.63%	4.64%	3.99%	744.86	45.03	6%
F2050	1,810.71	826.53	456.47	0.61%	4.64%	4.00%	777.31	49.22	6%

Vegetables (5% lower)

Year	Population (million)	Population Growth Rate	Vegetables [5% lower] (in million tonnes)	Vegetables Per Capita [5% lower] (in kg)	Vegetables Growth Rate [5% lower]	Vegetables Per Capita Growth Rate [5% lower]	Surplus/ Deficit Vegetables (in million tonnes)	Surplus/ Deficit Percentage Vegetables
2015	1,315.1	–	160.61	122.13	–	–	–	–
2016	1,330.63	1.18%	167.37	125.78	4.21%	3.00%	-14.98	-8%
2017	1,346.64	1.20%	175.18	130.09	4.67%	3.42%	-14.8	-8%
F2018	1,361.75	1.12%	183.35	134.64	4.67%	3.50%	-14.57	-7%
F2019	1,376.26	1.07%	191.91	139.44	4.67%	3.56%	-14.29	-7%
2020	1,389.97	1.00%	200.86	144.51	4.67%	3.63%	-13.96	-6%
2021	1,402.81	0.92%	210.23	149.86	4.66%	3.71%	-14.04	-6%
F2022	1,412.32	0.68%	220.03	155.8	4.67%	3.96%	-14.08	-6%
F2023	1,424.83	0.89%	230.3	161.63	4.67%	3.75%	-14.09	-6%
F2024	1,440.84	1.12%	241.04	167.29	4.67%	3.50%	-14.07	-6%
F2025	1,456.64	1.10%	252.29	173.2	4.67%	3.53%	-14.02	-5%
F2026	1,472.27	1.07%	264.06	179.36	4.67%	3.55%	-13.93	-5%
F2027	1,487.58	1.04%	276.38	185.79	4.67%	3.59%	-13.81	-5%
2028	1,504.4	1.13%	289.28	192.29	4.67%	3.50%	-13.66	-5%

Vegetables (5% lower) (continued)

Year	Population (million)	Population Growth Rate	Vegetables [5% lower] (in million tonnes)	Vegetables Per Capita [5% lower] (in kg)	Vegetables Growth Rate [5% lower]	Vegetables Per Capita Growth Rate [5% lower]	Surplus/ Deficit Vegetables (in million tonnes)	Surplus/ Deficit Percentage Vegetables
2029	1,520.94	1.10%	302.77	199.07	4.67%	3.53%	-13.56	-4%
F2030	1,537.18	1.07%	316.9	206.16	4.67%	3.56%	-13.6	-4%
F2031	1,553.18	1.04%	331.68	213.55	4.67%	3.59%	-13.62	-4%
2032	1,568.82	1.01%	347.16	221.29	4.67%	3.62%	-13.61	-4%
F2033	1,585.35	1.05%	363.26	229.14	4.64%	3.55%	-13.23	-4%
F2034	1,601.5	1.02%	380.11	237.35	4.64%	3.58%	-12.78	-3%
F2035	1,617.3	0.99%	397.74	245.93	4.64%	3.62%	-12.26	-3%
F2036	1,632.74	0.95%	416.19	254.91	4.64%	3.65%	-11.68	-3%
F2037	1,647.74	0.92%	435.5	264.3	4.64%	3.69%	-11.01	-2%
F2038	1,662.41	0.89%	455.7	274.12	4.64%	3.72%	-10.26	-2%
F2039	1,676.71	0.86%	476.84	284.39	4.64%	3.75%	-9.43	-2%
F2040	1,690.56	0.83%	498.96	295.14	4.64%	3.78%	-8.49	-2%
F2041	1,704.01	0.80%	522.1	306.4	4.64%	3.81%	-7.46	-1%
F2042	1,717.08	0.77%	546.32	318.17	4.64%	3.84%	-6.31	-1%
F2043	1,729.78	0.74%	571.66	330.48	4.64%	3.87%	-5.04	-1%
F2044	1,742.08	0.71%	598.18	343.37	4.64%	3.90%	-3.65	-1%
F2045	1,754.04	0.69%	625.93	356.85	4.64%	3.92%	-2.12	0%
F2046	1,765.77	0.67%	654.96	370.92	4.64%	3.94%	-0.45	0%
F2047	1,777.23	0.65%	685.34	385.62	4.64%	3.96%	1.38	0%
F2048	1,788.5	0.63%	717.13	400.97	4.64%	3.98%	3.37	0%
F2049	1,799.68	0.63%	750.4	416.96	4.64%	3.99%	5.54	1%
F2050	1,810.71	0.61%	785.21	433.64	4.64%	4.00%	7.89	1%

Milk

Year	Population (million)	Milk (in million tonnes)	Milk Per Capita (in kg)	Population Growth Rate	Milk Growth Rate	Milk Per Capita Growth Rate	Demand (Niti Aayog Report) Milk (in million tonnes)	Surplus/ Deficit Milk (in million tonnes)	Surplus/ Deficit Percentage Cereals
2015	1,315.10	155.50	118.24	–	–	–	–	–	–
2016	1,330.63	162.60	122.20	1.18%	4.57%	3.35%	147.54	15.06	10%
2017	1,346.64	170.10	126.31	1.20%	4.61%	3.37%	153.81	16.29	11%
F2018	1,361.75	177.90	130.64	1.12%	4.59%	3.43%	160.34	17.56	11%
F2019	1,376.26	186.06	135.20	1.07%	4.59%	3.48%	167.16	18.91	11%
2020	1,389.97	194.60	140.00	1.00%	4.59%	3.56%	174.26	20.34	12%
2021	1,402.81	203.50	145.07	0.92%	4.57%	3.62%	181.93	21.57	12%
F2022	1,412.32	212.83	150.69	0.68%	4.58%	3.88%	189.90	22.93	12%
F2023	1,424.83	222.59	156.22	0.89%	4.58%	3.67%	198.22	24.37	12%
F2024	1,440.84	232.79	161.56	1.12%	4.58%	3.42%	206.90	25.89	13%
F2025	1,456.64	243.46	167.14	1.10%	4.58%	3.45%	215.97	27.49	13%
F2026	1,472.27	254.62	172.94	1.07%	4.58%	3.47%	225.43	29.19	13%
F2027	1,487.58	266.29	179.01	1.04%	4.58%	3.51%	235.30	30.99	13%
2028	1,504.40	278.50	185.12	1.13%	4.58%	3.41%	245.61	32.89	13%
2029	1,520.94	291.30	191.53	1.10%	4.60%	3.46%	256.43	34.87	14%
F2030	1,537.18	304.65	198.18	1.07%	4.58%	3.48%	267.82	36.82	14%
F2031	1,553.18	318.60	205.13	1.04%	4.58%	3.50%	279.72	38.88	14%
2032	1,568.82	333.20	212.39	1.01%	4.58%	3.54%	292.15	41.05	14%
F2033	1,585.35	348.48	219.81	1.05%	4.58%	3.49%	304.89	43.58	14%
F2034	1,601.50	364.45	227.57	1.02%	4.58%	3.53%	318.19	46.26	15%
F2035	1,617.30	381.16	235.68	0.99%	4.58%	3.56%	332.08	49.09	15%
F2036	1,632.74	398.64	244.15	0.95%	4.58%	3.60%	346.56	52.08	15%
F2037	1,647.74	416.92	253.02	0.92%	4.58%	3.63%	361.68	55.24	15%
F2038	1,662.41	436.03	262.29	0.89%	4.58%	3.66%	377.46	58.58	16%
F2039	1,676.71	456.02	271.98	0.86%	4.58%	3.69%	393.92	62.10	16%
F2040	1,690.56	476.93	282.12	0.83%	4.58%	3.73%	411.11	65.83	16%
F2041	1,704.01	498.80	292.72	0.80%	4.58%	3.76%	429.04	69.76	16%
F2042	1,717.08	521.67	303.81	0.77%	4.58%	3.79%	447.76	73.91	17%
F2043	1,729.78	545.59	315.41	0.74%	4.58%	3.82%	467.29	78.30	17%

Milk (continued)

Year	Population (million)	Milk (in million tonnes)	Milk Per Capita (in kg)	Population Growth Rate	Milk Growth Rate	Milk Per Capita Growth Rate	Demand (Niti Aayog Report) Milk (in million tonnes)	Surplus/ Deficit Milk (in million tonnes)	Surplus/ Deficit Percentage Cereals
F2044	1,742.08	570.60	327.54	0.71%	4.58%	3.85%	487.67	82.93	17%
F2045	1,754.04	596.76	340.22	0.69%	4.58%	3.87%	508.95	87.82	17%
F2046	1,765.77	624.13	353.46	0.67%	4.58%	3.89%	531.15	92.98	18%
F2047	1,777.23	652.74	367.28	0.65%	4.58%	3.91%	554.32	98.42	18%
F2048	1,788.50	682.67	381.70	0.63%	4.58%	3.93%	578.50	104.17	18%
F2049	1,799.68	713.97	396.72	0.63%	4.58%	3.93%	603.73	110.24	18%
F2050	1,810.71	746.70	412.38	0.61%	4.58%	3.95%	630.07	116.63	19%

Milk (5% lower)

Year	Population (million)	Population Growth Rate	Milk [5% lower] (in million tonnes)	Milk Per Capita [5% lower] (in kg)	Milk Growth Rate [5% lower]	Milk Per Capita Growth Rate [5% lower]	Surplus/ Deficit Milk (in million tonnes)	Surplus/ Deficit Percentage Milk
2015	1,315.10	–	147.73	112.33	–	–	–	–
2016	1,330.63	1.18%	154.47	116.09	4.57%	3.35%	6.93	5%
2017	1,346.64	1.20%	161.60	120.00	4.61%	3.37%	7.79	5%
F2018	1,361.75	1.12%	169.01	124.11	4.59%	3.43%	8.66	5%
F2019	1,376.26	1.07%	176.76	128.44	4.59%	3.48%	9.60	6%
2020	1,389.97	1.00%	184.87	133.00	4.59%	3.56%	10.61	6%
2021	1,402.81	0.92%	193.33	137.81	4.57%	3.62%	11.40	6%
F2022	1,412.32	0.68%	202.19	143.16	4.58%	3.88%	12.29	6%
F2023	1,424.83	0.89%	211.46	148.41	4.58%	3.67%	13.24	7%
F2024	1,440.84	1.12%	221.15	153.49	4.58%	3.42%	14.25	7%
F2025	1,456.64	1.10%	231.29	158.78	4.58%	3.45%	15.32	7%
F2026	1,472.27	1.07%	241.89	164.30	4.58%	3.47%	16.46	7%
F2027	1,487.58	1.04%	252.98	170.06	4.58%	3.51%	17.68	8%
2028	1,504.40	1.13%	264.58	175.87	4.58%	3.41%	18.97	8%

Milk (5% lower) (continued)

Year	Population (million)	Population Growth Rate	Mils [5% lower] (in million tonnes)	Milk Per Capita [5% lower] (in kg)	Mailk Growth Rate [5% lower]	Milk Per Capita Growth Rate [5% lower]	Surplus/ Deficit Milk (in million tonnes)	Surplus/ Deficit Percentage Milk
2029	1,520.94	1.10%	276.74	181.95	4.60%	3.46%	20.31	8%
F2030	1,537.18	1.07%	289.41	188.28	4.58%	3.48%	21.59	8%
F2031	1,553.18	1.04%	302.67	194.87	4.58%	3.50%	22.95	8%
2032	1,568.82	1.01%	316.54	201.77	4.58%	3.54%	24.39	8%
F2033	1,585.35	1.05%	331.05	208.82	4.58%	3.49%	26.16	9%
F2034	1,601.50	1.02%	346.23	216.19	4.58%	3.53%	28.04	9%
F2035	1,617.30	0.99%	362.11	223.89	4.58%	3.56%	30.03	9%
F2036	1,632.74	0.95%	378.71	231.95	4.58%	3.60%	32.15	9%
F2037	1,647.74	0.92%	396.07	240.37	4.58%	3.63%	34.39	10%
F2038	1,662.41	0.89%	414.23	249.18	4.58%	3.66%	36.78	10%
F2039	1,676.71	0.86%	433.22	258.38	4.58%	3.69%	39.30	10%
F2040	1,690.56	0.83%	453.09	268.01	4.58%	3.73%	41.98	10%
F2041	1,704.01	0.80%	473.86	278.09	4.58%	3.76%	44.82	10%
F2042	1,717.08	0.77%	495.59	288.62	4.58%	3.79%	47.83	11%
F2043	1,729.78	0.74%	518.31	299.64	4.58%	3.82%	51.02	11%
F2044	1,742.08	0.71%	542.07	311.17	4.58%	3.85%	54.40	11%
F2045	1,754.04	0.69%	566.93	323.21	4.58%	3.87%	57.98	11%
F2046	1,765.77	0.67%	592.92	335.79	4.58%	3.89%	61.77	12%
F2047	1,777.23	0.65%	620.10	348.92	4.58%	3.91%	65.79	12%
F2048	1,788.50	0.63%	648.54	362.62	4.58%	3.93%	70.04	12%
F2049	1,799.68	0.63%	678.27	376.88	4.58%	3.93%	74.54	12%
F2050	1,810.71	0.61%	709.37	391.76	4.58%	3.95%	79.30	13%

Cereals

Year	Population (million)	Cereals (in million tonnes)	Cereals Per Capita (in kg)	Population Growth Rate	Cereals Growth Rate	Cereals Per Capita Growth Rate	Demand (Niti Aayog Report) Cereals (in million tonnes)	Surplus/ Deficit Cereals (in million tonnes)	Surplus/ Deficit Percentage Cereals
2015	1,315.10	235.22	178.86	–	–	–	–	–	–
2016	1,330.63	252.72	189.93	1.18%	7.44%	6.19%	233.79	18.93	8%
2017	1,346.64	258.85	192.22	1.20%	2.43%	1.21%	237.58	21.27	9%
F2018	1,361.75	265.16	194.72	1.12%	2.44%	1.30%	241.43	23.74	10%
F2019	1,376.26	271.63	197.37	1.07%	2.44%	1.36%	245.34	26.29	11%
2020	1,389.97	278.25	200.18	1.00%	2.44%	1.43%	249.31	28.94	12%
2021	1,402.81	285.07	203.21	0.92%	2.45%	1.51%	253.31	31.76	13%
F2022	1,412.32	292.13	206.84	0.68%	2.48%	1.79%	257.29	34.83	14%
F2023	1,424.83	299.36	210.10	0.89%	2.48%	1.58%	261.34	38.02	15%
F2024	1,440.84	306.77	212.91	1.12%	2.48%	1.34%	265.45	41.32	16%
F2025	1,456.64	314.36	215.81	1.10%	2.48%	1.36%	269.63	44.74	17%
F2026	1,472.27	322.14	218.81	1.07%	2.48%	1.39%	273.87	48.28	18%
F2027	1,487.58	330.12	221.92	1.04%	2.48%	1.42%	278.17	51.94	19%
2028	1,504.40	338.29	224.87	1.13%	2.48%	1.33%	282.55	55.74	20%
2029	1,520.94	346.75	227.98	1.10%	2.50%	1.39%	287.18	59.57	21%
F2030	1,537.18	355.47	231.24	1.07%	2.51%	1.43%	291.97	63.50	22%
F2031	1,553.18	364.40	234.62	1.04%	2.51%	1.46%	296.83	67.57	23%
2032	1,568.82	373.56	238.12	1.01%	2.51%	1.49%	301.78	71.78	24%
F2033	1,585.35	383.86	242.13	1.05%	2.76%	1.69%	306.63	77.23	25%
F2034	1,601.50	394.45	246.30	1.02%	2.76%	1.72%	311.56	82.89	27%
F2035	1,617.30	405.33	250.62	0.99%	2.76%	1.75%	316.58	88.76	28%
F2036	1,632.74	416.51	255.10	0.95%	2.76%	1.79%	321.67	94.85	29%
F2037	1,647.74	428.00	259.75	0.92%	2.76%	1.82%	326.84	101.16	31%
F2038	1,662.41	439.81	264.56	0.89%	2.76%	1.85%	332.10	107.71	32%
F2039	1,676.71	451.94	269.54	0.86%	2.76%	1.88%	337.44	114.50	34%
F2040	1,690.56	464.40	274.70	0.83%	2.76%	1.92%	342.86	121.54	35%
F2041	1,704.01	477.21	280.05	0.80%	2.76%	1.95%	348.38	128.83	37%
F2042	1,717.08	490.38	285.59	0.77%	2.76%	1.98%	353.98	136.39	39%
F2043	1,729.78	503.90	291.31	0.74%	2.76%	2.00%	359.67	144.23	40%

Cereals (continued)

Year	Population (million)	Cereals (in million tonnes)	Cereals Per Capita (in kg)	Population Growth Rate	Cereals Growth Rate	Cereals Per Capita Growth Rate	Demand (Niti Aayog Report) Cereals (in million tonnes)	Surplus/ Deficit Cereals (in million tonnes)	Surplus/ Deficit Percentage Cereals
F2044	1,742.08	517.80	297.23	0.71%	2.76%	2.03%	365.46	152.34	42%
F2045	1,754.04	532.08	303.35	0.69%	2.76%	2.06%	371.34	160.75	43%
F2046	1,765.77	546.76	309.64	0.67%	2.76%	2.08%	377.31	169.45	45%
F2047	1,777.23	561.84	316.13	0.65%	2.76%	2.10%	383.38	178.46	47%
F2048	1,788.50	577.34	322.81	0.63%	2.76%	2.11%	389.54	187.79	48%
F2049	1,799.68	593.26	329.65	0.63%	2.76%	2.12%	395.81	197.45	50%
F2050	1,810.71	609.63	336.68	0.61%	2.76%	2.13%	402.17	207.45	52%

Cereals (5% lower)

Year	Population (million)	Population Growth Rate	Cereals [5% lower] (in million tonnes)	Cereals Per Capita [5% lower] (in kg)	Cereals Growth Rate [5% lower]	Cereals Per Capita Growth Rate [5% lower]	Surplus/ Deficit Cereals [5% lower] (in million tonnes)	Surplus/ Deficit Percentage Cereals [5% lower]
2015	1,315.10	–	223.46	169.92	–	–	–	–
2016	1,330.63	1.18%	240.08	180.43	7.44%	6.19%	6.29	3%
2017	1,346.64	1.20%	245.91	182.61	2.43%	1.21%	8.33	4%
F2018	1,361.75	1.12%	251.90	184.99	2.44%	1.30%	10.48	4%
F2019	1,376.26	1.07%	258.05	187.50	2.44%	1.36%	12.71	5%
2020	1,389.97	1.00%	264.34	190.18	2.44%	1.43%	15.03	6%
2021	1,402.81	0.92%	270.82	193.05	2.45%	1.51%	17.51	7%
F2022	1,412.32	0.68%	277.52	196.50	2.48%	1.79%	20.23	8%
F2023	1,424.83	0.89%	284.39	199.60	2.48%	1.58%	23.05	9%
F2024	1,440.84	1.12%	291.43	202.26	2.48%	1.34%	25.98	10%
F2025	1,456.64	1.10%	298.64	205.02	2.48%	1.36%	29.02	11%
F2026	1,472.27	1.07%	306.04	207.87	2.48%	1.39%	32.17	12%
F2027	1,487.58	1.04%	313.61	210.82	2.48%	1.42%	35.44	13%
2028	1,504.40	1.13%	321.38	213.62	2.48%	1.33%	38.83	14%

Cereals (5% lower) (continued)

Year	Population (million)	Population Growth Rate	Cereals [5% lower] (in million tonnes)	Cereals Per Capita [5% lower] (in kg)	Cereals Growth Rate [5% lower]	Cereals Per Capita Growth Rate [5% lower]	Surplus/ Deficit Cereals [5% lower] (in million tonnes)	Surplus/ Deficit Percentage Cereals [5% lower]
2029	1,520.94	1.10%	329.41	216.59	2.50%	1.39%	42.23	15%
F2030	1,537.18	1.07%	337.69	219.68	2.51%	1.43%	45.73	16%
F2031	1,553.18	1.04%	346.18	222.88	2.51%	1.46%	49.35	17%
2032	1,568.82	1.01%	354.88	226.21	2.51%	1.49%	53.10	18%
F2033	1,585.35	1.05%	364.67	230.03	2.76%	1.69%	58.04	19%
F2034	1,601.50	1.02%	374.73	233.99	2.76%	1.72%	63.16	20%
F2035	1,617.30	0.99%	385.07	238.09	2.76%	1.75%	68.49	22%
F2036	1,632.74	0.95%	395.69	242.35	2.76%	1.79%	74.02	23%
F2037	1,647.74	0.92%	406.60	246.76	2.76%	1.82%	79.76	24%
F2038	1,662.41	0.89%	417.82	251.33	2.76%	1.85%	85.72	26%
F2039	1,676.71	0.86%	429.34	256.06	2.76%	1.88%	91.90	27%
F2040	1,690.56	0.83%	441.18	260.97	2.76%	1.92%	98.32	29%
F2041	1,704.01	0.80%	453.35	266.05	2.76%	1.95%	104.97	30%
F2042	1,717.08	0.77%	465.86	271.31	2.76%	1.98%	111.87	32%
F2043	1,729.78	0.74%	478.71	276.74	2.76%	2.00%	119.03	33%
F2044	1,742.08	0.71%	491.91	282.37	2.76%	2.03%	126.45	35%
F2045	1,754.04	0.69%	505.48	288.18	2.76%	2.06%	134.14	36%
F2046	1,765.77	0.67%	519.42	294.16	2.76%	2.08%	142.11	38%
F2047	1,777.23	0.65%	533.75	300.33	2.76%	2.10%	150.37	39%
F2048	1,788.50	0.63%	548.47	306.67	2.76%	2.11%	158.93	41%
F2049	1,799.68	0.63%	563.60	313.17	2.76%	2.12%	167.79	42%
F2050	1,810.71	0.61%	579.14	319.84	2.76%	2.13%	176.97	44%

Pulses

Year	Population (million)	Pulses (in million tonnes)	Pulses Per Capita (in kg)	Population Growth Rate	Pulses Growth Rate	Pulses Per Capita Growth Rate	Demand (Niti Aayog Report) Pulses (in million tonnes)	Surplus/ Deficit Pulses (in million tonnes)	Surplus/ Deficit Percentage Cereals
2015	1,315.10	16.35	12.43	–	–	–	–	–	–
2016	1,330.63	22.95	17.25	1.18%	40.37%	38.73%	23.61	-0.66	-3%
2017	1,346.64	23.80	17.67	1.20%	3.70%	2.47%	24.20	-0.40	-2%
F2018	1,361.75	24.68	18.13	1.12%	3.71%	2.56%	24.80	-0.12	0%
F2019	1,376.26	25.60	18.60	1.07%	3.71%	2.62%	25.42	0.18	1%
2020	1,389.97	26.55	19.10	1.00%	3.71%	2.69%	26.05	0.50	2%
2021	1,402.81	27.55	19.64	0.92%	3.77%	2.82%	26.72	0.83	3%
F2022	1,412.32	28.59	20.25	0.68%	3.78%	3.08%	27.40	1.20	4%
F2023	1,424.83	29.67	20.83	0.89%	3.78%	2.87%	28.09	1.58	6%
F2024	1,440.84	30.80	21.37	1.12%	3.78%	2.63%	28.80	2.00	7%
F2025	1,456.64	31.96	21.94	1.10%	3.78%	2.66%	29.53	2.43	8%
F2026	1,472.27	33.17	22.53	1.07%	3.78%	2.68%	30.28	2.89	10%
F2027	1,487.58	34.43	23.14	1.04%	3.78%	2.72%	31.04	3.38	11%
2028	1,504.40	35.73	23.75	1.13%	3.78%	2.62%	31.83	3.90	12%
2029	1,520.94	37.10	24.39	1.10%	3.83%	2.71%	32.64	4.46	14%
F2030	1,537.18	38.53	25.06	1.07%	3.85%	2.75%	33.48	05.05	15%
F2031	1,553.18	40.01	25.76	1.04%	3.85%	2.78%	34.34	5.67	16%
2032	1,568.82	41.55	26.48	1.01%	3.85%	2.81%	35.23	6.32	18%
F2033	1,585.35	43.89	27.69	1.05%	5.64%	4.54%	36.12	7.77	22%
F2034	1,601.50	46.37	28.95	1.02%	5.64%	4.57%	37.04	9.33	25%
F2035	1,617.30	48.98	30.29	0.99%	5.64%	4.61%	37.98	11.01	29%
F2036	1,632.74	51.75	31.69	0.95%	5.64%	4.64%	38.94	12.81	33%
F2037	1,647.74	54.66	33.18	0.92%	5.64%	4.68%	39.92	14.74	37%
F2038	1,662.41	57.75	34.74	0.89%	5.64%	4.71%	40.93	16.81	41%
F2039	1,676.71	61.00	36.38	0.86%	5.64%	4.74%	41.97	19.03	45%
F2040	1,690.56	64.44	38.12	0.83%	5.64%	4.77%	43.03	21.41	50%
F2041	1,704.01	68.08	39.95	0.80%	5.64%	4.81%	44.12	23.95	54%
F2042	1,717.08	71.92	41.88	0.77%	5.64%	4.84%	45.24	26.68	59%
F2043	1,729.78	75.97	43.92	0.74%	5.64%	4.86%	46.39	29.59	64%

Pulses (continued)

Year	Population (million)	Pulses (in million tonnes)	Pulses Per Capita (in kg)	Population Growth Rate	Pulses Growth Rate	Pulses Per Capita Growth Rate	Demand (Niti Aayog Report) Pulses (in million tonnes)	Surplus/ Deficit Pulses (in million tonnes)	Surplus/ Deficit Percentage Cereals
F2044	1,742.08	80.26	46.07	0.71%	5.64%	4.89%	47.56	32.69	69%
F2045	1,754.04	84.78	48.34	0.69%	5.64%	4.92%	48.77	36.02	74%
F2046	1,765.77	89.57	50.72	0.67%	5.64%	4.94%	50.00	39.56	79%
F2047	1,777.23	94.62	53.24	0.65%	5.64%	4.96%	51.27	43.35	85%
F2048	1,788.50	99.95	55.89	0.63%	5.64%	4.97%	52.57	47.38	90%
F2049	1,799.68	105.59	58.67	0.63%	5.64%	4.98%	53.90	51.69	96%
F2050	1,810.71	111.55	61.60	0.61%	5.64%	5.00%	55.27	56.28	102%

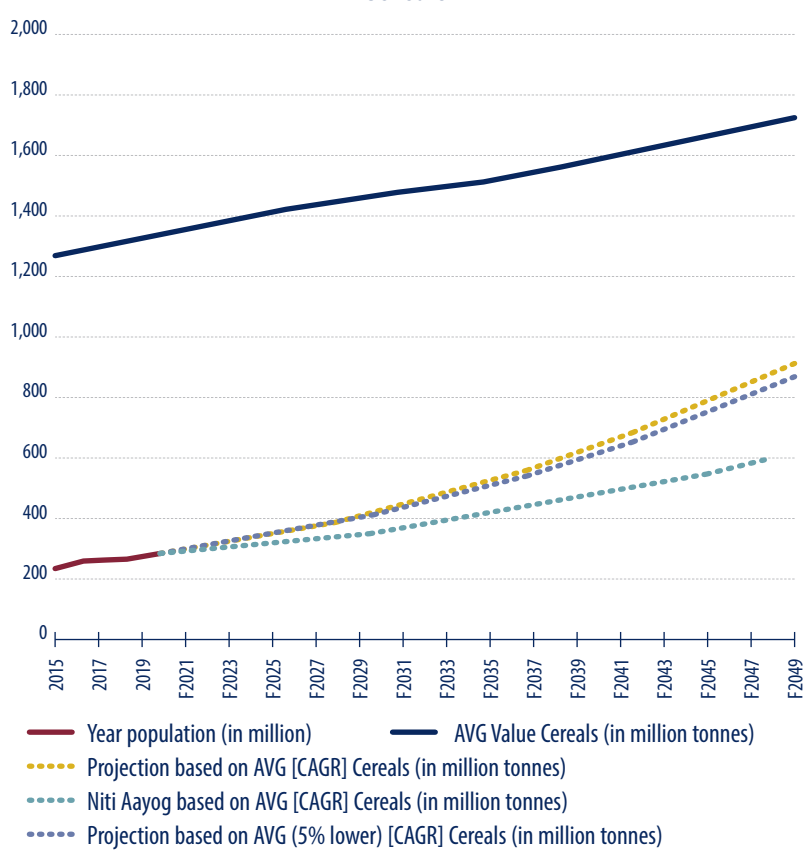
Pulses (5% lower)

Year	Population (million)	Population Growth Rate	Pulses [5% lower] (in million tonnes)	Pulses Per Capita [5% lower] (in kg)	Pulses Growth Rate [5% lower]	Pulses Per Capita Growth Rate [5% lower]	Surplus/ Deficit Pulses [5% lower] (in million tonnes)	Surplus/ Deficit Percentage Pulses [5% lower]
2015	1,315.10	–	15.53	11.81	–	–	–	–
2016	1,330.63	1.18%	21.80	16.39	40.37%	38.73%	-1.81	-8%
2017	1,346.64	1.20%	22.61	16.79	3.70%	2.47%	-1.59	-7%
F2018	1,361.75	1.12%	23.45	17.22	3.71%	2.56%	-1.35	-5%
F2019	1,376.26	1.07%	24.32	17.67	3.71%	2.62%	-1.10	-4%
2020	1,389.97	1.00%	25.22	18.15	3.71%	2.69%	-0.83	-3%
2021	1,402.81	0.92%	26.17	18.66	3.77%	2.82%	-0.55	-2%
F2022	1,412.32	0.68%	27.16	19.23	3.78%	3.08%	-0.23	-1%
F2023	1,424.83	0.89%	28.19	19.79	3.78%	2.87%	0.10	0%
F2024	1,440.84	1.12%	29.26	20.31	3.78%	2.63%	0.46	2%
F2025	1,456.64	1.10%	30.36	20.85	3.78%	2.66%	0.83	3%
F2026	1,472.27	1.07%	31.51	21.40	3.78%	2.68%	1.24	4%
F2027	1,487.58	1.04%	32.71	21.99	3.78%	2.72%	1.66	5%
2028	1,504.40	1.13%	33.94	22.56	3.78%	2.62%	2.11	7%

Pulses (5% lower) (continued)

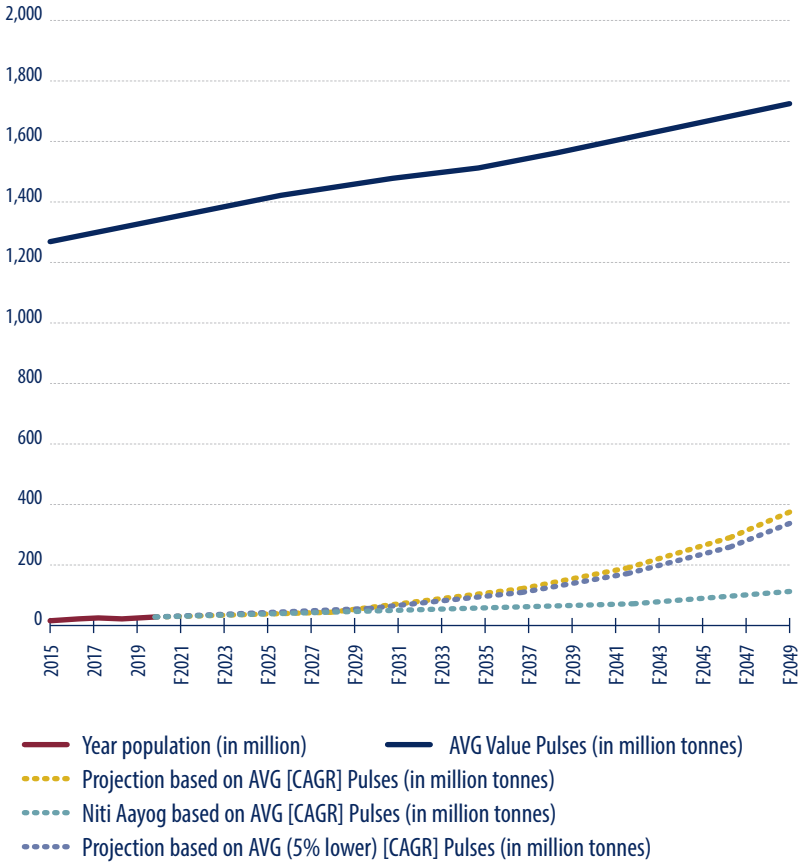
Year	Population (million)	Population Growth Rate	Pulses [5% lower] (in million tonnes)	Pulses Per Capita [5% lower] (in kg)	Pulses Growth Rate [5% lower]	Pulses Per Capita Growth Rate [5% lower]	Surplus/ Deficit Pulses [5% lower] (in million tonnes)	Surplus/ Deficit Percentage Pulses [5% lower]
2029	1,520.94	1.10%	35.25	23.17	3.83%	2.71%	2.61	8%
F2030	1,537.18	1.07%	36.60	23.81	3.85%	2.75%	3.12	9%
F2031	1,553.18	1.04%	38.01	24.47	3.85%	2.78%	3.67	11%
2032	1,568.82	1.01%	39.47	25.16	3.85%	2.81%	4.24	12%
F2033	1,585.35	1.05%	41.70	26.30	5.64%	4.54%	5.58	15%
F2034	1,601.50	1.02%	44.05	27.51	5.64%	4.57%	07.01	19%
F2035	1,617.30	0.99%	46.53	28.77	5.64%	4.61%	8.56	23%
F2036	1,632.74	0.95%	49.16	30.11	5.64%	4.64%	10.22	26%
F2037	1,647.74	0.92%	51.93	31.52	5.64%	4.68%	12.01	30%
F2038	1,662.41	0.89%	54.86	33.00	5.64%	4.71%	13.92	34%
F2039	1,676.71	0.86%	57.95	34.56	5.64%	4.74%	15.98	38%
F2040	1,690.56	0.83%	61.22	36.21	5.64%	4.77%	18.19	42%
F2041	1,704.01	0.80%	64.67	37.95	5.64%	4.81%	20.55	47%
F2042	1,717.08	0.77%	68.32	39.79	5.64%	4.84%	23.08	51%
F2043	1,729.78	0.74%	72.18	41.73	5.64%	4.86%	25.79	56%
F2044	1,742.08	0.71%	76.25	43.77	5.64%	4.89%	28.68	60%
F2045	1,754.04	0.69%	80.55	45.92	5.64%	4.92%	31.78	65%
F2046	1,765.77	0.67%	85.09	48.19	5.64%	4.94%	35.08	70%
F2047	1,777.23	0.65%	89.89	50.58	5.64%	4.96%	38.62	75%
F2048	1,788.50	0.63%	94.96	53.09	5.64%	4.97%	42.39	81%
F2049	1,799.68	0.63%	100.31	55.74	5.64%	4.98%	46.41	86%
F2050	1,810.71	0.61%	105.97	58.52	5.64%	5.00%	50.70	92%

Annex 3: Agricultural production and the Indian population by 2050[86]

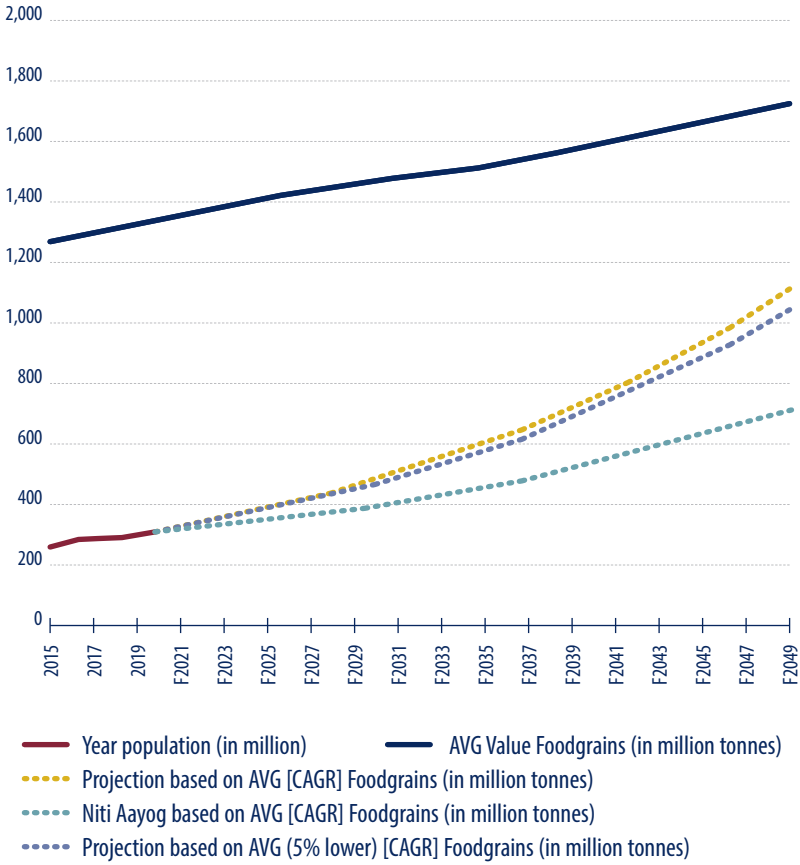


[86] *Sources: Annual Report, 2022-23, Department of Agriculture and Farmer Welfare. https://agriwelfare.gov.in/Documents/annual_report_english_2022_23.pdf; Basic animal Husbandry Statistics, Ministry of Fisheries, Animal Husbandry & Dairying. https://dahd.nic.in/sites/default/filess/BAHS_2022-English.pdf; Handbook on fisheries statistics, 2022, Ministry of Fisheries, Animal Husbandry & Dairying, https://dof.gov.in/sites/default/files/2023-01/HandbookFisheriesStatistics19012023.pdf.*

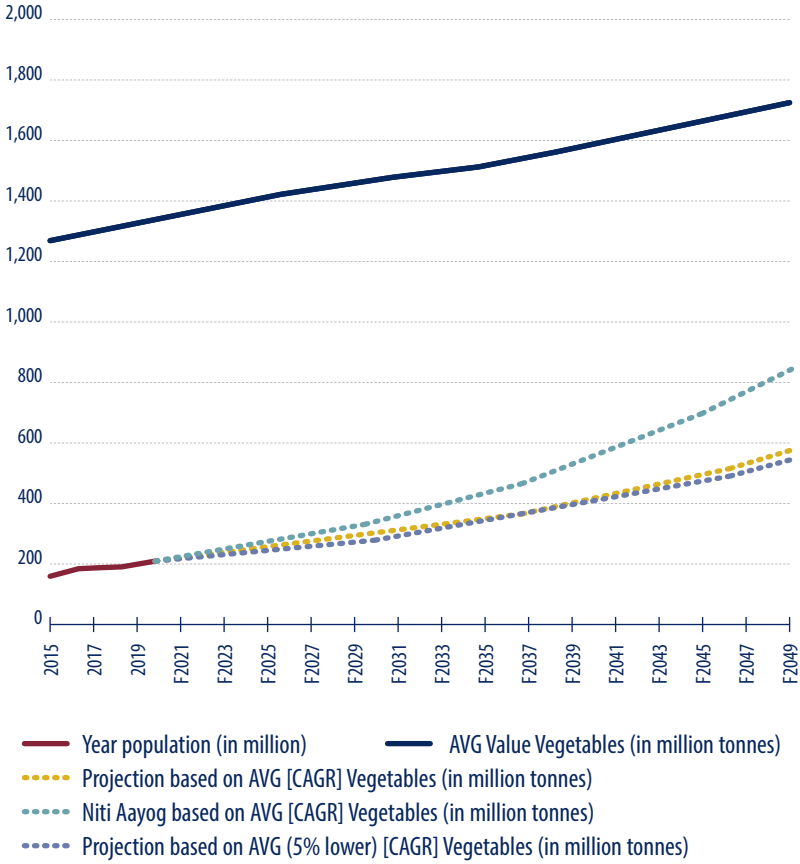
Pulses

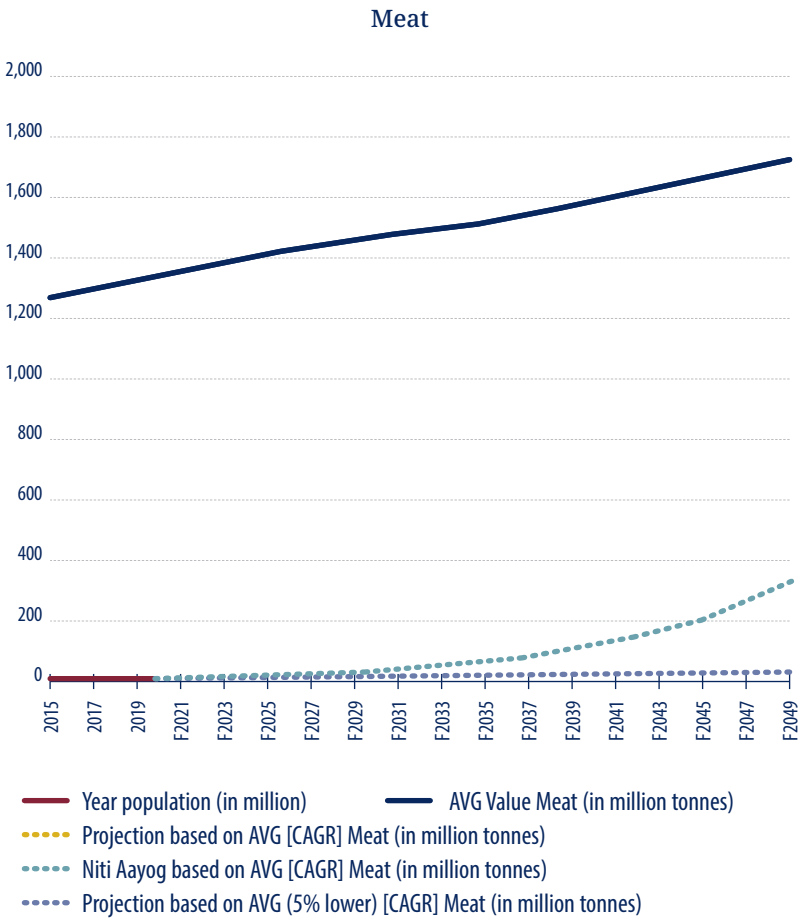

2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
2015
2017
2019
F2021
F2023
F2025
F2027
F2029
F2031
F2033
F2035
F2037
F2039
F2041
F2043
F2045
F2047
F2049
Year population (in million)
AVG Value Pulses (in million tonnes)
Projection based on AVG [CAGR] Pulses (in million tonnes)
Niti Aayog based on AVG [CAGR] Pulses (in million tonnes)
Projection based on AVG (5% lower) [CAGR] Pulses (in million tonnes)

Foodgrains

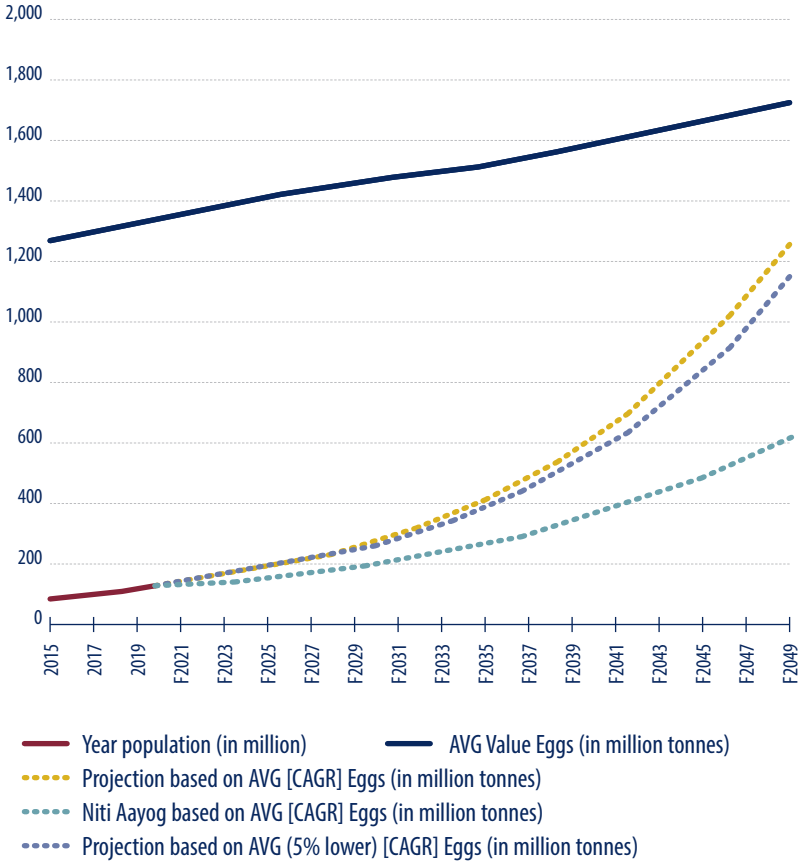

2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
2015
2017
2019
F2021
F2023
F2025
F2027
F2029
F2031
F2033
F2035
F2037
F2039
F2041
F2043
F2045
F2047
F2049
Year population (in million)
AVG Value Foodgrains (in million tonnes)
Projection based on AVG [CAGR] Foodgrains (in million tonnes)
Niti Aayog based on AVG [CAGR] Foodgrains (in million tonnes)
Projection based on AVG (5% lower) [CAGR] Foodgrains (in million tonnes)

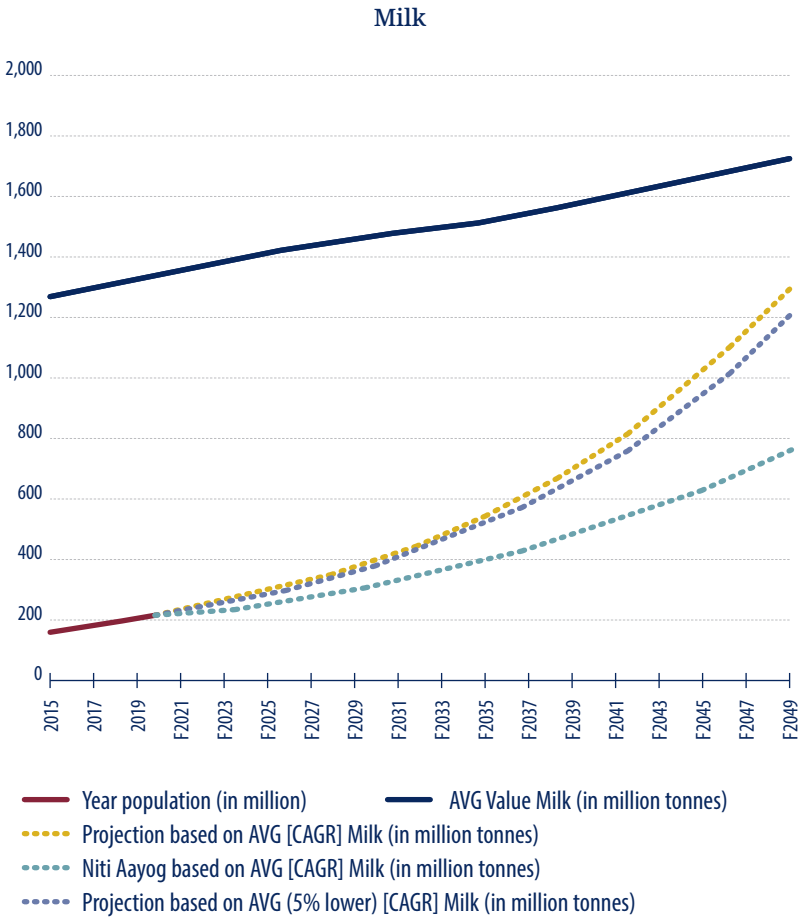
Vegetables


2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
2015
2017
2019
F2021
F2023
F2025
F2027
F2029
F2031
F2033
F2035
F2037
F2039
F2041
F2043
F2045
F2047
F2049
Year population (in million)
AVG Value Vegetables (in million tonnes)
Projection based on AVG [CAGR] Vegetables (in million tonnes)
Niti Aayog based on AVG [CAGR] Vegetables (in million tonnes)
Projection based on AVG (5% lower) [CAGR] Vegetables (in million tonnes)


Meat
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
2015
2017
2019
F2021
F2023
F2025
F2027
F2029
F2031
F2033
F2035
F2037
F2039
F2041
F2043
F2045
F2047
F2049
Year population (in million)
AVG Value Meat (in million tonnes)
Projection based on AVG [CAGR] Meat (in million tonnes)
Niti Aayog based on AVG [CAGR] Meat (in million tonnes)
Projection based on AVG (5% lower) [CAGR] Meat (in million tonnes)

Eggs


2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
2015
2017
2019
F2021
F2023
F2025
F2027
F2029
F2031
F2033
F2035
F2037
F2039
F2041
F2043
F2045
F2047
F2049
Year population (in million)
AVG Value Eggs (in million tonnes)
Projection based on AVG [CAGR] Eggs (in million tonnes)
Niti Aayog based on AVG [CAGR] Eggs (in million tonnes)
Projection based on AVG (5% lower) [CAGR] Eggs (in million tonnes)


Milk
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
2015
2017
2019
F2021
F2023
F2025
F2027
F2029
F2031
F2033
F2035
F2037
F2039
F2041
F2043
F2045
F2047
F2049
Year population (in million)
AVG Value Milk (in million tonnes)
Projection based on AVG [CAGR] Milk (in million tonnes)
Niti Aayog based on AVG [CAGR] Milk (in million tonnes)
Projection based on AVG (5% lower) [CAGR] Milk (in million tonnes)

Annex 4: Overview

Year	Population growth rate	Cereals growth rate	Pulses growth rate	Foodgrains growth rate	Vegetables growth rate	Milk growth rate	Meat growth rate	Eggs growth rate	Fish growth rate
CAGR from 2020 to 2050	0.82%	2.65%	4.90%	2.84%	4.65%	4.58%	11.57%	5.82%	8.95%
AAGR from 2020 to 2050	0.83 %	2.64%	4.87%	2.83%	4.65%	4.58 %	11.57%	5.82%	8.91%

Institut Montaigne welcomes thoughts and ideas on how to address these issues collectively to put forward recommendations which serve the public interest.

Institut Montaigne
59 rue La Boétie, 75008 Paris
Tél. +33 (0)1 53 89 05 60
institutmontaigne.org/en

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MACSF
Mazars
Média-Participations
Mediobanca
Mercer
Meridiam
Microsoft France
Mitsubishi France S.A.S
Moelis & Company
Moody's France
Morgan Stanley
Natixis - BPCE
Natural Grass
Naval Group
Nestlé
OCIRP
ODDO BHF
Oliver Wyman
Ondra Partners
Onet
OPmobility
Optigestion
Orano
PAI Partners
Pelham Media
Pergamon
Polytane
Publicis
PwC France & Maghreb
Qualisocial
Raise
RATP
Renault
Ricol Lasteyrie
Rivolier
Roche
Roche Diagnostics
Rokos Capital Management
Rothschild & Co
RTE
Safran
Sanofi
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ServiceNow
Servier
SGS
SIER Constructeur
SNCF
SNCF Réseau
Sodexo
SPVIE
SUEZ
Teneo
The Boston Consulting Group
Tilder
Tofane
TotalEnergies
TP ICAP Transformation
Factory
Unicancer
Veolia
Verian
Verlingue
VINCI
Vivendi
Wakam
Wavestone
Wendel
White & Case
Willis Towers Watson France
Zurich

Whatever the demographic scenario, India, now the world's most populated country, will see its population continue to grow for another quarter-century. Can it solve or at least alleviate the problem of mass undernutrition it faces today? This challenge persists despite the country's macroeconomic successes and a remarkable increase in agricultural production over the years.

This paper investigates the reasons for India's chronic undernutrition and questions its ability to reach long-term food security. While Indian authorities are working to address both issues, the public policy solutions put forward, despite some successes, tend to reproduce pitfalls without providing lasting remedies. This publication also showcases the trajectories that population and agricultural production curves are likely to follow in India up to 2050, through several scenarios guided by statistical projections.

The authors identify five key areas for action, which offer significant opportunities for collaboration with French and European partners.

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