



Indonesia's Vision 2045

Project Report
September 16, 2022

prepared for

**The Asian Development Bank
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Mandaluyong City 1550
Philippines**

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Under Contract with:

Asian Development Bank

6 ADB Avenue

Mandaluyong City, Philippines

Contract Number: S175187

**TA-9508 REG: Country Diagnostic Studies in Selected Development Member Countries
(Subproject 4) – Labor Forecasting Model for Indonesia (48186-006)**

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Glossary of Terms and Abbreviations

BAPPENAS – The Ministry of National Development Planning for Indonesia
BOP – Balance of Payments
BPS – Badan Pusat Statistik (Statistics Indonesia)
Comtrade – Bilateral commodity trade data from the United Nations
EAP – Economically Active Population
FCE – Final Consumption Expenditures
FDI – Foreign Direct Investment
GFCF – Gross Fixed Capital Formation
GTAP – Global Trade Analysis Project
HS – Harmonized System (classification system for trade statistics)
LFS – Labour Force Survey
ILO – International Labour Organization
IM model – Interindustry Macroeconomic model
INFORUM – Interindustry Forecasting at the University of Maryland
IO – Input-Output
IOT – Input-Output Table
ISIC – International Standard Industrial Classification
KILM – Key Indicators of the Labor Market
SITC – Standard International Trade Classification
SNA – System of National Accounts
Rp – Indonesian Rupiah, the national currency
UN – United Nations
ViewsWire – Forecasting service from *Economist* magazine
WDI – World Development Indicators
WDR – World Development Report
WIR – World Investment Report

1. The Setting

Indonesia is situated at a promising position among the spectrum of countries. It is currently the largest economy in Southeast Asia, yet still the 16th or 17th largest in the world in terms of market exchange rates, and the 7th largest in terms of purchasing power parity (PPP). What is the potential for growth over the next several decades? The *Vision 2045*², published before the Covid-19 pandemic, projected that with average real growth of 5.7%, Indonesia could take a place among the 5 largest countries, measured in terms of nominal market exchange rates. However, Indonesia's population growth will begin to slow down in the second part of this decade, and unless labour force participation can increase, higher productivity growth would be required to reach such a GDP growth rate.

Indonesia's situation is certainly unique. Comprised of 17,000 islands, the physical distance from east to west is 5,150 kilometers, more than the continental USA (4,654) and China (5,000). Communication and transportation within the country pose unique challenges. Furthermore, with roughly 300 ethnic groups and 700 languages, Indonesia is one of the most diverse countries in the world, which poses hurdles for governance, education and national identity.

Some of the numerous advantages of the country include rich land, water and mineral resources, a strategic position for world trade, and a strong entrepreneurial spirit. In recent years, there have been large strides made in education, particularly among the younger population, and a huge reduction of the poverty rate.

On the other hand, Indonesia is faced with overcoming some serious constraints to growth. The first is what some characterize as the 'scarring' from COVID-19³. Like many other countries across the globe, Indonesia suffered a decline in GDP growth of 2.1 percent in 2020, followed by 3.7 percent growth in 2021. Although growth for 2022 promised to be strong, the pandemic impacted Indonesia through loss of population and labour force, a pause in public and a decline in private investment, and a still-unmeasured loss in human capital development through students forced into virtual learning environments. Even before the pandemic hit, the demographic outlook for Indonesia called for slowing population growth, which implies slower labour force growth, unless labour force participation can increase, perhaps through increased participation of women.

Indonesia needs to invest more, for public and private infrastructure, for education, for health care and for R&D. However, tax revenues are lagging. With one of the lowest ratios of tax revenue to GDP of 10.1 percent, Indonesia is significantly below the Asia and Pacific regional average of 19.1 percent, and way below the OECD average of 33.5 percent. Furthermore, significant revenue continues to be spent on fuel subsidies, which reduces funds available for public investment. Although the subsidy has recently been reduced, it is a drain on public resources. The cost of not investing in infrastructure is higher costs of land and water transportation and communications, which holds back productivity growth in all sectors.

² Bappenas (2019).

³ World Bank, June 2022.

Although educational attainment has been steadily increasing, the quality of the education is uneven, and there are significant regional differences in quality. Not as much emphasis has been given to the learning of English as in some other Asian and Pacific countries⁴.

Indonesia is currently enjoying mixed benefits from the inflation in commodity prices. On the one hand, increases in minerals, metals and coal prices has increased export earnings. However, increases in food prices pose a threat to the vulnerable population. Since world commodity prices are quite volatile, the significant share of commodities in the export mix has resulted in large swings in export growth, and will continue to do so, until Indonesia can diversify into exports of manufacturing.

2. Goals for Indonesia

The *Vision 2045* lists four main pillar or principles invoked by President Joko Widodo and the Indonesian planning leadership. These are:

1. Human development and mastery of science and technology.
2. Sustainable economic development
3. Equitable development
4. Strengthening national resilience and governance.

Analysis performed to support the document suggested that with a baseline growth of 5.1 percent from 2016 to 2045 that Indonesia would reach number 7 in the global GDP rankings by 2045, and become a high-income country in 2038. In the high growth case, with average growth of 5.7 percent, Indonesia would be the 5th ranked country by 2045, and reach high-income status by 2036.

This would also entail achieving a higher manufacturing and services share, and a reduced agriculture share of GDP. The agriculture share of GDP has already fallen from 24 percent in the early 1980s to 12.7 percent just before Covid. It has risen slightly since then. The baseline projection envisions this share falling to 7.8 percent by 2045, and it falls to 7.4 percent in the high growth case. The share of agriculture in total employment would also decrease significantly. This has already fallen from a value of 45.3 percent in 2000 to 28.3 percent in 2021. It is projected to fall further to only 13.0 percent by 2045, through a combination of reduction in GDP share and increases in labour productivity.

An increased rate of foreign direct investment, higher investment in infrastructure, and increased R&D investment would also be required leading to a total rise in the investment to GDP ratio from 32.8 to 33.1 in the baseline, and to 38.1 in the high growth case.

Other economic goals in the Vision 2045 include an increase in the share of sustainable energy from 5 percent to 31 percent, an increase in capital investment for the maritime sector, and continued progress on reducing the poverty rate and increasing equality. Exports should shift to higher value-added industries, away from commodities, and Indonesia is expected to fulfill its significant tourism potential.

⁴ Although, according to *English First*, Indonesia's English proficiency index is higher than either Japan or China!

With regard to education, the vision incorporates plans to increase investment in academic and vocational education, with the result that the share of labor force with greater than high school education will increase to 90 percent by 2045, from its current level of about 44 percent.

Structural reforms relating to the workforce could result in increased labor force participation of women, from the current value of about 53 percent to 78 percent by 2045. This would represent a significant increase, as the rate in 2000 was 52 percent, so the participation rate of women has only increased slightly over the last 20 years. If it were possible, it would enable a much larger growth rate of real GDP, given the same productivity growth rates.

These goals cannot be viewed as a prediction, but rather a roadmap. Framing the goals in a consistent and workable fashion improves the likelihood that important stakeholders will contribute, and the vision provides metrics that can be checked at intermediate stages to the goals.

3. Goals for This Project

The main goal of this project is to build a consistent interindustry macroeconomic labor projections model for Indonesia, with the potential for projections out to 2045 and further, if need be. The model is grounded in an historical database, which includes data from Statistics Indonesia, Asian Development Bank (ADB), World Bank, the United Nations (UN), Bappenas and other sources.

The model is useful for making projections, as well as answering “what if” questions about the impacts of changes in given assumptions or relationships in the model. In addition to labour force issues, the model can be used to address policy issues such as:

- trade expansion and diversification
- education and workforce development
- urbanization
- environmental degradation, and,
- effects of COVID-19 and the path to recovery.

Most of these issues affect employment and the labor market, through numerous direct and indirect channels. When envisioning the course of the Indonesian economy over the next 10 years or more, it is useful to have both a broad and detailed picture of where the economy stands today, and where it is likely to go if current policies and trends continue. However, it is also useful to frame questions that relate to how policy, technology, trade, transparency, and other changes may impact the economic development of Indonesia as a whole, and for distinct industries and types of workers.

The model will help in the analysis of the labor market by quantifying the relationships between employment and other economic variables to allow policy makers in Indonesia to explore the implications of alternative possible scenarios.

Some of the questions that the model can help in addressing include:

- How much employment will this production support, and what kind of occupations will be employed?
- What skills, training, and education are needed to have a competent labor supply for these jobs?

- What is the expected skills/education gap, starting from currently projected investments in education and training?

This report, which is the third of four reports for this project, presents a trial baseline forecast or projection using the model, with a forecast horizon to 2035, slightly more than 10 years. Exogenous assumptions used to make this forecast will be clearly indicated, and suggestions for alternative assumptions will be discussed. We hope and expect that conversations and mutual cooperation with Bappenas and ADB will result in a forecast which may provide an important tool for developing the next version of *Vision 2045*.

The next section will cover the anatomy of a forecast, discussing in broad terms how the model works, and how important assumptions contribute to the end result. The next several sections will review main topics of the data and projections. Section 5 will discuss demographics, including population and labour force. Section 6 will cover the main components of GDP, and how labour productivity is determined. Section 7 will present the detail lying behind the GDP projection, namely, the final demand by industry. Section 8 looks at results for sectoral output, including an output ranking and an analysis of the sources of output growth. Section 9 covers labour productivity and employment, and section 10 continues this topic to look at the employment by occupation. Section 11 is about jobs and skills, and presents some additional information on how these topics have been treated in other similar studies. Section 12 summarizes assumptions that may be changed to make alternative projections. Finally, section 13 muses on the way forward with the modeling project.

4. Anatomy of a Forecast

Just as we study the anatomy of humans, animals and plants to understand how they work, we can look into the innards of an economic model to see the equivalent of bones, muscle and tissue. Perhaps the backbone of an economy is the potential GDP, which grows or declines each period according to labour force, labour productivity and cyclical factors, such as the unemployment rate, and the average hours worked. Underlying labour force growth is influenced by demographics, including the changing population and its age structure over time, and the participation rates of men and women of various ages. Underlying labour productivity is the growth of the capital stock, of “know-how”, some of it produced by R&D, but some of it embodied in capital imports or foreign direct investment. If we remove the cyclical factor of unemployment, and hold it to a constant percentage, then the relationship between this GDP potential, labour force growth and productivity growth comes into clearer focus.

In making projections about long-term GDP growth, we must be cognizant of the implications for required labour force and productivity. If productivity is to increase significantly, there should be some underlying explanation. GDP, in turn can be decomposed into:

1. Household and non-profits consumption
2. Government consumption
3. Gross private fixed investment
4. Inventory change
5. Exports less imports (net exports)

Given a certain GDP potential, we cannot have more household consumption without some other component of GDP being reduced, such as exports or investment. For example, too much

government spending will crowd out private investment, consumption and/or exports, unless it contributes strongly to overall productivity growth.

Furthermore, in an input-output based model, we can see something akin to the flow of blood and oxygen through the body. Firms in each industry depend on firms in other industries for their inputs, or these may be imported. Firms also sell to firms in other industries, or to consumers, investors, government, or net exports. The combination of sources of final demand gives rise to production in each industry. Increased production requires increased employment and capital for those industries. The demand for capital stimulates spending for investment, which may be comprised of purchases of investment goods from domestic industries (motor vehicles, communications equipment, furniture, computers) or it may be imported. Increased employment gives rise to increased wage payments by industry. The incomes from capital and labor, as well as government transfer payments, contribute to income. After taxes are removed, this is disposable income, which is then available for households to either spend or save.

The current model is at a level of 35 industries, based on a set of input-output (IO) accounts derived by the ADB, and modified by Inforum. This is a medium level of detail, as we have created models with as few as 8 industries, and as many as 360. The list of sectors for this model is shown in Appendix A. At this level of detail, we can discuss issues involving metals, machinery, construction, agriculture, and trade, but we cannot discuss questions about paddy rice, bananas, palm oil, pharmaceuticals, electric power (combined with gas and water), or computers. We often compare the choice of the number of sectors to salt in food. Too little, and it has no taste. Too much, and you get high blood pressure! Statistics Indonesia maintains benchmark IO accounts at a level of 185 sectors. Though these are only for limited points in time, they are helpful in understanding more fully the detailed structure of the Indonesian economy. Other good detailed indicators are the trade statistics, or data on household consumption by product.

A model such as this is most useful when the understanding of a particular industry is generated by sales to other industries, and to investment or net exports. If we did have a sector for bananas, the forecast for the banana industry would be very simple, relating to household consumption of bananas, or to sales by retail food establishments. However, understanding the demand for a sector such as Basic metals and fabricated metals (12) requires understanding the sources of demand, whether they be net exports, other industries that use metals, or consumer demand for metal products (tools, nails, scissors, etc.). When we speak of the impact coming through sales to other industries, this is called an *indirect effect*. When dealing with sales to net exports, investment, or household consumption, this is called a *direct effect*. Total output or production for each sector is the sum of direct and indirect effects.

Each industry can be considered to have an implicit level of capacity, just like the total economy. There are no statistics yet available in Indonesia for these capacity measures, and "data" on capacity created in the EU and the USA are based on indirect observations. However, if demand increases suddenly for a particular good, it is likely that domestic production expand increase capacity instantaneously, and the additional demand must be imported.

Industries' capacity may be constrained by the time required to make new investments, or lack of financing available for such investments. Capacity may also be constrained by a shortage of labor with the skills or education required to fulfill the employment roles in that industry productively.

So, although unobservable, we should keep in mind these notions of capacity when making and trying to understand the results of a forecast made using the IO/Macro labor projections model.

A simple picture of demand for skills can be used by combining the employment forecasts of the model with the matrix of employment by 8 occupations and 17 industries that is produced from the Integrated Labour Force Survey (ILFS). We will present forecasts of employment by occupation in section 7. Currently, these are based on the assumption of constant shares of each occupation by industry⁵. Data and projections on labour force by education and skill level can be compared to data on occupational employment to understand the relationship between education and occupation, and determine the degree of skill mismatch.

The relationship between education and wage rates is also of great interest. Other determinants of wage rates include the general level of inflation, and growth in labour productivity.

This model produces macroeconomic aggregates of GDP by expenditure category and by value added, as well as the total employment and productivity measures, based on the behavior at the 35-industry level. These aggregate data are convenient for summarizing the structure of a forecast, as well as making comparisons with historical data.

5. Demographics

We have compiled historical and projected data for population from the United Nations *World Population Prospects (WPP2022)*. These data include estimates for 21 5-year age groups. Statistics Indonesia (BPS) also compiles estimates of working age population for 10 age groups of population 15 and over, using a combination of the Integrated Labour Force Survey (ILFS) and the Population Census and Intercensal estimates. For purposes of determining labor force and labor force participation, the latter data are the official estimates used.

UN population by age group is also available in the model aggregated to the 10 BPS age groups. UN population projections from the medium fertility scenario are used to extend the BPS working age population by 10 age groups forward in time. However, alternate population scenarios could be run as well.⁶

The population data are crucial for determining the potential labor force, by defining the working age population. Table 5.1 summarizes the working age population projections for Indonesia driven by the UN medium fertility assumption⁷.

⁵ The “fixes” software for the model enables us to change these shares exogenously over the horizon of the forecast.

⁶ The other UN scenarios are low fertility, high fertility, constant fertility, instant replacement, zero migration, constant mortality and no change. The assumptions and the demographic model underlying these projections is described in UN (2022).

⁷ Although the current scenario runs out to 2035, we have compiled projections of the UN data that go out to 2050 and beyond.

Table 5.1. Summary of History and Projections of Working Age Population

Units: Thousands of Persons

	2010	2015	2021	2025	2030	2035	2040	2045	2021-2035 Average Growth	2021-2045 Average Growth
1 15-19	22,773.1	22,107.7	22,119.2	23,196.9	23,642.2	22,305.5	21,541.1	21,201.0	0.06	-0.18
2 20-24	18,286.1	21,467.8	21,946.7	21,939.3	23,181.7	23,637.7	22,304.0	21,542.5	0.53	-0.08
3 25-29	20,970.8	20,830.3	21,701.8	22,250.3	22,262.7	23,536.8	24,005.9	22,652.8	0.58	0.18
4 30-34	20,747.5	20,459.3	21,333.7	21,572.9	22,289.2	22,312.3	23,597.3	24,073.2	0.32	0.50
5 35-39	18,561.6	19,838.3	20,941.9	20,439.4	20,699.6	21,400.3	21,430.1	22,672.9	0.15	0.33
6 40-44	17,116.1	18,349.3	19,799.1	20,485.1	19,961.3	20,231.7	20,928.6	20,968.3	0.15	0.24
7 45-49	14,167.1	16,332.2	18,455.7	19,520.6	20,518.6	20,015.5	20,305.9	21,023.5	0.58	0.54
8 50-54	12,052.1	13,835.1	16,412.8	17,489.6	18,854.4	19,847.6	19,389.8	19,700.1	1.36	0.76
9 55-59	8,719.3	11,049.0	13,779.0	15,168.2	16,586.2	17,919.7	18,907.7	18,514.8	1.88	1.23
10 60+	18,676.6	21,831.9	30,218.3	34,614.1	41,609.4	48,670.5	55,689.5	62,259.7	3.40	3.01
Total	172,070.4	186,100.9	206,708.3	216,676.3	229,605.3	239,877.5	248,099.8	254,608.8	1.06	0.87

Source: Statistics Indonesia Labour Force Survey and Projections Using UN WPP2022

According to these projections, working age population for the 15-19 and 20-24 age groups will reach a peak around 2030 and then decline, resulting in negative growth for these groups from 2021 to 2045. The fastest growing group is the 60+, growing at 3.4 percent from 2021 to 2035, and about 3.0 percent from 2021 to 2045. Total working age population is growing at an average of 1.06 percent over the 2021 to 2035 period, and 0.87 percent over the 2021 to 2045 period.

Table 5.2 summarizes the labor force participation rates by age group. For the base scenario, these participation rates are kept constant at their last historical (2021) value, but they can be modified as desired, to experiment with effects of changing participation rates, or changing patterns of participation with increasing economic development. The ratio of total labour force to working age population (average labour force participation) does change over the model projection period, but this is due to shifts in the age-composition of the population. The average declines from 67.8 percent in 2021 to 66.5 percent in 2045 due solely to changes in the age distribution.

Table 5.2. Summary of Historical and Projected Labour Force Participation Rates

Units: Percent

	2010	2015	2021	2030	2045
1 15-19	33.7	27.4	27.8	27.8	27.8
2 20-24	68.3	66.5	66.8	66.8	66.8
3 25-29	75.5	73.3	75.5	75.5	75.5
4 30-34	76.7	74.6	77.2	77.2	77.2
5 35-39	78.4	76.5	79.4	79.4	79.4
6 40-44	80.7	79.2	81.7	81.7	81.7
7 45-49	80.6	79.0	82.0	82.0	82.0
8 50-54	78.5	77.2	79.6	79.6	79.6
9 55-59	73.7	72.3	73.7	73.7	73.7
10 60+	47.9	46.8	50.8	50.8	50.8
Average	67.7	65.8	67.8	67.1	66.5

Source: Statistics Indonesia Labour Force Survey and Projections Using UN WPP2022

Table 5.3 is a summary of labour force history and projections, given the working age population and the projected labour force participation rates by age group. The total average growth rate is 0.97 percent from 2021-2035 but falls to 0.79 percent for 2021-2045. However, the longer period

growth rates show that by this time the size of the younger cohorts will be declining. In either case, the size of the 60+ has become the largest group by 2025. Since population over 70 are less likely to be in the labour force, it may be more reasonable to slowly reduce the participation rate of the 60+ group, even if we make some upward adjustments to the other groups to model the increased participation of women.

Table 5.3. Summary of History and Projections of Labour Force

Units: Thousands of Persons

	2010	2015	2021	2025	2030	2035	2040	2045	2021-2035 Average Growth	2021-2045 Average Growth
1 15-19	7,671.5	6,060.3	6,146.2	6,445.6	6,569.4	6,197.9	5,985.5	5,891.0	0.06	-0.18
2 20-24	12,484.9	14,283.1	14,653.3	14,648.3	15,477.9	15,782.3	14,891.9	14,383.4	0.53	-0.08
3 25-29	15,832.6	15,273.6	16,380.8	16,794.8	16,804.2	17,765.8	18,119.9	17,098.6	0.58	0.18
4 30-34	15,909.6	15,264.5	16,462.5	16,647.1	17,199.9	17,217.7	18,209.2	18,576.5	0.32	0.50
5 35-39	14,561.5	15,175.1	16,624.1	16,225.2	16,431.8	16,988.1	17,011.7	17,998.3	0.15	0.33
6 40-44	13,804.6	14,523.7	16,182.1	16,742.7	16,314.6	16,535.6	17,105.2	17,137.7	0.15	0.24
7 45-49	11,419.3	12,910.0	15,127.2	16,000.0	16,818.0	16,405.6	16,643.6	17,231.8	0.58	0.54
8 50-54	9,464.8	10,677.7	13,060.6	13,917.4	15,003.5	15,793.9	15,429.6	15,676.4	1.36	0.76
9 55-59	6,423.6	7,984.8	10,151.4	11,174.9	12,219.5	13,201.9	13,929.8	13,640.3	1.88	1.23
10 60+	8,955.1	10,227.3	15,364.4	17,599.4	21,156.2	24,746.4	28,315.1	31,655.7	3.40	3.01
Total	116,527.5	122,380.0	140,152.6	146,195.5	153,994.8	160,635.2	165,641.6	169,289.9	0.97	0.79

Source: Statistics Indonesia Labour Force Survey and Projections Using UN WPP2022

6. GDP and Productivity Growth

Except for the periods of the Asian Crisis and the Covid pandemic, Indonesian GDP growth rates have been robust, at an average annual rate of 5.5 percent over the 1970 to 2021 period. Our baseline projection, shown in red in Figure 6.1, foresees an growth of 5.2 percent for the 2021-2026 period, slowing to 5.0 percent from 2026 to 2035. This results in an average growth rate for the whole forecast period of just under 5.1 percent.

Figure 6.1

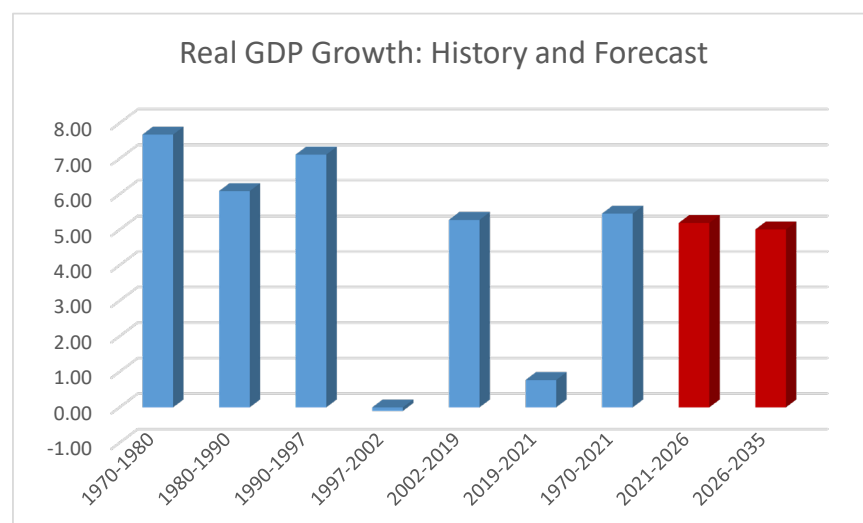
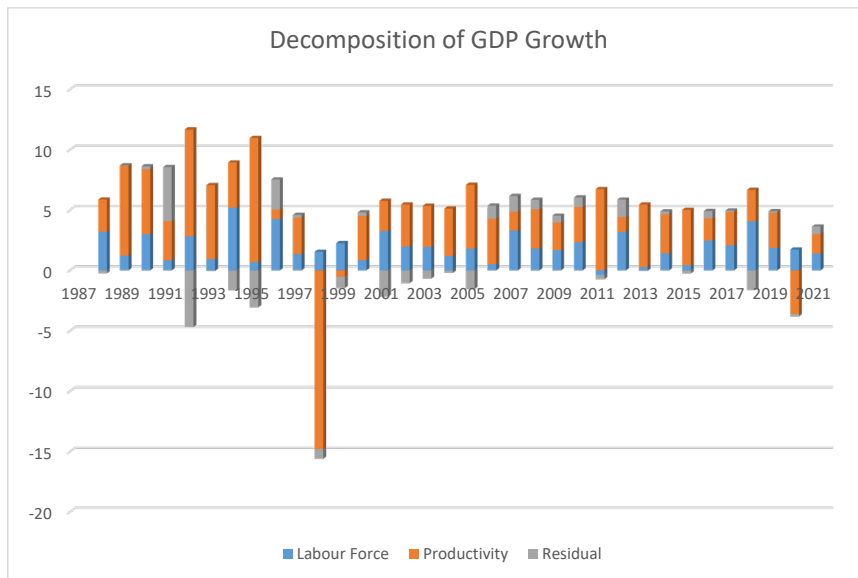


Figure 6.2

Another way to look at real GDP growth is to show the decomposition into labour force growth, productivity growth and residual factors, which include cyclical changes in the unemployment rate, among others. Figure 6.2 shows such a decomposition for the period 1987 to 2021⁸. For most years the residual is small, but it is larger in periods where there have been significant increases or decreases in unemployment.

In figure 6.3, we have summarized the decomposition over periods, including the forecast periods, to be comparable to figure 6.1.

⁸ 1987 is the earliest we have data for both labour force and employment, courtesy of Bappenas.

Figure 6.3

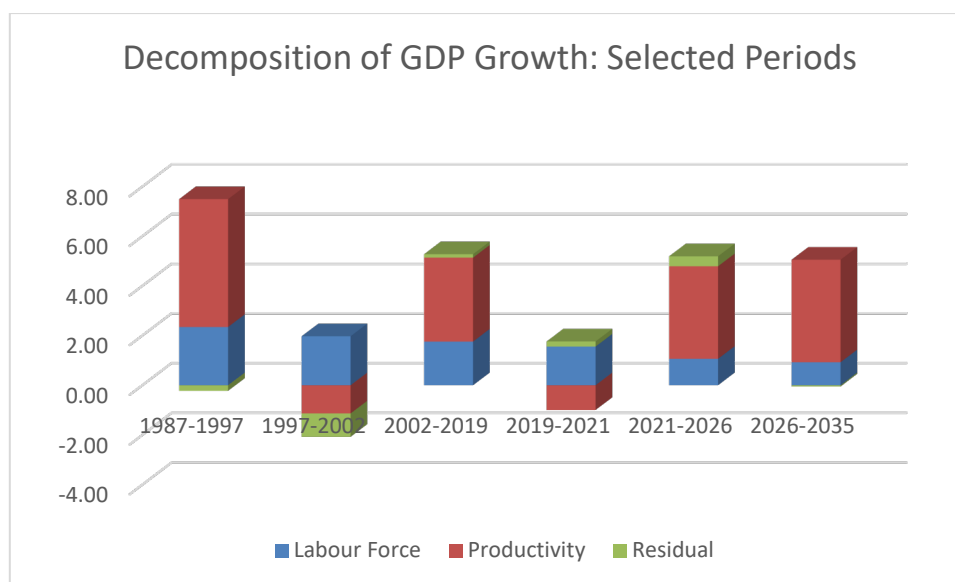


Table 6.1 shows the data underlying this graph. Note that while the labour force is continuing to slow down in the forecast period, productivity growth is higher than the 2002 to 2019 period, but still less than 1987 to 1997.

Table 6.1

	Decomposition of GDP Growth			
	Real GDP	Labour Force	Productivity	Residual
1987-1997	7.27	2.34	5.15	-0.22
1997-2002	-0.10	1.97	-1.13	-0.94
2002-2019	5.28	1.76	3.38	0.14
2019-2021	0.77	1.56	-0.99	0.21
2021-2026	5.19	1.06	3.73	0.40
2026-2035	5.01	0.93	4.13	-0.05

Table 6.2 below includes the macroeconomic summary of GDP and its components, and information on population, labour force, employment and productivity. Data are shown for the historical years 2012 and 2021, and for the forecast years 2025, 2030 and 2035. The last four columns are average growth rates for selected years. The growth rate for 2012 to 2019 has been included to provide historical context, to compare with the growth rates in the years immediately before the Covid pandemic.

GDP declined 2.0 percent in 2020, followed by 3.7 percent growth in 2021. We foresee growth returning to a normal rate of 5.0 to 5.2 percent during the projection period, led by private investment and exports. Of course, there is a significant probability of another near-term recession, which would reduce the outlook for 2022 and 2023, but medium term growth at about 5 percent is realizable.

Population growth from 2012 to 2019 was 1.2 percent, but is projected to slow to 0.75 percent from 2021 to 2026, and to 0.64 percent from 2026 to 2035. The growth in working age population (15+) was even faster (1.85 percent) from 2012 to 2019, thanks to the demographic boost. However, it is expected to slow to 1.19 percent from 2021 to 2026 and to 0.99 percent from 2026 to 2035. Employment growth in the first period (1.46 percent) outpaces labour force growth, due to a decline of the unemployment rate, which we have assumed to stabilize at about 5.0 percent starting in 2026. Aggregate productivity growth from 2021 to 2026 (2.89 percent) is only slightly higher than the 2012 to 2019 period (2.74 percent), but is projected to pick up in the final period to just over 4 percent. Note that given labour force growth assumptions, a slower productivity growth (such as 3 percent) would be consistent with a similarly lower GDP growth (such as 4 percent).

Table 6.2. Summary of GDP, Population, Labour Force and Employment

	2012	2021	2025	2030	2035	12-19	21-35	21-26	26-35
Real GDP Accounts (Tril 2010 Rp)									
Gross Domestic Product	7,727	11,119	13,716	17,598	22,623	4.98	5.07	5.19	5.01
Household and Nonprofit Consumption	4,278	6,029	7,545	9,617	12,327	5.00	5.11	5.45	4.92
Government Consumption	682	909	1,026	1,200	1,409	3.25	3.13	3.00	3.20
Gross Private Fixed Investment	2,528	3,549	4,408	5,802	7,580	5.04	5.42	5.46	5.40
Change in Inventories	174	63	93	102	130	-4.18	5.23	5.64	5.00
Exports	1,945	2,593	3,218	4,245	5,588	2.24	5.49	5.46	5.50
Imports	1,910	2,101	2,574	3,367	4,411	0.98	5.30	5.11	5.40
Population, Labour Force and Employment (Thousands of Persons)									
Population	245,425	272,583	280,798	290,901	299,596	1.20	0.67	0.75	0.64
Working Age Population	176,874	206,708	216,676	229,605	239,878	1.85	1.06	1.19	0.99
Labour Force	119,850	140,153	146,196	153,995	160,635	1.79	0.97	1.06	0.92
Employment	112,505	131,051	139,181	146,289	152,608	1.93	1.09	1.46	0.88
Unemployment	7,345	9,102	7,014	7,706	8,028	-0.48	-0.90	-5.84	1.85
Unemployment Rate	6.1	6.5	4.8	5.0	5.0				
Aggregate Productivity Index (2010=1.0)	110.1	140.6	155.9	192.3	235.1	2.74	3.67	2.89	4.10

Source: Statistics Indonesia, Bappenas and Inforum

In the next section, we'll review the projections of final demand underlying these GDP figures, and the implications for output by industry.

7. Final Demand Projections

7.1 Household and Nonprofits Consumption

Final consumption of households and non-profit institutions (*pceio*) is an important component of GDP, comprising about 53% of nominal GDP in 2021. Overall final consumption of households and non-profits is related to current and lagged values of real disposable income per capita through a regression equation. It is projected for 35 commodities of household and NPO consumption. This forecast can be modified if necessary.

Table 7.1 summarizes the forecast of real final consumption of households in 2010 prices aggregated to the 9-sector level. Total household consumption is shown at the bottom of the table in bold⁹.

Table 7.1. Final Consumption of Households and Nonprofits: 2021-2035
Units: Trillions of 2010 Rp

	Levels					Average Growth			
	2012	2021	2025	2030	2035	12-19	21-35	21-26	26-35
1 Agriculture, Plantation, Forestry, Hunting and Fisheries	366	527	656	841	1,082	5.36	5.14	5.33	5.04
2 Mining and excavation	1	1	1	1	1	7.14	4.12	3.83	4.28
3 Industry	1,711	2,491	3,085	3,903	4,970	5.42	4.93	5.21	4.78
4 Electricity, Gas and Drinking Water	112	152	179	221	276	3.48	4.27	4.09	4.37
5 Construction	0	0	0	0	0	4.02	4.12	3.83	4.28
6 Trade, Restaurant and Accommodation Services	978	1,393	1,827	2,403	3,166	5.47	5.86	6.54	5.49
7 Transportation, Warehousing and Communication	508	619	795	982	1,230	4.35	4.91	5.94	4.33
8 Financial Institutions, Real Estate, Rental Business, and Corporate Services	409	585	705	885	1,118	4.55	4.63	4.59	4.65
9 Community, Social, and Individual Services	440	644	777	989	1,264	4.82	4.82	4.67	4.91
TOTAL	4,524	6,411	8,023	10,226	13,108	5.13	5.11	5.45	4.92

Source: ADB-based Input-Output Data and Model Projections

7.2 Government Consumption

Final consumption of government is set exogenously, using an aggregate fix. Most of the spending is concentrated in sector 9, which includes government services.

Table 7.2. Final Consumption of Government: 2021-2035
Units: Trillions of 2010 Rp

	Levels					Average Growth			
	2012	2021	2025	2030	2035	12-19	21-35	21-26	26-35
1 Agriculture, Plantation, Forestry, Hunting and Fisheries	0	0	0	0	0	2.22	3.13	3.00	3.20
2 Mining and excavation	0	0	0	0	0	2.00	3.13	3.00	3.20
3 Industry	12	18	21	24	29	5.81	3.13	3.00	3.20
4 Electricity, Gas and Drinking Water	0	0	0	0	0	5.06	3.13	3.00	3.20
5 Construction	0	0	0	0	0	-1.95	3.13	3.00	3.20
6 Trade, Restaurant and Accommodation Services	5	7	8	9	11	5.73	3.13	3.00	3.20
7 Transportation, Warehousing and Communication	1	1	1	1	1	5.25	3.13	3.00	3.20
8 Financial Institutions, Real Estate, Rental Business, and Corporate Services	7	21	24	28	32	14.36	3.13	3.00	3.20
9 Community, Social, and Individual Services	650	934	1,055	1,233	1,447	4.10	3.13	3.00	3.20
TOTAL	674	982	1,108	1,296	1,521	4.30	3.13	3.00	3.20

Source: ADB-based Input-Output Data and Model Projections

⁹ Note that the total of the deflated IO data by sector is slightly different from the published real GDP totals.

7.3 Gross Capital Formation

Gross capital formation is projected by an aggregate accelerator investment equation, that relates gross investment to replacement needs, and a distributed lag of changes in real GDP. It can also be overridden, or modified by the model user.

Table 7.3 shows the projection of gross capital formation in the base scenario, at the aggregate 9 sector level.

Table 7.3. Gross Capital Formation: 2021-2035
Units: Trillions of 2010 Rp

	2012	2021	Levels			Average Growth			
			2025	2030	2035	12-19	21-35	21-26	26-35
1 Agriculture, Plantation, Forestry, Hunting and Fisheries	120	227	282	371	485	9.00	5.42	5.46	5.40
2 Mining and excavation	9	8	10	14	18	0.48	5.42	5.46	5.40
3 Industry	343	402	499	657	859	2.34	5.42	5.46	5.40
4 Electricity, Gas and Drinking Water	0	0	0	0	0	1.45	5.42	5.46	5.40
5 Construction	1,913	2,559	3,179	4,183	5,466	4.03	5.42	5.46	5.40
6 Trade, Restaurant and Accommodation Services	105	139	173	227	297	3.69	5.42	5.46	5.40
7 Transportation, Warehousing and Communication	19	24	30	39	51	2.38	5.42	5.46	5.40
8 Financial Institutions, Real Estate, Rental Business, and Corporate Services	35	70	87	114	150	8.61	5.42	5.46	5.40
9 Community, Social, and Individual Services	8	11	13	18	23	3.19	5.42	5.46	5.40
TOTAL	2,552	3,441	4,273	5,624	7,348	4.13	5.42	5.46	5.40

Source: ADB-based Input-Output Data and Model Projections

7.4 Imports and Exports

Imports by sector are endogenous to the model, with imports of each commodity determined by an import share equation.

Imports in the model are dependent upon domestic demand dd , which is defined as follows:

	dd	Domestic demand
=	$inter$	Total intermediate demand
+	$fceh$	Final consumption of households
+	$fceg$	Final consumption of government
+	gcf	Gross fixed capital formation

Equivalently, this can be expressed as $dd = out + im - ex$. The import share $impshr$ is calculated historically by commodity as:

$$impshr = im/dd$$

In the input-output solution block of the model, imports are calculated jointly with domestic output, as:

$$im = impshr * dd$$

This way of calculating imports ensures that commodities will be imported only when and where they are needed. By definition, the import share cannot be greater than one. If it were, then we would obtain the nonsensical result of negative output for certain commodities. Note that if

imports are specified prior to determining import demands, as they are in some IO models, this negative output result is quite common.

Table 7.4 shows the projection of imports by commodity in the base scenario, at the aggregate 9 sector level.

Table 7.4. Imports: 2021-2035

Units: Trillions of 2010 Rp

	Levels					Average Growth			
	2012	2021	2025	2030	2035	12-19	21-35	21-26	26-35
1 Agriculture, Plantation, Forestry, Hunting and Fisheries	366	527	656	841	1,082	5.36	5.14	5.33	5.04
2 Mining and excavation	1	1	1	1	1	7.14	4.12	3.83	4.28
3 Industry	1,711	2,491	3,085	3,903	4,970	5.42	4.93	5.21	4.78
4 Electricity, Gas and Drinking Water	112	152	179	221	276	3.48	4.27	4.09	4.37
5 Construction	0	0	0	0	0	4.02	4.12	3.83	4.28
6 Trade, Restaurant and Accommodation Services	978	1,393	1,827	2,403	3,166	5.47	5.86	6.54	5.49
7 Transportation, Warehousing and Communication	508	619	795	982	1,230	4.35	4.91	5.94	4.33
8 Financial Institutions, Real Estate, Rental Business, and Corporate Services	409	585	705	885	1,118	4.55	4.63	4.59	4.65
9 Community, Social, and Individual Services	440	644	777	989	1,264	4.82	4.82	4.67	4.91
TOTAL	2,040	2,218	2,717	3,554	4,655	1.13	5.30	5.11	5.40

Source: ADB-based Input-Output Data and Model Projections

Exports by commodity are specified exogenously, currently using an aggregate growth rate. Sensible baseline export forecasts can be made using data on the main destination countries for Indonesian exports, and their projected rates of growth. We have made use of the *Economist* ViewPoint forecast. Table 7.5 shows the baseline projection of exports at the aggregate level.

Table 7.5. Exports: 2021-2035

Units: Trillions of 2010 Rp

	Levels					Average Growth			
	2012	2021	2025	2030	2035	12-19	21-35	21-26	26-35
1 Agriculture, Plantation, Forestry, Hunting and Fisheries	55	68	84	111	146	2.40	5.49	5.46	5.50
2 Mining and excavation	220	289	359	473	623	-2.51	5.49	5.46	5.50
3 Industry	1,440	2,013	2,499	3,296	4,340	1.28	5.49	5.46	5.50
4 Electricity, Gas and Drinking Water	1	0	1	1	1	4.13	5.49	5.46	5.50
5 Construction	9	2	3	4	5	-8.10	5.49	5.46	5.50
6 Trade, Restaurant and Accommodation Services	77	72	89	117	155	10.52	5.49	5.46	5.50
7 Transportation, Warehousing and Communication	63	27	33	44	58	-1.11	5.49	5.46	5.50
8 Financial Institutions, Real Estate, Rental Business, and Corporate Services	67	32	40	52	69	0.93	5.49	5.46	5.50
9 Community, Social, and Individual Services	30	15	18	24	32	1.47	5.49	5.46	5.50
TOTAL	1,962	2,518	3,125	4,122	5,427	1.33	5.49	5.46	5.50

Source: ADB-based Input-Output Data and Model Projections

8. Output

8.1 Output by Commodity

Output, or production in the interindustry model serves to produce goods for domestic consumption, or for export. Domestic consumption by commodity is the sum of intermediate demands (as other industries' inputs), household consumption, government consumption, and investment. The input-output solution uses total demands as a starting point, then combines these demands with information about required industry inputs and assumed import shares to jointly determine a projection for imports and output. The aggregate projected output by commodity at the 9-sector level is shown as table 8.1. Keep in mind that all final demands and output are

calculated at the 35-sector level. The tables presented here are aggregates of the model data and forecasts.

Table 8.1. Output by Commodity: 2021-2035

Units: Trillions of 2010 Rp

	Levels					Average Growth			
	2012	2021	2025	2030	2035	12-19	21-35	21-26	26-35
1 Agriculture, Plantation, Forestry, Hunting and Fisheries	1,263	1,705	2,143	2,773	3,598	3.78	5.33	5.55	5.21
2 Mining and excavation	1,028	1,056	1,315	1,700	2,197	0.35	5.23	5.43	5.12
3 Industry	4,983	7,172	8,955	11,513	14,829	4.75	5.19	5.45	5.04
4 Electricity, Gas and Drinking Water	367	504	609	765	966	4.05	4.64	4.64	4.64
5 Construction	2,116	3,204	3,978	5,199	6,765	6.00	5.34	5.40	5.30
6 Trade, Restaurant and Accommodation Services	2,083	2,831	3,620	4,717	6,153	4.56	5.55	5.99	5.30
7 Transportation, Warehousing and Communication	1,001	1,631	2,051	2,588	3,286	7.49	5.01	5.56	4.70
8 Financial Institutions, Real Estate, Rental Business, and Corporate Services	914	1,559	1,909	2,424	3,087	6.63	4.88	4.99	4.82
9 Community, Social, and Individual Services	1,273	1,972	2,307	2,821	3,468	5.75	4.03	3.90	4.11
TOTAL	15,029	21,634	26,888	34,500	44,350	4.96	5.13	5.34	5.01

Source: ADB-based Input-Output Data and Model Projections

Table 8.2 presents forecast results for output at the 35-sector level, ranked by the overall growth rate from 2021 to 2035 (shaded column). Growth for hotels and restaurants tops the list, followed by Metals, Machinery and Food, beverages and tobacco. The slowest growing sector in this projection is the government sector (Public administration and defense, compulsory social security.)

Table 8.2. Detailed by Commodity: Ranked by 2021-2035 Growth

Units: Trillions of 2010 Rp

	2021	2025	2030	2035	21-35	21-26	26-35
22 Hotels and restaurants	686	944	1,286	1,744	6.66	7.67	6.10
12 Basic metals and fabricated metal	518	646	848	1,108	5.44	5.57	5.37
13 Machinery, nec	135	173	224	286	5.37	6.03	5.00
3 Food, beverages, and tobacco	2,645	3,322	4,303	5,584	5.34	5.57	5.21
18 Construction	3,204	3,978	5,199	6,765	5.34	5.40	5.30
6 Wood and products of wood and cork	133	164	215	280	5.33	5.34	5.33
1 Agriculture, hunting, forestry, and fishing	1,705	2,143	2,773	3,598	5.33	5.55	5.21
5 Leather, leather products, and footwear	66	81	105	137	5.25	5.24	5.25
11 Other nonmetallic minerals	185	229	297	384	5.24	5.32	5.19
2 Mining and quarrying	1,056	1,315	1,700	2,197	5.23	5.43	5.12
10 Rubber and plastics	262	329	421	542	5.20	5.59	4.98
15 Transport equipment	387	492	626	800	5.19	5.83	4.83
21 Retail trade, exc of motor vehicles; repair of household goods	650	809	1,041	1,342	5.18	5.36	5.07
16 Manufacturing, nec; recycling	117	144	186	241	5.17	5.21	5.15
20 Wholesale and commission trade, exc of motor vehicles and motr	1,108	1,378	1,773	2,284	5.17	5.35	5.07
30 Renting of M&Eq and other business activities	514	637	818	1,050	5.10	5.31	4.98
9 Chemicals and chemical products	687	851	1,092	1,402	5.10	5.27	5.00
24 Water transport	147	186	236	300	5.09	5.69	4.75
23 Inland transport	537	672	855	1,093	5.08	5.49	4.85
19 Sales, M&R of motor vehicles and motorcycles; retail sale of fuel	386	489	617	784	5.06	5.69	4.70
26 Other transport activities; activities of travel agencies	114	144	182	231	5.05	5.59	4.74
8 Coke, refined petroleum, and nuclear fuel	1,034	1,290	1,641	2,095	5.05	5.41	4.84
4 Textiles and textile products	315	382	491	631	4.95	4.88	5.00
27 Post and telecommunications	741	933	1,171	1,482	4.95	5.58	4.60
33 Health and social work	354	431	549	701	4.88	4.85	4.89
25 Air transport	91	116	143	180	4.84	5.63	4.39
28 Financial intermediation	642	784	990	1,255	4.79	4.91	4.71
7 Pulp, paper, paper products, printing, and publishing	283	344	434	550	4.74	4.79	4.72
29 Real estate activities	403	488	616	783	4.74	4.69	4.76
14 Electrical and optical equipment	407	507	631	788	4.72	5.33	4.38
17 Electricity, gas, and water supply	504	609	765	966	4.64	4.64	4.64
32 Education	542	639	791	983	4.26	4.10	4.35
34 Other community, social, and personal services	489	573	703	868	4.10	3.97	4.18
31 Public administration and defense; compulsory social security	587	664	779	916	3.18	3.04	3.25
TOTAL	21,634	26,888	34,500	44,350	5.13	5.34	5.01

Source: ADB-based Input-Output Data and Model Projections

8.2 Understanding the Sources of Output Growth

How can we understand what is contributing to the output growth of each sector? Table 8.2 provides a peak into the input-output detail for the Agriculture sector¹⁰. Each row of the IO table shows the sales of an industry to other industries and to final demand. The total sales will be equal to industry output. The table shows these sales of Agriculture to the other industries, and to final demand, for selected years, and provides the growth rates for each of these sales. The largest source of demand is sector 3 (Food, beverages and tobacco), which grows at 5.3 percent from 2021 to 2035. The second largest source of demand is household and nonprofits consumption expenditures, growing at 5.1 percent. Since not all agriculture is food related, we also see sales to Construction, Textiles and Wood products, among others.

Table 8.2. Disaggregation of Output Growth: 1. Agriculture, Hunting, Forestry & Fishing
Units: Billions of 2010 Rp

	Levels				Average Growth		
	2021	2025	2030	2035	21-35	21-26	26-35
1 Agriculture, hunting, forestry, and fishing	37,813	47,520	61,492	79,786	5.3	5.6	5.2
2 Mining and quarrying	44	54	70	91	5.2	5.4	5.1
3 Food, beverages, and tobacco	688,156	864,300	1,119,404	1,452,843	5.3	5.6	5.2
4 Textiles and textile products	10,724	13,010	16,696	21,458	5.0	4.9	5.0
5 Leather, leather products, and footwear	184	227	296	384	5.2	5.2	5.2
6 Wood and products of wood and cork	20,877	25,846	33,774	44,059	5.3	5.3	5.3
7 Pulp, paper, paper products, printing, and publishing	3,906	4,740	5,986	7,585	4.7	4.8	4.7
8 Coke, refined petroleum, and nuclear fuel	106	132	168	215	5.0	5.4	4.8
9 Chemicals and chemical products	15,219	18,862	24,187	31,066	5.1	5.3	5.0
10 Rubber and plastics	36,905	46,426	59,448	76,453	5.2	5.6	5.0
11 Other nonmetallic minerals	409	506	657	851	5.2	5.3	5.2
12 Basic metals and fabricated metal	423	528	693	905	5.4	5.6	5.4
15 Transport equipment	44	55	70	90	5.2	5.8	4.8
16 Manufacturing, nec; recycling	1,322	1,631	2,105	2,725	5.2	5.2	5.1
18 Construction	56,372	69,994	91,470	119,012	5.3	5.4	5.3
19 Sale, maintenance, and repair of motor vehicles and motorcycles; retail sale of fuel	51	64	81	103	5.1	5.7	4.7
20 Wholesale trade and commission trade, except of motor vehicles and motorcycles	55	69	88	114	5.2	5.4	5.1
21 Retail trade, except of motor vehicles and motorcycles; repair of household goods	32	40	52	67	5.2	5.4	5.1
22 Hotels and restaurants	60,406	83,073	113,237	153,469	6.7	7.7	6.1
24 Water transport	84	106	135	172	5.1	5.7	4.8
25 Air transport	460	582	723	906	4.8	5.6	4.4
28 Financial intermediation	36	44	56	71	4.8	4.9	4.7
31 Public administration and defense; compulsory social security	72	81	95	112	3.2	3.0	3.3
32 Education	913	1,077	1,333	1,656	4.3	4.1	4.3
33 Health and social work	12,549	15,273	19,462	24,848	4.9	4.9	4.9
34 Other community, social, and personal services	180	211	259	320	4.1	4.0	4.2
SUM: Intermediate	947,388	1,194,512	1,552,111	2,019,456	5.4	5.7	5.3
Household and nonprofit consumption expenditure	526,937	655,639	840,914	1,082,160	5.1	5.3	5.0
Gross private fixed investment	227,165	282,145	371,335	485,138	5.4	5.5	5.4
Inventory change	19,418	28,778	31,450	40,382	5.2	5.6	5.0
Exports	67,634	83,941	110,732	145,782	5.5	5.5	5.5
Imports	-83,365	-102,118	-133,585	-174,992	5.3	5.1	5.4
Output	1,705,182	2,142,903	2,772,962	3,597,934	5.3	5.6	5.2

Source: ADB-based Input-Output Data and Model Projections

¹⁰ We have switched to billion Rp in this table, as some table elements are rather small.

9. Productivity and Employment

Productivity and employment are calculated at the level of 17 sectors, shown in Appendix table A3. At this sectoral level, BPS publishes employment (from the ILFS), various employment indicators, GDP by industry and investment by industry.

The link between production and employment depends on the level and growth of labor productivity by sector, defined as out_i/emp_i .

At the sectoral level, productivity growth varies from one industry to another. Table 9.1 shows historical and projected productivity by industry

Table 9.1. Productivity Growth by Sector
Index (2010=100)

	Levels					Growth Rates				
	2012	2021	2025	2030	2035	12-19	21-35	21-26	26-35	
Aggregate Labour Productivity	108.3	133.8	155.4	189.6	233.7	3.05	3.99	3.73	4.13	
1 Agriculture, Forestry, and Fishing	120.1	173.0	226.9	313.1	442.2	5.36	6.70	6.62	6.75	
2 Mining and Quarrying	86.7	98.7	103.9	115.3	131.1	1.97	2.03	1.34	2.41	
3 Manufacturing	107.1	133.1	154.6	189.5	237.4	2.27	4.13	3.72	4.37	
4 Electricity, Gas & Steam	100.5	95.4	97.3	105.5	117.2	-4.68	1.47	0.60	1.96	
5 Water Supply; Sewerage, Waste Management & Remediation	130.4	58.8	57.6	59.4	62.9	-11.13	0.47	-0.40	0.96	
6 Construction	94.8	118.6	128.5	153.0	186.6	2.63	3.24	2.20	3.81	
7 Wholesale and Retail Trade; Repair of Motor Vehicles and Motorcycles	115.4	126.2	146.6	174.0	210.6	2.08	3.66	3.60	3.69	
8 Transportation and Warehousing	138.6	190.3	252.5	352.2	497.6	4.50	6.86	6.93	6.83	
9 Accommodation and Food Services	115.8	65.0	62.4	62.7	64.7	-6.27	-0.03	-0.90	0.46	
10 Information and Communication	153.1	181.2	219.2	282.1	369.1	1.17	5.08	4.74	5.27	
11 Financial and Insurance	73.7	106.8	108.5	129.8	160.9	3.11	2.93	0.87	4.07	
12 Real Estate	67.4	59.4	55.9	54.9	55.2	-4.33	-0.53	-1.40	-0.04	
13 Professional and Business Services	86.1	81.3	89.0	95.9	106.0	0.42	1.89	1.99	1.84	
14 Public Administration and Defence; Compulsory Social Security	122.1	116.7	122.0	135.2	153.6	-0.88	1.96	1.19	2.39	
15 Education	114.4	134.1	157.3	192.3	240.9	2.05	4.18	3.89	4.35	
16 Human Health and Social Work	116.6	131.6	135.4	155.8	184.2	0.21	2.40	1.01	3.18	
17 Other Services	104.9	180.2	232.7	335.2	494.8	6.64	7.21	6.47	7.63	

Source: ADB-based Input-Output Data, BPS ILFS Surveys, and Model Projections

Although the growth rates also vary considerably across subintervals, several clear patterns stand out in these data. Agriculture, forestry and fishing, which is by far the largest sector in terms of employment, has sustained a high average labour productivity growth rate of 5.36 percent over the period 2012 to 2019. Other sectors showing particularly strong productivity growth are Transportation and warehousing (4.5 percent) Information and communication (5.4 percent) and Other services (6.6 percent). Some of the fastest growing sectors may simply be just rising up from a low level of productivity, and so have more room to grow. This is probably true the agriculture related sectors. Other industries, such as Transportation and warehousing may be benefitting from increased capital investment.

Other sectors, such as Real estate (-4.3 percent), Water supply, sewerage and waste management (-11.1 percent) and Accommodation and food services (-6.3 percent), are characterized by negative average productivity growth. The first two sectors are two of the smallest, in terms of employment, and there may be measurement error involved. Accommodation and food services is quite large, and has experienced employment growth that is faster than the growth of real output. Although the productivity equations have been estimated with a time trend term, we have adjusted initial projections for continued rapid falling productivity in these sectors to not fall as fast.

To forecast productivity growth, exponential time trend regressions were fitted both at the aggregate and sectoral level. The sectoral equations affect the distribution of productivity and

employment across sectors. Sectors are then controlled to agree with the total employment figure calculated from the aggregate equation. Table 9.2 summaries the results of using these equations in the base case scenario.

Employment by sector is then forecast as output divided by productivity. Table 9.2 shows the corresponding employment forecast by sector, which are consistent with the total employment in table 6.2.

Table 9.2. Employment Projections by Sector
Units: Thousands of Persons

	2012	2021	Levels			Growth Rates			
			2025	2030	2035	12-19	21-35	21-26	26-35
1 Agriculture, Forestry, and Fishing	39,592	37,131	35,581	33,362	30,651	-1.58	-1.37	-1.06	-1.54
2 Mining and Quarrying	1,601	1,443	1,707	1,989	2,261	-1.62	3.21	4.09	2.71
3 Manufacturing	16,140	18,694	20,096	21,071	21,666	2.48	1.05	1.73	0.68
4 Electricity, Gas & Steam	199	285	337	390	444	8.65	3.17	4.05	2.69
5 Water Supply; Sewerage, Waste Management & Remediation	162	563	693	845	1,009	16.16	4.17	5.05	3.69
6 Construction	6,851	8,294	9,501	10,433	11,128	3.37	2.10	3.20	1.49
7 Wholesale and Retail Trade; Repair of Motor Vehicles and Motorcycles	20,722	25,736	27,652	29,860	31,711	2.20	1.49	1.81	1.31
8 Transportation and Warehousing	4,590	5,444	5,161	4,668	4,196	2.99	-1.86	-1.37	-2.13
9 Accommodation and Food Services	3,781	9,180	13,153	17,818	23,417	11.68	6.69	8.57	5.64
10 Information and Communication	536	998	1,023	1,020	1,001	7.72	0.02	0.57	-0.29
11 Financial and Insurance	1,399	1,598	1,920	2,025	2,072	3.40	1.86	4.04	0.64
12 Real Estate	216	356	458	589	744	8.96	5.27	6.10	4.80
13 Professional and Business Services	1,124	2,017	2,286	2,720	3,160	7.82	3.21	3.32	3.14
14 Public Administration and Defence; Compulsory Social Security	3,592	4,849	5,246	5,549	5,748	4.57	1.21	1.85	0.86
15 Education	5,049	6,492	6,527	6,611	6,559	3.42	0.07	0.21	0.00
16 Human Health and Social Work	1,237	2,197	2,599	2,877	3,107	6.74	2.47	3.84	1.72
17 Other Services	5,714	5,774	5,241	4,461	3,734	1.54	-3.11	-2.51	-3.45
TOTAL	112,505	131,051	139,181	146,289	152,608	1.93	1.09	1.46	0.88

Source: ADB-based Input-Output Data, BPS ILFS Surveys, and Model Projections

Table 9.3 summarizes the shares of employment by major sector (Agriculture, Industry, Services and Other). The Agriculture share declines from 28.3 percent in 2021 to 20.1 percent in 2035 based on the solution for output and the productivity projections. The share of Industry is expected to increase slightly. Most of the reduction in employment from Agriculture is taken up by Services.

Table 9.2. Employment and Employment Shares by Major Sector
Units: Thousands of Persons, and Percent

	2012	2021	Levels			Growth Rates			
			2025	2030	2035	12-19	21-35	21-26	26-35
<i>Employment by Major Sector (Thousands)</i>									
Agriculture	39,592	37,131	35,581	33,362	30,651	-1.58	-1.37	-1.06	-1.54
Industry	24,952	29,279	32,334	34,728	36,508	2.71	1.58	2.37	1.14
Services and Other	47,961	64,641	71,266	78,199	85,449	3.93	1.99	2.39	1.77
Total	112,505	131,051	139,181	146,289	152,608	1.93	1.09	1.46	0.88
<i>Shares by Major Sector (Percent)</i>									
Agriculture	35.2	28.3	25.6	22.8	20.1	-3.51	-2.46	-2.53	-2.42
Industry	22.2	22.3	23.2	23.7	23.9	0.78	0.49	0.90	0.26
Services and Other	42.6	49.3	51.2	53.5	56.0	2.00	0.91	0.92	0.90

Source: BPS ILFS Survey Data and Model Projections

10. Employment by Occupation by Industry

Employment by occupation is derived based on the combination of the occupational coefficients in the occupation by industry matrix and the total employment projected above. For this version of the model, the occupation coefficients are constant at the last estimated value. A more realistic approach, which could be investigated, would have the coefficients in each sector change to approach the occupational structure of a somewhat more developed economy. This would incorporate the additional effects on occupational employment brought about by investment and public policy, as well as the general improvement in the level of economic development.

Table 10.1 shows the total employment by occupation calculated by this method.

Table 10.1 Employment Projections by Occupation

Unit: Thousands of Persons

	Levels					Average Growth			
	2015	2021	2025	2030	2035	15-19	21-35	21-26	26-35
1 Professional, Technical and Related Workers	8,133	9,580	10,063	10,452	10,669	4.65	0.77	1.19	0.53
2 Administrative and Managerial Workers	1,235	1,481	1,631	1,760	1,871	11.64	1.67	2.31	1.31
3 Clerical and Related Workers	6,650	7,317	8,003	8,516	8,918	3.57	1.41	2.11	1.02
4 Sales Workers	21,376	26,637	30,158	34,195	38,355	3.50	2.60	3.06	2.35
5 Services Workers	7,038	7,917	8,725	9,537	10,559	3.50	2.06	2.35	1.89
6 Agriculture, Animal Husbandry, Forestry Workers, Fishermen and Hunters	37,061	35,941	34,441	32,293	29,669	-1.82	-1.37	-1.06	-1.54
7 Production and Related Workers, Transport Equipment Operators and Laborers	32,682	39,920	43,691	46,856	49,696	4.99	1.56	2.17	1.23
8 Others	644	2,257	2,470	2,680	2,872	31.52	1.72	2.19	1.46
TOTAL	114,819	131,051	139,181	146,289	152,608	2.86	1.09	1.46	0.88

Source: Statistics Indonesia National Accounts, IIFS and Model Projections

The projections in table 10.1 are essentially the column sums of a matrix that is projected for every year. The last historical matrix, for 2021, is shown in table 10.2. The projection to 2035 is in table 10.3. Of course, all intervening years are available in the model database.

Table 10.2 Industry by Occupation Matrix for 2021

Main Industry	Main Occupation									Total
	0/1	2	3	4	5	6	7/8/9	X/00		
	Professional, Technical and Related Workers	Administrative and Managerial Workers	Clerical and Related Workers	Sales Workers	Services Workers	Agriculture, Animal Husbandry, Forestry Workers, Fisherman and Hunters	Production and Related Workers, Transport Equipment Operators and Laborers	Others		
A	56.6	9.5	74.4	69.5	184.2	35,940.7	709.4	86.4	37,130.7	
B	38.3	23.9	56.6	10.3	52.5	0.0	1,217.6	44.2	1,443.4	
C	339.1	215.7	608.6	510.6	343.5	0.0	16,456.5	220.5	18,094.5	
D	86.4	4.6	47.9	14.8	8.2	0.0	102.7	20.0	284.5	
E	12.2	5.6	40.5	25.0	32.5	0.0	441.7	5.2	562.7	
F	235.8	216.6	145.0	28.3	115.5	0.0	7,527.6	24.9	8,293.8	
G	192.0	48.6	836.8	20,856.8	580.7	0.0	3,094.6	126.6	25,736.1	
H	113.9	49.3	382.5	35.5	298.0	0.0	4,495.8	68.7	5,443.7	
I	28.3	55.4	175.6	4,235.1	2,058.9	0.0	2,560.1	67.0	9,180.4	
J	285.0	15.0	202.8	323.5	49.9	0.0	103.1	18.9	998.2	
K	231.5	82.0	807.2	216.4	70.3	0.0	102.3	88.1	1,597.8	
L	12.5	36.7	39.0	86.8	73.2	0.0	35.7	72.0	356.0	
M,N	323.1	73.5	255.7	115.4	289.4	0.0	602.5	357.5	2,017.1	
O	482.1	390.1	2,676.3	15.6	171.7	0.0	363.8	749.4	4,849.0	
P	5,311.7	180.0	520.1	4.8	146.8	0.0	201.9	126.3	6,491.6	
Q	1,379.0	29.5	295.3	8.2	232.4	0.0	194.1	58.9	2,197.3	
R,S,T,U	452.3	45.2	153.2	80.8	3,209.4	0.0	1,710.3	122.7	5,773.9	
Total	9,579.8	1,481.1	7,317.4	26,637.4	7,917.0	35,940.7	39,919.7	2,257.4	131,050.6	

Source: Statistics Indonesia, Labor Force Situation, August, 2021, Table 18.1.

Table 10.3 Industry by Occupation Matrix for 2035

Main Industry	Main Occupation								Total
	0/1 Professional, Technical and Related Workers	2 Administrative and Managerial Workers	3 Clerical and Related Workers	4 Sales Workers	5 Services Workers	6 Agriculture, Animal Husbandry, Forestry Workers, Fishermen and Hunters	7/8/9 Production and Related Workers, Transport Equipment Operators and Laborers	X/00 Others	
A Agriculture, Forestry, and Fishing	46.7	7.8	61.4	57.4	152.0	29,668.6	585.6	71.3	30,651.0
B Mining and Quarrying	60.0	37.4	88.7	16.1	82.3	0.0	1,907.4	69.2	2,261.1
C Manufacturing	393.0	250.0	705.3	591.8	398.0	0.0	19,072.1	255.6	21,665.7
D Electricity, Gas, Steam/Hot Water and Cold Air	134.7	7.2	74.6	23.1	12.7	0.0	160.1	31.2	443.6
E Water Supply; Sewerage, Waste Management, and Remediation Activities	21.8	10.0	72.7	44.9	58.2	0.0	792.2	9.4	1,009.1
F Construction	316.4	290.6	194.5	38.0	154.9	0.0	10,100.1	33.5	11,128.1
G Wholesale and Retail Trade; Repair of Motor Vehicles and Motorcycles	236.5	59.9	1,031.1	25,699.2	715.5	0.0	3,813.1	156.0	31,711.4
H Transportation and Storage	87.8	38.0	294.8	27.4	229.7	0.0	3,465.3	53.0	4,195.8
I Accommodation and Food Service Activities	72.1	141.4	447.9	10,802.6	5,251.9	0.0	6,530.1	171.0	23,416.8
J Information and Communication	285.6	15.0	203.3	324.3	50.0	0.0	103.4	19.0	1,000.5
K Financial and Insurance Activities	300.3	106.4	1,046.7	280.6	91.2	0.0	132.7	114.2	2,072.0
L Real Estate Activities	26.1	76.8	81.6	181.4	153.0	0.0	74.5	150.6	744.0
M,N Business Services	506.2	115.2	400.6	180.8	453.4	0.0	943.9	560.0	3,160.1
O Public Administration and Defence; Compulsory Social Security	571.5	462.4	3,172.5	18.5	203.5	0.0	431.3	888.4	5,748.0
P Education	5,367.2	181.9	525.6	4.9	148.3	0.0	204.0	127.6	6,559.5
Q Health Services and Social Work Activities	1,950.0	41.7	417.5	11.6	328.6	0.0	274.5	83.2	3,107.1
R,S,T,U Other Services	292.5	29.2	99.1	52.2	2,075.4	0.0	1,106.0	79.3	3,733.7
Total	10,668.5	1,870.7	8,917.8	38,354.7	10,558.7	29,668.6	49,696.0	2,872.5	152,607.6

Source: Statistics Indonesia, Model Forecast.

11 Jobs and Skills

11.1 Labor and Skills Demand

What do the projections in section 10 tell us about demand for skills and education? Not as well measured, but just as important as employment by sector and occupation are the education and skill characteristics of the labor force. In Indonesia, nearly 30 percent of labor is still employed in Agriculture, hunting, forestry, and fishing. As table 10.2 shows, this employment is primarily in the occupation “Agriculture, animal husbandry, forestry workers, fishermen and hunters”, not surprisingly. However, Indonesia is well on the way to moving a large percentages of the labor force from agriculture to manufacturing and service sector jobs, and plans to continue. In doing so, these agriculture-related sectors will probably become more capital-intensive and less labor-intensive. This increased productivity in the agriculture sectors facilitates the absorption of labor into the secondary and tertiary sectors of the economy. An important question is: “How fast is this likely to occur, and what are the constraints?”

11.2 The Skills Gap

The skills gap can be conceived broadly as the lack of supply of people with necessary skills to perform the types of jobs required in a more advanced economy. Although somewhat qualitative in nature, the skills and education set can be mapped to quantitative indicators by various methods. In some studies, a simple index indicating skill or education level has been used. Then the skills gap is defined as the difference in the demand for those at a certain skill or education level.¹¹

¹¹ See El Achkar Hilal, et. al. (2013) for an innovative use of this technique. Sparreboom and Nübler (2013) demonstrate the use of the mapping of skills to occupations using an indicator variable.

In actuality, the situation in any given industry can be characterized both by skill shortages, and skill surpluses. In other words, some workers have inadequate training or education for the jobs they are asked to perform, whereas other workers are overqualified, and could be adding more economic value and earning more if they could obtain a position commensurate with their education or training. The problem is acute in both developed and under-developed economies, and has spurred both academic studies as well as improved labor market information systems necessary to study the problem more accurately¹². In addition to the situation of educated workers finding jobs for which they are over-qualified, educated workers tend to have a higher unemployment rate in many countries because they hold out for a job which matches their qualifications. Thus, within the same country there are cases of underqualified workers and bottlenecks alongside overqualified or unemployed educated workers.

11.3 Educational Attainment

To approach the problem quantitatively, it is convenient to classify the workforce into categories related to their education or training. In Indonesia, the labour force data collect information on eight categories:

1. No education
2. Some primary
3. Completed primary, with perhaps some secondary
4. Completed secondary
5. Some higher education (college or technical school)
6. Completed higher education

The ideal dataset, which is actually available for some countries, would have annual data historically on the number of labour force in each group. A simple model can then be built that projects completion rates and number of new workers in each category in each projection year. Such a model also needs to project how many from each category leave the labor force due to retirement or other reasons. The ideal labor force survey would question respondents on their industry of work, occupational classification, and education level. These results can then be cross-tabulated to show the numbers of workers in each cell of an occupation by industry employment matrix that fall into each education category.

Sparreboom and Nübler (2013) performed an analysis of skill mismatch, measuring both under- and over-qualified workers, using the 2001 and 2006 ILFS from Tanzania. Their results are reproduced below, as table 11.3.1¹³. The national system of classifications in Tanzania (TASCO) is similar to the international system ISCO, and similar to that of Indonesia. As described in their Appendix B, they used the following mapping between TASCO major groups and levels of education:

- Major groups 1-3: tertiary education
- Major groups 4-8: secondary education
- Major group 9: primary education

The 9 groups are shown in order in the table, so that Managers, Professionals, and Technicians and associate professionals correspond with tertiary education. Workers with education levels in

¹² Quintini (2011) serves as an excellent introductory review of this literature.

¹³ Sparreboom and Nübler (2013), Table 4, p.18.

accordance with the correspondence are considered as adequately educated (A), while those with a lower or higher level are undereducated (U) or overeducated (O), respectively.

Table 11.3.1. Occupational Distribution and Qualification Mismatch in Tanzania

	2001 (%)	2006 (%)	Change (p.p.)	2001 (%)			2006 (%)			Change (percentage points)		
				A	U	O	A	U	O	A	U	O
Managers	0.2	0.2	0.0	10.4	89.6	0.0	10.8	89.2	0.0	0.4	-0.4	0.0
Professionals	0.4	0.7	0.3	25.4	74.6	0.0	12.0	88.0	0.0	-13.4	13.4	0.0
Technicians and associate professionals	2.3	1.9	-0.5	1.6	98.4	0.0	7.0	93.0	0.0	5.4	-5.4	0.0
Clerical support workers	0.4	0.4	0.0	61.1	38.6	0.3	48.6	48.8	2.5	-12.5	10.3	2.2
Service and sales workers	5.0	10.4	5.4	10.9	89.0	0.1	11.4	88.3	0.3	0.5	-0.7	0.2
Skilled agricultural, forestry and fishery workers	81.6	72.0	-9.6	1.5	98.5	0.0	1.5	98.5	0.1	-0.1	0.0	0.0
Craft and related trades workers	2.8	5.0	2.2	9.9	90.0	0.1	11.0	88.6	0.5	1.1	-1.4	0.4
Plant and machine operators, and assemblers	0.9	1.4	0.5	10.0	90.0	0.0	16.4	83.6	0.0	6.4	-6.4	0.0
Elementary occupations	6.4	8.1	1.7	57.0	39.8	3.2	64.7	29.3	6.0	7.7	-10.5	2.8
Total	100.0	100.0		6.2	93.5	0.2	8.7	90.7	0.6	2.5	-2.8	0.4

Source: Sparreboom and Nübler (2013) calculations based on the NBS ILFS 2000/01 and 2006.

Notes:

A = Adequately qualified

U = Underqualified

O = Overqualified

The conclusions shown in the table are powerful: except for Elementary occupations and Clerical support workers, the majority of workers in both the 2001 and the 2006 survey are underqualified. These two occupations are also the only ones with any significant count of overqualified workers.

A similar technique was used in a study that developed a model comparable to the current project, but for the Philippines.¹⁴ This study benefitted from availability of an annual time series of workforce by education level and industry and occupation of employment. Projections of future labor supply in each category were made using linear time trends. In summary, the study found that in 2010, out of 36 million employed in the Philippines, about 46 percent were employed in occupations corresponding to their skill level, 25 percent were overqualified, and 29 percent were underqualified. The study also found significantly higher unemployment amongst educated workers.

The usefulness of this type of analysis for Tanzania highlights the need to develop more frequent and in-depth labor force surveys. The additional cost may not be as much as perceived, as there should be economies of scale in doing the studies more frequently. The next release of the ILFS is anticipated for September 2014, with 2011 as the reference year. Additional value could be gained

¹⁴ El Achkar Hilal, et. al. (2013).

by surveying employers to gauge their perception of where skill levels of employees and job applicants were lacking. Such a survey could provide more fine-grained information as to particularly *which* types of skills were needed. For example, one set of interviews of SMEs in Tanzania reported that numeracy, behavioral, inter-personal, job-specific technical, problem-solving, ICT, communication, and literacy skills ranked high on firms' lists of what skills were in relatively scarce supply¹⁵. This type of information is invaluable, as secondary schools, technical schools, and universities need to position their students better for the job market of the next decade.

12. Alternative Forecasts

The trial baseline scenario presented in this paper can be criticized on several points. However, we have made reasonable assumptions about demographics, labour force participation, productivity, exogenous components of GDP, and personal savings rates. The material in this report establishes that the model is producing sensible, consistent and coherent forecasts out to 2035, a forecast interval of 13-14 years (depending on your starting point).

If need be, the forecast could be extended to 2045, to support Bappenas' project to revamp and update the *Vision 2045*. Patterns of labour force participation of women could be modified to obtain a faster labour force growth without productivity growth rates that strain credibility. It may also pay to revisit the data on employment and population. We have used growth rates from the UN WPP2022, but there may be a desire to use BPS SUPAS estimates instead.

This work could be performed by Inforum, but ideally the capacity would be put into place at Bappenas to continue to work with the model and adjust the forecast to be an integral part of their work. To this end, report 4 has been developed to provide hands-on training with the model.

13. The Way Forward

Although an interindustry macroeconomic model such as this has many applications, the current model was developed with a goal of serving as a labour projections model. At present, the demand side of the model is well-developed, but the supply of workers by education and skill level still needs to be fleshed out, and we should apply some of the thinking in section 11 to approach this topic in a more interesting way. Other aspects that could be explored more thoroughly include understanding the data and dynamics of labour productivity in Indonesia, and the interaction with labour force participation and labour force growth. This is particularly relevant in envisioning the future of the agriculture sector, but also in understanding the competitiveness of manufacturing.

¹⁵ Sabarwal (2013).

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Appendix A. Classification Schemas

A1. Producing Sectors of the ADB Input-Output Tables

- 1 Agriculture, hunting, forestry, and fishing
- 2 Mining and quarrying
- 3 Food, beverages, and tobacco
- 4 Textiles and textile products
- 5 Leather, leather products, and footwear
- 6 Wood and products of wood and cork
- 7 Pulp, paper, paper products, printing, and publishing
- 8 Coke, refined petroleum, and nuclear fuel
- 9 Chemicals and chemical products
- 10 Rubber and plastics
- 11 Other nonmetallic minerals
- 12 Basic metals and fabricated metal
- 13 Machinery, nec
- 14 Electrical and optical equipment
- 15 Transport equipment
- 16 Manufacturing, nec; recycling
- 17 Electricity, gas, and water supply
- 18 Construction
- 19 Sale, maintenance, and repair of motor vehicles and motorcycles; retail sale of fuel
- 20 Wholesale trade and commission trade, except of motor vehicles and motorcycles
- 21 Retail trade, except of motor vehicles and motorcycles; repair of household goods
- 22 Hotels and restaurants
- 23 Inland transport
- 24 Water transport
- 25 Air transport
- 26 Other supporting and auxiliary transport activities; activities of travel agencies
- 27 Post and telecommunications
- 28 Financial intermediation
- 29 Real estate activities
- 30 Renting of M&Eq and other business activities
- 31 Public administration and defense; compulsory social security
- 32 Education
- 33 Health and social work
- 34 Other community, social, and personal services
- 35 Private households with employed persons

A2. Aggregate Industry Sectors (9)

	ISIC
1 Agriculture, forestry, hunting and fisheries	A
2 Mining and quarrying	B
3 Manufacturing	C
4 Electricity, gas and water	D,E
5 Construction	F
6 Trade, restaurants and hotels	G,I
7 Transportation, storage and communication	H,J
8 Finance, insurance, real estate and business services	K,L,M,N
9 Public administration, defense, health and social work, other services	O,P,Q,R,S,T,U

A3. Aggregate Industry Sectors (17)

	ISIC
1 Agriculture, Forestry, and Fishing	A
2 Mining and Quarrying	B
3 Manufacturing	C
4 Electricity and Gas	D
5 Water Supply; Sewerage, Waste Management, and Remediation Activities	E
6 Construction	F
7 Wholesale and Retail Trade; Repair of Motor Vehicles and Motorcycles	G
8 Transportation and Storage	H
9 Accommodation and Food Service Activities	I
10 Information and Communication	J
11 Financial and Insurance Activities	K
12 Real Estate Activities	L
13 Business Activities	M,N
14 Public Administration and Defence; Compulsory Social Security	O
15 Education	P
16 Human Health and Social Work Activities	Q
17 Other Services Activities	R,S,T,U

A4. Occupational Categories

	Code
1 Professional, technical and related workers	0/1
2 Administrative and managerial workers	2
3 Clerical and related workers	3
4 Sales workers	4
5 Services workers	5
6 Agriculture, animal husbandry, forestry workers, fisherman and hunters	6
7 Production and related workers, transport equipment operators and laborers	7/8/9
8 Others	X/00