TRENDS REPORT

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FREDERICK S. PARDEE CENTER FOR INTERNATIONAL FUTURES
JOSEF KORBEL SCHOOL OF INTERNATIONAL STUDIES
UNIVERSITY of DENVER

UNDP

GUINEA-BISSAU:

Exploring Alternative Futures of Development

Economic and Human Development Trends to 2040

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EXPLORING ALTERNATIVE FUTURES OF DEVELOPMENT

What kind of economic growth does Guinea-Bissau need for the achievement of the SDGs in Guinea-Bissau? What is the effect of investing in basic service delivery like education and health on poverty levels in two decades from now? What could a green growth strategy for the country look like and how can it benefit economic and human development? Guinea-Bissau is at a crossroads where informed choices are available regarding different growth and development paths. The country should aspire to live up to its economic growth potential even in light of persisting challenges: inadequate infrastructure, dependence on monoculture, a lack of financial resources and capital flows, low levels of education and the shallow reach of the state, have prevented healthier growth and economic opportunities for Bissau-Guineans.

The pandemic has shown that we need to deeper reflect on viable growth models. It is imperative to look at the costs of not going green, now that the country has the chance to redefine its growth path. This paper aims at contributing to a nascent discussion on how to take the costs of the status quo into account and develop a new modus operandi when thinking about public policies to promote long-term green growth for Guinea-Bissau. The challenge is enormous, and the effort must be a joint one, which can only be addressed through national and international partnerships. As a major international development actor, it is UNDP's mission to promote a broader framework of environmentally, economically, and socially sustainable development and to illuminate possible pathways to better and more sustainable livelihoods for all. Although it is among the smallest West-African countries, Guinea-Bissau is well renowned for its biodiversity, both on land and in the marine environment. For centuries its inhabitants have been living in a tight relationship with the various ecosystems while exploring its rich natural resources. However, it has proven difficult to implement a sustained approach to strategic development planning. This has remained an obstacle for Guinea-Bissau to sustainably utilize its vast and largely untapped blue and green economy potential.

The use of scenarios to explore long-term development is posed to show alternative growth models for Guinea-Bissau. The present paper explores that path, providing insights into the current trends in economic and human development, and the underlying challenges to development. It is the first chapter of a comprehensive two-volumes study that uses state-of-the-art modelling techniques to help Guinea-Bissau's policymakers and planners better grasp the complex development ecosystem for difficult policy decisions about the future of the country's development. It is the result of a collaboration between UNDP Guinea-Bissau and the Frederick S. Pardee Center for International Futures at the University of Denver.

The report provides an integral overview of the national development trends and prospects. It focuses on a base case scenario to project the ongoing economic and human development trends. It provides a mixed outcome on the projected economic and human development progress in the next 20 years by simulating how different economic growth trajectories can help promote SDG achievements across development sectors. The aim is to prioritize decisions on the multi-dimensional development challenges and understand the interconnectedness between development goals and the acceleration of human development. In addition, understanding current trends will provide a background against which to assess the effectiveness of green growth and alternative development paths in future reports.

We hope that this paper will be a major step forward, provide the basis to explore and understand long-term economic and human development in Guinea-Bissau. I already look forward to the second volume, which will explore policy options for green growth in Guinea-Bissau. I sincerely hope that this first chapter provides all readers some clues about a possible future growth model for the country while provoking a deeper conversation among the different stakeholders of how to achieve and build a domestic green model for development.

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LIST OF ABBREVIATIONS

COVID-19	Coronavirus disease of 2019
GDP	Gross Domestic Product
HDI	Human Development Index
IFs	International Futures
IMF	International Monetary Fund
ODF	Open Defecation Free
SDG	United Nation's Sustainable Development Goals
SIDS	United Nation's Small Island Developing States
SSA	Sub-Saharan Africa
UN	United Nations
UNDP	United Nations Development Programme
UNICEF	United Nations International Children's Emergency Fund
WAEMU	West African Economic and Monetary Union
WATSAN	Water and Sanitation
West Africa	Benin, Burkina, Faso, Cabo Verde, Côte D'Ivoire, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone, Togo
WHO	World Health Organization

Abul River, Ingoré, Cacheu Region

SECTION

01

Executive Summary

Market at the Port of Bissau, Bissau, Autonomous Region of Bissau

Guinea-Bissau is currently one of the least developed countries in the world, ranking 178th out of 189 countries on the Human Development Index (2019). We study the economic and human development outlook to 2040. We show that economic growth will improve the human condition in Guinea-Bissau (extreme poverty, undernourishment and child stunting), but that progress remains stunted without addressing broader development progress in education, governance and infrastructure.

Guinea-Bissau is one of the least developed countries in the world, ranking 178th out of 189 countries on the Human Development Index in 2019, 27th on the State Fragility Index, and holding the 7th highest poverty rate in the world.[1] The combined set of development challenges and state fragility have resulted in historically low economic growth, averaging 3.4 percent between 2000 and 2019. This falls below sub-Saharan Africa's 4.5 percent average growth. The COVID-19 pandemic resulted in an additional economic decline of 1.4 percent in 2020, further stunting economic and human development.

Current levels of development in Guinea-Bissau reflect multidimensional challenges to human wellbeing, and these challenges may persist. Underlying causes of low levels of development, such as high population growth, and low levels of government capacity are not just temporary barriers, rather, they are driven by structural factors and instability. In addition, infrastructure, the rule of law, and capital accumulation all remain persistent challenges. Overall, prospects may look bleak on one hand. However, many countries in Africa have experienced dramatic transformations, building from similarly poor levels of development as emerging success stories.

What could long-term economic and human development look like in Guinea-Bissau? In this report, we explore long-term projections on human and economic development for Guinea-Bissau. These projections are important as they quantify the challenges associated with Sustainable Development Goal (SDG) achievement and provide a baseline against which alternative policy strategies can be tested. First, we use existing literature and data to assess current country-level development in Guinea-Bissau. We then use this information to build scenarios projecting development out to 2040 using the International Futures (IFs) model (**Section 3**). Last, we quantify development indicators for Guinea-Bissau in 2040 (**Section 4**).

Using the IFs model, we explore economic and human development across a wide set of indicators for Guinea-Bissau out to 2040. We develop a *Current Path* scenario that extends the current development trajectory for Guinea-Bissau with an average annualized economic growth rate similar to the 15-year historical average, at 3.2 percent.[2] In addition, we assess adjusted economic growth trajectories by exploring two scenarios with a +1 percent (average: 4.2 percent) and +2 percent (average: 5.2 percent) higher economic growth in each year. We quantify the outcomes across indicators of GDP, GDP per capita, and population, as well as more specific SDG indicators on extreme poverty, undernourishment, child stunting, education, governance, and access to water and sanitation infrastructure. Together this report helps policymakers, the international development community, and development practitioners to assess the *Current Path* of long-term development in Guinea-Bissau.

Along the *Current Path* of development, the overall economic size of Guinea-Bissau, measured through GDP, increases from 1.5 billion USD in 2019 to 2.8 billion USD by 2040 in the *Current Path*. Population continues to rise from 1.9 million people in 2019 to 3.1 million by 2040. Together, the increase in population and GDP contribute to a slow increase in GDP per capita, an important indicator to compare levels of development across countries. In 2019, GDP per capita at purchasing power parity was 1,650 USD (Figure 1), ranked 174th out of 186 countries. The *Current Path* results in a rise in GDP per capita to 2,025 USD in 2040, reaching levels slightly above that of Ethiopia today (ranked 167th out of 186).[3] Scenarios with higher economic growth further drive GDP per capita up, to 2,267 USD (+1 percent economic growth) and 2,535 USD (+2 percent economic growth). The more optimistic economic growth scenarios reach a level of Guinea (ranked 161st) and Zimbabwe today (ranked 158th).

While economic development is on a slightly upward trajectory, the outlook for human development is less optimistic. Across all indicators of human development, Guinea-Bissau is set to make progress in relative terms (percent of population). However, the high population growth outpaces the relative development gains, and by 2040 more people are found in poor and vulnerable conditions.

Figure 1 *GDP per Capita at purchasing power parity from 2019 to 2040 in Guinea-Bissau for the Current Path and more optimistic economic growth scenarios*

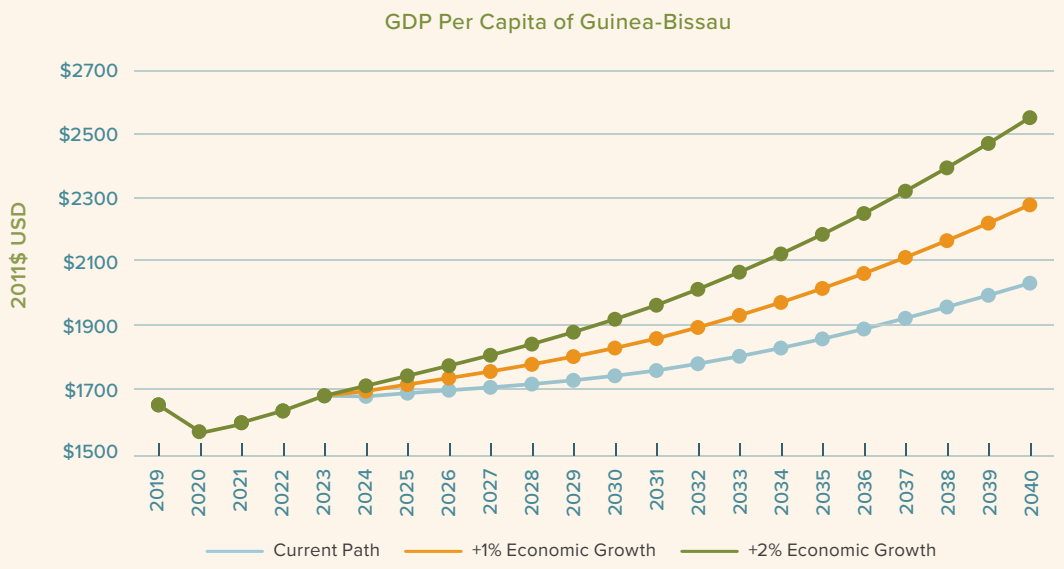
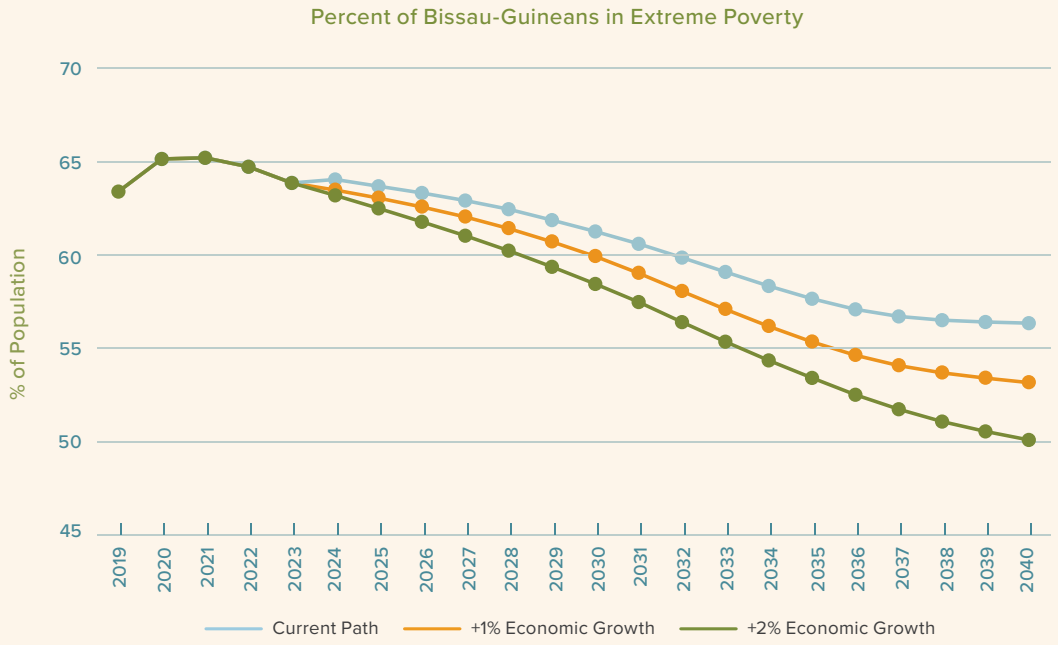


Figure 2

Percent of Bissau-Guineans living in extreme poverty over time from 2019 to 2040. The lines depict the Current Path and the two more optimistic economic growth scenarios. Extreme poverty is defined as the population living at or below 1.90 USD per day



Here we use extreme poverty (Figure 2), measured as the share of population living on less than 1.90 USD per day,[4] to describe the general trends observed across multiple SDGs. In 2019, extreme poverty was 63.4 percent, the highest extreme poverty rate of all countries in Western Africa. By 2040, the extreme poverty rate is expected to drop to 56.3 percent of the population, with the more optimistic economic growth scenarios declining further to 53.2 percent (+1 percent economic growth) and 50.1 percent (+2 percent economic growth).

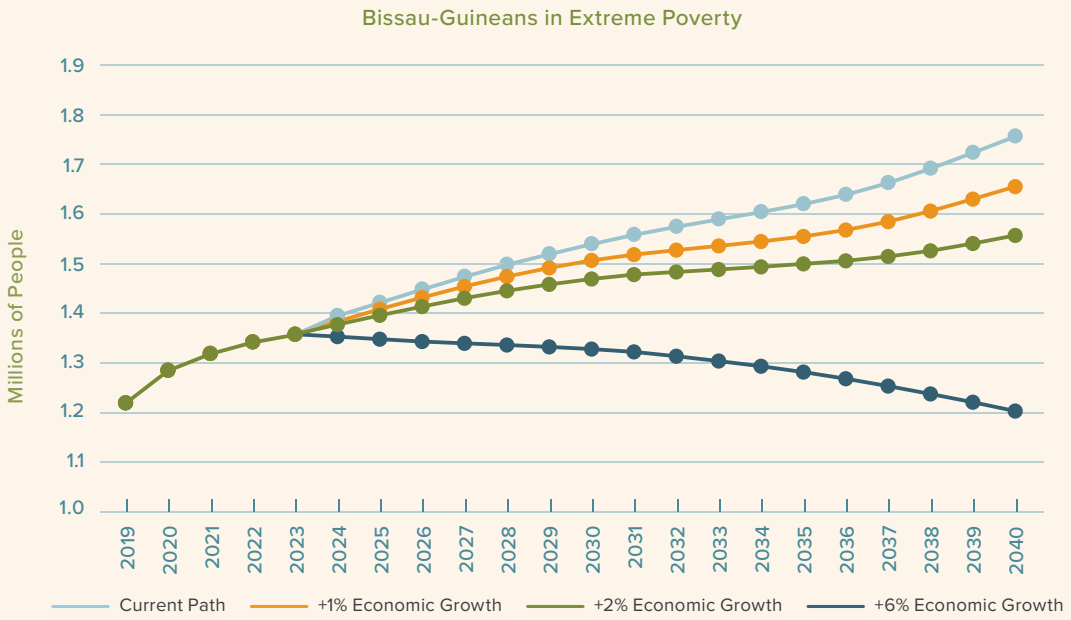
With the rise in population between 2019 and 2040, all scenarios project an increase in the number of people living in extreme poverty in Guinea-Bissau between 2019 and 2040 (Figure 3). Extreme poverty rises to 1.8 million people in 2040 in the *Current Path* showing that a continuation of historical trends will increase the human suffering and development burden in Guinea-Bissau.

What economic growth is sufficient to stabilize extreme poverty levels at the 2019 value? Our analysis suggests that an average economic growth of 9.2 percent (+6 percent above the historical average) or higher is required to stabilize absolute poverty in 2040 at the 2019 level. Such a period of sustained economic growth rate has not been achieved by Guinea-Bissau in its recent history and is likely overly optimistic in the near future. However, countries such as Cabo Verde, Ethiopia, and Rwanda have realized multi-year sustained economic growth at or above these levels in the last 20 to 30 years at least partly due to stable and effective governance, suggesting that while ambitious, it may be an achievable outcome of a well-crafted and executed development strategy.

There are several underlying characteristics to explain the continued low levels of development in Guinea-Bissau, including indicators related to education, governance, and political instability. Guinea-Bissau is projected to make progress across all these indicators,

Figure 3

Number of Bissau-Guineans living in extreme poverty (<1.90 USD/day) from 2019 to 2040. Besides the three core scenarios we added a fourth scenario that keeps absolute poverty numbers at or below the 2019 value. This scenario has a +6 percent economic boost relative to the base case, resulting in an on average 9.2 percent economic growth from 2024 to 2040.



but underlying drivers such as these tend to be relatively slow-changing, and the benefits take time to manifest.

Another major issue is underlying inequalities within the society. Here we take a holistic[5] approach to inequality, by combining aspects of income inequality, gender inequality, and resource inequality in a single framework. The multidimensionality of inequality connects issues of household income and income inequality with differences in education between gender, access to health, and access to basic services in water and sanitation among urban and rural communities (UNDP Guinea-Bissau and UNICEF 2021). Already today Guinea-Bissau has one of the most unequal distributions of income, with a Gini coefficient[6] of 0.51 in 2019 (ranked 1st among countries in Western Africa and 6th highest among small island developing states). This inequality is the core determinant of the continued high level of extreme poverty over time. Other dimensions of inequality are also prominent. Females on average have two years less of educational attainment than males in 2019, with a 1-year gap that is likely to remain in 2040. Similarly, strong developmental differences and challenges exist between urban and rural communities, where urban electrification (around 50 percent of the urban population) is slightly over four times that of rural areas.

To conclude, our analysis provides a mixed outcome on the progress of economic and human development in the next 20 years. While Guinea-Bissau is projected to make progress across all indicators in relative terms (percent with the indicators expressed as a percentage of population), the high population growth in tandem with slow economic growth means that by 2040 more people are projected to live in extreme poverty than in 2019. Guinea-Bissau will continue to face significant multidimensional developmental challenges through 2040. Accelerating progress requires a broad and inclusive human development agenda that addresses many of the underlying structural causes, which must incorporate sustained economic growth along with

Sailor, Urok Islands, Bolama Region

improved state fragility, governance, education levels, access to safe water, equality in income, gender equality, and a lower rural-urban divide in development.

But what could such an economic growth strategy look like in Guinea-Bissau? Economic growth in Guinea-Bissau is below its potential, and the country faces several challenging contradictions. The country is rich in natural resources with potential for development, such as fertile agriculture especially of cashew nuts, rich fishery grounds, natural resources, and potential for combined eco-tourism and biodiversity conservation. While potential exists, inadequate infrastructure, a lack of financial resources and capital, low levels of educational attainment, and inadequate governance have failed to capitalize on these economic opportunities. The current national development plan aims to link these dimensions by fostering economic growth, while simultaneously strengthening human and institutional foundations. Thus a path of green economic growth in the primary sectors must be accompanied by broader economic and human development.

Economic growth is unlikely to be sufficient on its own. A second core challenge will be realizing pro-poor human and economic development. Part of the reason that economic growth has limited potential to promote human development is that the benefits do not reach poor populations. Inequality, measured through the income distribution, gender inequality and differences in development between urban and rural communities, remains high through 2040. This means that accelerating economic growth without addressing these underlying inequalities does not benefit the most vulnerable populations. Finding policy strategies and investments to target pro-poor growth will be a key objective for policymakers.

Future reports can assist this challenge by focusing on developing alternative policy strategies. These scenarios need to address some of the fundamental development roadblocks around gender inequality, high fertility rates, economic restructuring, improving governance, increasing access to vital infrastructure, and raising education levels. In addition, these alternative scenarios can test the effectiveness and validity of the current focus on economic growth in agriculture, fisheries, mining, and tourism that jointly provide a green growth path for Guinea-Bissau. Quantifying the benefits of these alternative policy strategies can help Guinea-Bissau prioritize areas to invest in. Thus, the scenarios presented here are only half of the puzzle, providing a baseline against which to test alternative policy scenarios.

Sunset on the big river of Buba, Buba, Quinara Region

SECTION

02

Economic and Human Development in Guinea-Bissau

Preparations for fishing, Fish market, Bissau, Autonomous Region of Bissau

Guinea-Bissau is a country in West Africa with a population of 1.9 million people (United Nations Department of Economic and Social Affairs 2019). Guinea-Bissau is a fragile state, with one of the lowest levels of development in the world, ranked 178th out of 189 countries in the United Nation's Human Development Index (HDI) in 2019 (United Nations Development Programme 2019). In 2021, the country was labeled the 27th most fragile nation in the world, according to the 2021 Fragile State Index (The Fund for Peace 2021).

EXPLORING ALTERNATIVE FUTURES OF DEVELOPMENT

Average economic growth of 3.4 percent over the past two decades has been below the 5.4 percent average growth in sub-Saharan African or the 3.6 percent average growth in small-island development states (SIDS) over the same period (World Bank Group 2020b). Moreover, Guinea-Bissau's economy is heavily reliant on cashew nut production and exports, making it vulnerable to international economic shocks (Arvanitis and Weigert 2017). The COVID-19 pandemic resulted in a negative 1.4 percent contraction of the economy in 2020 (International Monetary Fund 2021), further hindering near- and long-term prospects for sustainable economic growth and human development.

These trends illustrate the severity of multidimensional challenges to economic development, governance, and human development in Guinea-Bissau today. However, with challenges also come opportunities. Guinea-Bissau's position on the West African coast provides an opportunity for economic growth. The country is rich in natural resources with some of the most abundant fishery grounds in the world, and high biodiversity with a possibility for eco-tourism development (Republic of Guinea-Bissau 2011; 2018). More recently, Guinea-Bissau has made improvements in access to water and sanitation infrastructure, and with green energy development and accessibility, domestically and throughout West Africa (United Nations Children's Fund 2021; World Bank Group 2020a). Clearly, some conditions exist for long-term development trajectories that achieve sustainable economic and human development.

In this report, we explore long-term projections on human and economic development for Guinea-Bissau. These projections quantify the challenges associated with SDG achievement in Guinea-Bissau. First, in this report, we use existing literature and data to assess the current country-level development in Guinea-Bissau. We then use this information to build scenarios projecting development out to 2040 using the IFs model (Section 3). Last, we quantify development indicators in Guinea-Bissau in 2040 (Section 4). Together this report helps policymakers, the international development community and development practitioners to assess the *Current Path* of long-term development in Guinea-Bissau. Furthermore, it provides the foundation against which to explore alternative development trajectories to improve sustainable economic and human development.

CURRENT ECONOMIC AND HUMAN DEVELOPMENT IN GUINEA-BISSAU

GUINEA-BISSAU, GEOGRAPHY

Guinea-Bissau is situated along West Africa's Atlantic Coast, and borders Senegal to the north and Guinea to the south-east (Figure 4). It gained independence from Portugal in 1973 and has Portuguese as its official language and Crioulo as its lingua franca (Só et al. 2018). Bissau, the capital and main city, hosts around one-fifth of the total 1.9 million population with the remaining population spread across eight primarily rural provinces (United Nations Department of Economic and Social Affairs 2019). Guinea-Bissau has an extensive coastline, with the Bijagós archipelago consisting of 88 islands. Due to its archipelago, Guinea-Bissau is a member of the United Nation's Small Island Developing States (SIDS) group (UN-OHRLLS 2011).

Figure 4 *Country map of Guinea-Bissau with the Bijagós Archipelago for the coast. The small cutout situates Guinea-Bissau within the African continent.*

Cashew campaign, Oio Region

GOVERNANCE AND POLITICAL INSTABILITY

Guinea-Bissau has a history of political instability and conflict, which has imposed significant economic and social development costs. From 1974 to 2014, the government endured several coup attempts, with four successful coup d'états, several interim presidents, one transitional head of state, and five elected presidents (IMF 2015). In the 1990s, the country attempted its first democratic elections with multiple political parties but remained a dictatorial one-party regime until 1994 (Só et al. 2018). In 1998 and 1999, a country-wide civil war took place, resulting in hundreds of deaths and further depleting its economic and physical infrastructures (World Bank Group 2016, 2016). In 2014, Jose Mario Vaz won the presidential election, and in 2019, he became the first president in the history of the country to complete a full presidential term. Umaro Sissoco Embalo became president in 2019 and remains the president as of October 2021.

This political volatility is fundamental to understanding Guinea-Bissau's low performance on governance indicators. Out of the six main indicators used to assess the quality of governance by the World Bank in its Worldwide Governance Indicators analysis (where 0 percent corresponds to the lowest ranking, *least-effective*, and 100 percent to the highest ranking, *most-effective*) Guinea-Bissau consistently scores around the lowest of all countries. In 2019, Guinea-Bissau scored 6.2 percent for the Government Effectiveness indicator, and 5.2 percent for Control of Corruption. For Rule of Law and Political Stability, it scored 7.6 and 24 percent (World Bank Group 2019). The Guinea-Bissau government also faces a gender gap in political participation and representation, with only 13.7 percent of seats in parliament held by women in early 2021 (UN Women 2021). These low government capacity, inclusion, and political stability levels directly diminish the state's ability to sustain and improve spending in sectors essential for economic and human development, such as health, education, and infrastructure.

ECONOMIC GROWTH AND STRUCTURE

Instability has continuously hindered Guinea-Bissau's economic growth. Between 2000 and 2019,[7] the country's real GDP growth averaged 3.4 percent, below sub-Saharan African and West African Economic and Monetary Union (WAEMU) countries, which recorded growth averages of 4.5 and 4.4 percent in the same period (World Bank Group 2020b).

The economy is heavily reliant on agriculture and fisheries. Between 35 to 45 percent of GDP originates from agricultural practices and fisheries. Services, such as wholesale and retail trade, have a slightly smaller economic contribution; followed by other sectors. Most households are employed in agriculture, while distribution services and informal trade account for the remaining active workforce (World Bank Group 2020b).

Crop production primarily includes rice, cotton, peanuts, sorghum, palm, and cashew nuts. While rice production is the predominant agricultural practice for consumption, cashew nut production constitutes the main source of income for more than two-thirds of households (Santos et al. 2014). Because the country relies on the production of cashews, its economy suffers from a lack of diversification and is the second least diversified export portfolio in sub-Saharan Africa.

Significant constraints limit agricultural development in Guinea-Bissau; in particular, inadequate land management systems, limited access to technology and finance, and poor investments in the logistic, energy, and storage capacity of its infrastructure (World Bank Group 2016). The lack of available labor force is another limitation, with young people leaving their villages to pursue opportunities in the capital. Access to electricity is another serious constraint. In 2019, 27.9 percent of the population had access to electricity countrywide compared to only 10.2 percent in the rural areas of the country (50.2 percent in urban settings). These figures are far below the 2010 to 2018 average for WAEMU countries, which recorded close

to 80 percent of access in urban settings and 20 percent in rural areas (World Bank Group 2020b). The availability and cost of electricity is concerning, with the average cost of electricity in Guinea-Bissau (USD 0.42/kWh) amongst the highest in sub-Saharan Africa (World Bank Group 2020a, World Bank Group 2020b).

Another significant economic pillar is the fisheries sector, but most revenues do not benefit the domestic economy despite Guinea-Bissau's coastal waters having the highest levels of primary fish productivity in the world. The fisheries sector employs 120 thousand workers both directly and indirectly and contributes to about 3 percent of its GDP, 40 percent of the State's budget, and 4 percent of its exports portfolio (Republic of Guinea-Bissau 2018). Exploitation of the fishing industry by foreign companies is a major issue (World Bank Group 2016) with only a small portion of the revenues benefiting local households and the national economy.

A general issue across sectors is the large share of informal labor in Guinea-Bissau. A recent UN country analysis suggests that over 75 percent of employment in Guinea-Bissau is in the informal sector, and IMF estimates that 40 percent of the economy is informal (UN Guinea-Bissau 2020; Medina, Jonelis, and Cangul 2017). In addition, much of the work in the agricultural sector is seasonal, meaning that income is only generated for part of the year (UN Guinea-Bissau 2020). There is also a gender gap between the formal and informal sector with 52 percent of informal jobs held by women and 73 percent of formal economy jobs held by men (UN Guinea-Bissau 2020). Similarly, according to the Women, Business and the Law Index, women in Guinea-Bissau enjoy disproportionately fewer legal rights than men (World Bank Group 2020b).

There are several challenges associated with a large informal sector. First, the informal sector tends to be far less productive than the formal economy. People working in the informal sector in Guinea-Bissau are generally poorer than households employed in the formal sector. Data from a Harmonized Living Conditions Survey in 2018 report that 52 percent of those working in the informal sector in Guinea-Bissau are considered poor, in contrast to only 25 percent in the formal sector (Ndoye 2020). Second, the informal economy often generates little to no government revenues. Third, individuals and companies operating in the informal sector often have much less access to public goods, services, and social safety nets. The lack of access to public goods and services limits their productivity, while the lack of access to social safety nets increases vulnerability to poverty and undernourishment.

Nevertheless, the informal sector provides a vital source of income to those unable to find employment in the country's underdeveloped formal sector. Without the informal sector, many more individuals and households would lack a source of income, and the associated economic and human development issues in Guinea-Bissau would be more severe. But given the lower productivity in this sector, there are lost opportunities for more effective allocation of labor, investment, and resources to spur economic growth. It might also mean that economic growth differs from official statistics because growth figures in the informal sector are not considered. Getting clearer insights into the size of the informal sector and transitioning work from the informal to the formal sector is key.

Development of businesses is further constrained by a lack of functioning banking sectors. Many households in Guinea-Bissau generally do not have a bank account or utilize bank services, with access to a bank account in 2013 below 1 percent of the population. Consequently, businesses cannot reliably

Waitress serving oysters, Quinhámel, Biombo Region

access capital, which impacts operations and is cited by businesses as a core issue just below political instability and at the same level as access to electricity (Arvanitis 2014). Additionally, poor access to internet (only 10 percent of the population had access to internet in 2018) further diminishes the ability of businesses and individuals to benefit from the digital transformation (UN Guinea-Bissau 2020).

DEMOGRAPHICS

A rapidly growing population further strains limited economic and governance resources. Between 1973 and 2019, the population increased rapidly from 743 thousand people in 1973 to 1.9 million in 2019 (World Bank Group 2021). Fertility rates dropped from 4.6 per woman in 2017 to 4.4 in 2019, which is below the average of sub-Saharan Africa during that same period with recorded rates of 4.8 and 4.6 respectively (United Nations Children's Fund 2021; World Bank Group 2021).

In 2015, 49 percent of the population primarily resided in urban areas, and a strong urbanization trend has mirrored the rapid growth in the population. The capital Bissau is the most populated city in the country, with 492 thousand residents (United Nations Children's Fund 2021). Although many households live in cities, there are real developmental challenges for rural communities and those living in the archipelago. These groups heavily depend on agriculture, especially fisheries and cashew production, but lack adequate infrastructure and access to markets.

HEALTH AND UNDERNOURISHMENT

Despite its reliance on agriculture, the population suffers from high malnutrition and food insecurity rates, with 18.9 percent experiencing undernourishment (Baquedano et al. 2021). There is a significant urban-rural divide, with 20 percent of households in rural communities being food insecure relative to 3 percent of families surveyed in urban areas (World Food Programme 2019). Stunting in children under five was at 26.8 percent in 2019, and acute malnutrition (wasting) was 7.3 percent (United Nations Children's Fund 2021; UNICEF, WHO, and World Bank Group 2020). Food insecurity was worsened by replacing rice production (a staple crop) with cashews, resulting in an increase in rice imports (Catarino, Menezes, and Sardinha 2015).

There is also a lack of political and economic resources to invest in health, education, and infrastructure. Public investment is almost entirely financed by external aid, with major donors including the UN System, the West African Development Bank, the World Bank, and the African Development Bank (World Bank Group 2016). More than 90 percent of the government's health budget comes from international partners.

The health burden disproportionately affects children and women. The country's under-five mortality rate is 92 per 1,000 births, and the neonatal mortality rate is 37 deaths per 1,000 live births (United Nations Integrated Peace Building Office in Guinea-Bissau and Office of the United Nations High Commissioner for Human Rights 2017). Infant mortality rates in 2017 were at 49 per 1,000 live births, the highest amongst all SIDS countries albeit ranked only the 10th highest in Western Africa. Malaria, tuberculosis, and diarrheal diseases are the leading causes of death among children (United Nations Children's Fund 2021). Guinea-Bissau's maternal mortality rates are also among the world's highest (900 deaths per 100 thousand live births). Despite the scale of the problem, the government allocated less than 1 percent of its health budget to women's and children's health in 2013 (United Nations Integrated Peace Building Office in Guinea-Bissau and Office of the United Nations High Commissioner for Human Rights 2017). The COVID-19 pandemic has worsened the health and food security situation, and the country does not have proper medical facilities in place to support those impacted by the pandemic.

WATER AND SANITATION INFRASTRUCTURE

Another health, food security, and general development concern is the lack of access to safe water and sanitation. In 2020, only 24 percent of the nation had access to the highest standard of safely managed drinking water sources and 12 percent of households had access to safely managed sanitation (World Health Organization and United Nations Children's Fund 2020). The situation becomes more urgent when further analyzing the divide between urban and rural communities. In 2020, only 9 percent of the urban population lacked access to a source of safe drinking water, 40 percent of rural households relied entirely on unimproved water sources (World Health Organization and United Nations Children's Fund 2020). Nevertheless, since 2016, Guinea-Bissau has been actively working on improving sanitation infrastructure in its rural communities. More than 1,000 of its 4,000 rural areas were declared Open Defecation Free (ODF).

Entrepreneurship training, Bissau, Autonomous Region of Bissau

Access to water and sanitation isn't the only infrastructural challenge. The power sector constantly finds itself below the needed capacities due to poor management and political instability. Most households rely on traditional fuel sources such as charcoal and wood, which becomes a stressor on natural resources such as forest covers (Republic of Guinea-Bissau 2018). Energy consumption is mainly based on biomass (90 percent), with the remaining coming from oil-derived products (8 percent) and electricity (2 percent) (Republic of Guinea-Bissau 2018). Guinea-Bissau is heavily dependent on imported fossil fuels, importing the entire volume of diesel consumed (which constitutes more than 14 percent of its total imports in USD) (World Bank Group 2016).

EDUCATION

A third significant developmental lag for Guinea-Bissau is in the education sector. One-third of children between 6 and 11 years old have never attended school (Só et al. 2018; World Bank Group 2020b). Primary net enrollment and primary education completion rates are hindered by factors such as high repetition rates, which average between 10 to 20 percent across primary and secondary education (World Bank Group 2020b). Much of the education workforce lacks the necessary knowledge and proper understanding of the materials covered by the national curriculum, while many schools lack adequate learning materials for students. In addition, teacher strikes are persistent in the country, negatively impacting students through constant school closures (World Bank Group 2020b).

COVID-19 AND PROSPECTS FOR HUMAN AND ECONOMIC DEVELOPMENT

The COVID-19 pandemic further increases the challenges associated with economic and human development in Guinea-Bissau. The pandemic directly impacted human lives and health. The lack of a proper health infrastructure and the high prevalence of a variety of diseases means that Guinea-Bissau's ability to manage the COVID-19 pandemic is limited (UN Guinea-Bissau 2021).

Cashew nut shelling machine

According to the Global Health Security Index 2019, Guinea-Bissau has the second most fragile health system in the world (Cameron, Nuzzo, and Bell 2019). The direct health effects of the pandemic are likely to persist given that only 0.9 percent of the population is currently vaccinated.[8]

The COVID-19 pandemic also has widespread socio-economic consequences. GDP growth fell by 1.4 percent in 2020, resulting in lower household incomes (International Monetary Fund 2021). Consequently, extreme poverty rates went up (UN Guinea-Bissau 2021). The effects on cashew nut production have been especially detrimental. Lockdowns, international travel and trade restrictions, and reduced demand have resulted in loss of income for many households. The government has limited capacity to provide social safety nets. The high levels of informality limits the effects of recovery measures, such as reduction in income taxes and paid leave, in Guinea-Bissau's formal economy (World Bank Group 2020b). The risk of government debt distress is high, and the government does not have sufficient financial resources to provide social safety programs and support household incomes (IMF & World Bank 2021).

Women are disproportionately affected by the COVID-19 pandemic, further deepening inequalities based on gender. The consequences and underlying reasons are diverse and complex. First, efforts to reduce gender inequality that date prior to the start of the pandemic have crumbled. Second, because women in Guinea-Bissau primarily work in the informal sector they lack access to government services. Already before the pandemic, the extreme poverty rate for females was higher than for males (UN Women 2021). Third, indirect health consequences primarily affect women. Reproductive and sexual health support has been limited. Not having the ability to leave home and go to work also substantially increases the occurrence of gender-based violence. Lastly, school closures are directly associated with the increase of permanent school dropouts and of teen pregnancy and marriage (UNDP 2020). Schools have been closed for 18 weeks so far during the pandemic, and remote learning alternatives are non-existent in Guinea-Bissau (UNESCO 2021).

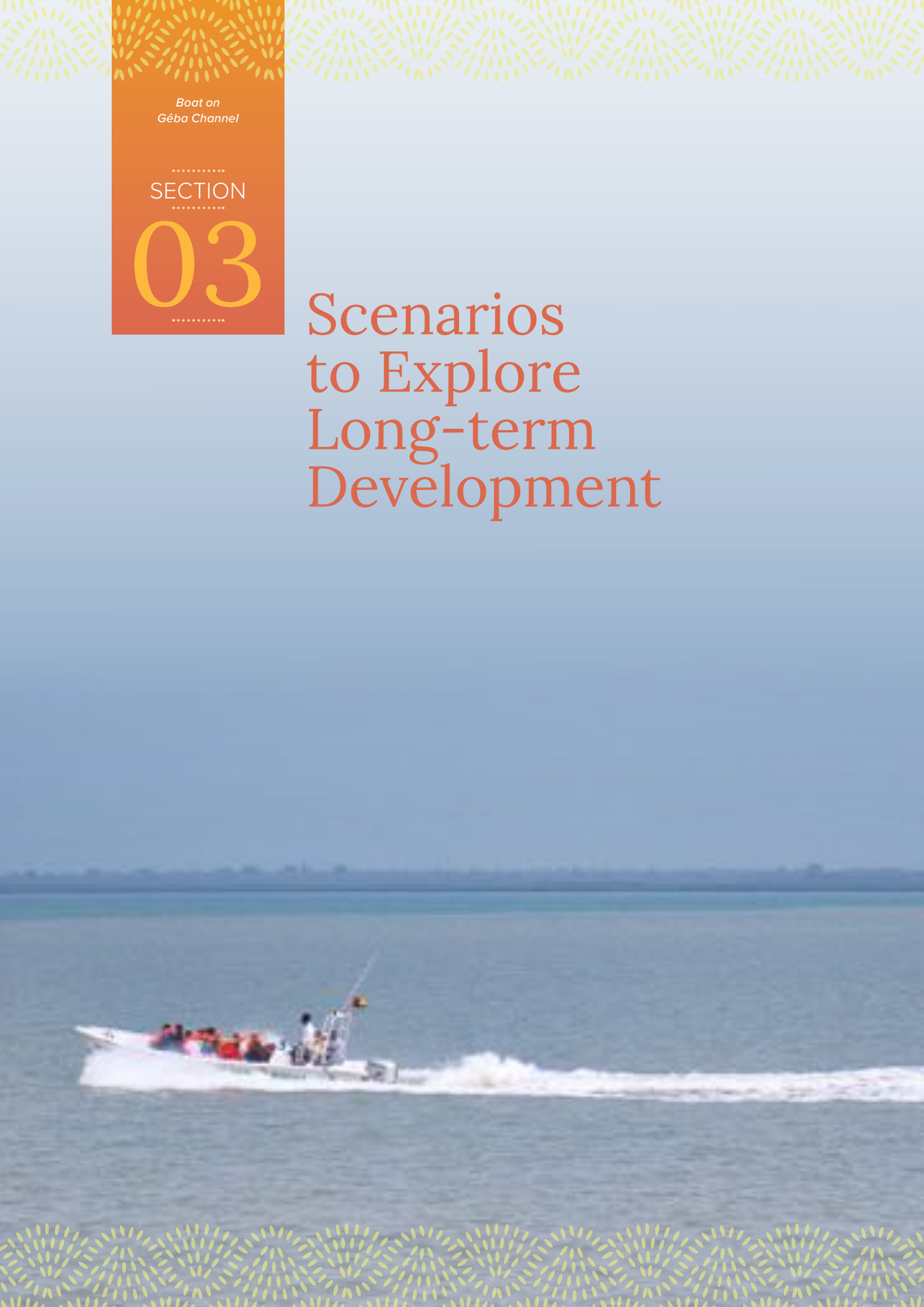
The setbacks of COVID-19 on human development are unlikely to be temporary and will impact economic and human development for the next decades. Learning losses from school closures are projected to be permanent and will affect human capacities and economic growth in the coming years (Kaffenberger 2021). Similarly, COVID-19 is projected to result in rising undernourishment, which will result in long-term economic losses (Osendarp et al. 2020). These potential risks for long-term setbacks are projected to result in less progress on SDG achievement out to 2030 and a rise in extreme poverty, undernourishment, and child stunting out to 2040, relative to a no-COVID scenario (Hughes et al. 2021). An analysis across 10 African countries showed that low levels of government capacity are associated with the strongest and longest negative effects of COVID-19 on economic growth, indirect mortality, and international trade (Verhagen, Bohl, Cilliers, et al. 2021). Given the low government capacity in Guinea-Bissau, it is unlikely that the effects of COVID-19 will subside when the pandemic is contained. Rather, it will be a multiplier on existing development challenges in Guinea-Bissau.

Boat on Gêba Channel

SECTION

03

Scenarios to Explore Long-term Development



Fish market, Bissau, Autonomous Region of Bissau

What are the main trends in long-term economic and human development in Guinea-Bissau out to 2040? Scenarios describing development trends can help us in better understanding the future. Scenarios are internally consistent stories of the future that are shaped by a set of decisions and trends today. Here we focus on a base case scenario for Guinea-Bissau.

USING SCENARIOS TO EXPLORE LONG-TERM DEVELOPMENT

A base case scenario focuses on describing the world as it is and using our current understanding of trends in economic and human development to project the level of development into the future. This type of scenario assumes a world with no major deviations from past historical development patterns, policies, or external shocks to the system (such as runaway climate change). However, the base case does allow for non-linear change, and deviations from past trends because growth in economic and human development can accelerate if the right conditions are met.

A base case scenario is used in two important ways. First, a base case scenario and the associated projections describe the expected future level of development in a country. It does so by providing a quantitative projection of the level of development of a country in 2040, and, secondly, by describing the underlying mechanisms and pathways. This can help policymakers discover important long-term obstacles and opportunities, both across countries and for a specific country like Guinea-Bissau.

Beyond this, the base case can serve as a reference scenario against which to test the effectiveness of alternative policy strategies. For example, how important is economic growth for SDG achievement in Guinea-Bissau? If we improve girls' education, what will be the effect on poverty two decades from now? What is a green growth strategy for Guinea-Bissau and in what ways can it benefit economic and human development in Guinea-Bissau?

THE INTERNATIONAL FUTURES MODEL

Scenarios can be both qualitative and quantitative. Here we focus on the latter by using scenarios to quantify outcome indicators of economic and human development out to 2040. We use the IFs model to project long-term economic and human development. The IFs model is a global integrated modelling platform that provides projections of long-term economic and human development for 186 countries (Hughes 2019). It consists of a set of interconnected systems such as agriculture, conflict, demography, economy, education, energy, governance, and infrastructure. These systems are interconnected in the sense that changes in health, governance, and education are driving long-term economic growth, and vice versa. It is also interconnected between 186 countries which interact over time through patterns of trade, migration, and remittances.

The IFs model has been widely used in policy and academic publications (Hughes et al. 2021; Moyer and Bohl 2019; Moyer and Hedden 2020; Verhagen, Bohl, Cilliers, et al. 2021; Moyer et al. 2020). It has informed long-term economic and human development at the country level for Egypt, Sudan, Brazil, Mexico, and Yemen as well as SDG achievement for all 186 countries (Bohl et al. 2017; Moyer et al. 2019; Hughes et al. 2021). Currently, it is one of the few global modeling platforms capable of projecting SDG achievement across all SDGs at the country level. This tool and all its underlying documentation are open-source and any individual can study projections and develop alternative scenarios. The tool and documentation are in English, with key components also translated into Portuguese.[9] In the technical appendix we describe the core sub-modules of the IFs model, with specific attention to the economic module, and the quantification of SDG achievement over time for Guinea-Bissau.

DEVELOPING A BASE CASE SCENARIO FOR GUINEA-BISSAU

Initial values for variables in the base case are informed by thousands of data series representing current levels of development in Guinea-Bissau. We refer to this base case scenario as the *Current Path* for Guinea-Bissau. As described above, a *Current Path* scenario projects development in a world without any major disruptions. This is challenging in fragile states, in which political instability and fluctuations in economic growth are a reality. The main question for the long-term development in Guinea-Bissau will then be when and if the country is capable of transitioning from a fragile state to a more stable political and economic climate. Therefore, we develop a set of uncertainty framing scenarios exploring alternative economic growth patterns on top of the *Current Path*.

The *Current Path* scenario follows historical growth patterns in Guinea-Bissau at an average of 3.2 percent. While Guinea-Bissau in the *Current Path* maintains several characteristics of a fragile state, it can make progress on strengthening governance and reducing

Bissau-Guinean man on a sea voyage, Gêba River, Autonomous Region of Bissau

the risk of conflict. Our two uncertainty framing scenarios assume higher economic growth, with an additional +1 percent and +2 percent of economic growth for each year. These increases in economic growth are applied post-COVID from 2024 to 2040. Economic growth is a core indicator of economic development in Guinea-Bissau, and is an important driver of human and social development more broadly. For example, stronger economic growth is expected to have positive impacts on several governance, health, and education indicators. While these scenarios are not full representations of alternative development trajectories for Guinea-Bissau, they explore some of the core uncertainties associated with economic and human development. We refer to these scenarios as *Current Path+1 percent Economic Growth* and *Current Path+2 percent Economic Growth*.

QUANTIFYING LONG-TERM DEVELOPMENT IN GUINEA-BISSAU

We use these scenarios to quantify economic and human development in 2040 for Guinea-Bissau. We start by quantifying changes in GDP,[10] GDP per capita,[11] and population growth. We then take a deeper dive into SDG indicators by quantifying effects on extreme poverty (people living on less than USD 1.90 per day), undernourishment, child stunting, adult educational attainment, access to water and sanitation (WATSAN), and governance.

Vendor, Fish market, Bissau, Autonomous Region of Bissau

Boat docked in bay, Guinea-Bissau

SECTION

04

Trends in Economic and Human Development in Guinea-Bissau to 2040

Passenger disembarkation, Bissau, Autonomous Region of Bissau

In the past two decades prior to the COVID-19 crisis (2000–2019), annual GDP growth in Guinea-Bissau averaged 3.4 percent. This growth rate is considerably lower than that of sub-Saharan Africa (4.3 percent) and across SIDS countries (3.6 percent) and is the second lowest in Western Africa (Gambia being the lowest over that period). COVID-19 further hampered economic growth, leading to a 2.4 percentage point contraction in 2020.[12]

TRENDS IN CORE ECONOMIC AND POPULATION INDICATORS

Following COVID-19, the *Current Path* assumes an average growth rate of 3.2 percent for 2024 to 2040 (Table 1). This is below the historic average growth rate (2000–2019: 3.4 percent), reflecting the potential long-term risk COVID-19 poses for economic growth. This scenario describes a continuation of trends across development indicators without any major adjustments in policies to try to accelerate growth in particular areas.

In the two adjusted *Current Path* scenarios we directly vary assumptions on economic growth, with economic growth rising to an average of 4.2 percent and 5.2 percent and the latter putting Guinea-Bissau just above the projected average economic growth rate across all of sub-Saharan Africa. This leads to the country outperforming at least six of its regional peers in Western Africa. These scenarios do not describe any major policy changes, but rather address some of the uncertainty associated with economic growth trajectories in Guinea-Bissau.

Table 1 *Average GDP growth from 2024 to 2040 for Current Path in sub-Saharan Africa and for Current Path, +1 percent economic growth, and +2 percent economic growth scenarios of Guinea-Bissau.*

Average GDP Growth (2024–2040)	
Sub-Saharan Africa (*Current Path*)	**5.1%**
Guinea-Bissau (*Current Path*)	**3.2%**
Guinea-Bissau (+1% Economic Growth)	**4.2%**
Guinea-Bissau (+2% Economic Growth)	**5.2%**

Children at water pump Guinea-Bissau

GDP was at 1.5 billion USD in 2019. In the *Current Path* this increases to 2.8 billion USD by 2040, whereas it grows further to 3.3 (*Current Path+1 percent*) and 3.8 billion USD (*Current Path+2 percent)*. Economic growth also translates to a slightly different economic structure with a transition between sectors away from agriculture and toward other sectors. While this transition occurs across all scenarios, agriculture remains a major contributor to GDP by 2040. In the *Current Path* in 2040 agriculture makes up 30.2 percent of GDP, further dropping to 23.7 percent to 20.1 percent in the more optimistic growth scenarios.

Population growth is another major driver of development trends in Guinea-Bissau (Figure 5). In 2019, the population in Guinea-Bissau totaled 1.9 million people, with a total fertility rate of 4.4 births per woman, driving a 2.6 percent annual population growth rate. Guinea-Bissau has the 4th highest population growth and total fertility rate out of Western Africa's 15 countries. By 2030, population in Guinea-Bissau is projected to reach 2.6 million, further rising to 3.1 million people in 2040. In 2040, population growth and total fertility rates are expected to fall to 2.0 percent and 3.4 births per woman.

In 2019, GDP per capita in Guinea-Bissau was at 1,650 USD per person[13] (Figure 6). This ranks Guinea-Bissau at 174th out of 186 countries in GDP per capita. In Western Africa, only Niger, Togo, Liberia, and Sierra Leone rank lower (Figure 7). By 2040, GDP per capita in the *Current Path* reaches 2,025 USD per person. In the more optimistic economic growth scenarios, GDP per capita increases to 2,267 USD (*+1 percent scenario*) and 2,535 USD (*+2 percent scenario*) per person. To put those numbers into perspective, the *Current Path* would result in a level of GDP per capita just above Ethiopia in 2019 (ranked 167 out of 186 countries globally). The more optimistic economic growth scenarios raise GDP per capita to the level of neighboring Guinea or Zimbabwe in 2019.

This highlights the challenges Guinea-Bissau faces in achieving economic and human development created by a legacy of persistent state fragility and low levels of development across issue areas. The SDGs provide a framework to measure this progress, as well as indicators that are fundamental building blocks for creating an environment for accelerating human development (education, governance, access to WATSAN). In the next section, we further analyze the effect of the *Current Path* scenario on SDG achievement.

Figure 5 *Population in Guinea-Bissau from 2019 to 2040 according to the Current Path. Other scenarios are not depicted because there are minimal changes in population size.*

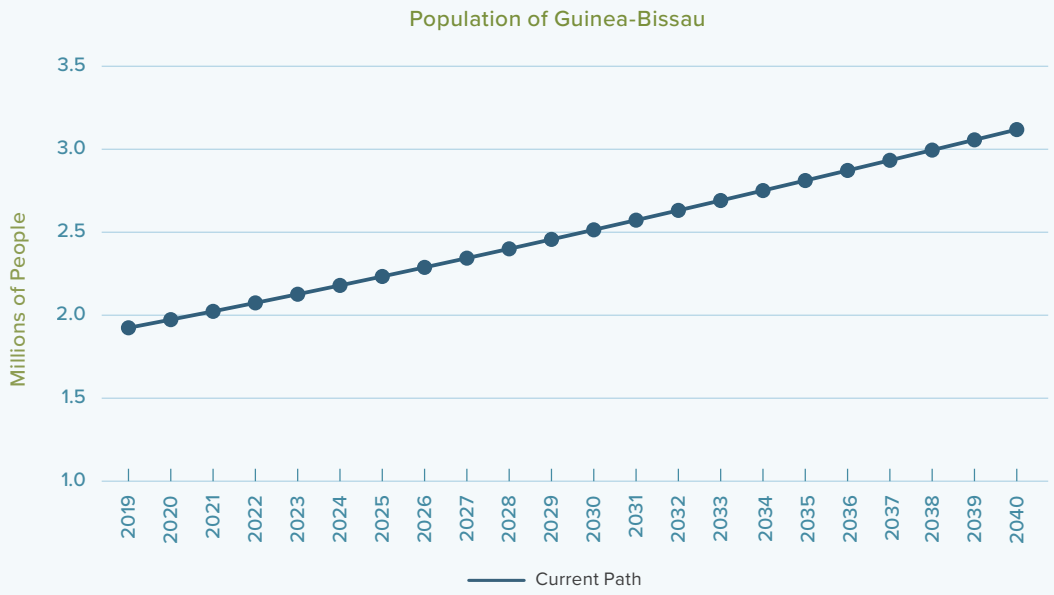


Figure 6 *GDP per Capita at purchasing power parity from 2019 to 2040 in Guinea-Bissau for the Current Path and more optimistic economic growth scenarios.*

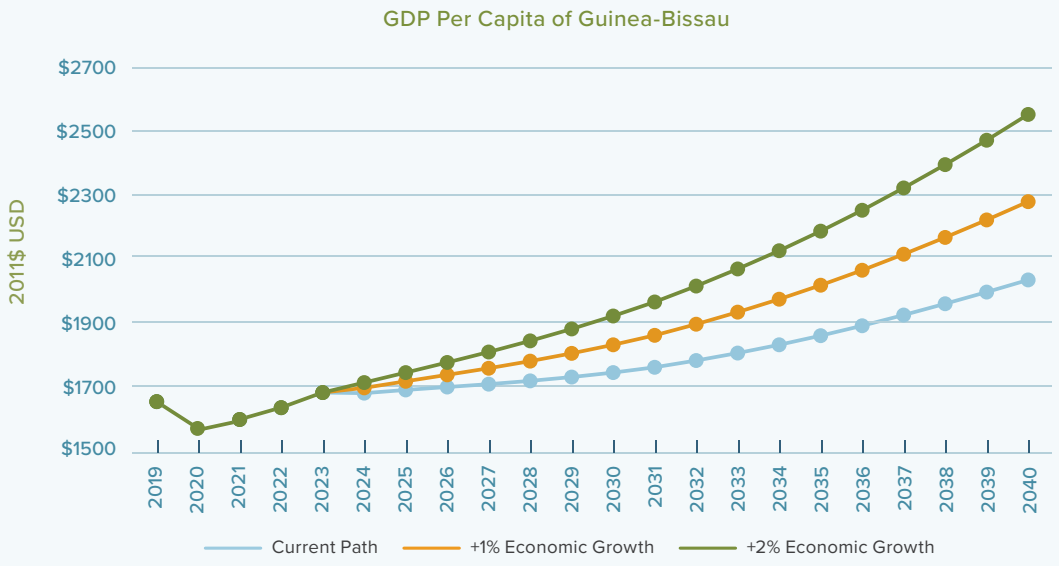
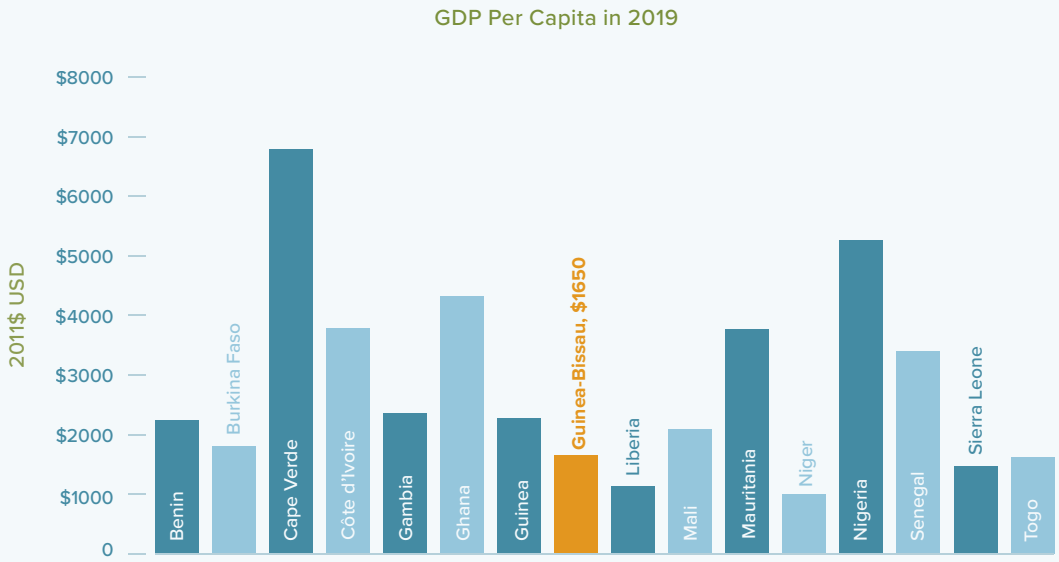


Figure 7 *GDP per capita in 2019 at purchasing power parity across countries in West Africa.*



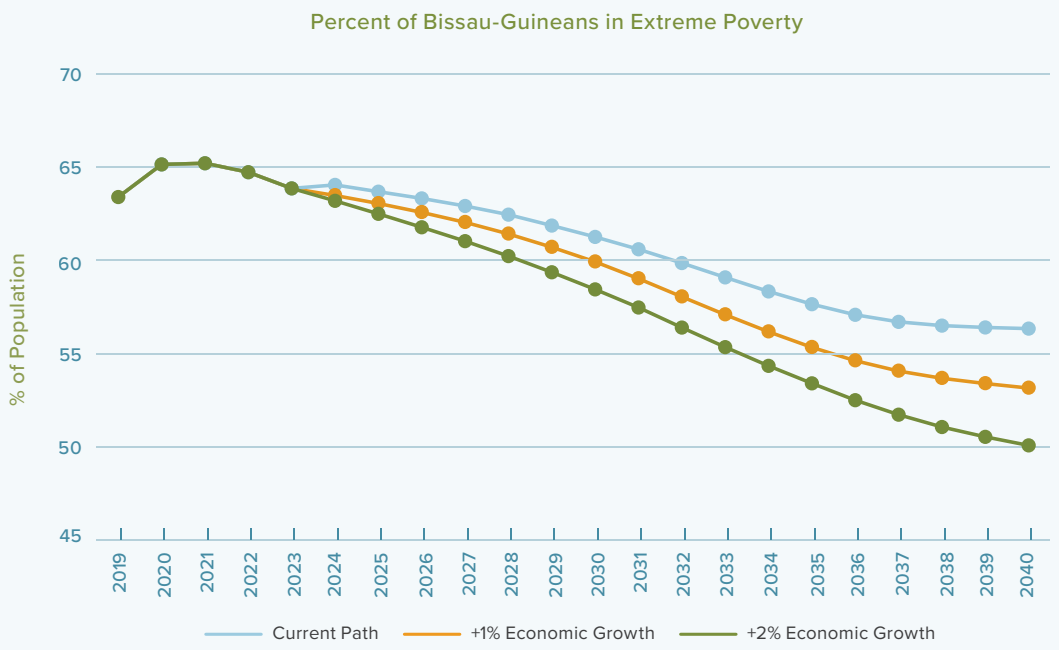
SDG 1: EXTREME POVERTY IN GUINEA-BISSAU

Across all scenarios, the rate of extreme poverty is projected to drop in Guinea-Bissau. Extreme poverty is measured as people living at or below USD 1.90 per day. In 2019, 63.4 percent of the population in Guinea-Bissau was living in extreme poverty (Figure 8). By 2040, this drops to 56.3 percent in the *Current Path* and to 53.2 percent and 50.1 percent in the scenarios with higher economic growth. These changes in extreme poverty are primarily driven by increases in GDP per capita, but the effectiveness of economic growth in lowering poverty remains low because of high inequality in income.

Economic growth results in a rise in disposable income, leading to an increase in average household consumption across all scenarios. But even in the most optimistic economic growth scenario, household consumption in Guinea-Bissau is ranked 11th out of all 16 countries in Western Africa. All else equal, the increase in household consumption will lift some households out of poverty. However, the degree to which this increase reduces poverty also depends on how income (and thus consumption) is distributed.

The distribution of income within a society is measured using the Gini coefficient. The higher the value of the Gini coefficient, the more unequal the distribution of income, with a value of 0 indicating no differentiation in income across households and a value of 1 indicating that a single person owns all income in a country. Guinea-Bissau had a Gini coefficient of 0.51 in 2019, which is the highest of all countries in Western Africa. Our endogenous forecast of the Gini coefficient over time suggests that Guinea-Bissau will continue to experience high levels of income inequality. This means that the rise in economic growth and household income only partly benefits the poorest households. Identifying policies that do not only improve economic growth, but particularly drive pro-poor economic growth will be crucial to accelerate extreme poverty reductions in Guinea-Bissau. While the latter is true across all countries, particularly high levels of income inequality make improving income distributions even more important.

Figure 8 *Percent of Bissau-Guineans living in extreme poverty over time from 2019 to 2040. The lines depict the Current Path and the two more optimistic economic growth scenarios. Extreme poverty is defined as the population living at or below 1.90 USD per day.*



Whilst relative poverty is in decline, the absolute number of people living in extreme poverty is projected to rise in Guinea-Bissau (Figure 9). In other words, the rise in population outpaces the progress made on lowering poverty rates. In 2019, 1.2 million people suffered from extreme poverty. Due to the COVID-19 pandemic, more people were pushed into extreme poverty in 2020. However, even after 2020, extreme poverty continues to rise to 1.8 million in the *Current Path*, with the more optimistic economic growth paths resulting in a level of 1.7 (*+1 percent scenario*) to 1.6 (*+2 percent scenario*) million people by 2040. A total of 0.9 million females are living in extreme poverty in the *Current Path* in 2040, relative to 0.6 million in 2019. Of these 0.9 million females in extreme poverty, girls under the age of 15 make up 42.6 percent showing the disproportionate impact extreme poverty has on the youngest generation.

What would economic growth need to be to keep extreme poverty values constant over time? In order to reach a level of 1.2 million people in extreme poverty in 2040, economic growth relative to the *Current Path* would need to increase by an additional 6 percentage points (Figure 9). This means that on average, Guinea-Bissau would have a 9.2 percent annual economic growth rate between 2024 and 2040. Such a period of sustained economic growth has not been achieved by Guinea-Bissau in its recent history and is overly optimistic in the near future. However, countries such as Cabo Verde, Ethiopia, and Rwanda have realized multi-year sustained economic growth at or above these levels in the last 20 to 30 years. As such, while ambitious, it may be an achievable outcome of a well-crafted and executed comprehensive development strategy.

Community health worker, Guinea-Bissau

Figure 9 *Number of Bissau-Guineans living in extreme poverty (<1.90 USD/day) from 2019 to 2040. Besides the three core scenarios we added a fourth scenario that keeps absolute poverty numbers at or below the 2019 value. This scenario has a +6 percent economic boost relative to the base case, resulting in an on average 9.2 percent economic growth from 2024 to 2040.*

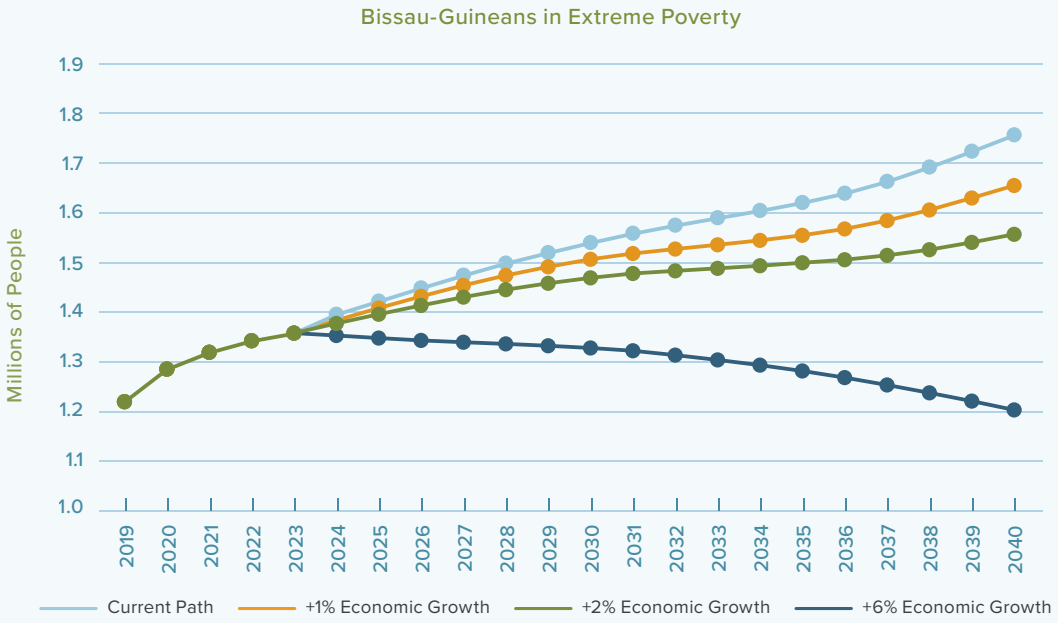
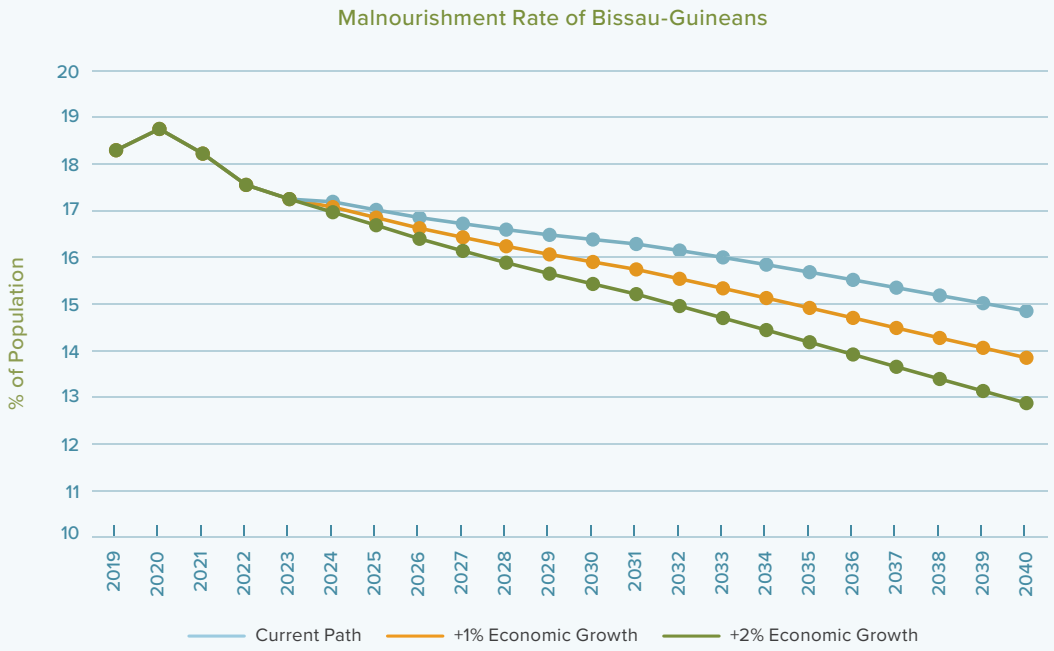


Figure 10 *Prevalence of undernourishment rate from 2019 to 2040 for the population of Guinea-Bissau.*



SDG 2: UNDERNOURISHMENT AND CHILD STUNTING

Over the next two decades, Guinea-Bissau is set to make general progress in lowering undernourishment from a level of 18.3 percent of population in 2019 to 16.4 percent in 2030 and 14.9 percent in 2040 (Figure 10).

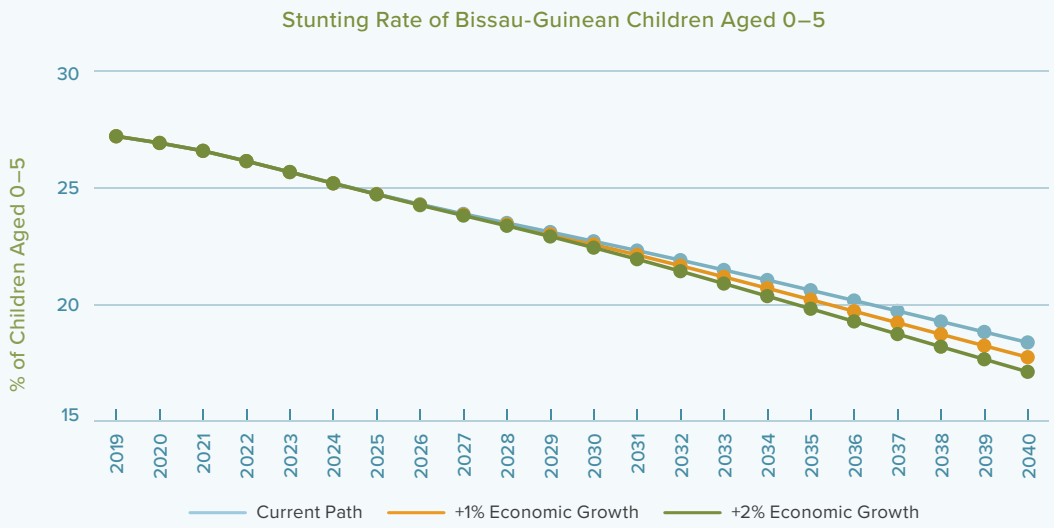
Fisherman in Bissau, Bissau Autonomous Region

The more optimistic economic growth scenarios suggest further improvements are possible, reducing undernourishment to 13.8 percent (*+1 percent scenario*) or 12.9 percent (*+2 percent scenario*) by 2040. The country is home to fertile soils and some of the richest fishing grounds are just off the coast. Even so, the agricultural import dependence in Guinea-Bissau is around 12.2 percent of total agricultural demand and is expected to grow to 29.7 percent by 2040. Production and agricultural exports are largely focused on cashew nuts that are exported as non-processed agricultural products. The recent boom in cashew nut production has come at the cost of staple crops such as rice, which are often crucial for food security. So, while the economy is heavily dependent on agriculture, and many households earn their income from it, the population suffers from undernourishment in part due to the export of domestic production and an inability for household income to keep pace with agricultural demand and prices.

Child stunting can often be attributed to chronic food insecurity and has long-term effects for the cognitive and physical development of children. High rates of child stunting thus pose an immediate threat for child and human development, and represent economic loss and delayed development for future generations (Osendarp et al. 2020). In 2019, 26.9 percent of children between the ages of 0 to 5 suffered from stunting (Figure 11), with Guinea-Bissau ranking 10th out of the 16 countries in Western Africa. Child stunting is expected to drop to 22.6 percent by 2030 and 18.4 percent by 2040. Child stunting has decreased because of progress in raising household income and caloric intake, higher levels of maternal education, and improvements in WATSAN infrastructure (see later paragraphs). More optimistic economic growth lowers levels of child stunting to 17.8 percent (*+1 percent scenario*) and 17.1 percent (*+2 percent scenario*) by 2040, primarily by raising household income and caloric intake. Unfortunately, while progress has been made, these levels of child stunting remain far below SDG achievement levels by 2030 or even 2040. Although improvements in child stunting can be achieved by raising caloric consumption, further progress is broadly dependent on maternal education and disease prevalence associated with access to safe water and sanitation (Gakidou et al. 2010; Akseer et al. 2020). In the following sections, we will focus on some of these underlying drivers of development in conjunction with governance indicators. We focus on trends in the *Current Path* scenario since the more optimistic growth scenarios only result in minimal changes to the underlying drivers and would not highlight different trends or storylines.

Vendor, Port of Bissau, Autonomous Region of Bissau

Figure 11 *Stunting rate of children ages 0-5 from 2019 to 2040 in Guinea-Bissau*



SDG 4: EDUCATION ATTAINMENT AND GRADUATION

Raising levels of education, especially for girls, is an important goal to enable long-term economic and human development. Higher education levels raise the human capabilities that drive economic growth, and higher girls' education levels are an important means of overcoming inequalities in society. Furthermore, higher maternal education is linked to lower levels of child stunting and child mortality later in life (Akseer et al. 2020; Bhutta et al. 2020; Gakidou et al. 2010).

In 2019, adults 15 years and older had on average 4.3 years of education, with adults 25 years and older averaging 3.8 years of education (Figure 12). Over time this is expected to rise steadily to 4.8 and 5.5, respectively. This ranked Guinea-Bissau at 176th out of 186 countries for adults 15 years and older, and 169th out of 186 countries for adults 25 years and older.

There is a considerable gender gap between adult education attainment levels. Females have on average 2 years less of formal education in 2019 compared to their male counterparts. While the gender gap in adult educational attainment is expected to converge slowly over time because of increasing girls' education, females are still expected to have on average one year less of formal education (5.1 to 6.1 years respectively) by 2040.

Figure 12 *Average years of education for adults ages 15+ and 25+ from 2019 to 2040 in Guinea-Bissau. Results are only depicted for the Current Path scenario. The more optimistic economic growth scenarios show similar trends and values.*

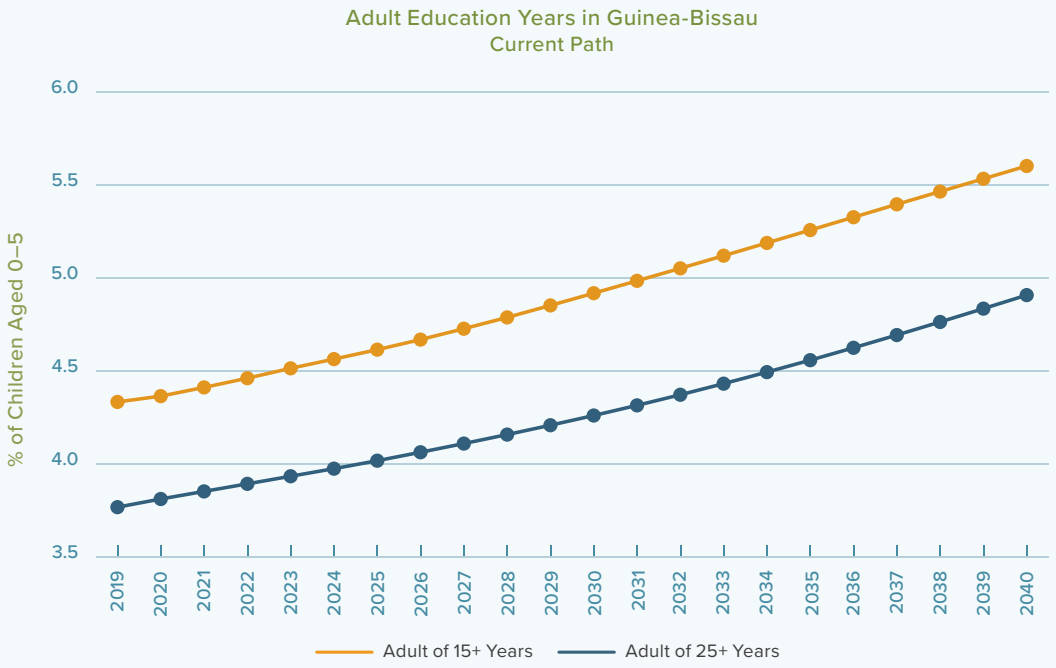


Table 2 *Development of infrastructure indicators over time in the Current Path scenario. Results for other scenarios are not shown since they indicate very similar values and trends.*

	2019	2030	2040
Electricity Access, Rural	10%	14%	20%
Electricity Access, Urban	50%	55%	62%
Cook Stoves, Traditional	95%	90%	83%
Water Access, Improved	74%	76%	80%
Sanitation Access, Improved	38%	46%	57%

SDG 6: INFRASTRUCTURE DEVELOPMENT

In Guinea-Bissau 49 percent of the population lives in urban areas. Rural areas face a set of unique and additional development challenges with limited paved roads, high reliance on traditional bioenergy sources (wood, plants, etc.), low levels of electricity access, and limited access to water and sanitation infrastructure (Table 2).

Across all of these indicators, progress is being made. Improved sanitation, access to safe water, and electricity access all increase, whereas the use of traditional biofuel stoves is decreasing. The more optimistic economic growth scenarios accelerate the trend, reaching 54.3 percent (*+1 percent scenario*) and 56.5 percent (*+2 percent scenario*) of the population with improved sanitation access by 2040, compared to 52.1 percent in the *Current Path*.

However, the strong divide between rural and urban areas continues to persist over the next two decades. In 2019, a total of 27.9 percent of the population had access to electricity, but this drops to 10.2 percent in rural areas relative to 50.2 percent in urban areas. By 2040, electricity access is expected to rise to 38.9 percent of the population, with a sharper increase in urban areas (61.3 percent) relative to rural areas (15.8 percent). These trends suggest that inequality of electricity access in Guinea-Bissau is likely to persist over time and that challenges for rural communities will continue into the next two decades.

SDG 16: GOVERNANCE

A crucial condition for economic and human development is a functioning and stable governance system combined with strong institutional capacities. Good governance and economic growth interact with and sustain one another, but Guinea-Bissau has also seen development gains being offset by political unrest. Here we focus on two indicators to measure governance.

First, governance effectiveness, as determined by the World Bank, measures the perceived quality and credibility of a government and the services it provides, with higher values representing greater effectiveness. While governance effectiveness has been consistently low in Guinea-Bissau, it had a downward trend between 2007 and 2018. In 2019, governance effectiveness is projected to be at a value of 0.9 out of 5 and is expected to gradually rise to 1.3 in 2040. Despite higher economic growth, improvements in governance effectiveness has been limited. To put these numbers into context, in 2019, this level ranks Guinea-Bissau 176th out of 186 countries, while progress made toward 2040 would place Guinea-Bissau in 2019 at 163rd, which is where Madagascar is ranked today.

Guinea-Bissau is also struggling with high levels of corruption, as measured by Transparency International's corruption perception index. Little historical data is available on corruption in Guinea-Bissau. In 2019, Guinea-Bissau ranked 163rd out of 186 countries in terms of corruption, and progress by 2040 would raise that ranking to 139th, or at the level of corruption in Pakistan today.

Guinea-Bissau continues to face challenges through 2040. However, while our projections suggest limited change over time, there is historical precedence for swift improvements in governance quality, catalyzing economic and human development and building resilience against shocks and disruptions. So, while the *Current Path* suggests limited progress, a more rapid improvement in governance could unlock higher levels of economic growth and human development. But developmental challenges stretch much further than governance alone, and sustainable economic growth needs to be coupled with addressing governance, education, infrastructure, food security, extreme poverty, and multi-dimensional inequality.

Musicians in Bissau, Bissau Autonomous Region

Parque Natural das Lagoas de Cufada, Quinara Region

SECTION

05

Conclusion

Boats docked at Bissau fishing port, Autonomous Region of Bissau

Today, Guinea-Bissau has one of the lowest Human Development Index rankings, facing a multitude of interacting development challenges across economic growth, poverty, education, WATSAN, and governance. Toward 2040, Guinea-Bissau can make progress in relative terms (percent of population) across a host of economic and human development indicators. However, this progress remains slow, and in 2040, Guinea-Bissau will continue to struggle with low levels of development across a wide range of indicators.

By 2040, poverty levels are expected to remain above 50 percent, child stunting rates at 18 percent, and graduation at lower and upper secondary levels below 50 percent. Even more so, our projections suggest that with rapidly rising population levels the number of people living in conditions characterized by low levels of development is projected to rise over time.

In 2040 more people will live in extreme poverty than today in Guinea-Bissau. This is true even for optimistic growth scenarios that surpass historical average economic growth rates. Relying on growth alone, only a scenario with an average sustained 9.2 percent economic growth rate results in a stabilization of absolute poverty in 2040.

The above picture identifies examples of challenges to Guinea-Bissau achieving sustainable economic and human development. Improvements will need to address many of the development roadblocks in Guinea-Bissau. This report is a first step in that direction, and future reports should explore alternative development trajectories. Doing so will help policymakers both prioritize decisions in the context of multi-dimensional development challenges, and understand the interconnectedness between development goals, accelerating human development in Guinea-Bissau.

This report provides the basis for additional analysis to explore alternative trajectories of economic growth and human development. Here are some of the key takeaways.

While progress is made across most indicators, Guinea-Bissau continues to suffer from low levels of development in 2040. The scenarios in this report demonstrate progress in economic growth and across indicators of human development in Guinea-Bissau. However, without any major policy changes, historical trends will remain inadequate to accelerate economic and human development in Guinea-Bissau.

Economic growth in Guinea-Bissau is below its potential. The country is facing several challenging contradictions. The country is rich in natural resources with potential for development, such as fertile agriculture for cashew nuts, rich fishery grounds, natural resources, and complementary potential for combined eco-tourism and biodiversity conservation. While development potential exists, inadequate infrastructure, a lack of financial resources and capital, low levels of educational attainment, and inadequate governance have failed to capitalize on this potential. Periods of higher economic growth have often been offset by political unrest, coup d'états, and ineffective governance. All of this is further complicated by high shares of the informal sector and seasonal labor in agriculture.

But what could such an economic growth strategy look like in Guinea-Bissau? The current Strategic Plan identifies agriculture, fisheries, mining, and tourism as potential growth sectors (OECD 2015). The Strategic Plan also has provisions for strengthening economic growth by protecting biodiversity and natural capital, improving human development, sustaining good governance and peace, and accelerating growth in crucial infrastructure. As such, a path of green economic growth in the primary

Maintenance of fishing nets, Varela, Cacheu Region

sectors must be coupled with progress on human development and governance.

But economic growth, even combined with accelerating human development is unlikely to be sufficient on its own. A second core challenge will be realizing pro-poor human and economic development. Part of the reason that economic growth has limited the potential to accelerate human development is that the benefits do not fall to the poor. Inequality measured through income distribution, gender inequality, and differences in development between urban and rural communities is high and remains so through 2040. This means accelerating economic growth without addressing underlying inequalities will not benefit the most vulnerable populations. Finding policy strategies and investments to accelerate pro-poor growth will be a key objective.

Future reports should focus on developing and testing alternative policy strategies. Likely these scenarios need to address some of the fundamental development roadblocks around gender inequality, high fertility rates, economic restructuring, improving governance, increasing access to vital infrastructure, and raising education levels. In addition, these alternative scenarios can test the efficacy and validity of the current focus on economic growth in agriculture, fisheries, mining, and tourism to jointly provide a green growth path for Guinea-Bissau. Quantifying the benefits of these alternative policy strategies can help Guinea-Bissau in prioritizing which sectors to invest in. The scenarios presented here are only half of the puzzle, they provide insights into the current development trajectory and present a baseline against which to test alternative policy scenarios.

Net preparation, Varela, Cacheu Region

Abul River, Ingoré, Cacheu Region

SECTION

06

Technical Appendix—The International Futures Model

Port of Bissau, Autonomous Region of Bissau

NOTE AND DISCLAIMER:

The technical appendix of the International Futures model, the submodules and the human development outcome indicators are based on a combination of resources including documentation on the IFs wiki, a publication on COVID-19 and food security (Verhagen, Bohl, Cannon, et al. 2021), as well as a report and academic article on economic and human development in Sudan (Kabandula et al. 2021).

While these descriptions are general across all countries, we updated the descriptions to match the specifics for Guinea-Bissau.

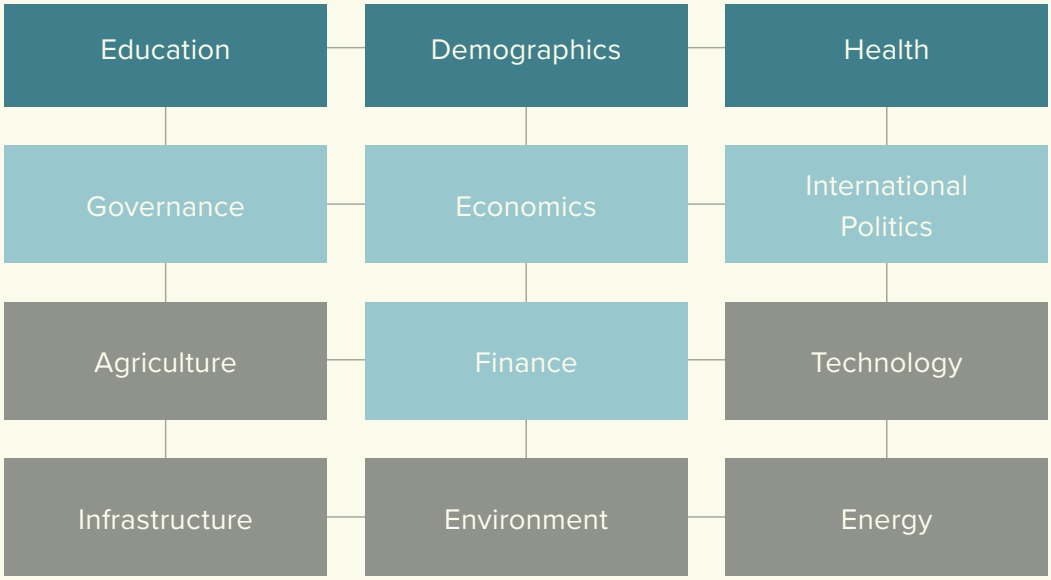
The IFs model undergoes continues updating. Therefore, some of the specifics described in this technical appendix might not reflect the most recent modelling practices. However, core concepts tend to be maintained between model versions, and the below description is the approach used for the report presented on Guinea-Bissau.

International Futures (IFs) is a tool for thinking about long-term, country-specific, regional, national, and global futures. IFs integrates forecasts for different sub-modules, including population, economy, agriculture, education, energy, sociopolitical, international political, environment, technology, infrastructure, and health (Figure 13). These sub-modules are dynamically connected, so IFs simulates how changes in one system lead to changes in all other systems. As a result, IFs endogenizes more relationships from a wider range of key global systems than any other model in the world.[14]

IFs leverages historical data, identifies and measures trends, and models dynamic relationships to forecast hundreds of variables for 186 countries for every year from 2017 to 2100. IFs is used to help understand dynamics within and among global systems, thereby allowing users to think systematically about potential futures as well as development goals and targets. There are three main avenues for analysis in IFs: historical data analysis (cross-sectional and longitudinal); *Current Path* analysis (where systems seem to be developing); and alternative scenario development (exploring if-then statements about the future). No software can predict the future. IFs forecasts are informed extensions of current trends and dynamics built on our current knowledge of development patterns, and should be used to try to understand and learn about long-term trends in development rather than predict.

Broadly speaking, the IFs model fits into the history of system dynamics and integrated assessment models. System dynamic models aim to represent the world as an interconnected system, in which positive and negative feedback loops between system components jointly drive development in economic, environment and human systems. Many of the concepts of system dynamics modeling have later been adopted by the integrated assessment modeling community, which primarily focuses on studying the interactions between

Figure 13 *Stylistic representation of the sub-modules of the International Futures model and the interactions between them.*



Note: This representation does not depict all the interactions between the submodules. Dark blue refers to the human development system, light blue refers to the governance and socioeconomic system, and grey refers to the components of the (bio)physical system represented in the IFs model.

the climate and the economic system. A famous example is the Dynamic-Integrated Climate-Economy model or DICE from Nobel laureate William Nordhaus (Nordhaus 2018). These integrated assessment models are primarily used to study the interactions between socioeconomic and climate change and the effects of mitigation and adaptation policies (van Vuuren et al. 2011; O'Neill et al. 2014). The IFs model has characteristics of both modeling philosophies by connecting a climate and economic model, as well as more broadly assessing development across a wider set of integrated connected systems.

THE ECONOMIC MODULE

A core component of the IFs model is the economic module with connections with all other sub-modules in IFs. For a country-level analysis, such as done for Guinea-Bissau, the core economic model output is on economic growth over time, the share of each sector in contributing to value add, the overall size of the economy (GDP over time), the change in GDP per capita, and often important for low-income countries the contribution of labor and the demographic dividend to economic growth. The IFs economic module is documented in academic literature and policy reports (Hughes and Narayan 2021; Verhagen, Bohl, Cannon, et al. 2021; Hughes 2019; Moyer and Hedden 2020), and all relevant documentation is publicly available.[15] Here we provide an overview of some core concepts of the economics module, largely building on existing documentation.

The economic module is a core component of the IFs system, in particular for its close interactions with all other modules. On the input side, variables from almost all other modules affect production levels. On the output side, the magnitude of GDP and the level of GDP per capita are critical for essentially all other modules. Most closely linked to the economic module are the energy and agriculture modules, both of which use a partial equilibrium structure that echoes the one in the economic module, and both of which provide physical values that fully determine the currency value-based representations of their respective sectors in the economic module.

Basic economic variables include GDP at market exchange rates, GDP at purchasing power parity, GDP per capita at market exchange rates, and GDP per capita at purchasing power parity. The module represents all of these in constant 2011 US dollars and includes a representation of the portion of the economy that is informal.

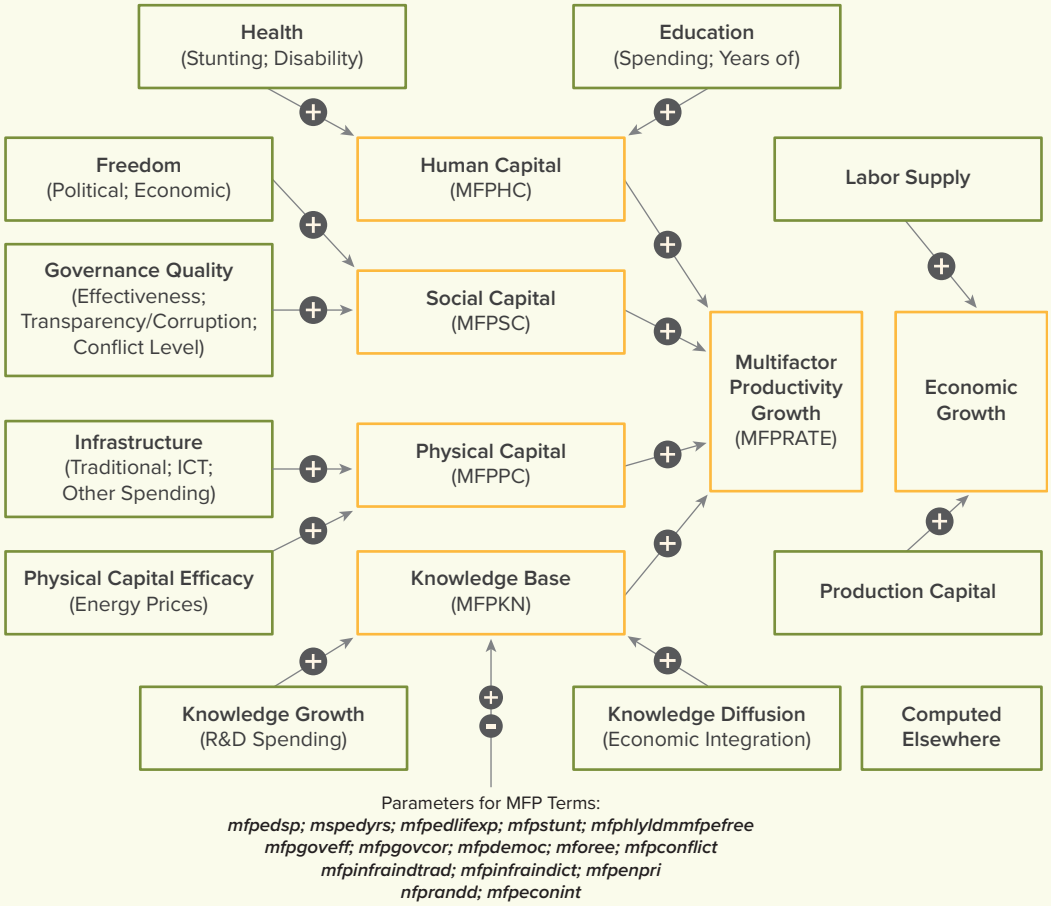
The treatment of economics in IFs draws on both the classical tradition's focus on economic growth (with great attention in IFs to the newer work on endogenous growth theory) and the neoclassical perspective's general equilibrium approach. The supply side of the economic module is based on the Cobb-Douglas production function:

$$V\,ADD_{r,s} = MFP_{r,s} * CAPUT_{r,s} * KS_{r,s}^{\alpha} * LABS_{r,s}^{(1-\alpha)}$$

The function uses labor, capital, and multifactor productivity (MFP) as the primary drivers of economic growth. In the above equation, capital stock (KS) is a function of investment and depreciation rates, labor supply (LABS) is determined from population and endogenously derived labor force participation rates, and there's an exogenous capacity utilization (CAPUT). Value add and each factor of production are specific to the country (r) and sector(s).

While the treatment of capital and labor in the IFs system will be familiar to users with an understanding of neoclassical economics, the treatment of productivity within IFs deserves greater explanation. Unlike most neoclassical models, which primarily focus on technology as the determining factor of productivity in their equations, the IFs system uses MFP, which is a broader definition of productivity. The MFP term in IFs has four basic components: human (MFPHC), social (MFPSC), physical (MFPPC), and knowledge capital productivity (MFPKN) (Figure 14). Each of these components can take on a positive or negative value, depending on whether the calculated value of the component is providing a positive or negative impact to economic growth rates relative to what would be expected based on the country's level of development.

Figure 14 *A stylistic representation of the IFs economic growth calculations.*



Note: Economic growth (far right) is driven by labor supply, production capital, and MFP. MFP is driven by the four components of human capital, social capital, physical capital, and knowledge base, which themselves are linked to other sub-modules in IFs about education, health, governance, and infrastructure.

Source: International Futures (IFs) model. Frederick S. Pardee Center for International Futures, Josef Korbel School of International Studies, University of Denver, Denver, CO.

Drivers of MFP vary by component. MFPHC is driven by years of education, education expenditures, life expectancy, and health expenditures. MFPSC is driven by Freedom House's measure of political freedom (a variable describing democracy), governance effectiveness, corruption perceptions, and economic freedom. MFPPC is driven by two separate indices of infrastructure: traditional (roads, electricity, and water and sanitation) and information and communication technology. Finally, MFPKN is driven by research and development expenditures and economic integration. This final component of MFP represents a measure of connectedness to the global economy. Thus, changes in other sub-modules of IFs will result in changes to the relevant component of multifactor productivity and therefore to economic growth.[16]

Figure 15 *Example of a condensed Social Accounting Matrix (SAM) for IFs in Guinea-Bissau in 2017 with a differentiation in the different sectors and actors and a representation of the flows.*

Social Accounting Matrix

Continue Using Countries/Regions Percent Change From Base Case Show Stocks Display for Print Expand SAM About SAM

Countries or Regions Guinea Bissau **Select Year** 2017

Select File: 0 - Working File, based on IFSBASE.RUN

Supplied by	Used by Sectors	Used by Household	Used by Firms	Used by Capital	Used by Government	Used by ROW	Used by Total	Environment
Sectors	0.4745	1.145	0	0.1289	0.1604	0.3523	2.261	0
Household	0.6733	0	1.056	0	0.027	0.0348	1.198	0
Firms	0.6729	0	0	0	0	0.0208	0.6937	0
Capital	0	0.1057	0.1289	0	0.0823	-0.0903	0.2266	0
Government	0	0.0875	0.0238	0	0	0.198	0.3093	0
ROW	0.4406	0	0.0014	0	0.0115	0	0.4535	0
Total	2.261	1.338	1.21	0.1289	0.2812	0.5156	5.736	0
Environment	0	0	0	0	0	0	0	0

Currency Units in the SAM are Billion $ except Environmental cells.
Goods and Services flow from suppliers to users; currency flows from users to suppliers
Double click on any numerical value for options.

Source: International Futures (IFs) modeling system, Version 7.78. Frederick S. Pardee Center for International Futures, Josef Korbel School of International Studies, University of Denver, Denver, CO.

The production function is embedded in a six-sector model of the economy featuring agriculture, raw materials, energy, manufactures, services, and information and communication technology that balances domestic demand and trade in a general equilibrium-seeking structure. Production and consumption of goods and services are in turn incorporated into a larger Social Accounting Matrix (SAM), which represents the behavior and financial interaction of households, firms, and government (Figure 15). A SAM traditionally represents flows among different economic sectors and agent categories (e.g., households, firms, and government). For instance, it represents private consumption and net national savings, as well as household income and savings; firm income, investment by sector, and savings; government revenues, total expenditures with transfers, transfers to households, directed consumption in total, and by sector, and balance. Not only does the SAM represent domestic flows, but it also represent international flows to government (foreign aid), firms (foreign direct investment) and households (remittances). IFs builds a full and balanced SAM of these and many other inter-agent flows. It also creates a second matrix that represents financial stocks (assets and liabilities) of different agent categories for all countries in the system, including, for instance, government debt. The representation of stocks in this fashion provides the foundation on which the system adjusts flows of finance among different agents and among countries over time, maintaining consistency with the liability-asset approach used in standard accounting systems.

The behavior of agents within this system is not fixed, as in many computable general equilibrium models (which use SAMs commonly). Instead, agent behavior is partially endogenized using algorithms that allow the behavior of agents to shift depending on the levels of stocks of relevant variables within the SAM. So, for example, different levels of government debt trigger different patterns of government expenditures and revenues in IFs, with forward effects on spending on education and water and sanitation infrastructure that

in turn affect economic growth, and food security in Guinea-Bissau over time.

Multifactor productivity and the SAM are two areas in the module deeply imbedded within many different systems in IFs. They both directly drive and are driven by changes in human, social, and physical variables and, as such, are key to evaluating trade-offs and synergies across and between alternative interventions.

OTHER MODULES IN IFs

Given the centrality of the economic module in IFs, we described at detail. The current trends in economic and human development analysis for Guinea-Bissau moves beyond economic growth to also describe trends in demographics, education, governance, and physical infrastructure. All of these modules have been extensively documented online,[17] and are part of a key series on Patterns of Potential Human Progress on advancing education, infrastructure and governance that in detail describe these modules (Rothman et al. 2014; Hughes et al. 2014; Dickson, Hughes, and Irfan 2011).

Demographic module in IFs: The IFs demographic module uses an age-sex cohort distribution and forecasts demographic changes based on births, deaths and migration patterns (Hughes 2019). Population data primarily come from the UN population division. The IFs population projections are based on two dominant flows, fertility determining the inflow of newly born on a yearly basis, and mortality, determining the outflow of deaths on a yearly basis. As such the population in a single year is a function of last year's population, plus the influx and outflux from births, and deaths. In addition, IFs forecasts migration using a push-pull logic. For Guinea-Bissau migration are only a small fraction of the overall demographic change, that is very strongly driven by high fertility and death rates, that both come down over time because of improvements in economic growth, (female) education and the health system. Data and projections on migration come from work done for the SSPs (O'Neill et al. 2014), or WIC/IIASA projections (Lutz, Butz, and KC 2014).

Education module in IFs: The IFs education module forecasts development at the country level on educational attainment of adults, and educational graduation rates of of-age children (Dickson, Hughes, and Irfan 2011). The module projects students' progress from primary to tertiary education, disaggregated by sex, driven by changes in demographics, the economic module and government investment in education (Dickson, Hughes, and Irfan 2011). The IFs model forecasts both education quantity (the number of students enrolled), and indicators of education quality (test scores on math, science and reading). Data to inform the forecast stem from a variety of sources with data on student flows and spending from UNESCO, data on educational attainment from Barro-Lee (Barro and Lee 2013), data on total education spending from IMF and world development indicators, and data on learning quality from the World Bank.

The IFs model aims to mimic the flow of a student through the education system. It is a bottom-up approach in which initial net and gross student enrollment in primary education is informed by education intake, primary education survival rates and dropouts, and re-entrance rates. From primary education students move through the education system towards lower secondary, upper secondary and tertiary

Fishing net maintenance, Varela, Cacheu Region

education systems based on transitions rates between education levels, graduation rates for each level, and dropout and re-entrance rates within each level. The spending on education is informed by data initialization and forecasted by changes in GDP per capita, changes in demand based on children of eligible age and government spending.

A key outcome indicator for human development is the average years of adult educational attainment. The average years of adult female education partly drive population growth, through changes in fertility rates, as well as economic growth, through changes in the contribution of human capital to economic growth based on a combination of educational attainment with education quality. Moreover, changes in education directly drive the relative portion of skilled and unskilled households which further impacts changes in inequality and poverty. Adult educational attainment is an important indicator in itself, but is also a component of measuring multi-dimensional poverty across dimensions of income, education and health (often measured as average life expectancy).

Fish filleting, Fish market, Bissau Autonomous Region

Education is a core human development indicator in itself. In the IFs model it is also linked to economic growth, MFP on human capital, and to the demographic module through changes in fertility rates. More specifically education projections are linked to indicators of child stunting (female education years), and to indicators of income and food consumption inequality that are core to projecting extreme poverty and undernourishment over time.

Governance module in IFs: The IFs governance module forecasts three governance dimensions around capacity, inclusiveness and security (Hughes et al. 2014). Governance is a key determinant for long-term development in Guinea-Bissau because of a history of (attempted) coups and government transition, and high levels of corruption today, that all dwarf the effectiveness and legitimacy of governance and more broadly economic and human development.

Government security is driven by state fragility, and the risk of internal conflict (Hughes, Moyer, and Sisk 2011; Moyer and Kaplan 2020). Effects of government security operate primarily through economic and demographic pathways through the contribution of social capital to economic growth and patterns of mortality and migration.

Government corruption is informed by data from Transparency International's Corruption Perception Index (Transparency International 2020). It is driven by a host of indicators including GDP per capita, the risk of conflict, gender equality, and the share of energy exports within the economy. Government corruption primarily affects human development through its impact on economic growth and revenue generation. For example, high levels of corruption hamper economic growth through a negative effect on productivity, as well as through a positive relationship with the size of the informal economy, which in itself poses a constraint on productivity and drives down government revenues through taxation. Government corruption is also more directly linked to human development indicators by increasing levels of child and infant mortality, as well as levels of child malnourishment and especially wasting (Moyer et al. 2020).

Levels of government effectiveness are informed by data from the World Bank's Governance Effectiveness index (Kaufmann, Kraay, and Mastruzzi 2010). The drivers and forward linkages of government effectiveness

largely resemble government corruption, with the main differences being in magnitude of the effect of the drivers and forward effects. The main difference is that increased government effectiveness effects human development through population and economic growth, but does not have direct linkages to child mortality, malnourishment and wasting. However, it does have positive linkages to the infrastructure module by driving access to electricity.

Infrastructure module in IFs: The IFs infrastructure module forecasts developments in physical infrastructure such as road density, electricity access, irrigation systems and access to water and sanitation (Rothman et al. 2014). Access to water and sanitation is informed by data from the Joint Monitoring Programme by WHO/UNICEF using their five tier ladder (WHO and UNICEF 2018). The sanitation data is then divided into three categories: unimproved, shared and improved. Similar, safe water access is divided in unimproved, improved (other) and piped water access. Projections over time are informed by an expected demand for access to safe water and sanitation, which is driven by general levels of development approximated by GDP per capita and average education years of the adult population, and further informed by information on government spending (percent of GDP going to health), and the share of the population living in urban areas. Together this constitutes the expected level of safe access to water and sanitation, which informs the government spending module required to invest in infrastructure to improve access to safe water and sanitation. Not in all cases will the expected demand be met by the required financial government resources, limiting the overall rise in access to safe water and sanitation.

Access to electricity partly follows the same logic as described above for water and sanitation infrastructure. Data on access to electricity for both rural and urban communities come from the World Development Indicators from the World Bank. Changes in electricity access over time are then a function of changes in population and household size, changes in urbanization rates and changes in government effectiveness and poverty levels that drives progress on electricity access. Access to electricity is separately forecasted for rural and urban communities, but given historic patterns in development we assume that urban electricity is always equal or higher than rural electricity access.

Changes in the infrastructure module are linked to economic growth in the MFP physical capital contribution. In addition changes in some infrastructure indicators are also linked to health and food security, with access to water and sanitation being an important driver of child health and child undernourishment and stunting.

FORECASTING KEY SDG OUTCOME INDICATORS IN IFs

The above descriptions focus on forecasting the underlying drivers of economic and human development. Together changes therein drive core outcome indicators of human development in extreme poverty, undernourishment and child stunting. In the trends in economic and human development in Guinea-Bissau report we focus on all three outcome indicators, as well as their underlying drivers. Below we explain how we forecast each of these development outcomes in IFs.

FORECASTING EXTREME POVERTY IN IFs

The IFs model forecasts extreme poverty for Guinea-Bissau based on dynamically connected representations of economic growth, income distribution, and demographic change. Poverty projections in IFs and the underlying methodological description have been published in academic and non-academic literature; here we provide a more concise overview (Milante, Hughes, and Burt 2016; Hughes 2019; Moyer and Bohl 2018; Moyer and Hedden 2020).

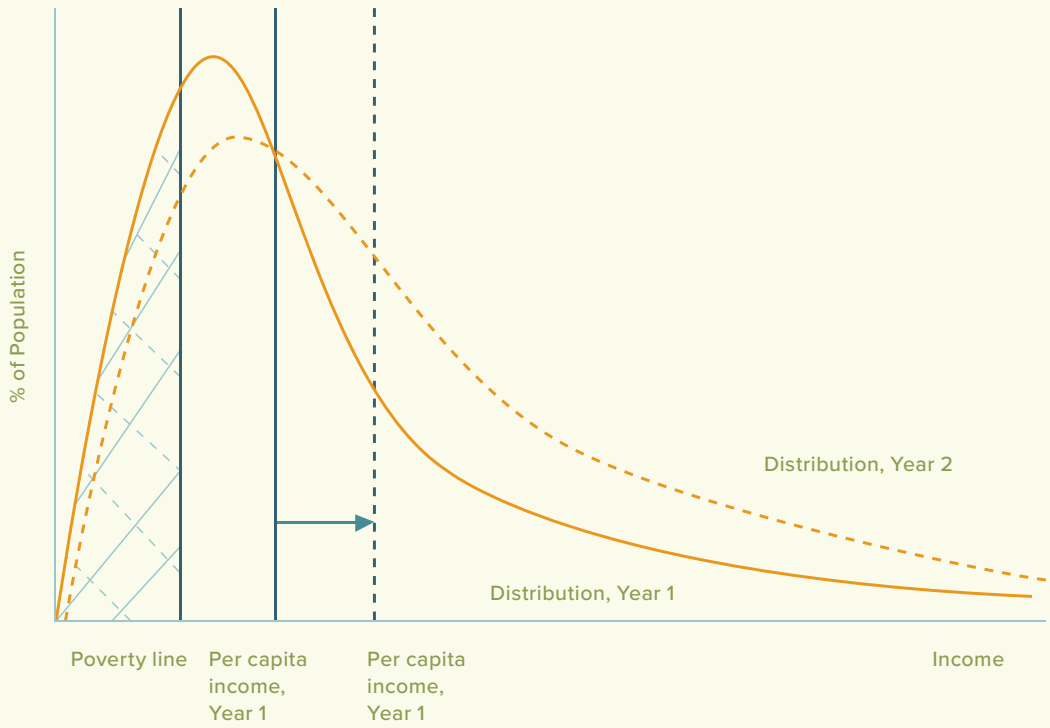
Economic growth drives changes in household income. The forecasts of economic growth have been described in the previous section, on the economic module in IFs. The other component relates to the need to understand

and forecast the distribution of income among households in society. The IFs approach uses a log-normal distribution of household income among all countries. The log-normal distribution is the most widely used distribution of household income, offers important advantages for long-term forecasts and has been empirically tested (Bourguignon 2004; Shorrocks and Wan 2008). Figure 4 provides an example of a log-normal distribution, or bell-curve, for income used in the IFs model.

One advantage of using a log-normal density to capture the distribution of income in a society is that it can be fully specified with only two parameters: average income and the standard deviation of it. Mean household consumption, logged, is used as the distribution variable and the Gini coefficient of income inequality for the standard deviation of the logged distribution variable. Forecasts are initialized using data from PovCalNet for different poverty thresholds (World Bank 2021). Using the log-normal distribution along with the mean household consumption provides us with an approximation of the distribution of income within Guinea-Bissau. The last component is then a minimum threshold value, below which one is considered to live in poverty. The IFs model can produce forecasts using a variety of international thresholds at $1.90 per day, $3.20 per day and $5.50 per day. In this report, we use the $1.90 per day threshold to assess the percentage of the population living in extreme poverty.

Figure 16 provides an example of how changes in per capita income and changes in the Gini coefficient drive our forecasts of extreme poverty. The changes in per capita income are a consequence of changes in economic growth and population dynamics from the IFs population module. Changes in Gini coefficient can either be endogenous forecasted or can be exogenous prescribed. For Guinea-Bissau we use the endogenous forecast of Gini, because it provides us with the opportunity to develop alternative scenarios that focus more on pro-poor growth in subsequent report. Together changes in population, average household income and changes in the Gini coefficient together drive forecasts on extreme poverty, as well as other poverty thresholds.

Figure 16 *Example of a log-normal distribution of income and how changes in per capita income, the distribution of income, and the poverty line threshold alter the calculation and forecasts of the percentage of population living in extreme poverty.*



FORECASTING UNDERNOURISHMENT IN IFs

In IFs, undernourishment is initialized by data gathered from the World Bank's World Development Indicators, which actually get their data from FAO (FAO et al. 2020). The data covers 170 countries over 27 years. Data for countries not covered in this series is supplemented with data from the United Nations Statistics Division. For countries not covered in either dataset, IFs estimates initial values using a statistical relationship with calories per capita.

There is a strong resemblance between forecasts of undernourishment and forecasts of poverty. Projections of undernourishment in IFs follows FAO and USDA methods (FAO et al. 2020; Baquedano et al. 2020; Hasegawa et al. 2018), which assume a log-normal distribution of calories described by mean caloric intake (CLPC) and the coefficient of variation (CV) to determine the proportion of a population living under the minimum dietary energy requirement threshold (MDER). As such, it very much resembles the approach used to forecast poverty, with a mean level of calories per capita, a parameter describing the distribution and a minimum threshold value.

The MDER for any given country is the cutoff point that FAO uses to determine undernourishment. It is reported in kilocalories/day and is based on the weighted average of minimum energy requirements of different age and sex groups. MDER data for the project came from the FAO's Food Security Indicators. We forecast MDER with a 2nd degree polynomial function, using the median age of the population as the sole independent variable.[18] Differences between data and statistical estimates are preserved through use of a multiplicative shift factor.

The CV is a measure of the dispersion of the distribution of the caloric intake within the general population. Higher CV values represent larger dispersion, or higher inequality in caloric intake. Thus, the CV for food consumption is like the Gini index of income inequality. The current version of IFs initializes the CV with an inferred value-based on data on MDER, prevalence of undernourishment, and the assumed log-normal distribution of calories. It's forecast is based on literature linking the coefficient of variation to differences in economic development and accessibility, physical accessibility, and social equality (Iram and Butt 2004; Headey and Alderman 2019; Hasegawa, Fujimori, Takahashi, et al. 2015) using GDP per capita, GINI coefficient, female labor participation and youth dependency ratios.

Combined the forecasts of calories per capita, coefficient of variation and MDER provide us with a forecast of undernourishment over time. Given the multi-dimensionality of food security these forecasts are affected by changes in agricultural production system, economic growth, household income, and food prices as well as more broadly by changes in water and sanitation infrastructure and education. The latter two are drivers of child undernourishment and stunting.

FORECASTING CHILD STUNTING IN IFs

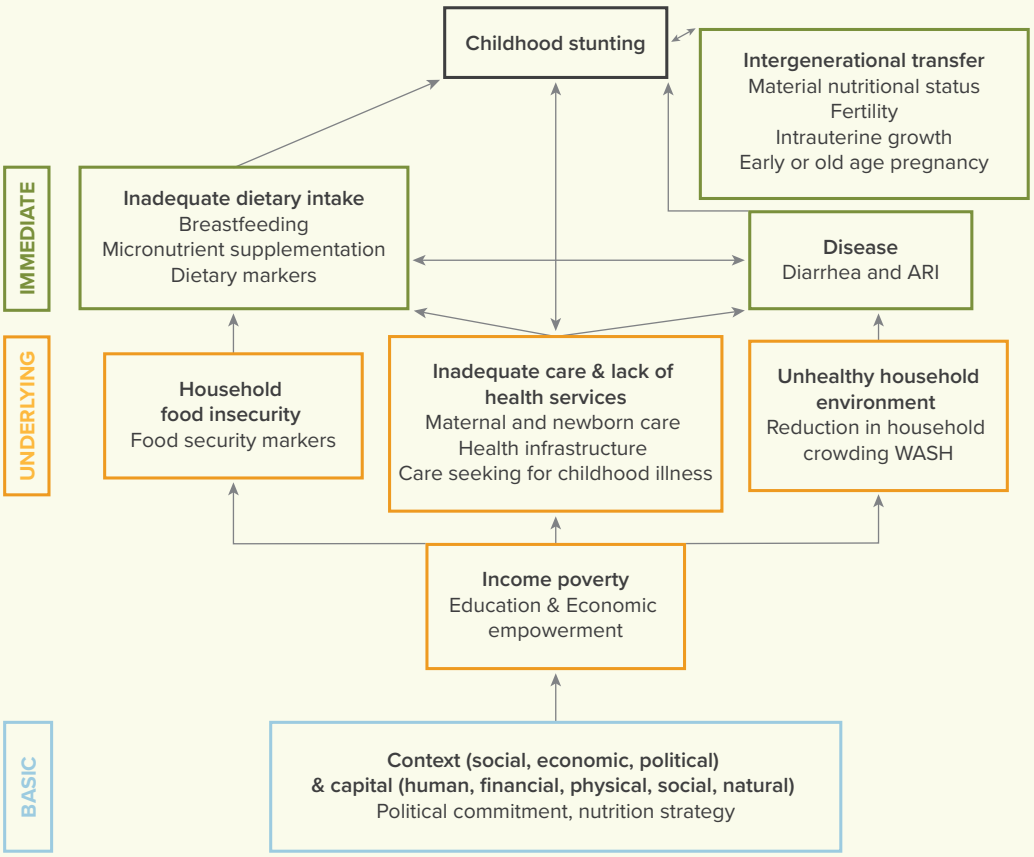
Child stunting refers to children from zero to 59 months of age with a height-for-age ratio greater than two standard deviations (<-2 SD) below the WHO Child Growth Standards median (FAO et al. 2020). In IFs, child stunting is initialized using data from the World Development Indicators compiled by the World Bank. For countries without data, child stunting is initialized using initial year values of malnourished children.

A survey of the literature suggested that drivers of child stunting are associated with factors contributing to undernourishment in children, such as disease spread, access to WATSAN, and caloric availability, as well as with the position of mothers in the household, their education levels, access to health and general use of vaccinations, and breastfeeding (Figure 17). Following the review, we built a statistical model. The final model comprised two variables: 1) the percentage of children under the age of five who are underweight relative to their age, which is driven by caloric intake and access to safe WATSAN, and 2) the secondary completion rate of females over the age of 15. Previous cross-country analysis of long-term trends in child mortality and child stunting has highlighted the strong link to maternal

education (Vaivada et al. 2020; Bhutta et al. 2020; Gakidou et al. 2010; Balaj et al. 2021). The IFs model is one of the very few models capable of providing projections on child stunting, with only one other model linking child stunting largely to economic and socioeconomic changes in caloric intake (Lloyd et al. 2018), without accounting for other long-term drivers on WATSAN and maternal education levels.

Child stunting is a core indicator of child development in itself. However, it is also strongly linked to other indicators of development. In a direct manner higher levels of child stunting are associated with higher levels of children disease and risk to mortality. Although the causal mechanism is difficult to entangle, since child stunting is both a driver and a consequence of child disease spread. A second important link of child stunting is to economic growth. Child stunting is often irreversible leading to long-term effects on physical and cognitive abilities of children affected by stunting. The IFs model has a bookkeeping system that keeps track of historic rates of child stunting in the adult working population. Higher levels of historic child stunting in the adult population then negatively affect economic growth through the MFP on human capital, literally stunting economic growth potential in Guinea-Bissau.

Figure 17 *Example of conceptual framework from that links childhood stunting to its associated immediate, underlying, and basic drivers.*



Source: Akseer et al. (2020).

ENDNOTES

1 We focus here and in the report on data starting in 2019 as a baseline. We decided to not focus on 2020 data, given the uniqueness of this year due to COVID-19 and the fact that data quality and consistency across countries is often poorer for 2020 because of data collection challenges due to COVID-19.

2 We use the IFs model to assess long-term development in Guinea-Bissau. The IFs model has over 10.000 data series to inform the forecasts. Throughout the report, if no source is given, the authors used the IFs model and their own calculations to arrive at the data point.

3 Throughout the report we compare levels of development in Guinea-Bissau in 2040 to levels of development in countries in 2019. This is purely done to provide a frame of reference to contextualize the 2040-numbers. Of course, progress on economic and human development will occur across all countries that is not reflected in this comparison. Also, a similar ranking on a single indicator (such as GDP per capita) does not suggest that countries share other similarities in their level of development. In other words, we are not suggesting development in Ethiopia and Guinea-Bissau is similar.

4 We measure extreme poverty in constant 2011 US dollars. Extreme poverty, and GDP per capita, are reported at Purchasing Power Parity. GDP is reported in constant 2011 US dollars at Market Exchange Rate.

5 Inequality is multi-dimensional and can be measured using several indicators. Here we decided to focus on multiple aspects of inequality, rather than focusing on a single indicator. A core aspect of inequality is horizontal inequality in income, often measured using the GINI-coefficient. Income inequality is gradual, and can be both a driver and a result of extreme poverty. Related to income inequality is inequality in food consumption between households. A second aspect of inequality is inequality between groups in society, often referred to as horizontal inequality. An example is gender inequality that refers to inequality in "opportunities" between sexes. Here we use "years of adult education" between males and females as an indicator of gender inequality, and allude to other measures in the background. Another form of inequality between groups is spatial inequality into access of resources. This is often a binary measure, stating whether a household does or does not have access to safe water, sanitation, paved roads, or electricity. For Guinea-Bissau, there is strong spatial inequality in access to resources between urban and rural communities. Together, these components of inequality describe a holistic view that moves beyond standard measures of income inequality per se. It means that income inequality is a cause of extreme poverty, but extreme poverty can also drive other forms of inequality such as girls' school attendance rates. Therefore, using this approach inequality is both a cause and a consequence of extreme poverty.

6 The GINI-coefficient is a measure of income inequality at the country level, ranging between 0-1. A value of 0 means no income inequality, has the same amount of income, and a value of 1 indicates absolute inequality, a single person has all the income in society and the rest has none.

7 We excluded 2020 because of the COVID-19 pandemic. With 2020 included average economic growth would drop to 3.1 percent.

8 There are several agencies and tools available that currently track vaccination rates per country. We used data from Johns Hopkins University, on 11/11/2021. For more information please see: *https://coronavirus.jhu.edu/vaccines/international*.

9 The IFs model can be accessed at *https://pardee.du.edu/* and the underlying documentation can be accessed at *https://pardee.du.edu/wiki/Main_Page*. The Portuguese version of the model and key documentation is currently under development and can be shared upon request.

10 Measured at 2011 US constant dollar using Market Exchange Rate

11 Measured at 2011 US constant dollar using Purchasing Power Parity

12 The analysis of this report were conducted with a growth rate of -2.4 percent of the April 2021 release. The more recent October release of the world economic outlook projects a -1.4 percent contraction of the economy. Given the timing of this, and the IMF report, the analysis uses the April 2021 number. The difference in growth rates in 2021 will have minimal effect on long-term trends reported in this analysis.

13 All GDP and GDP per capita values are in constant 2011 US dollars. GDP values are measured in Market Exchange Rates, whereas GDP per capita values are measured in Purchasing Power Parity.

14 IFs is free to download or use online from: *http://pardee.du.edu*

15 For the full documentation of the IFs economic module the interested reader is referred to our open-source wiki page: *https://pardee.du.edu/wiki/Economics*

16 For more information on the use and specification of multifactor productivity in IFs, see Hughes and Narayan (2021).

17 For demographics: *https://pardee.du.edu/wiki/Population* For education: *https://pardee.du.edu/wiki/Education* For governance: *https://pardee.du.edu/wiki/Governance* and for physical infrastructure: *https://pardee.du.edu/wiki/Infrastructure*

18 For information regarding the initialization and forecast of the median age of population, see *https://pardee.du.edu/wiki/Population*.

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