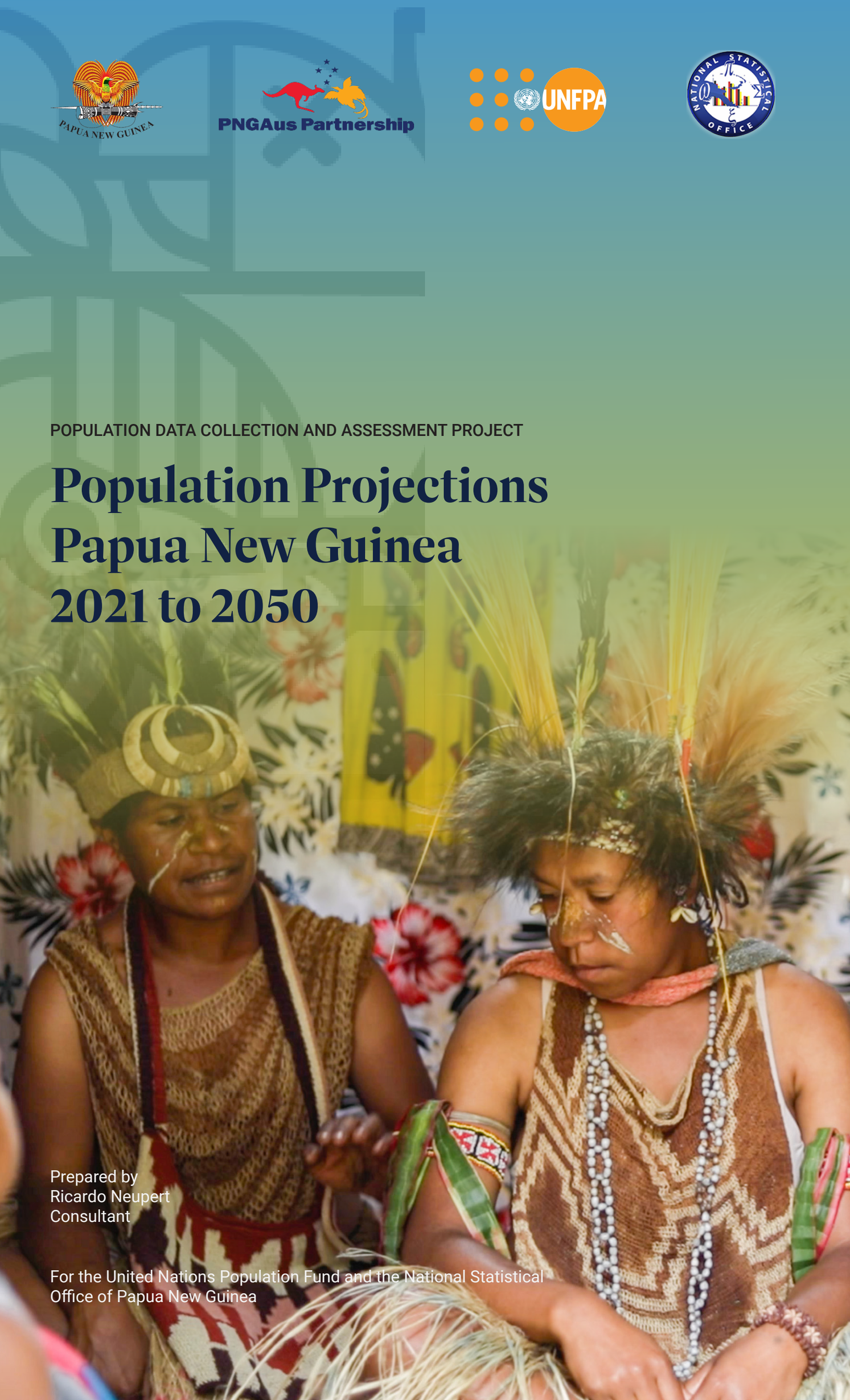
POPULATION DATA COLLECTION AND ASSESSMENT PROJECT

Population Projections Papua New Guinea 2021 to 2050



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Population Projections 2021 to 2025
ISBN: 978-9980-941-16-9

Published date:

FOREWORD BY THE NATIONAL STATISTICIAN

It is my pleasure to release the 2022 Papua New Guinea Socio-Demographic and Economic Survey's (SDES) thematic report on Population Projections for 2021 to 2050. The release of this report is another milestone achievement for the National Statistical Office (NSO) in its endeavour to provide comprehensive and quality statistics to the many users of the statistical information.

The 2022 SDES has given NSO the opportunity to introduce and experience improved statistical methodologies and standards supported by new technological innovations.

Apart from this report, the NSO is also in the process of releasing various thematic reports on Fertility and Mortality, Economic Wellbeing, Education, Migration, Youth, Gender and Demographic Dividend. The Population Projections report is concerned with estimating the size and age-sex composition that a population will have based on mortality, fertility and migration trends in PNG.

In this report, the data obtained from the 2022 SDES was analysed in conjunction with data from the 2011 Census as well as that from the 2016-2018 Demographic and Health Survey (DHS). The analysis of SDES on Population Projections will support all phases of development planning such as existing health and other related programs and projects that can be incorporated in several national and sectoral policies and plans that are currently being reviewed and formulated, such as the National Population Policy (NPP) 2025-2034, and the assessment of the Medium-Term Development Plan (MTDP) IV 2023 - 2027.

Moreover, the findings in this report will be used for future monitoring and evaluation of the objectives and strategies of other existing national and sectoral policies and plans as well as those associated with the global agenda from the Sustainable Development
Goals (SDG) and the Plan of Action of the International Conference on Population and Development (ICPD).

The conduct of the 2022 SDES would not have been possible without the financial support from the Australian Government through the "PNG Australia Partnership Program" in collaboration with the United Nations Population Fund (UNFPA), which provided the technical support for an in-depth analysis and production of the PNG Population Projection Papua for 2021 to 2050 Report.

Furthermore, I acknowledge the support from the Pacific Community (SPC) for technical assistance in using modern technology in collecting data from the field, which is the first for NSO in its endeavour to improve on its statistical methodologies.

Gratitude is also extended to all the field staff who worked hard to successfully implement the data collection phase of the survey. Further gratitude is due to the survey respondents who relentlessly continue to provide the information on which this report is based including the support from the Provincial and Local Level Governments during the data collection.

The Office of the National Statistician is also indebted to the NSO project Management Team for their tireless efforts in managing the technical and administrative aspects of this exercise for a successful conduct of the 2022 SDES.

I take this opportunity to urge all stakeholders and statistics producing agencies to foster and promote collaborative efforts which will contribute to making the PNG Statistical System effective. NSO as the central and mandated statistical agency has the legitimacy backed by the Statistical Services Act (1980) that ensures the confidentiality of raw data providers and assurance of integrity and accessibility for users.

Finally, with improved data sources, sound statistical methodologies and standards, new technologies and strengthen statistical system, these will enable the Government to formulate better policies and make evidence-based decisions for the betterment of PNG and its people.

Mr. John Aseavu Igitoi
National Statistician

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LIST OF ABBREVIATIONS AND ACRONYMS

ASFR	Age-Specific Fertility Rate
CWR	Child-woman ratio
DAPPS	Demographic Analysis and Population Projection System
DHS	Demographic and Health Survey
NSO	National Statistical Office
PAS	Population Analysis System
PME	Population Modelled Estimation
PNG	Papua New Guinea
SDES	Socio-Demographic and Economic Survey
TFR	Total Fertility Rate

EXECUTIVE SUMMARY

Population projections are essential in planning pursuits as they notably provide a basis for allocating resources between areas in relation to population size, and determine the need or scope for investment in particular places. The PNG National Statistical Office (NSO) is well aware of this and, accordingly, has prepared these population projections.

Papua New Guinea (PNG) did not conduct the census corresponding to the 2020-decade due to the COVID-19 pandemic. The last population census was conducted in 2011, but not followed with, a population projection, as it is the practice after a census. Therefore, a much-needed projection is still not available.

Although a census for the 2020 decade has not been carried out, the Population Modelled Estimation (PME) was conducted. This is an approach for quick generation of population counts for the whole country using geospatial technology (remote sensing) and statistical applications. The estimations provided by this instrument were the base population for these projections. This population was adjusted according to several considerations explained in the report.

The projections were conducted at the national, provincial and district level. The national and provincial projection covered the 2021-2050 period while the district projections the 2021-2030 period. For both national and provincial projections, the component method was used. For the district projections an iterative proportion approach was employed.

As mentioned above, the component method requires estimates of mortality, fertility and migration. The PME does not provide these data. Therefore, the components were obtained from other sources, particularly the 1980, 2000 and 2011 Censuses and two Demographic and Health Surveys (DHS): 2006 and 2016-2018.

For these projections, both at the national and provincial level, a software developed by the United States Census Bureau was used: Demographic Analysis and Population Projection System (DAPPS). For the district level projection, the worksheet CTBL32 was used. This is a Microsoft Excel worksheet included in the Population Analysis System (PAS) software, which is a set of Microsoft Excel workbooks for demographic analyses developed also by the U.S. Census Bureau.

The size, growth rate and age-sex composition of the projected population was examined and analysed using diverse methods and indicators such as population pyramids, exponential growth rate, sex ratio, age-dependency ratio, median age ageing index and child-woman ratio. These indicators provided relevant information about the future population and its possible social and economic impact.

This projection suggests three important trends for the following three decades:
1. A decline in the percentage of children;
2. An increase in the proportion of the working-age population; and
3. An increase in the proportion of the elderly.

Regarding the special distribution of the population, substantial concentration does not exist in PNG. It is assumed that it will not take place during the following three decades.

The economic and social implications of the future population size and changes in the age composition presented in this projection should be seriously discussed and analysed.

1. INTRODUCTION

A population projection can be defined as a demographic exercise consisting of empirically based calculations of the future size of the population under specified assumptions regarding changes in population growth or its components (mortality, fertility and migration).

Population projections are usually conducted by age and sex and the cohort component is the most frequently used method. It involves an independent projection of mortality, fertility and net migration. The procedure starts by establishing an initial or base population by sex and age groups (usually five-year age groups). It is frequently a census population that has been adjusted for under-enumeration and errors in age and sex composition. Each age-sex group of this population is aged through time by applying to them mortality and net migration rates, and by adding up new members using fertility rates.

It is important to clarify a very important issue regarding population projections. They are not a clairvoyant or fortune-teller exercise nor a complex scientific recipe to foresee the future. When conducting a projection, the purpose is not to predict the population numbers for future years or decades, but to provide the size and age-sex composition that a population will have if certain assumption regarding mortality, fertility and migration trends take place in the future.

In this sense, a population projection is more a prospective exercise than a prediction. What is important is not to guess the exact number of children, young adults or elders that will be living in a territory in 10 or 20 years. What is relevant is to know that, if the trends in the demographic components come about as proposed in the projection exercise, the number of schools, classrooms and teachers will have to increase by a given percentage to reach full education coverage in the future, the economy will have to generate jobs at a certain rate to reach low levels of unemployment, and a given quantity of new residential dwelling will have to be constructed to avoid housing shortages. In other words, projections are not instruments to predict the future, but to construct the future (Romaniuc, 1990).

The population dynamic of Papua New Guinea (PNG) should be included in all phases of development planning. The very first step of this task is to prepare population projections able to model the situation and supply reliable information on what is likely to happen in the future, to know what to expect and, if possible, to anticipate demographic changes of importance to national development. Well aware of this, the PNG National Statistical Office (NSO) has prepared these population projections.

The census corresponding to the 2020-decade was not conducted in Papua New Guinea mainly because of the COVID-19 pandemic which prevented to mount a national population census without compromising the health of the field workers as well as the general public while ensuring quality census data. The last population census was conducted in 2011; however, a population projection was not conducted as it is the usual practice after a census. Therefore, a much-needed population projection is not available.

Although a census for the 2020 decade has not been carried out, the Population Modelled Estimation (PME) was conducted. This is an innovative approach for quick generation of population counts for the whole country through geospatial technology (remote sensing) and statistical applications. Based on the population provided by this estimation these projections were conducted.

They were carried out at the national, provincial and district level. The national and provincial projection covered the 2021-2050 period and the district projections the 20212030 period. For both national and provincial projections, the component method was used. For the district projections an iterative proportion approach was employed.

As mentioned above, the component method requires estimates of mortality, fertility and migration. The PME does not provide these data. Therefore, the components were obtained from other sources, particularly the 1980, 2000 and 2011 Censuses and two Demographic and Health Surveys: 2006 and 2016-2018. Notice that these sources provide data for a relatively long period of time, which it is a major advantage since it allows establishing reliable and accurate trends.

For these projections, both at the national and provincial level, a software developed by the U.S. Census Bureau was used: the Demographic Analysis and Population Projection System (DAPPS)[1]. It was preferred because of its flexibility, which has the advantage of allowing a demographer to develop a projection model that accurately captures the demographic situation of a country and makes maximum use of available data in a way that is as close as possible to its original form. For the district projections an iterative proportion method was used. This approach and the respective software are explained later.

[1] See https://www.census.gov/data/software/dapps.html (The software can be downloaded on the same site).

2. METHODOLOGICAL ASPECTS

As mentioned above, a cohort component method was used to prepare the present population projections (national and provincial level). This is the most commonly used technique for these exercises. Its basic principle is that each five-year cohort from a base population (usually from the most recent census) is advanced through time in five-year increments (Shryock and Siegel, 1976). In other words, this method yields, in principle, the projected population by sex and five-year age groups for the end of each quinquennium of the projection period.

The base population for these projections was the people counted by the 2021 Population Modelled Estimation (PME). This population was adjusted according to several considerations explained elsewhere. This adjusted population was projected up to year 2050 at the national and provincial level and up to year 2030 at the district level.

The Demographic Analysis and Population Projection System (DAPPS) software developed by the U.S. Bureau of the Census was used to conduct this projection. One of its mayor advantages is to perform projections by single years of age (and not five-years as the conventional approach). This feature allows obtaining data for special age groups that do not fall into conventional five-year age groups. It also enables the tracking of population cohorts that may be smaller or larger than surrounding cohorts due to past demographic events. In addition, the projection is performed year by year. This feature makes it possible to add information on demographic events for a particular year without forcing the effect over a five-year period. It also provides planners with estimates for each year without having to interpolate between data for surrounding years. Input data for the population and components can be provided in either single years or five-year age groups. The age grouping of each item is independent, so it is possible to input five-year data for some items and single-year data for others. The software converts all data set to single years of age before performing the projection.

The flexibility described above has the clear advantage of allowing a demographer to create a projection model that accurately reflects what is known about the demographic situation in a country and making maximum use of available data in a way as close as possible to its original form. The software provides outputs on a variety of demographic measures for any specified year of the projection such as population by age and sex (single years, five-years age groups, and special age groups), summary measures, summary vital rates, life tables, migration rates, number of birth and death, etc.

The PME does not provide information on fertility, mortality or migration. As mentioned earlier, the respective information was obtained from the 1980, 2000 and 2011 Censuses and the 2006 and 2016-2018 Demographic and Health Surveys.

The calculations of fertility and mortality from these sources were conducted using mainly two software: PAS, developed by the U.S. Census Bureau[2] and MortPak developed by the United Nations Population Division[3]. They are collections of programs for population analysis, mainly for indirect estimates of mortality and fertility.

Following a usual practice, three additional projections were prepared based on hypotheses regarding future changes on fertility[4]. They are labelled here as High, Low and Constant. The High and Low hypotheses represent maximum or minimum values that fertility rates may take in the future. Actually, they may have a very low probability to occur, but are calculated for their analytical value and to set an upper and lower limit within which population growth is virtually certain to remain. The Constant scenario assume that fertility will not change during the entire projection period. Again, the situation proposed by this hypothesis is very unlikely to occur but it is included for its analytical value.

The projections of each of the 22 provinces in which PNG is administratively divided, were conducted with the same method, data source and software used in the national projections. The projected provincial populations by age and sex were adjusted so as its sum was equal to the national projected population. The adjustment was done using the PAS Microsoft Excel worksheet CTBL32. This software is designed to adjust subpopulations by age to the total population also by age. The worksheet proportionally adjusts the subpopulation totals to add to the country total.

For the district projections an iterative proportion method was used. The PAS software CTBL32 was also used here, but not to adjust results, but to conduct the projections. Using this software, the populations (by age groups and sex) of the districts belonging to a given province was increased every year at the same rate of increase of the respective provincial population.

[2] The Population Analysis System (PAS) software set of Microsoft Excel workbooks can be accessed at: https://www.census.gov/data/software/pas.html.
[3] The MortPak software for demographic measurements can be accessed at: https://mortpak.software.informer.com/
[4] In some projections, the hypotheses include future changes in the other components, that is in mortality and migration. However, for this projection, it was decided to formulate the hypotheses based on fertility only to centre the analysis on a specific component which is considered as the most important for the population change study in PNG.

3. ADJUSTMENT OF THE BASE POPULATION

An essential task in the preparation of population projections by age and sex with the cohort component method is to establish a base population. This is the initial population by age and sex of the projection and has to be defined for a given year. Most projections are based on a census; hence the base population is the census population and the initial year is the census year.

As mentioned above, for these projections, the base population is the 2021 Population Modelled Estimation (PME), which can be considered as a census.

The main problems that affect a census population by age and sex is under-enumeration and errors in age reporting. Under-enumeration is especially challenging when it affects more some age groups or sex than others. As much as possible, the census population to be used as a base population in a projection exercise should be free from underenumeration and age declaration issues. It is important to remember that an error in the base population is also projected and, as the population increases throughout the projection period, the error thus also increases.

There are several instruments to evaluate the age-sex distribution of a population. One of them is the United Nations Age-Sex Accuracy Index. It was applied to the 2021 PME to evaluate the accuracy and reliability of the age-sex distribution. The AGESEX program was used, which is included in the PAS, the set of Microsoft Excel workbooks previously mentioned and cited. The first panel in Table 1 shows the 2021 PME population by age groups and sex and at the bottom it is the result of the application of the Index. The result, 32.1, suggest that the age-sex distribution has some problems of reliability. To reduce this problem, the PME population was adjusted using the AGESMTH program also from PAS.

This program includes several adjustment methods. Here, the United Nations method was used (see second panel in Table 1). With the adjusted population the index declines substantially (18.4); therefore, this population was used as a base population for these projections. Note that the adjusted population is a little larger than the observed population. A difference is expected which is in this case very small: 35,691 or 0.3 per cent.

Table 1. Observed population (Population Modelled Estimation, PME) and Adjusted Population, 2021

Observed Population (PME, 2021)				Adjusted Population, 2021			
Age	Total	Male	Female	Age	Total	Male	Female
< 1	359,609	188,360	171,249	< 1	359,609	188,360	171,249
1-Apr	867,571	452,259	415,312	1-Apr	867,571	452,259	415,312
5-Sep	1,557,246	821,253	735,993	5-Sep	1,557,246	821,253	735,993
Oct-14	1,429,047	770,113	658,934	Oct-14	1,481,739	793,934	687,805
15 - 19	1,391,566	738,232	653,334	15 - 19	1,349,846	718,187	631,660
20 - 24	1,150,721	595,513	555,208	20 - 24	1,192,486	614,564	577,922
25 - 29	1,079,946	532,585	547,361	25 - 29	1,048,254	520,402	527,852
30 - 34	884,436	435,254	449,182	30 - 34	907,749	444,708	463,041
35 - 39	776,457	384,257	392,200	35 - 39	756,087	376,292	379,795
40 - 44	595,275	309,067	286,208	40 - 44	613,187	315,593	297,594
45 - 49	506,077	266,598	239,479	45 - 49	497,728	263,758	233,969
50 - 54	387,460	209,352	178,108	50 - 54	380,027	204,110	175,917
55 - 59	251,612	135,268	116,344	55 - 59	271,131	146,907	124,224
60 - 64	229,647	126,151	103,496	60 - 64	211,946	115,856	96,089
65 - 69	140,369	77,575	62,794	65 - 69	148,125	82,428	65,698
70 - 74	85,806	49,833	35,973	70 - 74	85,806	49,833	35,973
75 - 79	43,885	25,576	18,309	75 - 79	43,885	25,576	18,309
80 +	44,829	25,339	19,490	80 +	44,829	25,339	19,490
Total	11,781,559	6,142,585	5,638,974	Total	11,817,250	6,159,359	5,657,891
	Age-sex accuracy index = 32.1				Age-sex accuracy index = 18.4		

4. ESTIMATE AND PROJECTION OF THE COMPONENTS

The usual practice in most population projections is to extrapolate the components according to past trends. The most common strategy is to project into the future past trends of mortality, fertility and migration according to known functions such a straight line, an exponential or a logistic. In the case of the present projection, information from the 1980, 1990, 2000 and 2011 Censuses and from the 2006 and 2016-2018 Demographic and Health Surveys (DHS) were used to examine past component trends.

Mortality

The most adequate indicator of mortality to be used in a projection exercise is the survival rate by age and sex, which is a function of a life table[6]. Hence, for the purpose of population projections it is necessary to start by constructing a male and female life table for the beginning of the projection period.

Here, this initial life table was constructed with two basic data from the 2011 Census: (a) children ever born and surviving (by sex) by age of women, with which infant and child mortality by sex was estimated, and (b) the population who have died during the 12 months prior to the census (by sex), with which adult mortality by sex was estimated. These two indicators are combined to form a male and female life table [7].

The use of these two indicators to construct a life table require the use of model life tables. These tables are based on the actual mortality experience of countries with reliable mortality information. Model life tables are used mainly for providing estimates of mortality when the observed mortality data is not reliable and also to leverage partial information. For instance, one can estimate an entire life table based on a single estimate of infant mortality[8].

The first stage in the use of model life tables for adjusting or completing observed mortality data is to identify the most adequate model to be utilized. Here, this procedure was done with the age-sex specific mortality rates calculated from the 2011 Census data on population who died during the year prior to the census and the COMPAR program from the set of demographic software MortPak, previously cited. This program indicates the average absolute deviation of the observed mortality pattern from the pattern corresponding to the models. The smaller the deviation, the most similar is the observed pattern to the model pattern. The mortality rates calculated from 2011 Census data are in Table 2 and the results of the application of the COMPAR program are in Table 3. The two different families of models, United Nations and Coale-Demeny, and the corresponding pattern are in Table 3. According to this analysis, three models fit well with the PNG mortality pattern: South Asian, West and North. The West model was selected because it is the pattern observed in most countries in the world.

Table 2. Age-specific mortality rates based on the 2011 Census

Age	Deseased		Population		m(x)	
	Male	Female	Male	Female	Male	Female
0 - 1	12,120	9,842	54,451	49,674	0.22259	0.19813
1 - 4	13,279	10,706	392,555	363,308	0.03383	0.02947
5 - 9	4,944	3,790	471,138	434,890	0.01049	0.00871
10 - 14	2,918	2,162	431,595	378,642	0.00676	0.00571
15 - 19	2,242	2,061	449,544	404,250	0.00499	0.0051
20 - 24	1,698	1,603	359,168	336,474	0.00473	0.00476
25 - 29	1,432	1,340	310,521	321,715	0.00461	0.00417
30 - 34	1,151	982	253,753	261,280	0.00454	0.00376
35 - 39	841	883	251,624	256,163	0.00334	0.00345
40 - 44	713	683	196,740	188,625	0.00362	0.00362
45 - 49	633	566	179,410	164,026	0.00353	0.00345
50 - 54	643	436	129,156	112,218	0.00498	0.00389
‘55 - 59	529	312	94,184	79,579	0.00562	0.00392
‘60 - 64	569	324	71,329	59,335	0.00798	0.00546
‘65 - 69	465	234	49,556	38,785	0.00938	0.00603
‘70 - 74	365	204	28,255	21,392	0.01292	0.00954
‘75 - 79	283	153	15,679	11,595	0.01805	0.0132
80+	607	346	11,741	9,110	0.0517	0.03798
Total	45,432	36,627	3,750,399	3,491,061	0.01211	0.01049

[6] The life table is a tool used to simulate the lifetime mortality experience of a population. It does so by taking that population’s age-specific death rates and applying them to a hypothetical population of 100,000 people born within the same year. For each year on the life table, death reduces the hypothetical population size until the bottom row of statistics, where the entire population dies.

[7] It is worth mentioning that infant and child mortality can be estimated with the population who have died during the year before the census. However, this result is not reliable and, for this reason, it is preferable to measure it with the data on children ever born and surviving.

Table 3. Average deviation of the observed mortality pattern (Table 2) from the pattern corresponding to the model life tables

Implied Life Expectancy at Birth - Males										
Age Group	Empirical m(x,n)	United Nations Models					Coale-Demeny Models			
		Latin Am.	Chilean	So. Asian	Far East	Gene-ral	West	North	East	South
Average absolute deviation from the median										
Ages 0 to 10		2.4	5.7	3.9	0.8	1.7	4.6	1.8	6.2	4.2
Ages 10 and over		12.8	13.1	17.3	12.3	12.8	12.5	10.9	14.6	13.7
Ages 0 and over		15.8	17.1	18.1	16.4	16.1	16.1	14.2	17.3	15.9
Median (0-10)-Median (10+)		-33.7	-40.5	-26.6	-40.1	-34.3	-33.8	-31.0	-33.7	-29.7

Implied Life Expectancy at Birth - Females										
Age Group	Empirical m(x,n)	United Nations Models					Coale-Demeny Models			
		Latin Am.	Chilean	So. Asian	Far East	Gene-ral	West	North	East	South
Average absolute deviation from the median										
Ages 0 to 10		4.6	4.2	3.2	2.5	3.5	2.5	3.5	3.8	3.4
Ages 10 and over		11.9	12.1	14.7	11.1	11.5	10.9	10.7	13.0	12.2
Ages 0 and over		14.5	15.2	15.1	15.5	14.6	14.1	13.3	15.0	13.6
Median (0-10) - Median (10+)		-29.5	-33.2	-23.9	-39.4	-31.3	-30.7	-26.3	-28.1	-26.3

Using sophisticated demographic techniques, called indirect methods, it is possible to transform children ever born and surviving from the census into reliable infant and child mortality rates (0-1 and 1-5 years old, respectively). There are several approaches, or variants, to conduct these transformations. The variants used here are the Trussell and the Palloni-Haligman techniques. It is important to note that these procedures make use of model life tables.

Using the indirectly estimated infant and child mortality (by sex), and age-sex specific mortality rates computed from the deaths in the household during the 12 months prior to the census, an initial life table was prepared (Table 4). This life table was adjusted for possible errors (especially for under enumeration of deaths) using an indirect method: the Brass Growth Balance Equation method (see Dorrington 2013). Based on the observed early-age and adult mortality rates, and using model life tables, this method provided an empirical life table for PNG. This table was used as the base life table for the projections (Table 5).

[8] For a complete description of model life tables see Rowland (2003).

Table 4. Unadjusted life table, 2011 Census

Males

Age	m(x,n)	q(x,n)	l(x)	d(x,n)	L(x,n)	S(x,n)	T(x)	e(x)
0	0.22259	0.1937	100000	19370	87022	0.76605	5012600	50.13
1	0.03383	0.12419	80630	10014	296003	0.89826	4925579	61.09
5	0.01049	0.05111	70616	3609	344057	0.95759	4629576	65.56
10	0.00676	0.03324	67007	2227	329466	0.97058	4285519	63.96
15	0.00499	0.02463	64780	1596	319774	0.97628	3956052	61.07
20	0.00473	0.02337	63184	1477	312189	0.97696	3636279	57.55
25	0.00461	0.02279	61707	1406	304996	0.97713	3324089	53.87
30	0.00454	0.02244	60301	1353	298020	0.98063	3019093	50.07
35	0.00334	0.01656	58948	976	292248	0.98295	2721073	46.16
40	0.00362	0.01794	57972	1040	287265	0.98247	2428824	41.9
45	0.00353	0.0175	56932	996	282230	0.9792	2141559	37.62
50	0.00498	0.0246	55936	1376	276358	0.97391	1859330	33.24
55	0.00562	0.02772	54560	1513	269148	0.96687	1582971	29.01
60	0.00798	0.03915	53047	2077	260231	0.9576	1313823	24.77
65	0.00938	0.04586	50970	2337	249198	0.94656	1053592	20.67
70	0.01292	0.06266	48633	3048	235880	0.92859	804394	16.54
75	0.01805	0.08673	45585	3954	219037	0.61472	568514	12.47
80+	0.11913	...	41632	41632	349478	...	349478	8.39

Females

Age	m(x,n)	q(x,n)	l(x)	d(x,n)	L(x,n)	S(x,n)	T(x)	e(x)
0	0.19813	0.17553	100000	17553	88591	0.78917	5427230	54.27
1	0.02947	0.10937	82447	9018	305993	0.91064	5338639	64.75
5	0.00871	0.04262	73430	3130	359325	0.96446	5032647	68.54
10	0.00571	0.02815	70300	1979	346554	0.97308	4673322	66.48
15	0.0051	0.02517	68321	1720	337224	0.97565	4326768	63.33
20	0.00476	0.02351	66602	1566	329011	0.97792	3989544	59.9
25	0.00417	0.02063	65035	1342	321745	0.98043	3660533	56.29
30	0.00376	0.01862	63694	1186	315447	0.98225	3338788	52.42
35	0.00345	0.0171	62508	1069	309850	0.98251	3023340	48.37
40	0.00362	0.01794	61439	1102	304430	0.98253	2713491	44.17
45	0.00345	0.0171	60337	1032	299111	0.98187	2409061	39.93
50	0.00389	0.01926	59305	1142	293689	0.98083	2109949	35.58
55	0.00392	0.01941	58162	1129	288059	0.97704	1816261	31.23
60	0.00546	0.02694	57033	1537	281444	0.97188	1528202	26.8
65	0.00603	0.02972	55496	1649	273529	0.96266	1246758	22.47
70	0.00954	0.04665	53847	2512	263315	0.94679	973229	18.07
75	0.0132	0.0641	51335	3291	249304	0.64882	709914	13.83
80+	0.10431	...	48044	48044	460609	...	460609	9.59

First entry of S(x,n) is for survivorship of 5 cohorts of birth to age group 0-4 = L(0,5) / 500000
Second entry of S(x,n) is for S(0,5) = L(5,5) / L(0,5)
Last entry of S(x,n) is S(75+,5) = T(80) / T(75)

Table 5. Adjusted life table 2011 (Base Life Table)

Males

Age	m(x,n)	q(x,n)	l(x)	d(x,n)	L(x,n)	S(x,n)	T(x)	e(x)
0	0.03898	0.03773	100000	3773	96797	0.9594	6694522	66.95
1	0.00213	0.00847	96227	816	382901	0.99233	6597726	68.56
5	0.00087	0.00435	95411	415	476019	0.99606	6214825	65.14
10	0.0007	0.00352	94996	334	474145	0.99531	5738805	60.41
15	0.00127	0.00635	94662	601	471922	0.99227	5264660	55.62
20	0.00178	0.00888	94061	835	468275	0.99096	4792738	50.95
25	0.00182	0.00904	93226	843	464044	0.99047	4324462	46.39
30	0.00206	0.01023	92383	945	459622	0.98854	3860419	41.79
35	0.00263	0.01305	91438	1194	454354	0.98436	3400797	37.19
40	0.0038	0.01883	90245	1700	447250	0.97642	2946443	32.65
45	0.00593	0.02926	88545	2591	436702	0.96322	2499193	28.23
50	0.00932	0.04563	85954	3922	420640	0.94237	2062491	24
55	0.01483	0.07167	82032	5879	396398	0.91069	1641852	20.01
60	0.02319	0.10992	76153	8371	360995	0.86398	1245454	16.35
65	0.03631	0.16706	67782	11324	311894	0.79405	884459	13.05
70	0.05762	0.25276	56459	14271	247659	0.69297	572566	10.14
75	0.09172	0.37311	42188	15741	171620	0.47179	324906	7.7
80	0.17253	...	26447	26447	153287	...	153287	5.8

Female

Age	m(x,n)	q(x,n)	l(x)	d(x,n)	L(x,n)	S(x,n)	T(x)	e(x)
0	0.03372	0.03278	100000	3278	97208	0.96415	6968446	69.68
1	0.00208	0.00827	96722	800	384865	0.99311	6871237	71.04
5	0.00072	0.00359	95922	344	478750	0.99677	6486373	67.62
10	0.00058	0.00288	95578	275	477201	0.99635	6007623	62.86
15	0.00095	0.00476	95303	454	475459	0.99422	5530422	58.03
20	0.00136	0.00676	94849	641	472712	0.99251	5054963	53.29
25	0.00164	0.00816	94208	769	469172	0.9911	4582251	48.64
30	0.00195	0.00972	93439	908	464999	0.9891	4113079	44.02
35	0.00247	0.01229	92531	1137	459932	0.98582	3648080	39.43
40	0.00331	0.01644	91394	1503	453410	0.98022	3188148	34.88
45	0.0048	0.02371	89891	2132	444442	0.97117	2734737	30.42
50	0.00707	0.03477	87760	3051	431628	0.95753	2290295	26.1
55	0.01058	0.05161	84708	4372	413298	0.93543	1858668	21.94
60	0.01669	0.08033	80336	6453	386611	0.89757	1445369	17.99
65	0.02755	0.1294	73883	9561	347010	0.83428	1058758	14.33
70	0.04661	0.20979	64322	13494	289502	0.73673	711748	11.07
75	0.07833	0.32867	50828	16706	213285	0.49488	422246	8.31
80	0.16329	...	34122	34122	208961	...	208961	6.12

First entry of S(x,n) is for survivorship of 5 cohorts of birth to age group 0-4 = L(0,5) / 500000
Second entry of S(x,n) is for S(0,5) = L(5,5) / L(0,5)
Last entry of S(x,n) is S(75+,5) = T(80) / T(75)

As a second stage, future mortality levels were projected. This projection was done in terms of life expectancy at births (by sex). This is the most important value of a life table. It indicates the average number of years that a newborn baby is expected to live if the age-specific death rates for a given year prevail for the rest of his or her life. A very simple approach was adopted: it was assumed that life expectancy at birth for the last year of the projection period (2050) will be 78.0 years for males and 80.0 years for females. These values were considered to provide a realistic level of mortality for the future considering the present level and the experience of other countries.

The Demographic Analysis & Population Projection System (DAPPS) software can project linearly the base life table for year 2011 (with life expectancies at birth of 66.95 years for males and 69.68 for females; see Table 5), up to a life table with 78.0 years for males and 80.0 years for females in 2050. However, there is a major problem that affect this projection. In 2020 and 2021, PNG was affected by the COVID-19 pandemic. As a result, mortality increased substantially, and these two years are certainly out of the proposed trend between 2011 to 2050.

In fact, an important mortality increase is documented by a survey conducted in 2022, the Socio-Demographic and Economic Survey (SDES). The life tables for 2020 and 2021 were calculated using data from this survey. Table 6 shows the life table estimated for year 2020. The same mortality level and pattern is assumed for year 2021.

Table 6. Life Tables 2020 (Based on the SDES)

Male

Age	nmx	nqx	lx	ndx	nLx	Tx	ex
0	0.01046	0.01037	100000	1037	99170	6574321	65.74
1	0.00330	0.01310	98963	1297	392486	6475151	65.43
5	0.00081	0.00405	97666	395	487261	6082665	62.28
10	0.00066	0.00328	97271	319	485616	5595404	57.52
15	0.00120	0.00598	96951	580	483484	5109787	52.70
20	0.00181	0.00903	96372	871	479700	4626303	48.00
25	0.00210	0.01045	95501	998	475045	4146603	43.42
30	0.00246	0.01222	94504	1155	469719	3671558	38.85
35	0.00310	0.01539	93349	1437	463298	3201839	34.30
40	0.00415	0.02055	91912	1889	455073	2738540	29.80
45	0.00602	0.02966	90023	2670	443836	2283467	25.37
50	0.00932	0.04563	87353	3986	427474	1839632	21.06
55	0.01554	0.07499	83367	6252	402359	1412157	16.94
60	0.02779	0.13019	77115	10039	361212	1009799	13.09
65	0.05233	0.23198	67076	15560	297354	648586	9.67
70	0.09899	0.39852	51516	20530	207394	351232	6.82
75	0.17858	0.60669	30986	18799	105268	143838	4.64
80	0.31597		12187	12187	38570	38570	3.16

Female

Age	nmx	nqx	lx	ndx	nLx	Tx	ex
0	0.00749	0.00745	100000	745	99404	6631896	66.32
1	0.00263	0.01046	99255	1038	394344	6532492	65.82
5	0.00067	0.00334	98217	328	490201	6138147	62.50
10	0.00055	0.00273	97889	268	488830	5647946	57.70
15	0.00101	0.00504	97622	492	487032	5159117	52.85
20	0.00155	0.00773	97130	751	483792	4672085	48.10
25	0.00183	0.00910	96379	877	479736	4188293	43.46
30	0.00217	0.01082	95502	1033	475014	3708556	38.83
35	0.00279	0.01385	94469	1308	469217	3233543	34.23
40	0.00380	0.01882	93161	1753	461651	2764326	29.67
45	0.00562	0.02772	91407	2534	451100	2302675	25.19
50	0.00891	0.04365	88874	3879	435367	1851575	20.83
55	0.01527	0.07374	84994	6267	410537	1416207	16.66
60	0.02820	0.13202	78727	10393	368540	1005670	12.77
65	0.05492	0.24220	68334	16551	301345	637130	9.32
70	0.10661	0.42259	51783	21883	205257	335785	6.48
75	0.19395	0.63855	29900	19093	98442	130528	4.37
80	0.33683		10808	10808	32086	32086	2.97

First entry of S(x,n) is for survivorship of 5 cohorts of birth to age group 0-4 = L(0,5) / 500000

Second entry of S(x,n) is for S(0,5) = L(5,5) / L(0,5)

Last entry of S(x,n) is S(75+,5) = T(80) / T(75)

Thus, it is estimated that the life expectancy at birth declined from an historical trend approaching to 70 and 73 years, to 65.7 and 66.3 years. However, it was assumed that in 2022 ahead life expectancy recovers its historical trend. Table 7 shows the 2022 life table corresponding to the historical trend and Table 8 shows the historical life expectancy at birth for 2023 up to the end of the projection period.

Table 7. Life Tables 2022 (General Trend)

Male

Age	nmx	nqx	lx	ndx	nLx	Tx	ex
0	0.02993	0.02917	100,000	2,917	97,433	7,021,079	70.21
1	0.00155	0.00618	97,083	600	386,713	6,923,646	71.32
5	0.00066	0.00331	96,483	319	481,619	6,536,932	67.75
10	0.00053	0.00264	96,164	254	480,186	6,055,313	62.97
15	0.00097	0.00483	95,910	464	478,392	5,575,126	58.13
20	0.00135	0.00674	95,447	643	475,625	5,096,734	53.40
25	0.00138	0.00688	94,803	652	472,388	4,621,110	48.74
30	0.00156	0.00777	94,152	732	468,928	4,148,722	44.06
35	0.002	0.00995	93,420	930	464,773	3,679,794	39.39
40	0.00291	0.01447	92,490	1,338	459,104	3,215,020	34.76
45	0.00461	0.02281	91,152	2,079	450,561	2,755,916	30.23
50	0.00734	0.03604	89,073	3,210	437,337	2,305,355	25.88
55	0.01183	0.05746	85,862	4,934	416,976	1,868,018	21.76
60	0.01863	0.08901	80,928	7,203	386,633	1,451,042	17.93
65	0.02974	0.13842	73,725	10,205	343,113	1,064,408	14.44
70	0.04807	0.21456	63,520	13,629	283,529	721,295	11.36
75	0.07775	0.32547	49,891	16,238	208,862	437,766	8.77
80	0.14702	1.00000	33,653	33,653	228,905	228,905	6.80

Female

Age	nmx	nqx	lx	ndx	nLx	Tx	ex
0	0.027	0.02637	100,000	2,637	97,679	7,260,694	72.61
1	0.00164	0.00653	97,363	636	387,734	7,163,014	73.57
5	0.00056	0.00280	96,727	271	482,957	6,775,280	70.05
10	0.00046	0.00229	96,456	221	481,728	6,292,324	65.24
15	0.00075	0.00372	96,235	358	480,280	5,810,596	60.38
20	0.00106	0.00530	95,877	508	478,113	5,330,316	55.6
25	0.00129	0.00640	95,369	611	475,316	4,852,202	50.88
30	0.00153	0.00762	94,758	722	471,984	4,376,887	46.19
35	0.00194	0.00967	94,036	909	467,907	3,904,903	41.53
40	0.00263	0.01304	93,127	1,214	462,597	3,436,996	36.91
45	0.00382	0.01890	91,912	1,737	455,219	2,974,398	32.36
50	0.00564	0.02782	90,175	2,508	444,605	2,519,180	27.94
55	0.00849	0.04155	87,667	3,642	429,228	2,074,575	23.66
60	0.0134	0.06482	84,025	5,447	406,506	1,645,347	19.58
65	0.02251	0.10656	78,578	8,373	371,957	1,238,841	15.77
70	0.03872	0.17652	70,205	12,392	320,043	866,884	12.35
75	0.06617	0.28390	57,813	16,413	248,030	546,841	9.46
80	0.13855	1.00000	41,400	41,400	298,811	298,811	7.22

First entry of S(x,n) is for survivorship of 5 cohorts of birth to age group 0-4 = L(0,5) / 500000

Second entry of S(x,n) is for S(0,5) = L(5,5) / L(0,5)

Last entry of S(x,n) is S(75+,5) = T(80) / T(75)

Table 8. Life expectancy at birth, 2023 to 2050

Year	Male	Female
2023	70.5	72.87
2024	70.79	73.14
2025	71.08	73.4
:	:	:
:	:	:
2050	78.00	80.00

It is necessary to mention that the DAPPS software requires a limit life table for the far future, say 2100. The software itself provide this table (see Table 9). This life table is necessary for the calculations, but it does not affect the results.

Table 9. Limit Life table (circa 2100)

Male

Age	m(x,n)	q(x,n)	l(x)	d(x,n)	L(x,n)	S(x,n)	T(x)	e(x)
0	0.00198	0.00197	100000	197	99812	0.99793	9000001	90.00
1	0.00006	0.00025	99803	25	399152	0.99976	8900189	89.18
5	0.00004	0.00018	99778	18	498842	0.99983	8501037	85.20
10	0.00003	0.00015	99759	15	498759	0.99979	8002195	80.22
15	0.00006	0.00029	99744	29	498655	0.99965	7503436	75.23
20	0.00008	0.00040	99715	40	498478	0.99960	7004781	70.25
25	0.00008	0.00038	99675	38	498279	0.99960	6506303	65.28
30	0.00009	0.00043	99637	43	498080	0.99951	6008024	60.30
35	0.00012	0.00058	99594	58	497835	0.99927	5509944	55.32
40	0.00019	0.00094	99536	93	497470	0.99870	5012109	50.35
45	0.00035	0.00174	99443	173	496826	0.99764	4514638	45.40
50	0.00063	0.00312	99270	310	495651	0.99566	4017812	40.47
55	0.00116	0.00579	98960	573	493503	0.99245	3522161	35.59
60	0.00196	0.00973	98387	958	489776	0.98623	3028658	30.78
65	0.00382	0.01895	97430	1846	483033	0.97315	2538882	26.06
70	0.00745	0.03664	95583	3502	470065	0.94912	2055849	21.51
75	0.01420	0.06879	92081	6334	446146	0.90249	1585784	17.22
80	0.02835	...	85747	11413	402641	0.82128	1139639	13.29

Female

Age	m(x,n)	q(x,n)	l(x)	d(x,n)	L(x,n)	S(x,n)	T(x)	e(x)
0	0.0014	0.00140	100000	140	99867	0.9985	9500000	95.00
1	0.00007	0.00028	99860	28	399370	0.9998	9400133	94.13
5	0.00002	0.00012	99832	12	499128	0.9999	9000763	90.16
10	0.00002	0.00009	99819	9	499074	0.9999	8501635	85.17
15	0.00003	0.00014	99810	14	499019	0.9998	8002561	80.18
20	0.00004	0.00020	99797	20	498936	0.9998	7503542	75.19
25	0.00005	0.00024	99777	24	498826	0.9997	7004607	70.20
30	0.00006	0.00030	99753	30	498692	0.9997	6505781	65.22
35	0.00008	0.00040	99723	40	498521	0.9995	6007088	60.24
40	0.00012	0.00058	99683	58	498281	0.9993	5508568	55.26
45	0.00018	0.00092	99625	92	497914	0.9988	5010287	50.29
50	0.00028	0.00142	99533	141	497340	0.9982	4512373	45.34
55	0.00045	0.00223	99392	222	496449	0.9972	4015033	40.40
60	0.00072	0.00359	99170	356	495053	0.9947	3518584	35.48
65	0.00153	0.00764	98814	755	492422	0.9886	3023531	30.60
70	0.00328	0.01630	98060	1598	486798	0.9758	2531109	25.81
75	0.00701	0.03452	96461	3330	475013	0.9474	2044310	21.19
80	0.01555	...	93132	6996	450042	0.8960	1569297	16.85

First entry of S(x,n) is for survivorship of 5 cohorts of birth to age group 0-4 = L(0,5) / 500000

Second entry of S(x,n) is for S(0,5) = L(5,5) / L(0,5)

Last entry of S(x,n) is S(95+,5) = T(100) / T(95)

Fertility projection

The next component estimated was fertility and calculated with indirect methods from the 1980, 2000, and 2011 Censuses and directly from the 2006 and 2016-2018 Demographic and Health Surveys (DHS).

The fertility projection involves two measures: (a) the Total Fertility Rate (TFR), which is the total number of children a woman would have if fertility rates for a given year applies to her throughout her reproductive life (the TFR sums up, in a single number, the fertility of all women at a given point in time); (b) Age-Specific Fertility Rate (ASFR), which measure the annual number of births to women of a specified age or age group (see Houpt and Kane, 2000).

As mentioned above, these measures were estimated, first, from three censuses (1980, 2000 and 2011). The data used was the children born during the 12 months prior to the census by age of women. The problem is that this census information is not always reliable. Frequently, the number of children that women declare to have born during the past 12 months is under-enumerated. Problems are the no declaration of children who died just after birth, errors in the 12 months period of reference, among others. For this reason, ASFR and, therefore TFR, were adjusted using an indirect approach: the P/F ratio method. The children born in the past 12 months is adjusted using the number of children ever born by age of women, which is also usual census information. There are several versions of the P/F ratio method. In the present projection three versions were used: Arriaga, Trussell and Mortara. The software used were FERTPF and PFRATIO from the PAS package and FERTCB from the MortPak package (see Table 10).

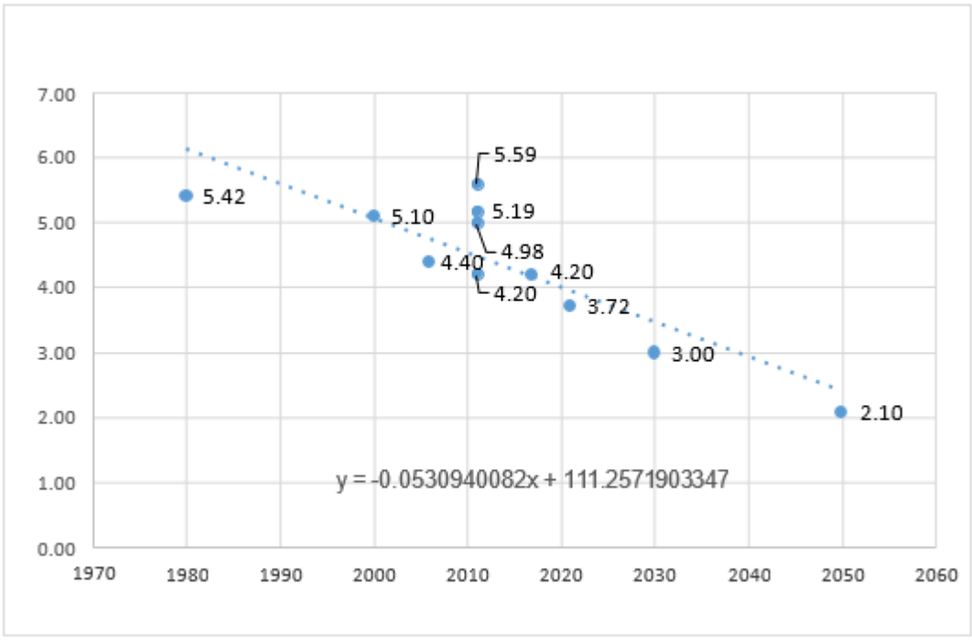
A second source of fertility estimation was two Demographic and Health Surveys (2006 and 2016-2018). It is considered that the ASFR and TFR from Demographic and Health Surveys do not require any adjustment since Information is more carefully collected in a survey than in a census.

As in the case of mortality, fertility was also projected based on past levels and patterns. Using the TFR estimated from the 1980, 2000 and 2011 Censuses with different indirect methods, and from the 2006 and 2016-2018 Demographic and Health Surveys (DHS), a trend was identified. It was concluded that a lineal trend was the most appropriate mathematical model to describe this tendency (see Figure 1). Using the respective equation, the TFR were projected for the entire projection period (see second panel in Table 10).

Table 10. Estimated and projected Total Fertility Rates, 1980 to 2050

Source	Year	Observed	Projected
Census 1980 (Mortara)	1980	5.42	
Census 2000, Mortara	2000	5.1	
DHS 2006	2006	4.4	
Census 2011, Arriaga (PAS)	2011	4.98	
Census 2011, Arriaga (Mortpack)	2011	5.19	
Census 2011, Mortara	2011	4.2	
Trussel (PAS)	2011	5.59	
DHS 2016-18	2017	4.2	
SDES 2022	2021	3.72	
Assumed	2030	3	
Assumed	2050	2.1	
Estimated	2020		4.01
Projected	2025		3.74
“	2030		3.48
“	2035		3.21
“	2040		2.95
“	2045		2.68
“	2050		2.41

Figure 1. Estimated and projected Total Fertility Rates, 1980 to 2050



Regarding the projection of the ASFR, it was considered that the age composition of fertility remained constant during the entire projection period. This means that the relative ASFR remained constant. Table 11 shows the ASFR for 2020 and 2050. Although the rates are different, the relative distribution is the same (first column).

Table 11. Estimated and projected age-specific fertility rates, 2020 and 2050

Age	Relative ASFR (Arriaga, PAS)	2020	2050
15-19	0.04233	0.03395	0.02040
20-24	0.18748	0.15036	0.09036
25-29	0.24024	0.19267	0.11579
30-34	0.22257	0.1785	0.10728
35-39	0.16938	0.13584	0.08164
40-44	0.09285	0.07447	0.04475
45-49	0.04516	0.03622	0.02177
SUM	1.00	0.80200	0.48200
TFR		4.01	2.41

In DAPPS, when the age composition of fertility is assumed to remain constant during the whole projection period, ASFR is to be included solely for the initial and final projection years (see Table 11).

Migration

In a national projection, only international migration is considered. The problem is that census data can only be used to estimate international immigration, but not emigration (unless censuses from other countries are used). Nevertheless, in most countries international migration is not significant. Therefore, in many cases, it is reasonable to assume that it is unlikely that, in the future, international migration will become a major component of population change in the country.

Therefore, for this projection, international migration will be assumed to be equal to zero. This is not to say that migration will not take place in the future 30 years, but probably its level will be low and hence, unlikely to impact the population size and structure. This is only an assumption and does not mean that in the near future emigration or immigration will not occur; however, there is no evidence for proposing such hypotheses regarding volume and trend of international migration. The usual practice in this case is to assume that it will be negligible.

5. ALTERNATIVE PROJECTION SCENARIOS

A usual practice in the preparation of population projections is to propose alternative scenarios. They are projections in which different behaviours of the components are assumed.

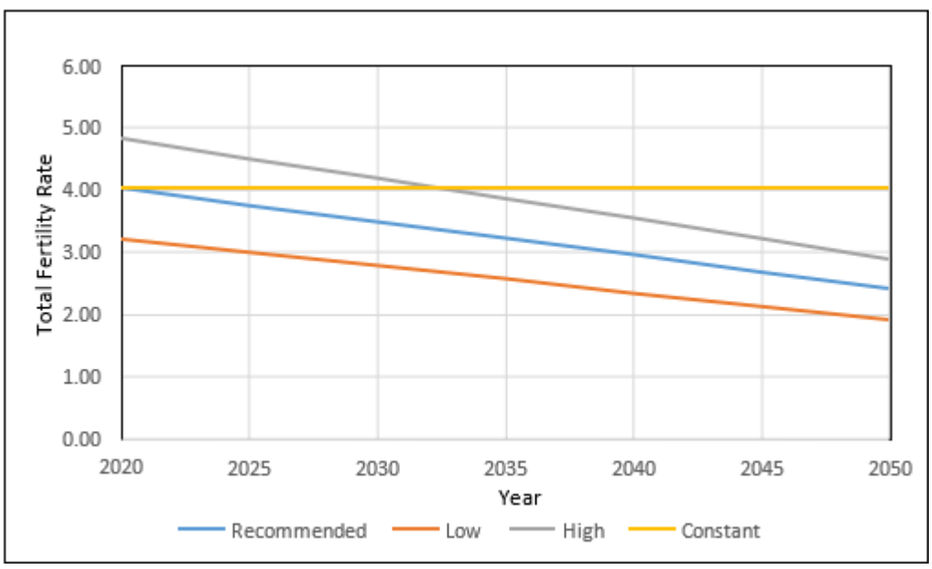
Three alternative projections were prepared based on hypotheses regarding future changes on fertility. They are labelled here as High, Low and Constant. The original projection is considered as the Recommended scenario because it is the most likely to occur in the future. The High and Low will represent maximum or minimum values that fertility rates may take in the future. Actually, they may have a very low probability to occur, but are calculated for their analytical value and to set an upper and lower limit within which population growth is virtually certain to remain. The Constant scenario assume that fertility will not change during the entire projection period. Again, the situation proposed by this hypothesis is very unlikely to occur, but it is included for its analytical value. They are also useful for setting limits on the size of the future population.

Table 12 and Figure 2 show the projected Total Fertility Rate according to the four fertility hypotheses, The Total Fertility Rate assumed in the High Scenario is 20 percent higher than that proposed in the Recommended Scenario and that assumed in the Low Scenario is 20 percent lower than that proposed in the Recommended Scenario. The Total Fertility Rate assumed in the Constant Fertility Scenario is the same during the entire projection period and correspond to the initial Total Fertility Rate in the Recommended Scenario.

Table 12. Projected Total Fertility Rates according to three fertility hypotheses, 2020 to 2050

Year	Projected TFR			
	Recommended	Low (20% lower)	High (20% higher)	Constant
2020	4.01	3.21	4.81	4.01
2025	3.74	2.99	4.49	4.01
2030	3.48	2.78	4.17	4.01
2035	3.21	2.57	3.85	4.01
2040	2.95	2.36	3.53	4.01
2045	2.68	2.14	3.22	4.01
2050	2.41	1.93	2.9	4.01

Figure 2. Projected Total Fertility Rate according to three fertility hypotheses, 2020 to 2050



6. PROVINCIAL PROJECTIONS – BASE POPULATIONS AND COMPONENTS

Papua New Guinea is administratively divided into 22 provinces. The population of each province was projected by age and sex also using the component method. As in the national projection, the base population was from the 2021 Population Modelled Estimation (PME). It is also important to mention that only the Recommended population projection will be disaggregated into provinces.

Table 13 shows the population of each province by sex. The provincial populations vary from more than one million population (Morobe, 1,139,789 people, which corresponds to 9.4 per cent of the population) to less than 100,000 people (Manus, 74,547 people, which corresponds to 0.6 percent of the population). Although there are important variations in the size of the provincial populations, there are not large population concentrations. The capital, Port Moresby, includes 4.3 per cent of the population (513,918 people).

Table 13. Population by sex and provinces, Population Modelled Estimation, 2021

Province	Total	Male	Female
Western	315,273	163,258	152,015
Gulf	201,388	106,311	95,077
Central	362,768	192,088	170,680
National Capital District	513,918	271,311	242,607
Milne Bay	748,196	395,458	352,738
Northern (Oro)	271,193	143,585	127,608
Southern Highlands	927,306	480,712	446,594
Enga	571,060	297,852	273,208
Western Highlands	531,402	269,119	262,283
Chimbu	816,280	535,457	280,823
Eastern Highlands	784,535	409,762	374,773
Morobe	1,139,789	601,322	538,467
Madang	797,807	422,345	375,462
East Sepik	681,518	348,959	332,559
West Sepik	421,470	220,193	201,277
Manus	74,547	38,747	35,800
New Ireland	232,351	121,700	110,651
East New Britain	457,169	237,615	219,554
West New Britain	356,343	188,047	168,296
A. R. of Bougainville.	641,431	330,323	311,108
Hela	765,142	389,935	375,207
Jiwaka	451,496	233,120	218,376
Total	12,062,382	6,397,219	5,665,163

Table 14 shows the estimates of the projection components, that is, mortality, fertility and migration. The source of these estimates is the 2011 Census. The respective information is not available at the provincial level in sources that have been already used (2021 Population Modelled Estimation, PME and 2022 Socio-Demographic and Economic Survey, SDES).

Table 14. Demographic indicators by provinces, 2011 Census

Province	TFR	e(0) males	e(0) females	Net Migration Rate (x 000)		
				Total	Male	Female
Western	6.2	70.58	72.37	-0.36	1.18	-1.98
Gulf	8.53	64.12	65.88	3.22	-0.75	7.44
Central	5.09	71.26	73.07	4.47	9.37	-0.99
National Capital District	3.38	75.92	77.49	9.97	4.65	16.07
Milne Bay	5.32	68.16	69.86	2.58	3.29	1.82
Northern (Oro)	7.32	68.64	70.39	3.59	4.6	2.49
Southern Highlands	5.5	69.02	70.81	11.32	12.33	10.24
Enga	4.09	68.05	69.74	0.54	2.73	-1.83
Western Highlands	4.61	73.73	74.04	-8.07	-7.83	-8.32
Chinbu	3.73	71.74	73.4	1.32	0.54	2.17
Eastern Highlands	4.37	69.44	71.17	2.15	3.5	0.69
Morobe	5.57	66.83	68.45	1.99	2.7	1.22
Madang	6.87	68.13	69.83	4.87	3.93	3.21
East Sepik	4.8	66.92	68.55	4.36	3.22	2.63
West Sepik	5.43	60.44	61.66	-1.04	0.5	-1.33
Manus	5.94	65.25	66.77	1	0.14	0.04
New Ireland	6.61	70.32	71.96	5.88	2.07	1.26
East New Britain	5.73	69.83	71.53	0.39	0.42	-0.06
West New Britain	5.92	72.57	74.26	5.6	2.9	1.44
A. R. of Bouganville.	5.97	72.03	73.72	1.54	0.61	0.53
Hela	6.83	67.94	69.62	-18.46	-17.75	-19.22
Jiwaka	4.54	72.88	74.57	-12.1	-5.94	-6.29
Papua New Guinea	4.49*	66.95	69.68	-	-	-

* Estimated from Table 10

According to Table 14, Total Fertility Rates (TFR) vary substantially among provinces from 8.5 children per woman in Gulf province to 3.4 in the National Capital District. The TFR at the national level is 4.5 children per woman for the year corresponding to the data in Table 14 (2011).

Mortality also fluctuates markedly among provinces as indicated by life expectancy at birth (by sex). The lower mortality is observed at the National Capital District with a life expectancy at birth of 75.9 years for males and 77.5 years for females, while the highest level is in West Sepik with 60.4 years for males and 61 7 years for females.

Interprovincial migration was estimated from the census question on place of residence in the previous year; hence, the data refers to annual migration rates. The data suggest that migration occurs, but it is not substantial. Some provinces show negative rates, meaning that they lose population, as is the cases of Hela, Jiwaka and Western Island (-18.5, -12.1 and -8.1 per thousand, respectively). On the contrary, some provinces gain population, such as Southern Island with a positive rate of 11.3 per thousand. In general, migration rates are higher among males than among females. There are, however, exceptions such as in the National Capital where the female rate is 16.1 per thousand while the male rate is only 4.7 per thousand. It is important to repeat that migration among provinces is limited and, therefore, it is unlikely to become a major component of population growth in the near future.

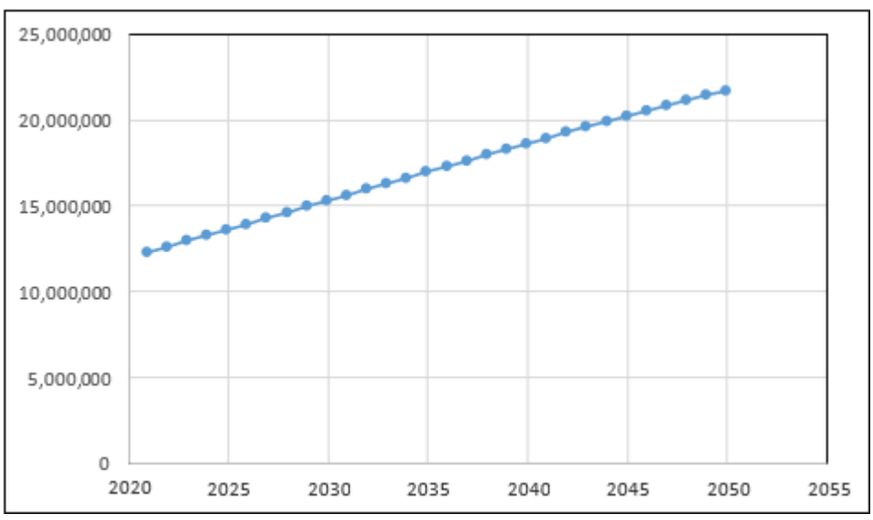
7. PROJECTED NATIONAL POPULATION

Table 15 shows the population projection for each year, from 2021 to 2050. The table also shows the projected deaths, births and subsequent natural increase. Between 2021 and 2050, the national population is expected to increase from 12.3 million people in 2021 to 21.7 million in 2050, which corresponds to a total of 9.4 million or 1.97 percent per year. Figure 3 shows the graph corresponding to the population projected for the 29 years considered in this projection. The projected population by sex and five-year groups are in Appendix 1.

Table 15. Projected population, vital events and natural increase, 2021 to 2050

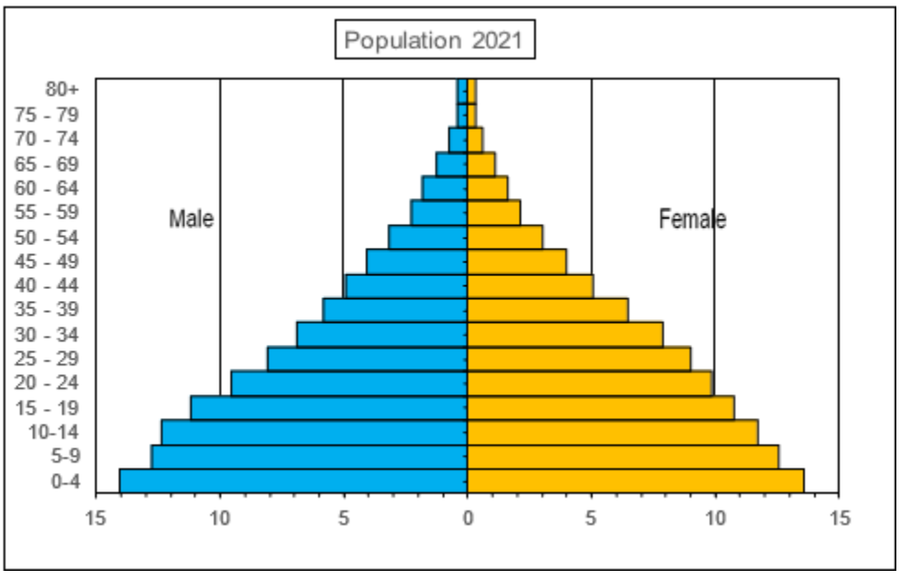
Year	Population	Births	Deaths	Natural increase
2021	12,291,999	369,869	77,399	292,470
2022	12,599,542	374,382	51,765	322,617
2023	12,923,883	378,588	52,522	326,066
2024	13,251,406	382,388	53,407	328,981
2025	13,581,614	385,797	54,362	331,435
2026	13,914,171	389,043	55,365	333,678
2027	14,248,746	391,935	56,463	335,472
2028	14,584,921	394,505	57,628	336,877
2029	14,922,302	396,736	58,850	337,886
2030	15,260,483	398,593	60,116	338,477
2031	15,598,925	399,819	61,412	338,407
2032	15,937,061	400,635	62,770	337,865
2033	16,274,488	401,165	64,177	336,988
2034	16,610,893	401,447	65,624	335,823
2035	16,946,014	401,526	67,107	334,419
2036	17,279,842	401,863	68,626	333,237
2037	17,612,164	401,601	70,193	331,408
2038	17,942,445	400,954	71,799	329,155
2039	18,270,389	400,179	73,446	326,733
2040	18,596,012	399,649	75,135	324,514
2041	18,919,800	399,939	76,877	323,062
2042	19,241,734	399,475	78,668	320,807
2043	19,561,171	398,570	80,504	318,066
2044	19,877,713	397,418	82,400	315,018
2045	20,191,108	396,144	84,372	311,772
2046	20,501,296	395,034	86,431	308,603
2047	20,808,048	393,474	88,574	304,900
2048	21,110,864	391,521	90,790	300,731
2049	21,409,293	389,195	93,069	296,126
2050	21,702,892	386,471	95,398	291,073

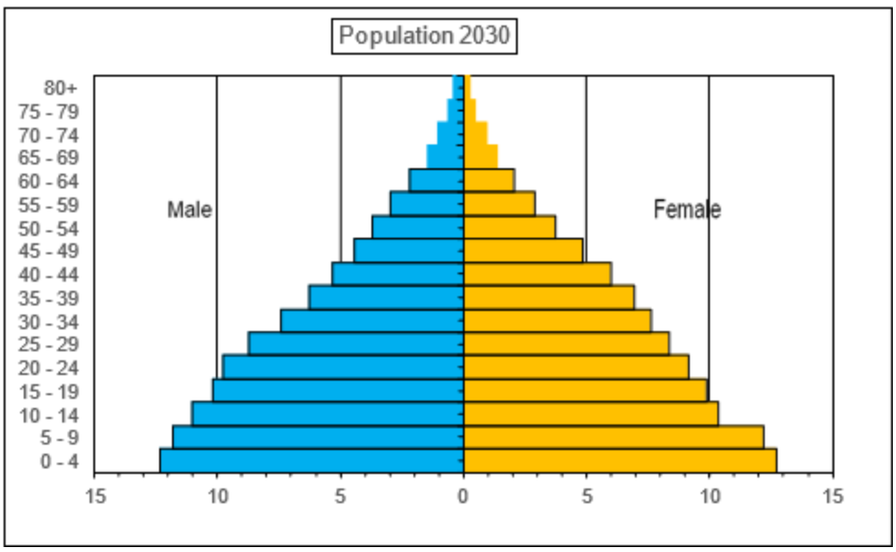
Figure 3. Population projection from 2021 to 2050

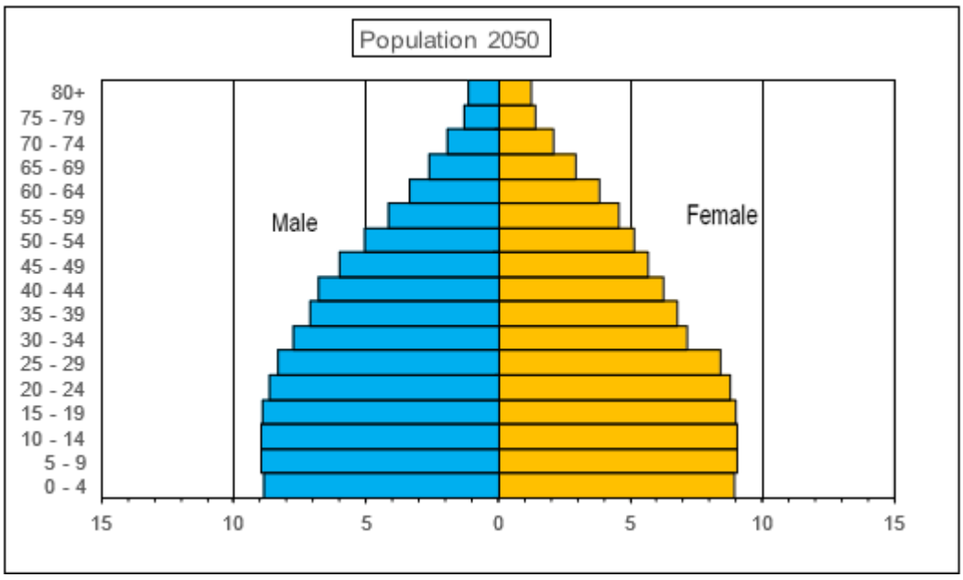


Figures 4 show the population pyramid corresponding to the percentage age-sex distribution of the initial projection year (2021), to 2030, and to the end of the end of the projection period (2050). The graph corresponding to year 2021 has the typical shape of a pyramid. The graph for the population in 2030 also has the shape of a pyramid, although the base is narrower, which is the result of fertility decline. The graph for year 2050 has lost the shape of a pyramid and has the typical form of a population experiencing a transition from high fertility to a fertility approaching replacement level[9].

Figure 4. Pyramids for the population projected for 2021, 2030 and 2050



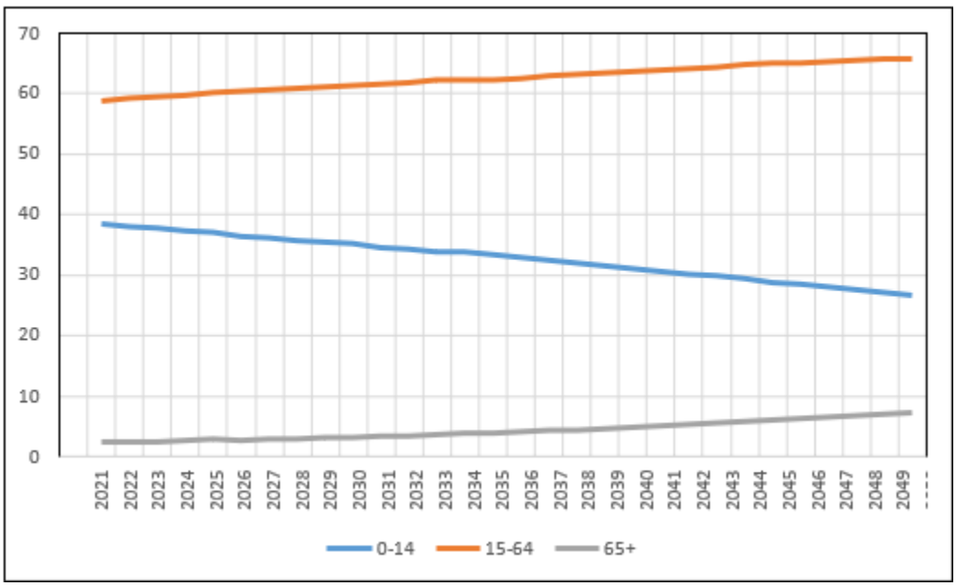




[9] Replacement level fertility is the total fertility rate at which a population exactly replaces itself from one generation to the next, without migration. This rate is roughly 2.1 children per woman for most countries, although it may modestly vary with mortality rates.

Figure 5 shows the projection of the percentage of the population according to three relevant age groups: the youngest population (0 to 14 years old), the working age population (15 to 64 years old), and the elderly population (65 years and older). The first age group, the youngest, is expected to experience a decline from 38.6 to 26.9 per cent. On the contrary, the age group 15 to 64 is likely to experience an increase from 55.8 to 65.8 per cent. The elderly population, from age 65 and above, is expected to increase from 2.6 to 7.3 per cent. The determinants of these changes are mortality and fertility decline.

Figure 5. Projected percentages of the population aged 0 to 14 years, 15 to 64 years and 65 years and above, 2021 to 2050



The age structure of a population affects key socioeconomic issues in a country. Nations with young populations (high percentage under age 15) need to invest more in schools; as the population gets older, while countries with older (increasing percentage ages 65 and above) need to invest more in the health sector. The age structure can also be related to potential political issues. For example, the rapid growth of a young adult population unable to find employment can lead to social unrest and discontent.

Figure 6 shows another important indicator of the future characteristics of the population: the age-dependency ratio. This is a measure of the number of dependents aged zero to 14 years plus those above the age of 65 years, compared with the total population aged 15 to 64 years. This demographic indicator gives an insight into the number of non-working age people, compared with the number of those of working age. This projection estimates a future fall in the age-dependency ratio mainly as a result of fertility decline. The expansion of the elderly population has prevented a more rapid and substantial decline of this measure. Notice that this is not a measure of the economically active population, but of the working age population. Hence, it can be considered an indicator of the potential economically active population.

Figure 6. Projected Age-Dependency Ratio, 2021 to 2050

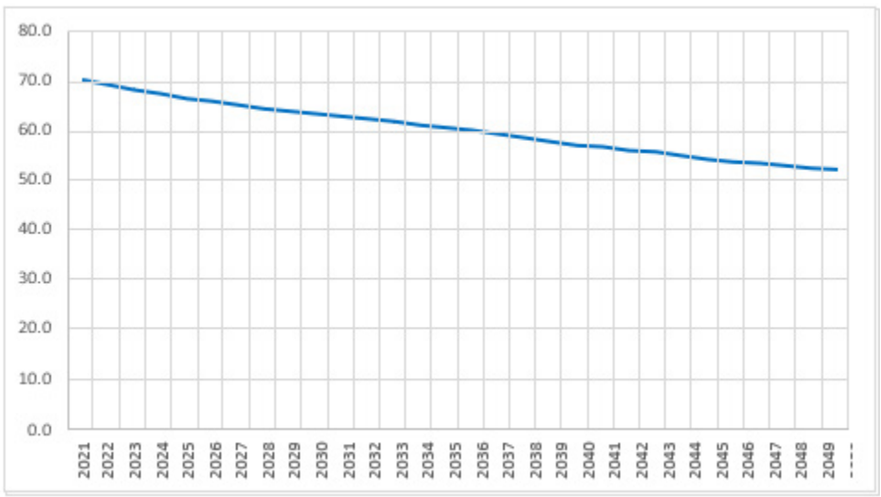
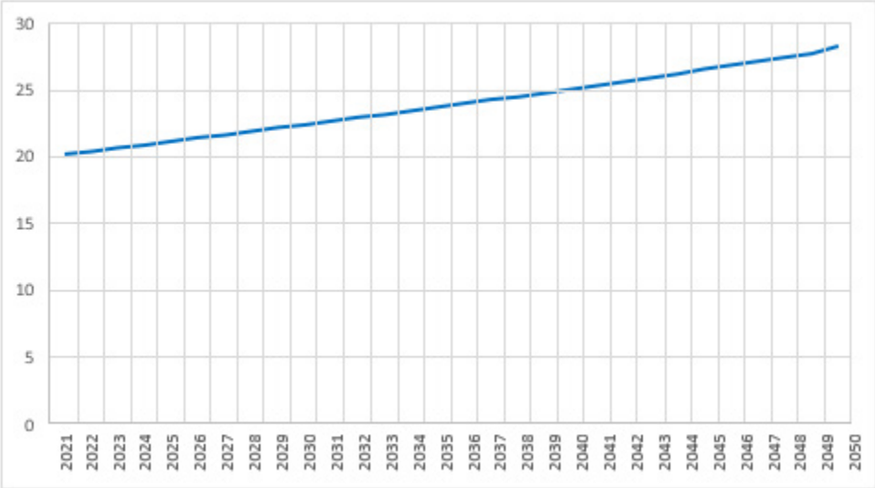


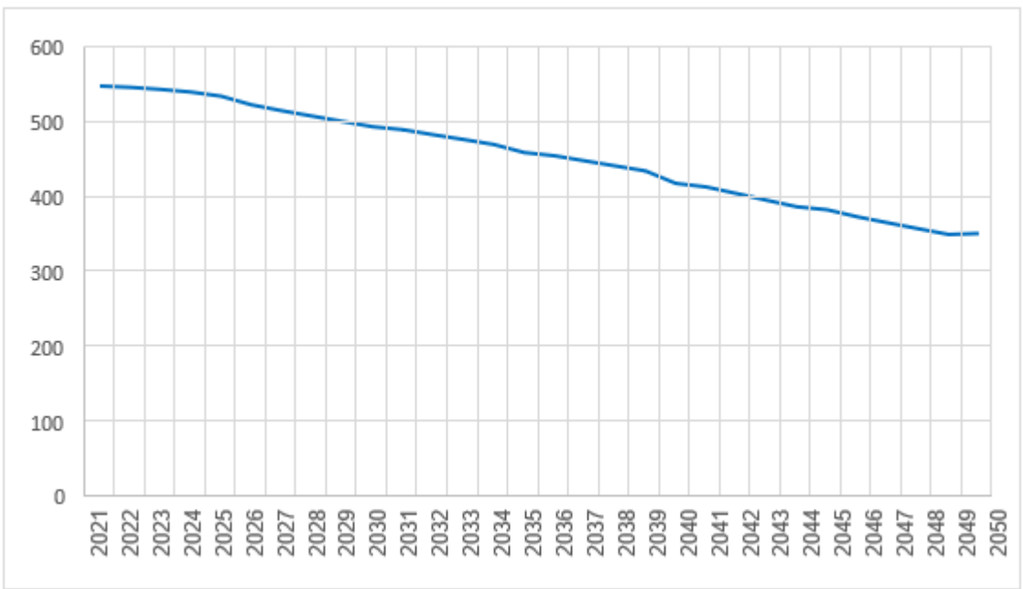
Figure 7 shows the projected median age. It is expected that it will experience a small increase: from 23.6 to 24.6 years of age. The reason for this limited increase is that PNG population is expected to experience a moderate population ageing process, that is, and decline in the infant and child population but a modest increase of the aged population.

Figure 7. Projected median age, 2021 to 2050



Finally, Figure 8 shows the child-woman ratio, which is a measure of the age composition of the population and, at the same time, a measure of fertility. Up to year 2025 the childwoman ratio is expected to experience an increase, mainly because of past high fertility levels. However, starting during the second half of the present decade, the child-woman ratio is likely to decline. This expected trend is, clearly, the result of the projected fertility decline.

Figure 8. Projected child-woman ratio, 2021 to 2050



To summarize, it is expected that the population in Papua New Guinea will continue growing during the next three decades in spite of a declining fertility trend. In any population, during a process of fertility decline, the large cohorts born before the decline start climbing in the population pyramid and enter into reproductive age. The number of children per woman decline, but the number of women having children increases. It is also important to mention that the population in Papua New Guinea will experience a slow ageing process as a result of a decline in the infant and child population and an increase of the aged population.

8. ALTERNATIVE HYPOTHESES PROJECTIONS

As posited in Chapter 5, three alternative population projections based on the behaviour of fertility are proposed (see Table 12 and Figure 2).

In the first one, a decline in fertility 20 percent slower than the decline assumed in the conventional or recommended projection is assumed. This is the low fertility hypothesis. In a second hypothesis, it was assumed a decline in fertility 20 percent more rapid than that assumed in the recommended projection. This is the high fertility hypothesis.

Finally, in the third alternative hypothesis it was assumed that the level of fertility will remain constant, at the level estimated for 2020, during the entire projection period. This is the constant fertility hypothesis. Assumptions of more rapid or slower fertility seem unrealistic. Even the assumption of future constant fertility is unlikely, but this assumption is useful for analytical purposes.

According to the recommended hypothesis, the total population in 2030 will be 15.3 million people and in 2050 it will reach 21.7 million (see Table 16). The population according to the high fertility hypothesis in 2030 will be a little larger than that projected in the recommended hypothesis: 15.9 million people; however, in 2050 the population according to the high fertility hypothesis is expected to be much larger: 24.2 million people. Regarding the low fertility hypothesis, the population in 2030 will be smaller than in the recommended hypothesis: 14.6 million people; in 2050 it will be much smaller: 19.3 million. Finally, according to the constant fertility hypothesis, the population in 2030 will be 15.5 million people a little larger than the population according to the recommended hypothesis; in 2050 it will be almost 25 million people, a population larger than those projected by the other projections.

The results of the three alternative projections by sex and five-year groups are in Appendix 1.

Table 16. National population projections according to three fertility scenarios

Year	High Fertility			
	Total population and vital events			
	Population	Births	Deaths	Natural increase
2021	12,291,999	443,732	77,399	366,333
2022	12,672,847	449,221	53,858	395,363
2023	13,070,315	454,346	54,771	399,575
2024	13,471,728	458,987	55,737	403,250
2025	13,876,565	463,164	56,739	406,425
2026	14,284,341	466,895	57,769	409,126
2027	14,694,567	470,194	58,868	411,326
2028	15,106,764	473,099	60,032	413,067
2029	15,520,468	475,590	61,248	414,342
2030	15,935,199	477,626	62,505	415,121
2031	16,350,451	479,177	63,794	415,383
2032	16,765,695	480,240	65,136	415,104
2033	17,180,467	480,964	66,525	414,439
2034	17,594,406	481,393	67,954	413,439
2035	18,007,208	481,582	69,418	412,164
2036	18,418,722	481,777	70,912	410,865
2037	18,829,095	482,362	72,481	409,881
2038	19,238,208	482,442	74,097	408,345
2039	19,645,672	482,336	75,753	406,583
2040	20,051,483	482,489	77,449	405,040
2041	20,456,495	484,188	79,203	404,985
2042	20,862,688	488,457	81,057	407,400
2043	21,270,923	492,055	82,983	409,072
2044	21,680,599	495,247	84,966	410,281
2045	22,091,318	498,178	87,021	411,157
2046	22,502,752	500,864	89,154	411,710
2047	22,914,923	504,010	91,377	412,633
2048	23,327,644	506,483	93,675	412,808
2049	23,740,191	508,313	96,028	412,285
2050	24,151,855	509,467	98,424	411,043

Low Fertility				
Year	Total population and vital events			
	Population	Births	Deaths	Natural increase
2021	12,291,999	296,009	77,399	218,610
2022	12,526,241	299,545	49,672	249,873
2023	12,777,457	302,832	50,273	252,559
2024	13,031,093	305,791	51,077	254,714
2025	13,286,674	308,433	51,984	256,449
2026	13,543,911	310,983	52,958	258,025
2027	13,802,522	313,248	54,049	259,199
2028	14,062,142	315,253	55,211	260,042
2029	14,322,439	316,986	56,433	260,553
2030	14,583,074	318,418	57,700	260,718
2031	14,843,696	319,530	59,005	260,525
2032	15,103,927	320,319	60,382	259,937
2033	15,363,433	320,885	61,810	259,075
2034	15,621,958	321,257	63,283	257,974
2035	15,879,285	321,472	64,791	256,681
2036	16,135,307	321,696	66,335	255,361
2037	16,389,386	320,695	67,897	252,798
2038	16,640,741	319,407	69,496	249,911
2039	16,889,145	318,033	71,136	246,897
2040	17,134,618	316,870	72,820	244,050
2041	17,377,531	316,332	74,556	241,776
2042	17,616,706	312,879	76,305	236,574
2043	17,850,542	309,180	78,082	231,098
2044	18,078,812	305,365	79,923	225,442
2045	18,301,381	301,540	81,844	219,696
2046	18,518,411	298,223	83,857	214,366
2047	18,729,560	293,886	85,952	207,934
2048	18,934,153	289,371	88,118	201,253
2049	19,131,947	284,688	90,354	194,334
2050	19,322,703	279,823	92,646	187,177

Year	Constant Fertility			
	Total population and vital events			
	Population	Births	Deaths	Natural increase
2021	12,291,999	374,918	77,399	297,519
2022	12,607,140	384,744	51,982	332,762
2023	12,944,333	394,526	52,903	341,623
2024	13,290,246	404,158	53,956	350,202
2025	13,644,629	413,649	55,084	358,565
2026	14,007,286	423,011	56,261	366,750
2027	14,378,021	432,250	57,531	374,719
2028	14,756,643	441,397	58,870	382,527
2029	15,142,987	450,428	60,267	390,161
2030	15,536,863	459,299	61,708	397,591
2031	15,938,053	467,972	63,182	404,790
2032	16,346,308	476,437	64,719	411,718
2033	16,761,431	484,832	66,306	418,526
2034	17,183,327	493,200	67,933	425,267
2035	17,611,961	501,595	69,595	432,000
2036	18,047,457	510,282	71,290	438,992
2037	18,489,744	518,611	73,030	445,581
2038	18,938,529	526,801	74,812	451,989
2039	19,393,799	535,187	76,635	458,552
2040	19,855,966	544,285	78,505	465,780
2041	20,326,294	555,312	80,436	474,876
2042	20,805,616	566,198	82,430	483,768
2043	21,293,879	577,233	84,475	492,758
2044	21,791,315	588,704	86,589	502,115
2045	22,298,388	600,818	88,788	512,030
2046	22,815,880	614,036	91,081	522,955
2047	23,344,428	627,612	93,471	534,141
2048	23,884,322	641,587	95,941	545,646
2049	24,435,905	656,002	98,482	557,520
2050	24,999,539	670,828	101,079	569,749

9. PROVINCIAL PROJECTION

Papua New Guinea is divided into 22 provinces. The provincial population and the respective components are presented in Chapter 6 in Tables 13 and 14. The base population was also the 2021 Population Modelled Estimation (PME). The population of each province was projected using the component method with the DAPPS software.

For the projection of the components, the same rates of mortality, fertility and migration (internal) were applied to each province. It is necessary to acknowledge that this is not likely since rates probably fluctuate among areas. However, evidence regarding variations among provinces is not available and a conservative approach was adopted.

Mortality was projected using life expectancy at birth. It was estimated from the 2011 census data on death in the past year and children born and died. The same indirect methods used in the national projections were used here. A 10 percent increase was assumed in the life expectancy at birth until the end of the projection period (2021-2050).

Regarding fertility, it was projected by assuming a decline in total fertility rates (TFR) of 15 percent per decade during the projection period. This is approximately the same rate of decline assumed at the national level. It was supposed that the relative age-specific fertility rate will remain constant during the projection period.

Finally, it was assumed that annual migration will be as reported in the 2011 Census during the entire projection period.

A major problem when sub-areas of a national population are independently projected is that the sum of the sub-areas' projected population is not equal to the projected national population. There are several ways to adjust the sum of the projected sub-areas populations to the national projected population. In this case, the approach used was an iterative projection contingency table. The worksheet CTBL32 from the set of PAS spreadsheets was employed and adjusted the provincial populations (by age and sex) so as the total add to the country population (also by age and sex).

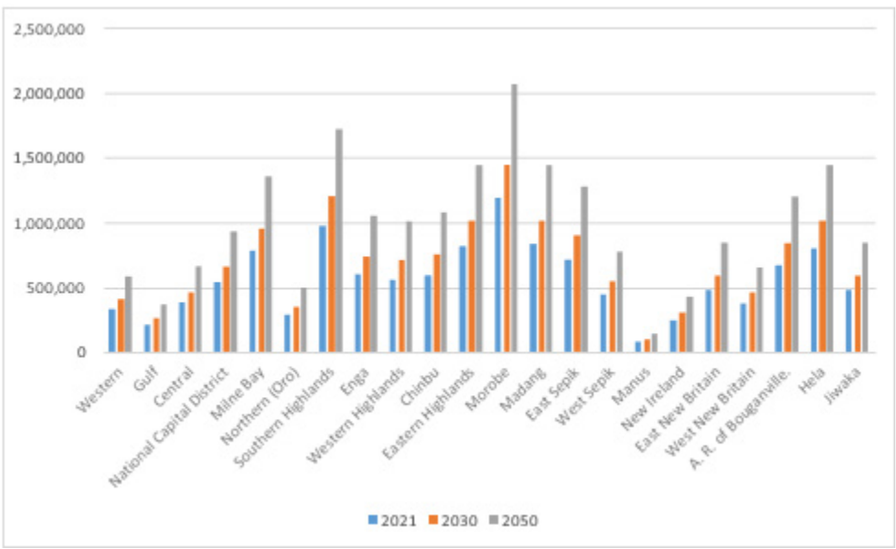
Table 17 shows the provincial population projected from years 2021 to 2050. It also shows the annual growth rate from 2021 to 2050 (see Figure 9). The projections by sex and five-year groups are presented in Appendix 1.

Table 17. Projected population by provinces, 2021 to 2050

Province	Year							
	2021	2022	2023	2024	2025	2026	2027	2028
Western	328,337	338,087	346,790	355,579	364,439	373,363	382,341	391,362
Gulf	209,371	211,455	216,898	222,395	227,937	233,518	239,133	244,775
Central	377,043	379,599	389,371	399,238	409,187	419,206	429,286	439,414
National Capital District	534,286	539,567	553,457	567,483	581,624	595,866	610,193	624,590
Milne Bay	777,767	784,503	804,698	825,091	845,651	866,358	887,190	908,121
Northern (Oro)	281,867	283,805	291,111	298,488	305,926	313,417	320,954	328,526
Southern Highlands	965,638	993,242	1,018,811	1,044,630	1,070,661	1,096,877	1,123,252	1,149,753
Enga	594,341	607,625	623,267	639,062	654,987	671,024	687,160	703,372
Western Highlands	554,504	583,328	598,344	613,507	628,795	644,192	659,682	675,246
Chinbu	586,709	624,561	640,639	656,874	673,243	689,728	706,313	722,977
Eastern Highlands	816,418	833,510	854,966	876,633	898,478	920,478	942,611	964,850
Morobe	1,185,035	1,197,571	1,228,400	1,259,530	1,290,916	1,322,525	1,354,326	1,386,279
Madang	829,219	835,042	856,538	878,245	900,129	922,170	944,344	966,624
East Sepik	710,465	739,624	758,664	777,890	797,274	816,796	836,436	856,171
West Sepik	438,588	447,648	459,171	470,808	482,540	494,355	506,242	518,186
Manus	77,610	79,621	81,670	83,740	85,827	87,928	90,042	92,167
New Ireland	241,732	246,092	252,427	258,824	265,274	271,769	278,304	284,870
East New Britain	475,956	488,297	500,866	513,560	526,357	539,245	552,212	565,240
West New Britain	370,480	374,297	383,932	393,662	403,471	413,351	423,290	433,277
A. R. of Bouganville	668,337	691,916	709,728	727,714	745,848	764,110	782,484	800,945
Hela	797,970	834,475	855,956	877,648	899,518	921,544	943,703	965,968
Jiwaka	470,326	485,677	498,179	510,804	523,533	536,352	549,249	562,207
Total	12,291,999	12,599,542	12,923,883	13,251,406	13,581,614	13,914,171	14,248,746	14,584,921

Province	Year						Annual growth rate
	2029	2030	2035	2040	2045	2050	
Western	400,415	409,489	454,717	498,992	541,794	582,360	1.976
Gulf	250,437	256,113	284,401	312,092	338,862	364,234	1.909
Central	449,579	459,768	510,549	560,261	608,318	653,865	1.898
National Capital District	639,038	653,520	725,702	796,362	864,671	929,413	1.909
Milne Bay	929,128	950,185	1,055,133	1,157,870	1,257,187	1,351,318	1.905
Northern (Oro)	336,125	343,743	381,710	418,876	454,805	488,858	1.899
Southern Highlands	1,176,349	1,203,009	1,335,882	1,465,954	1,591,698	1,710,874	1.972
Enga	719,643	735,952	817,238	896,811	973,736	1,046,643	1.951
Western Highlands	690,866	706,523	784,558	860,949	934,798	1,004,790	2.05
Chinbu	739,701	756,464	840,017	921,807	1,000,876	1,075,816	2.091
Eastern Highlands	987,169	1,009,541	1,121,046	1,230,200	1,335,722	1,435,732	1.947
Morobe	1,418,347	1,450,491	1,610,698	1,767,529	1,919,141	2,062,834	1.911
Madang	988,984	1,011,397	1,123,107	1,232,462	1,338,178	1,438,372	1.899
East Sepik	875,976	895,828	994,773	1,091,632	1,185,268	1,274,013	2.014
West Sepik	530,173	542,188	602,073	660,696	717,368	771,080	1.946
Manus	94,299	96,436	107,087	117,514	127,594	137,148	1.963
New Ireland	291,460	298,065	330,987	363,214	394,369	423,897	1.937
East New Britain	578,315	591,422	656,745	720,690	782,509	841,098	1.963
West New Britain	443,299	453,346	503,418	552,435	599,821	644,732	1.91
A. R. of Bouganville.	819,473	838,044	930,607	1,021,218	1,108,815	1,191,836	1.995
Hela	988,313	1,010,711	1,122,344	1,231,625	1,337,269	1,437,395	2.029
Jiwaka	575,213	588,248	653,221	716,824	778,310	836,585	1.986
Total	14,922,302	15,260,483	16,946,014	18,596,012	20,191,108	21,702,892	1.96

Figure 9. Projected population by provinces for 2021, 2030 and 2050



The population is assumed to grow in all provinces. Although there is variation, it is not substantial. The provinces that are expected to experience the largest growth are Chimbu and Western Island (2.09 and 2.05 percent per year between 2021 and 2050) while those that are expected to go through the lowest growth are Central and Northern (both 1.89 percent per year).

Table 18 shows selected indicator of the age-sex composition of the projected population. The following indicators were calculated: sex ratio, age-dependency ratio, ageing index, median age and child-woman ratio.

Table 18. Projected indicators of age-sex composition by provinces, 2021, 2030 and 2050

Province	Sex ratio			Age-dependency ratio			Ageing Index		
	2021	2030	2050	2021	2030	2050	2021	2030	2050
Western	110.5	107.7	103.2	72.5	65.3	53.4	5.9	8.4	24.1
Gulf	109.6	111.2	104.7	78.2	70.7	57.2	5.4	7.7	21.9
Central	123.6	126.3	115.1	79.9	72.2	60.4	7.4	10.6	31
National Capital District	106.1	107.7	103.1	53.5	47.8	38.5	6.9	9.8	26.7
Milne Bay	108.5	110.5	105.4	76.9	69.3	58.5	9.2	13.4	37.9
Northern (Oro)	106.8	109.1	103.2	78	70.5	58	6.2	8.7	25
Southern Highlands	110.8	108.2	104.2	72.2	65.3	53.7	6	8.5	24
Enga	138.4	136.9	118.2	60.8	55.1	46.9	8.6	12.2	34
Western Highlands	116.3	108.3	102.5	63.9	57.8	49.3	8.9	12.8	36.1
Chimbu	133.9	121.6	110.9	68.9	62.7	54.2	10.5	15.4	43
Eastern Highlands	109.1	108.3	102.3	61.5	55.2	44.4	6.2	8.8	23.9
Morobe	131.7	133.5	116.7	65.1	58.7	48	6.2	8.8	24.5
Madang	106	108.2	103.6	72.3	65.1	52.4	5.1	7.3	20.4
East Sepik	113.4	108	102.8	68.3	61.7	51.9	7.6	10.9	31
West Sepik	109.7	108.9	101.7	72.7	65.4	52.8	5.6	7.9	22.3
Manus	109.7	107.7	103.9	78.3	70.5	59.3	9.4	13.5	38.3
New Ireland	111.4	111.3	105.4	76.7	68.8	55.9	7	9.8	27.5
East New Britain	109.5	107.6	102.9	76.8	68.7	55.1	6.4	9	25.4
West New Britain	105.9	107.4	103.9	77.8	70.1	56.7	5.3	7.5	21.6
A. R. of Bouganville.	111.7	107.7	102.4	76.4	68.4	55	6.2	8.8	24.7
Hela	114.4	108	104.8	76.6	68.7	54.6	5.1	7.2	20.3
Jiwaka	112.3	108.8	103.6	68.1	61.7	51.8	7.8	11.2	31.2
Total	109.5	107.7	105.8	70.1	63.1	51.9	6.8	9.7	27.3

Province	Median age			Child-woman ratio		
	2021	2030	2050	2021	2030	2050
Western	19.7	21.6	25.8	577.7	520.6	373.3
Gulf	18.2	20.3	25.2	625.9	577.3	413.5
Central	18.5	20.7	25.6	623.8	576.1	414.2
National Capital District	23.8	25.9	30.5	467.6	425	300.2
Milne Bay	20.1	22.3	27.3	605.2	555	396.7
Northern (Oro)	18.7	20.5	24.5	603	557.8	399.2
Southern Highlands	19.8	21.9	26.5	519.7	467.3	333.1
Enga	21.9	24.2	29.3	402.8	362.7	257
Western Highlands	21.6	23.9	29.1	472.4	411.5	293.2
Chimbu	20.9	23.5	29.3	520	449	324
Eastern Highlands	21.4	23.6	28.5	466.1	420.2	296.3
Morobe	20.5	22.4	26.6	491.2	449.9	319.6
Madang	19.2	21.5	26.6	574.7	530.1	377.2
East Sepik	20.5	22.7	27.6	537.6	478	343.9
West Sepik	19.6	20.8	23.3	598.4	543.4	388.1
Manus	19.7	22.5	28.9	664.2	599.7	431.7
New Ireland	19.3	21.9	27.7	627.6	571.1	407.1
East New Britain	19.6	22.1	27.7	685.3	618.1	441.1
West New Britain	18.8	20.7	24.9	639.9	588.9	420.1
A. R. of Bouganville.	19.7	21.9	26.9	678.1	604.7	431.5
Hela	19.1	21.2	26.1	601.1	529.8	378.5
Jiwaka	20.2	22.6	28.1	475.6	424.8	301.6
Total	20.2	22.5	28.3	546.9	493.2	351.9

The sex ratio, (number of males per 100 females), has substantive variations among provinces. In 2021, it was as high as 138 males per 100 females in Enga and as low as 106 in West New Britain. It was 110 in the country. In 2030, it is expected to decline in some provinces while increasing in others, but changes are, in general, not substantial. An important decline was projected for the end of the projection period, (year 2050). For example, in Enga, which was the province with the largest sex ratio in 2021, it declined from 138 to 118 men per 100 women.

It is important to note that in all provinces, and consequently in the country, there are more men than females. Although this is a projection report and not a research paper, one reason might be a sex preference leading in a higher infant mortality among girls. A second reason could be an under-enumeration of women in the census. Some additional information is provided in the district projection.

The age-dependency ratio is the relation of persons in the usual dependency ages (under age 15 and above age 64) with those in the usually productive ages (15-64 years). In very general terms, this ratio is used as an indicator of the economic burden the productive proportion of the population must carry. The problem is that some persons under age 15 and above age 64 are in the labour force and some people in ages 15-64 are economically dependent. Therefore, this indicator should be used with caution.

In PNG, the age-dependency ratio is expected to decline from 70.1 to 51.9 (see Figure 6). There are important variations among provinces. For example, the Central province has the largest ratio (79.9), while the National Capital District has the lowest ratio (53.5). Most of the differences appears to be caused by the size of the population under 15 years old. This indicator experiences an important decline during the projection period. For example, the age-dependency ratio in the Central province declined to 60.4 and in the National Capital District to 38.5. The variations in this indicator are mainly caused by differences in fertility, which, in turn, affect the population under 15 years. The population above age 64 have a less important effect since it is smaller than the young population (see Figure 5).

The ageing index is the ratio between the population above 65 years old over the population 0 to 15 years. It is an indicator that summarizes the age composition of a population, whether it is an old or a young population; therefore, it is particularly useful to evaluate population ageing. In this projection, the ageing index in PNG is expected to increase substantially because of both a decrease in the proportion of the young population (as a result of fertility decline) and an increase in the old population (as a result of higher survival rate among the elderly). At the national level, it is expected to increase from 6.8 elders per 100 youngsters in 2021 to 9.7 in 2030 to 27.3 in 2050. It is foreseen that this increase will occur in all provinces. In 2021 the value of this index was a one-digit number (except in Chimbu) while in 2050 it is expected to be two digits. In some provinces it is expected to be noticeably high, such as in Chimbu (43.0), Manus (38.3) and Milne Bay (37.9).

The next age-sex indicator in Table 18 is the median age[10]. This is the age at which exactly half of the population is older and half is younger. As mentioned earlier, it is expected that, in the country, the median age will increase substantially, from 20.2 to 28.3 years (see Figure 7). This is mainly the result of the assumed fall in fertility and the subsequent decline in the number of children. There are important variations in the median age among the provinces. For example, in the Gulf province the median age in 2021 was 18.2 years while in the National Capital District was 23.8 years. Some provinces are assumed to experience a substantial increase in the median age of their populations during the projection period. For example, in the National Capital District the median age is expected to reach 30.5 years. Other provinces expected to exhibit high median age in the future are Enga, Western Island and Chimbu, with ages above 29 years.

The final indicator presented in Table 18 is the child-woman ratio (CWR) which is the number of children under age 5 per 1,000 women of childbearing age (15-64 years). At the national level, the CWR is expected to decline from 547 to 352 children per 1,000 women (see Figure 8). In the 22 provinces, the child-woman ratio is likely to decline substantially during the projection period. The rate of decline in the provinces between 2021 and 2050 is between 34 to 38 percent. The result of this decline is, obviously, the decline in fertility that all provinces are expected to experience.

These set of indicators point towards important changes in the age structure of the population in all provinces: an increase in the proportion of people in the labour force, a decline in the school population, different medical needs, and even different political preferences and behaviours. These possible changes should receive adequate attention and be examined in detail in relation to possible economic and social changes.

[10] In general, the arithmetic mean or average is a more frequently used summary measure. However, in the case of the population age distribution, the mean is strongly affected by a couple of very old ages, which may distort substantially its value. For example, a couple of ages above 90 years, or 100 years, may increase the mean unrealistically. Therefore, in age distributions, the median is the advisable measure.

10. DISTRICT PROJECTION

In PNG, each province is divided into districts. The number of districts vary from only one in some provinces (Manus) to nine in others (Morobe). There are 90 districts in the country, including the National Capital District. The size of the district populations varies substantially. According to adjusted figures from the 2021 Population Modelled Estimation (PME 2021), the largest district is the National Capita Districts with more than half a million people and the smallest is Obura-Wonenara in the Eastern Islands Province with a little more than 30,000 people.

The population of these districts were projected using the iterative projection contingency table. The worksheet CTBL32 from the set of PAS program was employed (see footnote 2). In the provincial projection, this program was used to adjust the sum of the provincial populations to the national population (by age and sex). Here, it was used to project the district population. The program adjusts the district populations (by age and sex) of a given year (year 1) to the respective provincial population corresponding to the next year (year 2). Actually, by adjusting the district populations to the provincial population, the program is really projecting the district populations. The projection was done up to year 2030 and not up to year 2050 as the national and provincial projections. Limited accuracy of projection of small areas suggests that they should be extended for fewer years into the future.

As indicated above, the source for this projection was the 2021 Population Modelled Estimation (PME 2021). The district populations were adjusted so that their sum correspond to the population of the provinces to which they belong.

The results are presented in Table 19. The population increases in all districts and the variations observed in 2021 continue during the projection period. Note that OburaWonenara is also the district with the smallest population in 2050 (about 30,000 people), and the National Capital is also the largest district (650,000 people).

Table 19. Projected population by districts, 2021 to 2030

Province and District	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
WESTERN										
South Fly	102,090	105,122	107,828	110,560	113,315	116,090	118,882	121,686	124,501	127,323
North Fly	90,375	93,059	95,455	97,874	100,312	102,769	105,240	107,723	110,215	112,712
Middle Fly	135,872	139,907	143,508	147,145	150,812	154,504	158,219	161,952	165,699	169,454
GULF										
Kerema	118,568	119,636	122,724	125,842	128,985	132,151	135,336	138,537	141,748	144,968
Kikori	90,803	91,819	94,175	96,553	98,951	101,367	103,797	106,238	108,689	111,145
CENTRAL										
Abau	80,318	81,210	83,280	85,370	87,478	89,601	91,736	93,882	96,036	98,195
Goilala	33,268	33,066	33,943	34,828	35,720	36,618	37,521	38,429	39,340	40,253
Kairuku-Hiri	133,191	133,236	136,717	140,231	143,774	147,342	150,931	154,537	158,156	161,784
Rigo	130,266	132,087	135,432	138,810	142,216	145,646	149,097	152,566	156,046	159,536
NATIONAL CAPITAL DISTRICT	**534,286**	**539,567**	**553,457**	**567,483**	**581,624**	**595,866**	**610,193**	**624,590**	**639,038**	**653,520**
MILNE BAY										
Alotau	185,132	186,528	191,343	196,206	201,108	206,045	211,012	216,003	221,012	226,032
Esa'ala	191,564	193,818	198,768	203,766	208,806	213,882	218,989	224,120	229,270	234,432
Kiriwina Goodenough	97,232	97,940	100,470	103,025	105,600	108,194	110,804	113,426	116,058	118,696
Samarai Murua	303,840	306,218	314,118	322,094	330,137	338,236	346,385	354,572	362,789	371,025
NORTHERN (ORO)										
Ljivitari	152,663	153,599	157,560	161,559	165,592	169,653	173,738	177,843	181,963	186,093
Sohe	129,204	130,206	133,551	136,929	140,335	143,765	147,215	150,683	154,162	157,650
SOUTHERN HIGHLANDS										
Ialibu/Pangia	127,801	131,447	134,829	138,244	141,688	145,155	148,644	152,150	155,668	159,195
Imbonggu	135,639	139,529	143,123	146,753	150,413	154,099	157,806	161,532	165,271	169,019
Kagua/Erave	148,393	152,625	156,551	160,517	164,514	168,540	172,591	176,660	180,745	184,839
Mendi/Munihu	197,084	202,706	207,921	213,187	218,497	223,844	229,224	234,630	240,055	245,493
Nipa/Kutubu	356,720	366,936	376,386	385,928	395,549	405,238	414,986	424,781	434,610	444,463
ENGA										
Kandep	87,447	89,388	91,698	94,030	96,381	98,750	101,132	103,526	105,929	108,337
Kompiam	78,675	80,440	82,507	84,594	86,699	88,818	90,950	93,093	95,243	97,399
Lagaip Pogera	142,361	145,453	149,253	153,089	156,957	160,851	164,770	168,706	172,657	176,617
Wabag	139,929	143,026	146,726	150,463	154,231	158,025	161,842	165,677	169,526	173,384
Wapena-Manda	145,928	149,319	153,083	156,886	160,719	164,580	168,465	172,369	176,287	180,215

WESTERN HIGHLANDS										
Dei	112,409	118,196	121,237	124,307	127,403	130,520	133,657	136,808	139,971	143,142
Mt Hagen	188,965	198,878	204,001	209,174	214,390	219,642	224,927	230,237	235,565	240,907
Mul/Baiyer	143,780	151,241	155,134	159,065	163,028	167,020	171,035	175,070	179,119	183,178
Tambul/ Nebilyer	109,350	115,012	117,972	120,961	123,975	127,010	130,063	133,131	136,210	139,296
CHIMBU										
Chuave	77,793	82,484	84,600	86,735	88,889	91,058	93,240	95,432	97,633	99,838
Gumine	105,805	111,084	113,905	116,753	119,626	122,518	125,429	128,353	131,288	134,231
Karimui Nomane	91,791	96,988	99,466	101,969	104,493	107,034	109,591	112,161	114,739	117,324
Kerowagi	105,360	113,303	116,248	119,223	122,221	125,241	128,279	131,331	134,394	137,464
Kundiawa Gembogl	127,950	137,140	140,694	144,282	147,900	151,544	155,209	158,892	162,588	166,293
Sina Sina Yongomugl	78,011	83,562	85,726	87,911	90,114	92,333	94,565	96,808	99,059	101,315
EASTERN HIGHLANDS										
Daulo	137,486	140,480	144,058	147,671	151,314	154,984	158,675	162,385	166,108	169,840
Goroka	209,031	213,372	218,876	224,435	230,039	235,682	241,361	247,066	252,791	258,530
Henganofi	101,915	104,037	106,719	109,427	112,158	114,907	117,674	120,454	123,243	126,039
Kainantu	106,019	108,222	111,013	113,832	116,674	119,536	122,416	125,309	128,212	131,123
Lufa	58,237	59,447	60,980	62,529	64,090	65,662	67,244	68,833	70,428	72,026
Obura Wonenara	24,299	24,804	25,444	26,090	26,741	27,397	28,057	28,721	29,386	30,053
Okapa	48,466	49,473	50,749	52,037	53,336	54,645	55,961	57,284	58,611	59,942
Unggai Benna	130,964	133,676	137,127	140,612	144,125	147,664	151,223	154,800	158,390	161,988
MOROBE										
Bulolo	205,915	208,493	213,830	219,219	224,653	230,125	235,631	241,163	246,715	252,281
Finschafen	178,082	181,272	185,839	190,452	195,103	199,788	204,501	209,237	213,991	218,756
Huon	159,837	161,159	165,335	169,553	173,804	178,086	182,394	186,723	191,066	195,420
Kabwum	104,303	105,877	108,567	111,284	114,023	116,781	119,556	122,345	125,144	127,950
Lae	149,730	150,253	154,202	158,188	162,207	166,254	170,325	174,416	178,521	182,635
Markham	72,071	72,254	74,158	76,080	78,018	79,969	81,933	83,905	85,884	87,868
Menyamya	110,076	110,565	113,462	116,388	119,337	122,307	125,295	128,296	131,309	134,328
Nawae	137,294	139,153	142,704	146,291	149,907	153,548	157,212	160,894	164,589	168,293
Tawae/Siassi	67,727	68,545	70,302	72,076	73,865	75,666	77,479	79,300	81,127	82,959
MADANG										
Bogia	107,481	108,240	111,026	113,840	116,676	119,533	122,407	125,295	128,193	131,098
Madang	171,524	172,707	177,154	181,645	186,173	190,732	195,320	199,929	204,555	209,192
Middle Ramu	232,551	234,154	240,183	246,272	252,411	258,593	264,812	271,062	277,334	283,620
Rai Coast	103,467	104,212	106,894	109,602	112,332	115,081	117,848	120,627	123,416	126,212
Sumkar	110,158	110,944	113,799	116,682	119,589	122,517	125,462	128,422	131,392	134,369
Usino Bundi	104,038	104,784	107,481	110,204	112,949	115,714	118,495	121,290	124,095	126,906
EAST SEPIK										
Ambunti Drekikier	119,151	123,986	127,174	130,394	133,640	136,909	140,199	143,503	146,820	150,145
Angoram	167,996	174,749	179,239	183,773	188,344	192,948	197,580	202,234	206,904	211,586
Maprik	111,513	116,075	119,062	122,078	125,119	128,182	131,263	134,360	137,467	140,581
Wewak	124,132	129,489	132,838	136,219	139,629	143,062	146,517	149,988	153,471	156,962
Wosera Gawi	104,631	108,885	111,685	114,513	117,364	120,236	123,125	126,028	128,941	131,861
Yangoru Saussia	83,041	86,441	88,666	90,912	93,177	95,458	97,753	100,059	102,373	104,693
WEST SEPIK										
Aitape / Lumi	109,912	112,227	115,102	118,006	120,934	123,882	126,849	129,830	132,821	135,820
Nuku	121,701	124,176	127,385	130,624	133,890	137,180	140,489	143,814	147,151	150,496
Telefomin	86,359	88,123	90,397	92,694	95,010	97,342	99,688	102,045	104,411	106,783
Vanimo Green River	120,616	123,122	126,287	129,483	132,706	135,951	139,216	142,497	145,789	149,090
MANUS	**77,610**	**79,621**	**81,670**	**83,740**	**85,827**	**87,928**	**90,042**	**92,167**	**94,299**	**96,436**
NEW ISLAND										
Kavieng	114,721	116,867	119,862	122,887	125,937	129,008	132,098	135,203	138,320	141,443
Namatanai	127,011	129,225	132,565	135,937	139,337	142,761	146,206	149,667	153,140	156,622

EAST NEW BRITAIN										
Gazelle	192,058	197,037	202,109	207,230	212,393	217,593	222,825	228,082	233,357	238,645
Kokopo	121,866	125,029	128,248	131,500	134,778	138,079	141,401	144,738	148,087	151,445
Pomio	95,477	97,950	100,470	103,015	105,581	108,164	110,764	113,376	115,997	118,625
Rabaul	66,554	68,281	70,039	71,815	73,605	75,408	77,222	79,044	80,873	82,707
WEST NEW BRITAIN										
Kandrian Glowcester	226,643	228,994	234,888	240,839	246,840	252,883	258,962	265,071	271,201	277,347
Talasea	143,837	145,302	149,044	152,822	156,632	160,468	164,328	168,206	172,098	175,999
AUTONOMOUS REGION OF BOUGAINVILLE										
North Bougainville	211,575	219,088	224,732	230,432	236,178	241,965	247,787	253,637	259,508	265,393
Central Bougainville	230,703	238,825	244,972	251,178	257,436	263,738	270,078	276,449	282,843	289,251
South Bougainville	226,059	234,003	240,024	246,104	252,234	258,407	264,618	270,859	277,122	283,400
HELA										
Komo Magarima	298,193	311,766	319,788	327,889	336,057	344,282	352,558	360,873	369,218	377,583
Koroba Kopiago	213,272	222,975	228,712	234,506	240,347	246,229	252,148	258,095	264,063	270,045
Tari Pori	286,505	299,734	307,456	315,253	323,114	331,032	338,997	347,000	355,032	363,083
JIWAKA										
Anglimp South Waghi	257,159	265,559	272,396	279,300	286,260	293,270	300,323	307,409	314,521	321,650
Jimi	69,320	71,568	73,409	75,268	77,142	79,029	80,928	82,835	84,750	86,669
North Waghi	143,847	148,550	152,374	156,237	160,131	164,053	167,998	171,963	175,941	179,929

Table 20 shows the main indicators of age and sex composition in the districts: sex ratio, age-dependency ratio, ageing index, median age and child-woman ratio. The interpretation of these indicators is the same as those calculated for the provinces (Table 18).

The sex ratio, which is the number of males per 100 females, vary substantially among provinces. In 2021 it was very low in the district Goilala in the Central province (17.7 males per 100 women), in Lae (35.0) and Markham (29.0) in the Morobe province. The number of males in extremely low compared to the number of women. On the contrary, in Wapenamanda (Enga Province) and in Finschhafen (Morobe province) the sex ratios a quite high: 347.2 and 354.5, respectively. The magnitude of these differences These differences among district are likely to be caused by sex-selective migration. The magnitude of these differences suggests discarding mortality sex-differentials or under-enumeration of women. This is an issue that should be considered in a further study.

According to Figure 6, the age-dependency ratio in PNG is expected to decline from 70.1 to 63.1 during the present decade (from 2021 to 2030). This means that people in the usually considered non-productive ages (0-14 years and 65 years and above) will decline as compared to the productive age population (15 to 64 years). This trend is observed in all districts. In some of them it is expected to be quite small. This is the case of Kikori (Gulf province), which is anticipated to remain constant (70.3 in 2021 and in 2030). On the contrary, a decline is expected to be more important in North Bougainville (84.3 to 75.1) and in Gazelle (79.7 to 71.1).

As indicated earlier, the ageing index is the ratio between the population above 65 years over the 0 to 15 years population. It is a suitable indicator of the age composition of a population, in particular to show whether it is a young or an old population. At the country level, the ageing index is expected to increase from 6.8 to 9.7 elders per 100 youths. In all districts it is expected to raise, but this increase will be moderate, similar to the national increase. This is expected considering that the projection period is just nine years.

The median age is the following age-sex indicator in Table 20. As mentioned previously, the median is the middle value in a set of numbers arranged in ascending or descending order. During the projection period, at the national level, the median will increase from 20.2 to 22.5 years. This is a modest increase, but it is important to remember that, as mentioned above, the projection period covers only nine years. In most districts the median age increases by 1 to a little more than 2 years. Only in two districts the increase is below 1 (Aitape-Lumi and Nuku in the West Sepik province).

The child-woman ratio (CWR) is the final indicator presented in Table 20. This is the number of children under age 5 per 1,000 women of childbearing age (15-64 years). In PNG, the CWR is expected to decline from 547 to 493 between 2021 to 2030. It is proposed that the CWR will decline in all districts. This is, obviously, the result of fertility decline. There is, however, one district where the CWR is likely to increase: Koroba-Kopiago in the Hela province (from 520 to 588). This is more the result of an increase in the number of women in reproductive age than an increase in fertility.

The set of indicators examined in Table 20 suggest changes in the age composition in most district populations during the present decade. These changes are moderate, but they may have social and economic impacts. For this reason, it is important that they are considered in policy-making and planning activities.

Table 20. Projected indicators of age-sex composition by districts, 2021 to 2030

Province and District	Sex ratio		Age-dependency ratio		Ageing Index		Median age		Child-woman ratio	
	2021	2030	2021	2030	2021	2030	2021	2030	2021	2030
Western										
South Fly	110.5	107.7	84.2	76	4.9	7	17.8	19.5	726	658
North Fly	110.5	107.7	62.4	56.2	5.5	4.9	21.1	23	475	426
Middle Fly	110.5	107.7	71.4	64.3	6.9	6.4	20.1	22.2	548	492
Gulf										
Kerema	93.2	94.6	78.4	78	5.4	7.7	18.6	20.4	585	541
Kikori	126	127.9	70.9	70.3	5.4	7.7	17.8	20.3	688	633
Central										
Abau	174.3	178.1	77.5	69.6	10.1	14.3	19.9	22.4	818	753
Goilala	17.7	18.1	77.2	71.6	3.9	5.9	18	19.3	250	236
Kairuku-Hiri	49.6	50.6	82	74.8	6.7	9.9	18.8	20.9	499	464
Rigo	253	258.4	80	71.4	7.3	10.3	17.9	20.8	1069	982
National Capital District	106.1	107.7	53.5	47.8	6.9	9.8	23.8	25.9	468	425
Milne Bay										
Alotau	91.9	93.5	69.4	60.7	10.4	15.1	22.1	24.4	485	444
Esa'ala	158.1	160.9	83.4	72	6.8	9.8	19.5	21.4	848	777
Kiriwina Goodenoug	88.9	90.5	88.3	77.1	6	8.6	18	20	600	554
Samarai Murua	95.3	97	81.4	70.8	11.4	16.5	20.7	23.5	573	524
Northern (Oro)										
Ljivitari	96.9	99	75.4	68.3	6.9	9.8	19.3	21.3	547	506
Sohe	116.7	119.1	81.3	73.2	5.4	7.6	18	19.7	683	632
Southern Highlands										
Ialibu/Pangia	112.9	110.3	63.9	58.5	11	15.7	21.5	23.9	451	403
Imbonggu	106.1	103.7	69.7	62.9	5.5	7.8	19.9	22.1	508	456
Kagua/Erave	113.6	111	69.9	63.5	5.8	8.3	19.6	21.6	516	464
Mendi/Munihu	113.3	110.7	75.5	67.9	6.8	9.6	19.3	21.5	567	508
Nipa/Kutubu	108	105.5	75.4	68.2	4.3	6.1	18.6	20.3	526	475
Enga										
Kandep	90.2	89.2	60.6	55	8.4	12.1	22	24.3	371	335
Kompiam	118.8	117.6	59.1	53.6	8.5	12.3	22	24.4	371	332
Lagaip Pogera	51.3	50.8	61.1	55.8	4.6	6.6	20.5	22.3	311	286
Wabag	84.4	83.5	60.5	55.1	9.5	13.7	22.4	24.8	368	332
Wapenamanda	347.2	343.6	61.9	55.4	12.1	17	22.6	25.2	840	741
Western Highlands										
Dei	119.6	111.4	63.4	57.2	7.9	11.2	20.9	23.2	444	386
Mt Hagen	112	104.3	64.4	58.4	8.3	12.2	21.5	23.8	502	439
Mul/Baiyer	116.4	108.4	59.4	53.7	10.3	14.7	22.9	25.4	421	365
Tambul/Nebilyer	117.2	109.2	70	63.2	9.3	13.3	20.9	23.5	525	457
Chimbu										
Chuave	144.1	130.8	65.3	59.4	13.1	17.4	22.5	25.4	574	491
Gumine	242.2	219.8	71.4	64.3	11.9	15.9	21.1	24.1	814	683
Karimui Nomane	171.7	155.8	76.7	68.4	4.9	7.1	18.7	20.7	774	659
Kerowagi	72.4	65.7	69.1	63.6	9.7	13.4	19.6	21.9	394	348
Kundiawa Gembogl	85.3	77.4	66	60.6	11.4	14.1	21.5	24	426	373
Sina Sina Yongomugl	87.9	79.8	65.2	59.6	13.2	17.2	21.9	24.8	404	351
Eastern Highlands										
Daulo	186.8	185.4	60.7	53.8	7.9	11.9	22.7	25.2	641	568
Goroka	97.5	96.8	59	53.2	6	9.5	21.7	23.6	430	389
Henganofi	101.3	100.5	64.3	57.6	5.9	8.8	20.8	23.2	443	399
Kainantu	98.3	97.5	60.6	54.5	6.5	10.3	21.7	23.9	434	392
Lufa	98.3	97.5	60.6	54.5	6.5	10.3	21.7	23.9	434	392
Obura Wonenara	98.3	97.5	60.5	54.5	6.5	10.3	21.7	23.9	434	391
Okapa	98.3	97.5	60.6	54.5	6.5	10.3	21.7	23.9	434	392
Unggai Benna	94	93.3	66	59.6	4.5	8	19.8	21.7	478	434

Morobe										
Bulolo	141.2	143.1	69.6	62.5	5.3	7.6	19.9	22	631	578
Finschafen	354.5	359.4	68.7	61.1	9.4	13.4	21.1	23.5	1157	1047
Huon	76	77.1	62.4	56.6	6.3	9.1	21.7	23.6	409	376
Kabwum	210.7	213.6	75.8	67.7	8.2	11.7	19.6	22.1	884	805
Lae	35	35.5	53.1	48.7	4.9	7.1	22.6	24.1	269	250
Markham	29	29.4	64.3	58.9	5.6	8.2	20.8	22.8	300	278
Menyamya	41.6	42.2	70.4	64.2	2.7	3.9	19.3	20.8	354	330
Nawae	164.6	166.9	61.6	55.2	6	8.5	21.4	23.4	607	553
Tawae/Siassi	132.5	134.3	61.7	55.5	5.9	8.5	21.4	23.3	534	488
Madang										
Bogia	106	108.2	87.9	78.9	5.1	7.3	17.6	19.6	793	734
Madang	104	106.2	69.1	62.2	5.4	7.7	20.4	22.4	571	526
Middle Ramu	104	106.2	60.5	54.6	5.2	7.5	20.9	22.7	348	320
Rai Coast	107.8	110	78.2	70.4	5.1	7.3	18.6	20.4	682	631
Sumkar	106.9	109.1	83.4	74.7	5.5	7.9	18.3	20.5	797	735
Usino Bundi	107.4	109.7	74.9	67.5	3.9	5.6	18.8	20.5	621	572
East Sepik										
Ambunti Drekikier	119.1	113.4	67.9	61.2	5.9	8.4	20	22	537	476
Angoram	124.3	118.4	75.3	68.2	6.9	9.8	19.2	21.1	606	540
Maprik	114.8	109.4	63.1	57.2	10.1	14.5	21.7	23.8	492	436
Wewak	89.6	85.4	60.5	54.7	7.7	11.1	22.1	24	437	389
Wosera Gawi	118.1	112.5	73.5	66.4	6.6	9.6	19.5	21.5	649	578
Yangoru Saussia	114.4	109	68	61.5	9.7	13.9	21	23.1	514	456
West Sepik										
Aitape / Lumi	137	136	72.1	64.6	6.7	6.9	19.9	20.4	679	614
Nuku	90.5	89.9	68.4	61.9	5.8	6.1	20.2	20.9	498	454
Telefomin	95.1	94.4	68.5	61.5	6.5	6.8	20.2	21.6	491	446
Vanimo Green River	116	115.2	81.3	72.8	3.9	4.3	18.3	20.2	742	674
Manus	109.7	107.7	78.3	70.5	9.4	13.5	19.7	22.5	664	600
New Ireland										
Kavieng	134	133.7	76	67.9	7.9	11.1	19.7	22.2	678	614
Namatanai	88.9	88.8	77.3	69.6	6.2	8.8	19.3	21.4	590	539
East New Britain										
Gazelle	110.3	108.4	79.7	71.1	5.7	8	19	21.3	741	669
Kokopo	107.4	105.5	71.8	64.3	7.3	10.3	20.6	22.9	605	545
Pomio	112.8	110.8	82.2	73.6	5.3	7.5	18.7	20.9	740	667
Rabaul	107.6	105.7	70.9	63.3	8.6	12.3	21.3	23.9	604	542
West New Britain										
Kandrian Glowcester	107.3	108.9	80.8	72.8	4.8	6.8	18.2	20	690	636
Talasea	104.5	106	73.3	66.1	6.1	8.7	19.4	21.4	563	518
A. R. of Bouganville.										
North Bougainville	107.6	103.7	84.2	75.1	5.1	7.3	18.3	20.5	749	670
Central Bougainville	113.2	109.1	71.4	63.9	5.9	8.4	20.3	22.5	626	557
South Bougainville	114.4	110.3	74.7	67	7.5	10.8	20.2	22.8	668	594
Hela										
Komo Magarima	116.5	109.9	82.7	74.1	4.1	5.8	18.1	19.8	666	659
Koroba Kopiago	116.7	110.1	69.4	62	5.9	8.4	20	22.6	520	546
Tari Pori	110.1	103.9	76.1	68.3	5.5	7.9	19.1	21.4	596	554
Jiwaka										
Anglimp South Waghi	110.5	107.1	68	61.6	7.7	10.9	20.3	22.6	473	423
Jimi	116.4	112.8	74.5	67.2	7.5	10.5	19.9	22.3	572	509
North Waghi	110	106.5	65.4	59.4	8.4	12	20.8	23	437	391
Papua New Guinea	**109.5**	**107.7**	**70.1**	**63.1**	**6.8**	**9.7**	**23.3**	**23.6**	**547**	**493**

11. CONCLUSIONS

This population projections provides a plausible future population size and age-sex composition at the national, provincial and district levels. Unless some of the components experience a substantial change, these results are reliable. However, it is always important to remember that projections involve a component of uncertainty. As mentioned in the Introduction, a population projection is more a prospective exercise than the result of clairvoyant techniques. As such, more important than exact figures, are the general levels and trends that can take place in the future. This projection suggests three important trends for the following three decades: a decline in the percentage of children, an increase in the proportion of the working-age population and an increase in the proportion of the elderly. These trends are very clear in Figure 5 and in the pyramids presented in Figure 4.

In any population, after a process of fertility decline, such the one that of Papua New Guinea has undergone, and that is likely to continue, the large cohorts born before the decline, start climbing in the population pyramid before entering into working-age. As a result, one of the challenges that are faced by countries that are undergoing this demographic dynamic is to implement employment policies directed to these expanding cohorts. They could be extremely beneficial for economic growth and development if there are enough opportunities in the labour market. It is considered that when the ratio between the dependent and the working population decrease, new economic and social opportunities arise. In fact, families tend to increase their saving capacities, the pressure on several government services decline (for example, education), the number of taxable adults increase, and families can invest more in each child.

This period is called the demographic window of opportunity and is considered highly favourable to socio-economic development, social investment and human development. This window provides the so-called demographic bonus or demographic dividend in reference to the opportunities provided by the demographic dynamics to increase socio-economic development and the levels of population wellbeing. It is important to point out, however, that the demographic window by itself cannot guarantee development and economic growth. The percentage of the population in working-age do not conduce directly and inevitably to development. On the contrary, if the economic and social environment are unfavourable, the economy cannot absorb the working age population. The large population of young adults may become a load to the country which may even result in social unrest and civil conflicts.

The economic and social implications of the future population growth and changes in the age composition presented in this projection should be thus seriously discussed and analysed.

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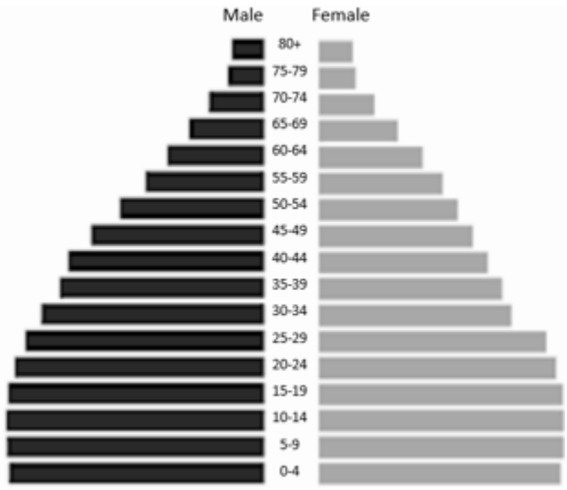
APPENDIX 1. National population projections for 2050 by sex and five-year groups



APPENDIX 2. National population projections 2024-2050