

Population projections planning tool Population projections in the State of Bouira until 2030

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Abstract:

This study aims to develop a route sheet in order to draw a development policy that extends until 2030. This indeed is based on the findings of a year-and-sex projection of Bouira population according to three possible scenarios. This study also is considered as important because it is a tool for development and it is one of the few studies that is concerned with projections that are often the responsibility of state-affiliated centers such as the National Bureau of Statistics and the United Nations Organization.

After presenting the definition of the projections, their history and importance, we later discussed the demographic characteristics of Bouira, such as the population distribution, birth rates, death and marriage, and this is what is called a situational analysis in demographic research. Finally, we carried out the projection process according to three scenarios; each scenario contains a number of hypotheses. Based on the adopted assumptions, the results of projections were reached until 2030.

Keywords: Population; projections; State of Bouira.

1. INTRODUCTION

The process of estimating the population is considered one of the practical and scientific foundations in the economic and social planning of modern societies. The projection process is based on the

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application of mathematical, statistical and demographic means, according to a detailed population data that reflects population features, components, and growth rates when making that extrapolation. These methods are called the population projections.

Population projections depend on the results of population census and on the study of mortality, fertility as well as migration levels prevailing in different periods. In addition to the assumed future trends of these components, then estimate their numbers and characteristics for the planners, policy makers and scholars to rely on.

2. History and Mechanisms of Population Projections

2.1. Definition of Demographic Projections: they are defined as the set of results of arithmetic operations that summarize the development if the future population. it is based on many hypothesis.⁽¹⁾

It is an attempt to measure the values of basic demographic characteristics such as the level of birth, death, and total fertility. Those characteristics show how population is developing in term of size (number) in relation to age⁽²⁾.

2.2. The Importance of Population Projections :

This importance appears in their role in planning and standing on the state of demographic structure, and their distribution on spatial and age. Projections can be used for several consideration, includingm

- **The Political Field:** It is concerned with population expectations as it determines and analyze the situation as well as studies its consequences, such as the results of the stability of the fertility level in the third world, especially in the last century. It means the population explosion and its impact on the policies and world powers view.

(1) Office National des Statistiques, Collection statistique n° 106, Projection de populations par wilaya à l'horizon 2030, 2004.p2.

(2) Nations Unies, Manuel 10 : Techniques Indirects D'estimation Démographique, New York, 1984, p2

- **The Economic Field:** the only way to confront the deficit and achieve economic development a long with parity between demand and supply is to know the level of demand and try to control it, as well as provide the corresponding or equal supply. As a result, we are obliged to know the population to provide enough housing and health services...etc.

2.3. History of Population Projections : at the beginning of the 18th century, some demographers tried to find demographic laws similar to other sciences (physics, chemistry...etc). The first works were to estimate the total population of the country, by assuming a simple mathematical law of growth. These laws did not take into account the age structure, fertility and death, and most of the assumptions were based on taking into account the doubling of the population. Population increases according to a geometric sequence when there are not obstacle.⁽¹⁾ FARR and CAMMAN used a method that takes into consideration age structure. This method was developed later by WILTHON when making projections in the USA. It is also called the method of compounds, which is used today. It estimate population component generation by counting the number of births, basing on hypothesis on death, fertility and immigration⁽²⁾

2.4. Mechanisms of Population Projections :

- **The Reference Date and Period of the Projection :** it depends on the available data. It often correspond to the date of projection.

- **Projection Duration :** As for the projection period, it usually fallows the desired aim of projection. Planners' forecasts are either in the short, medium and long term. It extends to tens of years or centuries, similar to what the United Nations accomplishes, such as 1973 projections, which extended to 2150. It also indicates that the shorter duration of the projections gives closer results to reality.

(1) <https://fr.wikipedia.org>, consulted on 21/03/2022, at. 22:25.

(2) Francis GENDREAU et autres, Manuel de Yaoundé : Estimations indirects en dermographie africaine, Institut de formation et de recherches démographiques (IFORD), 1995, p246

• **Situation Analysis:** It consists of collecting the necessary data ensuring its quality. The periods of fluctuating demographic indicators (wars, famine) should be eliminated. A comparison can be made with a country similar to the studied society in terms of culture and type of society.

• **Number of Scenarios :** It is rare for scalable predictions to be based on a single scenario, but three scenarios (minimal, middle and maximal). Practically, the middle scenario is most likely to occur, while the minimal and maximal represent the possible boundary expectations. KEYFIDIZ believe that the probability of the middle scenario is the closer reality (2/3), while the minimal and maximal probabilities gathered represent 1/3 of the real world.

• **Projection Methods :** there are several methods for population projections. They vary depending on the presentation of data and whether it is intended to only estimate the total population or compose it according to a specific characteristic such as gender, age, number, countryside. One of the most common methods is :

○ **Mathematical Method for Population Estimation:** these methods require the availability of two or more census data, through which it is possible to reconcile a straight line or an area on the basis of which the estimates of the total population are reached in the required period. To estimate the population in this way, several formulas are used, in all the following ways :

P_0 : is considered the current number.

P_n : the expected number.

r : the rate of growth.

n : projection period.

▪ Regular increment method ⁽¹⁾: $P_n = P_0 \cdot (1+r)^n$

▪ Continuous increment method ⁽²⁾: $P_n = P_0 \cdot e^{r \cdot n}$.

▪ Population growth on the basis of numerical formula : we suppose that population growth is based on a straight line and the required change is population size. It can be expressed as the

(1) خالد زهدي خواجة، إسقاطات السكان حسب العمر والنوع، المعهد العربي للتدريب والبحوث الإحصائية،

دون سنة النشر، ص01.

(2) Francis GENDREAU et autres, Op cit, p2.

difference between the two numbers and the formula r as follows :

$$P_n = P_0 (r.n)$$

○ **Population Estimation Using the Vital Statistics Methods :**

It includes the availability of data on births, deaths, immigration (arrivals and departures) in addition to the population in the base year. The estimate is made by adding births, coming immigrants and subtracting deaths as well as departing immigrants by : $P_n = P_0 + (N - D) + (I - E)$.

N = number of births.

D = number of deaths.

I = immigrant arrivals.

E = immigrant departing.

The method requires dynamic recording of events according to the month of their occurrence. Estimating in this way is useful if the estimation period is short, and it is not possible to estimate into the future because it is linked to real time recording.

○ **The Composite Synthetic Method:** it is the best, and the most common method, it is used to predict the population in long periods according to age and sex. As it deals with the changes that occur in the population growth components, ie – the changes to which births, deaths and migration are exposed during the assessment period. It is also based on the qualitative and age composition of the population in the base year in addition to the estimated numbers of the population, which are obtained by exposing the population in each age group to the assumed rates of mortality, and migration. Furthermore, estimating the number of births during the projection periods assuming a certain level and pattern of age fertility as well as the population in the base year constitutes an important point in structural projection.

3. Introducing the Study Area :

3.1. Location and Area: the state is located in the northern part of central region of Algeria, 80 Km from the capital. It occupies an area of 4454 Km² and it represents 0,19% of the total area of the national territory. The State of Bouira was established by virtue of ordinance

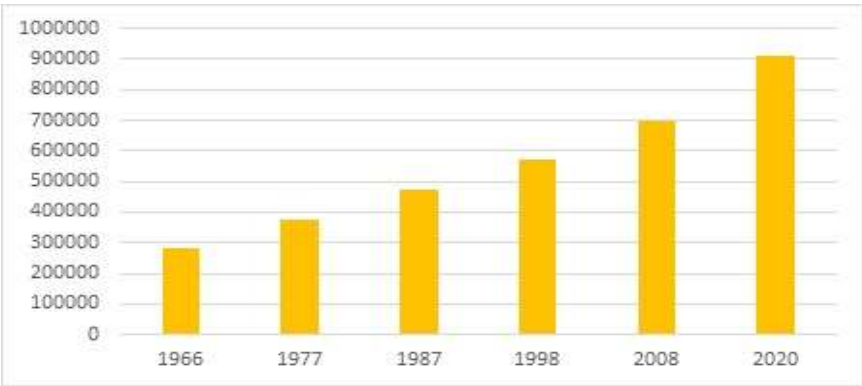
N° 69-74 dated July 02, 1974⁽¹⁾, related to the territorial reorganization of the states. It consists of the formation of the new original organization.

3.2. The Demographic Characteristics of Bouira State :

• Population Development :

According to the results of the general census of population and housing (April the 2nd, 2008), the state's population reached 695,583. This number was estimated at the end of 2008, at about 336 7ou, reaching 874977 on December 2020⁽²⁾.The following graph shows the evolution of the state’s population from 1966 to 2020:

Fig.1. Evolution of the state’s population from 1966 to 2020:



Source: Prepared by the researcher based on site data of the National Bureau of Statistics (ONS).

The curve shows the steady rise in the population which means that this number doubled during three decades, moving from 374300 people in 1977 to 695583 people in 2008, reaching 874977 people at the end of 2020. This increase is due to the increase in the number of

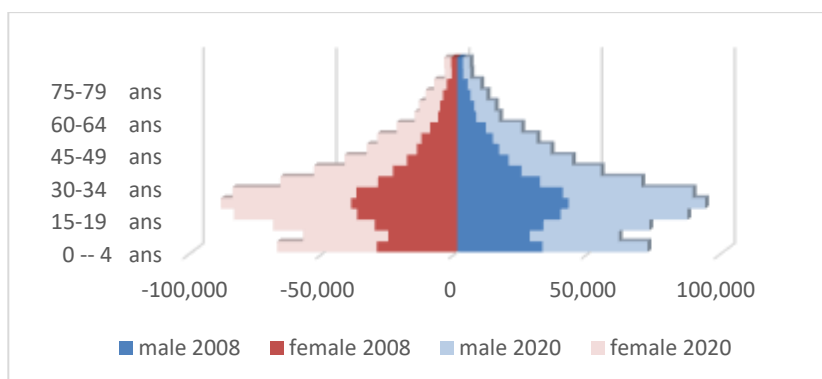
(1) الجريدة الرسمية للجمهورية الجزائرية، العدد 55 المؤرخ في 09 جويلية 1974

(2) Direction de la programmation et du suivi de budget de Bouira, Monographie de la wilaya 2020, p23.

marriages and births that was recorded. The total general fertility rate is 72,7% during the last general census of population and housing.⁽¹⁾

- **Population Location** : the following curve shows the distribution of the population by gender and age, which was prepared by the researcher based on the 1998 and 2008 census data.

Fig. 2. State population pyramid (2008-2020)



Source: Prepared by the researcher based on www.populationpyramide.com data.

According to the previous curves, the combination is characterized by a majority (68%) of the active group, aged from 15 to 59. The rest are distributed among the young (26%) and the elderly (6%).

We notice a difference in the base curves which represent births as that the number of women capable of childbearing is estimated at 29% of the total population and 59% of the total women.

- **The Natural Movement of Population** : through the data of civil status services, the number of live births reached 23133 during the year of 2020, while the number of deaths reached 3659 deaths and 10060 marriages in the same period. The table below represents the natural movement of the state's population during 2020.

(1) Office National des Statistiques (ONS), Collection statistique, N°156, Natalité, Fécondité et Reproduction en Algérie à travers les résultats du RGPH 2008, p49.

Table 1. The natural movement of the state's population during 2020

District	Number of			raw rate X 1000		
	Marriage	Births	Death	Birth	Death	Increase
Bouira	1456	4262	981	24,45	5,63	18,83
Haizer	466	973	75	21,08	1,61	19,46
Bechloul	696	1807	260	20,32	2,92	17,4
M'chedallah	1199	2504	495	19,49	3,86	15,64
Kadiria	554	847	121	17,77	2,54	15,23
Bordj Okhriss	929	1688	146	19,67	1,71	17,96
Bir Ghbalou	323	998	45	24,97	1,13	23,84
Lakhdaria	1753	3025	687	19,08	4,33	14,75
Ain Bessam	861	2524	333	26,48	3,49	22,99
Souk El Khemis	197	427	41	23,36	2,26	21,11
El Hachimia	433	1129	63	25,97	1,44	24,53
Sour El Ghozlane	1193	2949	413	23,24	3,25	19,99
Total	10060	23133	3659	21,95	3,47	18,48

Source: Direction de la programmation et du suivi de budget de Bouira,
Monographie de la wilaya 2020, p17.

The largest number of births was recorded in Bouira district (4262 births, representing 18% of the total births). This high number of births in the district of Bouira is due to the fact that it receives women from several regions surrounding the state such as, Haizar, El Hachimia. While, we note that Lakhdaria recorded (3025 births). The largest number of deaths was recorded at the level of Bouira (981), followed by Lakhdaria (687 deaths). The discrepancy observed between districts in the number of births is due to the fact that in regions that do not have the interest of maternity centers, citizens resort to another place that provides better quality of services.

• Population Distribution by District

From the data of the table below, we notice a huge difference in population density from one district to another, where Bouira district has recorded the largest density (805 people/km²), while the district El

Hachimia its population density is 99 people/km². Thus, we can say that more than 55% of the state's population (486130 people) lives in four districts, namely Bouira (144035), Lakhdaria (131060), M'chedallah (106138), and Sour El Ghoulane (104897), while the remaining eight districts represent 44% with 388847 people. Indeed, this discrepancy is due to the different standards of means of living (transportation, housing, and education) in addition to the rural exodus that occurred in remote areas throughout the 1990s as a result of the deteriorating security conditions. These reasons were translated into a kind of overcrowding in cities and social crises, such as the housing crisis, as well as the abandoning of agricultural resources in abandoned areas. This is what inspired the state to implement a rural development neighborhood program that favors rural dwellings. It entails reducing the discrepancy in living circumstances between urban and rural regions, as well as assisting the displaced rural population in returning to their original places.

Table 2. Population distribution according to districts.

District	Population	Surface m ²	Density	Percentage
Bouira	144035	179	805	16%
Haizer	38150	134	285	4%
Bechloul	73520	537	137	8%
M'chedallah	106138	488	217	12%
Kadiria	70905	237	299	8%
Bordj Okhriss	43450	708	61	5%
Lakhdaria	131060	441	297	15%
Bir Ghbalou	33040	169	196	4%
Ain Bessam	78749	258	305	9%
Souk El Khemis	15114	121	125	2%
El Hachimia	35921	363	99	4%
Sour El Ghoulane	104897	819	128	12%
TOTAL	874977	4 454	196	100%

Source: Direction de la programmation et du suivi de budget de Bouira, Monographie de la wilaya 2020, p29.

4. Projection Process

4.1. The Method Used: we have relied in this study on the method of the basic compounds for predicting the population, which estimates the population based on its constituent generations. It is one of the best long-term projection methods, and in order to facilitate the calculations, we have used the programs prepared by the United Nations Population Department (MORTPAK), which is employed frequently in such studies.

4.2. Projection Process Hypotheses : to apply the basic components method, the following demographic data and hypotheses must be available:

The Adoption of the Data of the General Census of Housing and Population : it was conducted on April 16th, 2008 to provide the necessary data for the projection process. We then estimate the population on July the 1st, 2008 (in the middle of the year) and after that adopt this date as a basis for forecasting the population.

The Age and the Gender Structure of the Population in the Base Year : the data of the age structure of the population represent the basic aspects on which it depends in preparing population projections and estimates. Thus, the population on July the 01st, 2008 is given by the following relationship :

$$(1+t_x)^n P_{16.04.2008}=P_{01.07.2008}, \text{ in this case } n \text{ is } 0.208.$$

$$(1+t_x)^{0.208} P_{16.04.2008}=P_{01.07.2008}$$

Table 3. Population during the reference date (1 July 2008).

Age	Male	Female	Total
0-4	32072	30397	62469
5-9	27252	26055	53307
10-14	32431	31118	63549
15-19	38920	37775	76696
20-24	41945	40029	81974

25-29	39818	38046	77864
30-34	31127	29925	61052
35-39	24197	24227	48424
40-44	19329	19025	38354
45-49	15739	15273	31011
50-54	13374	13519	26893
55-59	10800	10267	21067
60-64	7067	7226	14293
65-69	6367	6489	12856
70-74	4940	5366	10307
75-79	3897	3930	7827
80 and +	3891	3685	7576
Total	353167	342353	695520

Source: Prepared by the researcher.

Future Hypotheses Related to Fertility

The following table on fertility is built based on:

- Fertility data for the base year
- Fertility data for each scenario so that after consulting with some specialists in population projections at the level of the National Bureau of Statistics, as well as tracking the development of fertility over the previous years, it was determined that 2017 is likely to be the year of the beginning of the decline in this indicator. On the other hand, the inverse connection between fertility and various variables (urban expansion, educational level ...), makes us move towards the hypothesis of diminishing fertility, and the assumptions remain in such relative cases, regardless of the efficiency of those charged with population projections.

A study was carried out in order to confirm the relationship between educational level and fertility. It involved 12 countries, including England, the USA, and Yugoslavia... . Through this study, it was found that fertility changes in contrast to the level of education

of one of the spouses and that it (fertility) reaches high levels when the level of both spouses is below primary while it reaches its lowest level when both spouses reach secondary stage together.⁽¹⁾ Furthermore, female education has a strong negative impact that outweighs any other variable.⁽²⁾

When these findings are combined with the educational sector's progress in terms of the schooling of children in general and females in particular, the consequence is a delay in marriage age and an increase in the educational level of the spouses. As a result, we may formulate fertility assumptions for the projection period. The following table shows the distribution of fertility rate by age form the period of 2008 to 2030 :

Table 4. Distribution of fertility rate by age from 2008 to 2030 :

Age (year)	Fertility Rate According to the Scenario						
	2008	Minimum		Average		Maximum	
		2017	2030	2017	2030	2017	2030
15-19	0,006	0,007	0,005	0,007	0,006	0,007	0,005
20-24	0,063	0,076	0,055	0,078	0,065	0,077	0,06
25-29	0,122	0,147	0,107	0,151	0,125	0,149	0,116
30-34	0,133	0,159	0,117	0,164	0,136	0,161	0,126
35-39	0,105	0,126	0,092	0,13	0,107	0,127	0,1
40-44	0,045	0,053	0,039	0,055	0,046	0,054	0,042
45-49	0,006	0,007	0,005	0,007	0,006	0,007	0,005
ISF	2,4	2,87	2,1	2,96	2,45	3	2,65

Source: Prepared by the researcher based on the MORTPAK program.

(1). سامي جيلالي، حركية السكان والتخطيط المدرسي: حالة التعليم الابتدائي والمتوسط في ولاية المدية، مذكرة ماجستير ديموغرافيا كلية الآداب والعلوم الاجتماعية بجامعة البليدة، 2011، ص 46.

(2). عدنان وديع محمد، قضايا السكان في الوطن العربي: قراءة في الواقع والتحديات، مجلة التنمية والسياسات الاقتصادية، المعهد العربي للتخطيط، الكويت، العدد 01، 1999، ص 2.

Hypotheses Related to Death

The low infant mortality rate is one of the most important indicators of the high level of health and social progress of the population and vice versa. It is critical here to know the probabilities of infant mortality of less than one year and the death of children under 5 years of age for both males and females. As for the death table for the state, it was obtained according to the MORTPAK program, the latter enables us to obtain the death table based on the civil status data for the state of Bouira for the year 2008, as well as the adoption of a death form.

The following table contains all of the relevant death statistics for the year 2008 :

Table 5. Probability of dying by sex and age in the base year

Age	The Probability of Death	
	Male	Female
0 - 1	0,03102	0,02502
1 - 5	0,00562	0,00462
05 - 10	0,00344	0,00246
10 - 15	0,00302	0,00191
15 - 20	0,00395	0,00244
20 - 25	0,00585	0,00286
25 - 30	0,00665	0,00359
30 - 35	0,00761	0,00497
35 - 40	0,00904	0,00716
40 - 45	0,01202	0,01005
45 - 50	0,01692	0,01354
50 - 55	0,02584	0,02039
55 - 60	0,03733	0,02708
60 - 65	0,06189	0,04542
65 - 70	0,08641	0,06986
70 - 75	0,14246	0,12404

75 - 80	0,21939	0,19816
80 and +	0,36089	0,36275

Source: Prepared by the researcher based on the MORTPAK program.

The National Bureau of Statistics provided information on life expectancy at birth, which showed that men had a life expectancy of 73.65 years and females had a life expectancy of 76.12 years.⁽¹⁾ The table below shows the evolution of this indicator during the projection period.

Table 6. Life expectancy at birth during the projection period

Period	Scenario 3		Scenario 2		Scenario 3	
	Male	Female	Male	Female	Male	Female
2009 - 2008	73,7	76,12	73,7	76,12	73,7	76,12
2030 - 2029	78	79.3	78,5	79,5	78.6	79.6

Source: Office National des Statistiques, collection statistique n° 116:
Projection de populations par wilaya à l'horizon 2030, 2005

Hypotheses Related to Migration

Because the available data on population mobility is frequently inaccurate, the migration variable is one of the most challenging variables to assess. Furthermore, the absence of data on the characteristics of migrants, particularly the level of fertility and death in administrative records, makes it difficult to study the impact of these elements on the population in a meaningful way, as does the change in the concepts used in measuring migration. In the present study, we have adopted the hypothesis that net migration to and from the state is zero.

5. The Results

Based on the foregoing hypotheses, an estimate was obtained for

(1). Office National des Statistiques (ONS), collection statistique n° 116 : Projection de populations par wilaya à l'horizon 2030, 2005, p 13.

the state's population until 2030, divided into five age groups. We content ourselves with presenting the results of projections by year, gender, and age groups for the middle (most likely) scenario.

Table 7. The results of the state's population projections until 2030:

Age	2023		2024		2025		2026	
	M	F	M	F	M	F	M	F
0	46434	43976	45771	43340	45057	42654	44288	41917
5	47445	44917	47751	45199	47738	45178	47440	44885
10	41064	38886	42832	40556	44358	41998	45642	43210
15	31720	30071	33552	31793	35547	33682	37553	35587
20	26992	25877	26917	25753	27319	26068	28229	26864
25	32033	30887	30663	29515	29369	28248	28240	27157
30	38312	37429	37188	36333	35953	35057	34635	33659
35	41160	39554	40903	39426	40469	39170	39858	38754
40	38931	37448	39895	38357	40524	38934	40854	39231
45	30245	29290	31962	30846	33788	32563	35598	34301
50	23246	23514	24370	24505	25557	25470	26834	26475
55	18207	18224	18985	19119	19809	20075	20691	21072
60	14348	14316	14873	14817	15459	15425	16101	16126
65	11564	12220	11915	12556	12264	12809	12629	13033
70	8593	8722	9052	9289	9448	9863	9796	10414
75	4918	5495	5277	5801	5757	6200	6302	6664
80+	6434	7054	6545	7223	6641	7384	6757	7562

Age	2027		2028		2029		2030	
	M	F	M	F	M	F	M	F
0	43461	41126	42574	40279	41621	39369	40600	38395
5	46886	44348	46282	43765	45628	43134	44922	42456
10	46695	44204	47356	44823	47664	45106	47655	45087
15	39410	37346	40978	38815	42745	40484	44271	41924
20	29667	28176	31622	30010	33452	31730	35445	33616
25	27382	26321	26883	25811	26813	25688	27217	26004

30	33266	32212	31885	30784	30526	29419	29242	28157
35	39068	38127	38104	37264	36994	36175	35771	34908
40	40953	39337	40872	39317	40625	39193	40202	38943
45	37223	35872	38541	37137	39505	38042	40138	38619
50	28238	27614	29784	28941	31487	30483	33297	32185
55	21647	22083	22688	23093	23798	24071	24969	25024
60	16788	16897	17512	17718	18274	18593	19080	19529
65	13028	13304	13476	13675	13983	14161	14549	14750
70	10124	10907	10453	11319	10784	11638	11115	11881
75	6837	7161	7310	7662	7712	8170	8062	8686
80+	6933	7788	7195	8080	7545	8439	7967	8857

Source: Prepared by the researcher.

6. Commenting on the Results and Recommendations:

Population projections for the state of Bouira were made based on the data of the 2008 housing and population census, which included the age, gender structure of the population, fertility, and mortality indicators. The middle of 2008 was considered a base point for the projection for the next stage after processing the data and projecting the population according to age and gender to this point. In addition to the population's age structure, future assumptions about fertility and mortality were made, as well as three fertility alternatives (high, medium, and low). In terms of migration and its impact on population growth, it was assumed that net migration equals zero, implying that it has no effect. By combining assumptions about population growth factors, fertility, and mortality, we have generated three projection scenarios.

These scenarios depict the expected upper limit of the most likely population estimates, as represented by the medium scenario, in which we see an increase in the state's population beginning in 2016, when the population is (806,685 people), and reaching 960,428 people at the end of the projection period, according to the middle scenario. The researcher suggests that the state adopt this scenario for planning and development objectives, and there are two possibilities that reflect the

minimum and maximum scenarios based on the reality of the community at that time

Accordingly, the researcher recommends starting to support development policies and programs and bring them in line with the size of the population. All this is to reduce the gap between the size of the population and development because the widening of the gap leads to the exacerbation of problems and the deterioration of the situation to the extent that it loses control over it or increases the requirements of dealing with it in terms of effort and time. On the other hand, demographic pressures lead to a negative and direct impact on education, health, housing, and the environment. The obtained results also help to :

Education Sector, Education and Training: knowing the number of the population of school age, and thus estimating the demand for structures, supervision, and budget for this sector.

The Security Sector: this study makes it easy to figure out the number of young people of national service age, and therefore it is easy to know the capabilities of young people capable of serving and protecting the homeland.

The Health Sector: to determine the number of births and childbearing, and thus take into account the health facilities affiliated to the sector in order to better ensure the population in this respect. In addition to the number of women of childbearing age (15-49 years), which can be known each year of the projection period, this indicator is important because it controls the number of newborns and it helps to know the health status of mothers.

Pension Fund: Knowing the number of retirees and estimating their budget.

The Political Sector: knowing the number of voters (population over 18 years old) on the one hand, and estimating the number of elected council members representing each region and the state on the other.

In addition to the given findings, we may determine the actual population by knowing the number of specific ages, which are crucial data, using the Sprague or Karup King Methods. It is also conceivable to estimate the population of each district and then each municipality separately; however, we were unable to do so in this study due to the restrictions of publication, and as a result, our study leaves the door open for future researchers.

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