INTRODUCTION:

1.1 Overview: A brief description about your project.

1.2 Purpose: The use of this project. What can be achieved using this.

Problem Definition & Design Thinking.

What is banking is a simple question. To define the term banking, you must say it is an industry that deals with credit, cash, and numerous other transactions. A bank provides a secure place where you can store some additional credit and cash. Banks also propose Certificates of Deposit. Savings accounts and checking accounts. A bank uses various deposits for making loans, and they comprise business loans, car loans, and home mortgages. Hence, banking is called the business activity to safeguard and accept money that other entities and people own before this money is lent out for earning a profit.

art
rnz

Project Report Template

1 **INTRODUCTION**

1.1 Overview

A brief description about your project

1.2 Purpose

The use of this project. What can be achieved using this.

2 **Problem Definition & Design Thinking**

2.1 Empathy Map

Paste the empathy map screenshot

2.2 Ideation & Brainstorming Map

Paste the Ideation & brainstorming map screenshot

3 **RESULT**

Final findings (Output) of the project along with screenshots.

4 **ADVANTAGES & DISADVANTAGES**

List of advantages and disadvantages of the proposed solution

5 **APPLICATIONS**

The areas where this solution can be applied

6 **CONCLUSION**

Conclusion summarizing the entire work and findings.

7 **FUTURE SCOPE**

Enhancements that can be made in the future.

8 **APPENDIX**

A. Source Code

Attach the code for the solution built.

1.

TRACING THE GROWTH OF THE GLOBAL COMMUNITY _A POPULATION FORECASTING ANALYSIS

Forecasting of Population: 9 Methods | Water Quantity | Water Engineering

Article shared by:

The following are the standard methods by which the forecasting of population is done: 1. Arithmetical Increase Method. 2. Geometrical Increase Method. 3. Incremental Increase Method 4. Decreasing Rate Method 5. Simple Graphical Method 6. Comparative Graphical Method 7. Master Plan Method 8. The Logistic Curve Method 9. The Apportionment Method.

1. Arithmetical Increase Method:

This method is based on the assumption that the population is increasing at a constant rate. The rate of change of population with time is constant.

i.e. $dp/dt = C$ (a constant)

integrating $P_2-P_1 = C(t_2-t_1)$.....(5.5)

Where P_1 = Population at the time t_1 first census

P_2 = Population at the time t_2 last available census

The value of constant C is determined.

Now the population after n decade can be determined by the formula

$P_n = P + n. C$

Example 1:

The following data have been noted from the census department:

Year	*Population*
1940	8,000
1950	12,000
1960	17,000
1970	22,500

Calculate the probable population in the year 1980, 1990 and *2000.*

Solution.

Year	*Population*	*Increase in Population*
1940	8,000	
1950	12,000	4000
1960	17,000	5000
1970	22,500	5500
	Total	14,500
	Average Inverse	4,833

Year	*Population*
1980	22,500 + 1 × 4833 = 27,333
1990	27333 + 1 × 4833 = 32,166
2000	32166 + 1 × 4833 = 36, 999

2. Geometrical Increase Method:

This method is based on the assumption that the percentage increase in population from decade to decade remains constant. In this method the average percentage of growth of last few decades is determined; the population forecasting is done on the basis that percentage increase

per decade will be the same.

If the present population is P and the average percentage growth is I_G the population at the end of n decade will be:

$$P_n = P\left(1 + \frac{I_G}{100}\right)^n \qquad \ldots(5.7)$$

Example 2:

Forecast the population of example 1 by means of geometrical increase method.

Year	*Population*	*Increase in Population*	*Percentage increase in Population*
1940	8,000	—	
1950	12,000	4,000	$\frac{4000}{8000} \times 100 = 50.0\ \%$
1960	17,000	5,000	$\frac{5000}{12000} \times 100 = 41.7\ \%$
1970	22,500	5,500	$\frac{5500}{17000} \times 100 = 32.4\ \%$
	Total	14,500	124.1
	Average per decade	4,833	41.37

3. Incremental Increase Method:

This method is improvement over the above two methods. The average increase in the population is determined by the arithmetical method and to this is added the average of the net incremental increase once for each future decade.

P is the present population, la = Average Arithmetical increase, and I_C is the average incremental increase, then population after 'n' decade will be

$$Pn = P + n (la + Ic)$$

Solved example 3 will explain this method clearly.

Example 3:

Forecast the population of example 1, by means of incremental increase method.

Solution:

Year	*Population*	*Increase in Population*	*Incremental increase i.e. increment on the increase*
1940	8,000	—	—
1950	12,000	4,000	—
1960	17,000	5,000	+1000
1970	22,500	5,500	+0500
	Total	14,500	+1500
	Average	4,833	(+) 750

The population at the end of various decades shall be as follows:

4. Decrease Rate of Growth Method or Decreasing Rate Method:

It has been seen that all life grow within limited space. If the complete growth of a very old city is plotted, it will be seen that the curve has S-shape, which indicates that early growth takes place at an increasing rate, latter growth is at a decreasing rate which indicates that saturation limit is reached.

In this method, the average decrease in the percentage increase is worked out and is then subtracted from the latest percentage increase for each successive decade.

Example 4:

Solve example 1, by using decrease rate of growth method.

Solution:

Year	*Population*	*Increase*	*Percentage increase in Population*	*Decrease in the percentage increase*
1940	8000	—	—	—
1950	12000	4000	$\frac{4000}{8000} \times 100 = 50.0$	—
1960	17000	5000	$\frac{5000}{12000} \times 100 = 41.7$	+8.3
1970	22500	5500	$\frac{5500}{17000} \times 100 = 32.4$	+9.3
	Total	14500		17.6
	Average	4833		8.8

Now the population at the end of various decades shall be as follows:

Year	*Net percentage increase in Population*	*Population*
1980	$32.4 - 8.8 = 23.6$	$22{,}500 + \frac{23.6}{100} \times 22{,}500 = 27{,}810$
1990	$23.6 - 8.8 = 14.8$	$27{,}810 + \frac{14.8}{100} \times 27{,}810 = 31{,}926$
2000	$14.8 - 8.8 = 6.0$	$31{,}926 + \frac{6}{100} + 31{,}926 = 33{,}842$

Example 5:

The population of five decades from 1940 to 1980 are given below. Find out the population in decades 1990, 2000 and 2010 by using decrease rate of growth method.

Year	1940	1950	1960	1970	1980
Population	25000	28000	32500	40000	45000

Solution:

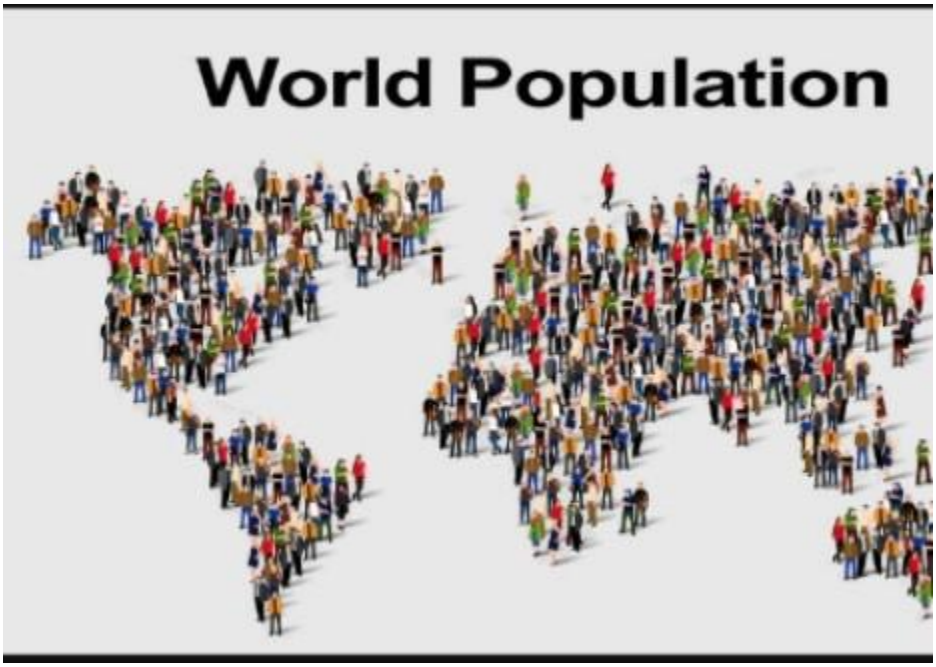
Year	*Population*	*Increase in Population*	*% increase in Population*	*decrease in the % increase*
1940	25000	—		
1950	28000	3000	$\frac{3000}{25000} \times 100 = 12\%$	
1960	32500	4500	$\frac{4500}{28000} \times 100 = 16.1\%$	(–) 4.1%
1970	40000	7500	$\frac{7500}{32500} \times 100 = 23.1\%$	(–) 7.0%
1980	45000	5000	$\frac{5000}{40000} \times 100 = 12.5\%$	(+) 10.6%
	Total	20000		(–) 11.1 + 10.6 = (–) 0.5%
Average per decade		5000		$(-)\frac{0.5}{3} = (-)0.17\%$

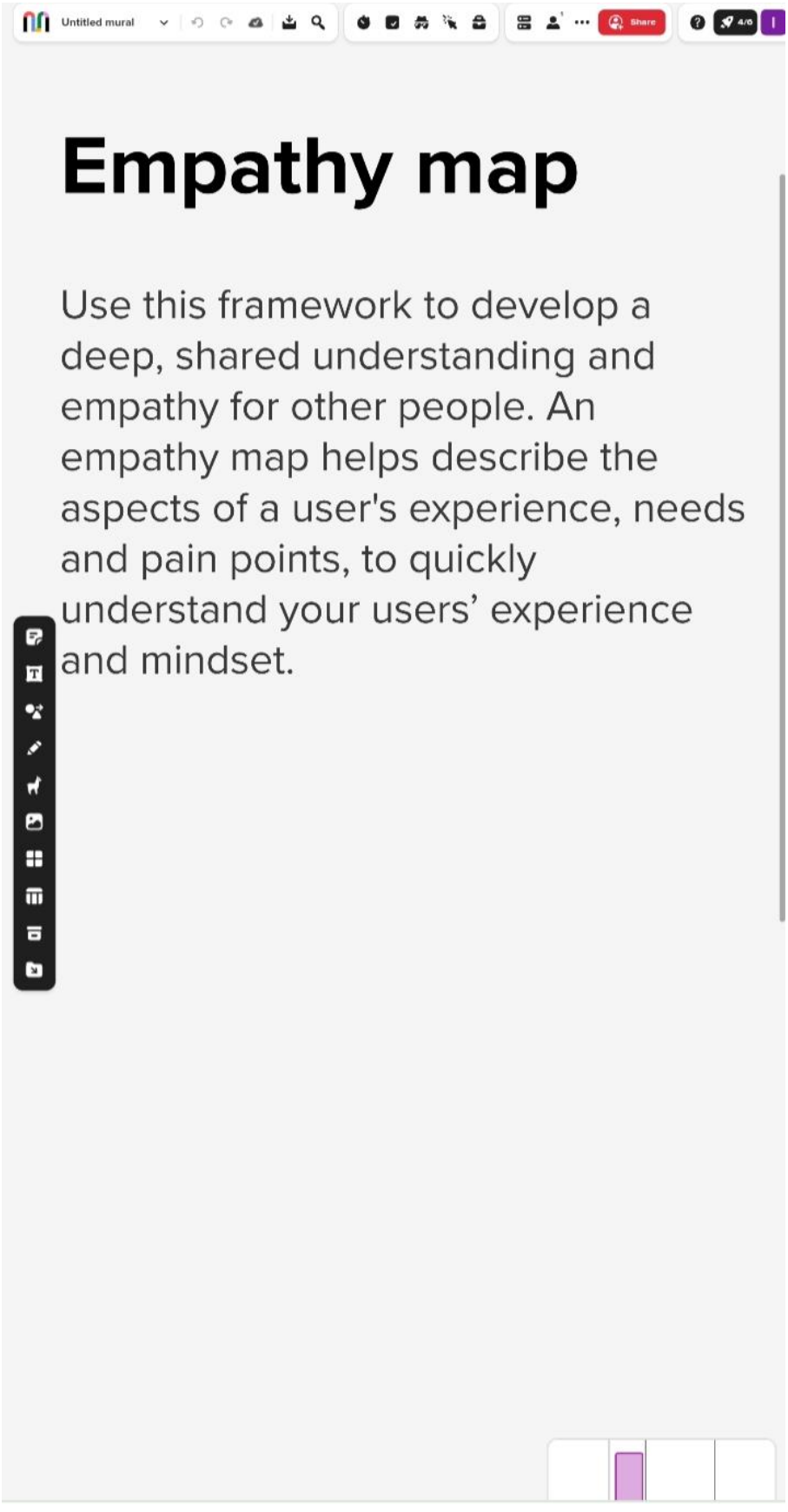
Now the population at the end of various decades shall be as follows:

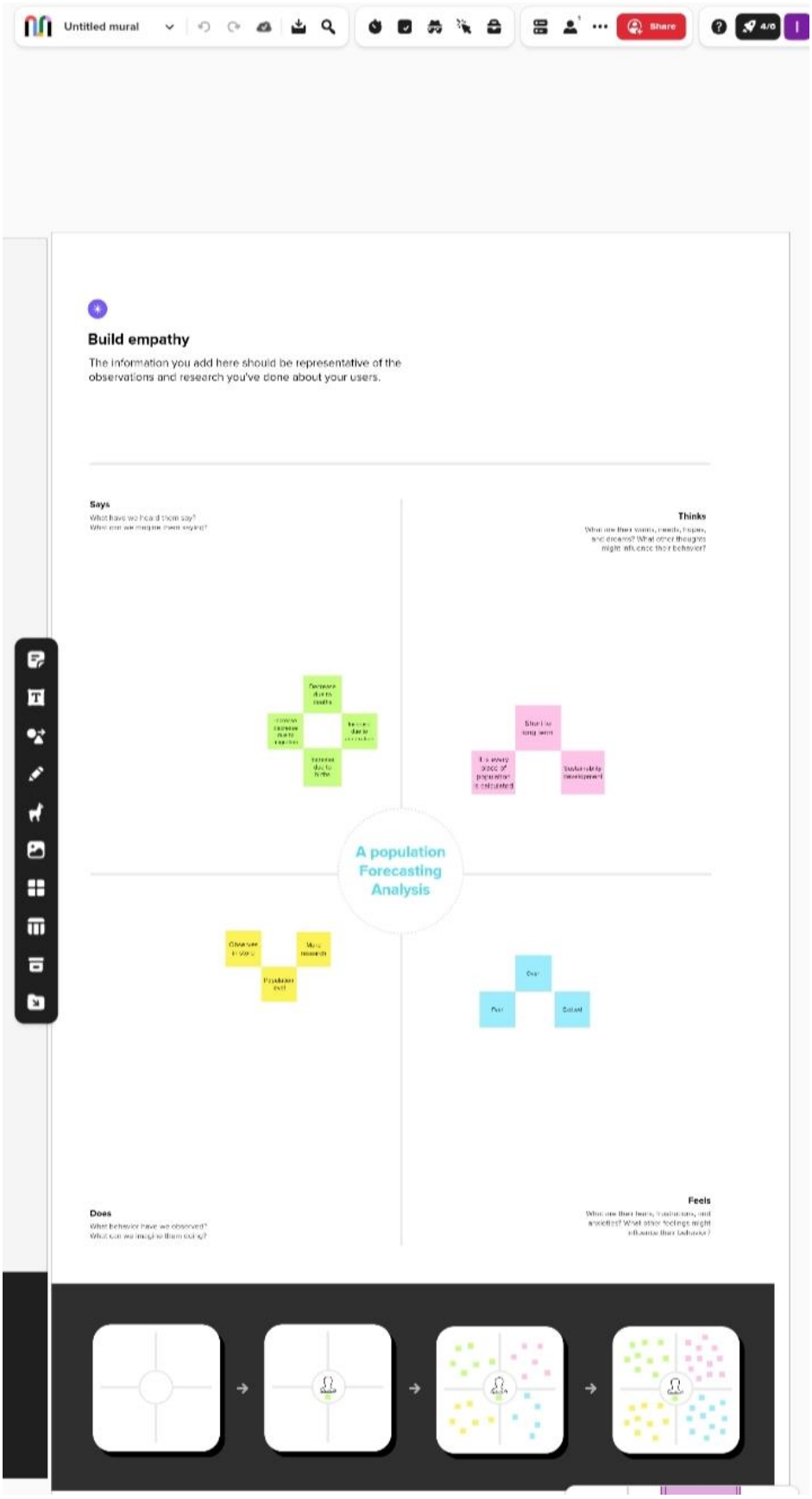
Year	Net percent increase in Population	Population
1990	$12.5-(-0.17)=12.67$	$4500+\frac{12.67}{100}\times 4500=50702$
2000	$12.67-(-0.17)=12.84$	$50702+\frac{12.84}{100}\times 50702=57212$
2010	$12.84-(-0.17)=13.01$	$57212+\frac{13.01}{100}\times 57212=64654$

5. Simple Graphical Method:

In this method the populations of last few decades are correctly plotted to a suitable scale on the graph with respect to decade. The curve is smoothly extended to forecast the future population. The graph of present city is plotted from the beginning and it will show the growth curve. Fig. 5.1 shows the typical growth curve


World Population


Untitled mural
Share
4/0
Empathy map
Use this framework to develop a deep, shared understanding and empathy for other people. An empathy map helps describe the aspects of a user's experience, needs and pain points, to quickly understand your users' experience and mindset.


Untitled mural
Share
4/6
Build empathy
The information you add here should be representative of the observations and research you've done about your users.
Says
Thinks
A population Forecasting Analysis
Does
Feels

Ok

Template

Brainstorm & idea prioritization

Use this template in your own brainstorming sessions so your team can unleash their imagination and start shaping concepts even if you're not sitting in the same room.

10 minutes to prepare
1 hour to collaborate
2-8 people recommended

Share template feedback

Before you collaborate

A little bit of preparation goes a long way with this session. Here's what you need to do to get going.

10 minutes

A **Team gathering**
Define who should participate in the session and send an invite. Share relevant information or pre-work ahead.

B **Set the goal**
Think about the problem you'll be focusing on solving in the brainstorming session.

C **Learn how to use the facilitation tools**
Use the Facilitation Superpowers to run a happy and productive session.

Open article →

Need some inspiration?
See a finished version of this template to kickstart your work.

Open example →

2

Brainstorm

Write down any ideas that come to mind that address your problem statement.

10 minutes

Person 1

Person 2

Person 3

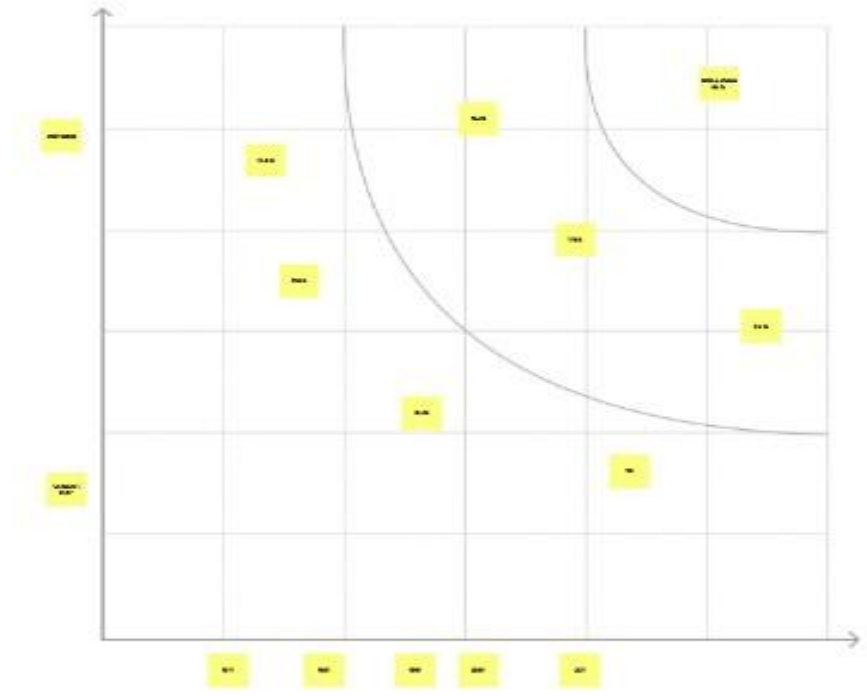
Person 4

Person 5

Person 6

Person 7

Person 8



3

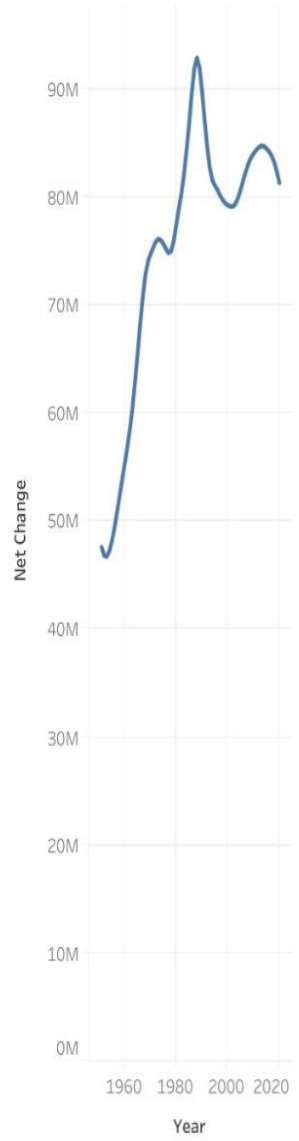
Group ideas

Take turns sharing your ideas while clustering similar or related notes as you go. Once all sticky notes have been grouped, give each cluster a sentence-like label. If a cluster is bigger than six sticky notes, try and see if you and break it up into smaller sub-groups.

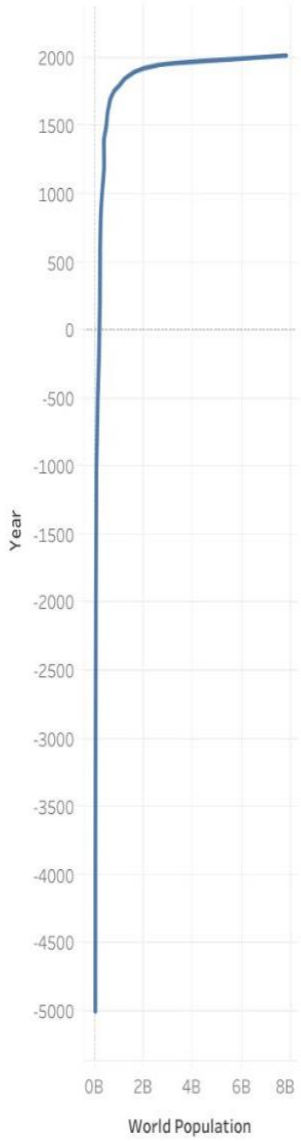
20 minutes

Story 3

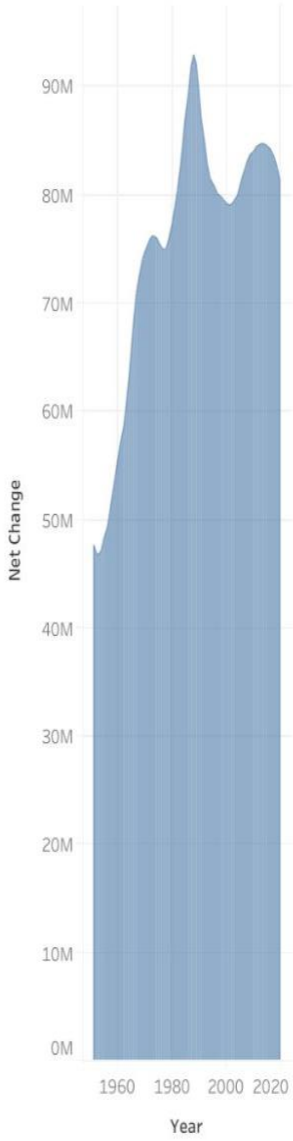
Sheet 3



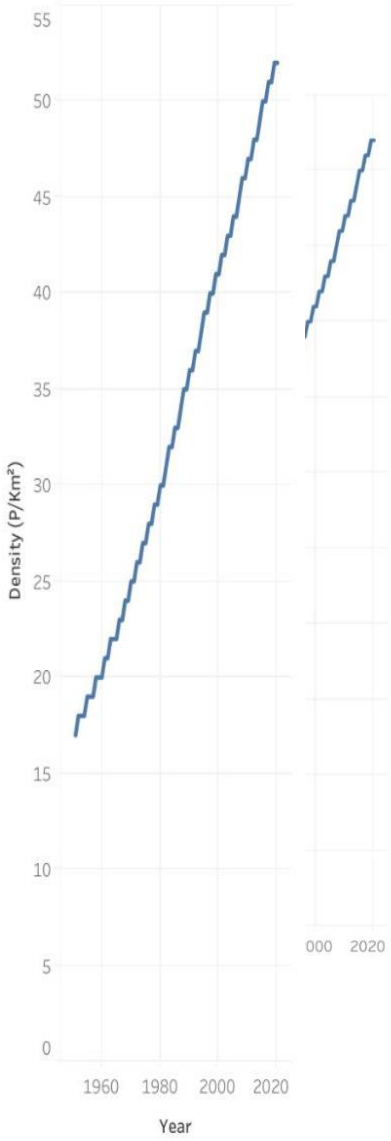
Sheet 4



Sheet 6



Sheet 2



Year	*Population*	*Increase*	*Percentage increase in Population*	*Decrease in the percentage increase*
1940	8000	—	—	—
1950	12000	4000	$\frac{4000}{8000} \times 100 = 50.0$	—
1960	17000	5000	$\frac{5000}{12000} \times 100 = 41.7$	+8.3
1970	22500	5500	$\frac{5500}{17000} \times 100 = 32.4$	+9.3
	Total	14500		17.6
	Average	4833		8.8

Now the population at the end of various decades shall be as follows:

Now the population at the end of various decades shall be as follows:

Year	*Net percentage increase in Population*	*Population*
1980	$32.4 - 8.8 = 23.6$	$22{,}500 + \frac{23.6}{100} \times 22{,}500 = 27{,}810$
1990	$23.6 - 8.8 = 14.8$	$27{,}810 + \frac{14.8}{100} \times 27{,}810 = 31{,}926$
2000	$14.8 - 8.8 = 6.0$	$31{,}926 + \frac{6}{100} + 31{,}926 = 33{,}842$

Example 5:

The population of five decades from 1940 to 1980 are given below. Find out the population in decades 1990, 2000 and 2010 by using decrease rate of growth method.

Year	1940	1950	1960	1970	1980
Population	25000	28000	32500	40000	45000

Solution:

Year	*Population*	*Increase in Population*	*% increase in Population*	*decrease in the % increase*
1940	25000	—		
1950	28000	3000	$\frac{3000}{25000} \times 100 = 12\%$	
1960	32500	4500	$\frac{4500}{28000} \times 100 = 16.1\%$	(–) 4.1%
1970	40000	7500	$\frac{7500}{32500} \times 100 = 23.1\%$	(–) 7.0%
1980	45000	5000	$\frac{5000}{40000} \times 100 = 12.5\%$	(+) 10.6%
	Total	20000		(–) 11.1 + 10.6 = (–) 0.5%
Average per decade		5000		$(-)\frac{0.5}{3} = (-)0.17\%$

Now the population at the end of various decades shall be as follows:

Year	*Net percent increase in Population*	*Population*
1990	12.5 – (–0.17) = 12.67	$4500 + \frac{12.67}{100} \times 4500 = 50702$
2000	12.67 – (–0.17) = 12.84	$50702 + \frac{12.84}{100} \times 50702 = 57212$
2010	12.84 – (–0.17) = 13.01	$57212 + \frac{13.01}{100} \times 57212 = 64654$

5. Simple Graphical Method:

In this method the populations of last few decades are correctly plotted to a suitable scale on the graph with respect to decade. The curve is smoothly extended to forecast the future population. The graph of present city is plotted from the beginning and it will show the growth curve. Fig. 5.1 shows the typical growth curve of a city of example 1.

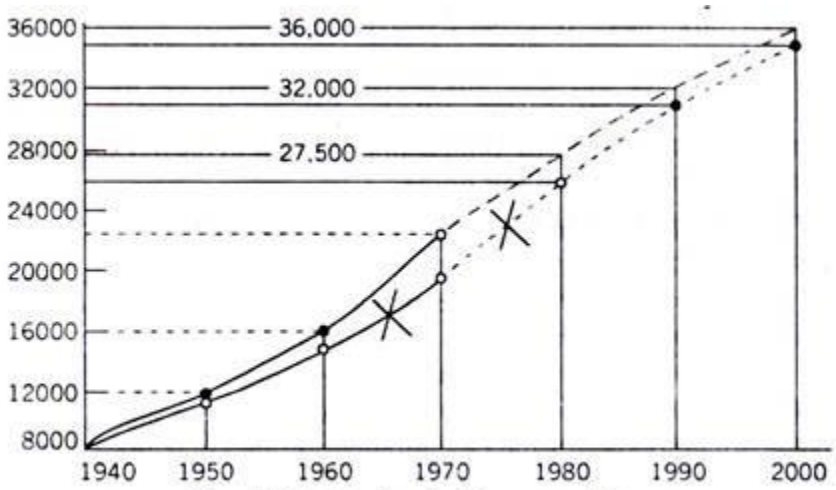


Fig. 5.1. Typical city growth curve.

After extending the curve and determining the forecasts of population at various decades, following results are noted on the graph of Fig 5.1.

Year	*Expected Population*
1980	27,500
1990	32,000
2000	36,000

6. Comparative Graphical Method:

In this method, the cities having conditions and characteristics similar to the city whose future population is to be estimated are first of all selected. It is then assumed that the city under consideration will develop as the selected similar cities have developed in the past. This method has a logical background, and if statistics of development of similar cities are available quite precise and reliable results can be obtained.

Consider Fig. 5.2. Let the population of a city A be given for 4 decades (say 1940, 1950, 1960 and 1970) the population time curve is then plotted.

Now, Suppose it is required to estimate the population of the city A at the end of year 2010. And let the available data show that this city A has reached the present population of 42500 in the year 1970. Then the available data of similar cities Band C is

analyzed. Let it be found that city B has reached 42500 in the year 1940 then its curve is plotted beyond the year 1940 onward.

However, this curve for city B should start from point P which represents the present population of city A. Similarly, the population of city C is plotted from the year it has reached 42500 onwards. Now the curve for city A is carefully extended between the curves of cities B and C as shown in Fig. 5.2.

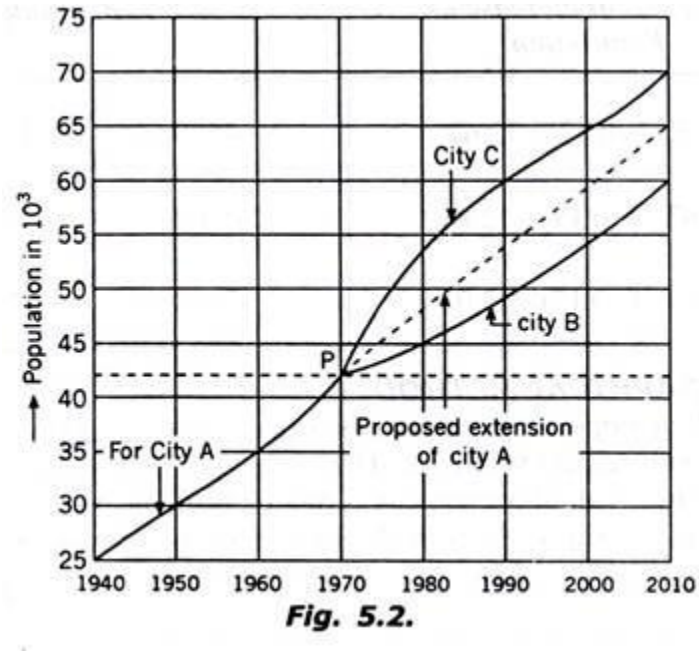


Fig. 5.2.

Fig. 5.2 shows the development of cities A,B, C and D. The development of the city 'X' under consideration has been shown by dotted line. Future expected population at any decade can be directly determined from this graph.

7. The Master Plan Method or Zoning Method:

The development of towns and cities is not allowed in haphazard way. For the development of the towns and cities, their master plans are prepared. The city is divided into various zones such as commercial centres, industrial areas, residential areas, the schools, colleges, parks etc. The future expansion of the cities is strictly regulated by various bylaws of corporations and other local bodies, according to the master plan.

The master plans are prepared for the development of the cities for 25-30 years. The population densities for various zones of the towns to be developed are also fixed. Now when the population of a particular zone is fixed, it is very easy to design the water supply schemes for the particular zones. The future development of the water works is also designed on the basis of the master plan.

Table 5.5 gives the common population densities for preparation of master plans:

Table 5.5. Common Population Densities.

S.No.	*Type of area*	*Population Density in No. of persons per hectare*
1.	Residential Areas	
	(a) Large lots of single family residences	10 – 40
	(b) Small lots of single family residences	40 – 90
	(c) Multiple family quarters	90 – 250
	(d) Tenement houses.	250 – 3500
2.	Commercial areas	40 – 75
3.	Industrial areas	10 – 40
4.	Parks, playgrounds etc.	25 – 125

8. Logistic Curve Method:

If the population of a town is plotted with respect to time, the curve so obtained under normal conditions shall be as shown in Fig. 5.3.

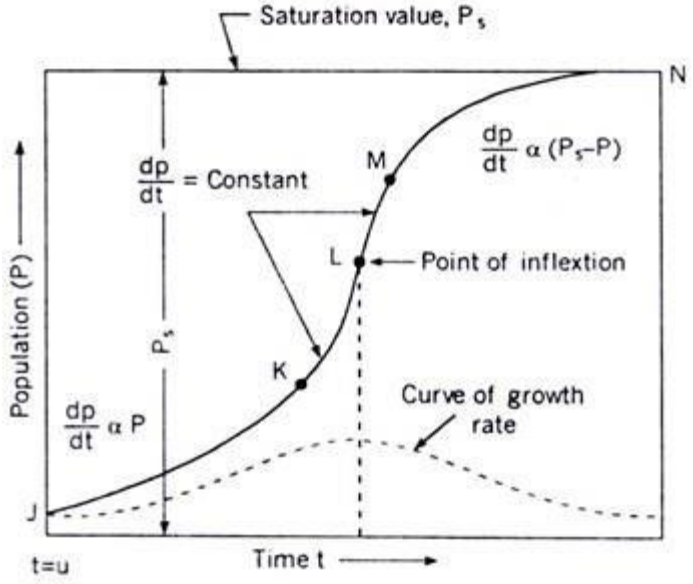


Fig. 5.3. Logistic curve.

The early growth of the city is shown by curve JK at an increasing rate of dp/dt α p. The growth rate between point K to M follows curve of dp/dt = constant. The transitional curve KM also passes through the point of inflexion L.Later on the growth from M to N follows the decreasing rate i.e., dp/dt α (p_s-p) where p is population of the town at point t from the origin j and p_s is the saturation value of the population. The s-shaped curve JKLMN is called logistic curve.

P.F. Verhulst after long research work has given the following mathematical solution of logistic curve:

McLean further suggested that if three pairs of the characteristics values P_0, P_1 and P_2 at times t_0, t_1, and t_2 which are extending over the useful range of the population are so chosen that t_0= 0, t_1, and t_2 = 2t_1 the saturation values P_s and constants m and n can be determined from the following equation:

Example 6:

Following is the population of a city as noted from the census department:

Year	Population
1950	35,000
1960	78,000
1970	1,15,000

Determine (a) the saturation population (b) the expected population in 1980 and the equation of logistic curve.

Solution:

(b) Now substituting the values of P_s m and n in equation (5.10),

9. The Apportionment Method:

This is also known as the ratio method of forecasting future population. In this method the census population record is expressed as the percentage of the population of the whole country. The population of the city under consideration and the country's population for the last four to five decades are collected from the census department.

The ratio of the town under consideration to the national population is calculated for these decades. Now a graph is plotted between these ratios and the time. The extension of this graph will give the ratio corresponding to the future years for which the forecasting of population is to be done.

The ratio so obtained is multiplied by the expected national population at the end of the designed period, for determining the expected national population of the town under reference.

This method is suitable for those towns and cities whose development is likely to take place according to the growth

Conclusion

In this study, population projection was made with both state of the art time series and regression algorithms. According to the results, ensembling regression algorithms with the cohort component methods have very successful results in the prediction. Machine learning algorithms, especially ensemble regression models, can better estimate the country's future population by minimising the factors that make it difficult to estimate the country's population and by analysing uncertainties on demographic data. Therefore, machine learning algorithms on population estimation will make an essential contribution to the country. This will facilitate the planning of national needs about the country and pave the way for more consistent social, economic and environmental decisions.

The cohort components method is used to estimate the population by using variables such as the total population of the country, birth, death and migration rates, life expectancy at birth and sex ratio at birth. However, different features can also affect the total population of the country. Thanks to machine learning, algorithms are successful in learning these effects from the dataset.

One of the study limits can be said to be the pooling of 257 differene

countries and

training the model with all data. According to the results, training models with all data gives better performance results than training with fewer data. However, according to their developed levels, clustering the training data, cultural characteristics, or geographical location may provide different results.

Another limitation of the study is the data size. Machine learning algorithms give more meaningful results with more extensive datasets. However, due to the nature of the problem, population statistics and demographic indicators have limited dataset. Besides, the dataset is insufficient, especially for underdeveloped countries. The consistency of available data is also questionable. Increasing the accuracy and texture of the collected data will improve the population projection. So, the population projection of underdeveloped countries with limited datasets is more complex than developed countries' population projections.

In future studies, machine learning algorithms can be synthesised with the cohort components method. In the cohort components method, all input data up to the desired year is needed. For example, when it is expected to estimate population for 2050, all variables, such as birth rates for each year during the 29 years, must be predicted. Machine learning algorithms can estimate these input data for each year. Later, the data obtained from machine learning algorithms can be used in the cohort component method. This study can also be expanded by increasing the number of years to be estimated.

Countries may need to estimate 50 yearsAdvantages of Forecasting Helps in Scheduling: One of the greatest benefits of forecasting is that it helps the manager to prepare for the organization's future. Currently, planning and forecasting go hand in hand. We will not prepare for it without an understanding of what the future holds for the business. Forecasting, therefore, plays a very significant role in planning.Changes to the Climate: Prognostics should be able to point out the potential environmental changes when performed correctly. This implies that it will allow the organization to benefit from such environmental changes. It can develop and grow its business if the changes are beneficial to the company. And it may intend and prepare to defend itself in circumstances that are adverse.Weak Spots Detection: Another benefit of forecasting is that it can help the manager find any weak points that the company may have or overlooked areas. When attention has been drawn to these areas, succes