Tracing the Growth of the Global Community: A Population Forecasting Analysis

Project Based Experimental Learning program

Tracing the Growth of the Global Community: A Population Forecasting Analysis

Milestone 1: Define Problem / Problem Understanding

Acknowledgments

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Activity 1

Project Description

The world's population is more than three times larger than it was in the mid-twentieth century. The global human population reached 8.0 billion in mid-November 2022 from an estimated 2.5billion people in 1950, adding 1 billion people since 2010 and 2 billion since 1998. The world's population is expected to increase by nearly 2 billion persons in the next 30 years, from the current 8 billion to 9.7 billion in 2050 and could peak at nearly 10.4 billion in the mid-2080s. This dramatic growth has been driven largely by increasing numbers of people surviving to reproductive age, the gradual increase in human lifespan, increasing urbanization, and accelerating migration. Major changes in fertility rate have accompanied this growth. These trends will have far-reaching implications for generations to come.

Activity 2

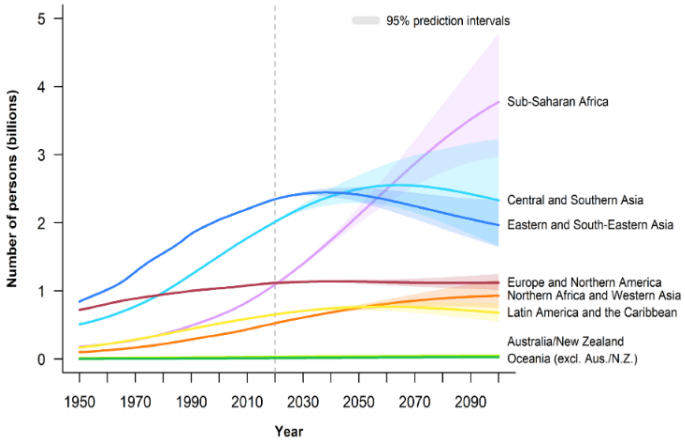
Business requirements

1.) Spatial patterns of population growth

The Goals and the narrative of the 2030 Agenda for Sustainable Development emphasize the importance of the spatial dimension of sustainable development. Most of the world's low-income countries are experiencing rapid population growth. Some middle-income countries are also among the fastest growing. The population of Europe is expected to fall by 5 per cent between 2020 and2050, while the population of sub-Saharan Africa is projected to double in size over the same period. Expected future changes in population size in the other world regions fall in between these two extremes. Population dynamics determine how human numbers change over time across countriesandregions.In2020,the continent of Asia was home to 60 per cent of the world's population of 7.8billion(figure4.1).Eastern and South-Eastern Asia, the most populous region, comprised 30 per cent of the total; it had 2.3 billion people in2020, of which 1.4 billion lived in China. Another 26 per cent of the global population was concentrated in Central and Southern Asia, the second largest region; it had 2 billion

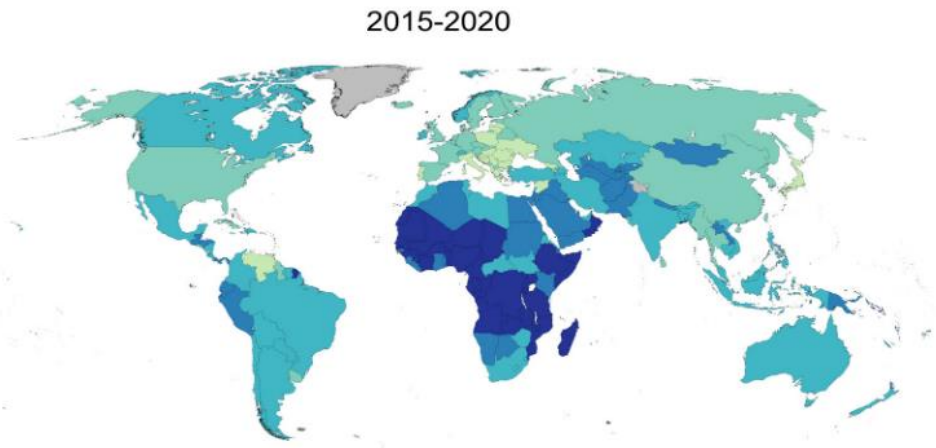
peoplein2020, of which almost 1.4 billion were in India. The populations of both regions have grown rapidly since the middle of the twentieth century and are expected to reach their peak size within a few decades. According to projections by the United Nations, the population of Eastern and South-Eastern Asia is likely to peak at 2.4 billion people around2040,while Central and Southern Asia is projected to reach its maximum populationsome25yearslater,risingtoaround2.6billionin 2065 (United Nations, 2019).

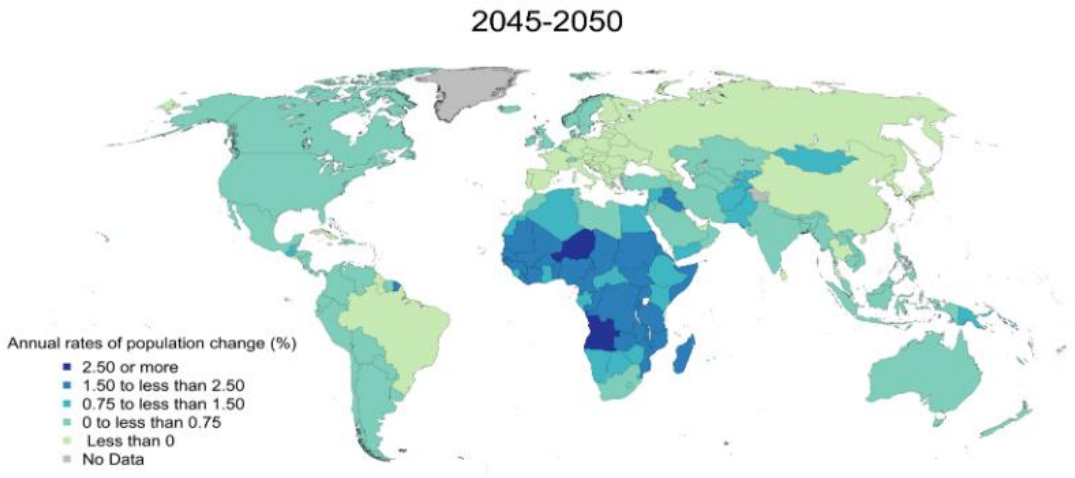
Population estimates, 1950-2020, and projections with prediction intervals, 2020-2100, by region



The number of persons residing in Europe and Northern America is now stabilizing. Their combined population is projected to grow more slowly than the world average, reaching just under 1.14 billion in 2040 and remaining stable or declining slightly through the rest of the century. The population of Latin America and the Caribbean is also projected to grow more slowly than the global average in the coming decades and will likely start decreasing in the second half of the century. By contrast, it is expected that the populations of Northern Africa and Western Asia, and Oceania will sustain their current pace of growth throughout the century.

2.) Annual rates of population change (percentage), selected periods, by country





In 2050, the world's population will be around 1.94 billion larger than today; the countries and areas whose populations are projected to increase between 2020 and 2050 will add a total of 2.06 billion, while those projected to decrease in size will lose 122 million persons. The deceleration of global growth is likely to continue throughout the current century, but with significant differences across regions.

The highest growth rates are expected in parts of sub-Saharan Africa. Three fourths of the projected increase in world population during the next three decades will take place in sub-Saharan Africa and in Central and Southern Asia. Sub-Saharan Africa is expected to account for most of the global increase until the end of the century, adding between 23 and 38 million people per year between 2020 and 2100. The contribution to growth of all other regions is likely to decrease substantially over time. Two regions, Eastern and South-Eastern Asia, and Europe and Northern America, are projected to switch from population growth to population decline during the 2040s. Two other regions, Latin America and the Caribbean, and Central and Southern Asia, are likely to follow suit in the 2060s.

3.) The ability to identify key factors influencing population growth and demographic changes.

When demographers attempt to forecast changes in the size of a population, they typically focus on four main factors: fertility rates, mortality rates (life expectancy), the initial age profile of the population (whether it is relatively old or relatively young to begin with) and migration. In the case of religious groups, a fifth factor is switching – how many people choose to enter and leave each group, including how many become unaffiliated with any religion. This chapter presents an overview of each of these five main drivers of population change. It highlights important trends, discusses key assumptions about the future and acknowledges weak spots in the demographic data currently available on some countries and religious groups. In some cases, this chapter also shows how different the projections would be if particular factors, such as migration, were not taken into account. These hypothetical scenarios are intended to give readers a sense of how much impact various factors have on the projections.

4.) Data visualization and big data

The increased popularity of big data and data analysis projects has made visualization more important than ever. Companies are increasingly using machine learning to gather massive

amounts of data that can be difficult and slow to sort through, comprehend and explain. Visualization offers a means to speed this up and present information to business owners and stakeholders in ways they can understand.

Big data visualization often goes beyond the typical techniques used in normal visualization, such as pie charts, histograms and corporate graphs. It instead uses more complex representations, such as heat maps and fever charts. Big data visualization requires powerful computer systems to collect raw data, process it and turn it into graphical representations that humans can use to quickly draw insights.

5.) Data integration in modern business

Data integration isn't a one-size-fits-all solution; the right formula can vary based on numerous business needs. Here are some common use cases for data integration tools:

Leveraging big data

Data lakes can be highly complex and massive in volume. Companies like Face book and Google, for instance, process a non-stop influx of data from billions of users. This level of information consumption is commonly referred to as big data. As more big data enterprises crop up, more data becomes available for businesses to leverage. That means the need for sophisticated data integration efforts becomes central to operations for many organizations.

Population Size

The most fundamental demographic **parameter** is the number of individuals within a population. Population size is defined as the number of individuals present in a **subjectively designated geographic range**. Despite the simplicity in its concept, locating all individuals during a census (a full count of every individual) is nearly impossible, so ecologists usually estimate population size by counting individuals within a small sample area and **extrapolating** that sample to the larger population.

Populations display distinctive behaviours based on their size. Small populations face a greater risk of **extinction**. Individuals in these populations can have a hard time finding quality mates so, fewer individuals mate and those that do risk **inbreeding** (Hamilton 1967). Additionally, individuals in small population are more susceptible to random deaths. Events like fire, floods, and disease have a greater chance of killing all individuals in the population.

Sex Ratio

Sexually reproducing organisms must find mates in order to produce offspring. Without comparable numbers of males and females, mating opportunities may be limited and population

growth stunted. Thus, ecologists measure the number of males and females within a population to construct a sex ratio, which can help researchers predict population growth or decline. Much like population size, sex ratio is a simple concept with major implications for population dynamics. For example, stable populations may maintain a 1:1 sex ratio and therefore keep their growth rate constant, whereas declining populations may develop a 3:1 sex ratio favouring females, resulting in an increased **growth rate**. In species where males contribute significantly to offspring **rearing**, populations may instead maintain a ratio skewed towards males (Hamilton 1967).

6.) Organizations benefiting from data-driven decision-making

Thanks to modern business intelligence, organizations are inching closer and closer to understanding the value of data-driven decision-making across all departments and roles. Here are a few examples of organizations that are effectively leveraging the value of their people and their data.

Simplifying business intelligence (BI)

By delivering a unified view of data from numerous sources, data integration simplifies the business intelligence (BI) processes of analysis. Organizations can easily view, and quickly comprehend, the available data sets in order to derive actionable information on the current state of the business. With data integration, analysts can compile more information for more accurate evaluation without being overwhelmed by high volumes.

Activity 3

Literature Survey

3. LITERATURE REVIEW

According to optimists like Keynes, development in a country without population growth will cause problems. When the population increases, they expect the savings and investments also to increase. When the population decreases, the production, capital accumulation, employment, incomes and savings will also decrease and may negatively affect the development. According to Keynes, the growth of population will cause a strong demand for goods that will make it possible to establish a good market as well as increase the demand for capital. Other studies have reported that the shift in age distribution pattern has had a significant impact on economic growth through savings and investments (Mason, 1988; Bloom and Williamson, 1997).

Mason (1988) has investigated the correlation between savings, economic growth and demographic change. He has studied the economic consequences of the developing countries' growing populations. According to him, a rapidly growing population requires increasing investment to maintain the labor to capital ratio. Therefore, the labor productivity increases. Besides this simple relationship between population growth, savings and economic growth, the increase of human capital, institutional and restructuring problems also play an important role.

Deaton and Paxson (1999) have been studying the relationship between demographic structure, economic growth and savings. Their study focused on Taiwan. They examined this topic within the framework of the life cycle hypothesis. They also used a time-series of cross sectional household surveys in Taiwan to estimate the age profiles for consumption, income, and savings. They have used these results to investigate the extent to which demographic change and economic growth can account for the increase in Taiwan's savings rate.

KannanNavaneetham (2002) studied the age based structural transition and its linkages with the economic growth of countries in South Asia (Bangladesh, India and Sri Lanka) and South-east Asia (Indonesia, Malaysia, Philippines, Singapore and Thailand).This study found that the age based structural transition was not uniform among the countries of South and South-east Asia. The differences in age based structural transition are due to differences in the fertility and mortality rates among these countries. The window of opportunity or demographic bonus had a positive impact on the economic growth of all South-east Asian countries except the Philippines.

Activity 4: Social or Business Impact.

4.1. Social Impact:

Population growth is desirable as long as a country has plenty of land or human made capital. More people will be used to utilize these resources; then it is more likely that total and per capita output will increase Also; larger population can have posith'e effect of providing market for domestkally produced goods. Unemployment will spread; income distribution will worsen; government revenues will not be sufficient to provide people with social services; and finally' social welfare will diminish.

4.1.1. Unemployment

The economic development of Western Europe and North America has often been described in terms of continuous transfer of economy activity and people from rural to urban areas both within and between countries which spread over two centuries (Rattan, J982: 38. 39). On the other hand. Today many LDCs are plagued by massive rural to urban population movements prompted by development strategies and high population growth in much short time. In the 1950's rural-urban migration was viewed favorably in economic development literature. It was thought to be a natural process in which zero or low productivity surplus labor was gradua1Jy withdrawn from the rural sector to provide needed mended manpower for high productivity modern Industrial sector (Lewis-fey-Rains Model).

4.1.2. Poverty

Poverty is the direct consequence of the high population growth in most LDC's, and can be described as the failure to achieve certain minimum standards of living for same segment of population in a country. Poverty has many facets; hunger and malnutrition, poor health, high infant mortality, law life expectancy. This number could be reduced by a strategy of both labor-intensive economic growth and efficient social spending. Economic growth İs necessary to reduce poverty, but experience show s that it is Insufficient Social expenditure on health eared and schooling expand opportunities for the poor, but again may not be enough.

4.1.3.Hunger and Alalnıtritioıı

Hunger and malnutrition are the most obvious forms of poverty as being the primary cause of poor health, high Infant mortality, and low life expectancy. Food supplies, that \could increase arithrnetically in contrast with population that
Would increase geometrically. were the essential ingredients of T. Malthus's theory of population. According to his theory, insufficient supply' of food would be the ultimate check on population growth. As we near the end of the second century since this prediction was made. It is generally concluded that Malthus has been proven wrong.

4.2.Business Model/Impact

Business leaders should care about population growth, but it's not as simple as focusing on the total gain or decline. Overall population growth in the United States crept up very slowly last year, relative to historical experience. Growth in the year through July 1, 2022 was the third lowest of the last 100 years, with the two lower years in 2020 and 2021. In simple terms, businesses see slower growth in the number of potential customers.

Demographic change is often ignored because it comes on so gradually. Newspaper headlines don't proclaim, in huge font, slower birth trends. But demographic forces are strong. Today's labor shortage predates the pandemic. In December 2019 I wrote, "The labor markets have been tight for several years, and it's only going to get worse in 2020." Yet the retirement of the baby boom generation could have been predicted 60 years earlier. Minor details changed recently, such as the drop in immigration, but the big picture was clear long ago.

Milestone 2: Data Collection & Extraction from Database

Introduction

At present the data is been generated everywhere like YouTube, Tumblr, Reddit, Facebook, WhatsApp, Twitter, Instagram Gmail, LinkedIn and Academia. Understanding this data is very important as this is crucial and very important entity of an Organization, Nations, and Institutions. Big data is a collection of large and complex data which are difficult to be handled with traditional data processing application software. Analyzing and visualizations the data sets can give a new business trends, prevent diseases, and model to forecast future paradigms and combat crime and soon. At this time, the most used tools for data analytics and visualizations, data discovery are tableau. Tableau is one of the fastest upcoming business intelligence (BI) tool. It is fast to deploy, easy to learn and very useful for a user. Tableau is a that can help users explore and understand their data by creating interactive visualizations. The software has the advantages that it can be used in conjunction with almost any database, and it is easy to use by dragging and dropping to create an interactive visualization expressing the desired format. Data visualization is an intuitive way for users to easily read and understand data, especially in big data analyses. It helps to improve the quality of governance policies or services by presenting an integrated view and evidence for making better decisions . Tableau connects users with a variety of data sources and enables them to create data visualizations by making charts, maps, dashboards, and stories through a simple drag and drop interface.

Activity 1: Collect the dataset

Data Visualization

Data visualization is the use of human natural skills to enhance data processing and organization efficiency. Data visualization is the representation of data or information in a graph, chart, or other visual format. Visualization can help us deal with more complex information and enhance memory. It communicates relationships of the data with images. This is important because it allows trends and patterns to be more easily seen. With the rise of big data upon us, we need to be able to interpret increasingly larger batches of data. Machine learning makes it easier to conduct analyses such as predictive analysis, which can then serve as helpful visualizations to present. But data visualization is not only important for data scientists and data analysts, it is necessary to understand data visualization in any career. Whether you work in finance, marketing, tech, design, or anything else, we need to visualize data. That fact showcases the importance of data visualization. Its main goal is to distill large datasets into visual graphics to allow for easy understanding of complex relationships within the data . It is often used interchangeably with terms such as information graphics, statistical graphics, and information visualization. Data visualization is a huge field with many disciplines. It is precisely because of this interdisciplinary nature that the visualization field is full of vitality and opportunities.

Necessity of Data Visualization

According to the World Economic Forum, the world produces 2.6 quintillion bytes of data every day, and 90% of all data has been created in the last two years . With so much data, it's become increasingly difficult to manage andmake sense of it all. It would be impossible for any single person to wade through data line-by-line and see distinct patterns and make observations. Data proliferation can be managed as part of the data science process, which includes data visualization. We need data visualization because a visual summary of information makes it easier to identify patterns and trends than looking through thousands of rows on a spreadsheet. It's the way the human brain works. Since the purpose of data analysis is to gain insights, data is much more valuable when it is visualized. Even if a data analyst can pull insights from data without visualization, it will be more difficult to communicate the meaning without visualization. The charts and graphs make communicating data findings easier even if we are identify the patterns without them. The numerous types of data visualizations for example Line charts, Box plots, Area charts, Sankey diagram, Scatter plots, Bar charts. Population pyramids, Pie charts, Heat maps, Bar chart (actual vs. expected), Tree maps, Histograms, Bubble charts, Chloropleth, Network diagram etc.

Subfields of Data Visualization

Data visualization is the presentation of quantitative information in a graphical form. In other words, data visualizations turn large and small datasets into visuals that are easier for the human brain to understand and process. Data visualizations are surprisingly common in our everyday life, but they often appear in the form of well-known charts and graphs. In terms of business intelligence (BI), these visualizations help users make better data-based decisions. Data visualization transforms raw data into information. The data visualization has three significant subfields.

Scientific Visualization

Scientific visualization is the representation of data graphically to gain understanding and insight into the data. This allows the researcher to gain insight into the system that studied information in ways previously impossible. It is also referred to as visual data analysis . The purpose is to convey the scientific data accurately, reveal underlying structures in data and encourage the exploration of the data. Scientific visualization is an interdisciplinary research andapplication field in science, focusing on the visualization of three-dimensional phenomena, such as architecture,meteorology, medicine or biological systems. Its purpose is to graphically illustrate scientific data, enabling scientists to understand, explain, and collect patterns from the data.

Information Visualization

Information visualization refers to the use of computer-supported, interactive visual representations of numerical and non-numerical abstract data sets in order to amplify human cognition. Information visualization, the art of representing data in a way that it is easy to understand and to manipulate, can help us make sense of information and thus make it useful in our lives. Information visualization is the communication of abstract data through interactive visual interfaces. Graphics such as histograms, trend graphs, flow charts, and tree diagrams all belong to information visualization and the design of these graphics transforms abstract concepts into visual information.

Activity 2: Storing Data in DB & Perform SQL Operations

Creating a schema

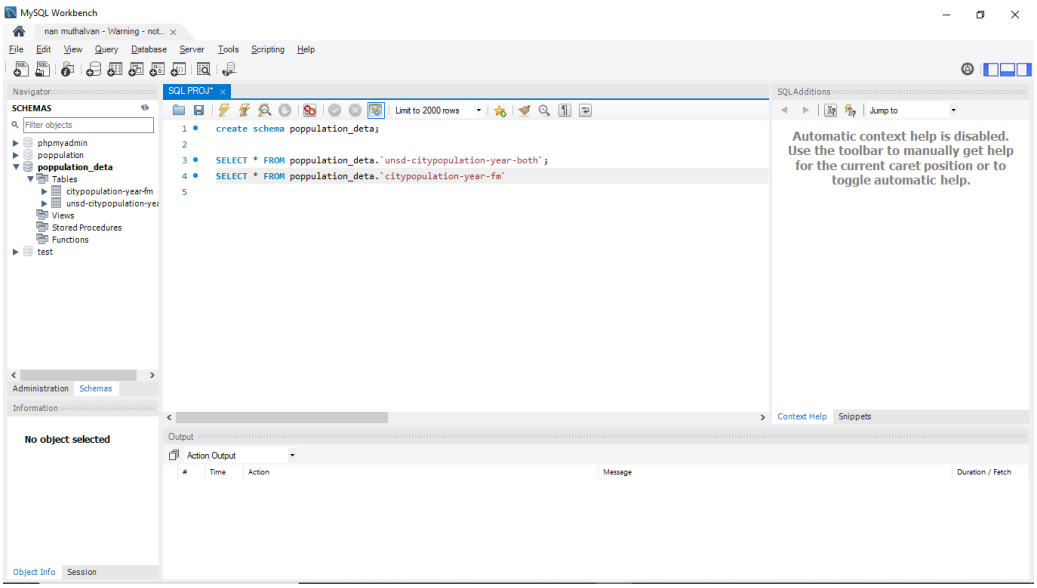
A schema provides a logical grouping of SQL objects. To create a schema, use the CREATE SCHEMA statement. A schema consists of a library, a journal, a journal receiver, a catalog, and optionally, a data dictionary. Tables, views, and system objects (such as programs) can be created, moved, or restored into any system libraries. All system files can be created or moved into an SQL schema if the SQL schema does not contain a data dictionary. If the SQL schema contains a data dictionary then: v Source physical files or non source physical files with one member can be created, moved, or restored into an SQL schema. Logical files cannot be placed in an SQL schema because they cannot be described in the data dictionary.

Creating a table

A table can be visualized as a two-dimensional arrangement of data that consists of rows and columns. To create a table, use the CREATE TABLE statement. The row is the horizontal part containing one or more columns. The column is the vertical part containing one or more rows of data of one data type. All data for a column must be of the same type. A table in SQL is a keyed or non-keyed physical file. You can create a table using the CREATE TABLE statement. You provide a name for the table. If the table name is not a valid system object name, you can use the optional FOR SYSTEM NAME clause to specify a system name. The definition includes the names and attributes of its columns. The definition can include other attributes of the table, such as the primary key

Adding and removing constraints

Constraints can be added to a new table or to an existing table. To add a unique or primary key, a referential constraint, or a check constraint, use the CREATE TABLE or the ALTER TABLE statement. To remove a constraint, use the ALTER TABLE statement.



Activity 3: Connect DB with Tableau

Tableau

Tableau is a data analysis and visualization tool which can connect with many data sources comfortably. The big advantage with Tableau is its ability to create interactive dashboards. These dashboards can be created without much coding knowledge, through visual intuitive drag and drop interface. Tableau has been very popular among organizations due to its ability to translate data into insightful visual dashboard. The Tableau utilizes application integration innovations like JavaScript APIs and single sign-on application to include Tableau analytics into basic business applications consistently. Tableau can create an ample range of visualization to interactively present the data and showcase insights. It comes with tools that allow to drilldown data and see the impact in a visual format that can be easily understood by any individual.

Tableau also comes with real-time data analytics capacity and cloud support. Here we discuss the various versions of tableau, it benefits and implementation. We will see how tableau is various from MS excel and other spreadsheet tools. Tableau is the most strong, safe and flexible end-to-end analytical platform for our information from connection via cooperation. It also enhances data power for people. Tableau is the only business intelligence platform designed for the individual but scaled for business that turns information into an insight which drives action. Tableau can manage millions of rows of data with ease. Different types of visualization can be created by the large amount of data without having another performance of the dashboards. Also, there is an option in Tableau where user can make live two connections to different data sources like SQL etc. There are, any different types of visualization options available in tableau which egregious the user experience. Lastly, Tableau is very easy to learn, anyone without having any knowledge of coding can easily learn Tableau.

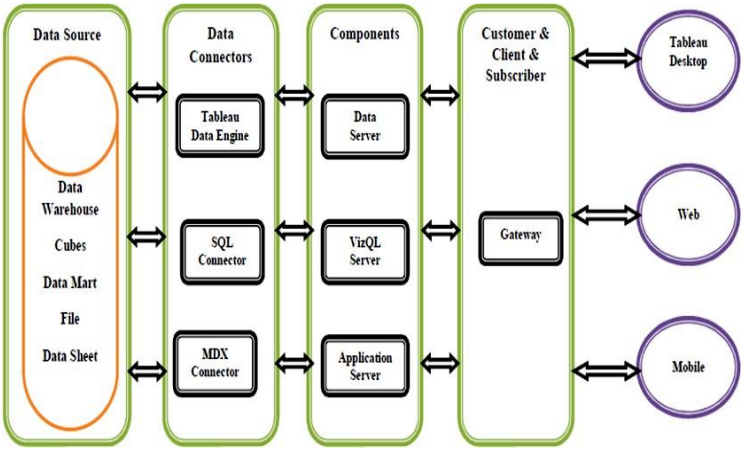
Tableau Desktop

Tableau Desktop is similar to Tableau Public with the difference being you can load the worksheet in our system. It is a licensed version with two weeks of trail. We are enjoy real-time data analytics by directly connecting to data from your data warehouse. We are easily import our data into Tableau's data

engine from multiple sources and integrate them by combining multiple views in an interactive dashboard. Tableau desktop produces files with extensions twb and twbx. Tableau desktop users can make use of server & online for a high-performance data repository.

Tableau Server

In Tableau Server Users can interact with the dashboards on the server without any installation on their machines. Tableau Online is Tableau Server hosted by Tableau on a cloud platform. Tableau Online is a fully hosted solution, organizations don't have to spend resources on configuring hardware, scalability or maintenance. Tableau server also provides robust security to the dashboards. Tableau Server web-edit feature allows authorized users to downloadand edit the dashboards. Tableau server allows users to publish and share their data sources as live connections or extracts. Tableau Server is highly secured for visualizing data. It leverages fast databases through live connections.



The Tableau Architecture

Tableau Data Connectors Process

The data connectors provide an interface to connect external data sources to Tableau Data Server. Tableau has in-builtODBC/SQL connector. This ODBC connector can connect to any databases without using their native connector. Tableau has an option to select both live and extract data. Tableau includes various connectors for databases, for example, Microsoft Excel, SQL Server, Oracle, Teradata, Vertica, Cloudera Hadoop, and significantly more. Tableau provides you with two options for storing this transferred data. Firstly, the real time data in this method we are transfer data directlyfrom an external source in this method.

Tableau sends SQL statements and multi-dimensional expressions for transferring data. The secondly option extracted data in this method apart from relying on a live data source, we can retrieve data from a particular source as well. Tableau enables you to create a local copy of the data as an extract file. Tableau's data extraction is capable of extracting millions of records from a data source. The straightforward interface ensures that data extraction doesn't remain complicated for you.

Tableau Application Server Process

The application server is used to provide the authentications and authorizations. It handles the administration and permission for web and mobile interfaces. It assures security by recording each session id on Tableau server. The administrator can configure the default timeout of the session in the

server. The application server handles the web application and REST API calls. The application server also supports browsing and searching. To ensure high availability of application server, configure instances on each node in the Tableau server cluster. It also handles processes related to the VizQL server that isn't concerned with data visualization.

Tableau Backgrounder Process

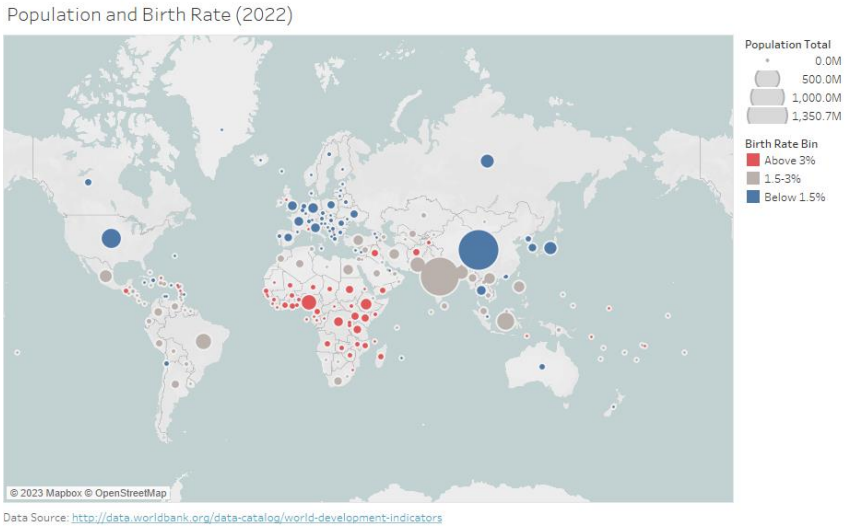
Backgrounder is an essential multi-process, a multi-process element that manages schedules for information refreshing and ensures proper functioning of the Tableau server and data engine. The backgrounder process runs server jobs, including extract refreshes, subscriptions, flow runs, and data driven alerts. Jobs are initiated both from scheduled tasksand when started manually using 'Run Now', REST API, or tabcmd commands. it also helps in rebuilding search indexes, checking available disk space, and synchronizing directory groups.

Tableau Repository Process

The repositories in Tableau server stores server metadata related to users, permissions, assignments, groups, and projects, data sources, and extract metadata and refresh information. Along with the metadata, it stores visualizations in flat files (TWS, TDS), and performance data for auditing. Whenever a server service or component demands for metadata, it is provided from the repository. It also stores the visualizations in the form of flat files. It can also store performance data for future audits. It works with the active directory to send information to the application server for login verification.

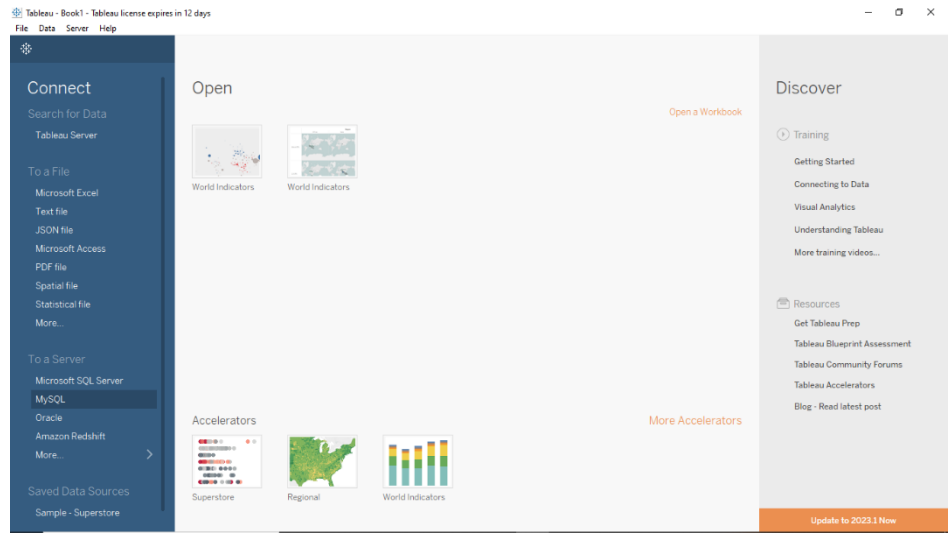
Tableau Server File Store Process

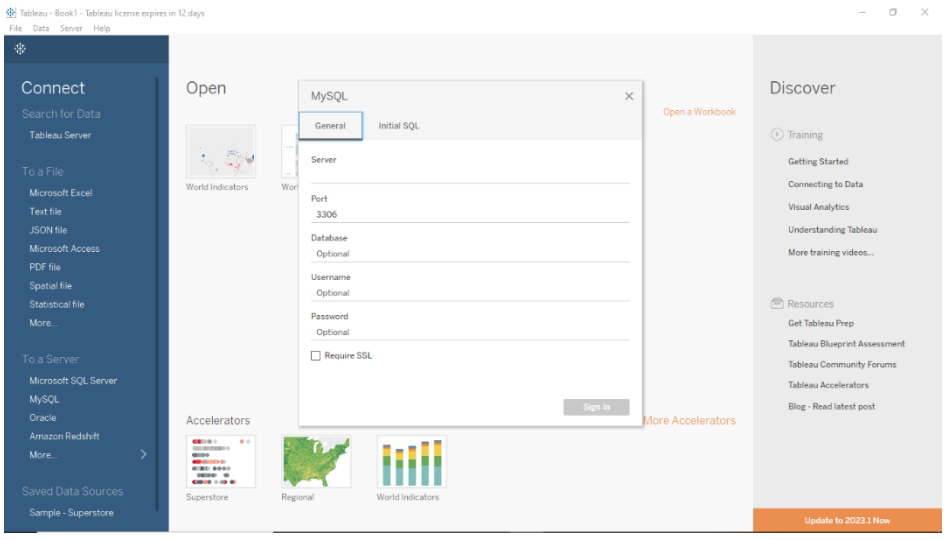
The Tableau server file store process controls the storage of extracts. When file store is installed, an instance of the dataengine is also installed unless the node already has an instance of the data engine. However, file store can be run locally as well as external to Tableau server. In highly available environments, the file store ensures that extracts are synchronized to other file store nodes so they are available if one file store node stops running.



1. How to Connect Our Data in Tableau

When open Tableau you are taken to the home page where you can easily select from previous workbooks, sample workbooks (Tableau Workbook files [twb] are the main file type created by Tableau to save your entire workbook.), and saved data sources. We are also connecting to new data sources by selecting connect to data. Theoption in a file is for connecting to locally stored data or file based data. If your database isn't listed try the other database connector (ODBC) that utilizes the Open Database Connectivity standard. We are seeing a list of saved data sources on the right. Saved data source files (.tds) are found on your computer's hard disk in the data sources directory under the My Tableau repository.





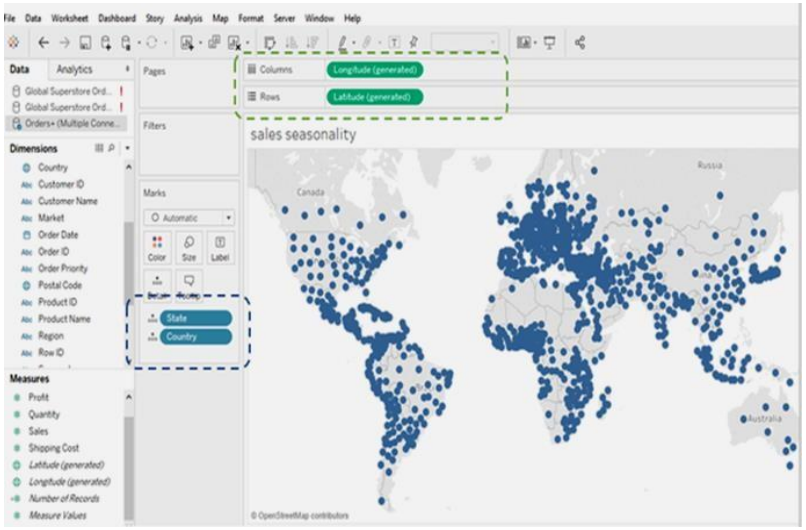
The Connect to Data

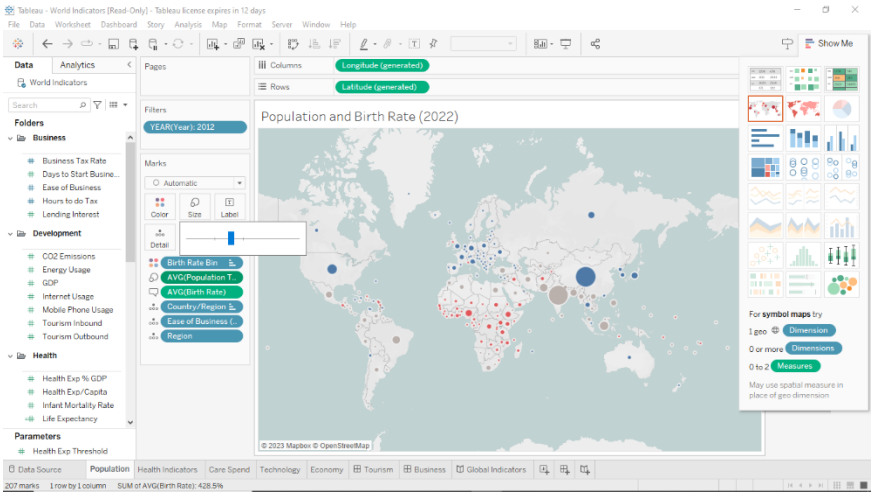
If we are logged into Tableau server you may also see saved data sources on your server's repository. The picture showsthe connection window with the data source being the file that is being

accessed. There are three tabs in the spreadsheet file. Tableau interprets these tabs the same way it views different tables in a database. Once you have selected and customized your data connection, you will be taken to the second data connection window where you must decide whether or not to create an extract. There are advantages to extracting the data into Tableau data engine, particularly when you are using Excel, Access, or text files as your data source.

Tableau Geocoding Process

Suppose our data contains standard geographic fields like country, state, province, city, or postal codes denoted by a small globe icon Tableau will automatically generate the longitude and latitude values for the centre points of each geographic entity displayed in your visualization.





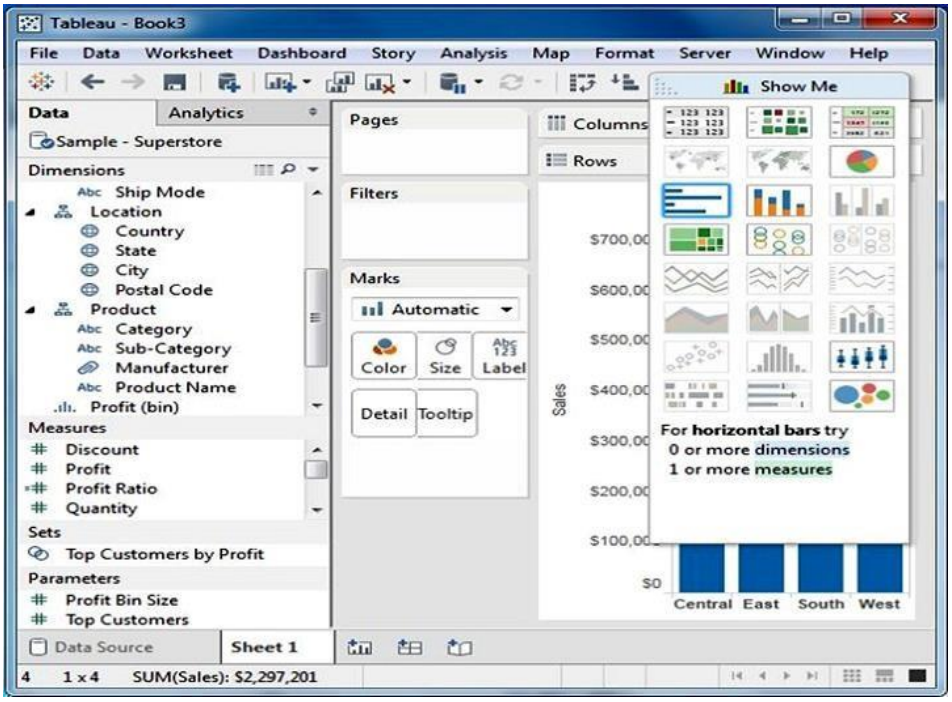
The Longitude & Latitude Generated Measures in Tableau

If for some reason Tableau doesn't recognize a geographic dimension, you can change the geographic role of the field by right-clicking on the field and selecting the appropriate geographic role. picture shows a map created using country, state, and city, then using show me to display the symbol

map. The map option menu seen on the left was exposed from the map menu, map option selection. If Tableau failed to recognize any location, a small gray pill would appear in the lower right of the map. Clicking on that pill would expose a menu that would help you identify and correctthe geocoding.

2. Visualization in Tableau

In this section, we are discussing add trend lines, reference lines, and control the way your data is sorted and filtered. Tableau's mission statement is to help you see and understand your data by enabling self-service visual analytics. The software is designed to facilitate analysis for non-technical information consumers.

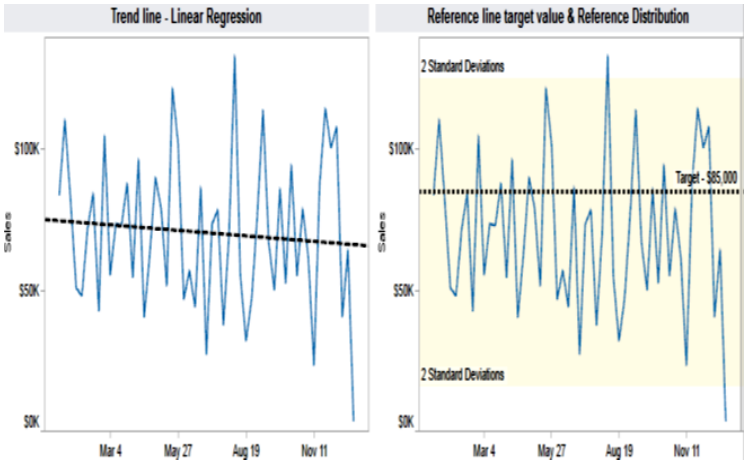


Show Me Displays Chart Options

This is the concept behind Tableau's show me button. Show me to be your expert helper. Show me tells you what chart to use and why. It will also help we create complicated visualizations faster and with less effort. Show me looks at the combination of measures and dimensions we are selected and interprets what chart types displaythe data most effectively. At the bottom of the show me area you also see additional details regarding requirements needed for building any available chart. The time series chart requires one date, one measure, and zero or more dimensions. Pointing at other chart options in the Show Me menu changes the text at the bottom of the menu. This textprovides guidance on the combination of data elements required for the chart being considered. Clicking on any of the highlighted show me icons alters the visualization in the worksheet.

Trend Lines and Reference Lines in Tableau

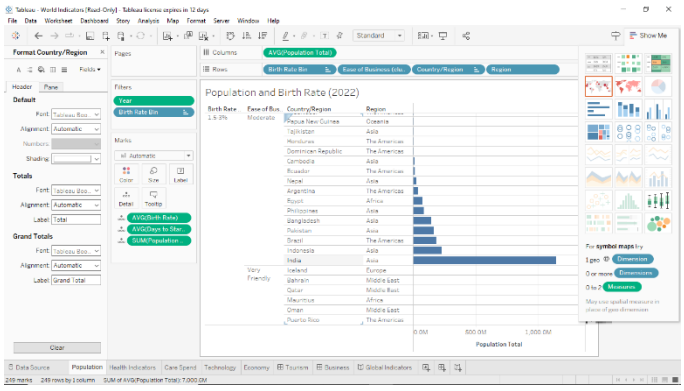
Trend lines are considered to be of great use in data visualization and analysis. In Tableau, we get a lot of options to create different types of trend lines which helps in inferring important patterns and trends in our data. In visualizing granular data sometimes results in random-looking plots. Trend lines help you interpret the data by fitting a straight or curved line that best represents the pattern contained within detailed data plots. Reference lines provide visual comparisons to benchmark figures, constants, or calculated values that provide insight into marks that don't conform to expected or desired values. Trend lines help you see patterns in data that are not apparent whenlooking at your chart of the source data by drawing a line that best fits the values in view. Reference lines allow you to compare the actual plot against targets or to create statistical analyses of the deviation contained in the plot; or the range of values based on fixed or calculated numbers.



Trend Line and Reference Line

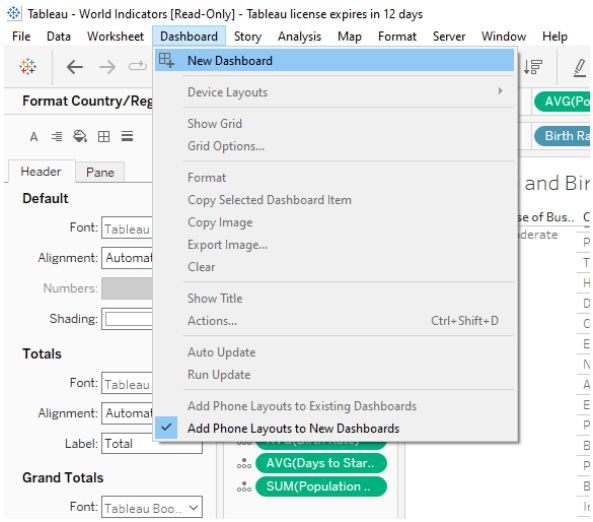
Sorting Data in Tableau

Tableau provides basic and advanced sorting methods that are easily accessed through icons or menus. The most basicway to sort is via the icons that appear in the toolbar menu. The toolbar menu sort icons provide ascending and descending sorts. In a bar chart in which a manual sort was applied from the toolbar icon. Tableau also provides sorting icons near the headings and mark axis. If we don't see an icon, hover your mouse near the area and it will appear. The clicking on the sort icon floating over the right side of the sub-category heading provides ascending and descending sorts using the text of the product category headings. The sort icons that appear over and under the mark (bar) axis provide ascending and descending sorts based on the values displayed by the marks, and also add data source order sorting.



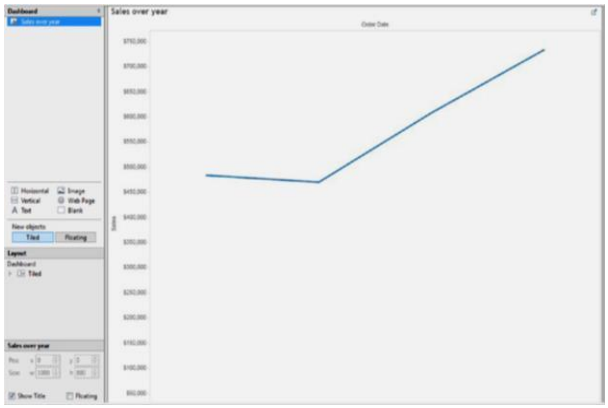
3. Dashboard and Stories in Tableau

First of all question arises why use a dashboard in tableau because dashboard helps one to show several worksheets in a single space. In addition to this, one can provide supporting information, compare and monitor varieties of data simultaneously. A dashboard is a visual display of the most important information needed to achieve one or more objectives that fits entirely on a single computer screen, so that it can be viewed, monitored and managed at a glance. In other words, we can say that a dashboard is a user interface that organizes and presents information in a way that is easy to read.



The New Dashboard in Tableau

It consolidates and arranges numbers, metrics and sometimes performance scorecards on a single screen. We are seeing the dashboard tab at the bottom of the workbook similar to the worksheet tab. We are adding views from your workbook to the dashboard. You can add web pages, images and text areas to our dashboard as well. A dashboard allows you to format, edit, drill-down, and edit axes on our view. When add a view to the dashboard , it automatically connects to the corresponding worksheet. When modify the worksheet, the dashboard is updated automatically and vice-versa. One or more views & worksheets can be pulled into a dashboard. We are add interactivity to the dashboard and can do much more. We are creating a dashboard in the same way you create a new worksheet. After creating a new dashboard sheet, we are adding one or more views and objects to the dashboard. Firstly select dashboard for new dashboard. Alternatively, we are click on the “New dashboard” tab at the bottom of the workbook and click on “Dashboard” to open the dashboard.



Dashboard Actions in Tableau

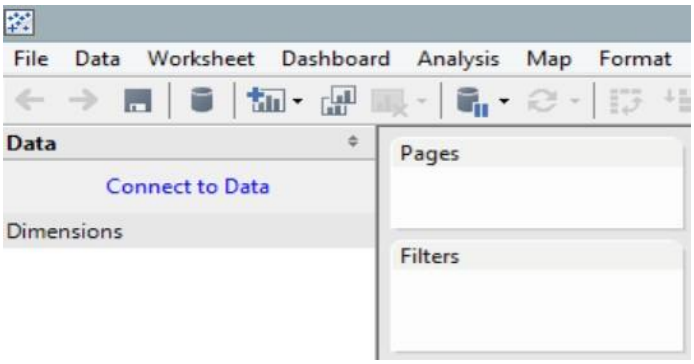
Tableau allows you to add interactivity to the dashboard using actions. With the help of actions, we can use data in oneview to filter data in another view, to link external web pages, to highlight specific results. There are three types of actions in Tableau. Firstly, filter actions are defined by a source sheet that passes one or more dimensional values as filters to target sheets upon an action. Secondly, highlight actions allow you to call attention to marks of interest by coloring specific marks and dimming all others. Thirdly, URL actions allow you to generate dynamically a URL based onan action and open it within a web object in the dashboard or in a new browser window or a tab.

Creating a Story in Tableau

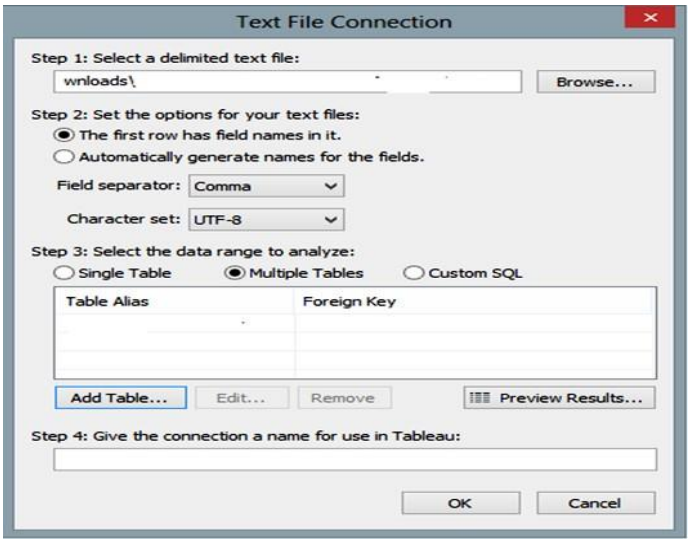
A story is a sheet or a collection of worksheets arranged in sequence. Each individual sheet in a storyis known as story point. In Tableau, stories are not just a collection of static sheets. We are making your story points remain connected to the underlying data to reflect data changes. We are us stories in different ways. Firstly, we can assemble the sequence sheet to perform what-if analysis. Secondly, we can use stories to present history of views or dashboards to audience.

4. Using Dashboards to get Outcomes in Tableau

The dashboards are more than visual tools to display data and dashboards are used as decision making tools to obtain outcomes quickly. We are helping our population growth researcher to make decisions fast by producing dashboards that are inline with the current research and thinking about dashboard structure. We are also help researcher get results from their dashboard by improving the availability of growth of population data. Using dashboards facilitating the researcher to explore and understand the data speedily and sharing information with analysis team members and beyond. Providing adaptability in the dashboard and allowing flexibility for population growth researcher to add notes to their dashboard. On the initial Tableau page, select connect to data and navigate to the location where you stored the data files.



Connect to Data and Navigate in Tableau



Text File Connection in Tableau

5. Data Items and Calculated Fields in Tableau

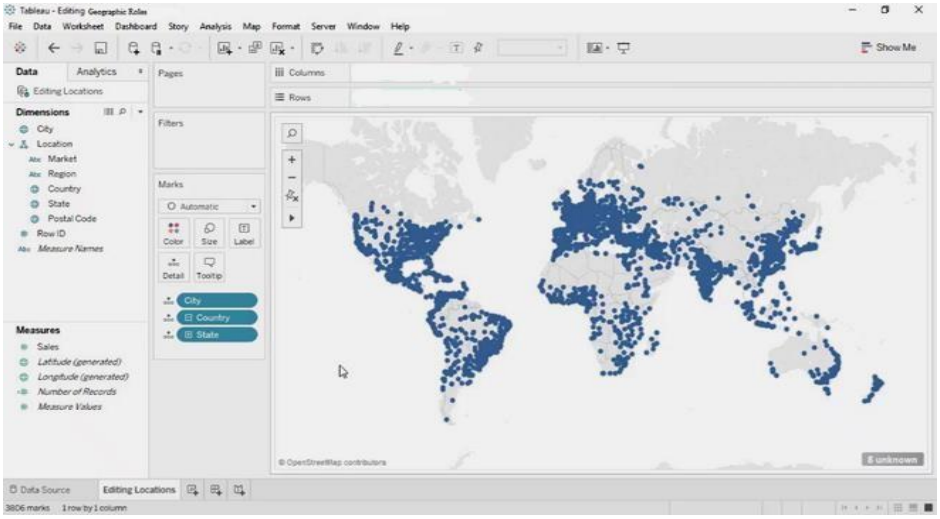
The item names are based on the names in your selected data source. Within Tableau, We are renaming items to make them relevant for our audience. Tableau offers five types of data items Number, Date & time, Date, String, and Boolean. By default, when Tableau connects to our data, it determines which type is the best match for a data item using the data source information and rules around data types. It is important to note that items will behave differently in our views based on the data type. Usually, we only will need to modify data types when using Access, Excel, or text files as data sources. Relational and multidimensional databases are usually preformatted so that Tableau can select the correct data types when we open them.

Dimensions and Measures in Tableau

In Tableau, dimensions and measures are the primary means of grouping data items in the data Items pane. Tableau treats any field containing qualitative or categorical information as a dimension. In general, dimensions are items usedto create row or column headers in a view. Thereunto, Tableau treats any field containing numeric information as a measure. Measures typically produce axes when added to the rows or columns shelves. Measures are computed using the specified aggregation for each unique combination of row and column dimensions used in the view.

Geographic Roles in Tableau

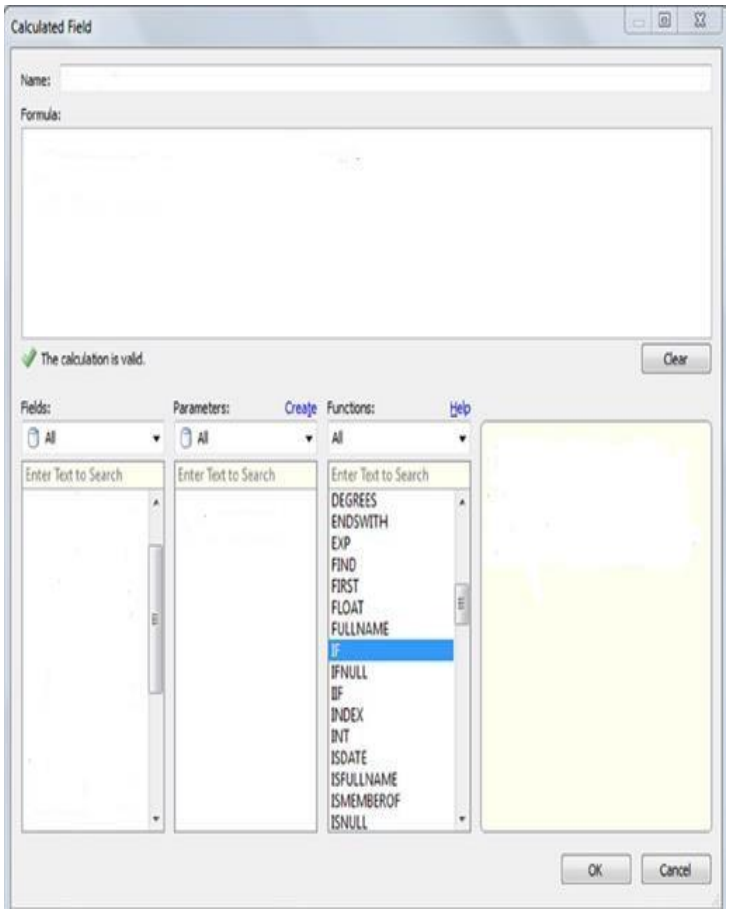
Tableau offers exciting mapping capabilities to overlay our data onto relevant maps. Tableau automatically assigns a geographic role to data items that have certain name and data types assigned to them. All other items have a default geographic role of none. Additionally, we are adding our own geographic roles to extend the capabilities of Tableau, such as the location of our stores based on store identifier. If Tableau does not properly identify our geographic item, we are changing this role by right-clicking the item, selecting Geographic Role, and choosing the proper geographic role from the list. Once our data item is assigned a geographic role, it is distinguished with a small globe icon. Our dataset may have some miscoded items that Tableau cannot map.



Geographic Roles in Tableau

Calculated Fields in Tableau

In Tableau the many functions available organized in a table for easy lookup, and parameters that allow you to quickly fine tune the data we use in our analyses. Sometimes ours analysis needs a data item that our original data source does not include but that oneself could calculate using the current data items. This is called a calculated field. For example, you might need a new data item called population ratio, the ratio of the total confirmed cases. To create a new calculated field, right-click an existing data item that you want to include in the calculation and select create calculated field. The calculated field dialog will appear as shown below. This dialog also was shown earlier in the custom table calculation section.

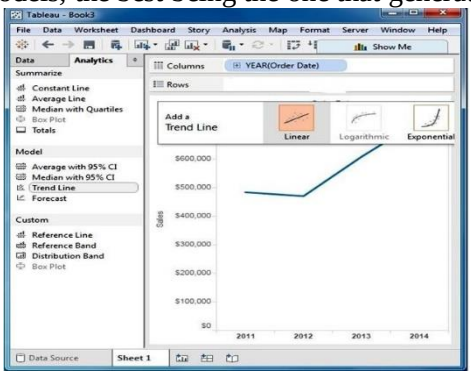


Calculated Field dialog in Tableau

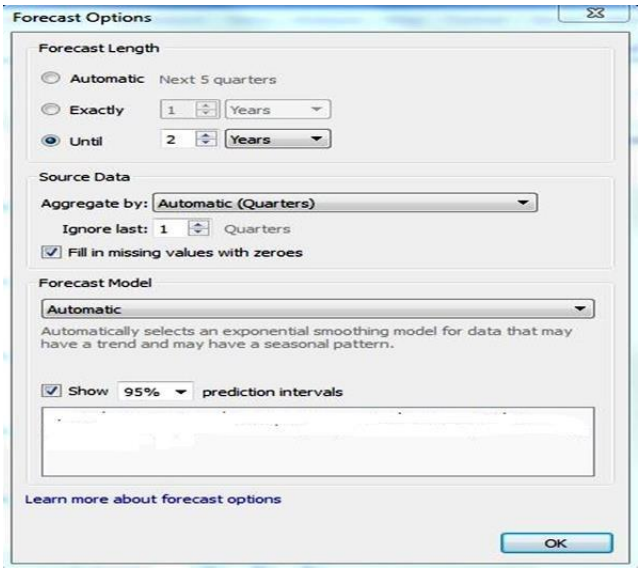
From the calculated field dialog, we can name the new calculated field, enter the formula for the new field, and add data items from the field's pane, create and use parameters, and find functions by category and add them to the formula. Weare covert the outcome of any calculation to a specific data type. The conversion functions are DATE, DATETIME, INT, STR, and FLOAT.

6. Forecasting in Tableau

Forecasting in Tableau uses a technique known as exponential smoothing. Forecast algorithms try to find a regular pattern in measures that can be continued into the future. Tableau automatically selects the best ofup to eight models, the best being the one that generates the highest quality forecast.



The smoothing parameters of each model are optimized before Tableau assesses forecast quality. The optimizationmethod is global. Therefore, choosing locally optimal smoothing parameters that are not also globally optimal is not impossible. There are two important concepts on which the process of forecasting is based trends and seasonality. Thetrend is the increase or decrease in data over time and seasonality is a repeating variation in values over a determined period of time (such as weekly, quarterly, yearly, etc) known as seasons.



Forecasting Options in Tableau

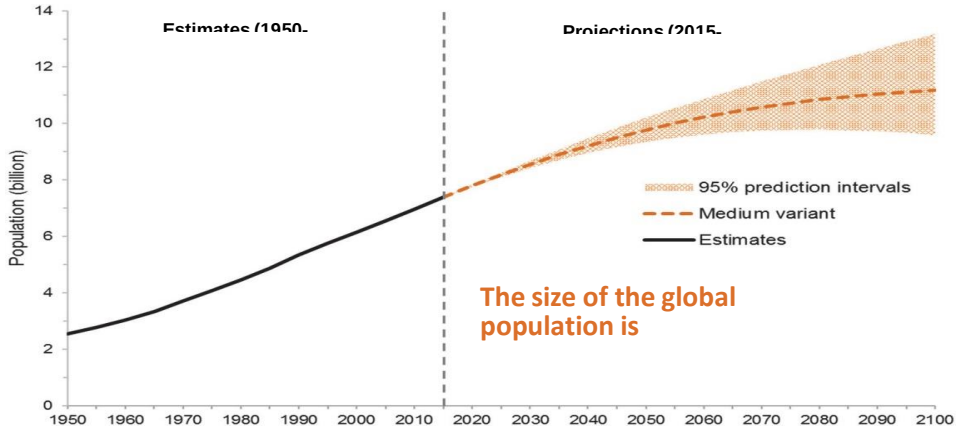
Usually, Tableau considers variations occurring in a 12-months cycle to predict a forecast as the time values are in a yearly manner. If the data values are given on a 6-months basis, a 12-month trend is determined with two sub-trends underlying it.

Forecast. The first step, add a date dimension in the columns section and a measure field in the rows section. This will give us a simple line chart. Now, go to the analytics pane and select forecast from the available model list. To exploremore options related to forecasting shown in picture, right-click on the forecasting section and go to Forecast optionand select forecast options . We are view a detailed description of the forecast by right-clicking on the forecast section and then go to Forecast and select the option describe forecast.

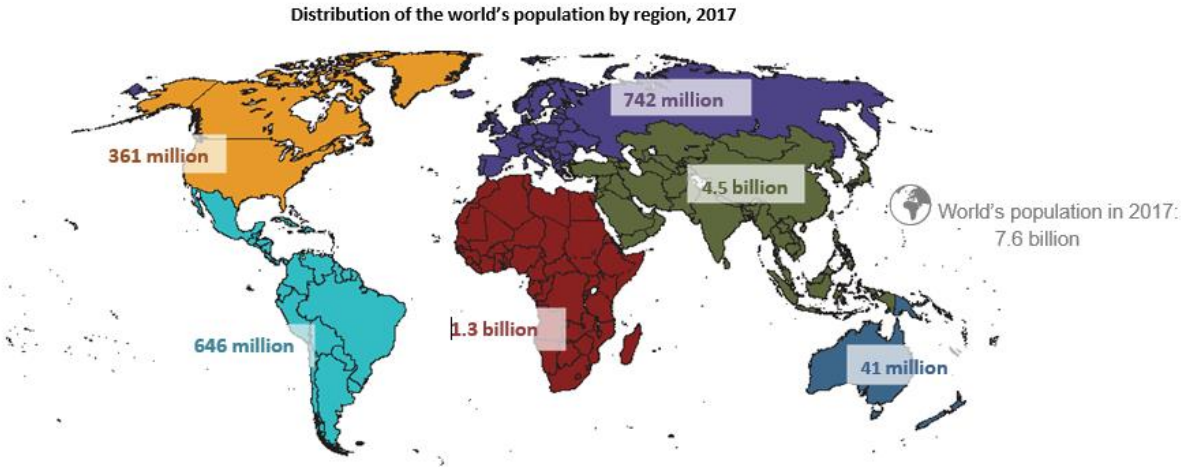
Milestone 3: Data Preparation

ACTIVITY - 1

According to the results of the *2017 Revision*, the world's population numbered nearly 7.6 billion as of mid-2017, implying that the world has added approximately one billion people over the last twelve years. The growth of the world's population has slowed down in the recent past. Ten years ago, the world's population was growing by 1.24 per cent per year; today, it is growing by 1.10 per cent per year, yielding an additional 83 million people annually. Based on the projection assumptions made in the *2017 Revision*, the growth of the world's population is expected to slow down even further in the future, and the population is projected to reach about billion in 2030. As the projection horizon extends, the projection results become increasingly uncertain. In this *Revision*, projection uncertainties are expressed using prediction intervals around the medium variant projection. With a certainty of 95 percent,the size of the global population will stand between 8.4 and 8.7 billion in 2030, between 9.4 and 10.2 billion in 2050, and between 9.6 and 13.2billion in 2100. Although a continued increase of the global population is considered the most likely outcome, there is roughly a 27 per cent chancethat the world's population could stabilize or evenbegin to fall sometime before 2100.



The world's regions vary considerably in population size and density



Asia and Africa, the most populous regions of the world, account for morethan three-quarters of the global population. Asia alone holds almost 60per cent of the global population and includes the two most populouscountries of the world, China (1.4 billion) and India (1.3 billion). It is also the region with the highest population density in the world. Africa and Europe are home to 17 per cent and 10 per cent of today's global dwellers,respectively, followed by Latin America and the Caribbean (9 per cent). The two least populous regions, Northern America and Oceania, are together home to only 5 per cent of the world's population and also havethe lowest population densities.

Based on the medium-variant projection, the world's population is expected to increase by 2.2 billion people between 2017 and 2050, reaching 9.8 billion people in 2050. It is expected that half of the population growth will occur in Africa. Asia is expected to be the second largestcontributor to this future growth, adding just over 750 million people during the same span. Africa and Asia will befollowed by Latin America and the Caribbean, Northern America and Oceania, where growth is projected to be much more modest. Europe is the only region projected tohave a smaller population in 2050 than in 2017. Beyond2050, Africa will be the main contributor to global population growth.

Ten countries with the largest populations, 2017 and 2050

Based on the medium-variant projection, the world's population is expected to increase by 2.2 billion peoplebetween 2017 and 2050, reaching 9.8 billion people in 2050. It is expected that half of the population growth willoccur in Africa. Asia is expected to be the second largestcontributor to this future growth, adding just over 750 million people during the same span. Africa and Asia will befollowed by Latin America and the Caribbean, Northern America and Oceania, where growth is projected to be much more modest. Europe is the only region projected tohave a smaller population in 2050 than in 2017. Beyond2050, Africa will be the main contributor to global population growth.

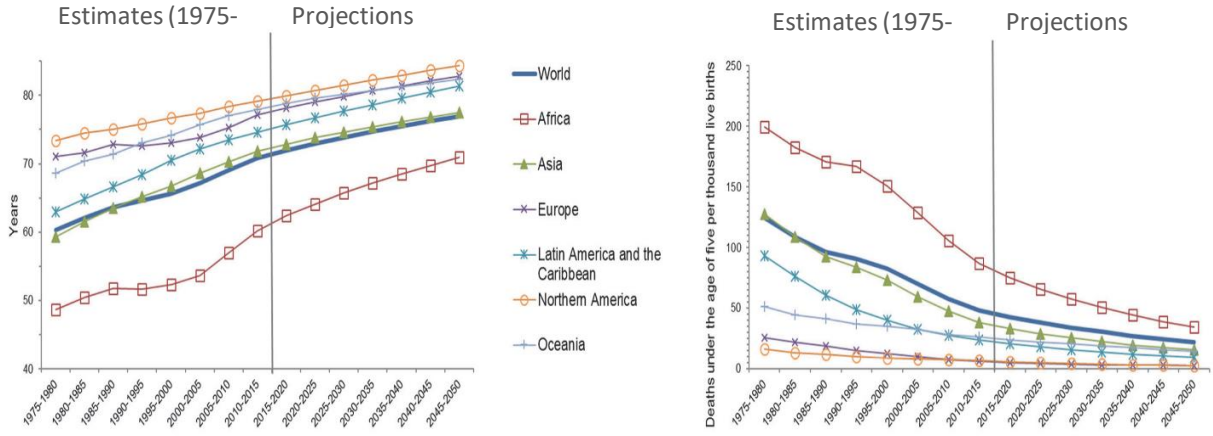
Among the ten most populous countries of the world today,one is in Africa (Nigeria), five are in Asia (Bangladesh, China,India, Indonesia, and Pakistan), two are in Latin America(Brazil and Mexico), one is in Northern America (UnitedStates of America), and one is in Europe (the Russian Federation). Amongst these, Nigeria's population, currentlythe seventh largest in the world, is growing the most rapidlyand is projected to surpass that of the United States shortlybefore 2050. In 2050, the populations in six of the ten largest countries are expected to exceed 300 million:

China,India, Indonesia, Nigeria, Pakistan, and United States of America (in alphabetical order).

Rank	Country	2017 population (millions)	Country	2050 population (millions)
1	China	1 410	India	1 659
2	India	1 339	China	1 364
3	United States of America	324	Nigeria	411
4	Indonesia	264	United States of America	390
5	Brazil	209	Indonesia	322
6	Pakistan	197	Pakistan	307
7	Nigeria	191	Brazil	233
8	Bangladesh	165	Bangladesh	202
9	Russian Federation	144	Dem. Rep. of the Congo	197
10	Mexico	129	Ethiopia	191

Survival prospects are improving across the world, but differences remain

Significant gains in reducing mortality have been achieved in recent years. Globally, life expectancy at birth rose by about 4 years between 2000-2005 and 2010-2015, from 67 to 71 years. Despite these gains, large inequalities in life expectancy persist between poorer and richer areas of the world. Life expectancy in Africa stood at 60 years in 2010-2015, compared to 79 years in Northern America. Life expectancy now exceeds 80 years in some high-income countries, whereas for several African countries it remains below 60 years. Globally, life expectancy is projected to rise to 77 years in 2045-2050, and eventually to 83 years in 2095-2100. In some parts of the world, the gains in life expectancy at birth are primarily driven by improved survival at young ages, particularly between birth and age 5. Between 2000-2005 and 2010-2015, deaths among children under age 5 fell from an estimated 70 to 48 per 1,000 live births, or about 30 per cent in one decade. Absolute declines were especially large in Sub-Saharan Africa (from 141 to 95 per 1,000) and in the least developed countries (from 123 to 83 per 1,000).



The reduction of under-five mortality has received intensive global attention as part of Millennium Development Goal 4 and Sustainable Development Goal 3. The 2030 Agenda for Sustainable Development calls for ending preventable deaths of newborns and of all children under 5 years of age, with all countries aiming to reduce under-five mortality to no more than 25 deaths per 1,000 live

Shifts in fertility and mortality are reshaping population age distributions

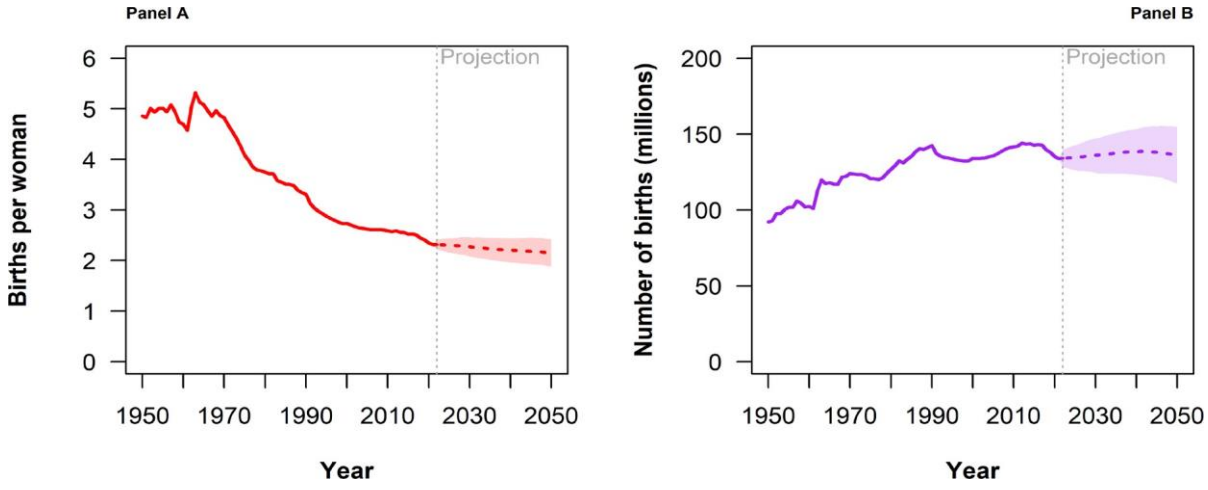
As fertility declines and life expectancy rises, the proportion of the population at older ages rises as well. This phenomenon, known as population ageing, is occurring throughout the world. Populations in many regions are still comparatively young. In Africa, children under age 15 account for 41 per cent of the population in 2017 and young persons aged 15 to 24 account for an additional 19 per cent. Latin America and the Caribbean, and Asia, which have experienced greater declines in fertility, have smaller percentages of children (25 and 24 per cent, respectively) but similar percentages of youth (17 and 16 per cent, respectively). In total, these three regions are home to 1.8 billion children and 1.1 billion young persons in 2017. The population aged 60 or over is growing faster than all younger age groups. Currently, Europe has the greatest percentage of population aged 60 or over (25 per cent).

Trends in fertility, mortality and international migration

Trends in population size and age structure are shaped mostly by levels of fertility and mortality, which havedeclined almost universally around the globe. In some countries, international migration also has become an important determinant of population change.

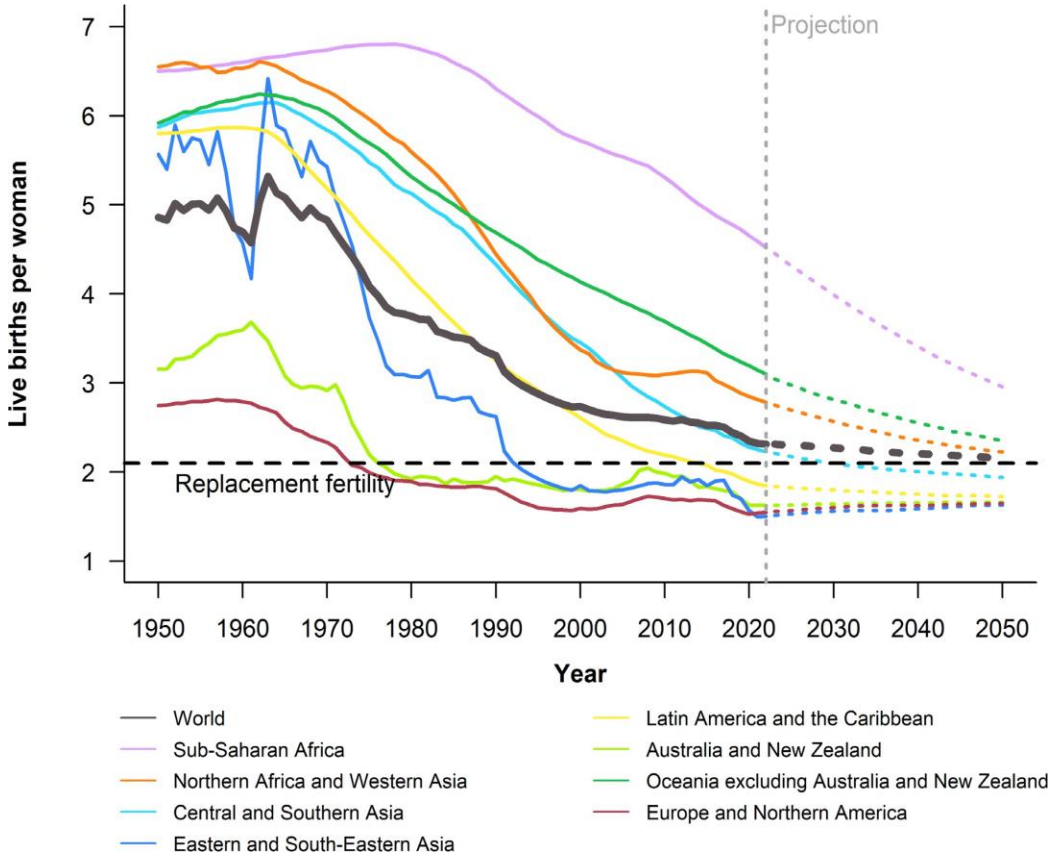
The fertility level, or the average number of births per woman over a lifetime, has fallen markedly over recent decades in many countries. Two-thirds of all people globally live in a country or area where fertility is below 2.1 births per woman, which is roughly the level required for populations with low mortality to stabilize in the long run. In 2021, the average global fertility rate stood at 2.3 births per woman, falling fromabout 5 births per woman in the mid-twentieth century (figure II.1, Panel A). According to the assumptionsabout future fertility made in the United Nations projections (box III.1), by 2050, the average global fertilityrate is expected to have declined to 2.1. To be more precise, with a probability of 95 per cent, global total fertility in 2050 is expected to lie between 1.88 and 2.42 births per woman (figure II. 1, shaded area aroundthe projected trend).

Global total fertility rate (Panel A) and number of births (Panel B): estimates, 1950-2021, and medium scenario with 95 per cent prediction intervals, 2022-2050



Despite the continuing decline in the average number of births per woman, the total annual number of births has remained stable at around 140 million since the late 1980s due to the youthful age distribution of the global population. The number of births has approached 140 million per year in the late 1980s, whenthe large cohorts of the earlier “baby boom” of the 1950s and 1960s were having their children (figure II.1,Panel B). In 2021, 134 million babies were born worldwide. In the future, the number of newborns is expected to slightly increase to reach 138 million annually between 2040 and 2045, despite the continuousdecline in the average number of births per woman. Because uncertainty around the number of births is cumulative —i.e., each birth cohort will potentially become the parents of future generations—the plausibleor likely range for future numbers of births is relatively wide: with a probability of 95 per cent, the size of theglobal birth cohort in 2050 will lie between 118 and 155 million.

In 2021, most births worldwide occurred in the two most populous regions—Central and Southern Asia (28 per cent of global births) and Eastern and South-Eastern Asia (18 per cent)—and in sub-Saharan Africa(29 per cent), the region with the highest fertility level. There is a wide variation in fertility levels across regions and countries (figure II.2, table II.1). In addition to sub-Saharan Africa (4.6 births per woman), fertility remained above the world’s average in 2021 in Oceania excluding Australia and New Zealand (3.1),Northern Africa and Western Asia (2.8), and Central and Southern Asia (2.3).



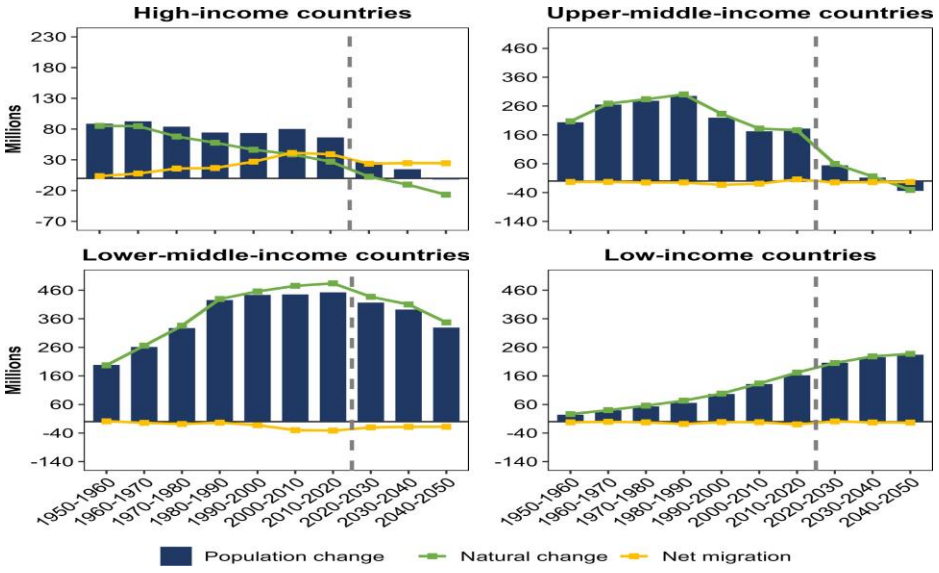
	Life expectancy at birth (years)								
	1990			2021			2050		
Region	Males	Females	Both sexes	Males	Females	Both sexes	Males	Females	Both sexes
World	**61.5**	**66.5**	**64.0**	**68.4**	**73.8**	**71.0**	**74.8**	**79.8**	**77.2**
Sub-Saharan Africa	47.3	51.2	49.2	57.8	61.6	59.7	64.3	69.1	66.7
Northern Africa and Western Asia	61.7	67.0	64.3	69.7	74.8	72.1	76.0	80.8	78.3
Central and Southern Asia	58.1	59.9	58.9	65.9	69.6	67.7	74.9	79.4	77.1
Eastern and South-Eastern Asia	65.6	70.7	68.1	73.6	79.6	76.5	79.4	84.1	81.7
Latin America and the Caribbean	64.6	70.9	67.7	68.8	75.8	72.2	78.1	83.1	80.6
Australia/New Zealand	73.7	79.8	76.8	82.7	85.6	84.2	85.4	88.6	87.0
Oceania*	60.3	65.5	62.5	64.6	70.1	67.1	68.4	74.9	71.6
Europe and Northern America	69.7	77.4	73.6	73.9	80.4	77.2	81.6	86.1	83.8
Least developed countries	48.7	51.6	50.1	61.7	66.5	64.1	67.8	73.5	70.6
Landlocked developing Countries	49.0	53.5	51.2	61.0	66.5	63.7	67.4	73.4	70.3
Small island developing States	63.4	67.9	65.6	68.0	73.9	70.8	74.1	80.0	77.0

Elsewhere, the total fertility rate has fallen below 2 births per women and has been fluctuating in recent years, typically between 1.5 and 2 births per woman. Today, such countries are home to two thirds of the world's population. Most countries in Europe and Northern America, as well as Australia and New Zealand,have experienced persistent low levels of fertility since the late 1970s, with several countries falling at leasttemporarily below 1.4 births per woman. In some of these countries, fertility, after increasing in recent decades, has slightly declined in the most recent years.

A large portion of the gap between countries with the lowest and highest levels of life expectancy at birth isattributable to disparities in the under-five mortality rate, which represents the probability of dying betweenbirth and age 5. Progress in reducing under-five mortality has been substantial and far-reaching in recent years, yet gaps remain. Globally, the under-five mortality rate fell from 92.8 deaths per 1,000 live births in1990 to 37.1 in 2021. Still, a child born in sub-Saharan Africa in 2021 is 20 times as likely to die before his or her fifth birthday as a child born in Australia and New Zealand.

Life expectancy at age 65 reflects the average number of additional years of life a 65-year-old person wouldlive, according to the prevailing mortality conditions. Before the outbreak of the, in 2019, people who had already survived to age 65, could expect to live on average an additional 17.5 yearsworldwide, 6.2 years longer than a person of the same age in the early 1950s. In 2019, women aged 65 yearscould expect to live an additional 18.8 years and 65-year-old men an additional 15.9 years.

Contributions to total population change of the balance of births over deaths and of immigration overemigration, by income group, from 1950-1960 to 2040-2050



Milestone 4: Data visualization

Data visualization

Data visualization is an intuitive way for users to easily read and understand data, especially in big data analyses. Ithelps to improve the quality of policies or services by presenting an integrated view and evidence for making healthcare decisions [1,2]. Tableau connects users with a variety of data sources and enables them to create data visualizations by making charts, maps, dashboards, and stories through a simple drag and drop interface. Although Tableau has received some attention in the healthcare field [3], Tableau is still not widely used in the healthcare industry. Therefore, this paper introduces Tableau and presents the procedure of using Tableau for the interactive visualization and analysis ofCovid-19 data to encourage its widespread use.

Methods

1. Installing Tableau Tableau provides three versions of Tableau Desktop . The Public version is free but thePersonal and Professional versions are available with a fee or free 14-day trial. However,

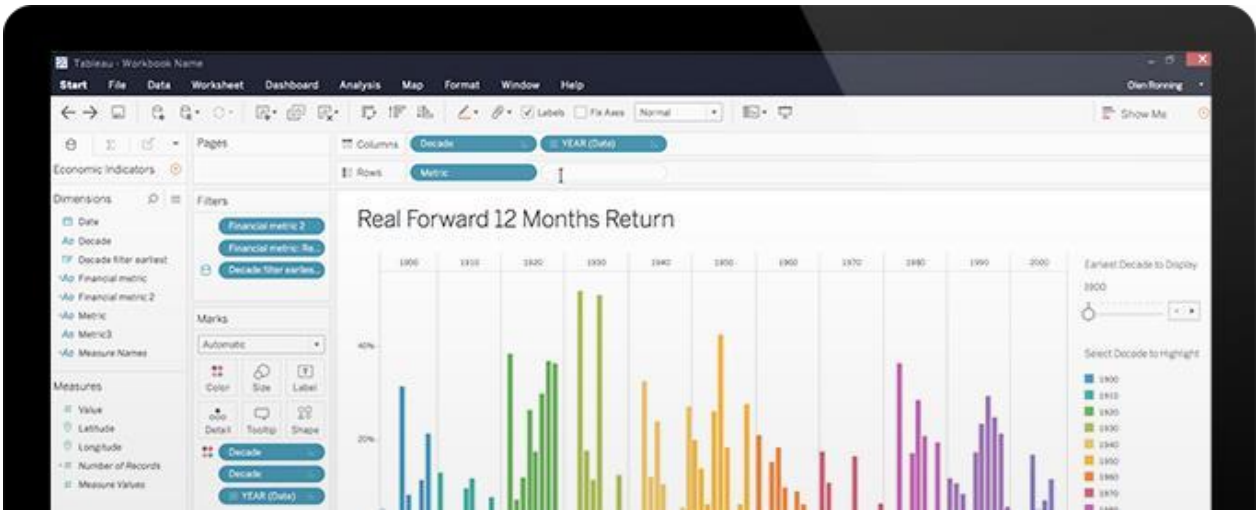
Tableau provides a 1-year free product key with support for students and instructors in

academic programs. This tutorial reflects the Tableau Desktop Personal version 10.3 (64-bit).To install Tableau, an e-mail address is required for the user to set up an account. Downloads can be accessed through the addresses. The user enters the e-mail address and clicks the 'Download' button. Then a download will be begin automatically. The 32- bit and Mac versions can be downloaded via the link "Need a different version?" If the user uses 32-bit OS, it can be downloaded with 32-bit version automatically. When the user runs a downloaded file, user agreement to the terms and conditions is required before installation. The user must confirm that agreement is checked and click the installation button. Installation will proceed and Tableau will be run automatically. When a Tableau activation window pops up, the user can click a trial or product key buttons. This procedure description is for a trial of TableauDesktop. To download a free product, Tableau Public, the user can click the 'Download' button of the Public version. The download and installation process is the same as that for the Tableau Personal version. To obtain a 1-year free product key, the user can apply for the Academic Programs supported by Tableau .Procedures can be followed by accessing the pertinent points (i.e., students, instructors, and administration). For example, a user who has access to students should click on the 'GET TABLEAU FOR FREE' button to enter his orher user information on the entry screen. One can receive a 1-year free product key by sending roof papers by emailaccording to the procedure shown in Tableau.

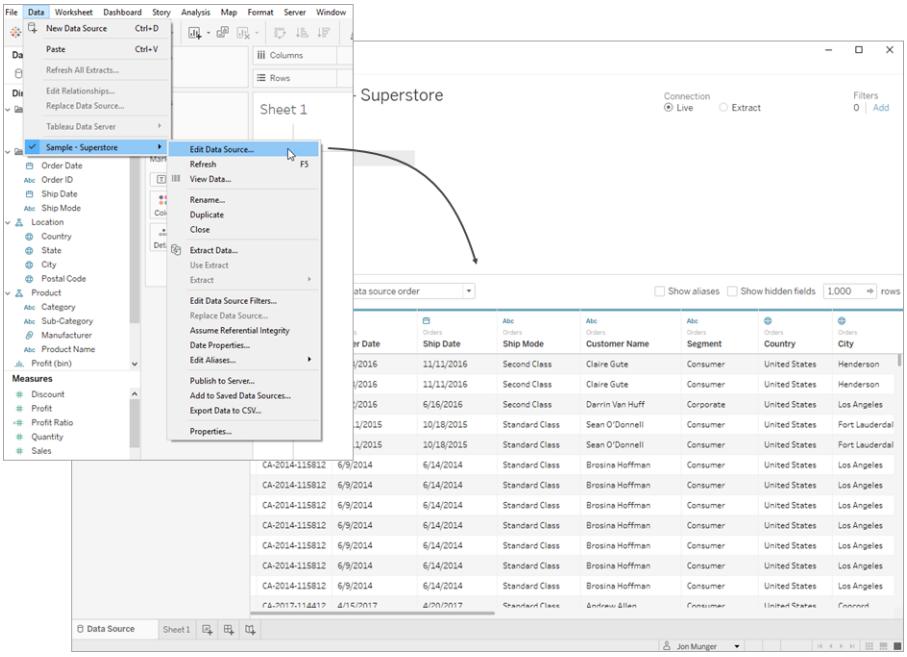
II. Connecting to Sample Data

The sample in this example procedure description includes the four attributes of Covid-19 data like Active cases, Conformed cases, Death cases, Discharge cases s from indiagov.in claims during the pandemic crisis of 2020,provided by the Indian Government. Once the data is ready, various files (Excel, text, Access, and so on) and a server (MS SQL, MySQL,etc.) can be connected via the Connections section to the left of the Tableau window. This sample is Excel formatted data, so Excel is selected to import the data. The attached datasets appear in the upper left corner, and the sheets are listed at the bottom of the datasets. These consist of four attributes. If the Activecases sheet is selected and dragged to the 'Drag sheets here' section, the Active cases sheet will be added to the section, and the data will be displayed below. To merge the Active and conformed cases sheets, the Conformed cases sheet is dragged to 'Union' as shown on the Active cases sheet. Then, the worksheet is clicked next to the bottom data source to create a new worksheet. The Tableau work space consists of the following items and functions. Menus: files, data, worksheets, dashboards, stories, etc.• Toolbar: undo, redo, swap rows and columns, show me, etc.

• Data Pane: Tableau assigns data fields of the connected dataset in the left section. 'Formatting' and 'Analytics'



Downloading a trial of Tableau Desktop



Interface o0f Workspace in tableau desktop

panes are also available.- ‘Dimensions’ in the upper section include discrete categorical data such as type or date.- ‘Measures’ in the lower section contain continuous data.• Shelves and Cards: page shelf, filter shelf, mark cards, andtop space with row and column shelves• View: The right space to create a view (table, graph) by adding fields• Sheet Tabs: Create or move to created worksheets, dashboards, and stories.

	Covid-19 data as on 07-08-2020			
States	Conformed	Active	PEOPLE WITH DISSEAS	Deaths
Telangana	75,257	21,457	53,239	601
Andhra Pradesh	196,789	82,166	1,12,870	1753
Goa	7,614	2,095	5,453	66
Jammu Kashmir	23,454	7,310	15,708	436
Tripura	5,853	1,957	3,860	36
Andaman& nicobar	1,123	752	355	16
Meghalaya	990	640	345	5
Tamilnadu	2,79,144	53,486	2,21,087	4,571
Maharastra	4,79,779	1,46,612	3,16,375	16,792
Kerala	30,449	12,019	18,333	97
Karnataka	1,58,254	75,076	80,281	2,897
Arunachal Pradesh	1,948	700	1,245	3
Delhi	1,41,531	10,348	1,27,124	4,059
Dadranagar Haveli Daman & Diu	1,391	416	973	2
Gujarat	67,699	14,766	50,350	2,583
Haryana	39,303	6,205	32,640	458
Himachal Pradesh	3,047	1,168	1,865	14
Jharkhand	15,756	9,017	6,594	145
Ladakh	1,595	411	1,177	7
Lakshadweep	0	0	0	0
Madhya Pradesh	36,564	8,716	26,902	946
Manipur	3,217	1,304	1,905	8
Mizoram	539	251	288	0
Nagaland	2,580	1,755	819	6
Odisha	40,717	13,594	26,888	235
Pudi Chery	4,621	1,743	2,808	70
Punjab	20,891	6,715	13,659	517
Rajasthan	48,996	13,108	35,131	75
Sikkim	829	475	353	1
Chattisgarh	10,932	2,767	8,088	77
Assam	52,817	15,467	37,224	126
Bihar	67,788	23,888	43,537	363

Uttar Pradesh	1,08,974	43,654	63,402	1,918
Chandigarh	1,327	530	777	20
West Bengal	86,754	23,829	61,023	1,902
Uttarakhand	8,552	3,027	5,427	98

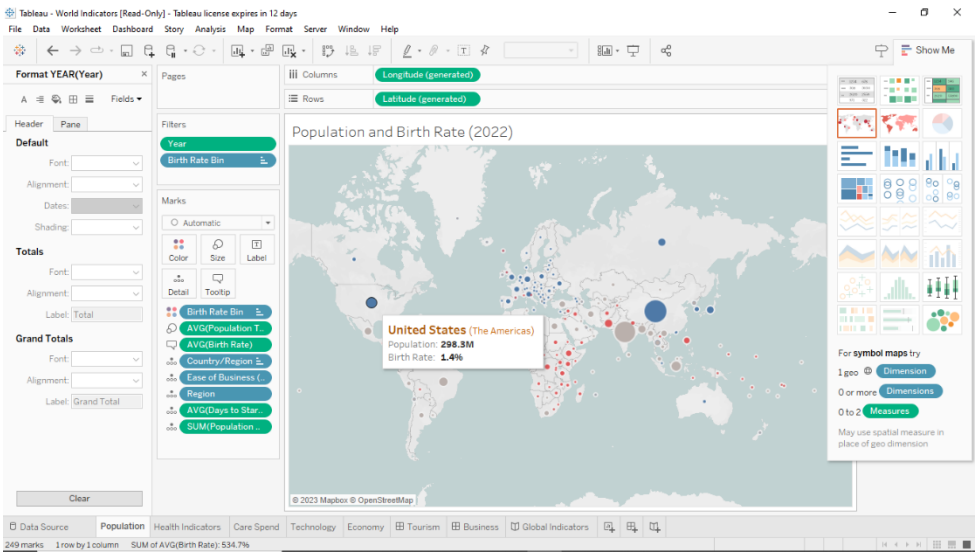
Interactive Visualization Using Tableau The filtered main code is updated to indicate the gender and the average LOS according to the final stage combined with the generation of the color legend. Building a Tableau Chart (Tree map) although the stacked bar chart is created automatically, it is possible for Tableau to change various graphs in the' Show Me' section [8]. For example, to change the graph to 'Treemap' on the toolbar, one should click Show Me in the upper-right corner, and then select Tree map. It appears as a changed tree map automatically. The size and color of the rectangle in the Tree map is determined according to the average LOS. The longer the average LOS, the darker the colorant the larger the size of the rectangle. The main code fields dragged and dropped to the color of the mark cards. Depending on the values of thepreviously filtered main code field, the color of the rectangle changes. The 'Active cases' field in the Conformed is dragged to the color of the mark cards, and the sum is changed to the average of the weight field. Then, the color canbe edited the color. 'Red-Blue-White Diverging' is selected, 'Reversed' is checked, and then the OK button is clicked. The average LOS determines the size of the rectangle, and the average weight determines the color of the rectangle.

Activity1:

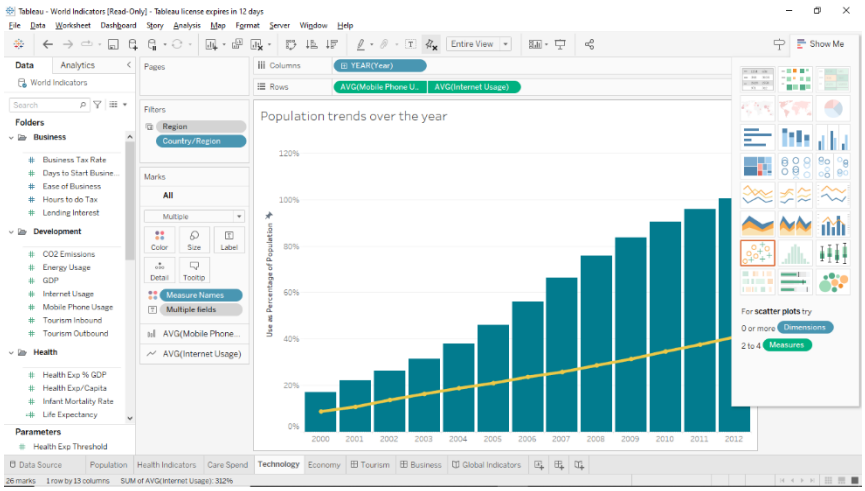
No of Unique Visualizations. The number of unique visualizations that can be created with a given data set. Some common types of visualizations that can be used to analyze the population growth in the cities, include bar charts, line charts, heat maps, scatter plots, pie charts, Maps etc. These visualizations can be used to compare performance ,track changes overtime, show distribution, and relationships between variables.

Activity 1.1: Population records by type of countries.

This is a list of countries and other inhabited territories of the world by total population, based on estimates published by the United Nations in the 2022 revision of World Population Prospects. These figures refer to the de facto population in a country of area as shown in the "estimates" section.The united nations publishes population estimates and projection for 235 countries of areas, comprising the entire population of the world. For 201 countries or areas that had at least 90,000 inhabitants in 2019, the data set contains complete time series of population size by age and sex and of the components of population change-fertility, mortality and international migration-from 1950 until 2100. Recent and historical data on the size of the population and its composition by age and sex, as well as information on levels and patterns of the components of population change, are used for the preparation of population estimates for each country or area.



Activity 1.2: Population trends over the years



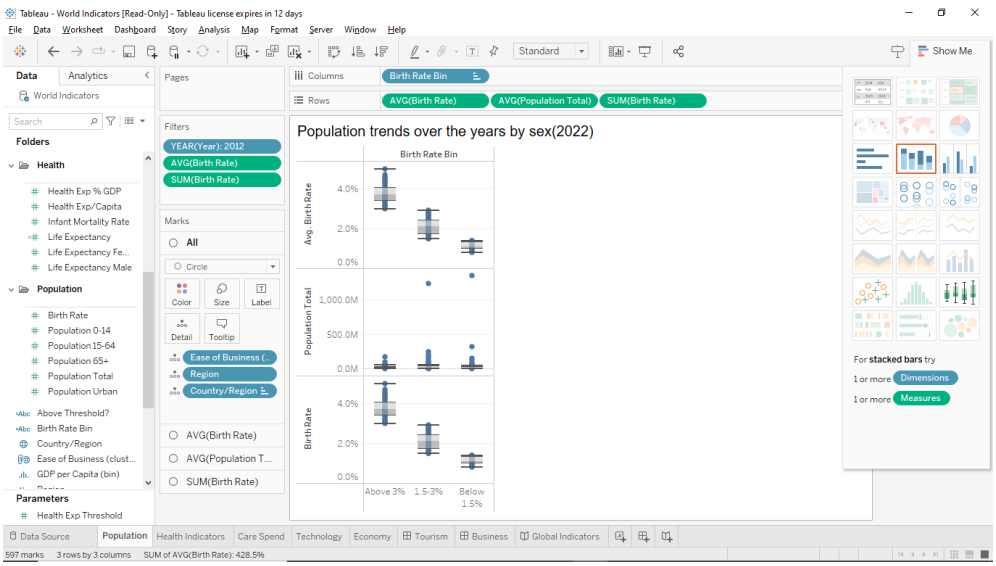
The world's population more than tripled in size between 1950 and 2020. Over the coming decades, it is expected to continue growing due to further gains in average life span, continuing high levels of fertility in some countries and a youthful global age distribution. The pace of world population growth has slowed considerably over the past 50 years and is expected to continue to decelerate. Much of the growth anticipate over the next few decades will be driven by the relative youthfulness of the current population

age distribution and is therefore very likely to occur. By the end of the twenty-first century, the global population is projected to reach almost 11 billion people. Although such forecasts are inherently uncertain, a substantially faster reduction in global growth is unlikely.

The world's population reached 7.8 billion in mid-2020, 1 billion more than in 2008 and 2 billion above its level in 1996. According to the last assessment by the United Nations (2019a), the global population is expected to reach 8.5 billion in 2030, the target data for achieving the Sustainable Development Goals. From there, it is projected to continue rising to around 9.7 billion in 2050 and 10.9 billion in 2100.

Activity 1.3: Population trends over the years by sex

The world's population, which numbered around 7.8 billion in 2020, has been growing rapidly and is expected to continue to grow in the coming decades, albeit at a progressively slower pace. Projections by the United Nations suggest that the size of the global population could rise to almost 11 billion by the end of the twenty-first century. The size of the global population is expected to stabilize around 2100, bringing an end to the current era of rapid growth that began around 1800 in some regions and in the middle of the twentieth century on a global scale. Plausible future trajectories of world population in the start or medium term lie within a relatively narrow range. Over the next 30 or 40 years, a slowdown in global growth that is substantially faster than anticipated in the United Nations projections is unlikely. This population trends over the years by sex. Having accurate estimates of population trends and reliable forecasts of future changes, including for the size of populations and their distributions by age and sex. However, there are still many gaps in the available data.



Activity 1.4: Cities with highest average populations

The list of cities in India by population. Often cities are bifurcated into multiple regions (municipalities) which results in creation of cities within cities which may figure in the list. The entire work of the article is based on Census Of India, 2011, conducted by the Office of the Registrar General and Census Commissioner, under Ministry of Home Affairs, Government of India.

Tokyo, Japan

Despite its huge prominence today, Tokyo (then Edo) only began its growth after the beginning of the Tokugawa Shogunate.

It grew from a few thousand around 1500, to 1,000,000 by the early 1700s.

Delhi, India

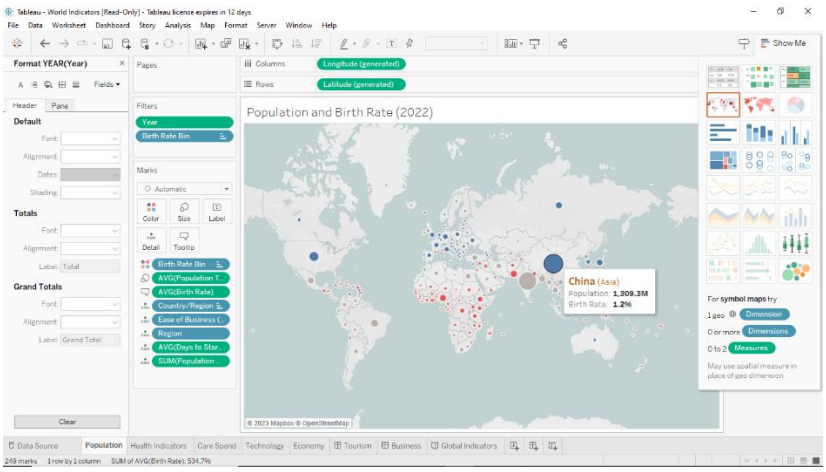
Delhi, the heart of numerous kingdoms and empires, has been inhabited continuously since at least the 600s BC; it is mentioned in the epic Mahabharata, which takes place a few centuries before that.

Mumbai (Bombay) India

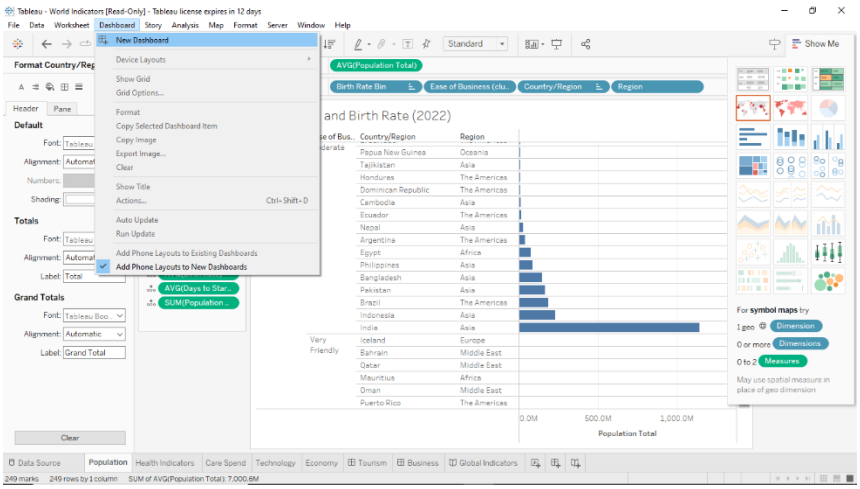
Although Delhi is listed with a higher population, Mumbai's city proper is the most populous in India. Not only that, but Mumbai is the wealthiest city in India.

Mexico City, Mexico

Mexico city, identified as the Federal District (Distrito Federal) until 2016, is the oldest capital and largest city in the Americas. The city is also one of only two capitals to be founded by Amerindians, the other being Quito, Ecuador.

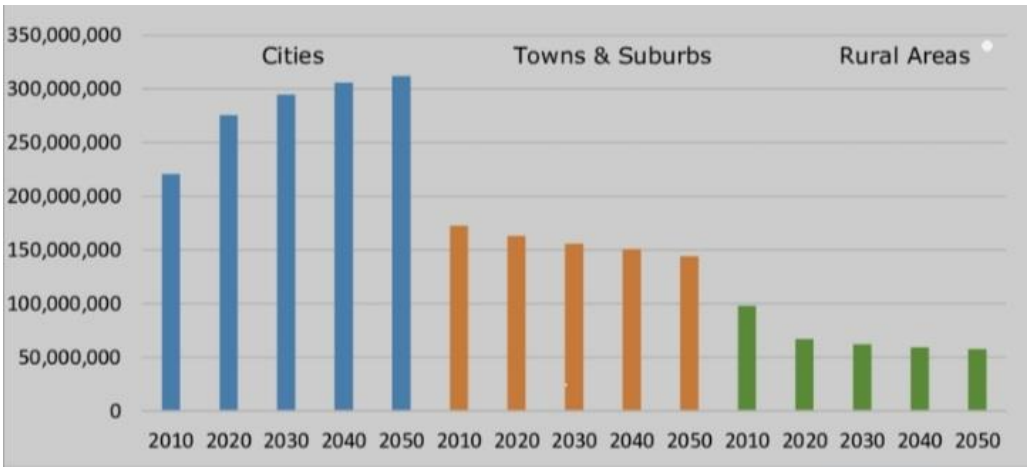


Activity 1.5: Countries with highest average population from 200-2014



Activity 1.6: Population by city type

Cities which have a population of at least 50,000 inhabitants in contiguous dense grid cells (>1,500 inhabitants per km^2); Towns and semi-dense areas, which have a population of at least 5,000 inhabitants in contiguous grid cells with a density of at least 300 inhabitants per km^2; Historically, city-dwellers have been a small proportion of humanity overall, but following two centuries of unprecedented and rapid urbanization, more than half of the world population now lives in cities, which has had profound consequences for global sustainability. Present-day cities usually form the core of larger metropolitan areas and urban areas –creating numerous commuters travelling towards city centres for employment, entertainment, and education. However, in a world of intensifying globalization, all cities are to varying degrees also connected globally beyond these regions.



Activity 1.7: Population of citied by year

At specific points in history, each of these cities outranked all others on the planet in terms of population, granting them the exclusive title as the single most populated city globally.

Today's animation comes to us from John Bur-Murdoch with the Financial Times, and it visualizes cities ranked by population in a bar chart race over the course of a 500-year timeframe. Beijing starts in the lead in the year 1500, with a population of 672,000. In the span of roughly a century, all of the world's biggest cities were able to pass the 1 million mark, making it no longer a particularly exclusive milestone.

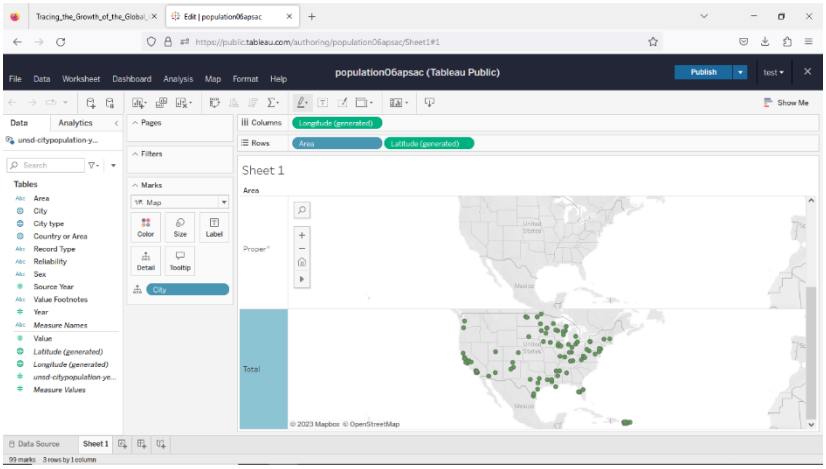
Rank	City	Population in Year 2018
#1	Tokyo	38,194,000
#2	Delhi	27,890,000
#3	Shanghai	25,779,000
#4	Beijing	22,674,000
#5	Mumbai	22,120,000
#6	Sao Paulo	21,698,000
#7	Mexico City	21,520,000
#8	Cairo	19,850,000
#9	Dhaka	19,633,000
#10	New York City	18,713,000

Milestone 5: Dashboard

A dashboard is a graphical user interface (GUI) that displays information and data in an organized, easy-to-read format. Dashboards are often used to provide real-time monitoring and analysis of data, and are typically designed for a specific purpose or use case. Dashboards can be used in a variety of settings, such as business, finance, manufacturing, healthcare, and many other industries. They can be used to track key performance indicators (KPIs), monitor performance metrics, and display data in the form of charts, graph, and tables.

Activity: 1- Responsive and Design of Dashboard

The responsiveness and design of a dashboard for analyzing population growth in the cities is crucial to ensure that the information is easily understandable and actionable. Key considerations for designing a responsive and effective dashboard include user-centered design, clear and concise information, interactivity, data-driven approach, accessibility, customization, and security. The goal is to create a dashboard that is user-friendly, interactive, and data-driven, providing actionable insights on the population demographics of different cities across the world



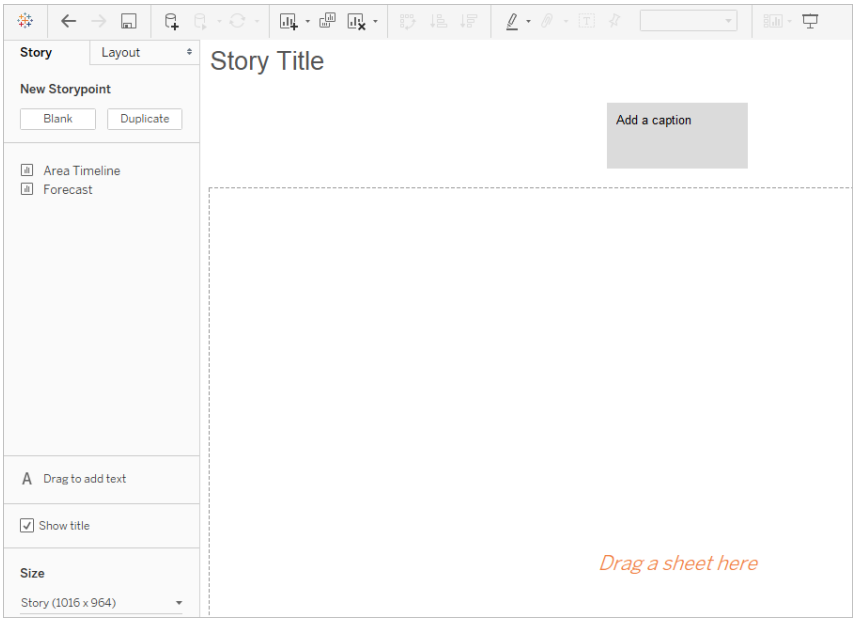
Milestone 6: Story

A data story is a way of presenting data and analysis in a narrative format, with the goal of making the information more engaging and easier to understand. A data story typically includes a clear introduction that sets the stage and explains the context for the data, a body that presents the data and analysis in a logical and systematic way, and a conclusion that summarizes the key findings and highlights their implications. Data stories can be told using a variety of mediums, such as reports, presentations, interactive visualizations, and videos

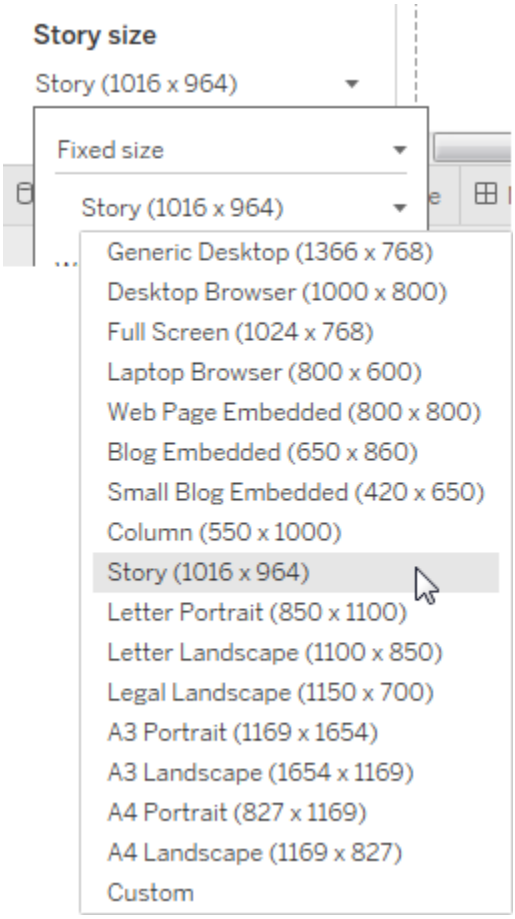
Activity:1- No of Scenes of Story

1. Click the New Story tab.

Tableau opens a new story as your starting point:



2. In the lower-left corner of the screen, choose a size for your story. Choose from one of the predefined sizes, or set a custom size, in pixels:



3. By default, your story gets its title from the sheet name. To edit it, right-click the sheet tab, and choose Rename Sheet.

   If you're using Tableau Desktop, you can also rename a story by double-clicking the title.

4. To start building your story, double-click a sheet on the left to add it to a story point.

   In Tableau Desktop, you can also drag sheets into your story point.

   When you add a sheet to a story point, that sheet remains connected to the original sheet. If you modify the original sheet, your changes will automatically be reflected on the story points that use it.

   If you are using Tableau Cloud to author on the web and the original sheet has Pause Auto Updates enabled, the story sheet will be blank until auto-updates are resumed.

5. Click Add a caption to summarize the story point.

   In Tableau Desktop, you can highlight a key takeaway for your viewers by dragging a text object to the story worksheet and typing a comment.

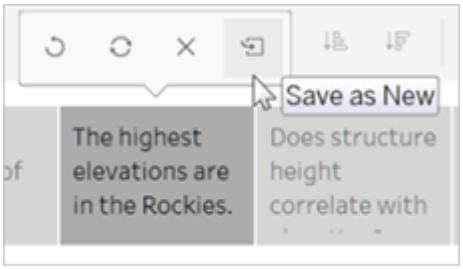
6. To further highlight the main idea of this story point, you can change a filter or sort on a field in the view. Then save your changes by clicking Update on the story toolbar above the navigator box:

7. Add another story point by doing one of the following:

   - Click Blank to use a fresh sheet for the next story point.

Start customizing a story point and click **Save as New** on the toolbar above the navigator box.

- Click Duplicate to use the current story point as the basis for a new one.



Explore layout options

You can refine the look of your story using the options on the Layout tab.

1. Click the Layout tab.
2. Choose a navigator style that best suits your story, and show or hide the next and previous arrows.

Format a story

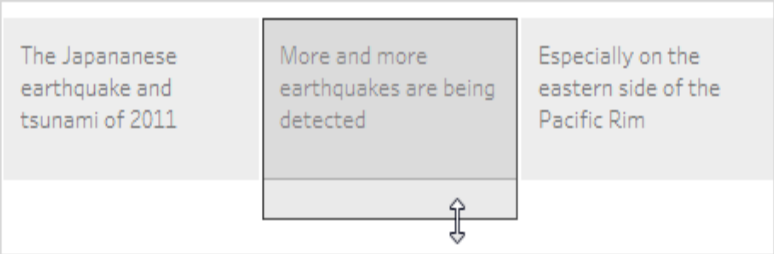
Resize captions (Tableau Desktop only)

Sometimes the text in one or more of your captions is too long to fit inside the height of the navigator. In this case, you can re-size the captions vertically and horizontally.

1. In the navigator, select a caption.

2. Drag the border left or right to resize the caption horizontally, down to resize vertically, or select a corner and drag diagonally to resize the caption both horizontally and vertically.

   All captions in the navigator update to the new size.

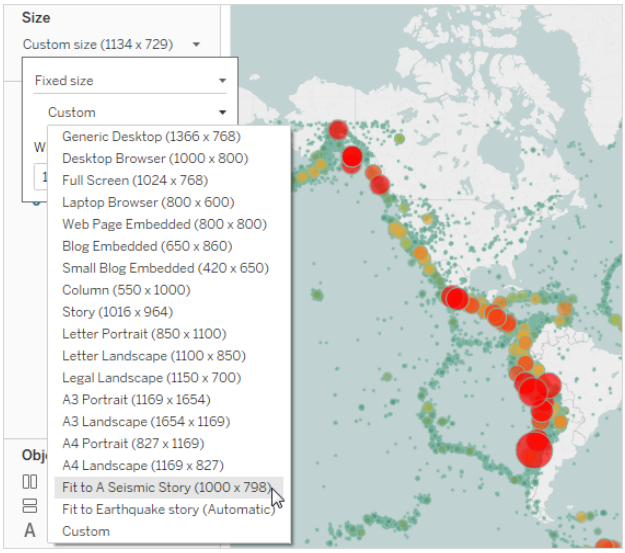


When you resize a caption, you can only select the left, right, or bottom border of the caption.

Fit a dashboard to a story

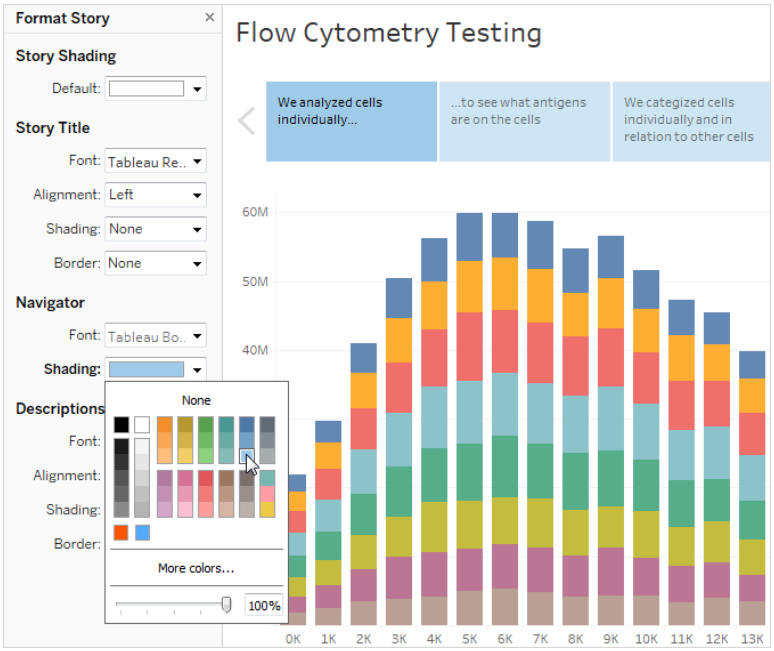
You can fit a dashboard to the exact size of a story. For example, if your story is exactly 800 by 600 pixels, you can shrink or expand a dashboard to fit inside that space.

Click the **Size** drop-down menu and select the story you want the dashboard to fit inside.



Format a story's shading, title, and text objects (Tableau Desktop only)

To open the **Format Story** pane, select Format > Story.



Milestone 7: Performance Testing

Tableau Performance and Stress testing

- **Performance testing:** BI Validator automates performance testing of Tableau dashboards by accurately measuring the time taken by Tableau bootstrap requests and tab-switch events. BI Validator further simplifies the performance recording.
- **Stress testing:** The performance of the Tableau reports under concurrent user load can be tested using the stress test plan. Stress testing can be very helpful when adding new users or upgrading to a version of Tableau.

Perform End-to-end Tableau testing

BI Validator helps automate the comparison of report data with database query output thus enabling end-to-end testing of Tableau reports and dashboards

- **Compare Report to SQL Query output:** Connect to any ODBC enabled data source and compare Tableau worksheet data with SQL Query output from the ODBC data source.
- **BI Tool Migration testing:** BI Validator makes it simple to compare the data between reports from different BI tools. Data from OBIEE, Business Objects and Cognos can be compared with data in Tableau worksheets

- **Compare Summary to Detail report data:** Compare aggregate metrics in a summary report with data in a detail report.

Activity 1:

Amount of Data Rendered to DB

● The amount of data that is rendered to a database depends on the size of the dataset and the capacity of the database to store and retrieve data.

● Open the MySQL Workbench, go to the database then click to expand the tables, select the table and click on button to get the information related to table such as column count, table rows etc.

Collect Data with the Tableau Server Repository

The Tableau Server repository is a PostgreSQL database that stores data about all user interactions, extract refreshes, and more. You can enable access to the repository and use the data in it to help analyze and understand Tableau Server performance.

After you enable access to the Tableau Server repository, you can create views with data from the repository. The views that you create with this data are sometimes called custom administrative views. In addition to being used for performance monitoring, custom admin views can be used for tracking user activity, workbook activity, and more. For more information on the type of data that you can use for these views, see Create Custom Administrative Views and About the Tableau Server Data Dictionary. Alternatively, if you are only interested in performance data, you can use the preselected database tables in the sample performance workbook.

Enable access to the Tableau Server repository

You can use Tableau Desktop to connect to and query the Tableau Server repository using two built-in users. The user named tableau has access to several database views you can use as part of building your own analyses of Tableau Server activity. The user named readonly has access to additional database tables that you can use to create views for even more in-depth analysis and this is the user we recommend you use.

Before you can connect to the repository, you need to enable access for the readonly user to the database. Use the tsm data-access repository-access enable command to enable repository access. When you enable repository access, you also create a password for the readonly user. You will use this password to access to the repository. You may also need to have port 8060 opened on the repository node so you can connect to the database.

Connect to the Tableau Server repository

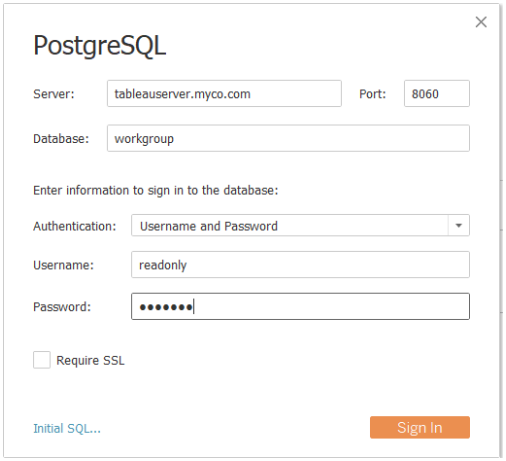
This section describes how to connect to a custom set of tables from Tableau Server repository. For more information on the tables that you can connect to.

1. In Tableau Desktop select Data > Connect to Data, and then select PostgreSQL as the database to connect to.
2. In the PostgreSQL connection dialog box, enter the name or URL for Tableau Server in the Server box. If you have a distributed server installation, enter the name or IP address of the node where the repository is hosted.
3. Connect using the port you have set up for the pgsql. port, which is 8060 by default.
4. Specify workgroup as the database to connect to.

4. Connect using the user and the password you specified.

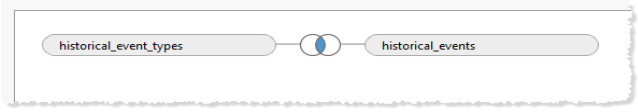
5. Click the **Require SSL** option if you have configured Tableau Server to use SSL for connecting to the repository. For more information.

6. Click Connect.



7. Select one or more tables to connect to.

   The tableau user has access to all of the tables that start with an underscore or with hist_. For example, you can connect to _background_tasks and _datasources. The readonly user has access to additional tables that can be used to query other information about server usage.



8. Click Go to Worksheet.

PostgreSQL Version

1. Log into Tableau Server directly or through a remote connection.

2. Launch **Task Manager**.

3. Click the **Details** tab.

4. Right click one of the postgres.exe processes and select **Properties** to see the version of PostgreSQL installed.

You can also connect to the workgroup database and issue the following query to get the version: select version().

Activity 2: Utilization of Data Filters

Filtering Order of Operations

Tableau performs actions on your view in a very specific order; this is called the Order of Operations. Filters are executed in the following order:

1. Extract filters

2. Data source filters

3. Context filters

4. Filters on dimensions (whether on the Filters shelf or in filter cards in the view)

5. Filters on measures (whether on the Filters shelf or in filter cards in the view)

Select to keep or exclude data points in your view

You can filter individual data points (marks), or a selection of data points from your view. For example, if you have a scatter plot with outliers, you can exclude them from the view so you can better focus on the rest of the data.

To filter marks from the view, select a single mark (data point) or click and drag in the view to select several marks. On the tooltip that appears:

Select headers to filter data

You can also select headers to filter them from your view. To filter entire rows or columns of data from your view, select the header in the view. On the tooltip that appears, select to Exclude or Keep Only the selected data.

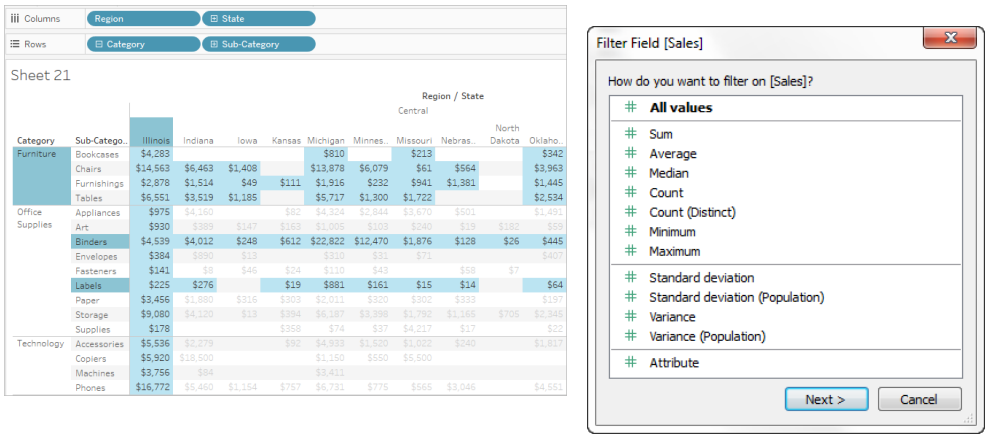
When you select a table header that is part of a hierarchy, all of the next level headers are also selected. For example, the view shown below consists of two unrelated dimensions placed on the Columns shelf, and two levels of the same hierarchy placed on the Rows shelf.

The selected row headers include the Furniture member of the Category dimension, and the Binders and Labels members of the Sub-category dimension. When Furniture is selected, all members

from the next (inner) level in the hierarchy are automatically selected. In this case, that means the Bookcases, Chairs, Furnishings, and Tables members.

Filter quantitative data (measures)

Measures contain quantitative data, so filtering this type of field generally involves selecting a range of values that you want to include. When you drag a measure from the Data pane to the Filters shelf in Tableau Desktop, the following dialog box appears:



Select how you want to aggregate the field, and then click Next.

In the subsequent dialog box, you're given the option to create four types of quantitative filters:

Range of Values: Select the Range of Values option to specify the minimum and maximum values of the range to include in the view. The values you specify are included in the range.

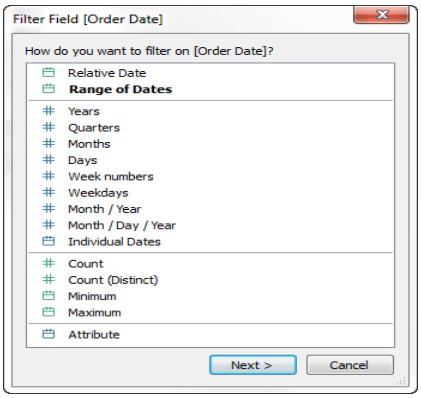
At Least: Select the At Least option to include all values that are greater than or equal to a specified minimum value. This type of filter is useful when the data changes often so specifying an upper limit may not be possible.

At Most: Select the At Most option to include all values that are less than or equal to a specified maximum value. This type of filter is useful when the data changes often so specifying a lower limit may not be possible.

Special: Select the Special option to filter on Null values. Include only Null values, Non-null values, or All Values.

Filter dates

When you drag a date field from the Data pane to the Filters shelf in Tableau Desktop, the following Filter Field dialog box appears:



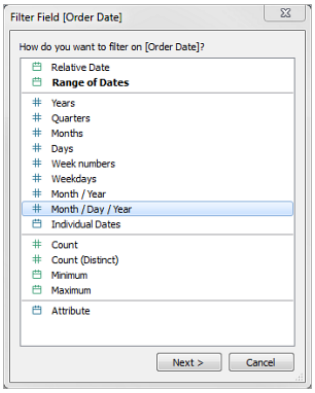
You can select whether you want to filter on a relative date; filter between a range of dates; or select discrete dates or individual dates to filter from the view.

- **Filter relative dates**: Click Relative dates to define a range of dates that updates based on the date and time you open the view. For example, you may want to see Year to Date sales, all records from the past 30 days, or bugs closed last week. Relative date filters can also be relative to a specific anchor date rather than today.

- **Filter a range of dates**: Select Range of dates to define a fixed range of dates to filter. For example, you may want to see all orders placed between March 1, 2009 and June 12, 2009.

- **Filter discrete dates**: Select a discrete date value in the dialog box if you want to include entire date levels. For example, if you select Quarters, you can choose to filter specific quarters (e.g. Q1, Q2, Q3, Q4) from your view, regardless of the year.

  Latest date preset: If you want to ensure that only the most recent date in a data source is selected in the filter when the workbook is shared or opened, select a discrete date such as Month/Day/Year or Individual Dates and then, on the General tab, select Filter to latest date value when workbook is opened.



- **Filter individual dates**: Select Individual dates to filter specific dates from your view.

- **Additional date filter options**: When you select Relative dates or Range of dates, the Filter dialog box opens. In that dialog box, you can define a Starting date or Ending date. You can also select Special to include null dates, non-null dates, or all dates.

Filter table calculations

To create a table calculation filter, create a calculated field, and then place that field on the Filters shelf. Filters based on table calculations do not filter out underlying data in the data set, because table calculation filters are applied last in the order of operations. This means Tableau evaluates any table calculations in the view first, and then applies table calculation filters on the results in the current view.

Display interactive filters in the view

When an interactive filter is shown, you can quickly include or exclude data in the view.

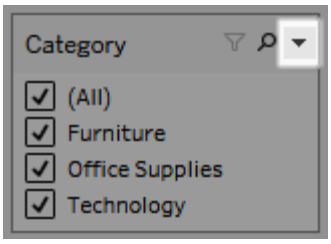
To show a filter in the view:

1. In the view, click the field drop-down menu and select Show Filter.

   The field is automatically added to the Filters shelf (if it is not already being filtered), and a filter card appears in the view. Interact with the card to filter your data.

Set options for filter card interaction and appearance

After you show a filter, there are many different options that let you control how the filter works and appears. You can access these options by clicking the drop-down menu in the upper right corner of the filter card in the view.



Some options are available for all types of filters, and others depend on whether you're filtering a categorical field (dimension) or a quantitative field (measure).

You can customize how filters appear in the view, in dashboards, or when published to Tableau Server or Tableau Cloud.

Activity 3: No of Calculation Fields

Types of calculations

You create calculated fields using calculations. There are three main types of calculations you can use to create calculated fields in Tableau:

- **Basic calculations** - Basic calculations allow you to transform values or members at the data source level of detail (a row-level calculation) or at the visualization level of detail (an aggregate calculation).

- **Level of Detail (LOD) expressions** - Just like basic calculations, LOD calculations allow you to compute values at the data source level and the visualization level. However, LOD calculations give you even more control on the level of granularity you want to compute. They can be performed at a more granular level (INCLUDE), a less granular level (EXCLUDE), or an entirely independent level (FIXED) with respect to the granularity of the visualization.

Create a calculated field

Once you have determined the type of calculation you want to use, it's time to create a calculated field. This example uses a basic calculation.

1. In Tableau, select **Analysis** > **Create Calculated Field**.

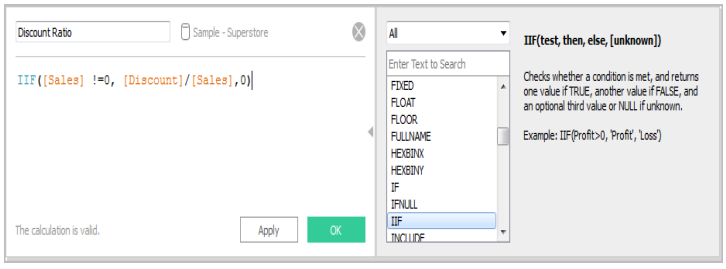
2. In the Calculation Editor that opens, do the following:

    - Enter a name for the calculated field. In this example, the field is called, **Discount Ratio**.

    - Enter a formula. This example uses the following formula:

      IIF([Sales] !=0, [Discount]/[Sales],0)

      This formula checks if sales is not equal to zero. If true, it returns the discount ratio (Discount/Sales); if false, it returns zero.

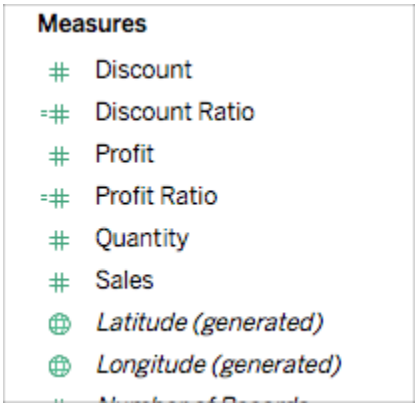


3. When finished, click OK.

The new calculated field is added to Measures in the Data pane because it returns a number. An equal sign (=) appears next to the data type icon. All calculated fields have equal signs (=) next to them in the **Data** pane.

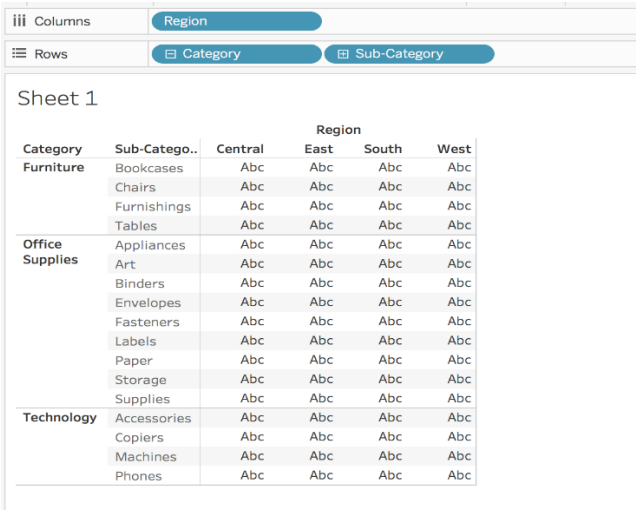
Use a calculated field in the view

Step 1: Build the view



1. From Dimensions, drag Region to the Columns shelf.
2. From Dimensions, drag Category to the Rows shelf.
3. On the Rows shelf, click the plus icon (+) on the Category field to drill-down to Subcategory.

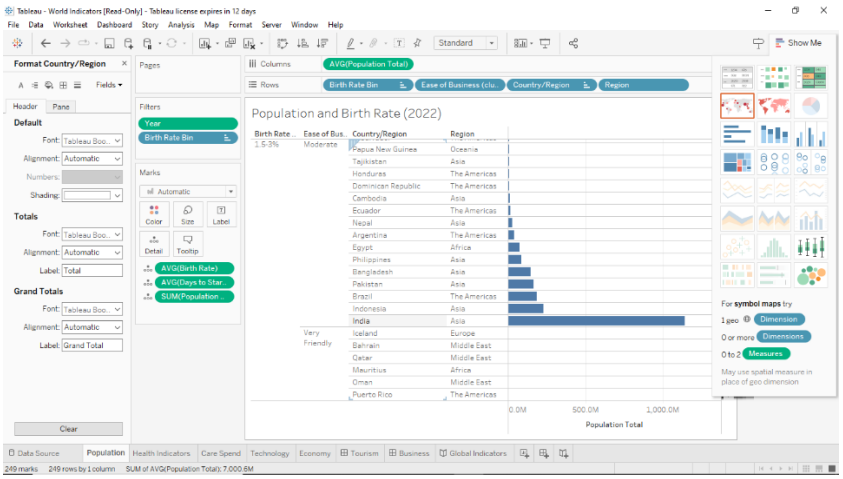
   The view updates to look like this:



Step 2: Add the calculated field to the view

1. From Measures, drag Discount Ratio to Color on the Marks card.

   The view updates to highlight table.



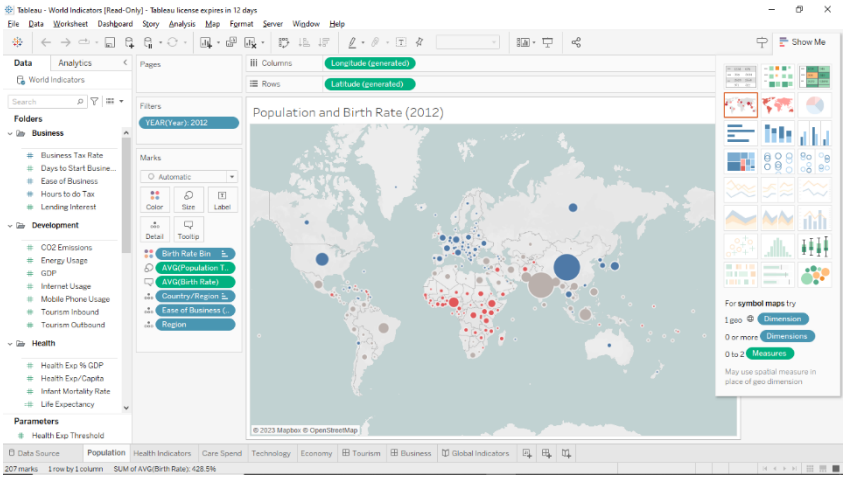
You can see that Binders are heavily discounted in the Central region. Notice that Discount Ratio is automatically aggregated as a sum.

2. On the Rows shelf, right-click SUM(Discount Ratio) and select Measure (Sum) > Average.

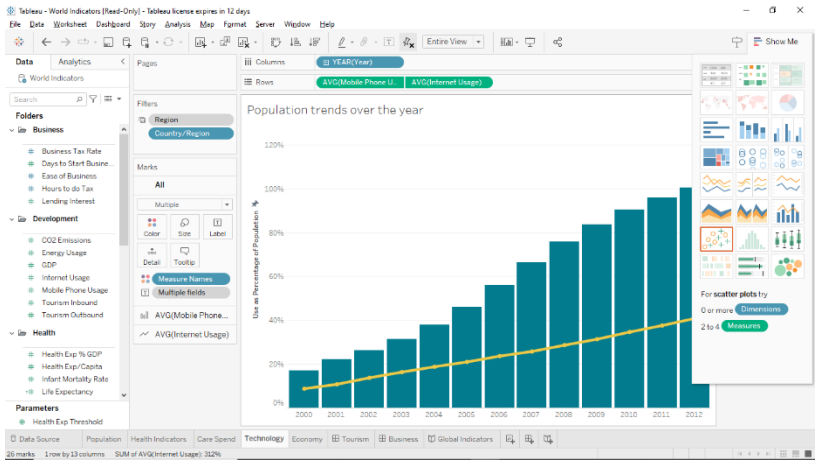
   The view updates with the average of discount ratio shown.

Activity 4: No of Visualizations/ Graphs

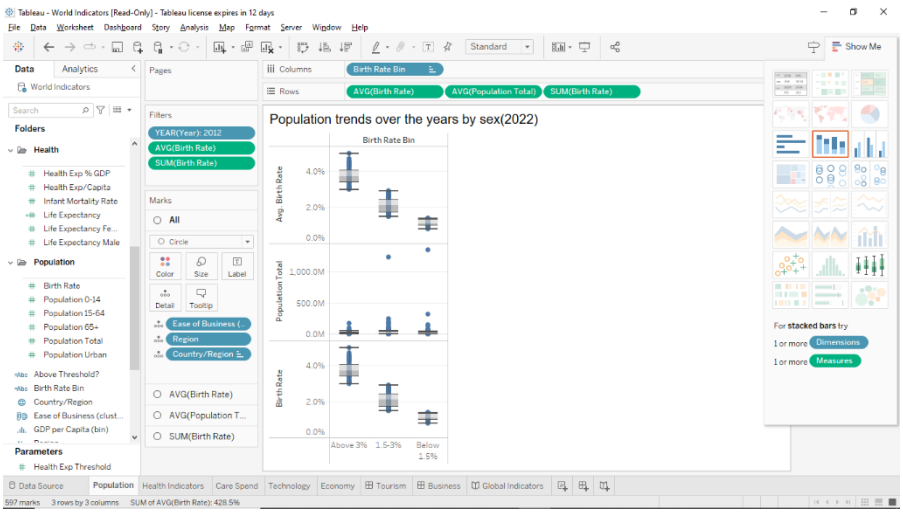
Population record types of countries



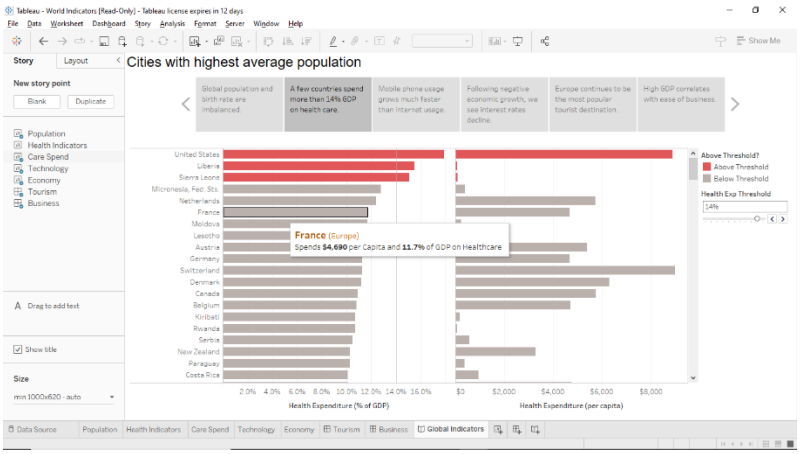
Population trends over the years



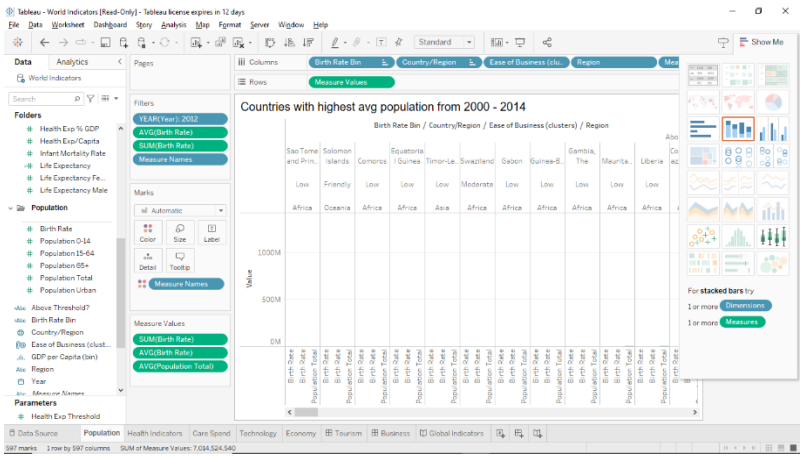
Population trends over the years by sex



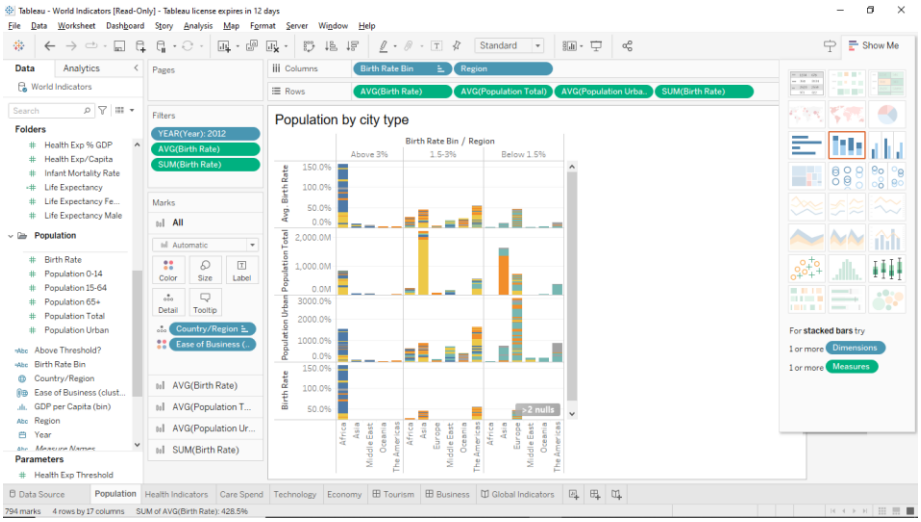
Cities with highest average population



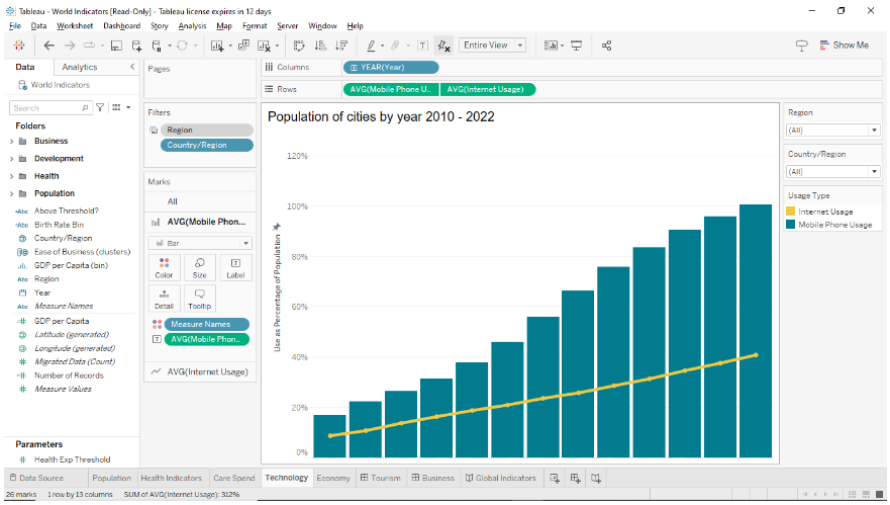
Countries with highest avg population from 2000 – 2014



Population by city type



Population of cities by year



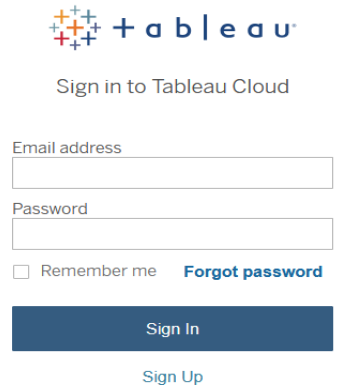
Milestone 8 : Web integration

Publishing helps us to track and monitor key performance metrics, to communicate results and progress. help a publisher stay informed, make better decisions, and communicate their performance toothers. Publishing dashboard and reports to tableau public.

Step 1: Go to Dashboard/story, click on share button on the top ribbon

Give the server address of your tableau public account and click on connect.

Step 2: Once you click on connect it will ask you for tableau public user name and password



Once you login into your tableau public using the credentials, the particular visualization will be published into tableau public.

Activity 1: Dashboard and Story embed with UI With Flask