High-Level Design (HLD)

Agriculture Data Analysis

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Document Version Control

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27th August 2021	1.0	First Version of Complete HLD	Satyam Nathoo

Contents

Abstract

The history of Agriculture in India dates back to Indus Valley Civilization. India ranks second worldwide in farm outputs. As of 2018, agriculture employed more than 50% of the Indian workforce and contributed 17–18% to the country's GDP.

In 2016, agriculture and allied sectors like animal husbandry, forestry and fisheries accounted for 15.4% of the GDP (gross domestic product) with about 41.49% of the workforce in 2020. India ranks first in the world with the highest net cropped area followed by the US and China. The economic contribution of agriculture to India's GDP is steadily declining with the country's broad-based economic growth. Still, agriculture is demographically the broadest economic sector and plays a significant role in the overall socio-economic fabric of India.

The total agricultural commodities export was the US $3.50 billion in March - June 2020. India exported $38 billion worth of agricultural products in 2013, making it the seventh-largest agricultural exporter worldwide and the sixth largest net exporter. Most of its agriculture exports serve developing and least developed nations. Indian agricultural/horticultural and processed foods are exported to more than 120 countries, primarily to Japan, Southeast Asia, SAARC countries, the European Union, and the United States.

1 Introduction

1.1 Why this High-Level Design Document?

The purpose of this High-Level Design (HLD) document is to add the necessary detail to the current project description to represent a suitable model for coding. This document is also intended to help detect contradictions prior to coding and can be used as a reference manual for how the modules interact at a high level.

The HLD will:

- Present all of the design aspects and define them in detail
- Describe the user interface is implemented
- Describe the hardware and software interfaces
- Describe the performance requirements
- Include design features and the architecture of the project
- List and describe the non-functional attributes like:
    - Security
    - Reliability
    - Maintainability
    - Portability
    - Reusability
    - Application compatibility
    - Resource utilization
    - Serviceability

1.2 Scope

The HLD documentation presents the structure of the system, such as the database architecture, application architecture (layers), application flow (Navigation), and technology architecture. The HLD uses non-technical to mildly-technical terms which should be understandable to the administrators of the system.

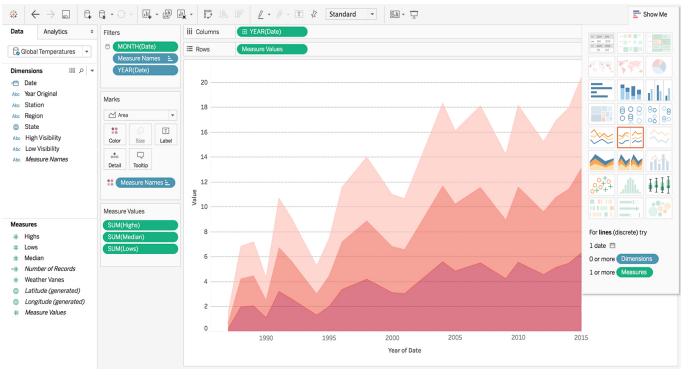
2 General Description

2.1 Product Perspective

- In 2018, fertilizer consumption for India was 175 kilograms per hectare. Fertilizer consumption of India increased from 12.4 kilograms per hectare in 1969 to 175 kilograms per hectare in 2018 growing at an average annual rate of 5.96%.
- In 2019, the agriculture value added per worker for India was 1,993 US dollars. Between 2000 and 2019, agriculture value added per worker of India grew substantially from 966 to 1,993 US dollars rising at an increasing annual rate that reached a maximum of 11.09% in 2011 and then decreased to 4.52% in 2019
- In 2018, the livestock production index for India was 116.8 index. Between 1969 and 2018, the livestock production index of India grew substantially from 18.3 to 116.8 index rising at an increasing annual rate that reached a maximum of 6.27% in 2007 and then decreased to 5.51% in 2018.
- The livestock production index includes meat and milk from all sources, dairy products such as cheese, and eggs, honey, raw silk, wool, and hides and skins. 2004-2006 = 100. In 2018, the food production index for India was 111.8 index. Between 1969 and 2018, the food production index of India grew substantially from 26.4 to 111.8 index rising at an increasing annual rate that reached a maximum of 12.38% in 1983 and then decreased to 3.71% in 2018.
- The food production index covers food crops that are considered edible and that contain nutrients. Coffee and tea are excluded because, although edible, they have no nutritive value. 2004-2006 = 100.

2.2 Tools used

Business Intelligence tool - Tableau is used to build the whole framework.



3 Design Details

3.1 Functional Architecture

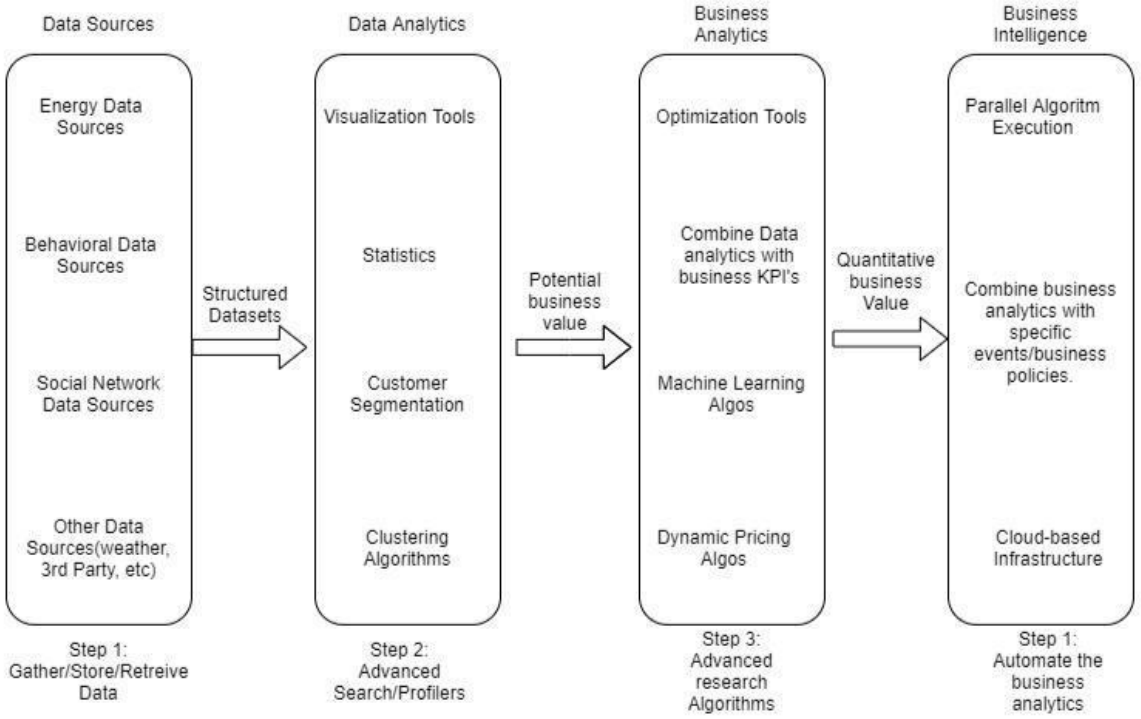
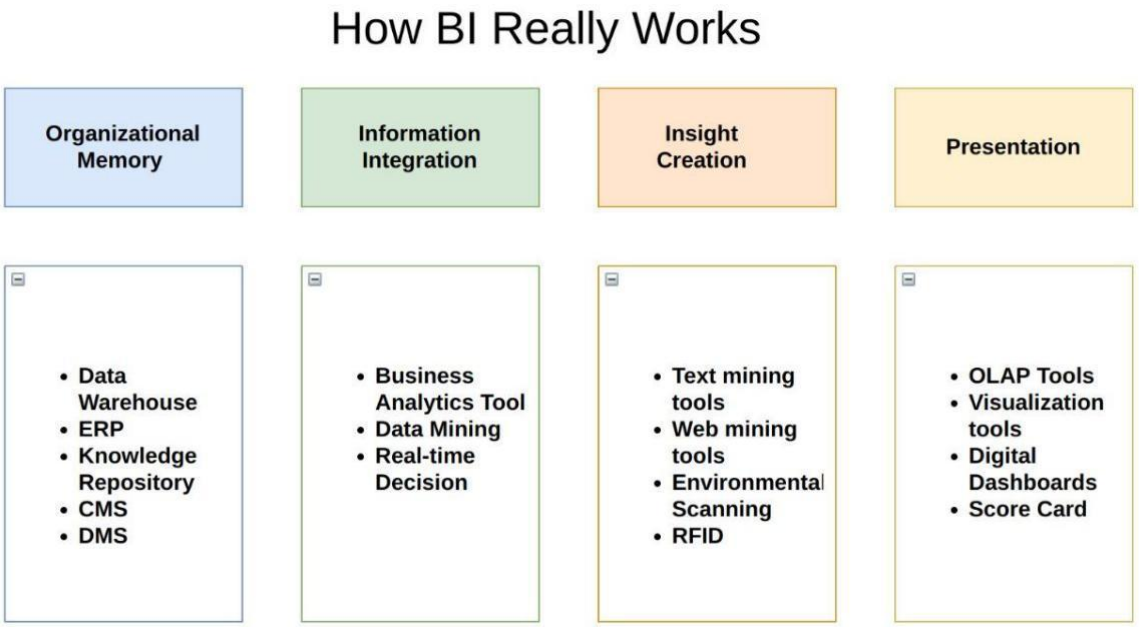


Figure 1: Functional Architecture of Business Intelligence



3.2 Optimization

Your data strategy drives performance

- Minimize the number of fields
- Minimize the number of records
- Optimize extracts to speed up future queries by materializing calculations, removing columns, and the use of accelerated views

Reduce the marks (data points) in your view

- Practice guided analytics. There's no need to fit everything you plan to show in a single view. Compile related views and connect them with action filters to travel from overview to highly granular views at the speed of thought.
- Remove unneeded dimensions from the detail shelf.
- Explore. Try displaying your data in different types of views.

Limit your filters by number and type

- Reduce the number of filters in use. Excessive filters on a view will create a more complex query, which takes longer to return results. Double-check your filters and remove any that aren't necessary.
- Use an include filter. Exclude filters load the entire domain of a dimension, while include filters do not. An include filter runs much faster than an exclude filter, especially for dimensions with many members.
- Use a continuous date filter. Continuous date filters (relative and range-of-date filters) can take advantage of the indexing properties in your database and are faster than discrete data filters.
- Use parameters and action filters. These reduce the query load (and work across data sources).

Optimize and materialize your calculations

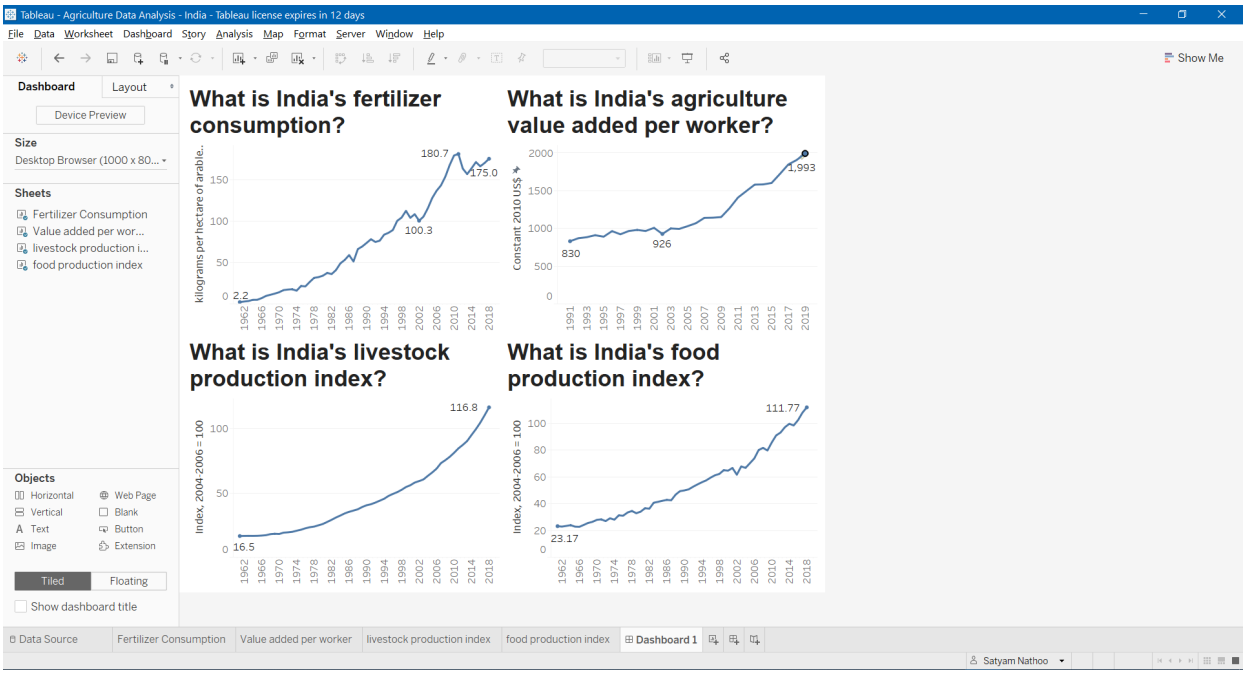
- Perform calculations in the database
- Reduce the number of nested calculations.
- Reduce the granularity of LOD or table calculations in the view. The more granular the calculation, the longer it takes.
    - LODs - Look at the number of unique dimension members in the calculation.
    - Table Calculations - the more marks in the view, the longer it will take to calculate.
- Where possible, use MIN or MAX instead of AVG. AVG requires more processing than MIN or MAX. Often rows will be duplicated and display the same result with MIN, MAX, or AVG.

- Make groups with calculations. Like include filters, calculated groups load only named members of the domain, whereas Tableau's group function loads the entire domain.

- Use Booleans or numeric calculations instead of string calculations. Computers can process integers and Booleans (t/f) much faster than strings. Boolean>Int>Float>Date>DateTime>String

4 KPIs

Dashboards will be implemented to display and indicate certain KPIs and relevant indicators for the disease.



As and when the system starts to capture the historical/periodic data for a user, the dashboards will be included to display charts over time with progress on various indicators or factors

4.1 KPIs (Key Performance Indicators)

Key indicators displaying a summary of the different indicators of agricultural output over the time series (1962 - 2020).

1. What is India's fertilizer consumption?
2. What is India's agriculture value added per worker?
3. What is India's livestock production index?
4. What is India's food production index?

5 Deployment

Prioritizing data and analytics couldn't come at a better time. Your company, no matter what size, is already collecting data and most likely analyzing just a portion of it to solve business problems, gain competitive advantages, and drive enterprise transformation. With the explosive growth of enterprise data, database technologies, and the high demand for analytical skills, today's most effective IT organizations have shifted their focus to enabling self-service by developing Automated Dashboards in Excel using Macros and VBA at scale, as well as organizing and unifying disparate sources of data for business users and experts alike to author and consume content.

Tableau prioritizes choice in flexibility to fit, rather than dictate, your enterprise architecture. Tableau Server and Tableau Online leverage your existing technology investments and integrate them into your IT infrastructure to provide a self-service, modern analytics platform for your users. With on-premises, cloud, and hosted options, there is a version of Tableau to match your requirements. Below is a comparison of the three types:

TYPE PROS CONS

Tableau Server - On-Premises

- Full control of hardware and software
- Infrastructure and data remain behind your firewall
- Need dedicated administrators to manage hardware and software
- The additional infrastructure needed to access off-network (mobile, external)

Tableau Server - Public Cloud (IaaS)

- Full control of software on managed hardware
- Puts infrastructure in the same place as data (for migration to the cloud)
- Flexibility to spin up/down hardware as needed
- Need dedicated administrators to manage software
- The additional infrastructure needed to access off-network (mobile, external)

Tableau Online (SaaS)

- Fully hosted solution (hardware, software upgrades)
- Fast to deploy
- Easy for the external audience to access
- Single-site in a multi-tenant environment
- Cubes are not supported
- No guest account access

Depending on your organizational roles and responsibilities, Tableau Server should be installed by a systems administrator and the designated Tableau Server Administrator in coordination with the appropriate IT roles. For Tableau Online, you will integrate with your existing technology and configure the site settings. The Data & Analytics Survey, completed by business teams, identifies and prioritizes data use cases, audience size, and users. You will use the information collected in both surveys to plan your deployment strategy, including sizing, installation, and configuration of your Tableau Server or integration and configuration of Tableau Online. In addition to installing Tableau Server or configuring Tableau Online, administrators will also need to plan for the client software installation of Tableau Prep Builder, Tableau Desktop, Tableau Mobile, and Tableau Bridge for Tableau Online where applicable.