Estimate the Crop Production using Data Analytics

Team ID: PNT2022TMID53910

Team Members:
Surya Priya S (95071912101)
Sumithra M (95071912098)
Sasi Keerthana M (95071912086)
Premi Jasmine A (95071912068)

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1. INTRODUCTION

1.1 Project Overview

Agriculture is important for human survival because it serves the basic need. A well-known fact is that the majority of population (≥55%) in India is into agriculture. Due to variations in climatic conditions, there exist bottlenecks for increasing the crop production in India. It has become a challenging task to achieve desired targets in Agri based crop yield. Factors like climate, geographical conditions, economic and political conditions are to be considered which have direct impact on the production, productivity of the crops. Crop yield prediction is one of the important factors in agriculture practices. Farmers need information regarding crop yield before sowing seeds in their fields to achieve enhanced crop yield. The use of technology in agriculture has increased in recent years and data analytics is one such trend that has penetrated into the agriculture field being used for management of crop yield.

1.2 Purpose

Estimate the past year production records to produce meaningful insights. By finding out the reasons, and laying the way for increasing the production rate.Crop yield prediction is an essential task for the decision-makers at national and regional levels for rapid decision-making. An accurate crop yield prediction model can help farmers to decide on what to grow and when to grow. Big data enables farmers to make smart decisions, such as what crops to plant for better profitability and when to harvest based on granular data on rainfall patterns, water cycles, fertilizer requirements, and more.

2. LITERATURE SURVEY

2.1 Existing Problem

Information on crop area, yield and production plays a vital role in planning and allocating resources for the development of the agricultural sector.The availability of crop area statistics is an essential requirement of the agricultural statistical system of any country, as it is a key variable in estimating crop production and crop yield. For the collection of crop area statistics, both subjective and objective methods are currently used around the world. The subjective methods, often used in developing countries.

2.2 References

Case Study 1: Methodology for Estimation of Crop Area and Crop Yield under Mixed and Continuous Cropping.

Authors:

Umesh Sud, Tauqueer Ahmad, Vk Gupta, Hukum Chandra – 2017.

Project Description:

This methodology has been developed to estimate crop area and crop yield in mixed and continuous cropping scenarios. In this regard, several alternatives have been considered, depending upon the information available in the agricultural statistical system. The different methods for the area apportionment of a crop mixture's various component crops are explained, as are methods for crop area and yield measurement, along with their respective advantages and disadvantages. Situations in which particular methods are suitable are described.

Case Study 2: Crop Estimation Survey

Authors:

Directorate of Economics & Statistics – Meghalaya, Shillong.

Project Description:

The Directorate of Economics & Statistics, Shillong, has been conducting the Crop Cutting Experiment on different crops since the inception of the State on 21st January 1972. In fact, this work has been inherited from the Government of Assam after attaining the full fledged Statehood.The Manual on Crop Estimation Survey – 2016 has been compiled for use in the Crop Cutting Experiment of different crops conducted by the Directorate of Economics & Statistics, Shillong. Now, the methodology developed by the Indian Agricultural Research Institute, PUSA, New Delhi, is used for the survey.

Case Study 3: Crop Estimation

Authors:

Viticulture Program, University of Nebraska Lincoln.

Project Description:

In this conventional crop estimation depends upon a reasonably accurate projected cluster size. The average weight per cluster for a given cultivar harvested from a particular vineyard is crucial to good crop estimation. The more years for which data have been acquired (a sort of "track record"), the better the accuracy of crop estimation. Lag phase crop estimation assumes that cluster weights double from the lag phase weight until the harvest weight. Lag phase occurs typically about 55 days after first bloom. Again, a representative sample of clusters needs to be collected and weighed then the weight doubled and used as the cluster weight

2.3 Problem Statement Definition

In India, the agricultural industry is trying to raise crop productivity. To meet the food needs of a growing population, we currently have an urgent need for a second Green Revolution. It is nearly impossible to report better agricultural output due to the global decline in arable land and the decline in arable water supplies. Agriculture-based big data analytics is one strategy that is thought to have a substantial and beneficial role in the expansion of crop output by creating the ideal conditions for plant growth and reducing yield gaps, crop damage, and wastage. In order to

accomplish this, the current study provides an overview of the numerous technological developments, design models, software tools, and algorithms used in the assessment, forecast, and estimation of crop production. India is primarily an agricultural nation, and 70% of our economy is tied to agricultural products either directly or indirectly. With a 40%+ contribution to overall yield generation, rice crop cultivation is crucial to India's food security. The increased production of the rice crop is strongly influenced by the climate and water availability.Big data analytical techniques for rice crop yield assessment and prediction would undoubtedly help farmers to comprehend the ideal state of key variables that affect rice crop production and therefore increase crop yield.

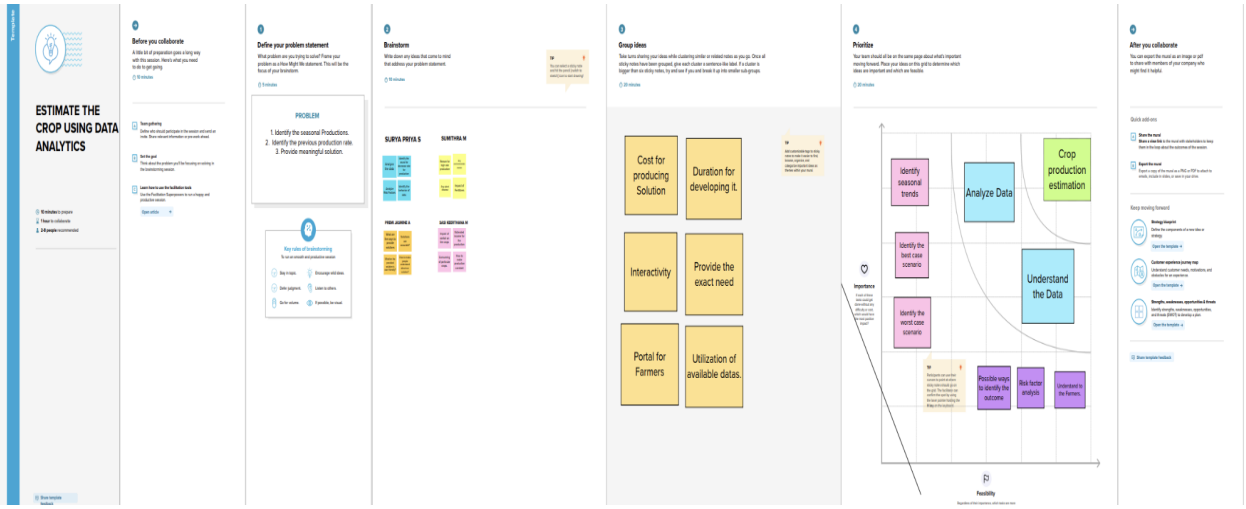
3. IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas

Agriculture is the most significant and important backbone to the country's economy and as compared to other countries Indian civilization depends on this agricultural field a lot. Different climate conditions such as rainfall, temperature, humidity levels, pesticide problems and so on need to be monitored continuously to maintain the agricultural field in good manner.Crop yield prediction is one of the important factors in agriculture practices.Farmers need information regarding crop yield before sowing seeds in their fields to achieve enhanced crop yield. The use of technology in agriculture has increased in recent year and data analytics is one such trend that has penetrated the agriculture field.

3.2 Ideation & Brainstorming

Farming has been the main occupation of Indians for over 5000 years. In the process of evolution, farmers have come out with numerous innovations which brought them good returns and made farming a sustainable practice. A number of farm implements were designed to increase farm efficiency.Monitoring crop yield is important for many agronomy issues such as farming management, food security and international crop trade.

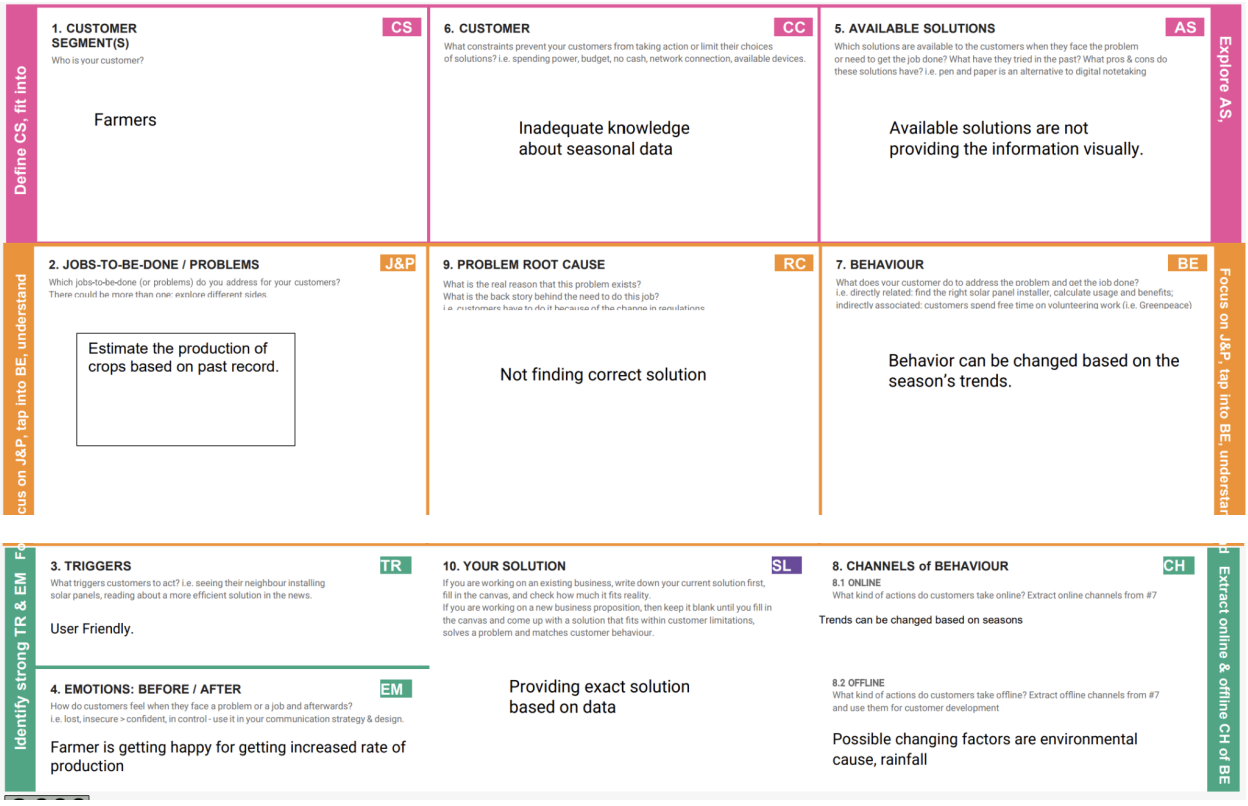


3.3 Proposed Solution

Crop production in India is one of the most important sources of income. Due to variations in climatic conditions, there exists a bottleneck for achieving the high production rate.Estimate the past year production records to produce meaningful insights. By finding out the reasons, and laying the way for increasing the production rate.It is interactive. It can give the information according to certain values. Increased rate of crop production is inversely proportional to food scarcity. Farmers can get more income and yield. It is a user-friendly model. Farmers or any other common people can easily access it. It can handle massive amounts of data and it can modify it accordingly.

3.4 Problem Solution fit

Crop production in India is one of the most important sources of income and India is one of the top countries to produce crops. Due to variations in climatic conditions, there exist bottlenecks for increasing the crop production in India. It has become a challenging task to achieve desired targets in Agri based crop yield.



4. REQUIREMENT ANALYSIS

4.1 Functional requirement

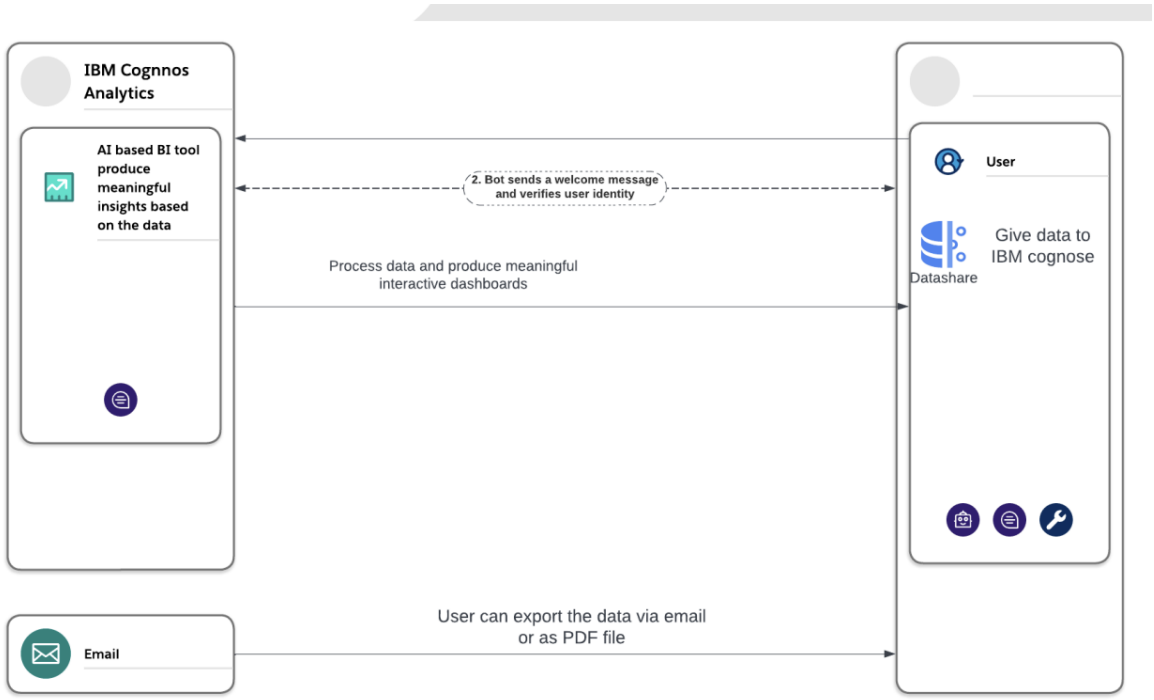
FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Form
FR-2	User Interaction	Interact through the Chat Bot
FR-3	Data Processing	It is assisted by AI
FR-4	Data Visualization	It is interactive and control by AI

4.2 Non-Functional requirements

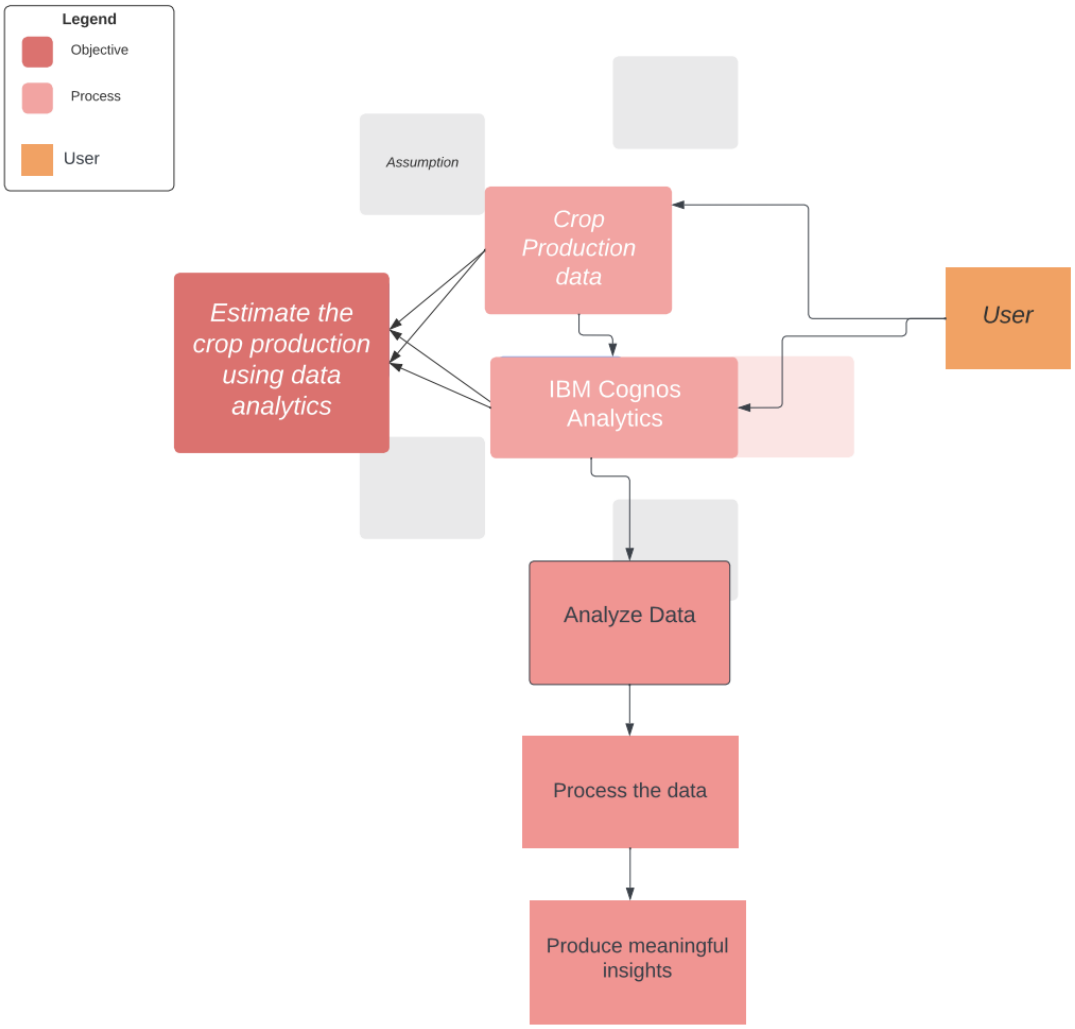
FR No.	Non-Functional Requirement	Description
NFR- 1	Usability	Using Android or IOS or windows applications.
NFR-2	Security	The user data is stored securely in IBM cloud.
NFR-3	Reliability	The Quality of the services are trusted.
NFR-4	Performance	Its Provide smooth user experience.
NFR-5	Availability	The services are available for 24/7.
NFR-6	Scalability	Its easy to scalable size of users and products

5. PROJECT DESIGN

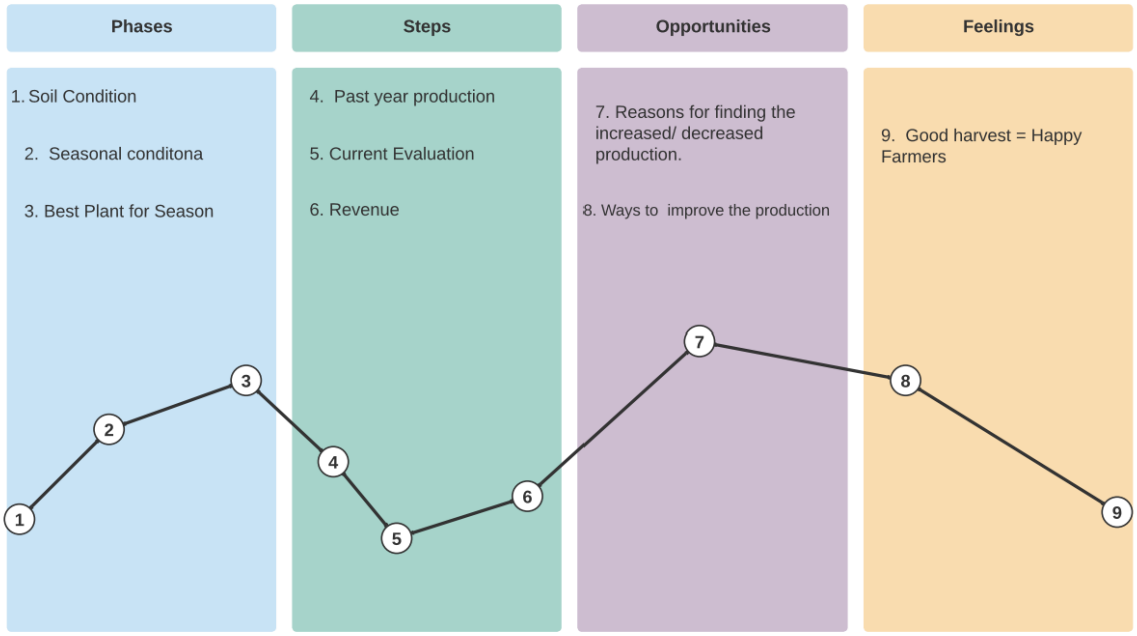
5.1 Data Flow Diagrams



5.2 Solution & Technical Architecture



5.3 User Stories



6. PROJECT PLANNING & SCHEDULING

6.1 Sprint Planning & Estimation

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Priority	Team Members
Sprint 1	Seasons With Average Productions	USN-1	Make an dashboard for know about productions in different seasons.	Medium	Surya Priya, Sumithra, Sasi Keerthana, Premi Jasmine
Sprint 2	With years of usage and area production	USN-2	Make an dashboard to understand about area of productions.	Medium	Surya Priya, Sumithra, Sasi Keerthana, Premi Jasmine
Sprint 3	Top 10 states with most area	USN-3	To find the top 10 states in a Country which has highest area.	High	Surya Priya, Sumithra, Sasi Keerthana, Premi Jasmine
Sprint 4	States with crop production	USN-4	To know about the crops which are cultivated in which states.	High	Surya Priya, Sumithra, Sasi Keerthana, Premi Jasmine
Sprint 5	States with crop production along with season	USN-5	To know about which crops are cultivated in a particular season in a particular state.	High	Surya Priya, Sumithra, Sasi Keerthana, Premi Jasmine

6.2 Sprint Delivery Schedule

Sprint	Duration	Sprint Start Date	Sprint End Date (planned)	Sprint release date(Actual)
Sprint 1	1 Day	19/10/2022	19/10/2022	19/10/2022
Sprint 2	1 Day	20/10/2022	20/10/2022	20/10/2022
Sprint 3	1 Day	21/10/2022	21/10/2022	21/10/2022
Sprint 4	1 Day	24/10/2022	24/10/2022	24/10/2022
Sprint 5	1 Day	25/10/2022	25/10/2022	25/10/2022

7. CODING & SOLUTIONING (Explain the features added in the project along with code)

7.1 Feature 1

Scalability

7.2 Feature 2

Interactive

Ease of learning

7.3 Database Schema (if Applicable)

Not Applicable

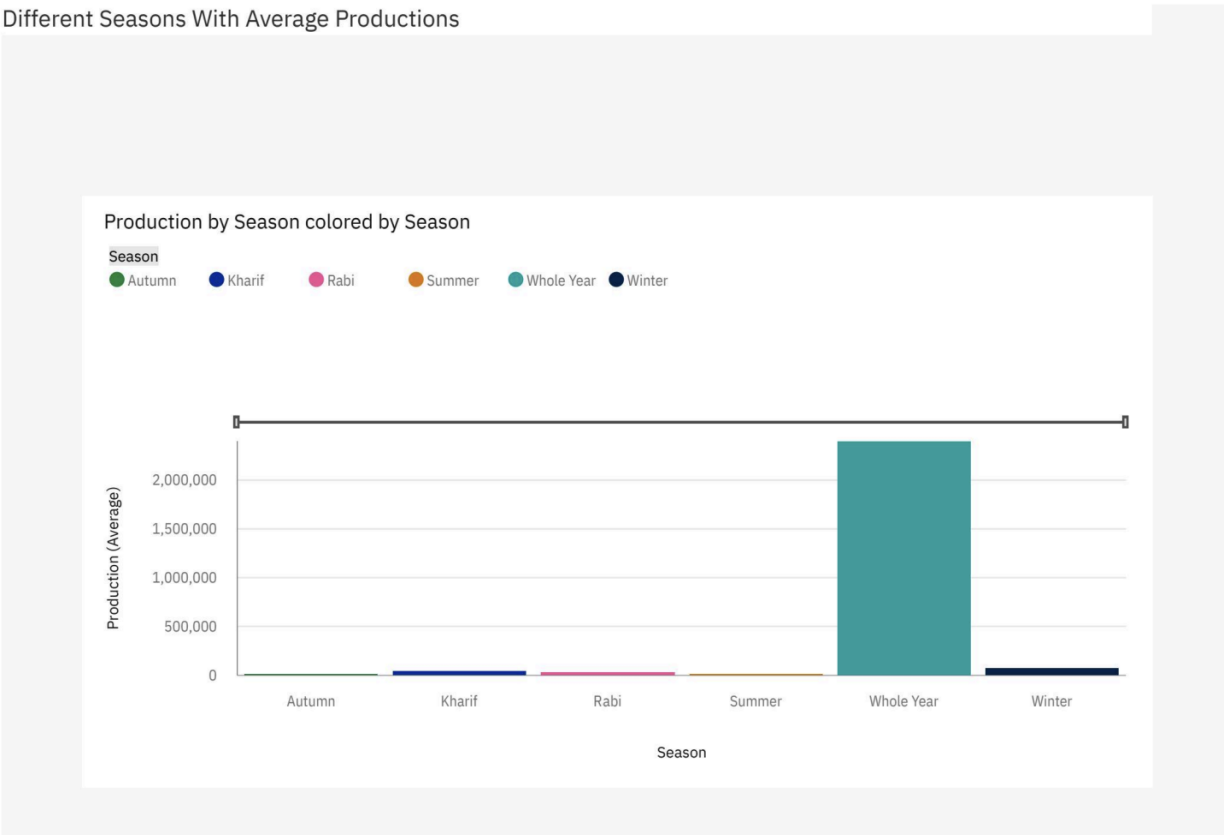
8. TESTING

8.1 User Acceptance Testing

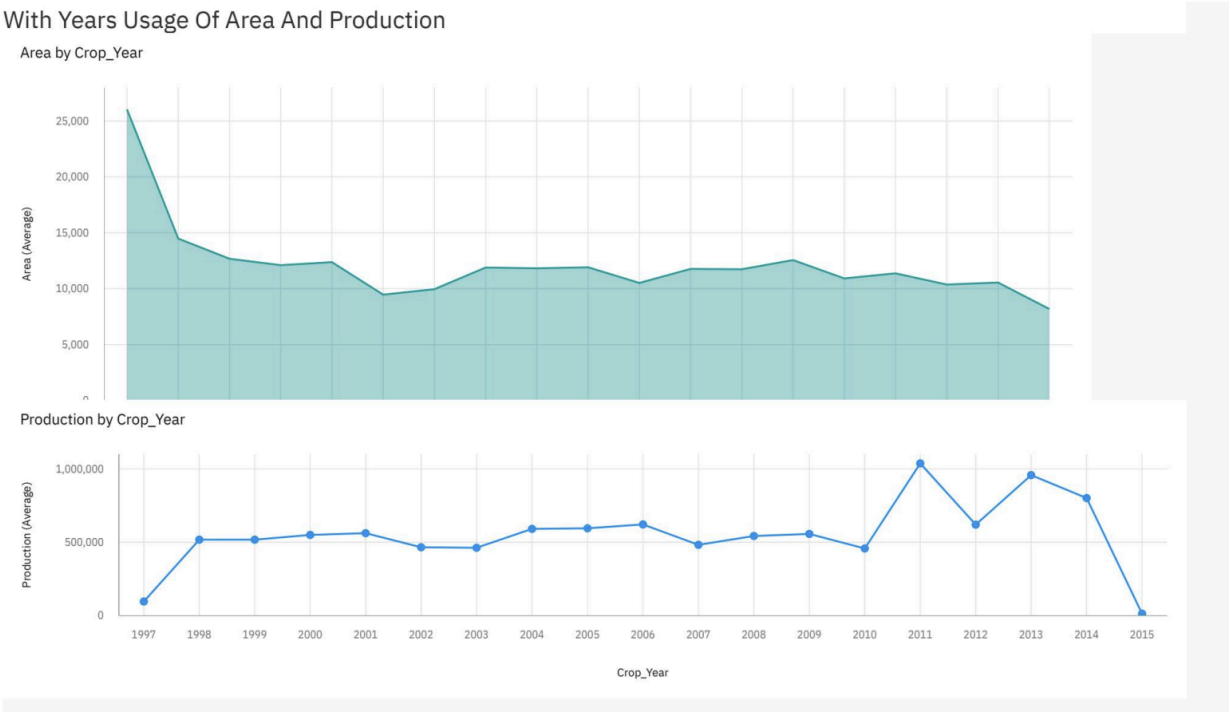
The dashboard meets all the requirements that were set out at the beginning of the project.

It loads the data and refreshes quickly when we filter or make any actions.

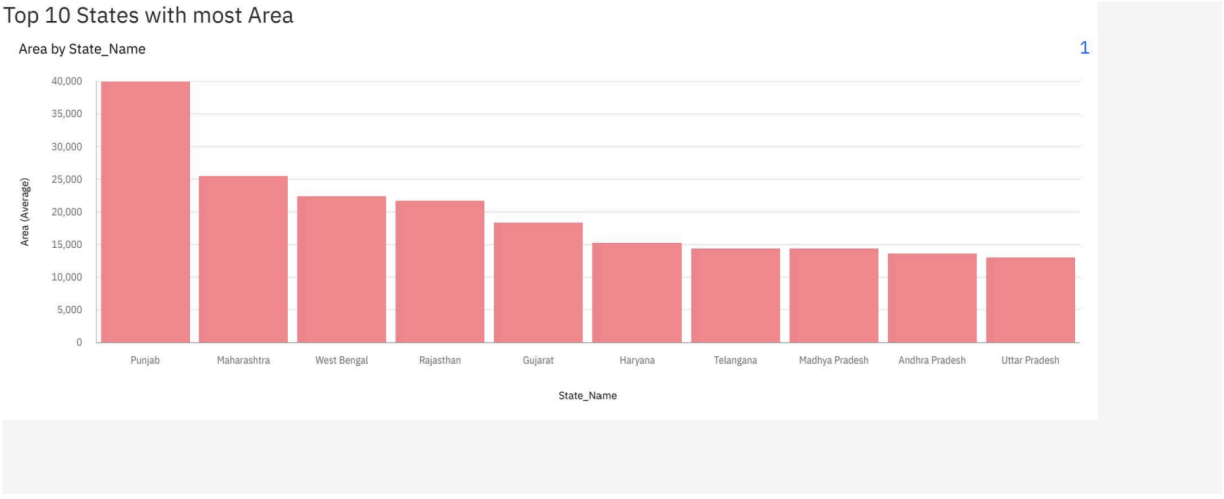
- Seasons with average production



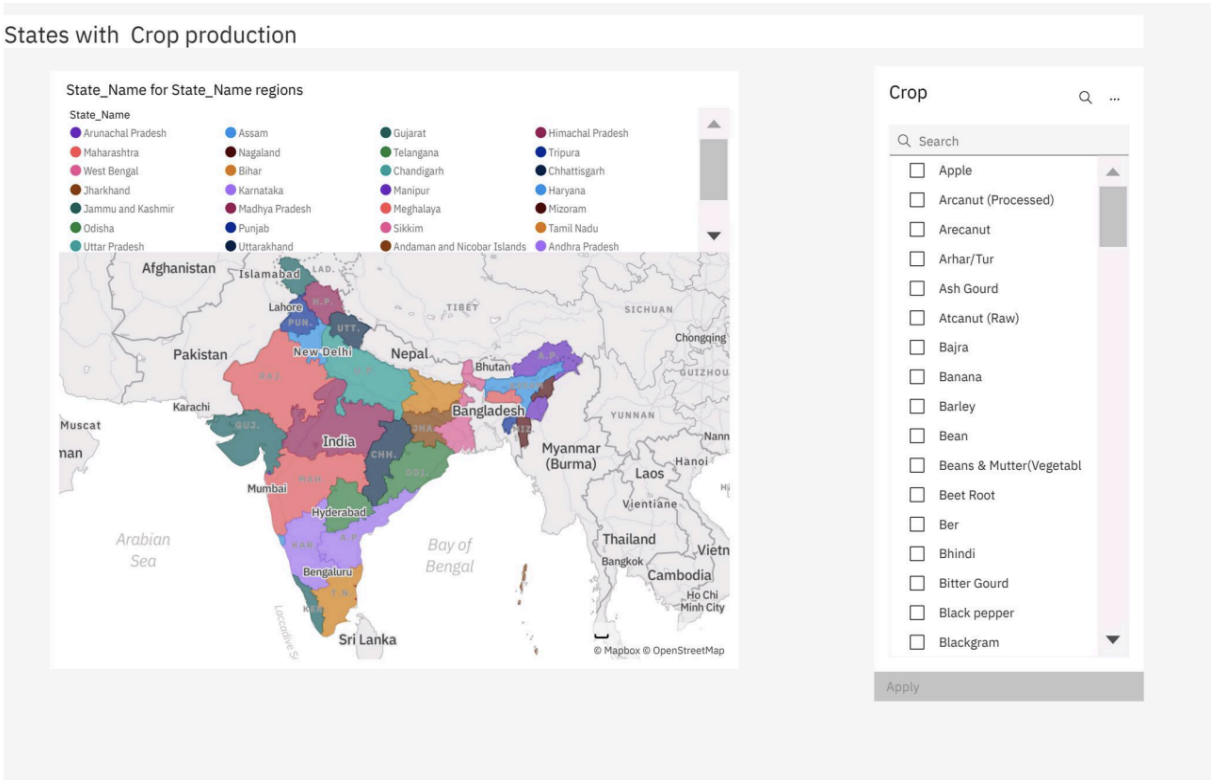
- With Years Usage Of Area And Production



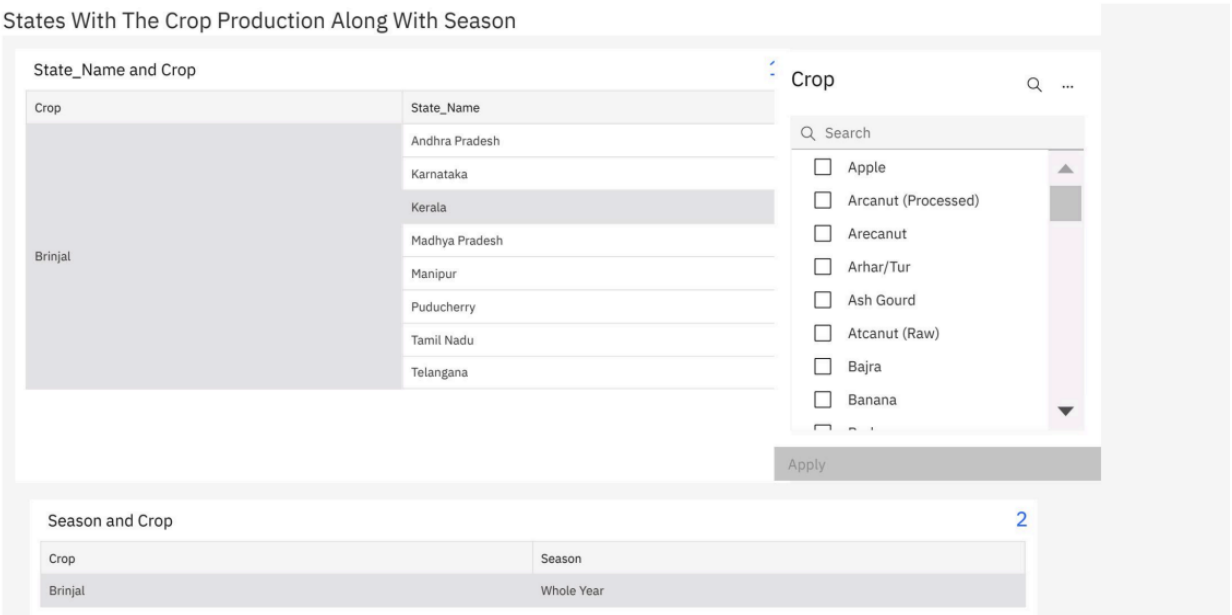
- Top 10 States With Most Area



- State With Crop Production



- States With The Crop Production Along With Season (Text Table)



9. RESULTS

9.1 Performance Metrics

The farmers necessarily require timely advice to predict the future crop productivity and an analysis is to be made in order to help the farmers to maximize the crop production in their crops. Yield prediction is an important agricultural problem. Every farmer is interested in knowing how much yield he is about to expect. In the past, yield prediction was performed by considering a farmer's previous experience on a particular crop. The volume of data is enormous in Indian agriculture. The data when it becomes information is highly useful for many purposes. IBM Cognos Business Intelligence is a web-based integrated business intelligence suite by IBM. It provides a toolset for reporting, analytics, score carding, and monitoring of events and metrics.

10. ADVANTAGES & DISADVANTAGES

In India, crop production is mostly determined by the biological and economic factors that affect a particular crop during a given season. Every nation may examine and benefit from reporting on agricultural progress through all of the seasons in terms of estimating and predicting the overall crop production. Farmers are currently under pressure to produce larger agricultural yields due to the influence of unpredictable weather fluctuations and the considerable global decline in water resources. In order to attain a better and improved crop yield, the most desirable crop should be chosen and used in accordance with the environmental circumstances. Accurate crop yield forecasting helps farmers earn the greatest pricing for their crops and choose the best strategy to minimize crop damage. In order to examine the numerous aspects that affect crop output, such as Area under Cultivation (AUC) interims of hectors, Annual Rainfall (AR) rates, and Food Price Index (FPI), a study group did a work with the goal of accurately predicting crop yield through big data analytics.

Crop yield gaps are measured as the difference between actual farm yields received and expected yields based on potency. Farmers must address the influencing factors, such as the impact of changing climate conditions on crop yield prospects and changes in how agricultural land is used, in order to assess and ultimately close the crop yield gaps.

11. CONCLUSION

The productivity of agriculture has slightly increased as a result of technology's introduction. New ideas like digital agriculture, smart farming, precision agriculture, etc. have been made possible by these innovations. In the literature, it has been noted that analyses of agricultural soils and the detection of hidden patterns utilizing data sets relating to meteorological conditions and crop yields have been conducted. Numerous operations are involved in the agriculture industry, including crop yield prediction, seed selection, soil quality evaluation, and weather forecasting. It is clear that research into using IT trends like data analytics in agriculture is still in its early stages. Since food is a basic human need, attaining the highest yields possible while using the best available resources will soon become a necessity due to the world's expanding population. The results of the poll show that crop yield analytics require new methods. There is a wide range of research potential in this field.

12. FUTURE SCOPE

Agriculture has advanced significantly since its traditional origins in the past. It has developed into a contemporary, data-driven sector from a point where it just relied on advice from other farmers. Farmers can now use historical data and insights to do a thorough study of the crop that should be planted and the cultivation technique that should be used. In order to reduce waste and improve productivity in cultivation, irrigation, harvesting, supply chain management, and transportation, data analytics is increasingly permeating centuries-old agri-processes. This reduces risk when working with perishable items.

With insightful crop data, farmers can choose the type of crop to cultivate and the strain that is most suited for the climatic conditions, rainfall seasons, and type of soil. Based on data analysis, hybrid varieties or breeds that are most resistant to disease and spoilage can be suggested that are best suited to the soil and climatic circumstances.

13. APPENDIX

GitHub & Project Demo Link

GitHub Link:

https://github.com/IBM-EPBL/IBM-Project-25042-1659952979.git

Project Demo Link:

https://github.com/IBM-EPBL/IBM-Project-25042-1659952979/blob/83b5bf7f8394fac523614f6eb69a444c21ae5375/Final%20Deliverables/Estimate%20the%20Crop%20Production%20Using%20Data%20Analytics.mp4