PROFESSIONAL READINESS FOR INNOVATION, EMPLOYABILITY AND ENTREPRENEURSHIP

TEAM ID:	**PNT2022TMID33122**	
TEAM LEAD:	GURU V	(922119104012)
TEAM MEMBERS:	DHANUSHKODI R	(922119104009)
	ANANTHA NIVETHAN GP	(922119104004)
	JEBARSON S	(922119104016)

INSTITUTION: **SSM INSTITUTE OF ENGINEERING AND TECHNOLOGY-DINDIGUL.**

ESTIMATE THE CROP YIELD USING DATA ANALYTICS

(DOMAIN: DATA ANALYTICS)

PROJECT REPORT

November 2022

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1. INTRODUCTION

Predicting crop yields is one of the most difficult problems in agriculture. It is crucial to decision-making at the international, regional, and local levels. Agricultural, soil, climatic, environmental, and other characteristics are used to predict crop yield.

Agriculture fulfils a fundamental need, which makes it crucial for human survival. It is a well-known fact that in India, agriculture employs the bulk of the population (about 55%). There are obstacles to expanding crop production in India because of weather changes. The way modern farms and agricultural enterprises operate differs greatly from how they did a few decades ago, largely due to technological developments in the form of sensors, machinery, devices, and information technology.

1.1. PROJECT OVERVIEW

It has become a challenging task to achieve desired targets in Agriculture based crop yield. Various factors 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. To reach desired crop yield goals has become a difficult undertaking in agriculture.

Numerous elements that directly affect the yield and productivity of the crops must be taken into account. One of the crucial aspects of agricultural techniques is the forecast of crop

production. Before planting seeds in their fields, farmers require knowledge about crop yield in order to increase agricultural output.
In recent years, the use of technology in agriculture has increased, and one such development is the use of data analytics.

Thus, a project that would suit the needs of a farmer and at least help them over a borderline to understand and predict or estimate the crop yield was the main aim and was brought to life.

1.2. PURPOSE

Estimation of Crop yield has become the need of the hour and one easy tool/method that can be used is Data Analytics. The term "data analytics" describes the methods used to analyse data in order to increase productivity and financial gain. In order to examine different behavioural patterns, data is extracted from a variety of sources, cleaned up, and classified. The methods and resources employed change depending on the group or person.

The purpose behind this project is to understand the variation in crop yield due to various parameters that can be natural or non-natural.

2. LITERATURE SURVEY

2.1. EXISTING PROBLEM

With the changing of climate, agriculture faces increasing problems with extreme weather events leading to considerable yield losses of crops. Most often, crop plants are sensitive to stresses since they were mostly selected for high yield, and not for stress tolerance. The four most important factors that influence crop

yield are soil fertility, availability of water, climate, and diseases or pests.

With such varying parameters, to understand or estimate the patterns with no technological involvements is very difficult. Thus, a solution that is technological and cater to the alterations and provide the predicted solution in a form that can be easily understood by end customers is essential.

2.2. REFERENCES

i. How data analytics is transforming agriculture - ScienceDirect - https://doi.org/10.1016/j.bushor.2017.09.011

ii. https://www.researchgate.net/publication/329467349_Agriculture_Data_Analytics_in_Crop_Yield_Estimation_A_Critical_Review

iii. https://www.researchgate.net/publication/359131334_Data_analytics_platforms_for_agricultural_systems_A_systematic_literature_review

iv. N. Chergui, M. -T. Kechadi and M. McDonnell, "The Impact of Data Analytics in Digital Agriculture: A Review," 2020 International Multi-Conference on: “Organization of Knowledge and Advanced Technologies” (OCTA), 2020, pp. 1-13, doi: 10.1109/OCTA49274.2020.9151851.

v. D. Elavarasan and P. M. D. Vincent, "Crop Yield Prediction Using Deep Reinforcement Learning Model for Sustainable Agrarian

Applications," in IEEE Access, vol. 8, pp. 86886-86901, 2020, doi: 10.1109/ACCESS.2020.2992480.

2.3. PROBLEM STATEMENT DEFINITION

The following instances define the problem of notice. Ram is a farmer who needs a way to understand and predict climatic conditions because he can decide on the safety measures to be followed with regards to the field setup.

Raj is a farmer who needs a way to decide what to grow and when to grow because he is uncertain of his environmental conditions.

Ranil is a grocer and crop distributor who needs to know the overall crop yield turnover because he has to understand his monetary turnover for the year.

Thus, a solution that can cater to all the needs put forth is being formulated.

3. IDEATION & PROPOSED SOLUTION

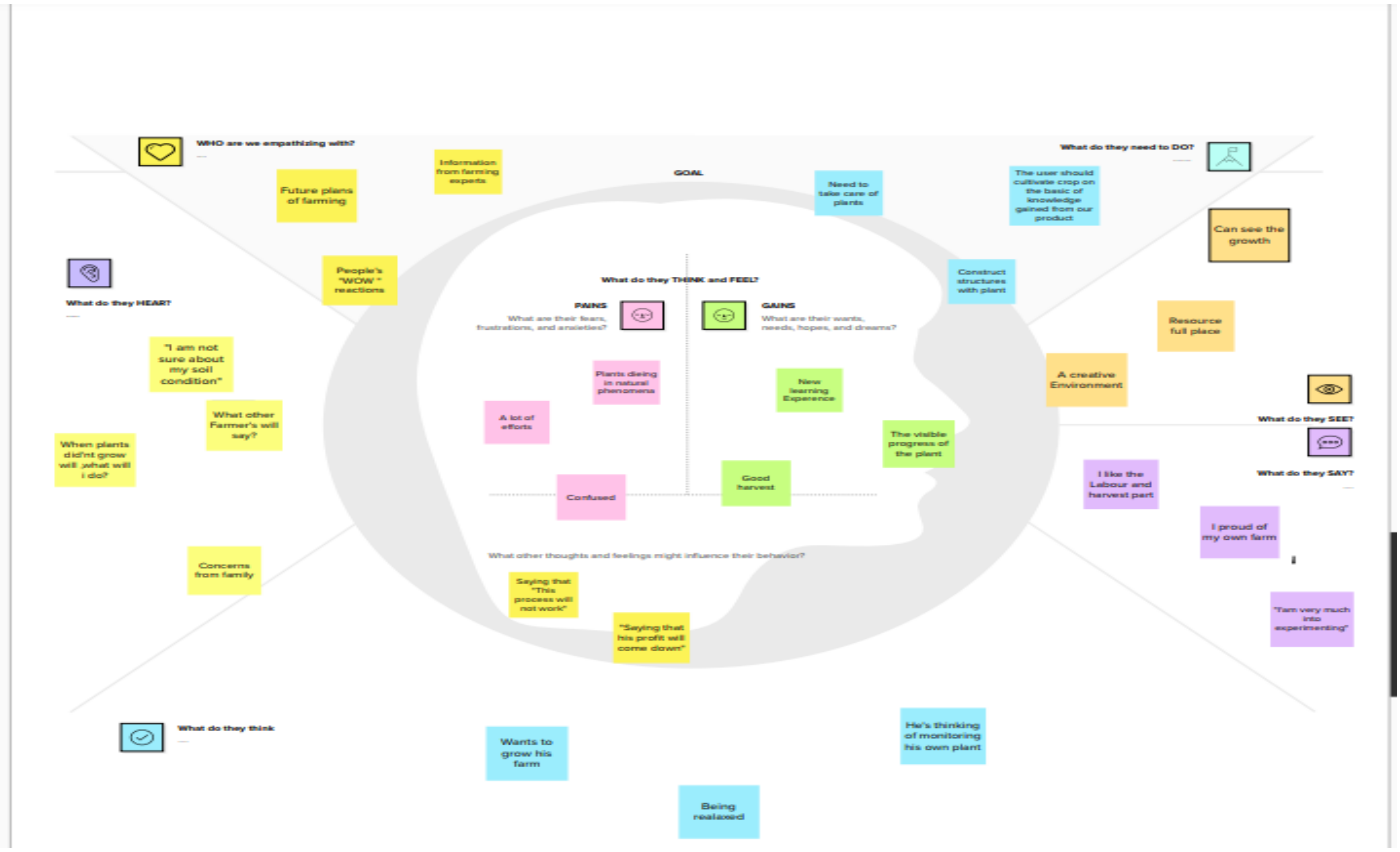
3.1. EMPATHY MAP CANVAS

A team of four members sat together to discuss on and empathize about the problem that people have been facing with regards to understanding and predicting the yield of crops.

As a part of what the customers or target audience felt, a conclusion was made such that they were concerned about elements like finances, monetary support, heavy unexpected losses, proper yield of crop and certain other unpredictable factors.

Under the concepts of what they see and on the basis of environment, friends and what the market offers, digital solutions for ever changing natural setup with the difficulty of moving from traditional to modern farming was sought.

The specifics of pain and gain along with speculations of the influence of affluent land buyers, self-doubt and fright added with this comes the fear to quit agriculture under the section of what they hear.



3.2. IDEATION & BRAINSTORMING

Ideation and the process of brainstorming was done by initially tracing the problem and defining it. This was followed by pushing in individual ideas about the problem and then grouping it in together under common grounds and making a graph out of the priority provided.

PROBLEM STATEMENT:

PROBLEM

A farmer should predict climatic conditions, decide what to grow & when to grow, should know the overall crop yield turnover

BRAINSTORMING:

Person 1

predicting weather	correct amount of water	knowing soil nature
knowledge of plant diseases	Planting the plants in correct distance	Notifying harvesting time
Maintaining and monitoring the plants	Methods followed for crop production	Using quality seeds

Person 2

Natural fertilizer	Soil Testing	Organic pesticides
Field Protection	Planting the plants in correct distance	Monitoring the crop Growth
Check the quality of seeds	Check the growth daily	Predicte the weather

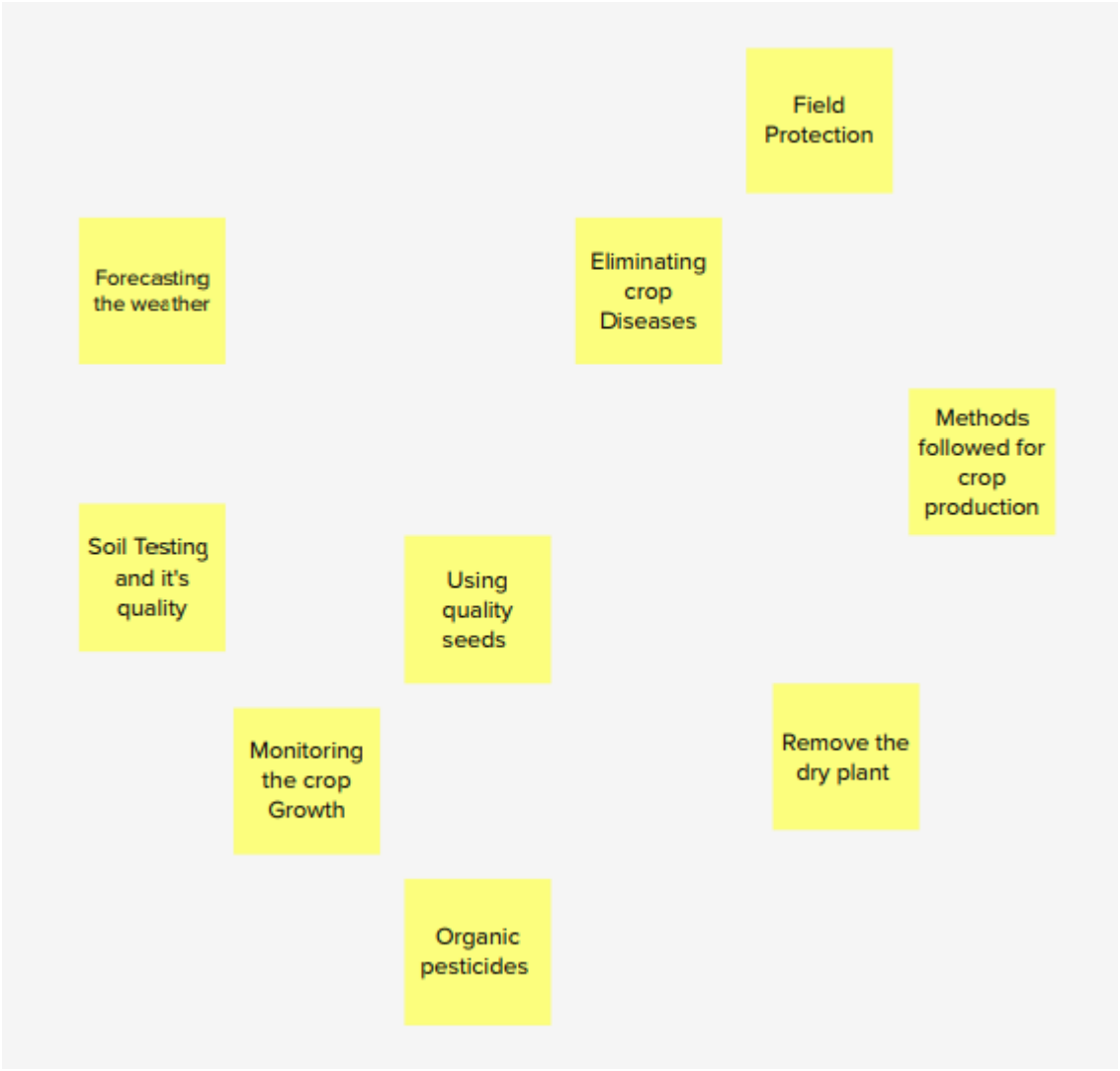
Person 3

Weed And Pest	Water	Healthy seed
Check the growth daily	Natural pesticides	Organic pesticides
Regular Scouting	Monitoring proper Irrigation	Remove the dry plant

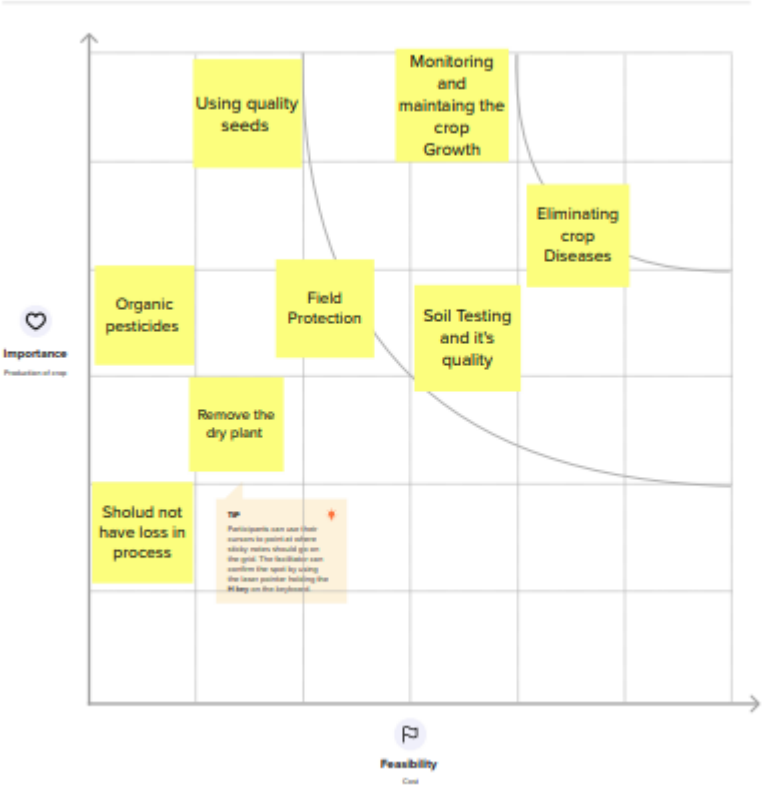
Person 4

Eliminating crop Diseases	Sholud not have loss in process	fertilizer application
Soil Testing & Its Quality	Forecasting Crop Yield	increased soil tillage
Less invesmnet and more profit	Forecasting the weather	improved farming

GROUPING:


Field Protection
Forecasting the weather
Eliminating crop Diseases
Methods followed for crop production
Soil Testing and it's quality
Using quality seeds
Monitoring the crop Growth
Remove the dry plant
Organic pesticides

PRIORITIZATION:



3.3. PROPOSED SOLUTION

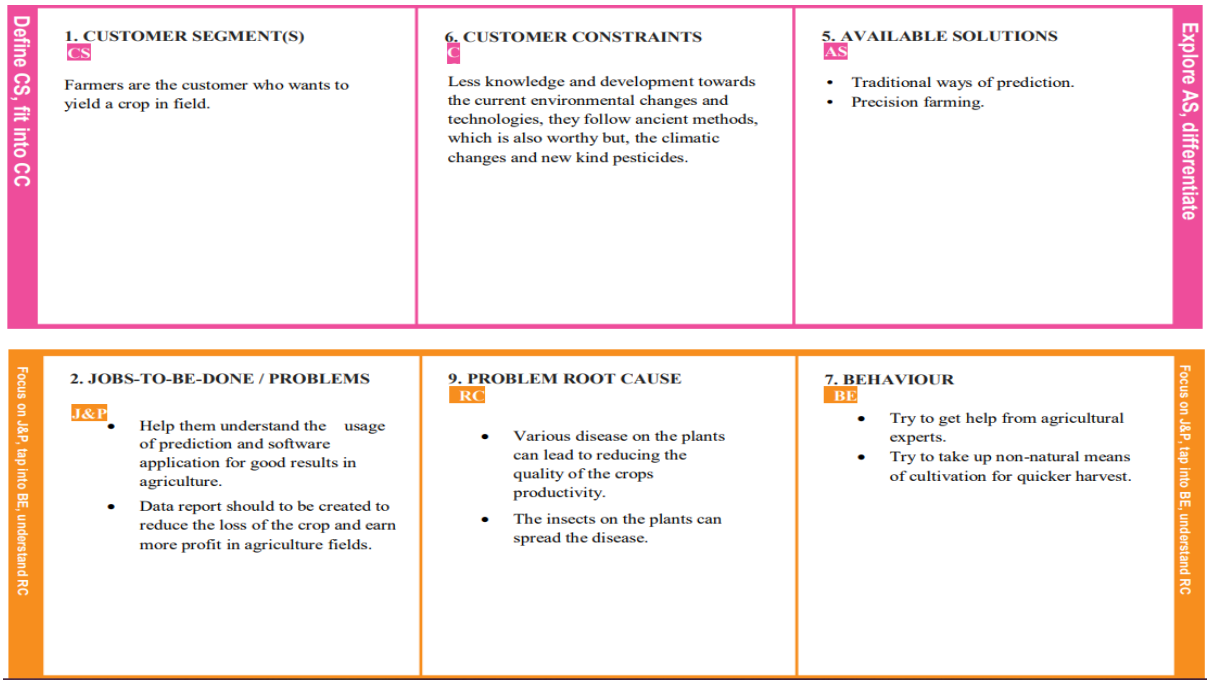
A farmer should predict climatic conditions, decide what to grow & when to grow, should know the overall crop yield turnover and must be able to be sure of the crop yield inspite of the environmental and other parameters. Analysis of important visualization using the previous years' data, creating a dashboard and by going the datasets to obtain most of the insights of Crop production in India is chosen and proposed as the solution.

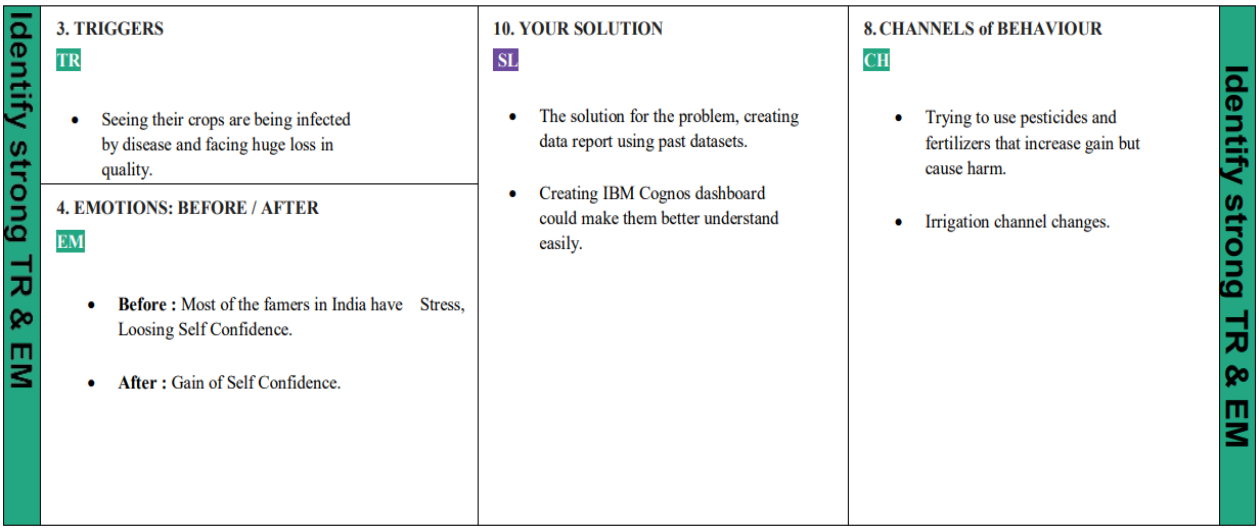
A one-stop solution for understanding and to get an insight about the previous years' data related to the harvest and cultivation. There is no other setup that's required to be installed as an adage;

Availability to all the farmers who need help and as this is a simple approach, understanding issues will not arise. A profit can be made by promoting the solution as an easily available mobile application for anyone to access and benefit out of it. Venture joints with government can be made to pull out monetary benefits. There is no issue with regards to storage of datasets and collection of data. Hence, the solution can be easily scaled to handle data needs, traffic and increased number of users.

3.4. PROBLEM SOLUTION FIT

There were multiple segments considered under the Problem Solution Fit and is illustrated below.





4. REQUIREMENT ANALYSIS

4.1. FUNCTIONAL REQUIREMENT

Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	**User Signup**	Registration through Gmail Registration through IBM
FR-2	**User Confirmation**	Confirmation via Email Confirmation via OTP
FR-3	**Data Collection**	
FR-4	**Data Processing**	Data cleaning, removal of noise and obsolete data
FR-5	**Visualization Tool**	Graphical visualization choices

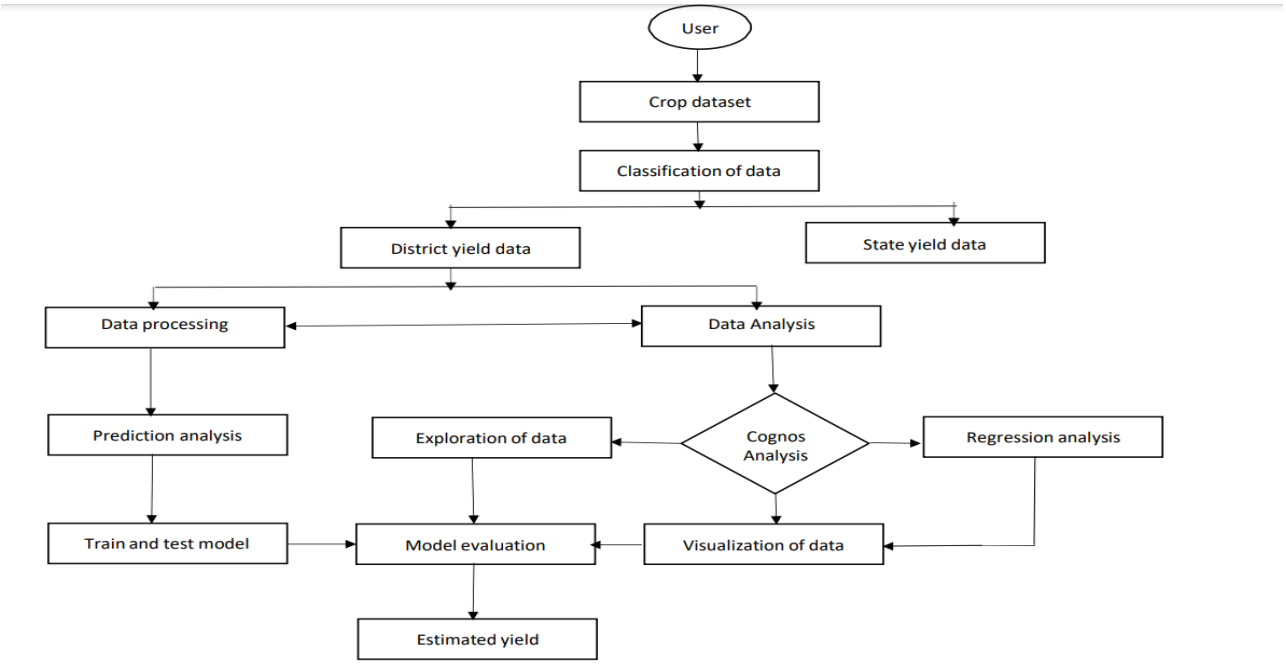
4.2. NON-FUNCTIONAL REQUIREMENTS

Following are the non-functional requirements of the proposed solution.

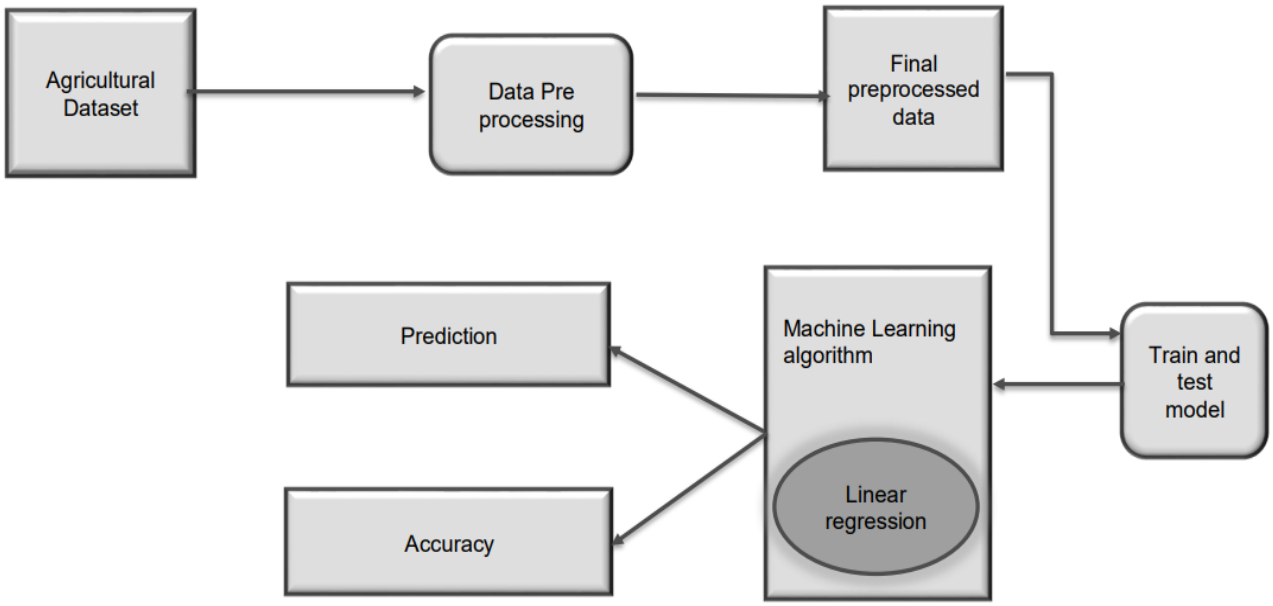
FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	Ease of usage along with ease in-access of tools and features
NFR-2	**Security**	Access to resources through two factor authentication and credentials
NFR-3	**Reliability**	There should be no crashes or loss of data or processes
NFR-4	**Performance**	High speed rendering of visualization and other readily available features
NFR-5	**Availability**	Should be available on demand
NFR-6	**Scalability**	Should be able to incorporate as many visualizations and datasets as possible

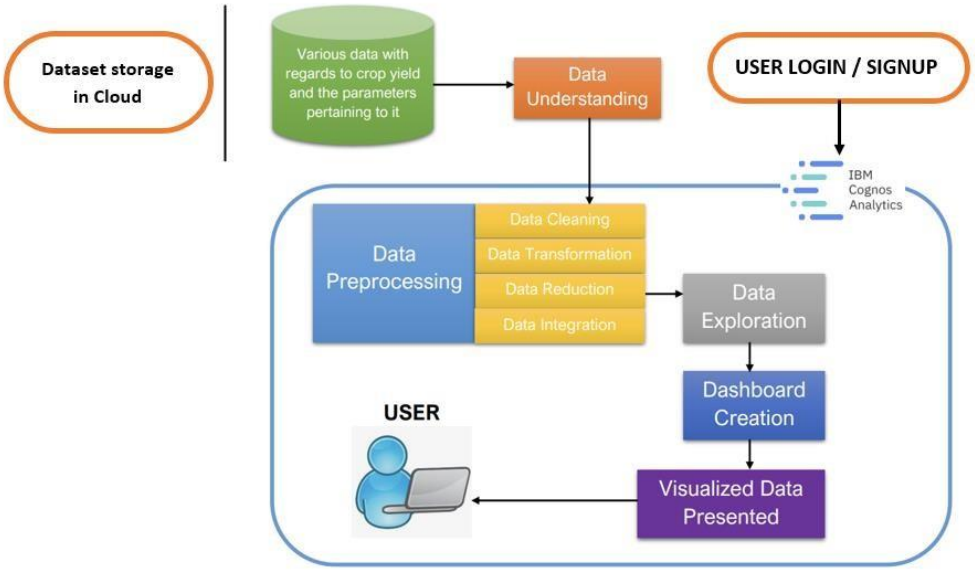
5. PROJECT DESIGN

5.1. DATA FLOW DIAGRAMS



5.2. SOLUTION & TECHNICAL ARCHITECTURE





IBM COGNOS

USER

&

ADMIN

5.3. USER STORIES

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Mobile user)	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password. As a user, I will receive confirmation email once I have registered for the application	I can access my account / dashboard	High	Sprint-1
		USN-2	As a user, I can register for the application through Google	I can receive confirmation email & click confirm	High	Sprint-1
		USN-3	As a user, I can register	I can register & access the dashboard with Google Login	Low	Sprint-2
		USN-4			Medium	Sprint-1

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
			for the application through Gmail			
	Login	USN-5	As a user, I can log into the application by entering email & password		High	Sprint-1
	Dashboard	USN-6	As a user, I can freely use my dashboard and explore the features		High	Sprint-1
	Access of Resources	USN-7	As a user, I can use the credentials to access the resources of my application	I can securely access my resources	High	Sprint-2
Administrator	Control over the application	USN-8	I can control the users of the application		High	Sprint-2

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer	Tools	USN-9	I can perform the required tasks on the application		High	Sprint-1

6. PROJECT PLANNING & SCHEDULING

6.1. SPRINT PLANNING & ESTIMATION

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	2	High	Jebarson Guru
Sprint-1		USN-2	As a user, I will receive confirmation email once I have registered for the application	1	High	Dhanushkodi Ananthanivethan
Sprint-2		USN-3	As a user, I can register for the application through Google	2	Low	Jebarson Dhanush

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1		USN-4	As a user, I can register for the application through Gmail	2	Low	Dhanush Guru
Sprint-1	Login	USN-5	As a user, I can log into the application by entering email & password	1	High	jebarson Anantha
Sprint-3	Dashboard	USN-6	As a user, I can freely use my dashboard and explore the features	2	High	Anand Guru
Sprint-2		USN-7	As a user, I can use the credentials to access the resources of my application	2	High	Dhanush Ananthanivethan
Sprint-3		USN-8	Performance of Data manipulations on the application	1	High	jebarson Guru
Sprint-3	Visualizations	USN-9	I can create dashboards with particular datasets	2	High	Guru Ananthanivethan
Sprint-4		USN-10	Predictive analysis can be done	1	High	Guru Anand
Sprint-3		USN-11	I can create stories with particular datasets	2	High	Jebarson Dhanushkodi

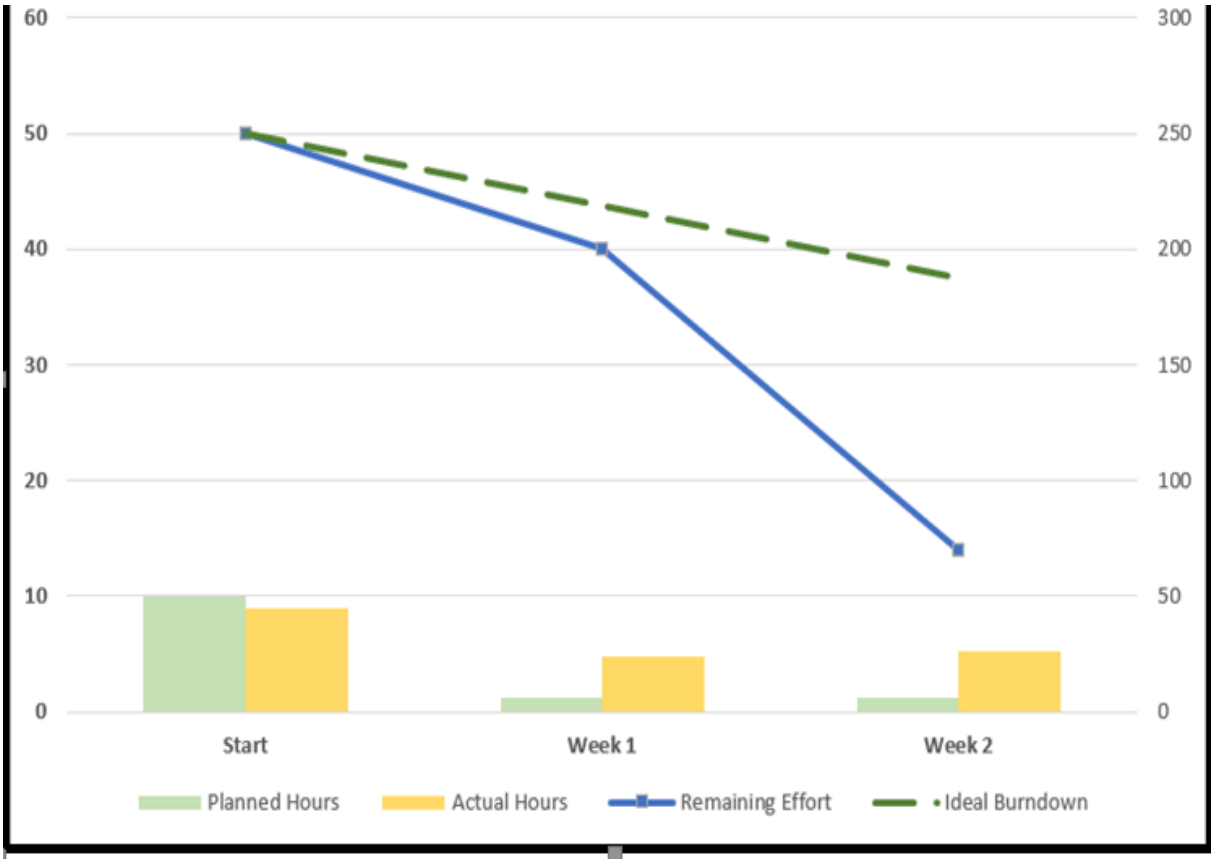
Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-4		USN-12	I can deliver and export reports according to the dashboards and stories created	2	High	Jebarson Anantha Nivethan

6.2. SPRINT DELIVERY SCHEDULE

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	20	6 Days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	20	05 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	20	12 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	20	19 Nov 2022

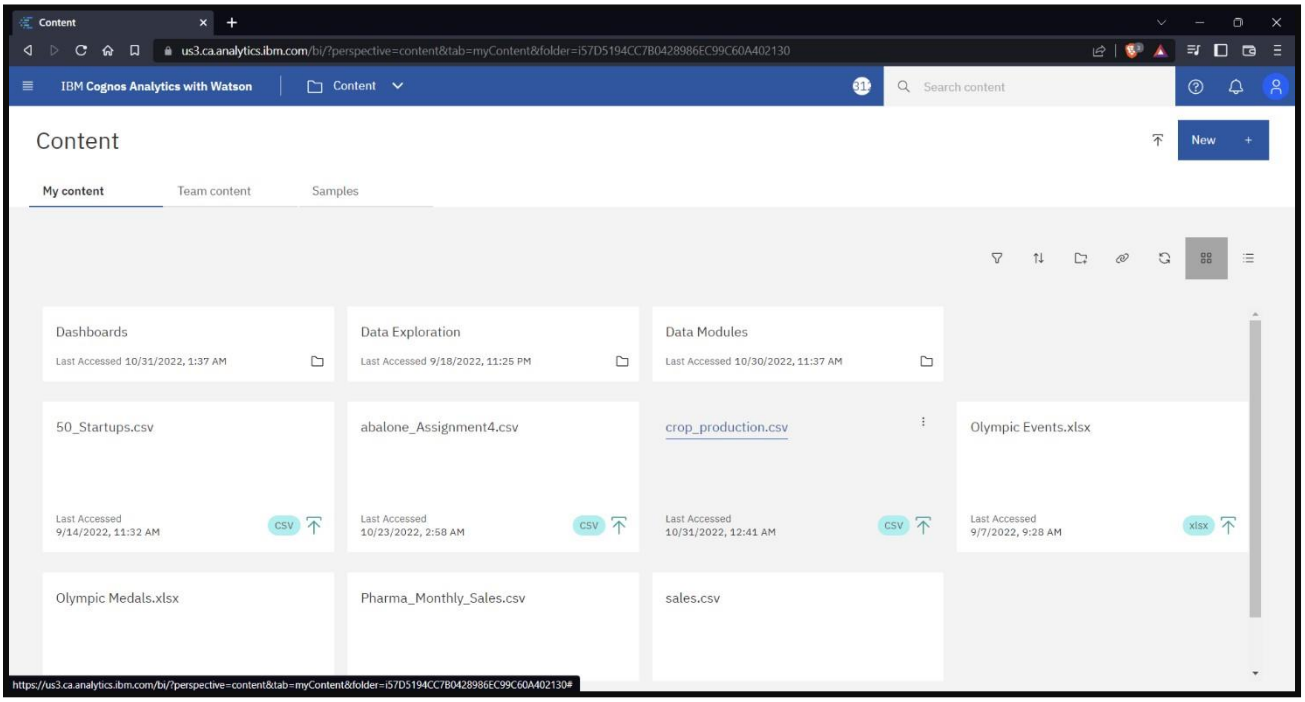
6.3. BURNDOWN CHART

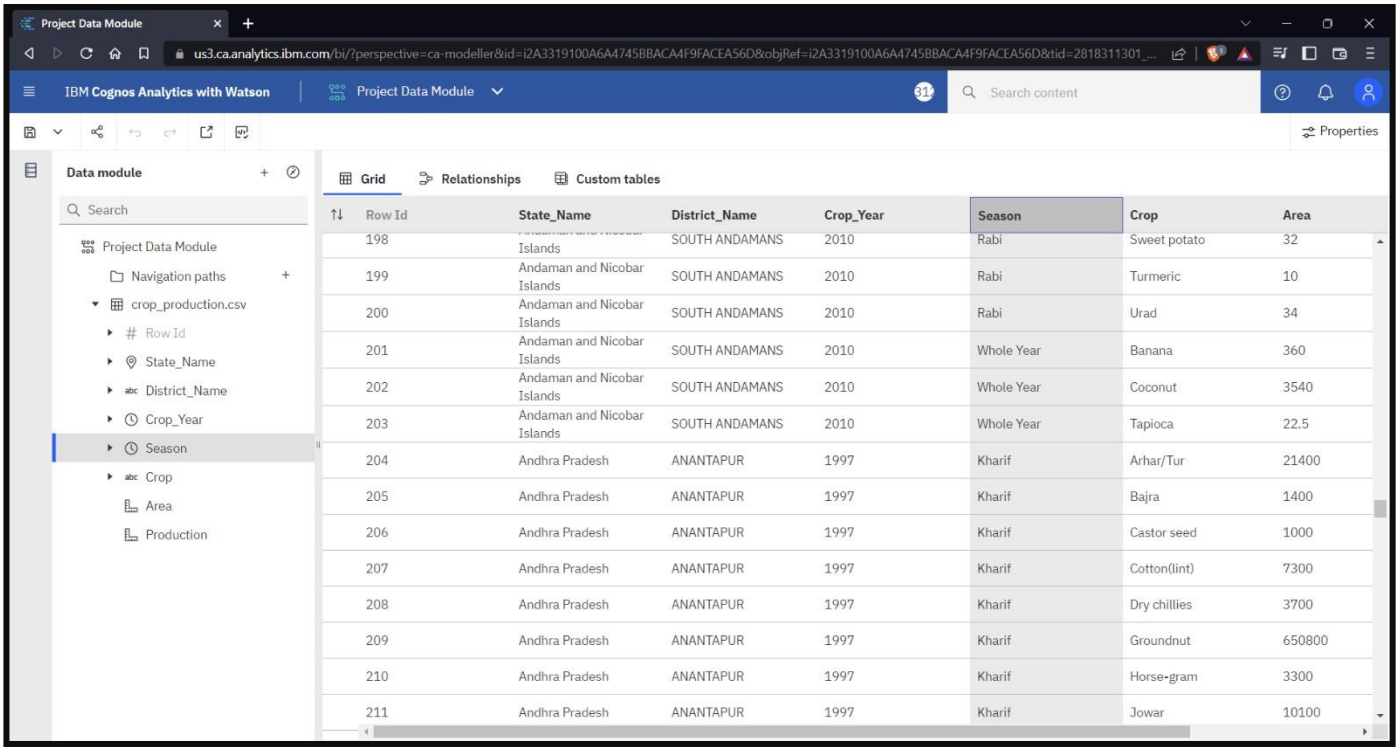
A burn down chart is a graphical representation of work left to do versus time. It is often used in agile software development methodologies such as Scrum. However, burn down charts can be applied to any project containing measurable progress over time.

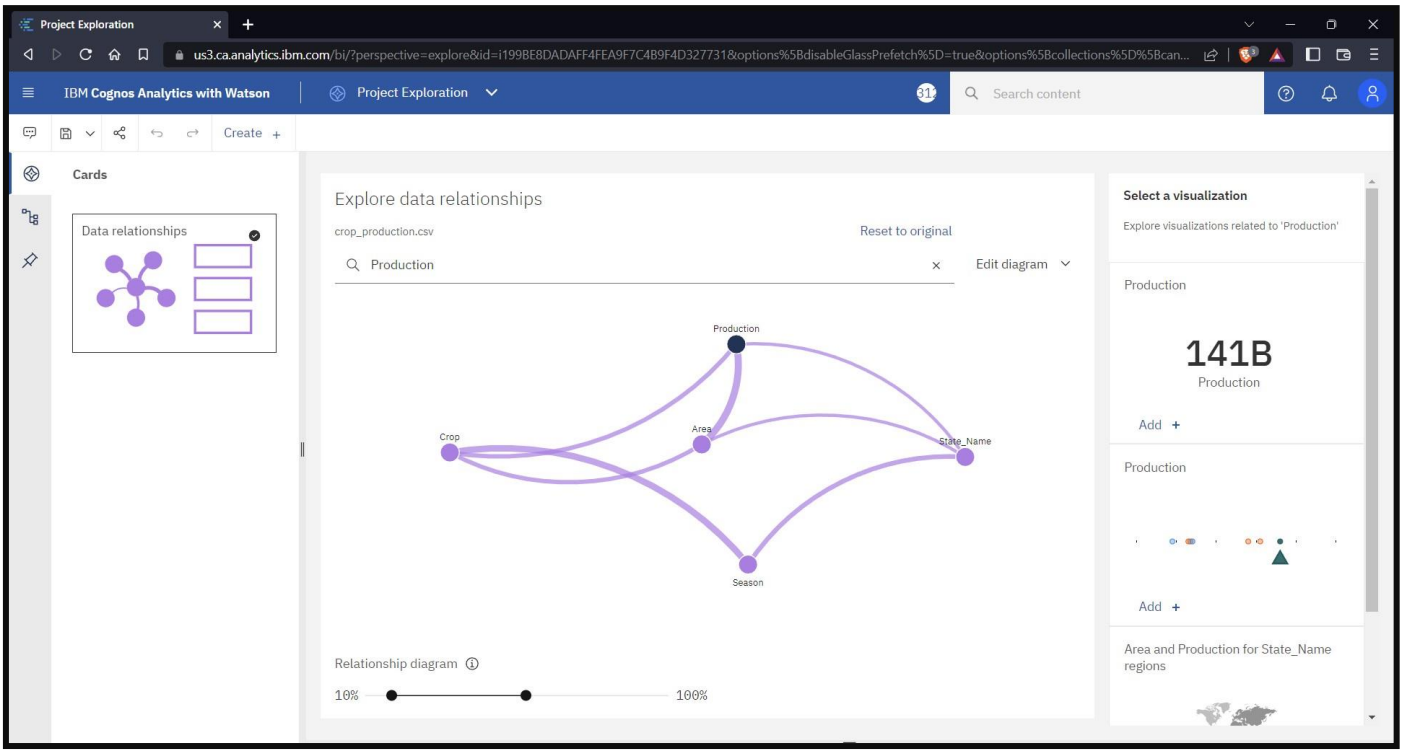


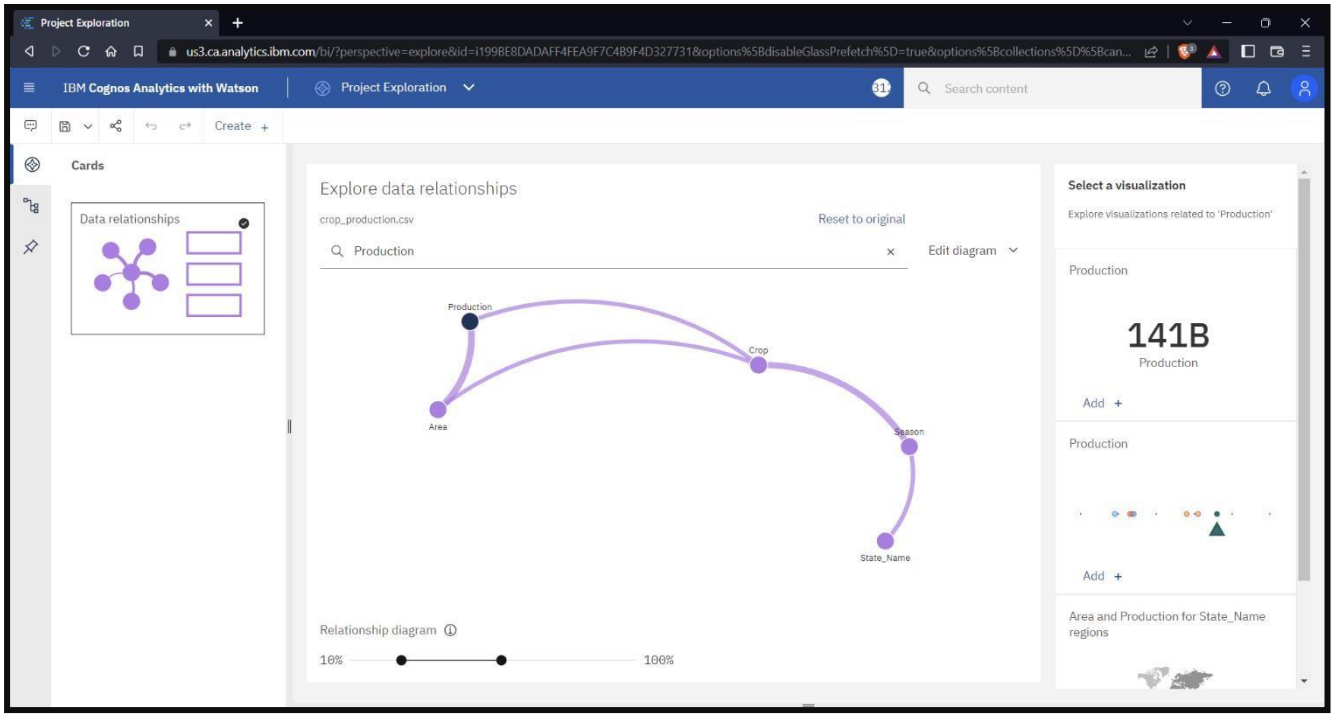
7. CODING & SOLUTIONING

7.1. DATA COLLECTION AND PREPARATION

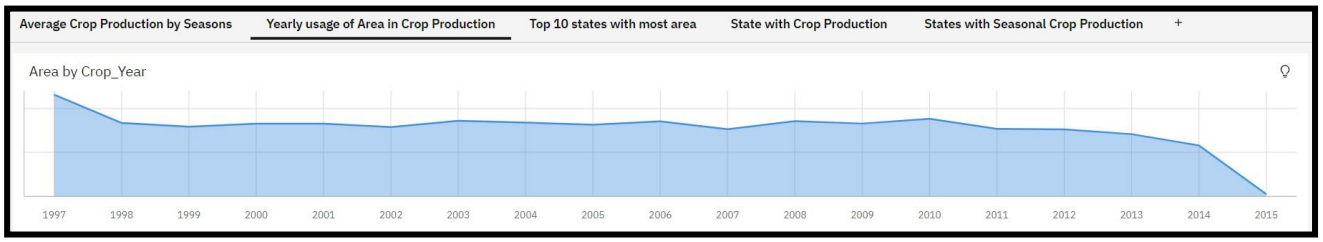


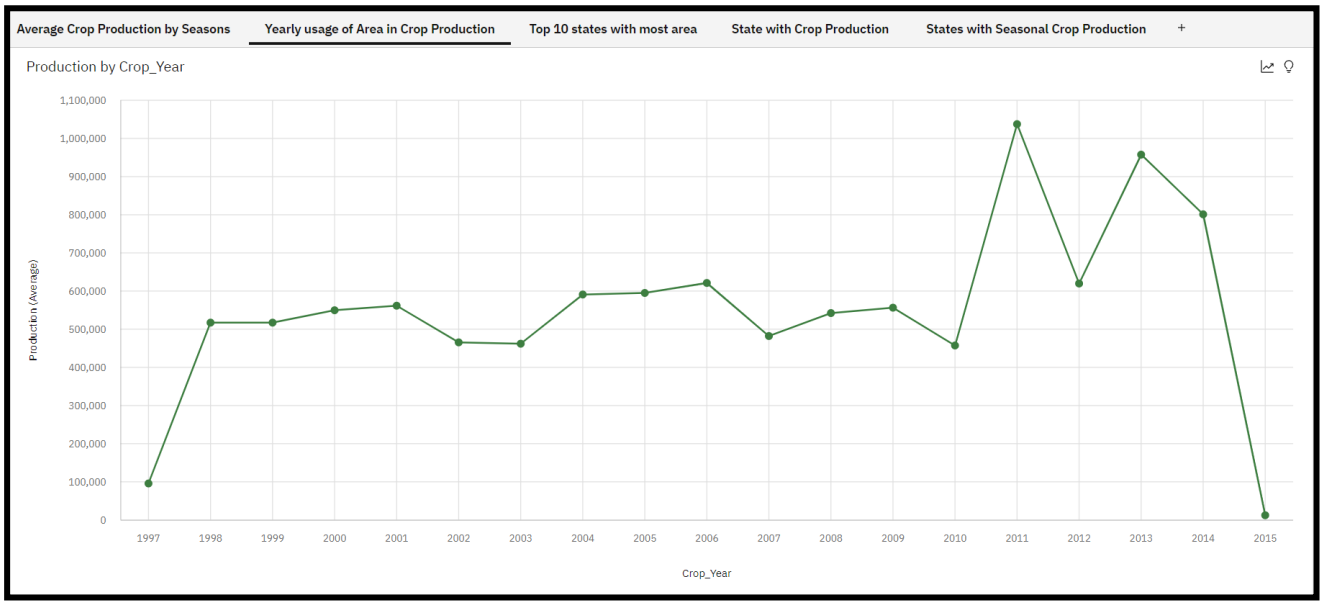

Project Data Module
IBM Cognos Analytics with Watson
Project Data Module
Search content
Properties
Data module
Search
Project Data Module
Navigation paths
crop_production.csv
Row Id
State_Name
District_Name
Crop_Year
Season
Crop
Area
Production
Grid
Relationships
Custom tables
Row Id | State_Name | District_Name | Crop_Year | Season | Crop | Area
198 | Andaman and Nicobar Islands | SOUTH ANDAMANS | 2010 | Rabi | Sweet potato | 32
199 | Andaman and Nicobar Islands | SOUTH ANDAMANS | 2010 | Rabi | Turmeric | 10
200 | Andaman and Nicobar Islands | SOUTH ANDAMANS | 2010 | Rabi | Urad | 34
201 | Andaman and Nicobar Islands | SOUTH ANDAMANS | 2010 | Whole Year | Banana | 360
202 | Andaman and Nicobar Islands | SOUTH ANDAMANS | 2010 | Whole Year | Coconut | 3540
203 | Andaman and Nicobar Islands | SOUTH ANDAMANS | 2010 | Whole Year | Tapioca | 22.5
204 | Andhra Pradesh | ANANTAPUR | 1997 | Kharif | Arhar/Tur | 21400
205 | Andhra Pradesh | ANANTAPUR | 1997 | Kharif | Bajra | 1400
206 | Andhra Pradesh | ANANTAPUR | 1997 | Kharif | Castor seed | 1000
207 | Andhra Pradesh | ANANTAPUR | 1997 | Kharif | Cotton(lint) | 7300
208 | Andhra Pradesh | ANANTAPUR | 1997 | Kharif | Dry chillies | 3700
209 | Andhra Pradesh | ANANTAPUR | 1997 | Kharif | Groundnut | 650800
210 | Andhra Pradesh | ANANTAPUR | 1997 | Kharif | Horse-gram | 3300
211 | Andhra Pradesh | ANANTAPUR | 1997 | Kharif | Jowar | 10100

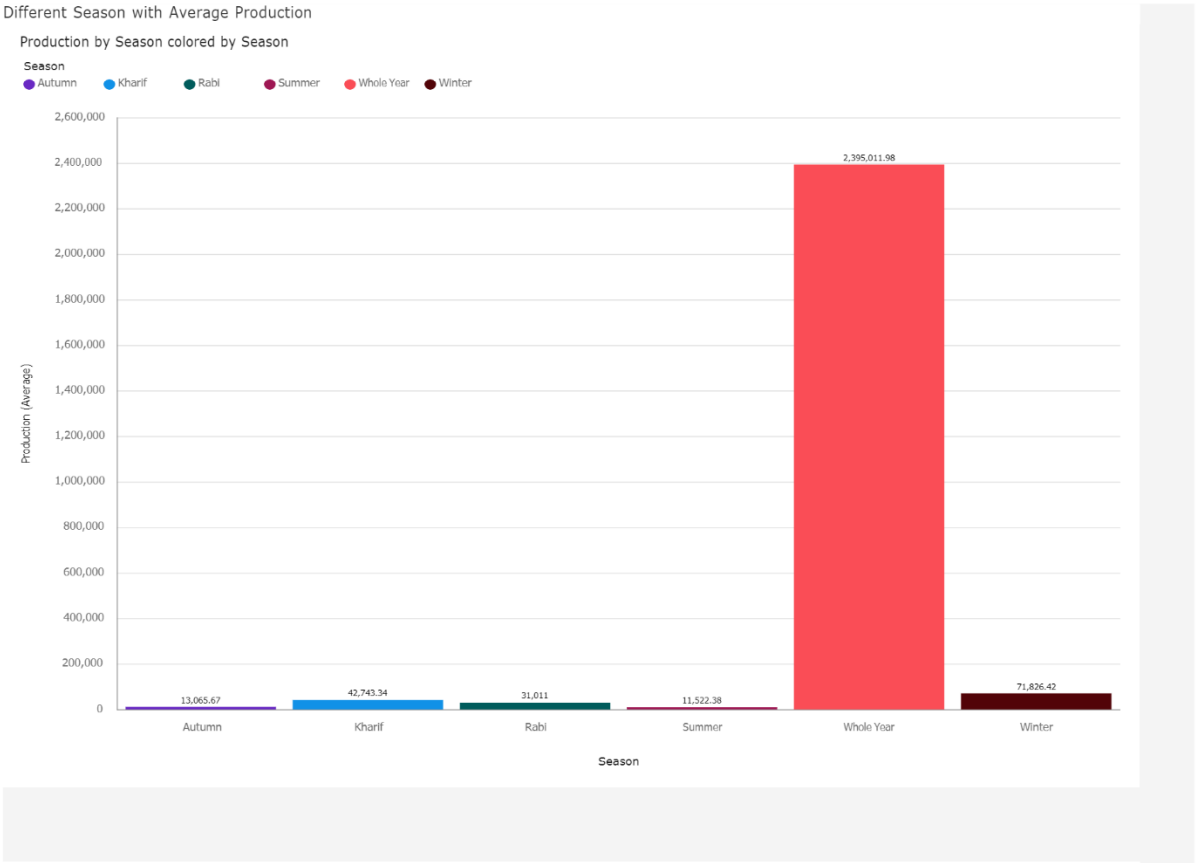

Project Exploration
IBM Cognos Analytics with Watson
Project Exploration
Search content
Create
Cards
Data relationships
Explore data relationships
crop_production.csv
Reset to original
Production
Edit diagram
Production
Crop
Area
State_Name
Season
Relationship diagram
10%
100%
Select a visualization
Explore visualizations related to 'Production'
Production
141B
Production
Add
Production
Add
Area and Production for State_Name regions



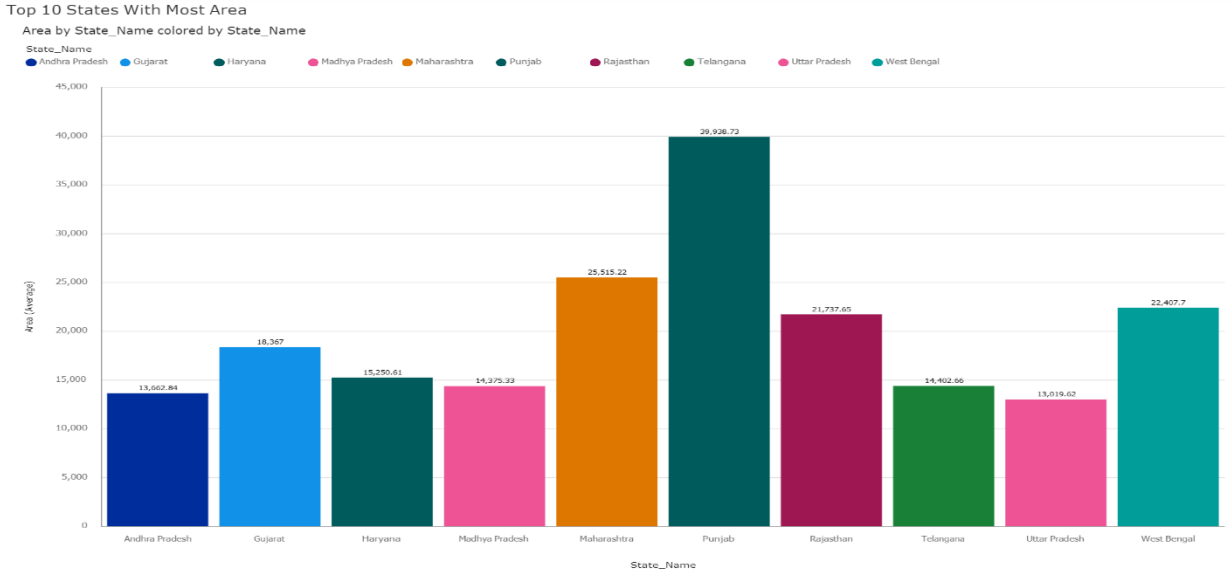
7.2. DASHBOARD CREATION

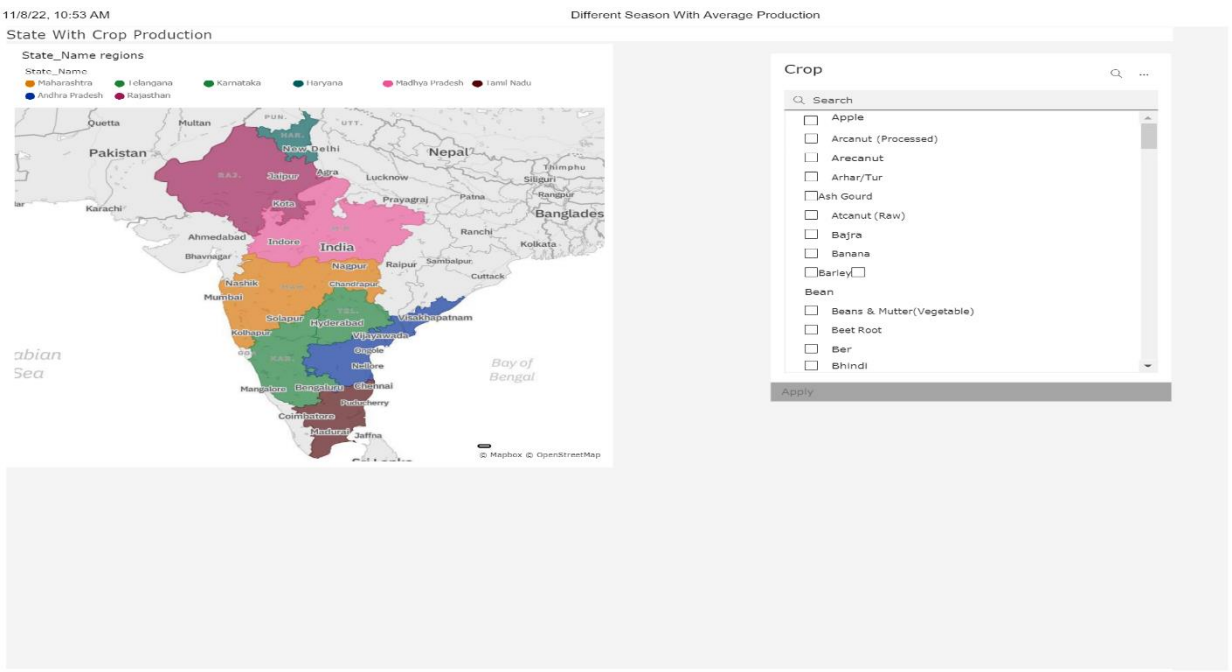


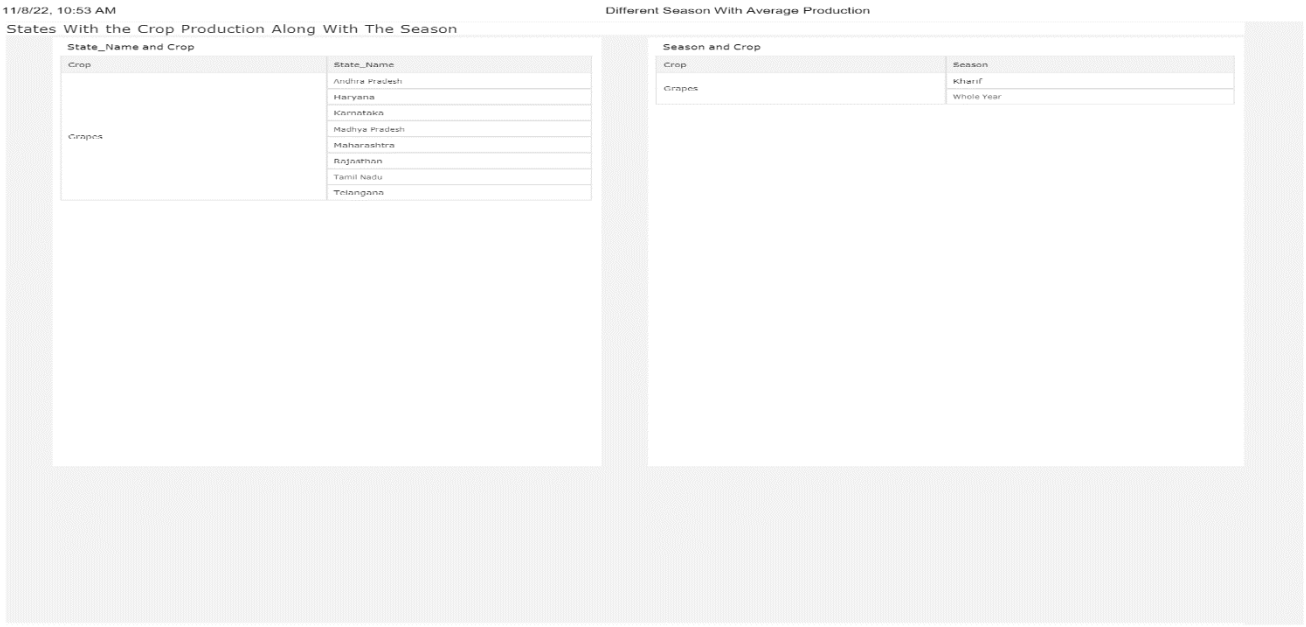




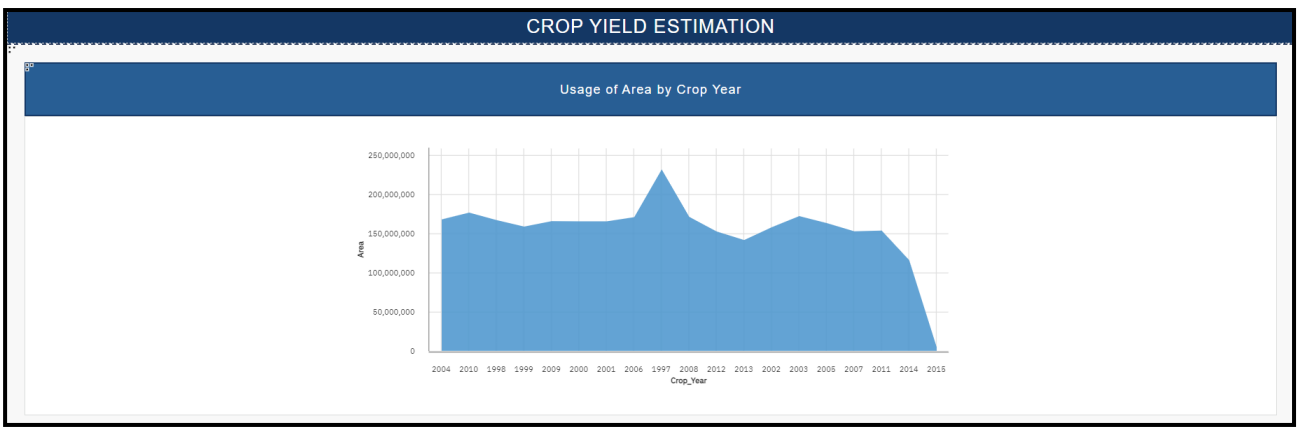
11/8/22, 10:53 AM Different Season With Average Production

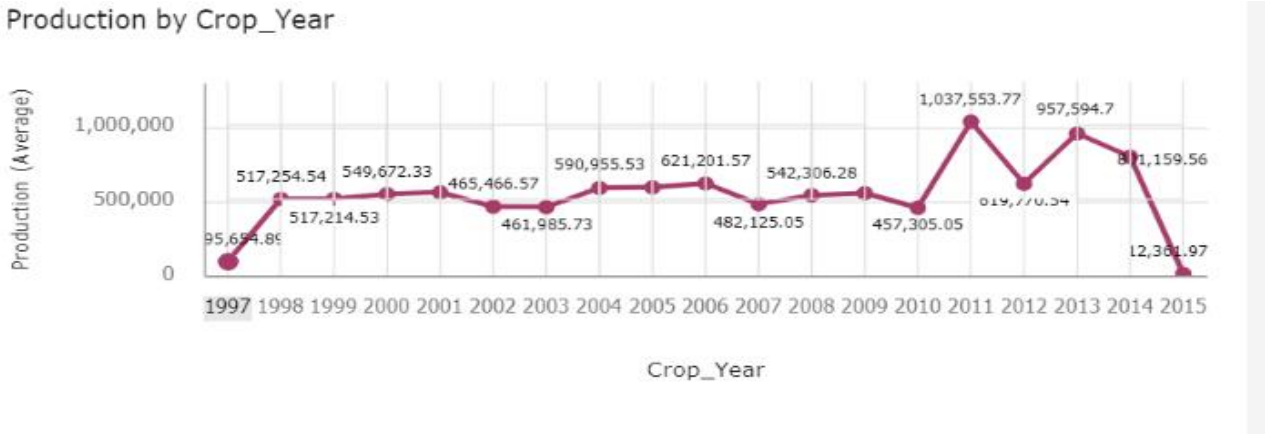


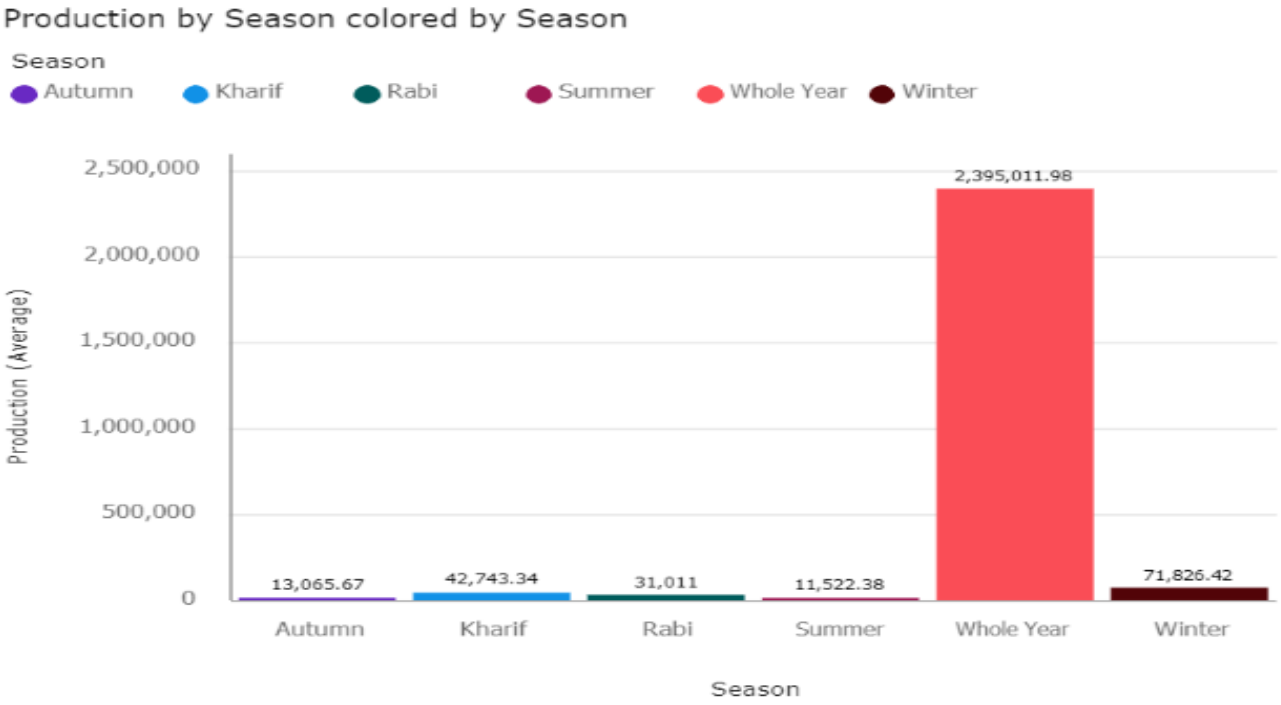


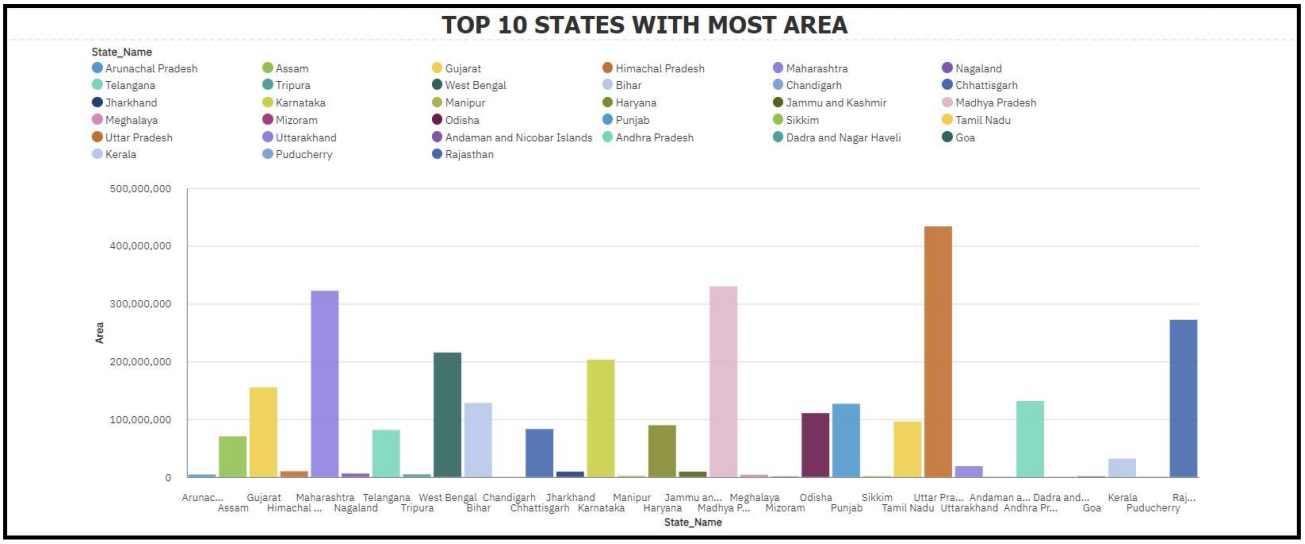


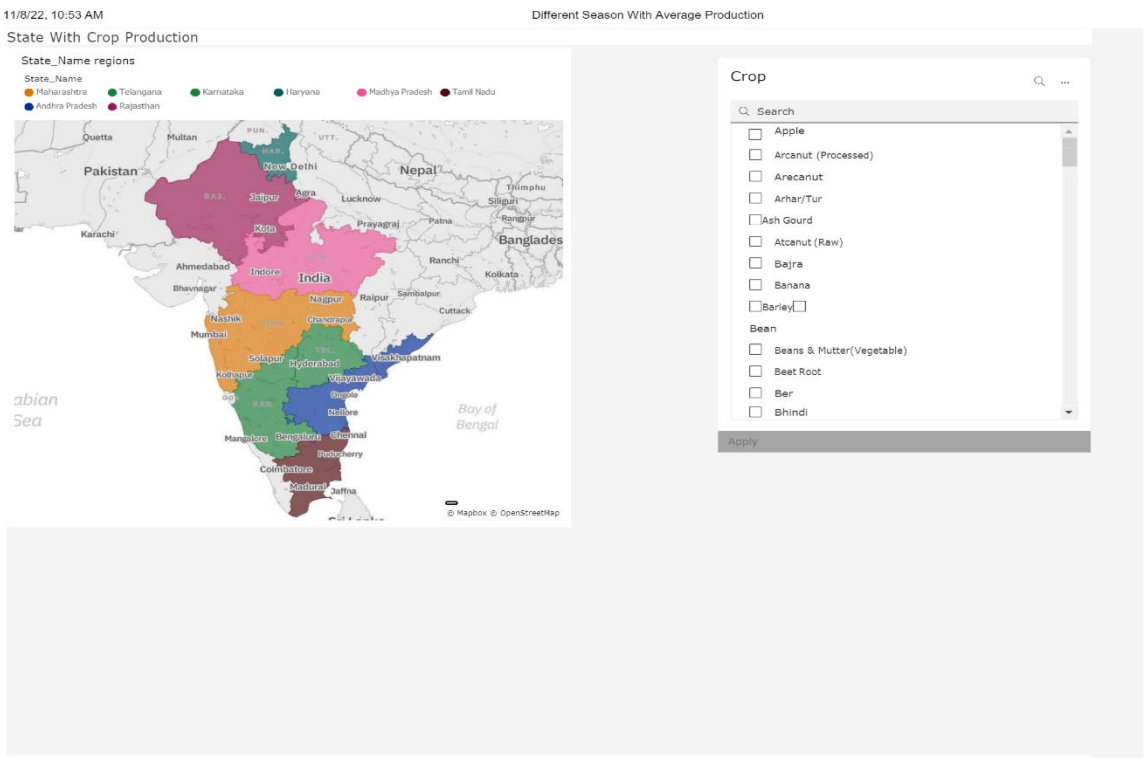
7.3. REPORT CREATION




Production by Crop_Year
Production (Average)
1,000,000
500,000
0
517,254.54
549,672.33
517,214.53
465,466.57
461,985.73
590,955.53
621,201.57
482,125.05
542,306.28
457,305.05
1,037,553.77
957,594.7
12,361.97
1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015
Crop_Year


Production by Season colored by Season
Season
Autumn
Kharif
Rabi
Summer
Whole Year
Winter
Production (Average)
2,500,000
2,000,000
1,500,000
1,000,000
500,000
0
13,065.67
42,743.34
31,011
11,522.38
2,395,011.98
71,826.42
Autumn
Kharif
Rabi
Summer
Whole Year
Winter
Season


TOP 10 STATES WITH MOST AREA
State_Name
Arunachal Pradesh
Assam
Gujarat
Himachal Pradesh
Maharashtra
Nagaland
Telangana
Tripura
West Bengal
Bihar
Chandigarh
Chhattisgarh
Jharkhand
Karnataka
Manipur
Haryana
Jammu and Kashmir
Madhya Pradesh
Meghalaya
Mizoram
Odisha
Punjab
Sikkim
Tamil Nadu
Uttar Pradesh
Uttarakhand
Andaman and Nicobar Islands
Andhra Pradesh
Dadra and Nagar Haveli
Goa
Kerala
Puducherry
Rajasthan
500,000,000
400,000,000
300,000,000
200,000,000
100,000,000
0
Area
State_Name

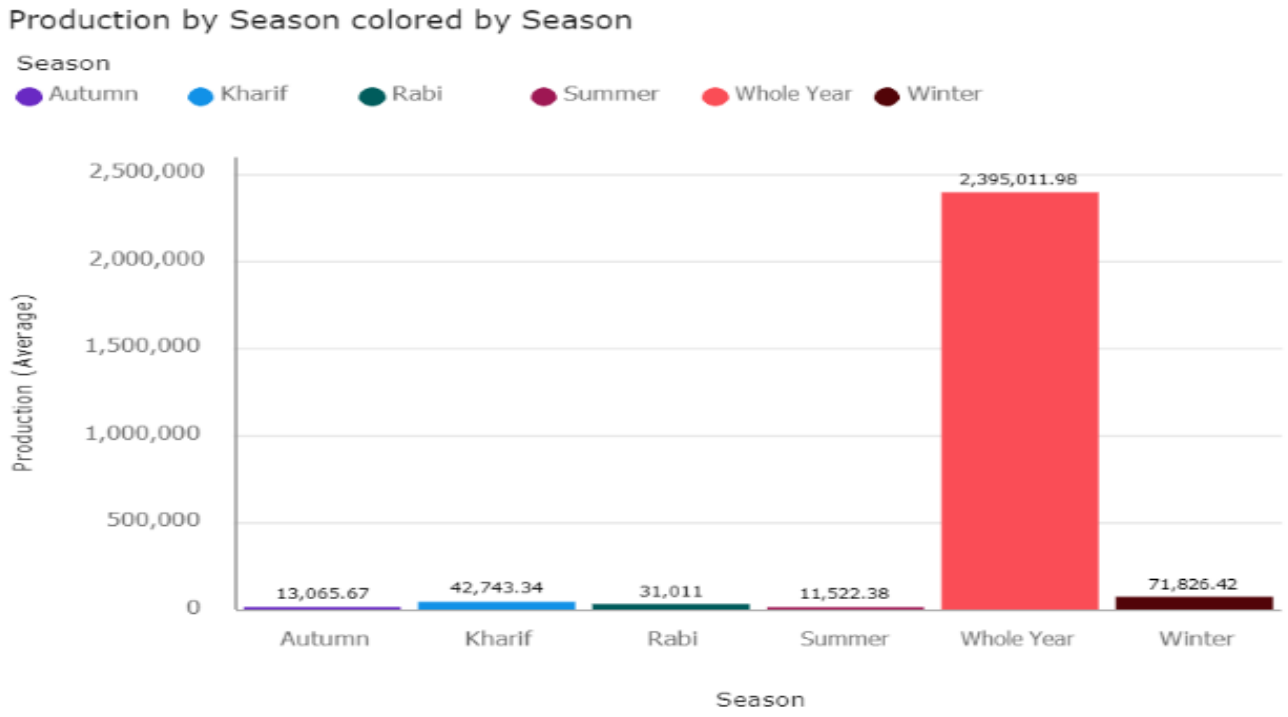


STATES WITH SEASONAL CROP PRODUCTION

Crop	State_Name	Season
Other Kharif pulses	Andaman and Nicobar Islands	Kharif
Rice	Andaman and Nicobar Islands	Kharif
Cashewnut	Andaman and Nicobar Islands	Whole Year
Horse-gram	Andhra Pradesh	Kharif
Tobacco	Andhra Pradesh	Kharif
Ragi	Andhra Pradesh	Rabi
Onion	Andhra Pradesh	Whole Year
other misc. pulses	Andhra Pradesh	Kharif
Sweet potato	Andhra Pradesh	Whole Year
Turmeric	Andhra Pradesh	Whole Year
Soyabean	Andhra Pradesh	Kharif
Beans & Mutter(Vegetable)	Andhra Pradesh	Whole Year
Bhindi	Andhra Pradesh	Whole Year
Grapes	Andhra Pradesh	Whole Year
Cowpea(Lobia)	Andhra Pradesh	Kharif
Arecanut	Andhra Pradesh	Kharif
Coriander	Andhra Pradesh	Kharif
Linseed	Andhra Pradesh	Kharif
Sapota	Andhra Pradesh	Kharif
Tomato	Andhra Pradesh	Kharif

7.4. STORY CREATION

Estimate the crop yield using data analytics



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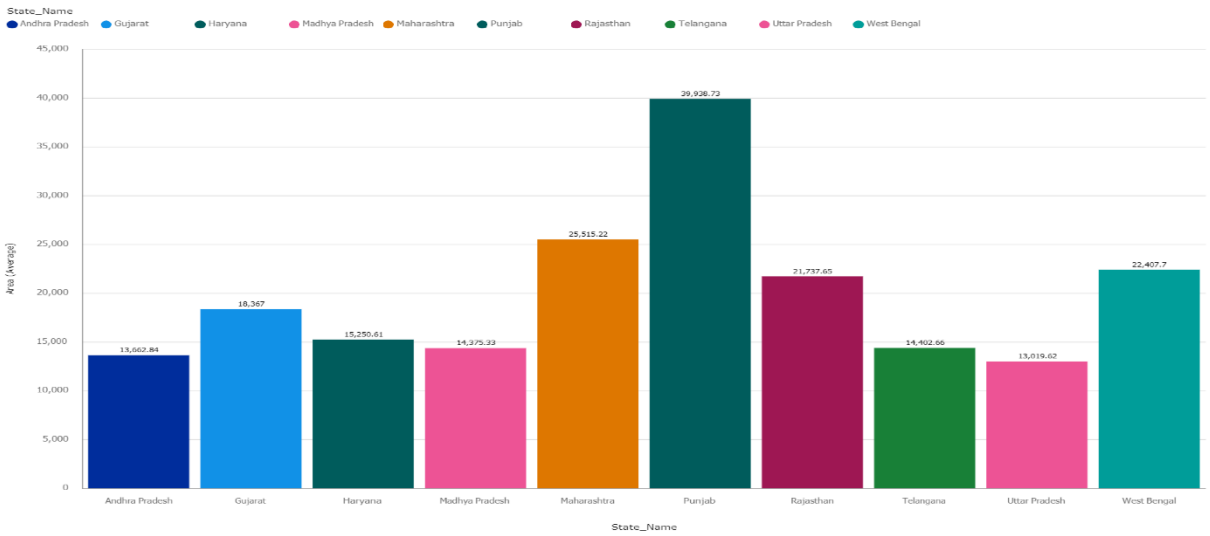
Different Season With Average Production

Top 10 States With Most Area

Area by State_Name colored by State_Name



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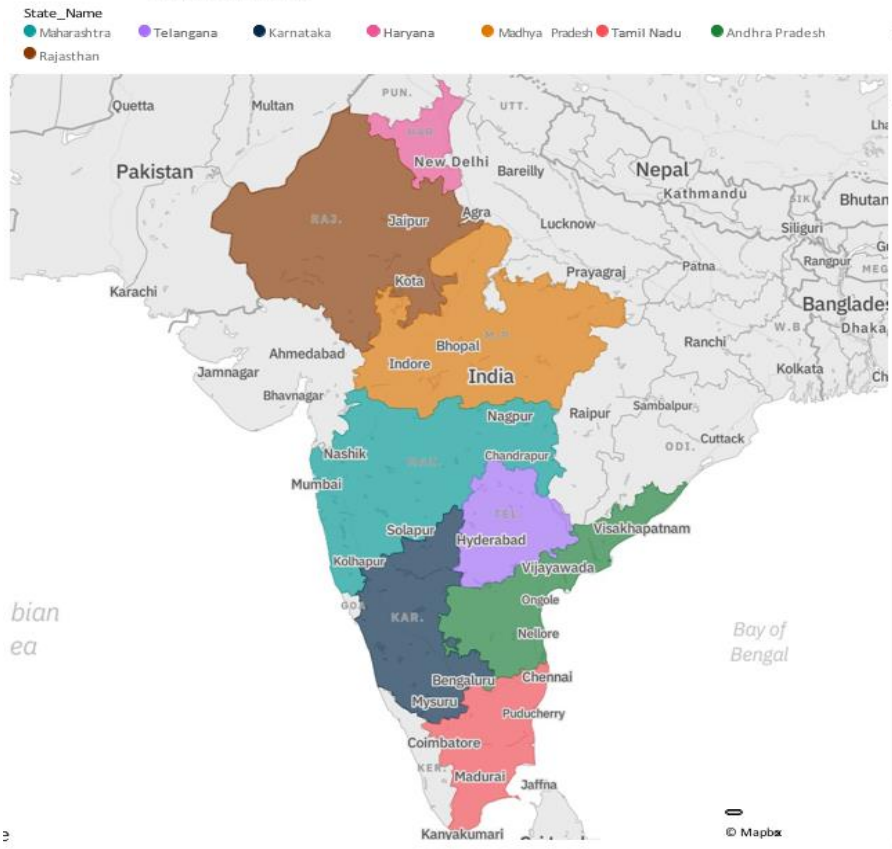
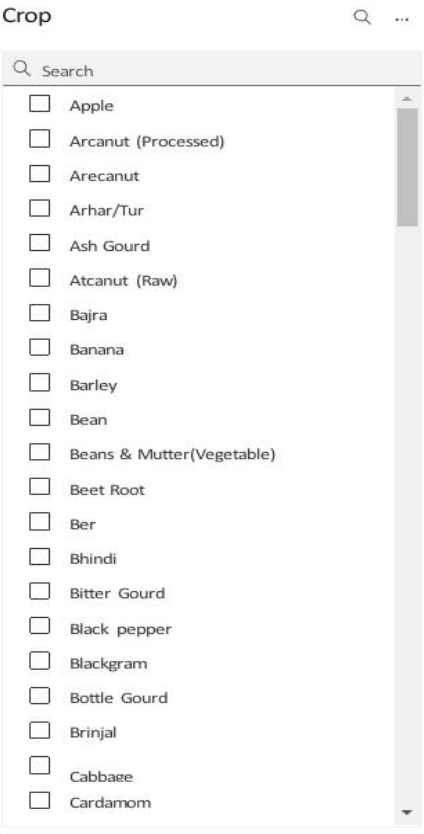
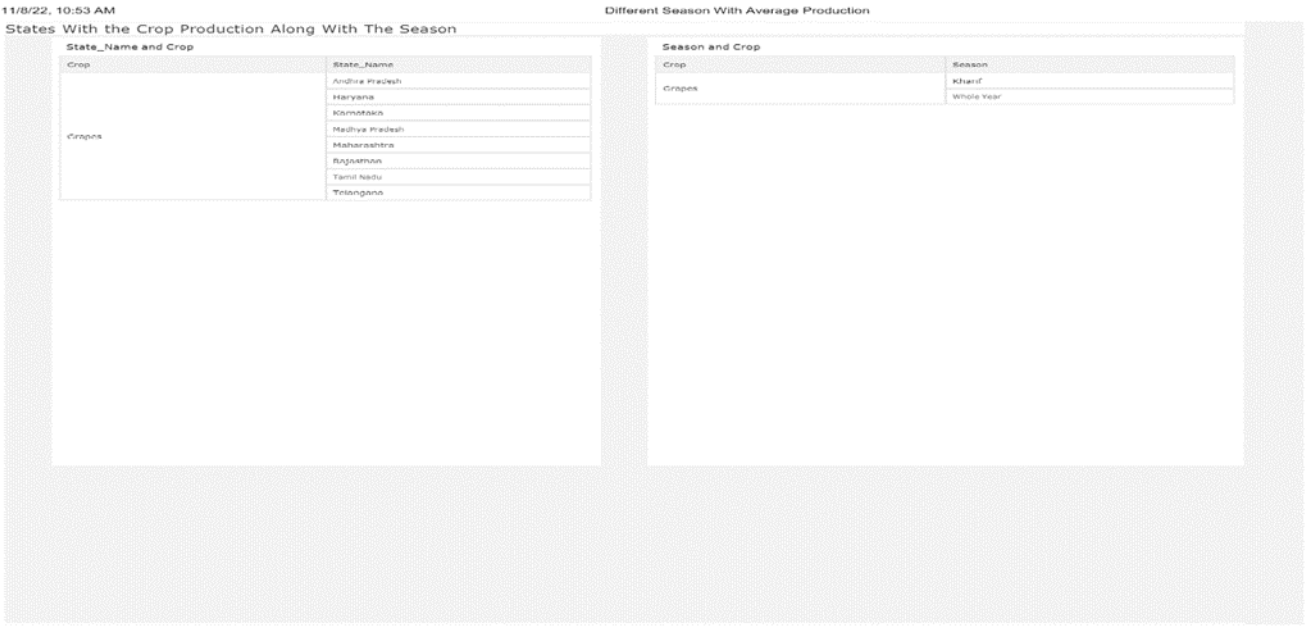
* Data Visualization Charts







8. ADVANTAGES

Productivity is boosted by technology. Agriculture has seen a significant boost in productivity as a result of technology; farmers can now do more work with less effort and in less time.

Technology saves money. Using current agricultural technology can help farmers save money. With the help of modern technologies, farmers may work more efficiently, with less effort, and in less time.

With modern technology, work that formerly required a big number of people and a lengthy period of time may now be accomplished swiftly

and cheaply. Farmers are not compelled to pay a separate price for their services.

9. DISADVANTAGES

High costs of maintenance. One of the downsides of agriculture technology is its high maintenance costs. The hefty maintenance costs of the technology make it tough for small enterprises and farmers to handle.

Farmers find it difficult to keep up with technology since they cannot afford the high maintenance costs of contemporary technical gadgets and machines. Farmers Who Are Undereducated are illiterate, and understanding how to use current technologies in farming is challenging.

10. CONCLUSION

Agriculture yield data is used to analyse and improve the crop yield and represent in the form of a Graphs through data visualization technique.

The visualization methods presented include interactive charts to enable our data users to drill down and focus on more detailed views of these data displays.

11. FUTURE SCOPE

In the future, we expect to extend the same as an even more easily accessible mobile application and further enhancements on the user experience is aimed to be implemented.

12. APPENDIX

Link to the GitHub Repository:

https://github.com/IBM-EPBL/IBM-Project-29026-1660120250

Project Demo Video Link:

https://drive.google.com/file/d/19ovHnY7Mzbli1AvswtFcupITbv4ntCSF/view?usp=sharing