IBM HACK CHALLENGE

2023

FINAL PROJECT REPORT ON

AGROLYTICS

(Analysis on Indian Agriculture)

By

TEAM INDUCE

P. Varsha Bala

D. Bhavani

N. Bhanu Tejaswini

D. Chenna Keshava Reddy

CONTENTS

1. INTRODUCTION

1.1 OVERVIEW

Agrolytics is a web-based application that provides an overview of current state of the Indian Agriculture. The application has following modules: overview of Indian Agriculture, comparitive analysis between India's and world's agriculture, crop suggestion and yield prediction, challenges faced by Indian agriculture, employment opportunities and technological interventions that can be brought in the agricultural sector.

1.2 PURPOSE

Agriculture, as a base of human civilization, has continually evolved to meet the demands of a growing global population. With climate change, changing weather patterns, and limited resources posing challenges to agricultural productivity, the need for accurate crop yield prediction has become most important. To overcome this situation machine learning uses historical data of weather conditions, and soil conditions, it estimates the future yield. This empowers the farmers, policymakers, and supply chains in making informed decisions, enhancing resource allocation, and ensuring food security among changing environmental factors.

2. LITERATURE SURVEY

2.1 EXISTING PROBLEM

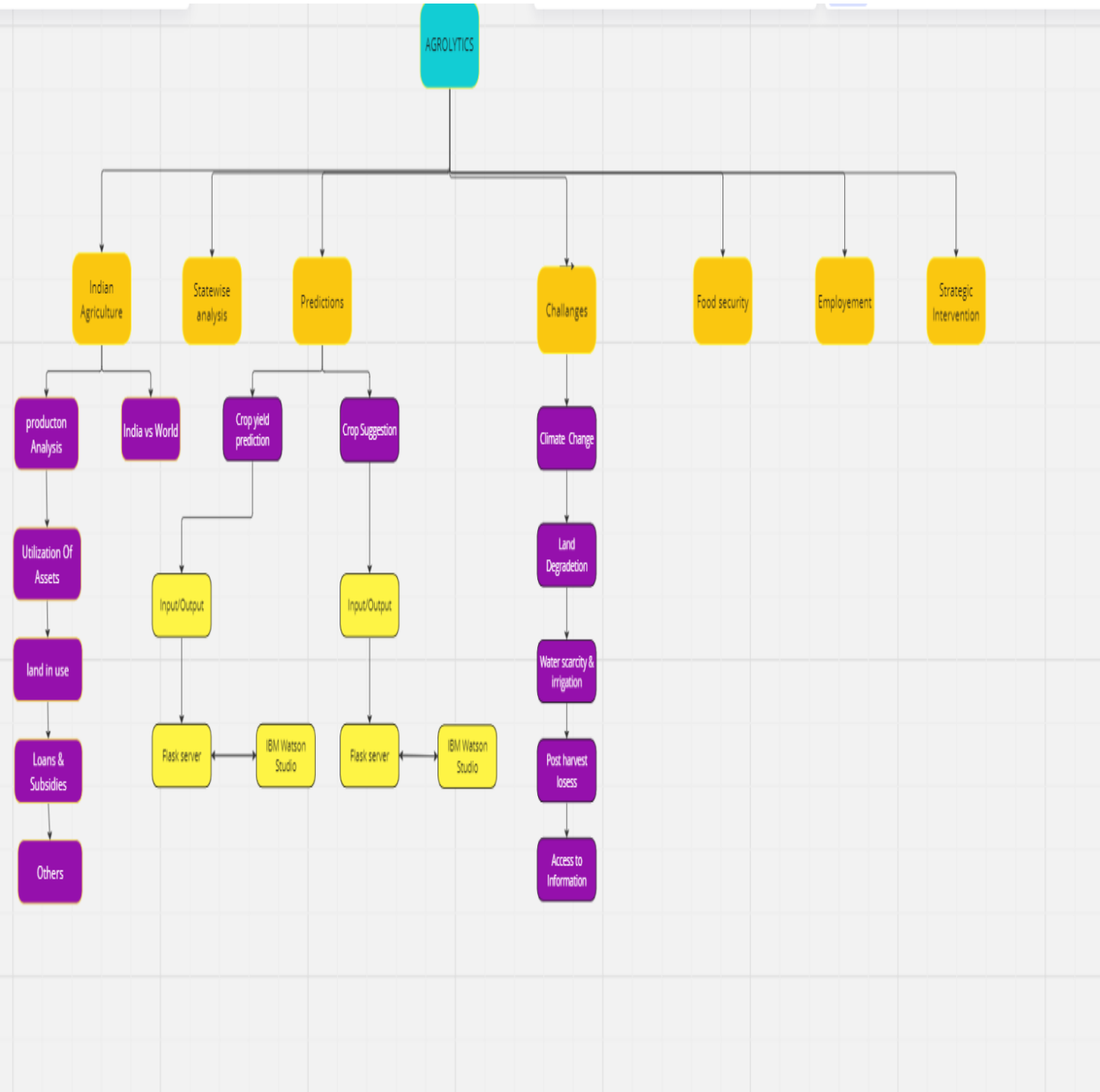
In India, though there are many third-party websites and organizations used to predict the crop yield they have used the traditional methods on historical data and statistical analysis. Some approaches also include remote sensing and satellite technology etc. The Space Application Centre (SAC) is already at an advanced stage of experimenting with the approach of Remote Sensing to estimate the area under principal crops through the scheme known as "Forecasting Agricultural output using Space, Agro-meteorology and Land based observations" FASAL (Forecasting Agricultural output using Space, Agro meteorology and Land). By combining these methods helps in understanding the diversified landscape, productivity and supporting the livelihoods of India.

2.2 PROPOSED SOLUTION

A web-based application in which the user can get the most suitable crop according to the climatic conditions of the selected state and the type of the soil using Machine Learning so that the user can get better yield. The user can also get the predicted crop yield according to the season and rainfall (current rainfall of each state is also displayed on the web application). Opportunities in the agriculture sector are also displayed. Seed requirement, availability and soil health cards are also displayed to help the farmers. Food security issues of a particular state and solutions to solve those problems are suggested. Problems faced by the farmers and solutions to those challenges are provided.

3.THEORITICAL ANALYSIS

3.1 BLOCK DIAGRAM



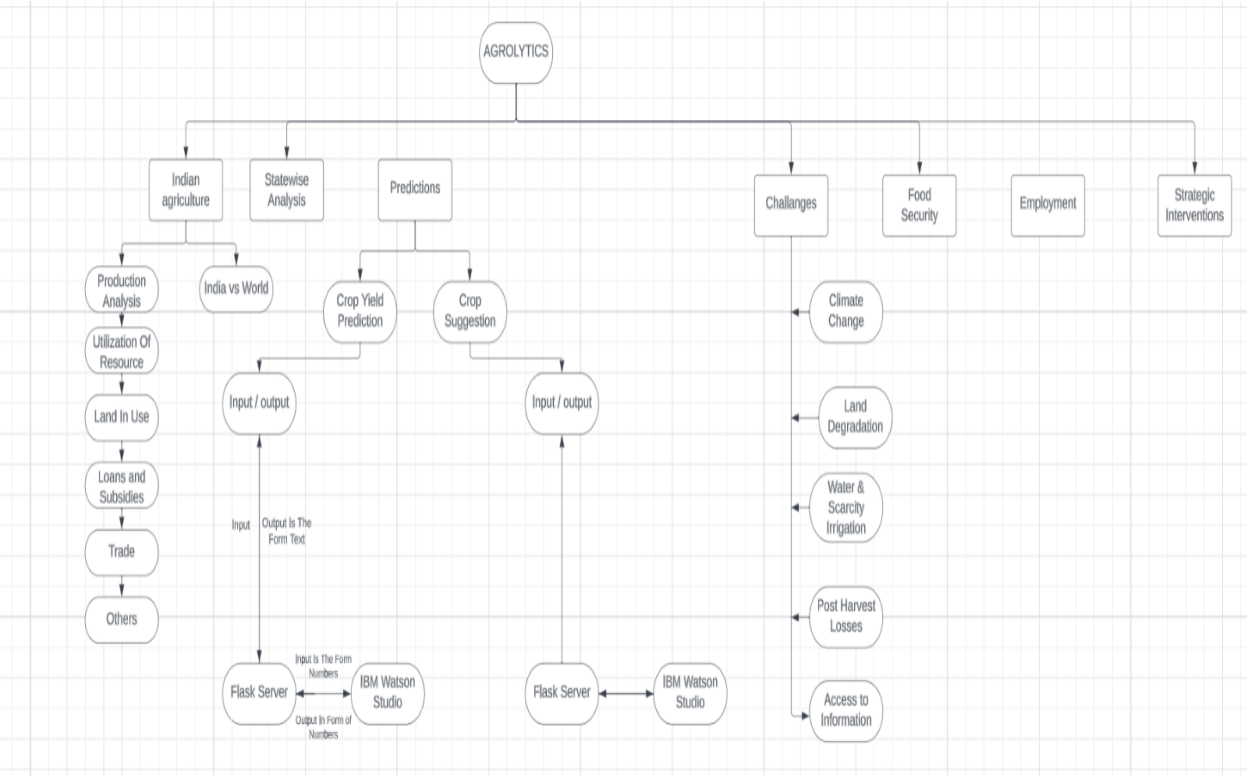
3.2 HARDWARE/SOFTWARE DESIGNING

- Front-end technologies like HTML, CSS, and React JS
- IBM Cognos Analytics for Data visualization
- Back-end technologies like Node JS, Flask, Machine Learning
- APIs like Topo-json, Rainfall and temperature API
- Red hat Open Shift for running flask application
- IBM Watson Studio and IBM cloud services to run ML models

4. EXPERIMENTAL INVESTIGATIONS

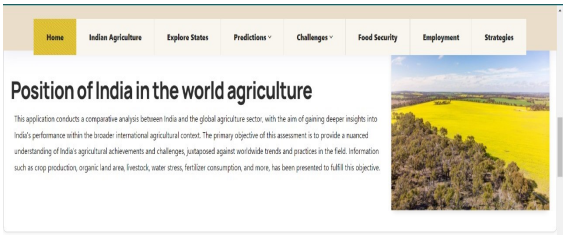
Our studies involve developing accurate models for forecasting agriculture. These projects include integration of various data sources such as historical crop yields, weather conditions and soil characteristics. Crop yield prediction models can benefit from ongoing improvement. Updating the models with new data and monitoring their performances helps to ensure accuracy all the time.

5. FLOWCHART



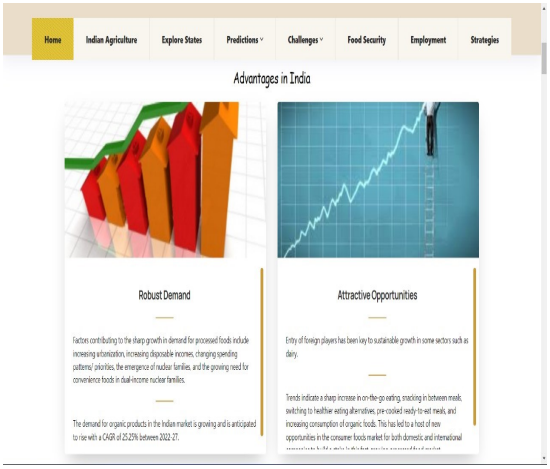
6. RESULT


Home
Indian Agriculture
Explore States
Predictions
Challenges
Food Security
Employment
Strategies
Agrolytics

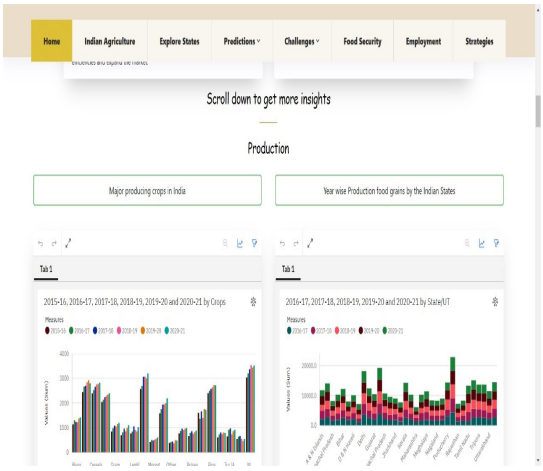

Home
Indian Agriculture
Explore States
Predictions
Challenges
Food Security
Employment
Strategies
Position of India in the world agriculture
This application conducts a comparative analysis between India and the global agriculture sector, with the aim of gaining deeper insights into India's performance within the broader international agricultural context. The primary objective of this assessment is to provide a nuanced understanding of India's agricultural achievements and challenges, juxtaposed against worldwide trends and practices in the field. Information such as crop production, organic land area, livestock, water stress, fertilizer consumption, and more, has been presented to fulfill this objective.

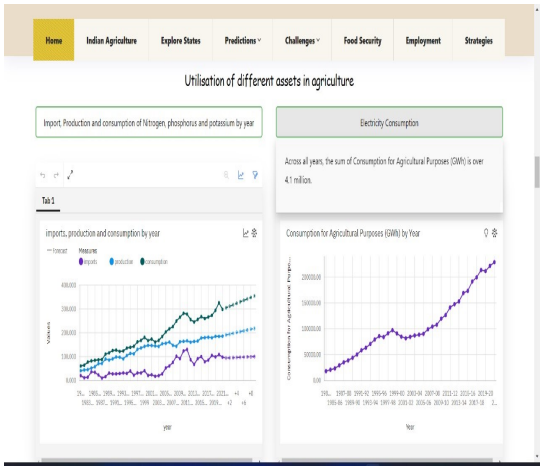

Predictions
Agrolytics provides crop yield predictions based on the type of crop, season and area production

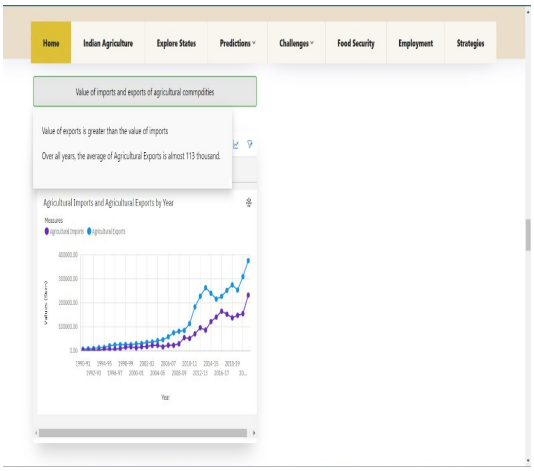

Home
Indian Agriculture
Explore States
Predictions
Challenges
Food Security
Employment
Strategies
Analysis of State-wise agriculture
As India is very diversified in the field of agriculture, it is hard to analyse the state of Indian agriculture at a time. Agrolytics helps in analysing the ariculture statics state-wise which helps in understanding the agriculture in India at the deeeper level. This feature of the application covers the major producing crops of each state, cost of production of different crops etc., which gives the clear understanding on the agricultural aspects of all the states in India.

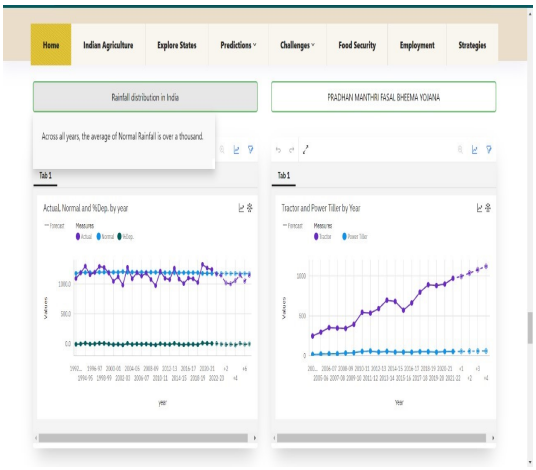

Home
Indian Agriculture
Explore States
Predictions
Challenges
Food Security
Employment
Strategies
Advantages in India
Robust Demand
Factors contributing to the sharp growth in demand for processed foods include increasing urbanization, increasing disposable incomes, changing spending patterns/ priorities, the emergence of nuclear families, and the growing need for convenience foods in dual-income nuclear families.
The demand for organic products in the Indian market is growing and is anticipated to rise with a CAGR of 25.25% between 2022-27.
Attractive Opportunities
Entry of foreign players has been key to sustainable growth in some sectors such as dairy.
Trends indicate a sharp increase in on-the-go eating, snacking in between meals, switching to healthier eating alternatives, pre-cooked ready-to-eat meals, and increasing consumption of organic foods. This has led to a host of new opportunities in the consumer foods market for both domestic and international

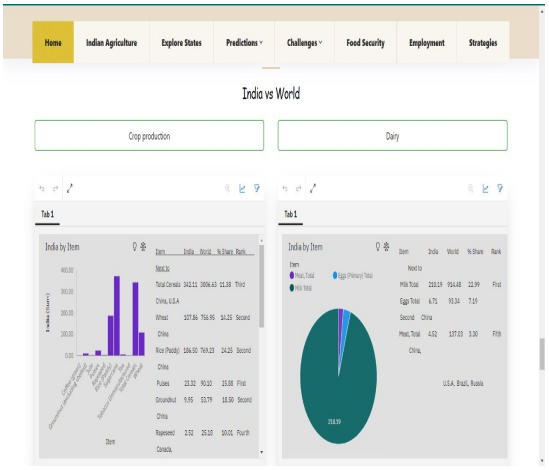

Challenges
This application highlights some of the main challenges facing the Indian agricultural sector, in
post-harvest losses, water scarcity and irrigation, climate change, land degradation, and timely access

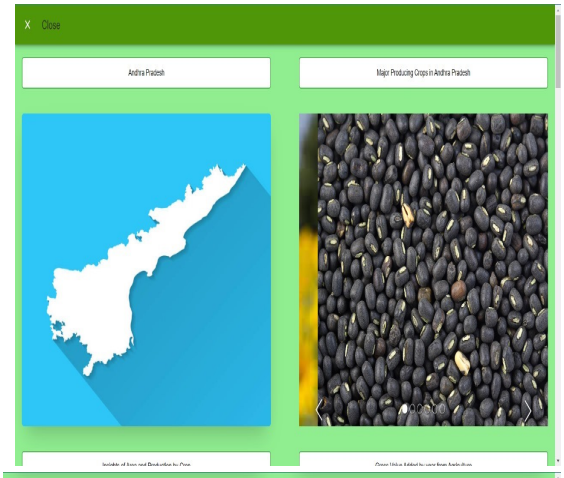

Home
Indian Agriculture
Explore States
Predictions
Challenges
Food Security
Employment
Strategies
Scroll down to get more insights
Production
Major producing crops in India
Year wise Production food grains by the Indian States
Tab 1
2015-16, 2016-17, 2017-18, 2018-19, 2019-20 and 2020-21 by Crops
Tab 1
2016-17, 2017-18, 2018-19, 2019-20 and 2020-21 by State/UT

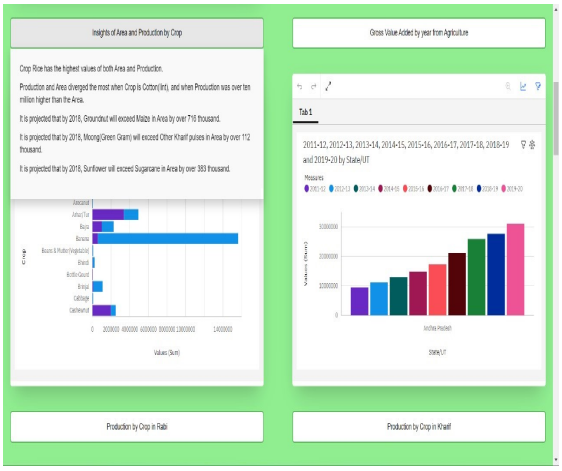

Home
Indian Agriculture
Explore States
Predictions
Challenges
Food Security
Employment
Strategies
Utilisation of different assets in agriculture
Import, Production and consumption of Nitrogen, phosphorus and potassium by year
Electricity Consumption
Across all years, the sum of Consumption for Agricultural Purposes (GWh) is over 4.1 million.
Tab 1
imports, production and consumption by year
Consumption for Agricultural Purposes (GWh) by Year

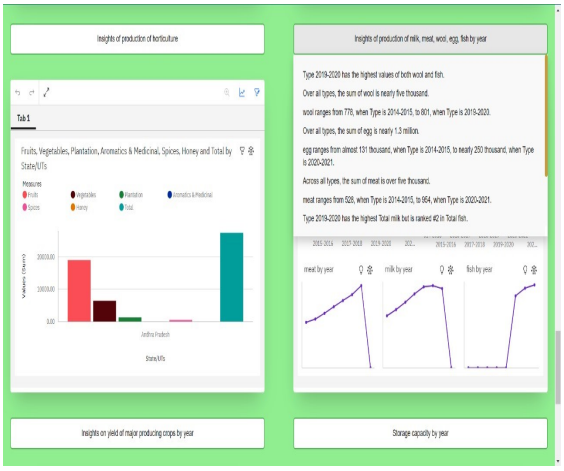

Home
Indian Agriculture
Explore States
Predictions
Challenges
Food Security
Employment
Strategies
Value of imports and exports of agricultural commodities
Value of exports is greater than the value of imports
Over all years, the average of Agricultural Exports is almost 113 thousand.
Agricultural Imports and Agricultural Exports by Year

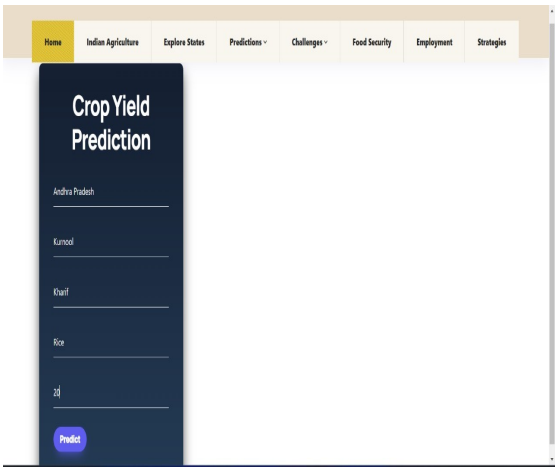

Home
Indian Agriculture
Explore States
Predictions
Challenges
Food Security
Employment
Strategies
Rainfall distribution in India
Across all years, the average of Normal Rainfall is over a thousand.
PRADHAN MANTHRI FASAL BHEEMA YOJANA
Actual, Normal and %Dep. by year
Tractor and Power Tiller by Year

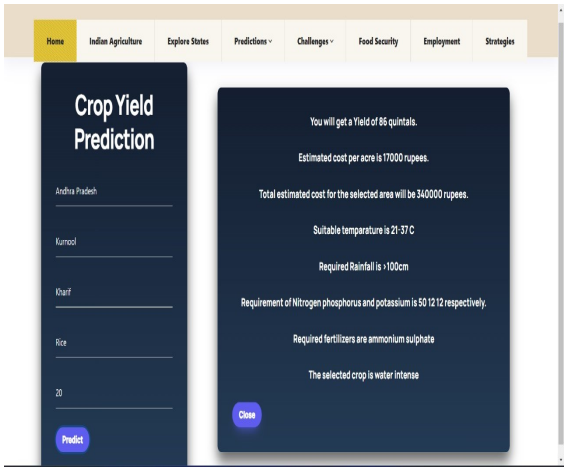

Home
Indian Agriculture
Explore States
Predictions
Challenges
Food Security
Employment
Strategies
India vs World
Crop production
Dairy
India by Item

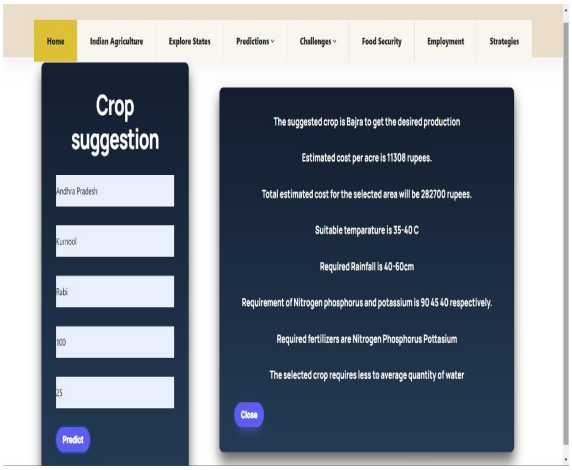

X Close
Andhra Pradesh
Major Producing Crops in Andhra Pradesh

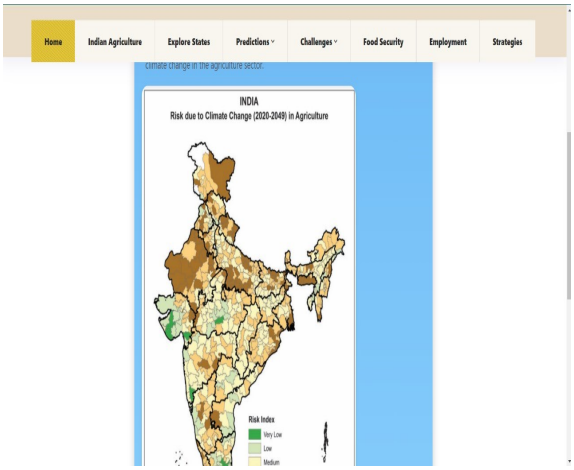

Insights of Area and Production by Crop
Crop: Rice has the highest values of both Area and Production.
Production and Area diverged the most when Crop is Cotton(lint), and when Production was over ten million higher than the Area.
It is projected that by 2018, Groundnut will exceed Maize in Area by over 716 thousand.
It is projected that by 2016, Moong(Green Gram) will exceed Other Kharif pulses in Area by over 112 thousand.
It is projected that by 2018, Sunflower will exceed Sugarcane in Area by over 383 thousand.
Gross Value Added by year from Agriculture
2011-12, 2012-13, 2013-14, 2014-15, 2015-16, 2016-17, 2017-18, 2018-19 and 2019-20 by State/UT
Production by Crop in Rabi
Production by Crop in Kharif

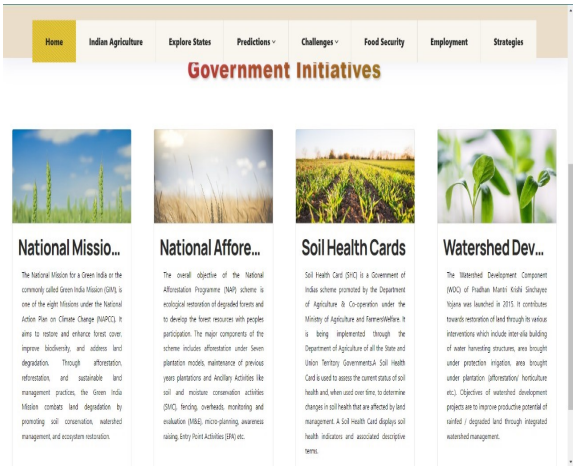

Insights of production of horticulture
Fruits, Vegetables, Plantation, Aromatics & Medicinal, Spices, Honey and Total by State/UTs
Insights of production of milk, meat, wool, egg, fish by year
Type 2019-2020 has the highest values of both wool and fish.
Over all types, the sum of wool is nearly five thousand.
wool ranges from 778, when Type is 2014-2015, to 801, when Type is 2019-2020.
Over all types, the sum of egg is nearly 1.3 million.
egg ranges from almost 131 thousand, when Type is 2014-2015, to nearly 250 thousand, when Type is 2020-2021.
Across all types, the sum of meat is over five thousand.
meat ranges from 928, when Type is 2014-2015, to 954, when Type is 2020-2021.
Type 2019-2020 has the highest Total milk but is ranked #2 in Total fish.
meat by year
milk by year
fish by year
Insights on yield of major producing crops by year
Storage capacity by year

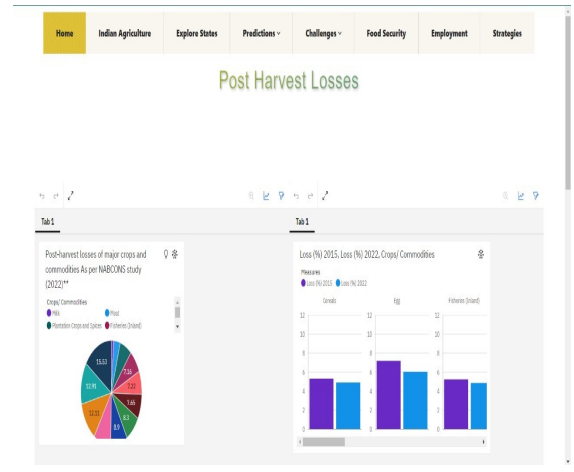

Home
Indian Agriculture
Explore States
Predictions
Challenges
Food Security
Employment
Strategies
Crop Yield Prediction
Andhra Pradesh
Kurnool
Kharif
Rice
20
Predict

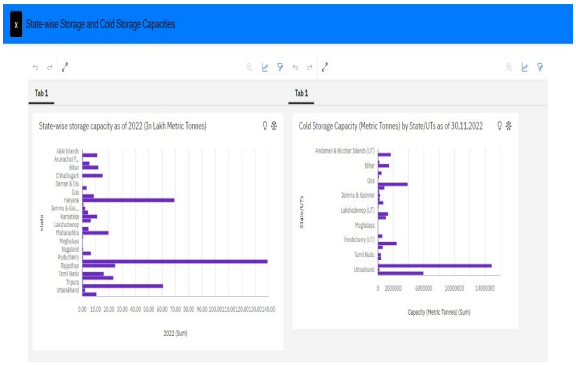

Home
Indian Agriculture
Explore States
Predictions
Challenges
Food Security
Employment
Strategies
Crop Yield Prediction
Andhra Pradesh
Kurnool
Kharif
Rice
20
Predict
You will get a Yield of 86 quintals.
Estimated cost per acre is 17000 rupees.
Total estimated cost for the selected area will be 340000 rupees.
Suitable temparature is 21-37 C
Required Rainfall is >100cm
Requirement of Nitrogen phosphorus and potassium is 50 12 12 respectively.
Required fertilizers are ammonium sulphate
The selected crop is water intense
Close

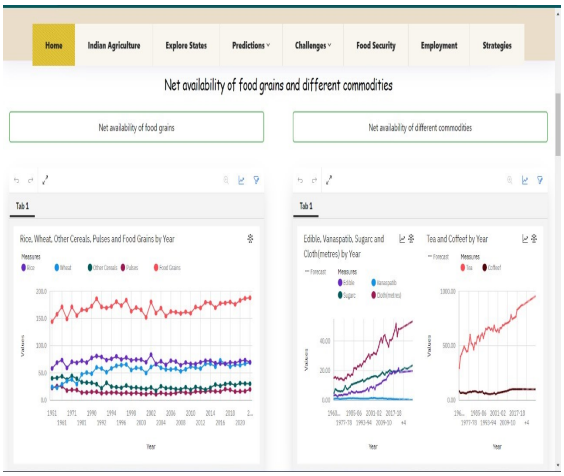

Home
Indian Agriculture
Explore States
Predictions
Challenges
Food Security
Employment
Strategies
Crop suggestion
Andhra Pradesh
Kurnool
Rabi
100
25
Predict
The suggested crop is Bajra to get the desired production
Estimated cost per acre is 11308 rupees.
Total estimated cost for the selected area will be 282700 rupees.
Suitable temparature is 35-40 C
Required Rainfall is 40-60cm
Requirement of Nitrogen phosphorus and potassium is 90 45 40 respectively.
Required fertilizers are Nitrogen Phosphorus Pottasium
The selected crop requires less to average quantity of water
Close

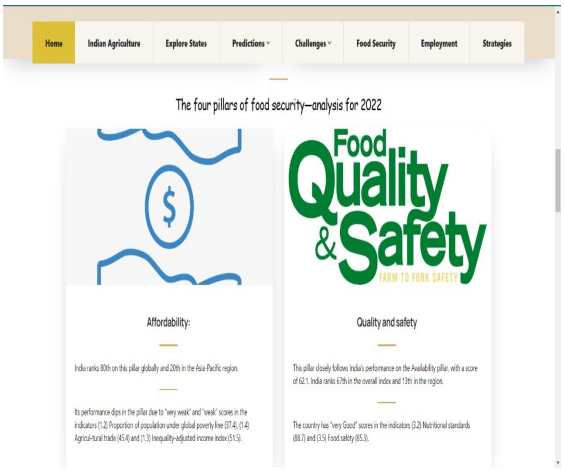

Home
Indian Agriculture
Explore States
Predictions
Challenges
Food Security
Employment
Strategies
INDIA
Risk due to Climate Change (2020-2049) in Agriculture
Risk Index
Very Low
Low
Medium

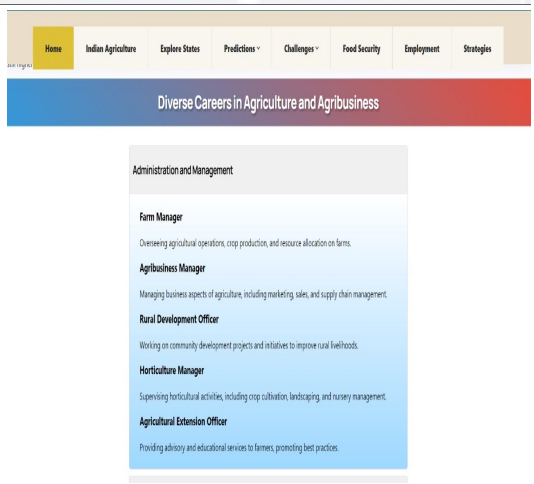

Home
Indian Agriculture
Explore States
Predictions
Challenges
Food Security
Employment
Strategies
Government Initiatives
National Missio...
The National Mission for a Green India or the commonly called Green India Mission (GIM), is one of the eight Missions under the National Action Plan on Climate Change (NAPCC). It aims to restore and enhance forest cover, improve biodiversity, and address land degradation. Through afforestation, reforestation, and sustainable land management practices, the Green India Mission combats land degradation by promoting soil conservation, watershed management, and ecosystem restoration.
National Afforе...
The overall objective of the National Afforestation Programme (NAP) scheme is ecological restoration of degraded forests and to develop the forest resources with peoples participation. The major components of the scheme includes afforestation under Seven plantation models, maintenance of previous years plantations and Ancillary Activities like soil and moisture conservation activities (SMC), fencing, overheads, monitoring and evaluation (M&E), micro-planning, awareness raising, Entry Point Activities (EPA) etc.
Soil Health Cards
Soil Health Card (SHC) is a Government of India's scheme promoted by the Department of Agriculture & Co-operation under the Ministry of Agriculture and Farmers'Welfare. It is being implemented through the Department of Agriculture of all the State and Union Territory Governments.A Soil Health Card is used to assess the current status of soil health and, when used over time, to determine changes in soil health that are affected by land management. A Soil Health Card displays soil health indicators and associated descriptive terms.
Watershed Dev...
The Watershed Development Component (WDC) of Pradhan Mantri Krishi Sinchayee Yojana was launched in 2015. It contributes towards restoration of land through its various interventions which include inter-alia building of water harvesting structures, area brought under protection irrigation, area brought under plantation (afforestation/ horticulture etc.). Objectives of watershed development projects are to improve productive potential of rainfed / degraded land through integrated watershed management.

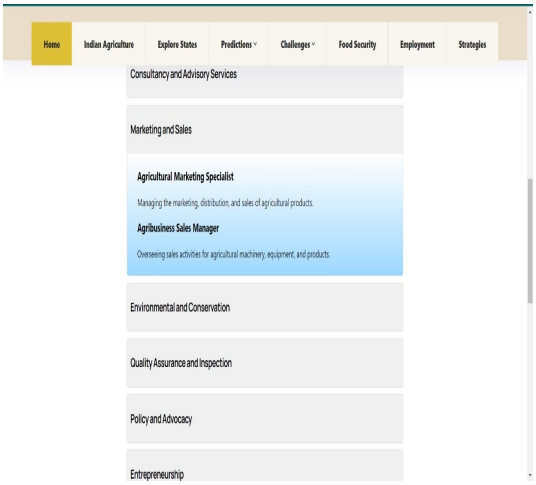

Home
Indian Agriculture
Explore States
Predictions
Challenges
Food Security
Employment
Strategies
Post Harvest Losses
Tab 1
Tab 1
Post-harvest losses of major crops and commodities As per NABCONS study (2022)**
Loss (%) 2015, Loss (%) 2022, Crops/ Commodities


State-wise Storage and Cold Storage Capacities
Tab 1
State-wise storage capacity as of 2022 (In Lakh Metric Tonnes)
Tab 1
Cold Storage Capacity (Metric Tonnes) by State/UTs as of 30.11.2022
Capacity (Metric Tonnes) (Sum)
2022 (Sum)

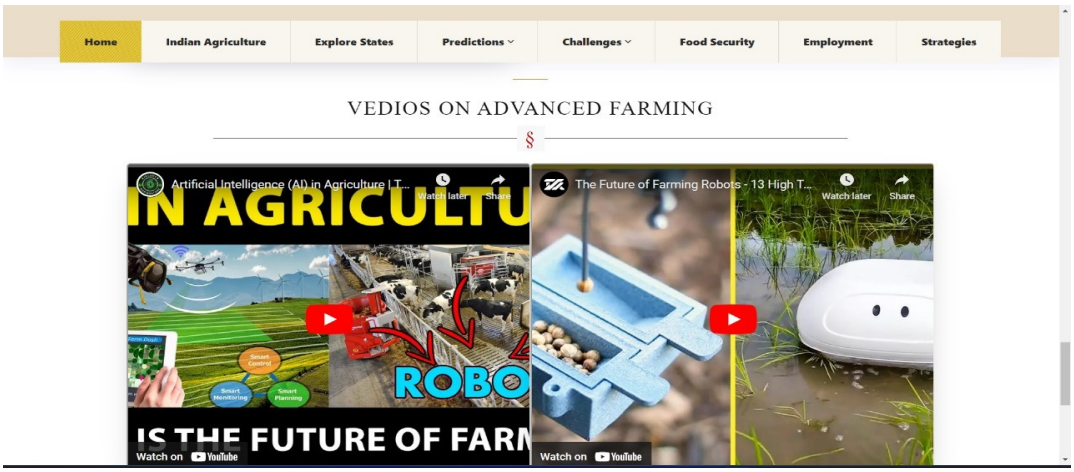

Home
Indian Agriculture
Explore States
Predictions
Challenges
Food Security
Employment
Strategies
Net availability of food grains and different commodities
Net availability of food grains
Net availability of different commodities
Tab 1
Rice, Wheat, Other Cereals, Pulses and Food Grains by Year
Tab 1
Edible, Vanaspatis, Sugarc and Cloth(metres) by Year
Tea and Coffeef by Year
Year


Home
Indian Agriculture
Explore States
Predictions
Challenges
Food Security
Employment
Strategies
The four pillars of food security—analysis for 2022
Affordability:
India ranks 80th on this pillar globally and 20th in the Asia-Pacific region.
Its performance dips in the pillar due to 'very weak' and 'weak' scores in the indicators (1.2) Proportion of population under global poverty line (37.4), (1.4) Agricultural trade (45.4) and (1.3) Inequality-adjusted income index (51.5).
Food Quality & Safety
FARM TO FORK SAFETY
Quality and safety
This pillar closely follows India's performance on the Availability pillar, with a score of 62.1. India ranks 67th in the overall index and 13th in the region.
The country has 'very Good' scores in the indicators (2.2) Nutritional standards (88.7) and (3.5) Food safety (85.3).


Home
Indian Agriculture
Explore States
Predictions
Challenges
Food Security
Employment
Strategies
Diverse Careers in Agriculture and Agribusiness
Administration and Management
Farm Manager
Overseeing agricultural operations, crop production, and resource allocation on farms.
Agribusiness Manager
Managing business aspects of agriculture, including marketing, sales, and supply chain management.
Rural Development Officer
Working on community development projects and initiatives to improve rural livelihoods.
Horticulture Manager
Supervising horticultural activities, including crop cultivation, landscaping, and nursery management.
Agricultural Extension Officer
Providing advisory and educational services to farmers, promoting best practices.


Home
Indian Agriculture
Explore States
Predictions
Challenges
Food Security
Employment
Strategies
Consultancy and Advisory Services
Marketing and Sales
Agricultural Marketing Specialist
Managing the marketing, distribution, and sales of agricultural products.
Agribusiness Sales Manager
Overseeing sales activities for agricultural machinery, equipment, and products.
Environmental and Conservation
Quality Assurance and Inspection
Policy and Advocacy
Entrepreneurship


Home
Indian Agriculture
Explore States
Predictions
Challenges
Food Security
Employment
Strategies
AGRICULTURAL TECHNOLOGIES & ADVANCED WAYS OF FARMING
FARMING 3.0
INDIA'S MISSION AGRITECH
Agriculture 4.0
5G
Agriculture 3.0, Or Precision Farming
Precision or smart farming, also called Agriculture 3.0, evolved out of the need to track and more efficiently manage all inputs into crop production. The pursuit of precision agriculture and its associated agricultural technology has led to the development of new farming methods and tools.
Agriculture 4.0, Or Connected Farming
The leap from smart farming to connected farming is a good example of how fast production technology used in agriculture moved forward at the turn of the century. Technology like autonomous machines, sensor-equipped robots, augmented reality, the Internet of Things (IoT), drones, and satellites is all part of the new agricultural environment, named Agriculture 4.0.



7. ADVANTAGES & DISADVANTAGES

7.1 ADVANTAGES

- Accurate yield predictions enable farmers to make well-informed decisions about planting, irrigation, fertilization, and harvest timing.
- Detailed analysis of Indian agriculture
- Deeper analysis of Indian Agriculture through State-wise agricultural analysis
- Farmers can allocate resources like water, fertilizers, and labor more efficiently based on predicted yields.
- Predictive models help farmers plan for potential yield fluctuations due to weather changes or other factors.
- Market segmentation for several types of agricultural allied sectors
- Accurate yield forecasts enable better market planning, preventing oversupply or undersupply situations.
- Farmers can use yield predictions to estimate their production cost for the season.
- Yield predictions provide insights into long-term trends in crop performance, aiding farmers in making decisions that impact their land use and crop choices.
- As climate change affects weather patterns, accurate yield predictions assist farmers in adapting their practices to evolving conditions, ensuring continued productivity.

7.2 DISADVANTAGES

- Unpredictable events like Natural disasters may affect the crop yields.
- Errors in weather forecasting can affect the reliability of yield predictions.
- Lack of adoption to modern technologies over traditional methodologies.

8. APPLICATIONS

- Accurate yield predictions help in market planning to prevent shortages or overproduction.
- Predictions help farmers in planning labor requirements, equipment usage, and other management decisions for optimal yield outcomes.
- Provide insights for farmers to adapt their practices and crops by shifting according to weather and climatic conditions.
- Allow farmers to estimate the cost of production and plan finances accordingly.
- Market segmentation for distinct types of agricultural allied sectors

9. CONCLUSION

Agriculture and associated businesses are critical to the economy's long-term development and prosperity. The key difficulties for agricultural production are decision making, crop selection, crop price, and supporting systems for enhanced crop output. The proposed technique helps farmers in decision making of which crop to cultivate in the field. This work is employed to search out the gain knowledge about the crop that can be deployed to make an efficient and useful harvesting. The accurate prediction of different specified crops across different districts will help farmers of India. This improves our Indian economy by maximizing the yield rate of crop production. With an increase in data, we can also increase accuracy. We made this project end-to-end so that farmers can directly use our web to decide which new crops to try out in a certain field that will bring maximum profits and income. The model improved by integrating this with other departments like horticulture, sericulture, and others towards the agricultural development of our country

10. FUTURE SCOPE

The future of crop yield prediction using machine learning lies in its potential to revolutionize agriculture by offering data-driven insights for more efficient, sustainable, and secure food production. As technology advances and more data becomes available, the potential for enhancing crop yield prediction using machine learning is vast. So, develop models that explicitly consider the effects of climate change on crop growth, integrate data contributed by farmers themselves, creating a collaborative platform where farmers can input local observations and practices to enhance model accuracy, combine traditional statistical approaches with machine learning techniques for a comprehensive approach to yield prediction, leveraging the strengths of both methodologies. These future directions aim to refine existing models, expand their capabilities, and ensure their practical applicability to benefit farmers, and the Indian agricultural sector.

11. BIBILOGRAPHY

11.1 REFERENCES

- A survey on different data mining techniques for crop yield prediction Int. J. Computer. Sci. Eng., 7 (1) (2019), pp. 738-744 https://doi.org/10.26438/ijcse/v7i1.738744

- N. Nandhini and J. G. Shankar, "Prediction of crop growth using machine learning based on seed", *Intact journal on soft computing*, vol. 11, no. 01, 2020.
- Basso, B. & Liu, L. Chapter four—Seasonal crop yield forecast: Methods, applications, and accuracies. In *Advances in Agronomy* Vol. 154 (ed. Sparks, D. L.) 201–255 (Academic Press, Cambridge, 2019)
- Abhishek, K., Singh, M., Ghosh, S., and Anand, A. (2012). Weather forecasting model using artificial neural network. *Procedia Technol.* 4, 311–318. doi: 10.1016/j.protcy.2012.05.047
- Dahikar S and Rode S V 2014 Agricultural crop yield prediction using artificial neural network approach International Journal of Innovative Research in Electrical, Electronics, Instrumentation and Control Engineering vol 2 Issue 1 pp 683-6.
- Sellam V, and Poovammal E 2016 Prediction of crop yield using regression analysis Indian Journal of Science and Technology vol 9(38) pp 1-5.

11.2 APPENDIX

Source Code:

https://github.com/Keshava369/induce_src.git

Website link:

https://agrolytics-ibmhack.netlify.app/