AGRICULTURAL WEBSITE FOR CROP MANAGEMENT AND FUTURE GRAIN ANALYSIS

PROJECT REPORT

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BONAFIDE CERTIFICATE

Certified that this project report **"AGRICULTURAL WEBSITE FOR CROP MANAGEMENT AND FUTURE GRAIN ANALYSIS"** is the Bonafide work of **"AKIRSHA REJI (962220205007), CANNIN F BENIFA (962220205014) ,DOMME SANDRA D (962220205017), SIVASANKARI M S (962220205044) "** who carried out the project work under my supervision.

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ABSTRACT

In a world witnessing a steady rise in population, the demand for efficient food production has become more essential than ever. However, contemporary farmers find themselves navigating a dynamic business landscape, grappling with challenging market conditions and unprecedented competition. Surprisingly, there is currently no dedicated platform for the live tracking of crops produced and stored on a daily basis. Recognizing this gap, we proudly present an innovative agricultural website tailored to meet these challenges head-on.

Our platform is strategically crafted to provide a comprehensive suite of features specifically designed for crop management and future grain analysis. With a user-friendly interface, it offers farmers an efficient means to oversee and organize their crop-related activities. Through this website, farmers can seamlessly input the details of the crops they cultivate, and this information is then dynamically reflected in the livestock.

This website serves as a valuable tool for farmers, offering real-time insights into current market trends and demand for grains. By staying informed, farmers can strategically align their crop production with lucrative opportunities, maximizing profits. The platform empowers farmers to make data-driven decisions, optimizing their agricultural practices based on consumer preferences and global market dynamics. This information not only enhances profitability but also promotes a more sustainable and adaptive approach to farming. Ultimately, the website acts as a crucial link between farmers and the ever-changing demands of the market. Our website analyzes crop production rates to predict future food sufficiency or scarcity, using data analysis and prediction algorithms. Our goal is to inform agricultural planning and policy formulation to address food insecurity and promote sustainability.

TABLE OF CONTENTS

LIST OF ABBREVATIONS

CHAPTER 1

INTRODUCTION

1.1 OVERVIEW

Inefficient crop production and the spectre of food scarcity are complex challenges rooted in various agricultural issues. Outdated farming practices, prevalent especially in developing regions, hinder productivity due to a lack of access to modern technologies and resources. Small-scale farmers face significant hurdles, including limited access to quality seeds, fertilizers, and irrigation systems, inadequate rural infrastructure, limited market access, and price volatility further contribute to the multifaceted challenges faced by farmers. Addressing these issues requires a comprehensive approach involving sustainable practices, technological advancements, improved resource access, and supportive policies to enhance agricultural efficiency and mitigate the global threat of food scarcity.

In the face of a surging global population, the need for efficient food production has become more pressing than ever. However, modern farmers find themselves navigating a complex and swiftly changing business environment characterized by challenging market conditions and intense competition. As the demand for food rises, major crops are under strain to meet these escalating needs. Compounding these challenges is the absence of a dedicated digital platform for storing and managing crucial crop details, leaving farmers without the essential tool of live tracking for crops stored in granaries. In recognizing these critical gaps, this website emerges as a solution poised to alleviate the challenges faced by farmers, offering a comprehensive record of grain stock and providing invaluable support for crop improvement.

Our platform offers a comprehensive suite of features, specifically tailored for crop management and future grain analysis. Boasting a user-friendly interface, it provides farmers with an efficient means to oversee and organize their crop-related activities. Through this website, farmers can effortlessly input details about their cultivated crops, and this information dynamically integrates with livestock data.

The primary objective of our project is to develop a website that addresses the critical issue of food scarcity by analyzing the rate of crop production. Through the utilization of data analysis and prediction algorithms integrated into the backend of the website, we aim to determine whether the current level of crop production is adequate for future needs or if it poses a risk of food scarcity. This functionality is crucial for assessing agricultural sustainability and ensuring food security. By providing insights into the sufficiency of crop production, our website seeks to contribute to informed decision-making in agricultural planning and policy formulation. Ultimately, our goal is to leverage technology to mitigate the challenges of food insecurity and promote sustainable agricultural practices.

This pioneering platform not only facilitates effective crop management but also addresses the broader market context. It serves as a valuable tool for farmers by offering real-time insights into current market trends and demand for grains. By staying informed, farmers can strategically align their crop production with lucrative opportunities, thereby maximizing profits. Empowering farmers to make data-driven decisions based on consumer preferences and global market dynamics, this website not only enhances profitability but also fosters a more sustainable and adaptive approach to farming. Ultimately, it acts as a crucial link between farmers and the ever-changing demands of the market, ushering in a new era of precision and efficiency in agriculture.

1.2 NEED OF STUDY

- Impact on Agricultural Practices: A study would assess the impact of the platform on modern agricultural practices, considering its potential to enhance efficiency and address challenges faced by farmers.
- Utility of Features: A detailed examination of the specific features, such as live tracking and data integration, is necessary to evaluate their practical utility for farmers.
- Economic Implications: The study should explore the economic implications for farmers, examining how real-time insights into market trends influence decision-making processes and profit maximization.
- Sustainability and Adaptability: Assessing the platform's role in promoting sustainability and adaptive farming practices is crucial for understanding its broader impact on the agricultural landscape.
- User Adoption and Practicality: Understanding the practical implications, challenges, and benefits of the proposed platform through a comprehensive study is essential for gauging user adoption within the agricultural community.

1.3DOMAIN DESCRIPTION

BIG DATA ANALYTICS

The domain of Big Data encompasses the management, processing, and analysis of extremely large and complex datasets that traditional data processing systems struggle to handle efficiently. It revolves around the four key characteristics known as the "Four Vs": Volume (large amounts of data), Velocity (high speed of data generation), Variety (diversity in data types and sources), and Veracity (ensuring data accuracy and reliability). The primary

objective within this domain is to extract valuable insights, patterns, and knowledge from massive datasets to inform decision-making processes.

1.3.1PREDICTIVE ANALYTICS

Predictive Analytics is a domain within big data science that involves the use of statistical algorithms, machine learning techniques, and data mining to analyze historical data and make predictions about future events or trends. It revolves around leveraging data-driven insights to forecast outcomes, identify patterns, and inform decision-making processes. This domain is crucial for organizations seeking to gain a competitive edge by anticipating future developments and making proactive, data-informed decisions.

Key components and aspects within the domain of Big Data include:

- Data Collection and Ingestion: The gathering of data from various sources, including structured and unstructured data, and the ingestion of this data into storage systems.
- Storage Systems: Utilizing distributed storage systems such as Hadoop Distributed File System (HDFS) and cloud-based storage solutions to accommodate the vast volumes of data.
- Data Processing: Employing parallel processing techniques and frameworks like Apache Spark and Apache Flink to analyze and process large datasets in a scalable and timely manner.
- Machine Learning: Applying advanced machine learning algorithms to identify patterns, make predictions, and derive actionable insights from data.
- Data Warehousing: Designing and managing large-scale data warehouses to facilitate efficient querying and analysis.

- Distributed Computing: Leveraging distributed computing paradigms to distribute computational tasks across multiple nodes or clusters for enhanced speed and efficiency.
- Data Governance and Quality: Ensuring the integrity, quality, and security of the data through effective governance practices and quality control measures.
- Real-time Analytics: Analyzing data in real-time to gain immediate insights and support decision-making processes in dynamic environments.
- Data Privacy and Security: Addressing challenges related to data privacy, security, and compliance with regulations to protect sensitive information.
- Data Visualization: Transforming complex data into visual representations such as charts and graphs to facilitate easier interpretation and communication of insights.
- Scalability and Flexibility: Adapting to the scalability requirements of growing datasets and accommodating changes in data sources and formats.

Predictive Analytics in Big Data finds applications in diverse industries, including finance, healthcare, e-commerce, telecommunications, and scientific research. The domain's significance lies in its ability to extract meaningful information from large datasets, driving innovation, and informing strategic decisions across various sectors.

1.4 OBJECTIVE

Enhance Agricultural Efficiency:

The primary objective is to improve agricultural efficiency by addressing inefficiencies in crop production, resource utilization, and outdated farming practices. This involves promoting sustainable agricultural methods and leveraging technological advancements.

Mitigate Food Scarcity:

Alleviate the global threat of food scarcity by implementing measures that increase crop yields, enhance productivity, and ensure a more sustainable use of resources. The platform aims to contribute to global food security by optimizing agricultural practices.

Empower Small-Scale Farmers:

Focus on empowering small-scale farmers, especially in developing regions, by providing them with better access to quality seeds, fertilizers, irrigation systems, and essential resources. Strengthening rural infrastructure and market access is pivotal in overcoming the challenges faced by these farmers.

Introduce Digital Solutions:

Introduce a dedicated digital platform to fill the existing gap in storing and managing crucial crop details. Enable live tracking for crops stored in granaries, offering modern farmers a crucial tool to navigate the complexities of the agricultural business environment.

Comprehensive Record Keeping:

Develop a comprehensive record-keeping system for grain stock to enhance transparency and streamline crop management. This ensures that farmers have accurate and up-to-date information about their cultivated crops and stored grains.

Real-Time Market Insights:

Provide farmers with real-time insights into current market trends and demand for grains. This objective aims to assist farmers in making informed decisions regarding crop production, aligning their efforts with market opportunities to maximize profits.

Facilitate Data-Driven Decision-Making:

Empower farmers to make data-driven decisions based on consumer preferences and global market dynamics. The platform's features should enable

farmers to optimize their agricultural practices, promoting efficiency and adaptability.

Promote Sustainability:

Foster a more sustainable and adaptive approach to farming by integrating sustainable practices into the platform. This involves promoting eco-friendly farming techniques, reducing environmental impact, and ensuring the long-term viability of agricultural practices.

Create a Crucial Link Between Farmers and Markets:

Establish the platform as a crucial link between farmers and the ever-changing demands of the market. This objective aims to facilitate a seamless exchange of information, creating opportunities for farmers to respond effectively to market dynamics.

Support Crop Improvement:

Provide invaluable support for crop improvement by offering a platform where farmers can input details about their cultivated crops. This information, dynamically integrated with livestock data, assists in comprehensive farm management and optimization.

Contribute to Global Food Security:

Ultimately, contribute to global food security by creating a platform that not only addresses immediate challenges faced by farmers but also fosters a sustainable, technology-driven approach to agriculture that can withstand the increasing demands of a surging global population.

1.5PROPOSED METHEDOLOGY

Literature Review:

- Conduct a thorough review of existing literature on challenges faced by contemporary farmers, global food production dynamics, and the absence of dedicated live tracking platforms.

- Examine studies related to the impact of technology on agricultural practices and the potential benefits of innovative platforms.

Survey and Interviews:

- Design and administer surveys to farmers to gauge their current challenges, technological needs, and attitudes towards adopting new platforms.
- Conduct in-depth interviews with agricultural experts, researchers, and technology developers to gather qualitative insights into the viability and potential impact of the proposed website.

Platform Feature Analysis:

- Evaluate the specific features of the proposed platform through usability testing, considering aspects such as user-friendliness, data input efficiency, and integration with livestock data.
- Gather feedback from a sample group of farmers using the platform in a controlled environment.

Economic Impact Assessment:

- Analyse economic implications by studying the financial outcomes of farmers using the platform compared to those relying on traditional methods.
- Examine the potential for profit maximization through strategic crop alignment and real-time insights into market trends.

Sustainability and Adaptive Practices Evaluation:

- Investigate the platform's role in promoting sustainable and adaptive farming practices through an analysis of user practices and changes in farming methodologies.
- Assess the environmental impact of the platform by considering factors like reduced wastage and improved resource management.

Quantitative Data Analysis:

- Utilize statistical methods to analyze quantitative data gathered from surveys, interviews, and platform usage statistics.
- Examine correlations between the use of the platform and positive outcomes in terms of crop yield, profitability, and sustainability.

Case Studies:

- Select representative farming communities to conduct detailed case studies on the implementation and impact of the proposed platform.
- Document success stories, challenges faced, and lessons learned from the adoption of the platform.

Comparative Analysis:

- Compare the proposed platform with existing agricultural technologies, if any, to identify its unique advantages and potential areas for improvement.
- Benchmark against international standards and best practices in agricultural technology.

Stakeholder Feedback:

- Solicit feedback from key stakeholders, including farmers, technology developers, and agricultural policymakers, to gather diverse perspectives on the platform's utility and potential improvements.

Report Compilation and Recommendations:

- Compile the findings from the literature review, surveys, interviews, and analyses into a comprehensive report.
- Provide recommendations for further enhancements to the platform and strategies for widespread adoption within the agricultural community.

CHAPTER 2
LITERATURE REVIEW

A literature survey is the most important step in the hardware and software development process. Before developing a tool, it is necessary to determine the time factor, economy, and company strength. Once these things are satisfied, the next step is to determine which operating system and language can be used for developing the tool. Once the programmers start building the tool the Programmers need a lot of external support. This support can be obtained from senior programmers, books, or websites. Before building a system, the above consideration is considered for developing the proposed system.

2.1 DATA ANALYTICS FOR CROP MANAGEMENT: A BIG DATA VIEW by Nabila Chergui, Mohand Tahar Kechadi

Recent advancements in Information and Communication Technologies (ICT) have catalysed the rise of Digital Agriculture, leveraging the democratization of digital devices, artificial intelligence, and data science. This transformation introduces innovative farming processes that enhance productivity and efficiency while maintaining environmental sustainability. By harnessing sophisticated digital tools and data analytics, Digital Agriculture enables the collection and analysis of extensive agricultural datasets, empowering farmers, agronomists, and professionals to make informed decisions regarding farming tasks. This paper presents a systematic review focusing on the application of data mining techniques specifically in crop yield management and monitoring within Digital Agriculture. It introduces the crop yield management process and its components, concentrating on crop yield and monitoring aspects. Identifying key categories of data mining techniques for crop yield monitoring, the paper explores existing works on data analytics in

this context. Furthermore, it conducts a broader analysis and discussion on the implications of big data in agriculture. In summary, the paper underscores the transformative potential of data mining techniques in enhancing agricultural practices, particularly in crop yield management and monitoring. It emphasizes the importance of leveraging digital technologies and data analytics to drive innovation and sustainability in agriculture, thereby contributing to global food security efforts.

2.2 DATA ANALYTICS PLATFORMS FOR AGRICULTURAL SYSTEMS: A SYSTEMATIC LITERATURE REVIEW by Ngakan Nyoman Kutha, Krisnawijaya, Bedir Tekinerdogan, Cagatay Catal, P.P.J. van der Tol

The abstract highlights the increasing adoption of data-driven approaches in agriculture, driven by rapid developments in Information and Communication Technologies (ICT) and advanced data analytics techniques. While numerous studies have explored data analytics platforms in the agricultural sector, the findings are scattered, lacking a comprehensive synthesis of their characteristics and challenges. This article addresses this gap by presenting the results of an in-depth systematic literature review (SLR) focused on analysing the domains, stakeholders, objectives, technologies, data properties, and obstacles associated with adopted data analytics platforms in agriculture. The SLR explicitly examines domains, stakeholders, objectives, adopted technologies, data properties, and obstacles associated with these platforms. A year-wise analysis reveals a surge in research interest in data analytics in agriculture, particularly from 2010 onwards, indicating its recent popularity. A total of 535 papers published between 2010 and 2020 were retrieved through automatic and manual search strategies, with 45 journal articles selected for detailed analysis. From these studies, 33 features and 34 different obstacles were identified, providing valuable insights into the diverse landscape of data analytics platforms in agriculture. This systematic synthesis of features and obstacles contributes to a

better understanding of the functionalities and challenges of data analytics platforms in agriculture. These findings not only characterize the diversity of platforms but also offer directions for further research and development in the field.

2.3 AGRICULTURAL DATA ANALYTICS – SMALL TO BIG DATA by S. Ravichandran, K. Kareemulla

Agriculture serves as the cornerstone of the Indian economy, heavily reliant on the seasonal monsoons, namely the South-West and North-East monsoons, occurring from June to December. The Southwest monsoon, predominant from June to September and responsible for 75% of India's rainfall, significantly influences agricultural outcomes, often resulting in favourable conditions for crop growth. To effectively manage agricultural processes and optimize productivity, statistical data is meticulously collected across various stages of crop growth. This data encompasses a wide array of parameters essential for understanding crop development and yield potential. However, to extract meaningful insights from this data deluge, sophisticated statistical analysis is imperative. The paper under scrutiny sheds light on the application of advanced statistical techniques tailored for agricultural data analysis. These techniques are indispensable for discerning patterns, trends, and relationships within agricultural datasets, enabling informed decision-making and strategic planning. Moreover, the paper underscores the pivotal role of highly specialized statistical software in facilitating robust statistical analysis across diverse agricultural experiments. By elucidating various statistical methodologies employed in agricultural research, the paper contributes to enhancing the analytical capabilities of researchers and practitioners within the agricultural domain. It emphasizes the importance of employing rigorous statistical approaches to interpret complex agricultural data accurately. Furthermore, the paper serves as a resource for researchers seeking to navigate

the intricacies of statistical analysis in agricultural research, fostering a deeper understanding of statistical techniques pertinent to crop growth analysis and agricultural experimentation. In summary, the paper underscores the critical nexus between statistical analysis and agricultural research, advocating for the utilization of advanced statistical methodologies and software tools to unravel the complexities of agricultural systems and drive sustainable agricultural development in India.

2.4 AGRICULTURE DATA ANALYTICS IN CROP YIELD ESTIMATION: A CRITICAL REVIEW by B M Sagar, N K Cauvery.

Agriculture is fundamental for human sustenance, particularly in India where over 55% of the population relies on it. However, challenges such as climatic variability hinder efforts to increase crop production, making achieving agricultural targets challenging. Factors like climate, geography, and economic and political conditions directly influence crop production and productivity. Crop yield prediction plays a crucial role in agricultural practices, providing farmers with essential information before sowing seeds to enhance yields. With the increasing use of technology in agriculture, data analytics has emerged as a prominent trend, aiding in crop yield management and crop health monitoring. The rise of big data in agriculture underscores its significance, although identifying its impact and effectiveness remains a challenge. Efforts are underway to understand how big data analytics can enhance productivity in agricultural practices. Analyzing agricultural data facilitates crop yield prediction and monitoring, among other related activities. Numerous studies in the literature explore the use of data analytics in agriculture, providing insights into various methods applied to crop yield prediction. This study contributes insights into different data analytics techniques used for crop yield prediction, highlighting lacunae in the research area. It emphasizes the importance of leveraging data analytics to address challenges and improve agricultural

productivity. By bridging the gap between data analytics and agriculture, this research aims to enhance understanding and drive innovation in agricultural practices.

2.5 A REVIEW ON THE PRACTICE OF BIG DATA ANALYSIS IN AGRICULTURE by Andreas Kamilaris, A Kartakoullis, F X Prenafeta-Boldú

To address the complexities of agricultural production, modern digital technologies offer continuous monitoring of the physical environment, generating vast amounts of data at an unprecedented pace. Harnessing big data analysis in agriculture has the potential to unlock value, improving productivity for farmers and companies. Despite its transformative impact across various industries, the widespread application of big data analysis in agriculture remains limited. This paper conducts a review of current studies and research in agriculture utilizing big data analysis, aiming to address pertinent agricultural challenges. Thirty-four studies are analyzed, examining the problems addressed, proposed solutions, tools, algorithms, data nature and dimensions, scale of use, and overall impact. The review underscores the significant opportunities presented by big data analysis in agriculture, paving the way for smarter farming practices. It emphasizes the availability of hardware and software, analytical techniques, and increasing accessibility of big data sources as drivers for academic research, public sector initiatives, and business ventures in agriculture. However, despite its potential, big data analysis in agriculture is still in its early stages of development, with several barriers to overcome. The paper highlights the need for further research and innovation to fully realize the benefits of big data analysis in transforming agricultural practices.

2.6 AGRICULTURE DATA ANALYTICS IN CROP YIELD ESTIMATION USING IBM COGNOS by Dr. Gururaj T, Prerana Prakash Latti, Rakshanda B, Rakshit V M, Ranjana B.

The abstract outlines the significance of analytics in decision-making and performance enhancement through the interpretation of data patterns, specifically in the context of agriculture and crop yield in India. By utilizing tools like IBM Cognos Analytics, which amalgamate various functionalities such as reporting, modelling, analysis, exploration, dashboards, and event management, organizations can comprehend their data effectively and make informed decisions. The focus is on leveraging analytics to gain insights into crop production in India. The project aims to employ analytics in agriculture data to analyze critical visualizations, create a dashboard, and extract insights about crop production in India. The utilization of a dashboard facilitates the monitoring of events or activities by providing comprehensive analysis and key insights on one or more pages or screens. Through visualization, analysis, and dashboard creation, the project endeavours to extract maximum insights and understanding from the data. Overall, the abstract highlights the importance of analytics in agriculture, particularly in analyzing crop yield data in India. It emphasizes the role of tools like IBM Cognos Analytics in integrating various functionalities to enable effective decision-making and performance improvement. The project's objective is to utilize analytics to visualize, analyse, and derive insights about crop production in India through the creation of a comprehensive dashboard.

2.7 LITERATURE REVIEW ON RECONCILING DATA FROM AGRICULTURAL CENSUSES AND SURVEYS by

Publication prepared in the framework of the Global Strategy to Improve Agricultural and Rural Statistics This technical paper examines methodologies for reconciling agricultural census and survey data by reviewing existing literature on the subject. It outlines various techniques available for data reconciliation, evaluating the advantages and disadvantages of each approach. Drawing from the literature, the paper offers recommendations for the

reconciliation process, considering the merits of each relevant methodology. Additionally, it conducts a gap analysis to identify and assess differences among the methods. The Food and Agriculture Organization of the United Nations (FAO) Member Nations have expressed a need for methodological guidance in reconciling census and survey data. In response, the Global Strategy to Improve Agricultural and Rural Statistics (Global Strategy) has conducted this literature review, which may serve as a foundation for the development of a handbook on the topic. The authors, Eloi Ouedraogo and Ulrich Eschol Nyamsi, acknowledge the contributions of Flavio Bolliger, Naman Keita, Dramane Bako of FAO, and Linda J. Young, Director of the USDA/NASS Research and Development Division, for their valuable feedback in refining the paper. This collaborative effort aims to enhance the quality of data reconciliation methodologies in the agricultural sector, providing valuable guidance for practitioners and policymakers alike.

2.8 ANALYSIS AND EVALUATE OF AGRICULTURAL RESOURCES USING DATA ANALYTIC METHODS by Li Liu.

In the agricultural sector, decision-making for farmers and agribusinesses involves navigating numerous complex choices influenced by various factors, impacting outcomes and revenue generation. Accurate predictions of crop yields are crucial for informed investment decisions and shaping agricultural policies. However, challenges arise from outdated or incomplete data regarding resource availability, complicating the evaluation process amidst diverse soil and climatic conditions. To address these challenges, this research proposes a novel approach, the Enhanced Gravitational Search Optimized-based Gated Recurrent Unit (EGSO-GRU), for crop production prediction. The methodology involves gathering and pre-processing data using normalization techniques, followed by feature extraction with Enhanced Independent Component Analysis (EICA). The proposed method achieves notable accuracy (95.89%), specificity (92.4%),

and low error metrics (MSE: 0.071, RMSE: 0.210, MAE: 0.199), outperforming existing models. This advancement is crucial for optimizing agricultural resources, enhancing productivity, and ensuring long-term sustainability in farming. By providing more accurate crop yield predictions, the proposed method contributes to informed decision-making and supports efficient resource allocation. Overall, this research represents a significant technological advancement in the agricultural sector, with potential implications for improving agricultural practices and industry sustainability.

2.9 PRECISION AGRICULTURE FOR CROP AND LIVESTOCK FARMING by António Monteiro et, al

Agriculture has significantly contributed to the global economy, but the pressure to meet the demands of a growing population poses challenges to crop and animal production while also impacting the environment negatively. To address these challenges, smart farming technologies, particularly Precision Agriculture (PA) and Precision Livestock Farming (PLF), are increasingly utilized to optimize production, reduce waste, and cut costs. PA, a data-driven farming management approach, analyzes individual field and crop needs through technology-enabled observation and measurement. Similarly, PLF employs automatic monitoring of individual animals to enhance growth, milk production, disease detection, and behavioral monitoring, among other aspects. This study provides a concise review of recent scientific and technological advancements in PA and their application in both crop and livestock farming. It serves as a guide for researchers and farmers seeking to integrate technology into agricultural practices. However, the development and implementation of PA applications require further investigation to ensure accuracy and viability in commercial settings. Overall, this research highlights the importance of embracing technology in agriculture to address productivity challenges and environmental concerns. By adopting PA and PLF, farmers can enhance

efficiency, reduce resource wastage, and contribute to sustainable agricultural practices.

2.10 AGRI-FOOD SUPPLY CHAIN MANAGEMENT: LITERATURE REVIEW by C. Ganeshkumar, et, al.

This paper offers a critical examination of prior literature on agri-food supply chain management (SCM), with a focus on identifying influential information and addressing gaps in understanding. It serves as a foundational effort to enrich both theoretical constructs and practical applications within the realm of agri- food SCM, particularly in developing countries like India. The review encompasses a wide range of sources, including research articles and materials from databases such as Scopus, EBSCO, and Google Scholar, spanning a decade from 2006 to 2016. Content and descriptive analyses are employed to dissect the literature, which is then categorized into four main themes: general review of agri-food supply chains, policies impacting various segments of the supply chain, the structure and conduct of individual segments, and performance assessment of these segments. By systematically categorizing and analyzing the literature, the paper highlights research gaps in agri-food SCM, providing valuable insights for both scholars and practitioners. Additionally, it offers a detailed case study of the potato supply chain in India, offering a practical illustration of the concepts discussed. Overall, this paper contributes to the understanding of agri-food SCM by synthesizing existing knowledge, identifying areas for further exploration, and providing a case study to illustrate theoretical concepts in a real-world context. It lays the groundwork for future research and practical applications in agricultural supply chain management.

2.11 SUSTAINABLE SUPPLY CHAIN MANAGEMENT- A LITERATURE REVIEW ON EMERGING ECONOMIES by Rebeca B, et, al.

The article explores the burgeoning interest in sustainable supply chain management (SSCM) within both business and academic spheres, particularly focusing on its emergence in emerging economies. Despite a noticeable increase in attention to SSCM globally, the spotlight on sustainable development in emerging economies is relatively recent. Through a systematic literature review encompassing 56 articles from 2010 to April 2020, the authors provide a comprehensive overview of the existing literature on SSCM in emerging economies. The findings reveal a growing interest in SSCM, yet the research in emerging economies lags behind that of developed nations. The authors emphasize the significance of considering the contextual differences of developing countries when conducting empirical or case study investigations. They also stress the necessity of integrating the three dimensions of sustainability into supply chain performance research from the perspective of emerging economies. Limitations of the existing literature are acknowledged, and opportunities for future research are identified, particularly within key supply chain functions. Collaboration, sustainable practices innovation, sourcing, and supplier development are highlighted as areas ripe for exploration from the standpoint of emerging countries. In conclusion, the article underscores the imperative for further research from diverse supply chain viewpoints, emphasizing collaboration, innovation, sourcing, and supplier development within the context of emerging economies. This review provides valuable insights for scholars and practitioners aiming to advance sustainable supply chain management practices in both developed and emerging markets.

2.12 SUSTAINABLE SUPPLY CHAIN MANAGEMENT PRACTICES(SSCMPS) AND ENVIRONMENTAL PERFORMANCE: A SYSTEMATIC REVIEW by Ernest Mugoni, et, al.

The study aimed to investigate the impact of Sustainable Supply Chain

Management Practices (SSCMPs) on environmental performance by conducting a systematic review and content analysis of 140 academic articles published between 2012 and 2022. Utilizing databases including ABI/INFORMs (ProQuest), ScienceDirect, SCOPUS, and the Directory of Open Access Journals (DOAJ), the research sought to discern insights into the relationship between the variables under study. Results from the review indicate a significant body of evidence supporting the notion that SSCMPs have a positive influence on environmental performance. However, the analysis highlights a notable gap in the literature concerning the investigation of operational performance and social aspects in relation to sustainable supply chain management. The study recommends that future research should delve into these areas, considering them as potential mediating variables. Furthermore, the authors suggest that forthcoming studies in the field should adopt more robust methodologies, such as mixed methods, and incorporate mediating and moderating variables to provide a deeper understanding of the relationship between SSCMPs and environmental performance. Additionally, there is a call for more industry-oriented research to complement the academic literature and provide practical insights for businesses aiming to enhance their sustainability practices within the supply chain.

2.13 QUANTIFYING VULNERABILITY AND IMPACT OF CLIMATE CHANGE ON PRODUCTION OF MAJOR CROPS IN TAMIL NADU, INDIA by K. Palanisami, P. Paramasivam, C.R. P. K. Aggarwal, S. Senthilnathan

Climate change is essentially a long-term phenomenon and is supposed to be gradual in its impact for most part The research paper explores the vulnerability and impact of climate change on crop production in Tamil Nadu, India. The paper utilizes statistical methodologies to assess the of coastal districts and quantifies the impact of climate change on agriculture using the

Ricardian model. The vulnerability index is constructed based on demographic, climatic, agricultural, occupational, and geographic factors, facilitating the classification of coastal districts into different vulnerability categories. The results indicate that Ramnad and Nagapattinam are the most vulnerable districts. Additionally, the paper presents regression analysis for crop yield and area, projecting a reduction in both area and yields of major crops (paddy, sugarcane, and groundnut) ranging from 4 to 13 percent under climate change scenarios. It is observed that climate change is expected to negatively impact crop production, with an overall decrease of up to 22 percent. The study emphasizes the importance of assessing vulnerability and projecting climate change impacts to plan suitable measures for mitigating the effects on agriculture. The findings provide valuable insights for policymakers and stakeholders to address the challenges posed by climate change in agricultural production in Tamil Nadu, India.

2.14 CROP DIVERSIFICATION IN TAMIL NADU-A TEMPORAL ANALYSIS by V C Elavan.

The study delves into the relationship between the size of agricultural holdings and productivity. It uncovers an inverse correlation between operational holding size and productivity in maize crops. Conversely, a constant productivity relationship is observed in paddy and wheat crops. These results shed light on the nuanced dynamics of farm size and its impact on different crops. In essence, the research underscores the intricate balance required in labor management within agriculture, advocating for a more nuanced approach to optimize productivity without overreliance on manual labor. This insight is crucial for policymakers, farmers, and stakeholders seeking sustainable practices in the agricultural sector, acknowledging the complexity of factors

influencing labor dynamics and overall productivity in diverse crop cultivation scenarios.

2.15 DRIVERS OF INCREASING GLOBAL CROP PRODUCTION: A DECOMPOSITION ANALYSIS by Linus Blomqvist, Luke Yates, Barry W Brook

Over the past 50 years, escalating crop production has significantly impacted human welfare and the environment. As global food demand continues to rise, a key challenge is to enhance crop production by increasing yields rather than expanding cropland, aiming to minimize agriculture's climate and biodiversity impacts. However, assessing progress is complex, with global yields influenced by various factors. This study, utilizing LMDI decomposition analysis, reveals that the predominant contributor to rising crop production has been the increase in aggregate yields (89%), as opposed to cropland expansion (11%). Notably, meeting global food demand has largely involved growing more crops on existing land. The second-stage decomposition identifies that nearly two-thirds of aggregate yield improvements stem from pure yield, emphasizing the output of a given crop per unit of harvested cropland area. The remainder results from less-explored factors such as cropping intensity, changes in cropland distribution, and crop composition. Furthermore, an attribution analysis categorizes contributions based on climate, income, region, and crop types. This detailed breakdown enhances accuracy in forecasting and enables policymakers to target the most effective strategies for sustainable food production.

2.16 AGRICULTURE PRODUCTIVITY TRENDS IN TAMILNADU BASED ON MAJOR CROPS by Arul Kumar C, Manimannan Ganesan, Dr Selvakumar V.

This research paper attempts to enhance the agricultural productivity trends of major crop yields in Tamil Nadu. The state is one of the most urbanized and industrialized states in India. About 60 percent of the total population is directly engaged in agriculture and depends on this sector for their livelihood. Hence growth in agriculture is important not only to ensure food security but also for high living standards of the population. The secondary sources of database were collected from the Department of Economics and Statistics, for a period of ten years from 2002-03 to 2011-12. The data has been analysed using statistical techniques. The findings reveal that there is some significant difference among the crop yield. The compound growth rate of yield for the selected crops in Tamil Nadu state were estimated for the study period using growth model.

2.17 EFFECTIVE USE OF BIG DATA ANALYTICS IN CROP PLANNING TO INCREASE AGRICULTURE PRODUCTION IN INDIA by Ch Chandra Sekhar, J Udaykumar, B Kishor Kumar, Ch Sekhar.

Farming turned to day-to-day activity for our farmers. This farming was inherited from our ancestors from long centuries. So, the conventional methods of farming are not apt for this badly affected global warmed environment Data is growing much quicker than the computation speeds. An instance of Big Data is cropping sales. Crop sales data will be used to represent the crops data. Since government has actively and constantly gathering crop sales dataset but the size of dataset is considered to be a big data which are a real-world data, which is really a hard problem to analyse it. In order to analyse big data, data mining and statistical techniques can be expanded under parallel and distributed computing platform, also which consumes large amount of storage and computational time

on handling massive dataset in this paper, applying data clustering to observe disseminated dataset of expansive crop deals for crop planning may additionally lead to the increase within the agriculture production in India. By using demand in crop kind as the clustering factor then predict the schedule of crop sowing or decide which crop should be sown in the season. Quality of inputs is vital to crop quality and yield, therefore availability and accessibility of right inputs to farmers is a key to farmer empowerment

2.18 WB-CPI: WEATHER BASED CROP PREDICTION IN INDIA USING BIG DATA ANALYTICS by Rishi Gupta, Akhilesh Kumar Sharma, Oorja Garg, Krishna Modi, Shahreen Kasim, Zirawani Baharum, Hairulnizam Mahdin, Salama A.

Due to sudden changes in weather conditions, farmers and agriculture throughout the country suffer as they fail to produce enough crops. This leads them to take serious steps as they are unable to provide for their family and make ends meet. This also leads to a scarcity of availability of food resources in the country. The conditions of farmers in our country need to be changed. This paper talks about how Big Data Analytics combined with various structured and unstructured data helps in providing insight to farmers to make a decision as to which crops to grow and reduce losses due to unexpected or unpredictable disasters

2.19 PREDICTION OF SOIL AND CROP YIELD BY BIG DATA ANALYSIS by Venkata Chennareddy, Ramanayagam S.

The agriculture sector in India faces a significant challenge in augmenting crop productivity, with a substantial portion of crops reliant on rainfall, making them vulnerable to climatic variability. Crop yield is influenced by a multitude of factors, including soil quality, climatic conditions, rainfall patterns, and the application of fertilizers and pesticides. These factors interact in complex ways, underscoring the need for comprehensive approaches to agricultural

management. In recent years, advancements in information technology have emerged as a promising avenue for addressing these challenges, particularly in the domain of assessing crop yields. The accurate estimation of yields is a critical concern, requiring the utilization of available data to provide insights that can inform decision-making for both farmers and government agencies. By leveraging information technology tools, stakeholders can gain valuable knowledge that enhances their ability to make informed decisions aimed at improving agricultural productivity. One proposed strategy involves providing farmers with tailored instructions regarding alternative crops suited to their specific land conditions, thereby diversifying agricultural practices and mitigating risks associated with dependence on specific crops. Additionally, various data mining techniques offer opportunities to predict future crop production, facilitating proactive planning and management strategies. This paper focuses specifically on the classification of soil fertility rates, employing algorithms such as K-Means, Random Tree, and Apriori. By systematically assessing soil fertility, researchers aim to identify patterns and relationships that can inform targeted interventions to optimize agricultural productivity. Ultimately, by integrating technological innovations with traditional agricultural practices, stakeholders can work towards sustainable solutions to enhance crop yields and ensure food security in India.

2.20 A DATA-DRIVEN CROP MODEL FOR MAIZE YIELD PREDICTION by Yanbin Chang, et, al.

The abstract presents a novel data-driven crop model designed to accurately predict crop yields, particularly important for ensuring food security amidst the challenges posed by climate change. Combining the strengths of process-based and data-driven modelling, the proposed model offers a comprehensive approach to tracking daily biomass accumulation throughout the maize growing season, utilizing this data to estimate final grain yield. The

model's efficacy was evaluated through computational studies conducted in the US Corn Belt region spanning from 1981 to 2020. Results indicate that the model demonstrates a high level of accuracy, with a relative root-mean-square error of average yield standing at 7.16% in 2020. Moreover, the model yields scientifically explainable results, offering insights into the interactions between genotypic parameters and environmental variables. One significant aspect highlighted in the study is the model's potential utility in aiding farmers to optimize seed selection, thereby enhancing crop yields. By leveraging the model's capabilities to detect and differentiate interactions between genetic traits and environmental factors, farmers can make more informed decisions regarding seed choice, ultimately leading to improved agricultural productivity. Overall, the proposed data-driven crop model represents a promising tool for predicting crop yields with precision and providing valuable insights for agricultural decision-making. Its ability to offer scientifically explainable results and identify key interactions between genetic and environmental factors underscores its potential to contribute significantly to addressing food security challenges in the face of climate change.

2.21 AN ANALYSIS OF PRODUCTIVITY OF FOOD GRAINS IN INDIA

by Dr. Ummed Singh, et, al.

The study delves into an analysis of the trends in the area, production, and productivity of major food grain crops in India spanning from 1990-91 to 2019-20. Employing statistical techniques such as trend analysis, analysis of variance (ANOVA), and line charts, the research aims to comprehend the behaviour of the data over the specified period. Additionally, to gauge the variability in these parameters, the coefficient of variation (CV) is computed .The findings of the study reveal upward trends in both production and productivity of major food grain crops during the reference period. However, there is a notable decline in the area under rice cultivation. Examining

production trends further, it is observed that major cereals like rice, wheat, and maize exhibit consistent improvement, while the production of pulses shows variability without a clear upward trajectory. Maize, categorized as a coarse cereal, emerges as significant alongside rice and wheat in terms of production. Notably, the overall growth trend for total food grains in India is positive and statistically significant, reflecting the resilience and progress of the agricultural sector. The study underscores the importance of analysing growth rates, productivity, and compound annual growth rates (CAGR) in understanding the dynamics of food grain production. Moreover, the utilization of ANOVA aids in dissecting the variance within the data, providing valuable insights into the factors influencing production trends. In conclusion, the research contributes valuable insights into the trends and patterns shaping food grain production in India over the past three decades. These findings can inform policymakers, agricultural practitioners, and stakeholders in making informed decisions to sustain and enhance food security in the country.

2.22 A REVIEW OF CROP YIELD PREDICTION BASED ON INDIAN AGRICULTURE SECTOR USING MACHINE LEARNING by Deepthi Thomas

The abstract highlights the critical role of agriculture in India, with approximately 60% of the population relying on it for their livelihood. However, the sector faces challenges such as a decline in agricultural production due to unstable climate conditions and global warming. Indian farmers often lack access to advanced technologies that could help improve and maximize their yields. Providing farmers with explicit information about soil characteristics, nutrient levels, pH values, climate changes, and previous yield data could enable them to optimize their farming practices effectively. The abstract suggests that leveraging advancements in machine learning, big data analytics, and cloud computing technologies holds promise for predicting

climate patterns and crop yields to aid farmers. Predicting yields in advance can empower farmers to make informed decisions regarding fertilization, storage, and marketing, ultimately boosting production and revenue. The paper discusses various research efforts in India focused on predicting crop yields using machine learning and deep learning techniques. Environmental parameters such as temperature, rainfall, and soil type are commonly utilized as key features for prediction. Multiple machine learning algorithms are explored in these studies, presenting the complex task of identifying the most effective algorithm for yield prediction. Overall, the research aims to accurately forecast crop yields, offering insights into enhancing production and optimizing fertilizer usage. By synthesizing data-driven approaches with agricultural practices, these efforts strive to address the challenges faced by Indian farmers and contribute to the sustainable growth of the agriculture sector.

2.23 THE TREND ANALYSIS OF MAJ R FOOD GRAINS IN INDIA by S.V. Halawar

The present study focuses on providing credible estimates of future production for key food grains in India, including rice, wheat, coarse cereals, sugarcane, and pulses. By examining differences in production levels across these various food grains, the research employs trend analysis and correlation coefficient calculations to elucidate potential future production trends. Given the significant importance of rice and wheat as staple foods in India, the study specifically assesses the correlation between their production levels. This correlation analysis aims to uncover any discernible patterns or relationships between rice and wheat production, offering valuable insights into the dynamics of food grain production in the country. Through trend analysis, the study aims to identify and analyse long-term patterns or shifts in production trends for each of the food grains under consideration. By discerning these trends, researchers can better anticipate future production levels and potential challenges or

opportunities facing the agricultural sector. Additionally, by calculating correlation coefficients between rice and wheat production, the study seeks to quantify the degree of relationship between these two crucial crops. Understanding the correlation between rice and wheat production can inform agricultural planning and policy decisions, helping stakeholders anticipate potential impacts on food security and market dynamics. Overall, the study contributes to enhancing our understanding of food grain production dynamics in India and provides valuable insights into future production trends. By employing rigorous analytical techniques such as trend analysis and correlation coefficient calculations, the research aims to offer credible estimates that can inform agricultural policy- making and support efforts to ensure food security and sustainability in the country.