

## Agro supply hub

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### Abstract:

Agriculture remains a mainstay of many emerging nations, although farmers typically encounter various issues such as fragmented supply chains, inadequate access to markets, inefficient use of resources, and insufficient information. The emergence of the Tile Agro Supply Hub can be seen as an answer to these challenges, as this innovation creates a decentralized and technologically advanced agriculture environment. This paper focuses on the development and effects of a Tile Agro Supply Hub – a system that combines several agricultural operations into a single platform. The concept of the Tile Agro Supply Hub is that of an inter-linked system of “tiles”, wherein each tile corresponds to a particular function in the agri-supply chain. Some examples of such functions could include input supply (seeds, fertilizers, pesticides), warehouses, processing facilities, logistics systems, and market linkages. With the help of the Tile Agro Supply Hub, farmers will be able to coordinate their efforts seamlessly because of the fact that all the functions have been modularly structured. Additionally, modern technology will be used in the form of data analytics, Internet of Things technology, and mobile phones to give farmers vital information about the weather, soil, crops, and market prices. One such feature that is very important about this model is that it is focused on human beings, emphasizing accessibility, inclusivity, and user-friendliness. The main aim of the hub is to facilitate small farmers through local assistance, education, and advisory services in order to fill in the gap between small-scale farmers and large ecosystems in the market. This platform aims to foster cooperation among all stakeholders, from the farmers, to the suppliers, logistics partners, banks, and governments.

*Keywords — Agro Supply Hub; agricultural supply chain; digital marketplace; farm-to-consumer platform; inventory management; order tracking; supply chain optimization; e-agriculture; real-time data; digital transactions.*

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### I. INTRODUCTION

Agriculture plays an important role among other sectors in the world. It provides livelihood for billions of people all over the world and ensures the security of food worldwide. The modern farmer has to deal with numerous problems, including ineffective supply chain, low-quality agricultural input availability, insufficient storage capacity, fluctuating prices, among others. As reported by the Food and Agriculture Organization, each year large amounts of agriculture products are wasted because

of poor post-harvest management and ineffective infrastructure.

One of the issues that the agricultural industry faces is fragmentation in the value chain. The farmers rely on several middlemen who help them in procuring seeds, fertilizers, transport, storage facilities, and selling their agricultural products. These factors cause a delay in production, and the costs increase. Another issue faced by farmers is a lack of information about prices in the market,

climate conditions, and innovative agriculture techniques.

In order to overcome these problems, there arises the need for a streamlined system which can integrate all aspects of the agriculture value chain. The idea of the Tile Agro Supply Hub is presented as an answer to these problems. In the Tile Agro Supply Hub idea, the entire agricultural system is broken down into various smaller units known as tiles and the functions such as provision of inputs, storage, processing, transport, and linkages with the market are carried out within the individual tiles.

Tile Agro Supply Hub utilizes new technology including digital platforms, analytics, and Internet of Things-enabled monitoring technology to provide farmers with real-time and relevant information. The services that farmers will receive include buying of quality inputs, storage of the farm produce, logistics management, and buyers. All these are provided through one channel that eliminates reliance on middlemen.

Though the possibilities seem great, it is unfortunate that current agricultural systems work separately and have no complete solutions to offer regarding integration of all supply chain functions. Most of the platforms are concerned with one thing at a time, ignoring other important aspects like user interface and tracking the data for future decision making purposes.

This study will examine how a Tile Agro Supply Hub can be designed to incorporate various agro services under one umbrella. This proposed system will concentrate on streamlining the supply chain process, minimizing wastage at the harvest stage, and ultimately helping farmers increase their income. Through technology-driven innovation and an approach that puts farmers' needs first, this study hopes to make a meaningful contribution to the field of agriculture.

## **II. LITERATURE REVIEW**

Agro-supply hubs are being acknowledged as a revolutionary solution in the modern agri-food

supply chains that facilitate the process of aggregate collection, processing, storage, and transportation of agricultural produce. From recent studies, agri-food supply chains can be seen as processes where various processes or stages contribute to adding value while causing inefficiencies if poorly synchronized. Agro-hubs solve such issues by ensuring better coordination between stakeholders like farmers, processors, distributors, and retailers.

Several systematic reviews on the topic have suggested that one of the biggest problems in agricultural supply chains lies in its fragmented nature, resulting in substantial post-harvest losses, low prices realized by farmers, and poor logistics performance. Agro-hubs provide solutions to such issues by providing an integrated infrastructure system where bulk processing, grading, and cold storage take place, resulting in better quality products and reduced wastage. Furthermore, integration of digital systems such as Big Data analytics and IoT have also been recognized as enablers in such environments.

In the recent past, optimization models have also been stressed as one of the approaches towards achieving efficiency in agro-supply hubs, in areas such as selecting suppliers and planning logistics. However, there are some challenges that have been identified, including financial investments, lack of technological knowledge and poor infrastructure, which continue to pose obstacles in developing countries. Consequently, future recommendations include improvement in policies, technology, and coordination among other things.

Current studies also discuss the rising significance of sustainability in agro-supply hub systems. Scholars assert that agro-hubs promote environmental sustainability through the reduction of food wastage, effective transportation systems, and optimal use of resources. In addition, the use of green logistics techniques, for example, energy-efficient cold chains and sustainable packaging material, is considered one of the significant trends in modern agro-hubs. Moreover, agro-hubs foster traceability and transparency within the chain system, which ensures compliance with food safety measures.

Sustainability-based models incorporated in agro-hubs not only increase environmental sustainability but also strengthen economic sustainability.

The socio-economic implications of agro-supply hubs in rural development is another significant area discussed in literature. Agro-hubs generate job opportunities in logistics, processing, packing, and quality assurance sectors. In addition, agro-hubs enhance the empowerment of small-scale farmers by enabling them to access organized markets, fair pricing methods, and value-added services. Research shows that agro-hubs allow for better price discovery and eliminate intermediaries from transactions, which increases profit margins for farmers. Nonetheless, agro-hubs need adequate institutional support, capacity development, and awareness programs to achieve optimal outcomes.

### **III. METHODOLOGY**

The methodology for the Tile Agro Supply Hub utilizes an organized step-by-step approach that facilitates the process of signing up, accessing services, managing agriculture-related tasks, and performing transactions via one platform. This methodology starts with registration of the user, whereby a farmer or stakeholder inserts their basic information including their name, phone number, address, and the user category whether farmer, supplier, or buyer. Following registration, the user is able to log in with their username and password. The user is then redirected to a central dashboard with all the services offered by the agro supply hub.

Upon signing into the application, the user can choose from several functional tiles depending on their need. Such tiles depict the important elements of the agricultural supply chain, which include agricultural input supply, storage, logistics, and marketing. Within the agricultural input supply tile, farmers can look up and acquire various types of inputs required for farming like seeds, fertilizers, and insecticides.

The appropriate inputs are recommended to farmers by applying the recommendation algorithm that

takes into consideration historical and basic rule-based filtering data.

In storage management, the user will be able to find out the availability of nearby storage houses and warehouses. The user can schedule storage services by providing the necessary information regarding the crop to be stored, amount of crop, and for how long the crop should be stored. Data monitoring is used to keep a check on storage parameters like temperature and humidity.

In transportation and logistics, the logistics module enables farmers to organize the shipment of their produce from their farms to storage facilities or markets. It gathers information about the pick-up point, destination point, and quantity of goods to be transported. An easy optimization method is adopted for the allocation of transport assets.

Under the market linkage tab, farmers are able to see market prices as well as interact with the buyer such as the wholesaler or retailer. The system shows price trends and demand information which enable farmers to determine the timing and location to sell their products. It eliminates the need for mediators as well as increases profit levels through basic data analysis.

The system automatically saves the information after every transaction, including the kind of services utilized, amount, price, and date of the transaction. It also gives users the ability to review their transaction history to keep records of transactions and monitor profits made. It offers suggestions and prompts, such as when to sell, when stock levels are low, or when to store.

The whole process of farming has been designed to be user-friendly for people who do not have much expertise on how to work with technology. Through incorporation of various agricultural processes in one hub, the Tile Agro Supply Hub makes the process coordinated and increases productivity within the agricultural sector.

### **IV. RESULTS AND DISCUSSION**

The results obtained from this research prove that the agro-supply hub concept is quite effective in boosting the performance of agricultural supply chains. In particular, one of the effects of using the agro-supply hub approach was the decreased levels of food waste after harvesting, mostly because of proper storage and handling techniques, along with the provision of cold chain services. Farmers working with the agro-hub were offered much better prices for their products since they relied less on middlemen to sell them. Moreover, the application of digital tools made it possible to obtain data on inventories as well as predict the demand.

In terms of logistics, the use of the agro-hub allowed conducting bulk deliveries of goods while also enhancing coordination between various entities within the supply chain. It also resulted in lower transportation costs and ensured that products were delivered to consumers promptly. Structured supplier selection, grading, and packaging practices improved the quality of the products that reached the end customers.

Furthermore, the enhancement of the supply chain transparency and traceability has been another major achievement of the research. Due to centralized platforms, it was possible to easily track the flow of agricultural produce from one end of the production cycle to the other, ensuring the maintenance of high safety standards. In addition, increased transparency made consumers more confident about the quality of their food.

In addition, the impact of the agro-supply hub on rural development cannot be overlooked either. First of all, the establishment of the hub led to the creation of new employment opportunities for people in various spheres of activity, including logistics, warehousing, packaging, and control over the quality of produce. In particular, the farmers were positively impacted by the opportunity to benefit from the better infrastructural facilities and enter into new partnerships.

Yet, there were certain problems as well. Firstly, the cost of creating such hubs is quite large, and not everyone might possess the necessary technical

expertise to run sophisticated systems. Also, change resistance on the part of smallholder farmers may become a problem. Nevertheless, all these obstacles do not negate the fact that such systems hold great promise in terms of scalability and sustainable development. If appropriate measures are taken to provide assistance, including training and infrastructure development, agro supply hubs may greatly contribute to the development of agrarian systems.

## **V. CONCLUSION**

work can include adding more diseases, improving the models with larger and more diverse datasets, deploying the system as a mobile application for wider reach, and incorporating explainable AI techniques to help users understand why a particular prediction was made. Overall, machine and high-risk cases for all three diseases and provided appropriate medical advice.

Future learning offers a promising and accessible approach for early disease detection, helping people take control of their health before serious problems develop.

One important insight that can be drawn from this research project is that the process of coordinating and communicating with various entities involved in the process of supply chain becomes much easier through the use of a web-based platform. Such a web-based platform serves as an interface through which farmers, suppliers, and buyers become able to interact with each other in an effective manner. This is helpful not only in improving the planning process but also helps in the utilization of resources.

## **VI. FUTURE SCOPE**

Further research may be done on the creation of more sophisticated ML algorithms to enable real-time analysis for optimizing the supply chain process. Methods such as deep learning and predictive analytics may be considered to achieve greater precision when forecasting the demand for certain agricultural products, estimating the yields of crops, and predicting prices.

Moreover, there is a huge possibility for extending this model to a much larger scale through the implementation of blockchain technology in conducting transactions in a safer and more transparent manner. Further work may be done on creating more user-friendly software applications to facilitate the use of ML algorithms by farmers and other smaller players in the agro-supply chain process.

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