Uplifting a Farmer through Connected Ecosystem

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Abstract—This project consists of developing a unified platform which can help farmers and consumers to come on the same platform and buy the agricultural products directly from the farmers. The application offers smooth online payment, user and farmer profile administration and real time inventory up to date. They are also key in establishing trust as they onboard verified farmers, and upload schemes which are advantageous to the farmers. Further down the line, vehicle and land renting functionalities, as well as tiny fertilizer management, will give farmers more support. Using this app, farmers can rent so agricultural machinery that includes tractor and harvesters at nominal costs finally using technology which was earlier not affordable for them. Farmer's use user friendly interfaces and robust backends to communicate with rental providers, manage bookings and track real time updates. The system is administered by an administration access pool who are responsible for overseeing the system (transaction transparency and efficient dispute resolution) as well as providing the users with the freedom to explore the ecosystem and contribute to it when they wish. We aim to help the agricultural community eliminate costs, increase production of goods, and work together. With this app, digital tools help fill the gap between modern tech and old school farming so we can farm a prosperous and sustainable future.

***Keywords*—- Farm-to-Consumer, Agriculture, Scheme Management, Vehicle Renting, Fertilizer, Land Renting.**

I.INTRODUCTION

For years, the agricultural sector has struggled with transparency, efficiency, and poor market access both for farmers who cannot easily access consumers and thus receive little money for their work. The goal of this project is to enable farmers to easily connect with consumers so that we can truly create an ecosystem where everyone is being treated fairly, we can all trust one another and we can genuinely have access to truly high quality food. This platform lets farmers know how to use technology with agriculture and manage their product, payments and access beneficial schemes in a strategic way. This will enhance farmers economic viability and foster an ongoing farm to consumer relationship and enhance the overall agricultural economy.The aim of this project is to help the farmers through an affordable platform where they can hire an essential farming equipment at a minimal cost. Expensive tools like tractors are essential for efficient farming operations, yet many small scale farmers are unable to buy. To fill this gap, this app will create a digital farm where farmers can rent the equipment they need at[7] affordable cost. It helps foster a connected ecosystem, so that even resource limited farmers can get benefit of modern mechanization thereby increasing productivity and resulting in better agricultural outcomes. The goal of this project is to enable farmers to use tools and resources to improve agriculture productivity, boost financial inclusion and run their businesses in a more efficient and effective way. The platform fills the information gap, provides financial management solutions and avails agricultural inputs and markets. The system helps to promote collaboration among stakeholders in the agricultural value chain with an aim to improve the efficiency and sustainability in crop value chain. Architecturally the platform is a Model- View-Controller (MVC) design making it a modular, scalable, and maintainable solution. Each component is responsible of a different task: Now people were talking about mvc term that encompasses three: Model deals with business logic and data, View deals with user interface management, Controller acts as a go-between. Separating these parts makes it easy to add new features and build future system enhancements. They are able to manage crops, access to machinery, loans, farmers manage crops, access machinery, apply loans, aggregators manage fertilizer and seed stocks, end user browse crops for purchase. Normalization to reduce redundancy is achieved using interconnected tables, which maintain data integrity. Data security is possible through regular backups. The user interface is intuitive and it has a minimalist design to remove clutter, and the layouts are responsive so that it can be used with accessibility across devices, as farmers in remote areas need this often. It uses the technology stack of HTML5, CSS3, JavaScript for security, This is expected to improve farmers access to resources, increase market reach across all tiers of market chain participants,

promotes, sustainable agricultural development by supporting collaboration and the use of data driven insights for decision making, scalability, and adaptability. Furthermore, technologies might be implemented later to extend its reach into creating a resilient agricultural community. Built on a scalable system, it can thus grow to encompass new technologies and new geographic regions in the future. An important factor for this adaptability is that the system can adjust to accommodate variability of climates, market demand, or resource availability. The platform's modular design also enable addition of new features without modifying the existing functionality ensuring that it is always relevant, effective as user needs and industry standards evolve. The development of this platform is carried out utilizing modern frameworks like Spring Boot and React to maintain rapid cycles of development and constant improvement. This

approach enables the system to respond quickly to feedback and changing needs create a continuing effective and usable system. In summary, in 'Uplifting the Farmer Through Connected Ecosystems' we have a holistic solution to dealing with farmer challenges. The platform benefits from leveraging technology to spin a connected ecosystem, enabling productivity levels, resources access, as well as promoting sustainable agricultural practices. This is a model for how digital innovation can help bring real change to an industry that is traditional, yet can also be a source of resilience and prosperity for the farming community.

II. RELATED WORK

One of the solution calls to use Mobile internet to make Farmers who are poor to directly connecting with consumers and the Food processing industry can easily sell the Product as using mobile internet to directly connecting will help sell this products in better way. By Sunil Mhamane, Pranav Shriram;[1] November 15, 2018. In this paper we describe a mobile application aimed for farmers to provide them with market information on an user friendly way. The app was supposed to be quick and up to date system of delivering necessary information to farmers, it was supported with local language to make the transactions go smoothly. The application can be used in different context, acting as a service for buyers or sellers on the farm market, for farming to trade agricultural produce, produce and products. Moreover, the application relies on market prices found at data.gov.in to keep a fair balance between buying and selling prices. In order to ease the use of the huge amount of products, the system provides with different filters that help to select the items of interest. This system is designed to address what farmers have often complained about when selling their products, make it convenient and engaging to them. This system provides diverse selection of agricultural products to consumers. Users can filter options and pick products according to their preference of price or, for the location feature guarantees the ease and speed with which both buyers and sellers canlocate products near them. This system aims to address various agriculture business users; fair and transparent agriculture business platform for farmers and consumers.

R. Ranjana; T. Subha;[3] Pravin Kumar P, Sneka L, Varsha S, and Jothishree N, "Agreliance: Advancements in telecommunication technology in today's world has revolutionized connectivity such that people separated thousands of miles apart can communicate without breaking a sweat via the internet, an Integrated Application for Farmers.," Pala presented in a conference on 16-17 December 2021. To improve the lives of farmers not only financially but also mentally, a specially designed integrated (with the village and mobile) mobile application has been designed. Telehealth systems were found to be very useful during the Covid-19 pandemic as a way to bring healthcare. Farmers with emotional and mental challenges can access virtual counseling conducted through the video conferencing technology, and the effectiveness of such sessions is equally effective as in person sessions. In addition to being able to track farmers' mental well being, the app can also track the health of crops that could be infected by different diseases. Agricultural experts will not only offer consultation services, but farmers can access it by scheduling appointments. The global pandemic has put a dampener to the farmers with the economic slowdown. The app is able to facilitate and boost online sale of agricultural goods directly to the consumers, thereby helping economic growth and reducing the intermediaries, thereby helping to bring the prices down for the end consumers.It also tells the farmer about the loan facilities available near his side and makes him economically useful to develop his agricultural activity. This multi–faceted solution helps farmers in dealing with the problems of the current agricultural system and helps them to raise their economic stability and overall standard of living. M. Krishnakanth; G. Praneeth Kumar, Prerna Jotwani and Utkarsh Tandon; Niket Chauhan, "Crop Shop – An application to maximize Farmers Profit," to be presented in conference on 30 and 31 March 2019. Farmers in India have had prohibitions on the markets and buyers to sell their agricultural produce for many years. In 27 of the 29 states, mandis (retail markets) through which farm goods must be sold and marketed are required by law to be run by the state, and there intermediaries (or middlemen) often exploit farmers to enrich the intermediaries. Goldman Sachs says these intermediaries have become the dominant players in agriculture, controlling farmers and monopolising profit. They should be allowed to keep all the value of their hard earned income. With this problem in mind, we present a system that utilities technology to enable direct sale from the farmer directly to the retailer or customer without the aid of middlemen. In many cases 70% of profits go to intermediaries, leaving little if anything for farmers to live on and perpetuating their financial troubles. This is a mobile application for the farmer to sell their produce directly to the retailer or the consumer. Although the farmers still receive a fair price for their products, buyers can buy the fresh products at a fair price which is lower than the normal market price. The system bypasses middlemen to create a win for farmers

Valuable user feedback helped us to refine the application features. Ten farmers from Matang market and ten university students were involved in usability testing to ensure the functions as well as the usability of the app. Evaluation proved that the eMarket application filled the needs of both farmers and consumers thereby serving as a practical platform for linking them.

III. METHODOLOGY

Accordingly, the methodology proposed is designed at enhancing farmers' awareness and demand for ecosystem services, including through a well structured questionnaire survey. Then policy recommendations are further suggested to bolster this awareness. The expected outcome of the results is to guide policymakers and managers towards sustainable sound construction and management in immigration zones, while meeting farmers' needs and promoting sustainable development. The architecture of the system follows the Model-View-Controller (MVC) design pattern to separate concerns cleanly and develop a highly usable, secure and scalable application.

The methods involved are

1. Questionnaire Development :

A questionnaire is developed to make an assessment of farmers' awareness and demand of different ecosystem services. The questionnaire has places to fill in personal elements,

socioeconomic factors and knowledge about basic ecosystem services.

Survey Execution
The farmers in these villages and especially in the immigration zone, are covered. Farmers are categorized based on their awareness of core ecosystem services into three levels: Low, Medium awareness,High

Data Collection and Analysis
The surveys are used to collect data on patterns and correlations between different socioeconomic factors and the farmers' awareness.

2. Policy Recommendations

Policy recommendations are formulated based on the survey results aimed at improving farmers' awareness of ecosystem services. Recommendations include developing educational programs, dissemination of informational materials and organizing community workshops.

Implementation Strategies:
Strategies for implementation of these recommendations are advised to policymakers. There is focus on sustainable practices that satisfy the farmers whilst catering to the ecosystem.

3. System Architecture: MVC Design Pattern
The MVC architecture separates the application into three interconnected components:
Model: It manages application's data, logic and rules. View: It is concerned with handling the information that is,View It is concerned with handling the information that we need to show to the user. MVC itself is an architecture which is broken down into Components. The core business logic is represented in Model and data. In this system, the Model will include Farmers data and survey result database schema. Analysis of survey data and reports generation algorithms. View is the user interface. For this system, the View will provide Interactive forms for farmers to input data on their farms. This is dynamic dashboards that display the survey results and policy recommendations. Controller It serves as a mediator between Model and View. In this system, the Controller will: It's up to them to handle incoming requests from the user interface. Updates the View in response to the Model Coordinate. What Makes MVC Architecture Ideal?Central Navigation Control Managing user navigation, as well as security, are better done with centralized control because of the controlled nature of serving the requests. Maintenance and Scalability Separating concerns makes large applications easily maintain and scale. It can add new features with minimal affect on existing component. System Features User-Friendly Interface The system is intended to be intuitive and accessible by all types of users, farmers with little technical knowledge. Security Protocols It carries security protocols to work out robust security to keep user data protected from unauthorized access. Crop Details Upload It provides a facility (to the farmer) to upload the details of crop harvested by him/her in the portal so that farmer can avail better market access and visibility. Based on MVC architecture, the proposed methodology has a robust framework for improving awareness of farmers about ecosystem services. In addition to helping in data collection and analysis, this system also facilitates an education and policy implementation platform which is scalable and maintainable. The system intends to achieve sustainable development in agricultural communities by taking advantages of modern design patterns and user-centric features.

IV. OBJECTIVES

1. The need is to develop a user friendly platform
help farmers in crop management and access to resources.

2. Real time market information for use in informed decision.

3. For an increased supply chain transparency, for stakeholders.

4. The services integrate financial services to improve credit access.

5. This is to guarantee system scalability for tomorrow's expansion and feature integration.

6. Real-Time Data synchronization of all data across devices,

V. MPLEMENTATION

1. Development

Front-End Development:
HTML, CSS, JavaScript, Technologies Intended User Interfaces for roles (farmers, aggregators, general users) Enhancements in interactivity and usability.

End Development:
It includes Server-Side Technologies Java will build RESTFUL APIs and how we implement client business logic.

2. Integration
It also appears in Front-End and Back-End Integration. API Consumption in Front-End Data Flow between client and server Third party services integration. Market Trends, Weather APIs as External Data Sources.

3. Testing
The process that is used to design test cases that prove the inner program logic is valid. The program inputs provide valid outputs, that is functioning properly. Within decision branches, and inner code flow. should be validated. This is testing an individual software unit(s) of application. And is done after

completion It's all done of a single unit prior to integration. Usually a structural test, that requires knowledge of the construction and is invasive. Generally, unit test is used to do basic test at component level and to test a certain business process. Determining the optimal application, and system configuration. Each unique path of a business process performs as expected, i.e. unit tests. it accurately models to documented conditions and has clearly defined inputs and expected results. This is an open source Unit Testing Framework for JAVA. The java developers use JUNIT testing for What this excites me is being able to focus just on writing the code and running the repeatable tests. Initially you develop it by Erich Gamma and Kent Beck. It's an architecture instance. The Unit Testing of a little chunk of code is done with that. When developers test drive, they must before any code write and execute unit tests. Once we have completed the code, all tests are to be executed and they must pass. So, every time you add code then you have to re run all test cases that you have written and make sure that nothing is broken.

4. Deployment

Environment Setup, Production and Staging Environments Automation Tools (GitHub Actions) Continuous Integration and Deployment Practices, Cloud Deployment, Load Balancing and Auto-Scaling.

5. Maintenance and Updates

Regular process for Updating, Security patches, bug fixes, feature enhancements based on user needs, Monitoring, Performance monitoring tools (AWS cloudWatch), Logs and alerts for Proactive (issue process), etc.

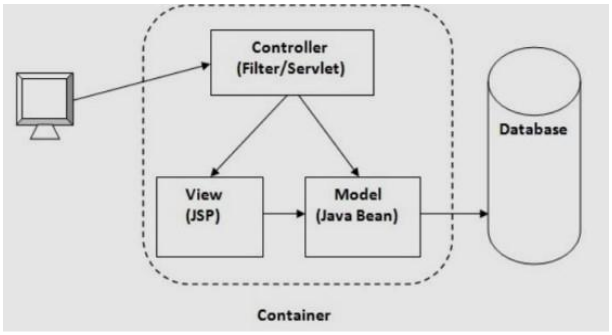

Fig1.Architecture for Uplifting the Farmer Through Connected Ecosystem

VI. PROBLEM DEFINITION

Agricultural practices are not productive and sustainable. The major problem facing the farmers are; outdated farming techniques, unavailability of modern tools such as ploughs and carts and lack of education to make use of modern tools. The poor productivity is also as a result of the limited knowledge of advanced methods such as the precision farming and resource management. The problem exacerbates, because poor management of water, fertilizers and seeds leads to environmental degradation and lower yields. In addition, inadequate pest and disease control, because of lack of timely information, causes crop damage. Better access to technology and education resource needs to be improved if this challenge must be eliminated.

2. Limited Market Access

One big challenge is the limited market access for farmers especially that in remote areas. Farmers depend upon middlemen — thereby reducing their profits — and geographic barriers prevent their transport to the bigger markets — hence resulting in spoilage and poorer prices. In addition, these issues are additionally compounded by market price volatility, the absence of postharvest storage facilities, and supply chains that are also fragmented. If the farmers do not have proper infrastructure, storage and real time price information, they do not bargain for the best prices and hence cannot maximize income. These challenges can be addressed and farmers profitability improved through digital platforms that provide direct market access, real time data and integrated supply chains, by linking the entire supply chain on a single platform, farmers can gain better market access to buyers, suppliers and logistics services and thus, better coordination, lower transaction cost and better use of goods.

3. inancial Constraints

Limited access to credit with locker collateral and credit history prevents farmers from obtaining credit and hence become financially constrain. They are trapped in debt cycles because high interest rates make it harder financially for them. Informed decision making about savings, borrowing and investments, is inhibited by financial illiteracy. Additionally, farmers have to turn to high interest informal channels as risk-averse loan providers, especially traditional financial institutions, do not lend to them. Furthermore, loan repayment is made difficult by the unpredictability of income from farming — coming as it does from a seasonal activity and weather— and also deters future investment.

4. Data Deficiency

Without real time data on weather, soil moisture, and known sites of pest outbreak, farmers are handicapped. Predictive analytics for weather and crop yields is essential for these businesses as they suffer from planning for seasonal variations and risks without it. Poor data quality regarding farming activities results in inefficient resource use and poor practices management. Agricultural data is fragmented and, spread across several platforms, it is hard to gain such holistic insights for better decision making. There is a lack of decision support tools and these in turn limit farmers' abilities to improve the productivity of farm management.

5. Fragmented Ecosystem

There is poor coordination between stakeholders in the agricultural ecosystem which has resulted in inefficiency and time delays. There is not a single platform to have information sharing which allows farmers to know the available resources. Thus, fragmentation leads to inefficient allocation of resources, as entries have mismatch between supplies and demand. The use of technology is also limited therewith operations being further slowed down, and costs increased as many use manual methods. Further, policy and regulatory gaps are impeding the process; since the conflicting regulations and policy misalignments inhibit collaboration and innovation, which in turn impedes agricultural growth growth.

VII. OUTCOMES

1. Enhanced Farmer Access: Farmers achieve easy access to the most important resources like seeds, fertilizers, machinery and expert counsel. This is a streamlined approach

which makes their operations simpler and gets their farming activities to be more efficient.

2. Efficient Marketplace: It provides a centralized marketplace where farmers can sell their produce directly to buyers, bypassing so called intermediaries and earnings more direct sales.Improved Financial Management: Integrated loan services assist farmers to effectively control their finances and harness easier access to credits for purchase of necessary farming inputs and machinery and help in better financial planning.

3. Data-Driven Decisions: Critical insights into market trends, crop performance and resource management are delivered through automated reports so farmers and aggregators make enhance productivity.

VIII. DISCUSSIONS

With the successful implementation of the digital portal, the hard work of the youths is getting noticed as the agricultural sector continues to be realized as a prime need human intervention. This goes a long way in unveiling the potential that accessible technology has to change the agricultural sector. In making technology easy to use, adoption and utilization is critical for any digital initiative aimed at rural communities. Digital platforms have the potential to provide a significant economic impact in rural economies, and the portal's effectiveness in expanding market access directly influenced farmers incomes. The platform aids in connecting the farmers with bigger markets to get better prices for produce thus aiding them with better financial sustainability. In addition, there are environmental benefits to the portal. To further emphasize this, this portal is capable of promoting ecologically friendly farming, as a useful way of alleviating the mounting demand for courier sustainable agriculture. The portal provides knowledge and other resources on a wide range of topics to empower farmers to make sound choices in their farming methods that boost productivity but also support environmental preservation. It also has some social implications of the platform. The portal is also allowing for increased collaboration among the farmers and this has helped farmers to form cooperatives that have strengthened community ties and helped with the buying power. . The platform brings farmers together; the solidarity and mutual support allows farmers to negotiate better terms on resources, inputs and market access. From a policy point of view, the platform's success provides insights to help governments try to drive agricultural development. This digital model could be scaled up and implemented in other regions of Africa, providing an alternative that is scalable and sustainable, and can benefit multiple different farmers. Such initiatives give governments a proven way to raise agricultural productivity and spur rural economic development. The security considerations continue to be an important part of the platform's success. Since financial transactions are involve in it and you need to build trust among your users for maintaining their data security to the highest level. Secondly, farmers, particularly the non tech savvy, should be continuously trained and supported in using this platform for its sustainability. Feedback from farmers can then be used to improve features and help platform be more reactive to farmers' developing needs. Furthermore, the platform can increase its impact also by integrating with existing agricultural systems and services to increase the user base.

unifying various stakeholders and functionalities on the platform that eliminate the complexities that present in the traditional farming operation, therefore, increasing overall efficiency and productivity. Another strong point of the platform is, this adoption of the MVC architecture. The design is chosen this way to separate concerns: between the business logic, the user interface, and the data management in order to ease system maintainability, scalability and clarity. This modular design not only guarantees effortless update, but also provides ease of incorporation new features, as the platform is developed to stay up to date with future emerging agricultural technologies. Almost every program written according to the MVC architecture provides better user experience, as this architecture ensures that the program is performant, reliable and highly understandable for all types of users. Another major achievement of the platform is its user friendly UI/UX design, which is suitable for any person from an amateur to a technical person. An accessibility to less experienced farmers, especially those working in remote areas, will ensure that farmers can access digital platforms. It has an intuitive interface with clear navigation and instructional guides to make it easy to use across devise of smart phone and tablets. It guarantees the functions of the platform to even those farmers who have very limited resources to be able to access it. The functional design of the platform fits the needs of the different user groups. This helps farmers manage crop planning, obtain machinery and get loans and provides a simple interface for aggregators to update availability of fertilizer and in seed stock. It will make farming available for the general users to browse and purchase crops without hassle giving a wider market for farmers. That data is then aggregated, analysed and fed back into the system so farmers and stakeholders have the ability to use it to help them make better decisions that lead to increased productivity and profitability of their farm. The platform uses MySQL to ensure data integrity and security while ensuring regular backups connected with inter tables. HTML and JavaScript do have support for high performance, high scalability and also continuous testing, continuous deployment supports rapid iterations and improvements. In total, the platform enables farmers, promotes collaboration among stakeholders and uplifts the society and economy by bridging the gap between technology and agriculture for the betterment of rural community livelihoods. The platform is powered by a robust database management system which uses MySQL with connected tables and regularly takes backups for maintaining the integrity and securing the data of the users at the same time supports for scalability and performance. This is important to keep trust of users and especially when processing their sensitive financial and operational data. Other performance features include HTML and JavaScript facilitating the responsiveness of the platform with ability to service on a higher demand basis. The platform can be easily updated as needed, with efficient processing and thencontinuous testing and deployment so unknown changes flow smoothly and can take advantage of new user feedback and technology changes. The platform enables real time data analytics and automated reporting and provides farmers

and stakeholders with insights that can improve crop yields, market strategies and profitability, all that in real time. Therefore, in a nutshell, the 'Uplifting the Farmer Through Connected Ecosystems' platform goes beyond being a technological solution. This creates a resilient and efficient agricultural ecosystem where all stakeholders can benefit from environment friendly and sustainable crop production systems that foster collaboration, optimizes resource management and drives socio economic development.

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