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1.CHALLENGES IN AGRICULTURE MARKET ACCESS

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| Many of the challenges that have confronted Indian agricultural marketing in recent decades arise from weaknesses and inefficiencies in and around the Agricultural Produce Marketing Committees. Originally devised to protect farmers from exploitation by middlemen traders and to provide a fair system of auctioning their produce, APMCs have turned out to be centers of bureaucratic control, corruption, and inefficiency. The mandis, or marketplaces, consisted of traders and middlemen who structured their organizations to avoid competition and act as monopolistic; thus, entry into the market was virtually impossible for any new entrepreneur. As a result, the farmers bargaining power was stripped away since they paid high market fees and commissions, and income was reduced as well as a great long chain of intermediaries that had a toll on the price they finally received on produce. | Barriers in Agricultural Marketing Inefficiencies in Indian agricultural marketing are attributed to several factors. The first problem is the direct sale of farm products by the farmers to the customers after taking a license. Under the APMC system, a farmer can sell his produce only through the licensed dealers and this limits him to bargain only for high prices. In addition, the farmers are charged with high market charges by both APMCs and the middlemen that further reduce their profit margins. Many mandis, additionally suffer from poor infrastructure and lack proper storage facilities. This puts them in a vulnerable state, and the produce is often perishable and of deteriorating quality by the time it hits the markets. Moreover, long and inefficient supply chains result in low remuneration for the farmer since the share of the final price is very small compared to the consumer price. |

Contribution of Income Sources to Total Farmers’ Income from 2002–2003 to 2018–2019.

| Year | Income from Crop Cultivation | Income from Wages and Salaries | Income from Farming of Animals | Income from Non-farm Business | Total |
| --- | --- | --- | --- | --- | --- |
| 2002–2003 | 45.8% | 38.7% | 4.3% | 11.2% | 100% |
| 2012–2013 | 47.9% | 32.2% | 11.9% | 8.0% | 100% |
| 2018–2019 | 37.7% | 40.3% | 15.7% | 6.4% | 100% |

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| State of Agriculture in India Low income of Indian farmers is directly a reflection of the challenges listed above. Even the average monthly income of agriculture households according to the NSSO's Situational Assessment Survey 2018-2019 was ₹10,218. The nominal growth has had little real growth with it kept adjusted for inflation. This cash the credit accordingly directly stagnated the potential for much income and has driven many farmers to diversify sources of revenue with a sizeable portion earning an income as wages and from animal farming. For example, from 2002 to 2019, the share of the income of farmers produced from crops went down from 45.8 percent to 37.7 percent, while that produced from wages and salaries went up to 40.3 percent.  **Total Wheat Procured from India vs the Percentage of Total Procurement from Punjab, Haryana and Uttar Pradesh.**  A graph with numbers and a red line  Description automatically generated | But, interesting enough, despite all the losses many states in India have faced due to their inefficient or not so efficient management of APMCs, the farmers in Punjab, Haryana, and parts of Uttar Pradesh received windfalls due to the following disproportionate central procurement of wheat and rice:. In these states, the government has, time and again, bought considerable quantities of these staple crops, which has greatly contributed to the higher incomes and, by extension, the greater political power wielded by the farming communities in those regions. For example, in 2021-22, Punjab, Haryana, and Uttar Pradesh supplied a share of 63.1% of all wheat and 39.8% of all rice procured by the central government even though these states accounted for less than half of India's total agricultural output  Historical Attempts at Reform Recognizing these systemic problems, various Indian governments have made multiple attempts to reform the agricultural marketing system. Since the 10th Five Year Plan during 2002-2007, policymakers started realizing ECA as one of the critical deterrents against investment in agriculture, particularly in areas like storage and warehousing. Following that, the governmen |

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| In an attempt to address these long-standing issues, Indian government passed three new farm laws in September 2020, which aimed at opening up agricultural markets to private investments and competition. This is why three legislations: the Farmers' Produce Trade and Commerce (Promotion and Facilitation) Act, 2020, the Farmers Empowerment and Protection Agreement on Price Assurance and Farm Services Act, 2020, and the Essential Commodities (Amendment) Act, 2020, were enacted for agriculture deregulation and freedom of farmers to sell where they want. Protests broke out against the laws in most parts of the country, particularly Punjab, Haryana, and western Uttar Pradesh, where the farmers had feared that such legislations would unravel the safety net that the government provided them in the form of minimum support prices (MSP). Most farmers were of the opinion that they would be left to the mercy of large corporations with such legislations, thereby reducing their already meager income. These protests were spearheaded by the umbrella organization of 32 farmer unions, Samyukt Kisan Morcha, and were eventually successful in compelling the government to withdraw the laws in November 2021 | dereserved most agricultural commodities from the ECA, but the rules under the ECA remained very rigid. In the Union Budget 2002-2003, the government therefore encouraged agrarian diversification and food processing. The Model APMC Act was thus enacted in 2003 to modernize and standardize the agrarian markets, with quality certification, grading, and transparent pricing mechanisms. This did little to relieve the situation because the strong lobby of middlemen and traders, along with the tardy implementation of this reform measure, continued to perpetuate problems.  **Total Rice Procured from India vs the Percentage of Total Procurement from Punjab, Haryana and Uttar Pradesh.**  A graph with numbers and a red line  Description automatically generated |

2.Proposed Platform: Flow and Features

2.1 User flow:- A diagram of a company

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2.2 *Core Features* & Security Management:-

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| The auction system is meant to carry out competitive bidding for agricultural produce. the system can be used by the farmer to advertise his produce on the same and await bids by real-time buyers. it is in this way that maximum return on produce is achieved through competitive bidding.  Live Auction Interface : a user interface that will allow real-time placing of bids, live status updates on the auction. Bid Tracking: Monitor the number of bids submitted in real time, including who has placed the highest bid currently, the periodic amount of the bids, and how much time is remaining in the auction. Notification System: Automatically notify bidders about the status of their bids, when a reoccurring scheduled auction is open and if they are selected with the winning bid Historical Data: Review historical data from all previous auctions to help you decide strategy and prepare for future auctions, including past winning auctions and trends of past bidding. Advantages: Greater Visibility: Facilitates farm producers to reach a larger number of potential buyers, which can translate to higher prices. Competitive Pricing: The auction format fosters competitive bidding, which tends to push up the final sale price of the produce. Efficiency: Streamlines the selling and buying process, saving time and effort as compared to traditional selling methods. A hand holding a glowing circle with text  Description automatically generated | Blockchain technology ensures that the entire contracts on the platform are safe, transparent, and clear. All agreements are recorded automatically and included in a decentralized ledger with smart contracts.  KeyElements:- Smart Contracts: Smart contracts are arrangements that self-execute contingent upon previously agreed terms and conditions of a contract. Once the said conditions are met, its terms are realized without an intermediary. Immutable Ledger: All transaction and modifications of contract on blockchain are almost impossible to alter or interfere with the details of thecontract. Access Control: Only legitimate parties are permitted to access or interact, thus ensuring privacy and security based on this characteristic. Benefits: Tamper-Proof Agreements : Smart contracts may not be altered once deployed in the network. They avoid fraud and unauthorized alterations. Transparency: All the details of the contract will be documented on the blockchain, hence creating a transparent system in which all parties can verify terms as well as their execution. Automatic Execution: These attempts reduce the need for manual enforcement of contract terms and minimize the possibilities of errors as well as delay.  A diagram of a farmer  Description automatically generated |

3. Data-Driven Insights on Digital Adoption

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| Adoption Statistics Current Statistics on Digital Adoption Among Farmers Digital adoption in agriculture has picked up rapidly over the years as a result of the immense technological progress and increased access to digital tools. Here is what's happening as of now with farmers with regard to digital adoption:  GlobalAdoptionRates: According to the Food and Agriculture Organization, at present about 50% of farmers in developed countries have adopted digital, while the growth rate of technology adoption into farming is increasing. Adoption rates are slightly lower again but still growing in developing countries, at around 30%.  The rate of application of digital technologies is also relatively high in Europe, with more than 60% farmers using digital solutions for agricultural tasks (World Bank, 2023). In Sub-Saharan Africa, the digital adoption is growing in a manner that there is a 25% increase in mobile internet access over the last two years that allows more farmers to access mobile-based agricultural applications(International Telecommunication Union, 2024)  In the recent past, several governments and international bodies have started implementation programs that will gain adoption of digital applications in agriculture. One of the most important digital agriculture strategies presented by the FAO focuses on supporting developing countries with the integration of digital technologies into their farming practices (FAO, 2023).  Digital tools minimize waste through optimization in irrigation and pest control. Implementation of precision farming technologies reduces crop waste by 15% as indicated by the Journal of Agricultural Science, 2024. Pie graph showing percentage saving through digital tools from waste. Wider Market Penetration  Digitally empowered farmers are now experiencing a 25% increase in market reach through online platforms and digital marketing strategies. This means that the farmer can tap into broader markets, negotiate better prices, and influence the interventions in their market (FAO Report on Digital Agriculture, 2024).A blue background with a graph  Description automatically generated with medium confidence | MarketTrendsGrowing Importance of AI, IoT, and Mobile Apps in Agriculture With the integration of Artificial Intelligence (AI), Internet of Things (IoT), and mobile applications into agricultural practices, they enhance both the productivity and efficient working of agricultural outputs. Here's how the current revolution is having its effect on agricultural activities:  Artificial Intelligence (AI): The other major application of AI in agriculture is predictive analytics, crop monitoring, and automated decision-making. McKinsey & Company estimates that today over 40% of U.S farms use AI-driven tools for crop health and yield outcome predictions (McKinsey,2024). AI algorithms analyze large volumes of data collected from various sources including satellite imagery and sensors, to give actionable insights to the farmer. That way, the farmer has the improved ability in decision-making related to crop and resource management. Internet of Things (IoT): Some of the IoT devices applied in agriculture include: soil sensors, weather stations, and smart irrigation systems. The International Data Corporation (IDC) reports that global usage of IoT devices in farms has grown by 30%, and yearly growth is expected to stand at 15% through 2024 (IDC, 2024). They collect real-time data concerning soil moisture content, weather conditions, and crop health, enabling farmers to make informed decisions and adapt their practice in such a way. MobileApplications:  Mobile applications have increasingly become a critical tool for farm management, as extended features include information on weather conditions, market prices, and crop management advice. As per the digital farming platform, usage of mobile apps related to agricultural activities has risen by 50% over the past three years (2024). These apps close the knowledge gap in rural areas through provision of life-changing information and services that are unavailable anywhere else. Impact of Technology Crop Yield Enhancement, Wastage Reduction, and Market Extensiveness  Digital technologies are transforming agricultural productivity and market efficiency. The following are even more specific visuals of how technology adoption creates advantages for early adopters: Enhanced Crop Yields:  Those farmers who have implemented digital practices point to a rise of 20% in crop yield on average. This is the fact because soil condition, presence of pests as well as weather conditions data are more reliable for the farmer (Agronomy Journal, 2024). Diagrammatic Representation: Pie chart representing percentage change in crop yields among adopter and non-adopter farmers. |

Frequency of use of agriculture mobile apps/social media by farmers

| **Agriculture mobile apps** | **Frequently *N* (%)** | **Sometimes *N* (%)** | **Occasionally *N* (%)** |
| --- | --- | --- | --- |
| **Mobile Apps** |  |  |  |
| Krish-e | 4 (1.3) | 2 (0.7) | 54 (18) |
| IFFCO Kisan Agriculture | 102 (34) | 5 (1.7) | 132 (44) |
| Pusa Krishi | 150 (50) | 35 (11.7) | 40 (13.3) |
| Agri App | 111 (37) | 25 (8.3) | 59 (19.7) |
| Crop Insurance | 165 (55) | 45 (15) | 50 (16.7) |
| Kheti-Badi | 95 (31.7) | 65 (21.7) | 88 (29.3) |
| Agri-Market | 96 (32) | 44 (14.7) | 74 (24.7) |
| Shetkari | 63 (21) | 12 (4) | 147 (49) |
| Kisan Suvidha | 256 (85.3) | 9 (3) | 21 (7) |
| **Social Media** |  |  |  |
| YouTube | 286 (95.3) | 10 (3.3) | 4 (1.3) |
| Facebook | 279 (93) | 9 (3) | 12 (4) |
| WhatsApp | 300 (100) | 0 (0) | 0 (0) |

4.Expected Impact of the Platform

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| 4.1. Financial Impact  Market Risks Reduction:  Present Scenario: Most of the farmers are at a loss due to unstable market prices and high transaction costs because of the involvement of intermediaries and brokers. This might further result in losses of considerable amounts of money. Platform Benefits: By providing a platform for direct market access, the farmer will be in a better bargaining position, hence reducing dependency on brokers who charge extra commissions. This shift will lessen market risks and lead to better stabilization of the cycles of income generation. Case Study Example: The World Bank estimated, in a study made in 2023, that farmers who utilized direct-to-market platforms realized a 15-20% increase in income, on account of reduced transaction costs with better price transparency. Price Stability:  Price Discovery Mechanism: The site | Price Discovery Mechanism: The site can also allow farmers to make real-time pricing and market trends information available, leading to better decision-making for improved prices. Impact Estimation: Based on similar platforms, it's estimated that farmers are able to realize as high as 25% improvement in the stability of prices for better predictability of inflow. FAO Report, 2024. Case Study: In a review of a similar platform in India, the average farm incomes increased by 30%, as there was improved price stability and therefore direct sales channels. Digital Agriculture Report, 2023  A graph of growth in farmers markets  Description automatically generated |

4.2. Social and Economic Impact

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| Community Growth Fostering:  The platform connects small farmers with buyers to ensure that the community is involved in such a way that there is connection and collaboration. This may be in the form of solving problems and sharing knowledge.  Example Impact: For instance, digital platforms have aided in forming farmer cooperatives in rural parts of Kenya to gain access to resources for more markets. FAO, 2023 Reducing Rural Poverty:  In all, economic upliftment through fair market access and better income opportunities helps in reducing rural poverty. Improved financial stability is utilized by farmers for investment in their communities and businesses. Statistical Impact: As the study by the World Bank estimates, digital market platforms have resulted in 10-15% rural poverty reduction in the places where implementation has taken  4.3. Data Visualization | place. It is by World Bank, 2023The Platform Encourages Younger Generations:  Youth Engagement: The use of modern digital platforms in agriculture is attracting more and more young people to the profession. In this profession, the better economic prospects and reduced hard work will certainly attract youth. Example: In the Philippines, digital agricultural initiatives result in a 20% increase in young entrants into farming. |
| Digital Adoption Trends: Current Trends: As per data, adoption amongst the farming fraternity is increasing year after year. FAO reported that at an annual growth rate of 5-7%, adoption rates are increasing (FAO, 2024).  Advantages of Contract Farming: Contract farming can promise stable income in terms of price, which means an effective reduction of risks in the market. It provides more predictable incomes and supports better financial planning as compared to directly involved farmers (FAO, 2023). Increasing Expectations: An estimation states that the stability of the income of participants will increase by 20-30% in the next ten years due to contract farming (Digital Agriculture Report, 2024) | Future Projections:  Going by the current trends, digital adoption among farmers may rise to 70-80% in developed economies and 50-60% in developing economies in the next 5-10 years as per a report from the World Bank in 2024. Impact of Contract Farming on Stable Incomes:  A graph of growth in a green background  Description automatically generated with medium confidence |

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