



Indian Farm Mechanization is halfway there

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Abstract: This article delves into the hurdles mechanizing agriculture faces in India and suggests a path forward through enhanced utilization of advanced technologies. The proposed solution entails the establishment of an online rental platform accessible to all farmers via a user-friendly mobile application. This innovative approach harnesses the power of artificial intelligence (AI) to optimize equipment usage, employ machine learning (ML) to forecast future crop season demand and supply and implement natural language processing (NLP) to provide rapid assistance to non-tech-savvy farmers through chatbots. There are a lot of new Entrepreneurship opportunities to explore in each step of mechanizing Indian farms.

Index Terms - Farm Mechanization, Artificial Intelligence, Natural language processing, Machine learning, Entrepreneurship

I. INTRODUCTION

India is one of the leading producers of agricultural produce in the world, yet the current Farm mechanization rate is low at 40-45% When compared to the USA (95%), Brazil (75%), and China (57%) [1]. Low Mechanization is mainly due to the high number of small and marginal farmers. According to the Agricultural Census 2014 in India, Small and Marginal farmers cultivate 44% of land to Produce 60% of total grain production. For small and marginal farmers, machinery is the heavy financial burden of buying or leasing the equipment and inadequate access to other essential resources such as credit and technical expertise. Lack of information about farm rentals and the locations where machinery is needed is causing underutilization of machinery among some farmers. Farm mechanization is essential in ensuring any farming enterprise's success, especially in India. As agricultural production increases and competition for land resources intensifies, it has become necessary that farmers make use of all available technologies to maximize productivity and income. One way they can do this is by using available farm machinery, which is possible through a hiring system.

II. ADVANTAGES OF DIGITAL PLATFORM

Underutilization of farm machinery is a problem in India, where many farmers own or have access to various machines but don't use them. By joining a farm machinery hiring system, farmers can rent out their unused equipment and get compensated for it. The Hiring system helps address the underutilization problem and increases farmers' income opportunities. Furthermore, a farm machinery hiring system can give farmers easy access to the latest agricultural technologies and techniques. This system allows them to access new machines and learn how to use them for their farming operations best. The increased efficiency of mechanization can also lead to better crop yields, which benefits both the farmer and the consumer. Additionally, a farm machinery hiring system can help promote sustainable agriculture practices. Making advanced technologies available to more farmers can reduce the need for intensive manual labor and promote greener farming methods. In this way, mechanization can encourage sustainability in Indian agriculture and ensure that farmers can continue to provide healthy, nutritious food for the country.

III. EASE OF USE USE OF TECHNOLOGIES

Emerging technologies like Artificial Intelligence (AI) and Machine Learning (ML) promise to revolutionize the Custom Hiring center for agriculture machinery. On the other hand, ML can be instrumental in improving the predictability of machinery breakdowns by learning from past patterns, ensuring timely maintenance, and avoiding downtime during crucial farming periods. Additionally, AI and ML can be employed to develop precision farming techniques, enabling farmers to optimize inputs, reduce waste, and improve yield. These applications, together, can make Farm Mechanization more efficient and beneficial for both small and marginal farmers.

Several AI methodologies can contribute to the Mechanization of Indian Agriculture. Predictive analytics, powered by AI, can forecast market trends, machinery demand and supply, weather patterns, and potential pest infestations, thus aiding farmers in planning their activities more effectively. Natural Language Processing (NLP) can facilitate the development of chatbots and digital assistants, making the digital platform more user-friendly and accessible, particularly for those farmers who may not be technologically savvy. Image recognition and processing can detect crop diseases or pest attacks in real-time, enabling rapid response and reducing crop loss. Machine learning algorithms can be employed to refine the digital matchmaking process between equipment owners and renters, ensuring that appropriate machinery is available at the right time and place. Reinforcement learning, a subfield of Machine Learning, can also be utilized to optimize routes for machinery delivery, minimizing fuel consumption and reducing carbon emissions. When implemented effectively, these AI methodologies can further enhance the Uberization model's effectiveness in Indian agriculture.

Block chain technology (BC) also has the potential to influence the mechanization of agriculture significantly. BC's transparent and immutable nature provides a secure platform for the rental transactions of agricultural machinery. Every rental can be logged on the block chain, providing a clear track record of the machine's usage, maintenance, and performance. This can be particularly beneficial for small and marginal farmers who can assess the records before renting any equipment, ensuring they receive machinery in good condition and helping them avoid any potential operational issues. Furthermore, the transparency of BC can also facilitate peer-to-peer rental transactions, eliminating the need for intermediaries and reducing costs. Integrating AI, ML, and BC technologies can enhance the effectiveness and profitability of the 'Uberization' model for agricultural machinery, providing a sustainable solution for the challenges faced by small and marginal farmers in India.

IV. ROLE OF GOVERNMENT

4.1 Custom Hiring Center

The government of India has initiated several schemes to promote the use of machinery in agriculture. Custom Hiring Centers (CHCs). Under this initiative, farming groups can establish centers where agricultural machinery is available for rent. This is an instrumental scheme to address the underutilization of farm machinery, as farmers can generate additional income by renting out their unused equipment.

4.2 The Farm Machinery Bank

It encourages farmers to form groups and set up machinery banks from where members can rent equipment. These machinery banks, funded by the government, aim to make modern machinery accessible to small and marginal farmers, pushing towards an increase in productivity and income.

4.3 Encouraging Start - Ups

The Government of India is helping young entrepreneurs with Programs like Startup India and incubation opportunities. The Startup India initiative, launched in 2016, aims to foster entrepreneurship and promote innovation. It offers various benefits, including tax exemptions, self-certification compliance, and a single-window clearance system. The Startup India website provides a platform for startups to register and access resources. Another initiative, the Credit Guarantee Fund Scheme for Startups (CGFS), aims to provide collateral-free credit to eligible startups. It offers credit guarantees to banks and financial institutions for startup loans. The Government has set a target of ₹18.5 lakh crores in agricultural credit flow in 2022-23. The Government has consistently increased this target every year and has also been able to surpass the mark set every year over the past several years. In 2021-22, it was about 13 percent more than the target of ₹16.5 lakh crores [2].



Source: Based on data from DAFW and Agricultural Statistics at a Glance 2021.

Fig. 1 Government of India Credit to agriculture sector in lakh Crores INR

Over a period, the government of India has started many Custom hiring centers in each state. There is significant growth of no of CHCs are started as below.

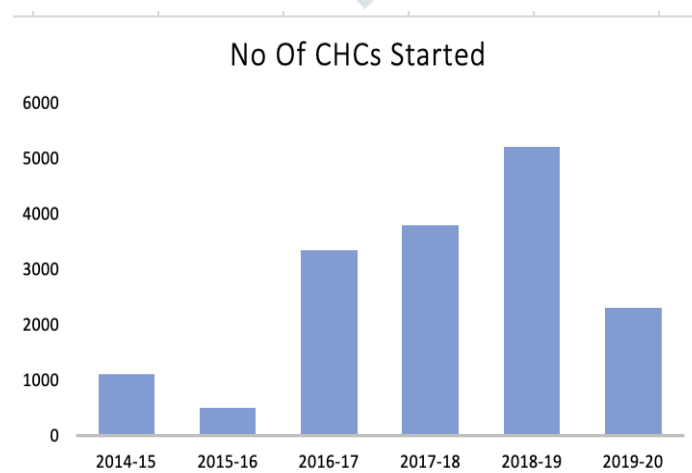


Fig 2. Government of India custom hiring centers started in each year. [3]

V. CONCLUSION

In conclusion, the state of farm mechanization in India presents both challenges and opportunities for the agriculture sector. While India is a global leader in agricultural production, the low mechanization rate, particularly among small and marginal farmers, has significantly impeded productivity and income. However, introducing digital platforms, adopting emerging technologies like AI and ML, and utilizing blockchain technology can potentially transform the country's farm mechanization landscape.

The advantages of a digital platform for farm machinery hiring are manifold. It addresses the underutilization problem, offers farmers access to the latest agricultural technologies, promotes sustainable farming practices, and enhances efficiency. Furthermore, integrating AI and ML can make the Custom Hiring Center model more practical, providing predictive analytics, NLP-driven user interfaces, real-time image recognition for crop health monitoring, and optimized machinery matchmaking. Blockchain technology adds more transparency and security to rental transactions, benefitting small and marginal farmers.

The role of the government is pivotal in driving these changes. Initiatives like Custom Hiring Centers, Farm Machinery Banks, and support for agricultural start-ups are essential steps in promoting farm mechanization and making it accessible to all farmers, regardless of their scale of operation. The commitment to increasing agricultural credit flow demonstrates the government's dedication to the sector's growth and modernization.

In essence, combining technological innovation, government support, and the active participation of farmers can lead to a revolution in Indian agriculture. This transformation will increase productivity and income for farmers and contribute to the sustainability of farming practices, ensuring food security for the nation. With these efforts, India can aim to close the gap with other leading agricultural countries and establish itself as a global powerhouse in farm mechanization and agricultural production.

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