

FARM MACHINERY AND ITS APPLICATION

Abstract

Machines allow farmers to enhance production (of food and fibre) while requiring less effort. It helps conserve resources like water and fertilisers, which are in short supply. It also aids in maintaining healthy soil conditions. The sophisticated equipment has sensors that will notify the operator when and where water or fertiliser is needed. To sum up, machines are capable of performing our tasks more efficiently and effectively. Mechanising farm labour can, therefore, be a huge help in reaching this objective. We gain from modern farming practises regardless of whether or not they allow us to harvest vegetables that are more nutritious.

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I. BACKGROUND

Despite the importance of farm mechanisation to boosting agricultural productivity, small and marginal farmers (who control around 85% of all land holdings in India) frequently lack the financial resources to buy their own machinery altogether.

Farm aggregation methods including co-operative farming, Joint liability groups (JLG), and Farm produce organisations (FPOs) are being encouraged to help small farmers have access to reliable farm machinery service at competitive prices and to promote mechanisation of their operations.

It is necessary to correctly classify agricultural farm equipment when performing automatic authentication of field activity in a remote system.

- In this setting, attempts are made to lessen agriculture's ecological footprint while simultaneously increasing farm output for financial gain.

If you're seeking to boost your income but find that the crops you grow using traditional methods are lacking in nutritional value, modern farming practises may be the way to go.

- The agricultural sector is evolving and growing at a lightning pace.

Therefore, there is a wide variety of agricultural resources available to help us maximise productivity while minimising costs. The top ten most widely used items of farm equipment in India, and what they do Use of the tractor, plough, cultivator, rotavator, baler, seed drill, sprayer, power tiller, and harvester is permitted.

II. TRACTOR

Tractors' prominence on the list is not surprising, given that no modern farmer could function without them. An essential component of agriculture machinery. The tractor's horsepower needs will be determined by the size of the field and the crops being cultivated. Ploughs, tillers, discs, harrows, planters, and so on are only some of the many uses for tractors on farms.

Modern tractors have several use outside of agriculture. This multipurpose vehicle can be used as a bulldozer, scraper, or even a digger!

The agricultural sector makes extensive use of the tractors we've included here.

1. Utility Tractor

- Commonly employed for ploughing and hauling massive pieces of farm machinery.
- These multipurpose tractors have an output that varies from 45 to 240 horsepower. Then, tools like a threshing machine or harvester can be pulled with ease.

2. **A Small Tractor:** Vineyards and orchards are ideal locations for small or miniature tractors. The tractor's adjustable seat and small rear track width make it possible to do tasks like picking low-hanging fruit and trimming trees.
3. **Row Crop Tractor:** Farmers use these tractors to do things like ploughing, levelling, harrowing, pulling, seed drilling, and weeding after they've planted their crops in rows. They also help farmers maintain proper row spacing, drive in comfort, manoeuvre with ease, and avoid damaging their crops.
4. **Implement Carrier Tractors:**
 - These tractors are designed primarily to carry and mount a wide variety of agricultural implements, including sprayers, drills, and so on.
 - The distance between the vehicle's front and back tyres has grown as a result of the additional cargo they are transporting.
5. **Two-Wheel Tractor:** These compact tractors are ideal for ploughing and tilling, as well as towing smaller implements like harvesters, trailers, etc. Fueled by petrol engines, these tractors are perfect for homesteads and gardens of any size.

A garden tractor makes short work of mowing the lawn and weeding the flower beds. Their small size belies the power of their engines, which may provide as much as 20 horse power. So, this is something that gardeners may put to good use. In today's farming, ploughs are needed for the first round of tilling the soil. Their task is to dig up the dirt and make it better. A plough's principal use is to break up the soil in preparation for planting. The plough breaks up compacted soil by turning it over, making it easier to deal with.

After being tilled with a plough, the soil is in prime condition for planting. Sowing seeds in the ensuing furrows is the next step. New roots are given an easier time penetrating the earth and establishing themselves.

6. **Examples Of Certain Types of Ploughs Are:** Wooden ploughs have been used by traditional farmers for centuries to prepare the soil for planting with iron and steel ploughs. Traditional wooden ploughs are still widely used in rural and less developed parts of India. This plough is made of wood and can be drawn by hand or drawn by an animal. Most wooden ploughs have been replaced by iron ones that are pulled by tractors.

To aerate and break up the soil, use a plough like the MB plough. The curved blade buries any residual agricultural debris or weeds by digging into the ground and flipping it over. The MB plough is excellent for breaking up hard, compacted soil prior to planting.

The disc plough, represented by the letter c in the preceding illustration, is another tool used for cutting and turning the soil. Turning the device causes a set of circular blades to spin and cut into the soil, loosening clods and aerating the ground. When working in stony or rocky soil, the disc plough really shines.

- **Chisel Plough:** The chisel plough is a deep-ploughing tool that is very sturdy. The chisel plough's long, pointed blades are excellent for penetrating the soil and slicing

through firmly rooted vegetation, making short work of hardpan dirt and improving drainage.

- **Hydraulic Reversible MB Plough:** The Hydraulic Reversible MB Plough is a modern plough that combines the best features of hydraulics with reversible ploughs. The versatility of this mb plough to efficiently plough on both sides of the furrow is its greatest strength. The hydraulic reversible mb plough is versatile due to its ability to be employed in a wide range of soil conditions.

7. **Cultivator:** Cultivators are essential farm equipment since they are used as secondary tillage tools to aerate the soil. Weeds may be buried, removed, and the soil aerated all at once using this technique, making it a win-win for growers. Every modern farmer needs a cultivator because of its low cost and great quality of field labour. The tractor's horsepower needs to match the cultivator's dimensions and load before it may operate.

8. **Rotavator:** • A rotavator is a tractor-drawn agricultural machine that, like a cultivator, has spinning blades to pulverise the soil. Also, rotavators are useful on the farm since they make tilling the soil much quicker. As a result, if you want to make money in farming, you need a rotavator. It also increases a farmer's income because of its superior performance in the field. Our farmer brethren wholeheartedly endorse this implement.

Any farm, no matter how little, will require some sort of trailer to transport harvested goods and other heavy farm equipment. Trailers are commonly used to solve these types of issues. However, the farmer can pick and choose which qualities are most useful for his or her particular field. Using a tractor trailer could boost profits by decreasing costs and increasing efficiency.

9. **Baler:** Farms produce waste products and pollution while raising crops for additional uses. This is why it's crucial to have a place to put rubbish, such as grass and straws. A baler would be helpful in this situation. When used to bale hay, straw, or other similar materials, it proves to be an invaluable piece of farm equipment. The cubic shape of the bales makes them easy to stack and carry

Planting seeds using a seed drill ensures uniform spacing and planting depth. In addition, a seed drill machine is simple to operate, allowing for rapid and efficient seeding. Both agricultural output and crop yield can benefit greatly from this technique. Because of this, seed drills are quite popular among Indian farmers.

10. **Sprayer:** For the best yield, it's important to apply fertilisers and other nutritious materials consistently. The development of spraying equipment and other agricultural technologies has made this possible. One of these sprayers is guaranteed to be perfect for your agricultural tasks. But sprayers do double duty as fertiliser distributors and watering machines. Therefore, demand for sprayers is increasing.

A power tiller is a multifunctional tool in the agricultural industry. Because of this, we can classify a power tiller as a subset of hand tractors. Watering, fertilising, and weeding are made simpler using a power tiller because of the machine's two wheels.

Therefore, investing in this piece of farm equipment once will have long-lasting benefits for crop yields.

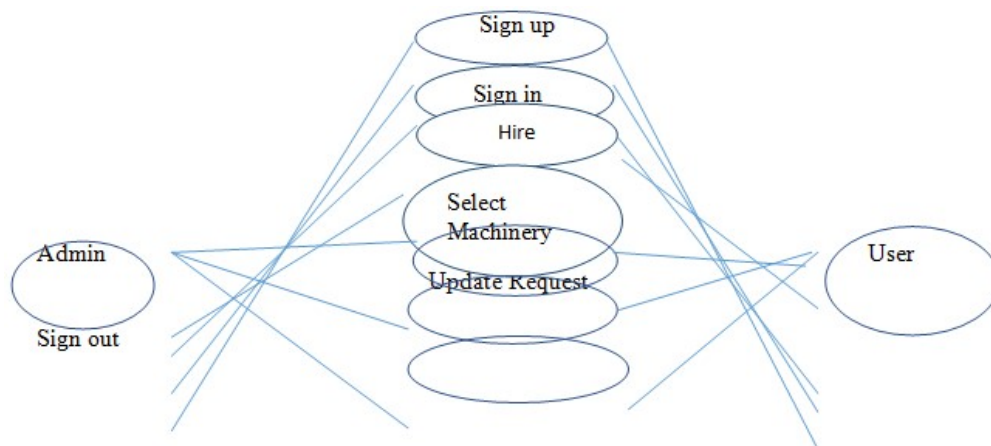
- 11. Harvester:** Getting the ripened crops is a time-consuming operation that requires hard work from farmers. However, this approach is both time-consuming and costly. Modern farm equipment includes, but is not limited to, harvesters. You can either use a tractor to pull the machinery, or you can drive it yourself out to the field. Additionally, a harvester can be used to simultaneously thresh the cripes, chop it, and gather it. In a shorter period of time, more money is made.

III. TECHNOLOGY FOR MOBILE FARMS IN ITS THIRD GENERATION INCLUDES

A unified, modular design that accommodates all system components. We've created a mobile app for Android-powered smartphones that allows farmers to quickly and easily find the nearest service location when they need to rent equipment. There are several tiers to the farmer employment structure. The presentation, business data, and storage layers make up the user model for a mobile app. This paradigm takes into account the importance of security and communication in a system's overall flexibility and dependability. The presentation layer stores both the user interface and the rules for navigating it. Information is translated into a form that can be understood by more people.

Mobile middleware is software that facilitates communication across disparate mobile application suites. Hides the complexities of working in a mobile environment, allowing users to more easily communicate between their numerous devices.

A set of instructions and protocols for creating programmes that communicates with the components of a human resource administration system. The farmer might also ask for a professional to be sent along with the machine or tool if he or she lacks the knowledge to run it.



- 1. Design of ICT convergence farm machinery:** With the recent incorporation of ICT (information and communication technology) into agriculture, we have entered the era of transition to smart agriculture, which aims to improve both agricultural productivity and

quality. In particular, adding a new automatic control system to an existing conventional agricultural field can increase output by managing growth and quality using optimal settings for each crop. We propose and develop a controller module that employs ICT convergence techniques in order to control the rotating velocity of the agricultural planter's multiple components in real time. When compared to traditional, mechanical planters, the ones with controllers are a significant time saver.

- 2. Keeping an eye on soil quality and harvest results:** Eight growing seasons were used to compare the effects of no field traffic, seasonal traffic control, and random field traffic on soil strength and soya-bean yield. According to the findings, significant output losses and financial penalties may result if soil compaction is not prevented or appropriately handled. Under no-traffic conditions (1.90 \pm 0.31 MPa), seasonal control (2.46 \pm 0.19 MPa), and random conditions (3.75 \pm 0.21 MPa), the soil cone index increased from 0-450 mm in depth, respectively. The two approaches to traffic control have always been vastly different from one another. Consistently higher values for the cone index were recorded by random traffic for all three depth categories (0-150mm, 150-300mm, and 300-450mm). Cone index values over the suggested threshold limit for soya bean root development (2MPa) accounted for production losses when field traffic was not managed or prevented. This was demonstrated by the fact that root biomass differed noticeably between traffic treatments. Grain yields in the zero-traffic condition tended to remain consistent over time, but those in the controlled-traffic and random-traffic conditions fluctuated by 35 kg ha annually and 30 kg ha annually, respectively. We measured yield gaps over eight growing seasons and found that they decreased with controlled traffic but increased with uncontrolled traffic.
- 3. Third, Spreading Knowledge about Farm Equipment:** Current estimates put the world population at 9.6 billion by the year 2050. As a result, it's expected that the global demand for wheat, rice, maize, beef, and fish would increase, especially in developing and third-world countries. The number of people living in extreme poverty (defined as earning less than USD 1.90 per day) is expected to rise to 274.5 million by 2050 in these same regions. Contrarily, there has been a significant decline in the amount of farmable land per person. The amount of farmland per capita in south Asian countries like Pakistan, India, Bangladesh, and Nepal has decreased from 0.17 to 0.36 ha in 1961 to 0.12-0.24 ha in 2012. South Asia, which has a very high population density, is particularly vulnerable to this issue because of its rapid population growth and its concurrent decrease in per capita farmland, both of which raise serious concerns about whether or not organic agriculture can produce a higher yield and sustain the increasing demand. The stakes of food security are high, and the low yield of organic farming compounds the problem. As other industries and job options have grown, many farmers have left the countryside for the cities.
- 4. Economic and Social Pressure to Implement Mechanisation in Farming:** Organic farms typically use diesel fuel to run their tractors and water irrigation systems. Having access to water is essential for OF. Due to electricity storage challenges, power disruptions, and the high upfront expenses associated with installing renewable energy sources, most farmers chose to continue utilising diesel engines. The current study indicated that farmers have other options besides solar and wind power, which have previously been proved to have a favourable effect on the adoption of agricultural tool

and equipment. Farmers that are willing to anticipate ahead may be more likely to purchase farm machinery if they employ renewable energy sources that lower operational expenses. In comparison to traditional energy sources, the operational costs of electricity and renewable energy are cited as being cheaper in the scientific literature.

Farmers are in a difficult position if they choose agricultural machinery over human labour because of the steady decline of rural manpower. The likelihood that a farmer would purchase and operate farm machinery decreased significantly as the number of interested family members increased. Even if a farmer can get by with less expensive in-house family labour than paying others, that doesn't mean he or she won't spend more money. As a result, there's no point in shelling out cash on farm machinery.

Organic farming practises, known for being time-consuming and labor-intensive, might gain a lot from mechanisation. Assisting in the allocation of funding and the management of available resources, decision-makers would significantly benefit from a comprehensive picture of the economic and social aspects influencing farmers' purchases and use of agricultural machinery for appropriate OFs. Access to agricultural machinery and tools can be further expanded by investing in infrastructure development in rural Pakistan. Renting farm equipment may be a good option for small organic farms. Having ready access to finance is a vital part of mechanisation activities since it allows farmers to grow in a healthy way and lessens production risks. When considering how to increase farming mechanisation in the country, politicians, decision-makers, and developers should prioritise providing farmers with the tools they need.

IV. MODEL-DRIVEN EXPANSION OF AGRICULTURAL MECHANISATION SERVICES

It is possible for buyers to negotiate lower pricing with small farmers thanks to a number of technological advancements. While certain enhancements can increase the positive outcomes for all parties, others may change the nature of the risks taken and the way they are shared. Some of these innovations make use of state-of-the-art technology, while others, despite being founded on extremely low-tech techniques to arranging partnerships and payments, are revolutionary in their implementation and capacity to keep interest over time. To create such distinctions, however, is unproductive because it may take a combination of these strategies to effectively engage with such challenges.

- 1. Contractual Safeguards for Reducing Exposure:** For low-income families, attempting to smooth out their consumption in the face of price and production shocks could result in the sale of assets or other unfavourable consequences for capital accumulation and future production (Rosenzweig and Wolpin, 1993; Carter and Barter, 2010; Cisse and Barrett 2018). Reducing uninsured risk might stimulate farmer investment in agricultural output even when credit markets are weak, as it has been demonstrated to have a negative influence on productivity (Rosenzweig and Binswanger, 1992).
- 2. Risk in Manufacturing:** Contract arrangements encourage individual farmers or groups of farmers to invest in new, risk-mitigating production, harvesting, and processing technology (for example, irrigation or cold chain). For instance, the World Bank has suggested that contracting relationships and associated services provide additional means

of enforcing the lending contract, making it easier for agricultural purchasers to combine financing and production insurance to small farmers. This hints at various production insurance alternatives for contract farming.

Evidence from a field study in Ghana (Karlan et al., 2014) demonstrates that production insurance is helpful for smallholders. A subset of the maize farmers in the trial were randomly selected to receive either cash subsidies, access to rainfall index insurance, or both. Researchers found that when farmers had access to production insurance, they were willing to take more chances and make more financially beneficial choices regarding their crops. Farmers were able to get the money they needed without worrying about going bankrupt in the event of a bad harvest. Some evidence in this direction comes from a research conducted by Cole et al. (2017), which found that after a group of small-scale Indian farmers bought rainfall insurance, they shifted their focus to "higher return, rainfall sensitive crops." The complexity of the basis risk that farmers must take on is one reason why the uptake of these output insurance products remains embarrassingly low. Both the first year of the study (Karlan et al., 2014) and the third and most recent year (Coel et al., 2017) made the production insurance product available at no cost to the researchers. When production insurance is not provided for free, farmers are hesitant to pay for it. Karlan found that between 40 and 50 percent of farmers were willing to pay a reasonable price for insurance in years two and three of his study.

- 3. Farming on Contract:** Farmers in Benin were permitted to seek out their own input services and financing, and research indicated that contracts guaranteeing a producer price had the same effects on production as contracts guaranteeing both a producer price and an interest rate on loans for agricultural inputs. Similarly, through long-term contracting arrangements, Intelligentsia Coffee ensures its coffee growers fixed pricing for predetermined amounts across numerous coffee quality ratings.

Contract farming arrangements between small farmers and purchasers have been facilitated and supported by several policies and private sector programmes in developing nations. Although there is a lack of consensus on the positive effects that these efforts have on people's well-being, most studies address the issue by comparing the net effect of a contractual relationship to the effect of not having a contract in place. Little formal experimentation has been done with the characteristics of contracts to determine the relative value of various contractual aspects. This type of contract can cover a wide range of farms, including the price, quantity, quality, timing, and details of delivery, and it can also bundle agricultural inputs, financial services, including credit and production insurance, and extension service, the combination of which is likely to prove most effective in achieving the goals of the contracting buyers, such as maintaining a consistent supply of products over time and maintaining quality standards.

V. INNOVATION

In support of this argument, Arouna et al. (2019) collaborated with a rice processor in Benin to perform an experiment in which they randomly assigned which features would be included in contracts with small-scale rice producers. The contractual buyers in this research were Enterprises de services à l'organisation (ESOP), a private rice processing and marketing firm. ESOP had successfully purchased rice through contracts with local farmers before. In

this randomised controlled experiment, 953 farmers were split into three treatment groups and a control group. Before the start of the growing season, the first group of farmers made a deal with ESOP to supply them with a predetermined quantity of high-quality rice in 80-100 kilogramme bags by a predetermined date and place, with the quality specified by the impurity percentage (the amount of foreign matter and debris contained in the rice). All of the contracted farmers produced the same variety of rice and agreed to sell it at a price of \$0.27 per kilo after harvest. The price per kilogramme ranged from \$0.20 to \$0.33 according to the study, with the range dependent on the kind of buyer (hoarders, traders, consumers). The contract also detailed what would happen in the event of a breach and how that would be handled.

VI. CONCLUDING REMARKS AND SUGGESTIONS

- Current worries and a critical outlook on multi-farm utilisation of farm mechanisation
- Agricultural cooperatives contribute significantly to the development of agricultural mechanisation.
- Agricultural equipment retailers should be rewarded to establish contract services in rural regions, where they can do things like provide farmers demonstrations of the advantages of using farm equipment properly.
Flexible and cooperative component design are long-term priorities for agricultural equipment.

The idea is to allow farmers to reap the financial and technological benefits of cutting-edge technology, which is often offered by third-party vendors.

- This requires a move towards standardised, basic components and a concentration on fewer machine types for output in the industrial sector.
- Concerns about food safety when demands for more food are created.

The desire to increase agricultural product quality is one example of a growing need. Second, you should try to reduce production expenses.

Increase agricultural value: More and more people are beginning to see the agriculture sectors as an interconnected whole, and this has created a new challenge: delivering agricultural raw material that is suitable for subsequent processing operations. Rapid field operations, less product loss and damage, and improved quality all necessitate the aforementioned.

For this reason, modern technologies such as computers, models, and sensors need to be included into the development of farm equipment. The commercial and agricultural sectors can benefit greatly from access to data on quality and production standards. Better research into harvesting machines to avoid damage and loss is crucial if the agricultural industry is to receive the highest quality product.

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