**FARM MACHINERY AND ITS APPLICATION**

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Abstract:

The use of machine allows farmers to produce more quantity of products (food & fibre) with less physical labour. It helps to conserve natural resources such as water and fertilizer. It also helps in maintaining the soil fertility. The specialized machine have sensor that know exactly when and where water and fertilizer is needed. Machines can carry out our task in a faster, quicker and more efficient way. Hence, mechanizing agriculture activity can be very helpful in achieving such a goal. If traditional farming methods produce highly nutritious crops, modern farming benefits us by creating higher income.

Keywords:

* Popular farm machinery and equipment with importance.
* A mobile based farm machinery.
* Design of an ICT convergence from machinery for an automatic agriculture planter.
* Creating an awareness on farm machinery.
* Monitoring of soil strength and crop yield.
* Socioeconomic determinants to adopt agriculture machinery for sustainable organic farming.
* Penetrations of farm mechanization service through rural dynamic based business modelling.

Background:

* Farm mechanization although one among the essential input to raise the agriculture productivity, but individual owing of farm machinery by resource constrained small and marginal farmers who constitute around 85% of operated land holdings in India is uneconomical.
* Hence, innovative arrangements such as custom hiring centre(CHCs) are being encouraged through farm aggregation models like co-operative farming, Joint liability groups(JLG), Farm produce organisation(FPOs), to get access to farm machinery service at an affordable prices and promote mechanization of operations on small farms.
* The classifying agriculture farm machinery is important where performing the automatic authentication of field activity in a remote system there is possibility of a fraudulent activity taking place.
* With this background the efforts are done to minimized the environmental burden caused by agriculture activity and increasing economic efficiency are key contemporary drivers in the precision agriculture remains.
1. **Introduction:**
* Mechanising agriculture activity can be very helpful in achieving such a goal if traditional farming methods produce highly un-nutritious crops, modern farming benefits you by creating higher income.
* Moreover we see tremendous daily growth and innovations in the farming industry.
* Therefore, loads of agriculture machines are available to help us reach the aim of cost-effective production.
1. **Application:**

 Top 10 agriculture equipment in India:

* Tractor
* Plough
* Cultivator
* Rotavator
* Baler
* Seed drill
* Sprayer
* Power tiller
* Harvester
	1. **Tractor:**
* No wonder a tractor comes on the top of the list as a modern farmer cannot imagine his field without tractor. It is a vital farm machinery. Different crops need different HP tractors, depending on implements and field dimensions. Basically the farm tractors are used for ploughing, tilling, disking, harrowing, planting etc.
* In today’s age and time, tractors find their application across several sectors. This multipurpose machine can be used as bulldozer, scraper or digger.

 Here are some types of tractors used in the agriculture sector for various purpose

1. Utility Tractor:
* Farmer use this tractor for operation like ploughing and pulling heavy implements
* In addition, these multifunctional tractors deliver a power range between 45Hp and 240Hp. As a result, they can easily pull heavy implements like harvesters, threshers etc.
1. Compact Tractor:
* Compact or mini tractors are ideal for farming operations in vine yards and orchards. They usually come with comfortable adjustable seats and narrow rear track width.
* With the help of this tractor one can pick low hanging fruits, trim the trees and more.
1. Row Crop Tractor:
* Farmers after plant their crops in a row to control weed growth and decrease soil pressure like ploughing, levelling, harrowing, pulling, seed drills and eliminating weeds.
* These tractors also ensure adequate row spacing comfortable driving, easy handling high ground clearance.
1. Implement Carrier Tractors:
* The use of tractors of this type primarily include carrying and mounting different implements, some of the implements are sprayer, drills, etc.
* Additionally, as they carry this additional equipment, there is an extension between the chassis of their front and rear tyre.
1. Two-wheel Tractor:
* Those light weight and compact tractors find their application in ploughing, tilling and puling small implements like harvesters, trailers, etc.
* One can use this tractors on small farms or gardens, further gasoline engines power these tractors.
1. Garden Tractor:
* Garden tractors are ideal for cutting grass and making flower beds. They come with a small construction size with an engine power ranging from 1Hp to 20Hp. As a result, these are convenient for those who engage in gardening.
	1. **Plough:**
* Plough are also crucial modern agriculture machines used for primary tillage. Their function is to dig up the soil for better soil quality
* Breaking up of soil- The primary use of a plough is to break up the soil in preparation for planting . By turning over the soil, the plough breaks up clumps and makes it easier to work with.
* Creating a seedbed- Ploughing helps to create a seedbed that is suitable for planting crops by turning over the soil, the plough creates furrow, which are then used for plant seeds.
* The also helps to loosen the soil, making easier for young roots to penetrate and establish themselves.

There are different types of plough like:

1. Wooden Plough:
* A wooden plough made of wood is a traditional ploughing implement that has been used for centuries to cultivate land and prepare it for planting.
* It is typically made up of iron and steel. Wooden ploughs are still used in some parts of India, particularly in rural and less developed areas.
* This wooden plough is operated manually by either humans or animals. However, the wooden ploughs are being replaced by iron ploughs nowadays and it is drawn by tractors.
1. MB plough:
* This is a common ploughing implement used to turn and loosen the soil. It is designed with a curved blade that cuts through the soil and turns it over, burying the weeds and crops residues underneath. The MB plough is ideal for breaking up hard, compacted soil and preparing it for planting.
1. Disc Plough:
* The disc plough is another type of ploughing implement that is used to cut and turn the soil. It is designed with a set of circular blades that rotate and cut through the soil , breaking up clumps and turning the soil over.
* The disc plough is deal for use in rocky or stony soils.
1. Chisel Plough:
* The chisel plough is a heavy-duty ploughing implement designed for deep tillage. It is equipped with long, sharp blades that penetrate the soil and break up deep-rooted vegetation.
* The chisel plough is ideal for breaking up hardpan soil and improving drainage.
1. Hydraulic Reversible MB Plough:
* The hydraulic reversible mb plough is a modern plough that combines the benefits of hydraulic technology and reversible plough design to create a highly efficient and effective tool.
* The main ability of this mb plough is to effectively plough both sides the furrow. Another advantage of the hydraulic reversible mb plough is its ability to work in a variety of soil conditions.
	1. **Cultivator:**
* Cultivators are secondary tillage machines which stir the soil, and this agriculture machine has a great significance in land preparation. Apart from this, cultivators can bury previously grown crops, remove weeds and effectively aerate the soil in a single operation. Hence, a modern farmer knows the importance of cultivator due to their cost-effectiveness and too-notch field work to boost crop production. Also, tractor power this farming tool, and various cultivators have different tractor Hp ranges according to their weight and working width.
	1. **Rotavator:**
* Rotavator is also a tractor-drawn agriculture machine that works like a cultivator but comprises rotating blades to pulverise the soil. Furthermore, rotavators benefit the farm by tilling at a higher rate. So, choosing a rotavator will make farming profitable for you. Along with this, it helps to increase a farmer’s income by delivering top-class field performance. Therefore, this agriculture machine is a recommended choice among farmer brothers.
	1. **Trailer:**
* A field always has some kind of haulage necessities, weather required for transporting harvested goods or carrying other heavy farm implements. So, trailers are the go-to choice for such needs. However, capacities, which the farmer can choose per the field’s requirement. Also, a tractor trailer helps to cut costs and labour, leading to higher profit.
	1. **Baler:**
* Farms produce waste products and impurities while growing crops which fulfils other purposes. That is why it is crucial to store waste properly, such as grass or straws. This is where a baler comes into play. It is valuable farm machinery equipment to collect hay, straws and other make compact bales. Moreover, the bales come in cubical structures for easier handling.

 **2.7 Seed Drill:**

* A seed drill sows seeds at a specific depth with uniform spacing between each seed. Moreover, a seed drill machine offers quick operation, leading to sowing at an efficient rate. This process helps to boost farm productivity and significantly increases yield. That is why seed drills are a popular choice among Indian farmers.

 **2.8 Sprayer:**

* A good quality yield requires an even distribution of fertilizers and other nutritional matter. This is accomplished by using modern farming machines such as spraying equipment. Moreover, there are lots of sprayers listed to provide the best quality field work. However, sprayers not only distribute fertilizers, but they also fulfil irrigation task. Thus, the demand for sprayers is rising prominently.

 **2.9 Power Tiller:**

* Power tiller are effective multipurpose agriculture machines that can accomplish many farming tasks. Therefore, a power tiller is also called a “hand tractor”. Mostly, power tillers come with two wheels and this single machine can effortlessly perform irrigation, distribute fertiliser and remove weeds. So, this agriculture machine is a one-time investment to improve farm productivity.

 **2.10 Harvester:**

* There is much work in obtaining the matured crops, and farmers do immerse labour to collect the yield. However, this process is also time-consuming and costly. So, there are various modern machines used in agriculture to harvest crops, such as harvesters. This agriculture machine can be tractor drawn or self-propelled, which you can choose as per your suitability. Also, a harvester can thresh, cut and collect cripes in a single operation. This results in higher profits in less time.
1. **Mobile Based Farm Machinery:**
* The design of the architecture was extensible and salable so that it can contain all parts of the system. Farm machinery hiring system is an application for smart phones that supports the android operating system and uses GPS function to locate the nearest service point for the farmers to hire machines at ease. The architectural design of the hiring system for farmers consists of multiple layers. The mobile app user model contains the presentation, business data and data storage layers. This frame works takes into consideration the case of security and communication angles since these factors determine the flexibility and reliability of the system. The presentation layer house user interface and the rules to transverse the interface. It translates the information into human readable format.
	1. **Mobile Middleware:**
* It’s software that connects disparate mobile application programs. Essentially hides the complexities of working in mobile environment, allowing for smoother device-to-device interaction on the hiring system.
	1. **Third-party (API):**
* It’s a set of function and procedure allowing the creation of application that access the feature or data on the hiring system.
	1. **Enterprise System:**
* It’s where all the request or complains are directed to for approval or attended to
	1. **Data Base:**
* Farm machinery hiring system is developed with MySQL database because it supports every platform for designing such as web, mobile and desktop applications. It also supports remote connection through the internet and is the most widely used database in the world because of its efficiency.
	1. **Hiring Strategy:**
* Several strategies are put in place to ensure smooth relationship between our service and customers. They include-
1. Any farmer can order for the delivery of any machinery/equipment
2. If equipment is not currently available in store, the date it would return to store will be made known to the customer. Provide the customer chooses to proceed with the order; the newly available date will then be assigned to the new customer.
3. Farmer can also request for a technician along with the machinery/ implement if they do not have technical skill to use them.

 Sign up

 Sign in

Hire

Select Machinery

 Make request

Admin User

 Update Request

Sign out

1. **Design of an ICT convergence farm machinery:**
* Recently, ICT technology such as information technology and automatic control technology has been applied into agriculture and the era of conversion to smart agriculture aimed at improving productivity and improving quality of agriculture has been reached. In particular, it is required to develop a technology that maximizes productivity through growth and quality control based on optimized parameters for each cultivated crop by applying a new automatic control system to the existing traditional agricultural field. In this paper, we propose and design a controller module of agriculture planter applying ICT convergence techniques in order to control rotating speed of various devices in real time. The planters with the controller are useful fir saving time than the existing planters which has been dependent on mechanical type.
1. **Monitoring Soil Strength and crop yield:**
* The long-term effect of zero, seasonally controlled and random field traffic were monitored by measuring the soil strength and yield of soya-bean over eight cropping seasons. The work showed that significant yield, and therefore, financial penalties may be incurred when soil compaction is not avoided or appropriately managed. Soil cone index (depth range:0-450mm) increased in the order; zero traffic (1.90+/-0.31 MPa)> seasonally controlled traffic (2.46+/-0.19MPa)> random traffic (3.75+/-0.21MPa) respectively. Difference between traffic treatment were consistent across years. Random traffic reported consistently higher cone index values at the three measured depth intervals (0-150, 150-300, 300-450mm). Values of cones index above the suggested threshold limit for root growth of soyabean (2MPa) explained yield penalties when failing to control or avoid field traffic. This was confirmed by relative difference in root biomass between traffic treatments. Grain yields in zero traffic were fairly consistent between years and increased in controlled traffic and decreased in random traffic at average rates of 35kg ha­ and 30kg ha per year respectively. Therefore, measured yield gaps over eight crop seasons reduced with controlled traffic and increased in random traffic related to zero traffic.
1. **Creating awareness on farm machinery:**
* According to current projections, the global population is expected to reach 9.6billion people in 2050. Consequently, the consumption of staple foods such as wheat, rice, maize, meat and fish is predicted to proliferate, especially in the third world countries and developing nations. These are same areas where many people also leave below the poverty line of USD 1.90 per day, this group of an impoverished population is predicted to increase to 274.5 million persons. On the contrary, the available area of agriculture land per capital is decreased sharply. For example, in south Asian countries such as Pakistan, India, Bangladesh and Nepal the farmland area has reduced from 0.17-0.36 ha per capital in 1961 to 0.12-0.24 ha in 2012. The rapid increase in population and the concurrent decrease in per ca-pita farmland creates serious concerned regarding weather organic agriculture can produce a higher yield and sustained the increasing demand this problem is incredible real for South Asia region, which has a high population density. The pressure of food security and the low yield of organic farming may worsen the situation. Furthermore, the simultaneous expansion of other sectors and employment opportunities has resulted rural-urban migration among the farming community.
1. **Socioeconomic determination to adopt agriculture machinery:**
* In organic farming, mainly tractors and irrigation ponds utilize diesel for running engines in case of energy consumption. OF is very sensitive to water and its availability. Due to severe electricity storage, sudden and unexpected power cuts, and large initial investments in installing renewable, most farmers still wanted to depended o diesel engine. However, the present study highlighted that other energy sources, influence of farmers adoption of agricultural tools and equipment could not be ignored. It can be concluded that saving operating cost by using renewable energy resources could motivate advance farmers to own agricultural machinery. It is also discussed in scientific literature that electricity or renewable energy sources have lower operating cost than current energy sources.
* Due to the rapid decline in the countryside workforce, agriculturists are also in a difficult situation if they were to choose agricultural machinery instead of labour. Current results show that farmer families with more family members who wished to work in the fields are less likely to purchases and own farm machinery. A farmer who can employ-cost family labour without having to outsource may incur additional costs. Therefore, do not feel the need to invest in agricultural machinery.
* Mechanization in organic farming can play an essential role in promoting and maintaining practices widely know as labour-intensive agricultural technologies. A comprehensive view of the economic and social variables affecting farmers purchasing and use of agricultural machinery for suitable OFs will be invaluable for decision-makers to make useful policies and will help budget distribution, as well as resources planning and management. The infrastructure improvements necessary in rural areas of Pakistan are basics to enhancing the possession of farm machines and equipment . One way is to rent agricultural machinery to small, organic farmers. Easy access to credit as an essential share of mechanization efforts enable suitable development and reduce production risks for farmers. In short, policy makers / decision makers and developers wishing to improve farmers farming mechanization n the country are required to consider increasing their needs and condition as needed.
1. **Penetration of farm mechanisation services through modelling:**
* Various innovations can decrease costs of contracting with small farmers to buyers. While another set of innovations can increase benefits to both parties of transacting, these innovations can change the amount and nature of risks involved and can change the distribution of that risk. Some of these innovations involve new technologies, others despite being relatively low-tech models of structuring relationships and incentives, innovative nonetheless in their execution and sustained engagement. Such distinctions, however are counter-productive as successful engagement with these challenges may acquire a blend of these strategies.
	1. **Risk mitigation through contracting:**
* For households with very limited financial resources, consumption smoothing in the face of price and production shocks may force asset sales or other adverse consequences for capital accumulation and future production ( Rosenzweig and Wolpin, 1993; Carter and Barter, 2010; Cisse and Barrett 2018). Because evidence suggests that uninsured risk can negatively impact production ( Rosenzweig and Binswanger, 1992), addressing such risk can promote farmer investment in agricultural production, even in circumstances where credit markets are systemically weak.
	1. **Production Risk:**
* Contract relationships that induce individual farmers or groups of farmers to invest in new, risk-mitigation production , harvesting or processing technology (for example-irrigation or cold chain) indirectly contribute to risk mitigation. Recent initiatives suggest a range of options for contract farming to include production insurance directly: the world bank, for example- has argued that agribusiness buyers are in a better position to bundle lending and production insurance to small farmers because the contracting relationship itself and associated services, provide additional means of enforcing the lending contract.
* Evidence from an experiment in Ghana, points to the value of production insurance for smallholders (Karlan et al, 2014). In the experiment, randomly selected group of maize farmers received either cash grants, or an opportunity to purchase rainfall index insurance, or both. The study found that production insurance alone led to strong increases in farmer investment, with farmers talking on riskier and potentially more profitable production choices. Insured from production risk, farmers were able to find the financing they needed. Other relevant evidence includes (Cole et al, 2017) who found that rainfall insurance uptake by a randomly selected group of Indian small-scale farmers led farmers to invest in “higher return, rainfall sensitive crops”. Nonetheless, take-up remains strikingly low for these productions insurance product, in part because of the complexity of the basis risk that farmer assume. Both studies- Karlan et al (2014) in the first year of the three year study and Coel et al (2017)- offered the production insurance product for free. In contexts where the products is not free, farmers have often proved unwilling to invest in production insurance. In the Karlan study, in years two and three they provided the insurance at randomly varied prices and found that 40-50 percent of farmers were wiling to purchase it at the actually fair price.
	1. **Contract farming:**
* The Benin case found that a contract guaranteeing a producer price showed production impacts similar to contracts that also included extension and input loans with a price guarantee, farmers were willing and able to seek out their own input services and financing. Relatedly, intelligentsia coffee provides guaranteed prices to its coffee growers for set quantities of multiple coffee quality grades in long term contracting arrangements.
* In developing countries many policies and private sector programmes have worked to facilitate and support contract farming arrangements between small farmers and buyers. Through empirical evidence regarding the welfare effects of these efforts is mixed these studies commonly approach the question by evaluating the net effect for household of a contracting relationship relative to a counterfactual of not having any contract. As yet, few studies or initiatives have formally experimented with the attributes of contracts to as certain the relative importance of different contractual features. A contract of this sort can take many farms- specifying price, quantity, quality, timing and specifics regarding delivery, but a contract can also bundle agricultural inputs, financial services( including credit and production insurance) and extension service which features prove to be most important to ensuring desired outcomes for the contracting buyers these desired outcomes likely include ensuring stable product supply overtime and meeting required quality standards without side selling for the farmer, they include a marketing relationship that simplifies transactions and provides some premium in services, mean price increase or price volatility reduction.
	1. **Innovation:**
* A recent study by Arouna et al (2019) implemented in collaboration with a rice processor in Benin was designed to provide evidence on this point, randomizing the feature included in rice contracts with small-scale rice farmers. The contracting buyers in the study was enterprises de services at organisation (ESOP) a private rice processing and marketing company with previous experience in using small-farmer contracts to purchase rice.
* The study worked with 953 farmers organized into 107 farmers groups, randomly assigning these farmers to one of three treatment groups or a control group. The first group signed written contracts with ESOP at the beginning of the production season for a specialised quantity of rice to be delivered in 80-100kg bags on a specified date and location, meeting a quality standard defined by an impurity percentage (presence of foreign matter and debris). Farmers in this group were contracted to grow a specific rice variety and all contracts guaranteed a harvest sale price fixed or USD 0.27 per kg. According to the researchers the price ranged from USD 0.20 to 0.33 per kg depending on the buyer, collectors, traders or consumer and the place of sale . The contract also defined what a breach of contract meant, and hoe such breaches by either party would be resolved.
1. **Conclusion and Recommendations:**
2. Current issues and critical view on farm mechanization multi farm use:
* Agricultural co-operations play an extremely important role in the development of agricultural mechanization.
* Farm machinery dealers should be encouraged to established contract services at the village level to perform the required task such as demonstrate to farmers the benefits of using farm machinery properly.
1. Component flexibility and co-operation as strategic objectives in farm machinery development:
* The purpose is to permit farmers to utilize the technical and economical benefits to modern high technology, often run by suppliers.
* Farm the industrial stand point, this makes it necessary to favour minimum components standardization and manufacturing concentration on fewer machine models.
1. Problems affecting the quality of new food production demand:
* Growing demands are:
1. Improve the quality of farm products.
2. Reduce production cost.
3. Increase value added at the farm level.
* This is due to the growing tendency to view the agriculture industries system as an increasingly interconnected, hence the need to supply agricultural raw material particularly suited to subsequent processing operations
* The above is essential to perform the various field operations on a more timely basis, reduce product damage and loss and improve quality.
* Consequently the design of farm machinery must be revised conceived with specific itineraries of techniques in which information technology, modelling the use of sensors and high technologies play a role.
* Quality and production standard information are of growing importance at the agricultural and industrial stage.

* In agriculture terms, improved research of harvesting machines in order to reduce damage and loss is of utmost importance to give the industry product at highest quality.
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