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Technological Innovation of Mini Tractor and Consumption by Tribal Farmers in South Gujarat

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Abstract/ Summary

In an agricultural country like India, the average land holding is very small and its population is steadily increasing without any possibility of increase in land area. The income from cropping for an average farmer is hardly sufficient to sustain his family. The tribal farmer has to be assured of a regular income, needed for a reasonable standard of living and the use of agriculture technology Mini Tractor, help them in improving their income which has been evident from this study. The Mini Tractor has been making a major impact on the social and economic life of tribal farmer in Surat district, Gujarat. Mini Tractors are mostly used for multipurpose activities such as ploughing, threshing, land levelling and transportation of goods from farms to market, etc.Mini Tractor is economically very cheaper than big tractor, so it is more convenient to small farmers. Big tractors are very costly and only big farmers can afford it and smaller farmers cannot afford big tractor. Since small farmers have smaller fields, so this kind of Mini Tractor is very useful for them. Mini Tractor is affordable for small and marginal tribal farmers and it can also be used in the field, when crops are grown, for various purposes like making small irrigation cannel, eradicating unwanted crops/weeds grown between two rows of crops, and putting fertilizers in the field, etc. It is not only low budget tractor but also low maintenance and operational cost due to low fuel consumption. The Government of India has been encouraging small and marginal farmers to use Mini Tractor in the country by making subsidy available to them. It is indigenously developed tractor and for promotion of its multipurpose use.

Key Words

Mini Tractor, Tribal farmers, Agriculture Technology, Grassroots Innovation, Mechanization

Introduction

This paper is intended to study new agriculture technology like Mini Tractor used by tribal farmers in Surat, Gujarat. The era of modernization is viewed with the use of science and technology in every sector including the agriculture sector. Technology can be termed as the application of knowledge for practical purposes. Those days are gone when farmers used to do hard labour to meet their needs and in the modern times, they are equipped with various agricultural technologies. The nation has celebrated the entry and increasing influence of the latest and trouble free science and technology in the traditional farming, 6 decade ago. The new technologies have helped farmers in utilizing even the small land into lots of profit making sources. Farmers whether small or big are getting more and more aware of the fact that technology use is very beneficial to them. In this context, technology makes people to become more efficient or to do things that were not possible before. To benefits from technology, it needs to be successfully linked with country's overall development objectives and helping in solving socio-economic problems.

The increase in population has raised the need of more production in the agriculture, which can be achieved by using technology in the agricultural activities. Up gradation of farming has been possible due to use of the latest and innovative agriculture tools and equipments. Agricultural technology is a term that is used to define tools and machinery that are used primarily or entirely in order to support agricultural enterprise. The important and useful agriculture technologies are ploughs, threshers, irrigation systems, tractor, power tiller, mini tractor, etc. These forms of agricultural technology, which are regularly used in modern agricultural settings, have a long history in agriculture use and have been reinvented and redesigned many times over the years. India has made impressive strides on the agricultural front during the last 6 decades. Much of the credit for this success should go to the several million farming families that form the backbone of Indian agriculture and economy. Policy support, production strategies, public investment in infrastructure, research and extension for crop, livestock, agriculture technology have significantly helped to increase food production and its availability. As commercialization of agriculture grew in intensity in the mid-to-late 19th century, the British Raj and the local legislatures and provinces began investing in agricultural development through support and agricultural research farms, colleges and large scale irrigation schemes. The socialist oriented Five Year Plans of the 1950s and 60s aggressively promoted rural mechanization via joint ventures and tie-ups between local industrialists and manufacturer of agricultural equipment that is tractor. Despite this aggressive mechanization the first three decades after independence local production of 4-wheel tractors grew slowly. Yet, by the late 1980s tractor production was nearly 140,000 units per year and by the late 1990s this production was approaching 270,000 per year (Kulakarni, 2009).

These agricultural technological sources are costly. But farm mechanization shows in increasing trend, there are wide ranging disparities in the levels of mechanization across states in India. Northern States such as Punjab, Haryana, and Utter Pradesh have achieved faster growth in agricultural mechanization. The pace of mechanization in North-Eastern States has not been satisfactory due to constraints such as hilly topography, socio-economic conditions, and high cost of transport and lack of farm machinery manufacturing industries. Mechanization in Western and Southern states of country viz. Gujarat, Maharashtra, Rajasthan and certain areas of Tamil Nadu, Andhra Pradesh etc., has increased with the increase in area under irrigation and also with the growing awareness of use new agricultural technology among farmer[1]. The technological source has helped to increase the production in less of labour work, effective land cultivation and crop supply. Thus need has risen to look for use of high production technology like Tractor. Tractor industry plays an important role in agriculture sector, which has contributed in a major way to India's GDP. Tractor is an important part of agriculture machinery Industry. Tractor came to India through imports and later on was indigenously manufactured with the help of foreign collaborations. The manufacturing of agriculture tractor started in 1961-62. Indian tractor industry is relatively young but now has become the largest world market. The higher productivity and various usability of tractor are the two major contributions in agricultural mechanization. Tractor is a highly versatile piece of machinery having a multitude of uses, agriculture use for land reclamation and for various crops cultivation[2] (Singh and Mani, 2009).

The productivity increase has been possible though profitable technologies and use of Mini Tractor is also considered as a profitable technology for the farmers. In agriculture technology, India has manufactured Mini Tractor having an integrated body tractor with 12 HP. It has been equipped with water cooled engine, hydraulic system and special designed reduction gear to minimize the loss of power by way of wheel slippage. This Mini Tractor is the need of today's small and marginal farmers. It is real low budgeted tractor useful for small farmers with ease of maintenance and operational cost due to low fuel consumption. It is indigenous tractor available with subsidy from Government of India to small and marginal farmers. Due to shortage of agriculture labour and small productivity in the rural area in India, farmers were compelled to opt for farm mechanization of agriculture. The small land holding farmers are supposed to go for a Mini Tractor which suits their financial budget and small land holding.

India after Independence has opted for Five Year Plan for its development. In various Five Year Plans, several types of technology & machines are used widely resulting into various revolutions over a period of time, which gave boost to production and Indian economy. In the field of agricultural, various revolutions such as, Green Revolution (grain), White Revolution (milk), Yellow Revolution (flower, edible oil), and Bio-Technology Revolution- after liberalization, privatization and globalization took place over a period of time and made our country independent in agricultural food production.

[1] Kulkarni S.D. 2009. "Mechanization of Agriculture-Indian Scenario". Central Institute of Agricultural Engineering (CIAE), Bhopal, India

[2] Singh Gajendra and Indra Mani. 2009. "Mechanization of Agriculture-Indian Scenario". www.jstor.org

Over the years, agriculture has emerged as one of the top priorities of the Central and State Governments. Keeping this in mind, various schemes have been launched to improve farm productivity and the standard of living of millions of farmers who work to feed the nation. In 2000, the Government of India has announced the First National Agriculture Policy focusing on agriculture mechanization, increasing yields, increasing agriculture labour income, agriculture subsidies, etc. The main aims of this policy are following.

1. To actualize the vast untapped growth potential of Indian agriculture.
2. To strengthen rural infrastructure to support faster agricultural development.
3. To promote value addition, and accelerate the growth of agro business.
4. To create employment in rural areas.
5. To secure a fair standard of living for all agriculturalists.
6. To discourage migration to urban areas and face the challenges arising out of economic liberalization and globalization (Government of India, 2011).

There is no separate National Policy on Agricultural Mechanization, which is covered under the regular Agricultural Policy[3]. The promotion of agricultural mechanization has been directed towards the promotion of eco-friendly and selective agricultural implements and machines with the aims of optimal utilization of the available sources of human, animal and mechanical/electrical power. Farmers have also been provided financial assistance for owning a wide range of agricultural equipment viz. tractors, power tillers, bullock/tractor drawn implements, reapers, threshers, irrigation equipment, hand tools etc. Further, new technology such as precision planter, zero till drill, seed cum fertilizer drill, raised bed planter, plant protection equipment, harvesting and threshing machines, drip, micro sprinkler and sprinkler irrigation equipment have been made available to the farmers. As a result of the joint efforts made by the public and the private sector, the level of mechanization has been increasing steadily over the years. The government promotes agricultural mechanization with the following goals in mind.

1. Agricultural mechanization should lead to a sustainable increase in yields and cropping intensity with the objective of meeting the planned rate of growth in agricultural production and maintaining it.
2. The income of agricultural workers should rise at a satisfactory rate so that the disparity between urban and rural incomes is contained.
3. The benefits of agricultural mechanization should apply to all types of farmers including small and marginal ones in different regions of the country.
4. Agricultural mechanization should create a worker friendly environment especially for women workers by lessening hard labour, health hazards and improve safety in production operations.
5. Agricultural mechanization should lead to a reduced cost of production of agricultural commodities. This should increase the income of farmers and impart a price advantage while competing for export contracts in the international market.

[3] Government of India, 2011. Department of Agriculture & Cooperation. www.India.org.in

The Government of India (GOI) uses a variety of policy instruments in attempting to achieve these goals. The instruments are domestic subsidies to inputs, outputs, transportation, storage, and consumption to reduce producer costs and consumer prices on the one hand and on the other hand border measures such as subsidies, tariffs, quotas, and non-tariff measures to protect domestic producers from import competition, manage domestic price levels, and guarantee domestic supply (Government of India, 2010).

Agriculture Mechanization in India after Independence

Since India has been known for its agriculture and the development of country was primarily based on development of agriculture. The agricultural mechanization has started in India even before Independence and pre-Independence mechanization of agriculture has been done by use of various agricultural tools, such as plough, drill plough, harrows, leveller, clod crushers and other implements since 17th century. After Independence, in the First Five Year Plan (1951-1956), the Government has paid considerable attention for using agricultural implements for preparing seed bed, cultivation, fertilizer, operation, harvesting and threshing work, processing and utilization of agriculture produce, power driven machine, electric motor, diesel engine for irrigation and other agriculture purpose. Besides all implements the use of tractor technology for agriculture has been very prominent in First Five Year Plan and a total Rs.30.00 crore was invested for importing tractors. The Second Five Year Plan (1956-1961) was designed to bring greater diversification in agriculture production and more attention was given to cash crop such as vegetable, fruit, dairy product, etc. The other important aspect for agriculture development in India in this plan was related to institutional arrangement for promoting land use and land management in a more efficient manner. The Third Five Year Plan (1961-1966) was designed to achieve high agriculture growth and intensive efforts were taken to promote irrigation programmes- comprising major, medium and minor irrigation schemes, for agriculture in India. The role of fertilizer has been important for increasing agricultural production and several efforts were taken to introduce modern technology in rural areas through a comprehensive programme. A community development programme was extended to rural areas for bringing technical assistance and supply within the reach of rural farmers. All villages were planned to serve by block, panchayat and cooperatives. In the Fourth (1969-1974) and Fifth Five Year Plan (1974-1978) emphasis was nearly given on the use of improve agriculture implements research and training centres of industrial tool, electricity generation, etc. in the country. And by this time, the demand of modern agriculture technology that is tractor has been reason high and in 1973-74 annual demand of tractor was over 100000. The efforts were met to increase the indigenous capacity for manufacturing of tractor and several tractor centres were opened in India. The Central Tractor Training Centre in Bundhi and Hissar were expanded. In the Sixth (1980-1985), Seventh (1985-1990) and Eight Five Year Plan (1991-1996), the focuses are given to promote research and development activities in agricultural university, establishing agro industries, agro repair and maintenance centres, scheme for assistance to small and marginal farmers for increasing agricultural production Integrated Rural Development Programme (IRDP), modern irrigation devices like drip irrigation, sprinklers, etc. have been launched and promoted in India.

National Agriculture Policy was framed for bringing major changes in firm produce and agriculture practices in Ninth Five Year Plan (1997-2002). The development of energy, time saving efficient machines and implements, and their adequate production and supply was given special attention in the Tenth Five Year Plan (2002-2007). National Agriculture Policy was focuses on optimal use of land, water and genetic resource in a sustainable manner. Agriculture education and research have also been given priority and till the end of the 9th Plan a network of 49 Research Institutes, 30 National Research Centres, 10 Project Directorates, 28 State Agricultural Universities, and 1 Central Agricultural University have been working for agricultural development in India. National Agriculture Innovation Project (NAIP) and National Agriculture Technology Project (NATP) - two important project have been launched in the Tenth Five Year Planning. NATP is a long term vision of Government of India for bringing a comprehensive agriculture and rural development in the country. The project has focused on research capacity and efficiency enhancement through development of ICAR. It aims to implement the shared understanding of Government of India and the World Bank on technology led poor growth and facilitating the public sector reform process for aspiring the flow of agriculture technology. NAIP also seeks to actualize untapped growth potential and agriculture to generate income and employment opportunities for rural communities across the country. In the Eleventh Five Year Plan (2007-2012) more focuses have been given on mechanisation, and different machines are developed for effective cultivation, intercultural operations, harvesting, grading, packaging, and value-addition for agriculture. The Government of India has planned to increase public expenditure on agriculture research from around 0.7% of agriculture GDP to 1%. The aim of National Agriculture Policy -2000 was to achieve growth of 4% per year, based on efficient use of resource, conservation of soil, water and bio-diversity in a sustainable manner.

Various states like Haryana, Punjab, Maharashtra and Gujarat are considered high in the use of tractors in the country. The 60% population of Gujarat has been depending on agriculture activities. Gujarat Government has set up market boards, research institutes, agriculture universities, various corporation and agencies for adding the development of agriculture sector in the state. Besides all the Gujarat Government has also set up *Kishan Call Centre*, E-gram Network Portals, *Kishan Vigyan Kendra*, *Krishi Mahotsav*, Soil Health Card Schemes for farmers and teaching innovative techniques of farming through soil analysis and genetic crop sciences. Gujarat stands highest in mustered, cotton, onion and potato production in the India. It is the second highest for ground nut, bajra and banana production. And it stands third highest for groom, juwar, mango, pomegranate and tomato in India. In *Krishi Mahotsav* farmer of the state get opportunity for knowledge sharing and orientation toward value added agriculture, modern marketing methods; organic farming etc. The Mini Tractor was probably the main attraction of *Krishi Mahotsav* in 2006.

Tractor as an agriculture technology is widely used for performing multipurpose task in Indian agriculture. Tractor as an agriculture technology and its innovation has mainly noticed in European and American countries. The history of tractor can be trace back from the developmental of Steam Engine. The Royal Agriculture Society of England had given a price of £ 500.0 in 1854 to John Flower, who innovated and agriculture implement, latter on it was known as tractor. The further evolution and innovation of tractor was shared evolution of automobile industries in USA. The early tractor was very heavy machines of

around 10 tones. The first internal commercial tractor had modelled on the similar tone of Steam Traction Engine. After First World War companies, which were engaged in producing war machinery turned to produce agriculture tractor. The companies' rivalry laid the foundation of innovating various tractors and their innovative model in USA and Britain. And these Fowler's Traction, Fordson F, Farmall tractor, Steam Powered Caterpillar, Fergusson, and two wheel garden tractors had been very popular in USA since 1913. The most developed and small tractor finally made by Asian country. Japan has developed four wheel model tractors and also adopted for rice fields and vegetable garden. And other Asian countries like South Korea and India emerged as an exporter for tractors after 1960.

The innovation of Mini Tractor in Gujarat has been done mainly by four people Mansukhbhai Jagani, Bhanjibhai Mathukiya, Mulubhai and Nathalal Rirchanddas Patel. Mansukhbhai Jagani has used Bullet Shanti motorcycle based multipurpose plough, as an alternative for big tractor. It meets, initially various needs for farming such as ploughing, weeding and sowing seeds. Mansukhbhai Jagani has been awarded First National Award by National Innovation Foundation (NIF) in 2001. The Mini Tractor has been design by a grassroots person Bhanjibhai, his son and his nephew who knew the problem of using big tractor in small farms. It was firstly, three wheel tractors followed by a whole series of prototype development and selling of them to the farmers of village. Bhanjibhai has been awarded National Award in Second National Competition of NIF in 2002. Bhanjibhai invented 10 Horse Power (HP) Mini Tractor named it Vanraj. Earlier Vanraj was three wheeler low speed farming tractor and it converted into four wheel high speed tractor. He has obtained patents for his Mini Tractor in India and USA. Nathalal Rirchanddas Patel has developed the Mini Tractor which is useful for interculturing in standing crop. It is cheaper in cost and developed by using Sunny Scooter model. He was awarded Sardar Patel Award by Government of Gujarat for his contribution of Mini tractor in 2005-06. At present Mahindra & Mahindra and Captain DI 2600 two companies are in leading role for producing of Mini Tractor in India. Mahindra & Mahindra has been producing Mini Tractor model Yuvraj-215 and Captain Company is producing Mini Tractor DI 2600. These both tractors are having facility of multipurpose use for agriculture farming especially in small farms.

For the development of tribal of National Tribal Policy has been constituted aiming for providing special plan and institutional arrangement for overcoming the challenge face by tribal in the country. It has covered mainly two point programme - Promotion of development activities to raise the living standards of Scheduled Tribes (ST) community and also protection of their interest through legal and administrative support. In this context Fifth Scheduled and Sixth Schedule of constitution are important to mention. The Fifth Schedule area is covered by PESA Act, which enables tribal community to assume control over their own destiny to preserve and conserve their right over natural resources. Sixth Schedule of constitution is designed to develop autonomy of wide magnitude for district and regional councils in tribal area. A wide range legislative, judicial, executive and financial power have been conferred to this council. It is also described as "a constitution within the constitution". In the year 2011-12 the Department of Welfare of

Schedule Tribe, Ministry of Tribal Development New Delhi has proposed Rs.650.04 crore for the tribal development in Gujarat.

The Government of Gujarat has launched Chief Minister Ten Point Programme for development of tribal areas which is known as *Vanbandhu Kalyan Yojana* in 2007. This programme was allocated a package of Rs.15000.0 crore for five year, which comes Rs.3000.0 crore every year. The main key features of programme are improving family income, imparting skills, dairy projects, setting up of technical institutions, involving local people in planning and monitoring, equal participation of men and women etc. for tribal in the region.

Objectives - The study has following objectives

1. To analyze use of various existing agriculture technology in relation to agriculture productivity of tribal farmers in Surat, Gujarat.
2. To analyze theoretical idea of social shaping of technology in case of invention of Mini Tractor in Surat Gujarat.
3. To identify the effectiveness and availability of technological feasibility of Mini Tractor to tribal farmers in Surat, Gujarat.
4. To study the improvement of socio-economic condition of tribal farmers through the use of Mini Tractor technology in agriculture in Surat, Gujarat.

Literature Review

Brunside (1968) has viewed that a shielded tractor mounted sprayer for research plots, which is described with the increased use of herbicide application with equipment that can be thoroughly cleaned between treatments, and spray applications. This need has stimulated the development of a variety of hand carried, bicycle-mounted and finally tractor-mounted spray shields. The design for experimental sprayers for herbicides numerous and varied some of the early small plot spray devised and small tractor-mounted sprayers are also discussed. The basic components of the sprayers are tractor, shield, boom, pressure system, and spray cans. The disadvantages of wheel tracks are also made during post emergence spray applications.

Sharma (1972) has discussed about the impact of tractor on farm employment in a selected region of Haryana state. The actual displacement of labour by tractors in the area has been quite small. The extent of labour displacement by tractor is likely to increase in the near future because of the rising costs of tractor fuel, and labour are acting as strong compulsions on the farmers to tractorization of all the possible farm operations. The opposition to the use of tractor in over populated countries like India arises from the fear that tractors reduce the requirements of human labour in agriculture. The impact of tractor on farm employment has been considered in terms of both the number of labourers and their utilization. But the contradictory situation has been observed as the tractor farmers employ more permanent labourers than the bullock farmers. This is the fact that the tractor farmers have more family workers than the bullock farmers.

The use of tractor has not affected the requirements of labour for sowing operations. As far as the threshing is concern, all the bullock and tractor, farmers use threshing machines. The labour requirement for threshing is almost the same for both the tractor and bullock farms.

Aurora & Morehouse (1972) in their article have taken up a sing1e developmental event to illustrate the conflicts which invariably accompany attempts to introduce indigenous technology in the face of the existing preference for foreign technology. The paper indicates certain fundamental issues that need to be resolved before which indigenous technology can flourish.

Singh (1979) has studied the determinants of tractorization in Punjab using both rank correlation analysis as well as functional analysis. The study concluded that by variables such as farm size distribution, agricultural productivity, irrigation, rural literacy, and wages of agricultural labour were positively correlated with tractor density. There a negative correlation of tractor density and tractor price, labour density and draft animal density was also noticed.

Morehouse (1980) has discussed about the Indian tractor industry provides an opportunity to examine the basis for the conventional wisdom while technological self-reliance is an attractive political slogan, in the real world. In the real world choices for investment technological options, decision etc, are made and foreign technology in preferred because it is better. It suggests that even in the real world of factory, boardroom, and market place, foreign, technology can be a powerful stimulus to indigenous technology generation because of the demands of this real world.

Gujja et al. (1985) has studied the determinants of tractorization in arid areas of Western Rajasthan and found that the agricultural productivity, size of holding, labour density, draught animal density and rural literacy were important factors for registering a positive impact on the tractorization in the area. It was suggested that a concrete policy to provide sufficient tractors would help to increase agricultural productivity without replacing human labour and draught animal power.

Rijk (1989) this book deals with definition, terminology, and concept on agricultural mechanization strategy formulation in Thailand. It provides a comprehensive review of agricultural mechanization and addresses important development issues of mechanization in relation to crop production, social change, and transfer of mechanization technology and energy consumption. It discusses the need of mechanization policy and strategy.

Ali & Parikh (1992) analyze in their article the relationships among different inputs on tractorized and non-tractorized plots in the North West Frontier Province of Pakistan. This analysis is based on survey data for 1987-88 covering two seasons. A duality approach with a transom cost function is used to estimate cost and input shares. All the assumptions of the duality approach are fulfilled by the estimation procedure and the restrictions of theory are not rejected by the data.

Pagoulatos and Blackwell (1996) have argued that the equipment replacement decision is concerned to minimization of cost in producing output. Model was later extended to incorporating specific expressions for taxes and inflation. The attempts are also made to find out the optimal age at which equipment should be replaced are also made. A dynamic programming framework is proposed to model the decision alternatives of overhauling and trading of a 110-HP tractor. The dynamic programming model considers the relevant costs of owning and operating costs like repair, maintenance, and fuel costs. The implications of alternative tax strategies upon the costs of owning and operating the tractor over a period of time are also examined. The model is expanded to consider a breakdown requiring and overhaul. The result of present and future costs, discount rates, hours of use and planning horizon, the usefulness of the analytical framework are presented and specific information as solution to them are also given.

Singh (1997) gives an overview of the farm mechanization that helps in effective utilization of inputs to increase the productivity of land, labour, irrigation and higher returns that has enabled farmers to adopt mechanization of agriculture.

Viegas (2003) has discussed the rural and agricultural development having and its impact on East Timer's economic agenda. The aim was achieving food self-sufficiency and the quality and standard of living of its people. Agricultural mechanization plays a key role in which the increasing in agricultural productivity. The farmer who knows how to use scientific knowledge for soil, plants, animals and machines can produce a lot of food through even use of poor land. The number of bottleneck like socio-economic, political and technological are needed to be overcome before and then it can be an engine of growth and source of adequate food production. Agriculture is the main source of income for the vast majority of villages and the major concern is of cash shortages in introducing improvements in rural areas where the majority of the poor live. Farmers' extension workers and policy makers will be frequently required to make decisions on the level of technology that is suitable for individual farmers. If we think on agricultural development, the main preoccupied problem, of achieving food self-sufficiency through the adoption of green revolution technologies such as large scale machinery, hybrid seeds, chemical fertilizers, and a large irrigation network has been shortage of cash. Agricultural mechanization embraces the use of tools, implements and machines for farming and land development, production harvesting and on-farm processing. The reason for mechanization mainly expressed in economic terms such as increase in labour productivity, increase in land productivity and decease in production costs. During the period of the green revolution in Asia, besides irrigation schemes the use of tractors was one of the major power sources which shows an increasing trend for all Asian countries for farm mechanization.

Singh (2005) has discussed that agriculture mechanization, which is very important for increasing commercialization of farming in India. There has been increase in the use of farm machinery in Indian agriculture as it contributed to the increase in output due to timeliness of operations and increasing precision in input application. Most of the mechanical inputs have displaced human and bullock labour, which is socially unjustified. He said that mechanization is not going back but we frame suitable policies

such as liberalizing land lease market, encouraging cooperative management and custom hiring of machinery, imparting training to the farmers regarding such investment, encouraging standard service inputs, devising machinery problem from small farmers and dry land cultivation. Many state like Punjab and Haryana have excelled experience in farm mechanization.

Pandey (2005) has discussed about farm equipment and their use for increasing productivity of land and labour through timeliness of operation. It brings improvement in quality of produce safety and comfort of farmers on the one hand and on the other hand it reduces loss of produce and drudgery of farmers. In the article he has discussed about use of tractor as an agricultural technology and its various parts-mould board ploughs, disc ploughs, cultivators and other crop-specific equipment and widely used for seed bed preparation. These equipments are used for farming of cereal crops, soybean, groundnut; sunflower etc. Pandey has emphasized that, harvesting equipment for sugarcane and cotton required to be developed.

Singh and Mani (2008) analyze the influence of subsidies for helping agricultural mechanization and market relation in India. These subsidies are mainly provided in three areas irrigation, fertilizers and electricity. From 1993 to 2002 it amount of Rs.140.7 billion in 1993 to 350.3 billion 2002 in India. It was given mainly to marginal farmers. And subsidy system on agriculture machinery also discussed about status of farm machinery industries in India.

Kulakarni (2009) has discussed about the role playing in increasing production and productivity through appropriate mechanization of agriculture in India. This mechanization of Indian agriculture has bright self-sufficiency and buffer stock in food gain production. This impressive production of food gains is noted in oil seeds, horticultural crops, milk, poultry etc.

Duarte et.al (2009) have discussed about the arrival of modernization, before the beginning of the twentieth century, which changed agricultural production and the whole economy by dramatically reducing work force and improving productivity. It advocates that the negligence of research on the history of farm mechanization is surprising because history of economic growth has been strongly affected by farm mechanization. This paper has studied evolution of a major agricultural input, cause for farm development, the farm tractor, the history of the early tractors, and the mechanism behind the birth of new technologies that pushed agriculture forward. It has used a unique data set of the United States tractor industry through which. It analyzes the evolution of the tractor industry, its major innovations and identifies fundamental breakthroughs. It is supposed to be first where the history of the development of tractors is presented in the fundamental context of innovation.

Vaidyanathan (2010) gives brief description about appreciating the role of technology in raising agricultural output. He emphasizes a long term plan for Indian agriculture with important policy implications, and also argues that agriculture cannot be jacked up to a higher growth trajectory without a significant shift in strategies, priorities and major institutional reforms in India.

The above mentioned studies argue about agricultural technological equipment increasing of productivity of land and labour use of tractor, reduction of loss of produce and drudgery of farmers etc, in relation to various uses of agricultural technologies. There is less number of works available on tractor in agriculture sector, related to technological feasibility, effectiveness and impact of technology on the one hand on the other not a single study has been found on Mini Tractor & its impact on farmers. This proposal tries to explore the use of Mini Tractor technology and improvement of socio-economic condition and productivity of small and marginal farmers in Surat, Gujarat.

Methodology

This study has been based on both primary and secondary data. The secondary sources include government documents, journals, articles, books and national and international reports, and various websites literature dealing with agriculture policy, programmes, use of technology in agriculture sector, tractor and Mini Tractor, etc. The primary data has been generated by using interview and focused group discussion from tribal farmers using Mini Tractors in the field. The study area of research has been two blocks-Mandvi and Mahuva Taluka of Surat, Gujarat. This area is chosen because there are many tribal farmers using Mini Tractor (MT) from only 2 years i.e.2009 onwards. The 50 Tribal Farmers family using MT in Surat has been taken as sample for the study.

The study has been done after conducting the study of 50 small tribal farmers families using Mini Tractor in two blocks-Mandvi and Mahuva where a total 30149 tribal family reside in the district. Only 6% of total tribal family are illiterate out of all 50 families who keep Mini Tractor. 58% tribal family residing in *Pakka* house and the same percentage of tribal family living in joint family, 54% of tribal farmers who keep Mini Tractor have 3 to 4 acre of land. The 76% of tribal farmer grow commercial crop mainly sugarcane and only 24% grow rice. The high majority of tribal farmers i.e., 96% know about State Government policy and programmes for agriculture mechanization and the same percentage of tribal farmer visit frequently the Tribal Sub Plan office in the area. 98% of tribal farmer have used subsidy system for purchasing Mini Tractor in the area. 84% of tribal farmers used attached agriculture implements with Mini tractor for conducting farming. The main socio-economic impacts of Mini Tractor in the life of tribal farmer of the area are observed under following

1. The majority tribal farmer in the district has started doing commercial farming rather than traditional farming.
2. The multipurpose use of Mini Tractor can help farmer in saving their labour charges since before the use of Mini Tractor tribal farmer used to hired labours for conducting various agricultural activities like ploughing, sowing seeds, helping in irrigation, spraying fertilizers and pesticides, harvesting, etc.
3. With the use of Mini Tractor tribal farmers are able to directly save their money from which they used to do purchasing bullocks, bullock cart and rearing and caring of bullocks.

4. Mini Tractor can be a good source of direct income to the tribal farmers in the area. All the tribal families do not keep Mini Tractor and the families, who have Mini Tractor, have bright chance to do business also with use of Mini Tractor on the one hand and on the other it can also help them in employing their unemployed family member/son. As they go to perform various agricultural activities such as ploughs, seed sows, eradicating weeds and harvesting, etc. to those small farmers in the area who do not have Mini Tractor. The rate of Mini Tractor for ploughing land for one hour is Rs.400.00. It provides them a chance to have direct income also.
5. By the use of Mini Tractor in various agricultural activities tribal farmer are able to save their time, which they can use for their families and community life as a quality time. In family they spend this time for their children rearing and caring, their daily education, with relative and in community life for socio – cultural celebration, village celebration, festival, marriage, occasional emergency, etc. in the area.

Conclusion

A wise use of technology has been always problem solving, which also holds true for agriculture. The use of various kind of technology in the area of agriculture leads to enhancement of agriculture production, helping in solving food crisis of country on the one hand and improving its GDP on the other. After acquiring Independence, Indian Government just after Independence has started agriculture mechanization with the help of Five Years Planning and promoting use of several agriculture tools and technology. And probably tractor is the most important multipurpose agriculture technology used in agriculture. Tractor/Big Tractor has been more suitable for big firms and big farmers, not for small firms and small farmers. Big tractor has been always costly in India. It has made small farmers more dependent on tractors own by big farmers even then also all kind agriculture activities are not completely done by big tractor. This high cost and unsuitability of big tractor for small farming have laid compelling condition for technological innovation of Mini Tractor at grassroots level in Gujarat. This research has been an empirical study conducted in the Surat districts of Gujarat. The study covers 50 tribal farmers family who keep Mini Tractors in the two blocks - Mandvi and Mahuva in Surat for its sample size. The main objectives of the study are following

1. To analyze use of various existing agriculture technology in relation to agriculture productivity of tribal farmers in Surat, Gujarat.
2. To examine theoretical idea of social shaping of technology and grassroots innovation in case of Mini Tractor in Surat, Gujarat.
3. To identify the effectiveness and availability of technological feasibility of Mini Tractor to tribal farmers in Surat, Gujarat.
4. To study the improvement of socio-economic condition of tribal farmers through the use of Mini Tractor technology in agriculture in Surat, Gujarat.

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