AN INVESTIGATION INTO THE MECHANISMS OF FARMING SUGARCANE CULTIVATION IN THE ERODE DISTRICTS OF TAMIL NADU

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ABSTRACT

India's agricultural sector has been marked by low salaries, a skewed distribution of land, a huge labor supply relative to demand, and little opportunities for subsistence. The Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS) and other public works initiatives, along with the rise in rural-to-urban migration, have caused significant changes in this sector in recent years. Wages in agriculture have increased as a result of the program. Due to the lack of farm labor, agricultural salaries have increased. The need for labor is primarily seasonal because agriculture is typically a seasonal activity. The main consequences of the labour shortage in agriculture are the delay in field operations, change in cropping pattern, degradation of quality of products and low market price. It has been found that farmers suffer because of labour shortage during peak period of agricultural operations (field preparation to harvesting to post-harvest). To overcome labour shortage in the agriculture, farmers have adopted such strategies as obtaining labour from outside the village, giving contract for farm work, share-farming and farm mechanisation.

KEY WORDS: Agriculture, Labour, Supply, Cropping, Market Price**.**

INTRODUCTION

India's agricultural sector has been marked by low salaries, a skewed distribution of land, a huge labor supply relative to demand, and little opportunities for subsistence. The Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS) and other public works initiatives, along with the rise in rural-to-urban migration, have caused significant changes in this sector in recent years. Wages in agriculture have increased as a result of the program. Due to the lack of farm labor, agricultural salaries have increased. The need for labor is primarily seasonal because agriculture is typically a seasonal activity. During lean seasons, landless, tiny, and marginal farmers (as family laborers) in rural areas provide labor to supplement their meager agricultural revenue. As of right now, agricultural areas and regions with high seasonal labor demand have seen a significant shift in the scenario. Although farm

mechanization could significantly lower the labor need, it is dependent on migrant labor from labor surplus states.

The necessity of automation

i) Power from farms

Manual labor, draught animals, tractors, agricultural tools, implements, equipment, and machinery—all necessary farm inputs—make up this category. The annual cost of farm electricity, labor, draft animals, fuel, and machine depreciation in any agricultural production system is significantly higher than the cost of other inputs like seeds and agrochemicals. Inadequate utilization of farm electricity, low worker productivity, and/or labor scarcity have negatively impacted agricultural production and food security in many developing nations.

The term "mechanization" is frequently misinterpreted, and its true goal—increasing labor and land productivity—is little understood. In actuality, an agricultural technology plan, which is a component of an overall agricultural development strategy, should include an agricultural mechanization strategy. The following is a summary of the three main goals of mechanization in this context:

ii) A rise in worker productivity

The introduction of machines to replace labor and increase labor efficiency is linked to labor migration for jobs in other economic sectors or to enable the cultivation of a bigger area with the same work force.

iii) A rise in the productivity of land

Increasing production on the available land is the goal of mechanization. In order to increase land productivity—for instance, by introducing pump sets or accelerating turnaround times to increase cropping intensity—machinery is a complementing input.

iv) A reduction in production costs

A machine's introduction could reduce manufacturing costs or counteract rising manpower or draft animal costs. Reductions in danger and timeliness, as well as a decrease in the tediousness of farm labor, may offer further advantages to the user.

Mechanization's significance in sugarcane production

One of the most significant cash crops and a key component of the Indian economy is sugarcane. A total of 192.67 lakh tonnes of sugar are produced from 42.45 lakh hectares of sugarcane cultivation. One of the biggest producers of sugar, India and Brazil are vying for the top spot. India has roughly 13.25 and 41.11 percent of the world's total sugar production, and 41.11 percent in Asia.

Uttar Pradesh has the largest sugarcane plantation in India, with 21.4 lakh hectares. Madhya Pradesh has the lowest productivity in the nation (39.3 MT/ha), while Tamil Nadu has the greatest (140 MT/ha).

In terms of the nation's total sugarcane production and cultivated area, Tamil Nadu comes in third and fifth, respectively. It accounts for about 10% of the nation's total sugar production and is one of the state's major commercial crops. About 36.34 million tonnes of sugarcane, with an average yield of 110 t/ha, are produced in Tamil Nadu on about 3 lakh hectares of land, of which 65% is planted and 35% is cultivated as ratoon crop. Sugar, gur, jaggery, khandsari, ethanol, and other items are made with it.

OBJECTIVES OF THE STUDY

1. To examine the sugarcane growers' characteristics
2. To evaluate the degree of farm mechanization awareness and expertise in sugarcane production
3. To determine how much sugarcane growers use farm equipment
4. To investigate the connection between profile traits and farm equipment awareness and usage.

5. To develop and assess sugarcane growers' attitudes on farm mechanization in sugarcane production.

THE STUDY'S SCOPE AND SIGNIFICANCE

Agricultural mechanization refers to the use of different power sources and better farm tools and equipment in order to lessen the labor-intensive tasks performed by humans and draught animals, improve cropping intensity, precision, and timeliness of the efficient use of various crop inputs, and minimize losses at various stages of crop production. The ultimate goal of farm mechanization is to increase total output and productivity while lowering production costs. It is an excellent option for farmers who want to earn more money.

LIMITATIONS OF THE STUDY

The study had the time, resource, and facility constraints that a student researcher would typically face. Nonetheless, sufficient care was taken to ensure that the research was as methodical, objective, and scientific as feasible.

METHODOLOGY

A solid theoretical foundation is essential to the success of any research endeavor. It centers on the three pillars of the research study: plan, structure, and strategy. Everything the researcher undertakes, from choosing the study problem to the last data analysis, is included in the plan. The process of combining the variables under inquiry into a coherent piece of analysis is known as the structure. The particular techniques utilized to collect the data, analyze it, confirm its accuracy, and interpret the findings are referred to as the strategy.

The research techniques and processes used in this study are explained in this chapter. The following subheadings include the grouping and presentation of the methodology.

- Research location
- An explanation of the research area
- Design of research
- Variable selection, operationalization, and measurement
- Technique for gathering data
- Utilized statistical tools
- Conceptual framework

Selection of District

The Tamil Nadu seasonal crop report included the district-specific sugarcane area and production. Erode district was purposefully chosen for the study out of all 32 districts in Tamil Nadu, taking into account the largest area under sugarcane farming. In Tamil Nadu, Erode district ranked top and second for both area and sugarcane production.

Choice of Block

The "block list" for Erode can refer to its administrative divisions, which are the 10 taluks and 20 block panchayats that make up the district. The taluks are Erode, Modakkurichi, Kodumudi, Perundurai, Bhavani, Anthiyur, Gobichettipalayam, Sathyamangalam, Thalavadi, and Nambiyur. The 20 blocks include taluks like Thalavadi and T.N. Palayam, among others.

Table 1
List of the Selected Blocks

Sl.No	Name of District	Name of Blocks
		Ammapet
		Anthiyur
		Bhavani
		Bhavanisagar,

1.	**Erode**	Chennimalai
		Gobichettipalayam
		Kodumudi
		Modakurichi
		Nambiyur
		Perundurai
		Sathyamangalam
		Talavadi
		Thoockanaickenpalayam

SELECTION OF REVENUE VILLAGES

Three revenue villages were selected from each block and accordingly 9 revenue villages were selected from two blocks of each district. Thus, a total of 12 revenue villages were selected.

Table 2
List of selected revenue villages

Sl.No	District	Block	Selected revenue villages
1.	**Erode**	**Bhavani**	Jambai
			Varadhanallur
			Bhavani
			Paruvachi
		Gobichettipalayam	P.Mettupalayam
			Kugalur
			Perunthaliyur
			Alukuli
		Sathyamangalam	Sikkarasampalayam
			Ikkarainegamam
			Allathukkombai
			Arasur

Respondent selection

Considering the researcher's restrictions, a sample size of 100 responders from each block was taken into consideration for the study. A total of 250 sugarcane growers were chosen to participate in the study. Using the following formula, the number of respondents from each chosen block was determined using the proportionate random sampling method.

$$ni = \frac{N_i}{N} \times n$$

Where,

ni   =   Number of respondents to be selected from the ith village

Ni   =   Number of respondents in the ith village

N   =   Total number of respondents in the three villages

N   =   Total number of respondents to be selected from the three villages

Table 3
Distribution of the sample size

Sl.No	District	Block	Selected revenue villages	Population Size	Sample Size
1.	Erode	**Bhavani**	Jambai	617	21
			Varadhanallur	439	15
			Bhavani	393	14
			Paruvachi	150	20
		Gobichettipalayam	P.Mettupalayam	473	14
			Kugalur	594	18
			Perunthaliyur	617	18
			Alukuli	236	16
		Sathyamangalam	Sikkarasampalayam	256	22
			Ikkarainegamam	184	19
			Allathukkombai	238	24
			Arasur	260	28

Source: Primary records from Assistant Director of Agriculture (20011-12), Erode.
Agriculture

The district's residents work primarily in agriculture. Paddy, turmeric, millets, sugarcane, pulses, oil seeds, and cotton are the district's main crops. Table 5 shows the areas covered by various crops.

Table 4
Total area under different crops in Erode district

S.No.	Crops	Area (ha)
1.	Paddy	34,335
2.	Turmeric	65,604
3.	Millets and other cereals	40,130
4.	Pulses	3,985
5.	Sugarcane	30,385
6.	Ground nut	18,444
7.	Cotton	733
8.	Gingelly	7.857

Source: Primary records from Joint Director of Agriculture (Erode District, 20011-12)
The study's research design
Selection, operationalization and measurement of variables
Selection of independent variables

After reviewing the literature and consulting with experts, a set of independent variables pertinent to the goals and nature of the study were first chosen. 34 independent

variables have been found that may have an impact on the dependent variables. On a three-point continuum, the seasoned and senior behavioral scientists and farm scientists were asked to assess each variable's level of relevance. The "relevant," "somewhat relevant," and "not relevant" comments received scores of 3, 2, and 1, respectively.

The mean and coefficient of variation for each independent variable were calculated based on the judges' ratings. Additionally, the coefficient of variations and overall mean were calculated. The following criteria were applied for choosing the variables.

- The mean of each variable should be higher than the total mean. Mean for each individual > Mean for the total

- The coefficient of variation (CV) for each individual variable should be lower than the overall CV.
Individual CV < Overall CV

18 variables were chosen from the judges' assessments using this method. Table 8 provides an overview of the chosen factors and how they were measured. The chosen variables are displayed in the table along with their mean value and CV.

Operationalization and measurement of independent variables

 Age

Chronological age was used as the measure, and age was operationalized as the number of years completed by the respondents at the time of inquiry. According to Trivedi (1963) and Pauline (2012), the respondents were divided into three groups: young, middle-aged, and old. These groups are listed below.

S. No	*Categories*	*Age*	*Scores*
1.	Young	Upto 35 years	1
2.	Middle	Above 35 upto 45 years	2
3.	Old	*Above 45 years*	3

 Educational status

In this study, "educational status" refers to the respondent's years of formal schooling at the time of inquiry. The sub-items included primary school education, middle school education, secondary education, college education, functionally literacy, and illiteracy. A person who lacked the ability to read and write was considered illiterate. A person who could read and write was considered functionally literate. Formal education up to the fifth standard was referred to as primary school education.

The scoring procedure developed by Mansingh (1993) and followed by Anitha Pauline (2011) was used in this study.

S.No.	Category	Score
1.	Illiterate	1
2.	Functionally literate	2
3.	Primary school education	3
4.	Middle school education	4
5.	Secondary school education	5
6.	Collegiate education	6

Occupational status

It has been defined as the occupation in which a person invests a significant amount of time, money, and resources in order to improve their standard of living and support their family. This study employed a slightly modified version of Mansingh's (1993) scoring methodology.

S.NO	Category	Score
1.	Farming alone	4
2.	Farming + wage earner	3
3.	Farming + business	2
4.	Farming + service	1

Farm size

Farm size is defined as the amount of land that a single farmer owns and cultivates. To determine the total area of land, the conversion process outlined in the Tamil Nadu Government notification rules of new project (1974) was used, which equates two acres of dry land to an area of irrigated land. According to Subramanian (2000), the respondents' farms were divided into four groups.

Sl.No.	Category	Score
1.	Up to 2.51 acre (Marginal)	1
2.	2.51-5.02 acre (Small)	2
3.	5.02-10.01 acre (Medium)	3
4.	Above10.01 acre (High)	4

Experience farming

Farming experience was defined as the number of years that the respondent had been engaged in agricultural practice at the time of the inquiry. Based on cumulative frequency, the respondents were divided into three groups: low, medium, and high. This study employed Arulmurugan's (2000) scoring methodology.

Sl.No.	Category	Year	Score
1.	Low	Up to 10 years	1
2.	Medium	11- 20 years	2
3.	High	Above 20 years	3

Area used for sugarcane production

In this survey, "area under sugarcane" meant the percentage of the respondent's entire farm that was planted to sugarcane. This was computed as follows.

$$\text{Area under sugarcane} = \frac{\text{Area under sugarcane cultivation (in acres) x 100}}{\text{Total area of the farm}}$$

Using the cumulative frequency method, the respondents were further divided into low, middle, and high categories. For this study, Jayashree's (2004) grading methodology was applied.

Annual Earnings

The respondent's gross earnings from both agriculture and other occupations during the investigation period were referred to as their annual income. According to Persis (2007), the respondents were categorized as low, middle, and high.

Sl.No.	Category	Amount (Rs)	Score
1.	Low	(< Rs 30,000)	1
2.	Medium	(Rs.30,000 - 60,000)	2
3.	High	(>Rs.60, 000)	3

Finally the respondents were classified in to low, medium and high using cumulative frequency method.

Inventiveness

According to Roger and Shoemaker (1971), innovativeness is the extent to which a person adopts new ideas more quickly than other members of a social system. This study used Marimuthu's (2001) scoring methodology.

When would you like to switch to a better farming method?

Sl No.	Category	Score
1.	As soon as it is brought to your knowledge	3
2.	After you have seen other farmers have tried successfully in their firms	2
3.	You prefer to wait and take your own time	1

Utilization of information sources

The frequency with which the respondents used the three main information sources—institutional, non-institutional, and media—was referred to as information source utilization in this study. In this study, the Madhivanane (1990) scoring method was applied with the necessary adjustments. The responders received ratings of 3, 2, and 1 for "frequently," "sometimes," and "never," respectively

Participation in society

This was a reference to a person's level of participation in a formal organization, either as an office bearer or a member. This study employed Seethalakshmi's (1999) grading method. The following is the scoring method used:

Nature of participation	Score
Member in the Past	1
Office bearer in the past	2
Member at present	3
Office bearer at present	4

Financial incentives

Supe (1969) defined economic motivation as a farmer's relative worth of economic aims and their professional achievement in terms of maximizing profits. Supe's (1969) scale and Pandiyarajan's (1994) scale were used to measure it. Out of the six statements on the scale, only the final one was negative. The following scoring method was used:

Response	Strongly agree	Agree	Undecided	Disagree	Strongly agree
Positive statement	7	5	4	3	1
Negative statement	1	3	4	5	7

Involvement in training pertaining to farm machinery

The number of trainings that the respondents had actually attended at the time of inquiry was referred to in this study as "training undergone." This study employed Ponmani's (1993) scoring methodology. For missing the event, one point was awarded.

Training, plus an extra point for each training session completed. The following scoring method was used.

Availability of labor

The amount of labor available in a timely manner to perform agricultural operations, as well as the operation of farm equipment, including machinery, tools, and implements, as well as labor for maintenance and repairs, is referred to as labor availability. Scores of 3, 2, and 1 were assigned to the categories of availability, readily available, not readily available, and not at all available. This study employed Anitha Pauline's (2012) grading methodology.

S.No.	Availability	Score
1.	Readily available	3
2.	Not readily available	2
3.	Not at all available	1

Understanding of farm automation in sugarcane production

Sugarcane growers' level of knowledge on farm mechanization in sugarcane growing was assessed. According to Bloom et al. (1985), knowledge is defined as behaviors and test scenarios that highlight the recall or recognition of concepts, objects, or phenomena. One of the key elements of behavior is knowledge, which is essential to the adoption of better habits.

Final set of attitude items selected with corresponding S and Q values and the nature of statement

S. No.	Statement No.	Scale Value	Q Value	Statement	Nature of the statement
1.	11	4.890	0.606	Farm mechanization will solve the problem of labour scarcity	Favourable
2.	16	1.531	1.053	High maintenance cost of machinery pose a threat to farm mechanization	Unfavourable
3.	22	4.080	0.691	Farm mechanization reduces the drudgery on human beings	Favourable
4.	44	3.980	0.740	Farm mechanization has made significant contribution in enhancing cropping intensity	Favourable
5.	49	2.793	0.917	Farm mechanization is a male dominated technology	Unfavourable
6.	17	2.220	0.809	Farm mechanization is uneconomical for small land holdings	Unfavourable
7.	19	2.050	0.995	Heavy financial investment is needed to mechanize a farm	Unfavourable
8.	40	3.570	0.625	Farm mechanization helps in effective utilization of inputs	Favourable
9.	20	1.040	0.540	Farm mechanization leads to migration of agricultural labourers	Unfavourable

The scale's dependability

The "split-half" method was used to assess the scale's dependability. Many people believe that the split-half method is the most effective way to measure reliability (Garrett and Woodworth, 1973). Using the odd-even method, the nine chosen attitude items were split into two equal halves (Singh, 1986). Thirty farmers in a non-sample area received the two halves individually. The reliability of the half-test was determined by applying the product moment correlation test to the scores. At the five percent probability level, the half-test reliability coefficient (r) of 0.570 was significant. Additionally, the Spearman-Brown prophecy method was used to calculate the test's overall reliability coefficient. The overall test reliability (rtt)

was 0.726. Singh (1986) states that a reliability coefficient of 0.50 or 0.60 would be adequate when the two groups' mean scores are within a small range. Because the rtt was higher than 0.60, the created scale is therefore trustworthy.

Farm mechanization's effects

In this study, a framework was created. This approach included crop-specific, environmental, social, economic, and physical aspects of advantages and issues. There are three to seven assertions for each dimension, each of which represents a different level of influence. The answers were collected on a two-point continuum, with "Yes" and "No" receiving scores of two and one, respectively.

Sugarcane growers' challenges

Limitations on the use of farm equipment and machinery based on sugarcane The issues that sugarcane growers faced when using farm mechanization in sugarcane cultivation were examined using the Garrette ranking system. The sugarcane growers were asked to rank their perceived problems. The following formula was used to translate the respondents' order of merit for the various issues into rankings.

$$\text{Percent position} = \frac{100\,(R_{ij} - 0.5)}{N}$$

Where

R is the rank that the jth person assigned to the ith factor.

N is the number of factors ranked by the jth person.

The calculated % positions were transformed into scores by consulting Garrett's table . The mean value was then determined by adding each person's scores for each factor. The order of the means was downward. The constraint deemed most significant had the greatest mean value score.

Statistical tools used

The data gathered were quantified and tabulated for statistical analysis.
The following statistical techniques were applied for the study.

1. Percentage analysis

2. Mean and standard deviation

3. Cumulative frequency

4. Correlation analysis

5. Multiple regression analysis

6. Garrette ranking

Distribution of respondents based on their overall Knowledge on farm equipment

(n=200)

S.No.	Category	Number	Per cent
1.	Low	36	18.00
2.	Medium	113	56.50
3.	High	51	25.50
	Total	**200**	**100.00**

Demonstrates that the majority of respondents (56.50%) had a medium level of knowledge, followed by those with high and low levels of expertise (25.50% and 18%, respectively). It may be inferred that a greater proportion of respondents (82.00%) possessed medium to high levels of expertise on farm equipment and machinery based on sugarcane.

Distribution of respondents according to overall extent of utilization on farm equipment

(n=200)

S.No.	Category	Number	Per cent
1.	Low	30	15.00
2.	Medium	138	69.00
3.	High	32	16.00
	Total	**200**	**100.00**

The majority of sugarcane growers (69.000%) used farm equipment at a medium level, followed by 16.00% who used it at a high level and 15.00% who used it at a low level. The majority of responders had medium to high levels of use, which makes sense.

Distribution of sugarcane growers based on their attitude towards farm mechanization

(n=200)

S.No	Category	Number	Per cent
1.	Less favourable	51	25.50
2.	Moderately favourable	111	55.50
3.	Highly favourable	38	19.00
	Total	**200**	**100.00**

As can be seen from the above table, almost two-thirds of farmers had moderately to highly favorable attitudes regarding mechanization, while the remaining farmers had less favorable attitudes. As a result, respondents' attitudes regarding farm mechanization were rather positive. This suggests a very positive view of farm mechanization as one of the best ways to increase labor and land productivity. The respondents' less positive attitudes may be caused by their incapacity to recognize the effects of mechanization on their own farms, low use of information sources, and inadequate revenue.

Suggestions for popularizing farm equipment (n=200)

S.No.	Suggestions	Number	Per cent
1.	Availability of farm implements for hire by the cooperative society at government fixed rate	200	100.00
2.	Providing credit facilities to the small and marginal farmers in purchasing of farm implements	199	99.50
3.	Avoid interfere of agent in hiring farm implements	200	100.00

4.	Providing subsidies to farmers	197	98.50
5.	Training programmes on sugarcane based farm implements	189	94.50

CONCLUSION

India's agricultural sector has been marked by low salaries, a skewed distribution of land, a high labor supply relative to demand, and few opportunities for making a living. Although farm technology might significantly lower the labor requirement, the agriculture in areas/regions with high seasonal labor demand peaks was entirely dependent on migrant labor from labor surplus states. Delays in field activities, altered cropping patterns, declining product quality, and poor market prices are the primary effects of the labor shortage in agriculture. It has been discovered that labor shortages during the busiest times of agricultural operations—from field preparation to harvesting to post-harvest—cause farmers to suffer.

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