**A Study on Agricultural Engineering Equipment in South Tamil Nadu Using Linear Regression**

**Objective:** This study aims to analyze the usage of agricultural engineering equipment across five southern districts in Tamil Nadu— Dindigul, Madurai, Theni, Ramnad, and Virudhunagar—using linear regression. The research seeks to predict which agricultural machinery is most suitable for these areas based on the geographic and agricultural features of the region.

**Methodology:** The research utilized a linear regression model to predict the usage of various agricultural machinery based on real data collected through the DBT portal (https://agrimachinery.nic.in). The key steps in the methodology include:

1. Data Collection:
    - The study gathered data on the names, mobile numbers, and choice of implements for farmers across five districts in Tamil Nadu. The data was sourced from the DBT portal, ensuring it reflects the actual usage patterns of machinery.
2. Linear Regression Approach:
    - Two methods were used for analysis:
        1. Statistical Formula-Based Regression: This involved calculating the mean values for various parameters and using the formula $y=mx+cy = mx + cy=mx+c$, where m represents the slope and c the intercept. A scatter plot was used to visualize the relationship between the predictor variables (e.g., type of machinery, land type) and the dependent variable (e.g., machinery usage).
        2. Python-Based Linear Regression: The study used Python's sklearn library to implement the Linear Regression model. The dataset was divided into training and testing sets, and the model's accuracy was evaluated by comparing predicted values with actual outcomes.

**Results:**

The results of the linear regression analysis indicated several key trends:

1. Machinery Usage Across Districts:
    - The most commonly used machinery was Tractor Type 80 (2WD, 40-70 PTO HP), followed by Tractor Type 160 (2WD, 20-40 PTO HP). The usage of these tractors is crucial for tasks like land preparation, ploughing, and transportation in the region.
    - A line chart revealed that machinery selection is influenced by geographical features, with some districts having distinct preferences for specific types of equipment.

2. District-Specific Findings:
    - Dindigul showed minimal usage of machinery above Type 250, while Virudhunagar exhibited a diverse usage pattern, with machinery up to Type 350 being utilized.
    - Madurai predominantly used machinery within the 40-90 HP range, while Ramnad had the highest population of farmers, influencing a wider range of machinery usage.
3. Impact of Machinery on Agricultural Operations:
    - The use of tractors, rotavators, cultivators, and sowing machines significantly boosted agricultural productivity, helping reduce labor and time requirements. This trend was more pronounced in districts with larger land areas and higher agricultural activity.

**Conclusion:**

This study highlights the increasing adoption of agricultural machinery in South Tamil Nadu, driven by the need to improve efficiency and productivity in farming operations. The tractor (Type 80) emerged as the most commonly used machinery across all districts, followed by other implements like cultivators and rotavators.

The study's linear regression model effectively predicted the suitability of different machinery for various districts, based on geographical and agricultural factors. The findings are valuable for farmers and agricultural consultants in selecting appropriate equipment tailored to the needs of each district, thus aiding in the optimization of farming operations.

**Key Takeaways:**

- The tractor is central to agricultural operations in South Tamil Nadu, with significant variations in usage across districts.
- Linear regression proves to be a useful tool in predicting machinery preferences based on regional characteristics.
- The findings underscore the importance of machinery selection in enhancing agricultural productivity and reducing reliance on labor.

This research provides a valuable framework for understanding agricultural machinery usage and can guide future investments in farming technology, improving the overall efficiency and sustainability of the agricultural sector in Tamil Nadu.

**Keywords:**

Agricultural Engineering, Linear Regression, Machinery Usage, Tamil Nadu, Tractor, Cultivators, Rotavators, Agricultural Productivity.

**Full Paper:** https://www.beei.org/index.php/EEI/article/view/3325

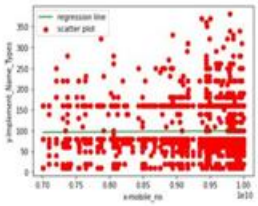


Figure 4. Scatter plot using linear regression with statistical formula

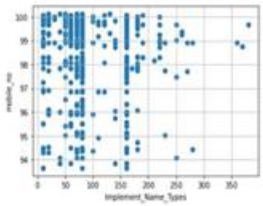
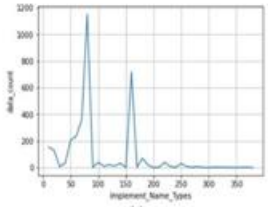


Figure 5. Scatter plot using linear regression by model selection



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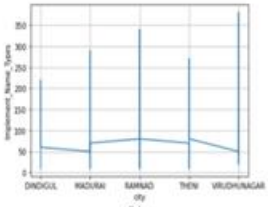

(b)

Figure 6. Line chart showing the machinery used mainly by the farmers all over five districts (a) the relationship between the machine name (in number) and (b) the distribution of the machine among five districts

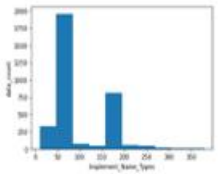

Figure 7. Histogram graph for machinery

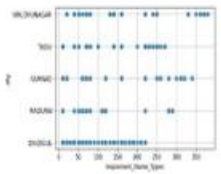

Figure 8. Scatter plot for representation of machinery

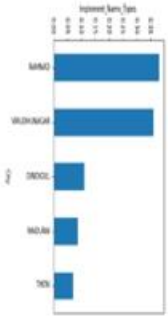

Figure 9. Bar chart for machinery

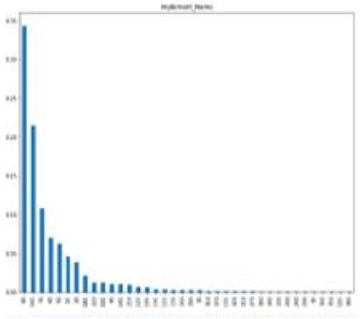

Figure 10. Bar chart for the city as the x-axis & population as the y-axis

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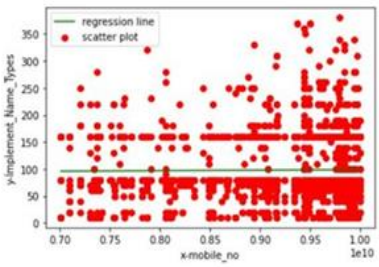
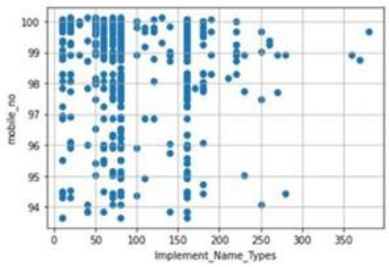



Figure 4. Scatter plot using linear regression with statistical formula

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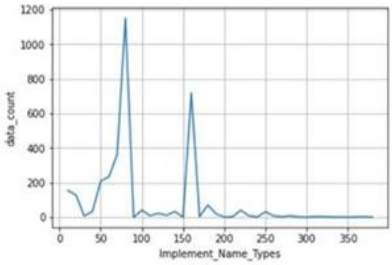


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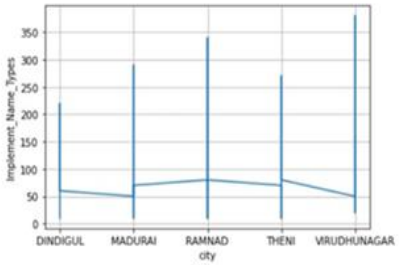


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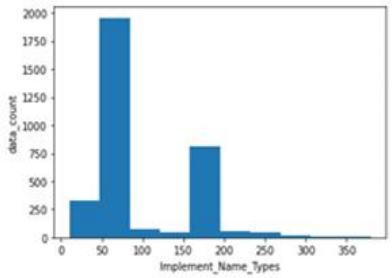


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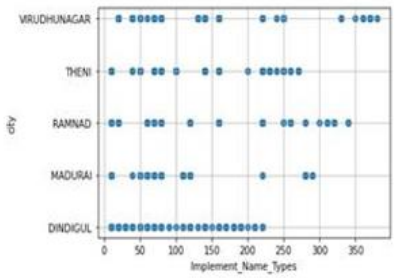


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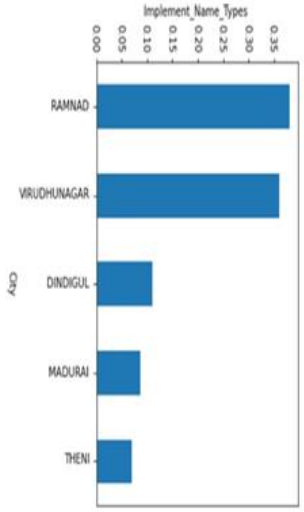


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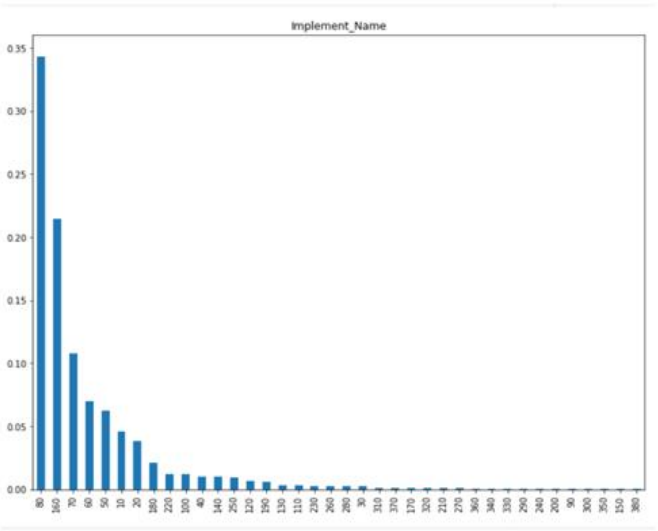


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