Diffusion of Farm Tractor in India from 1960 to 2012: Patterns and Prospects

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**Introduction**

- India has one of the largest tractor industries in the world. On average, about 700,000 tractors are sold in India per annum with its market value of about USD 4 billion. The average tractor use in India is still lower by the world standard, and a huge disparity exists on its uses across states (regions) in the country.
- With a sharply declining trend in draft animal over the years, increased use of farm tractors (and machinery) is inevitable in India now to increase crop productivity, sustain farm households’ income, and rural economic growth.

**Objectives**

- To analyze pattern of growth of tractor uses at national level and across major states of India during the last four decades.
- To evaluate process, speed of diffusion, and ceiling of diffusion of tractors across various states.
- To assess the policy implications for efficient uses of the tractor technology by smallholding farmers in India.

**Methodology and Data**

- We have analyzed market size, growth patterns, and diffusion of tractor across 14 major states of India during the last four decades. This has been done using the diffusion study framework of Griliches (1957):  
  \[ TD = \frac{K}{1 + e^{-(a+K)t}} \]
  where:
  - \( TD \) = Tractor density (tractor per 1000 ha of Net Sown Area (NSA)).
  - \( K \) = Ceiling level of tractor density (model determined)
  - \( a \) = Exponential term
  - \( b \) = Rate of adoption of tractor in a place (slope)
  - \( t \) = Intercept value of the diffusion model
- Secondary data on tractors used are used published from national and state-level agencies of Government of India.

**Results and Discussions**

- The tractor use at all India level has increased exponentially after liberalization of tractor industry policy in 1992 (Fig. 1).
- The adoption and diffusion of tractors in India has been concentrated in Punjab and Haryana than in other states (Fig. 2).

**Fig. 1.** Tractors growth at all India level, 1960 to 2012

**Fig. 2.** Spread of tractors across states of India, 1962-2012. (Unit: Tractor No. per 1000 ha of Net Sown Area)

**Fig. 3.** Trend on male bovine and tractor use in India, 1972 to 2012

**Fig. 4.** Tractor Intensity across states of India in 2012 (Unit: Tractor per 1000 ha of Net Sown Area)

**Fig. 5.** The tractor diffusion curve for all India

**Table 1. Parameters of tractor diffusion curve across states of India, 1982-2012**

<table>
<thead>
<tr>
<th>States</th>
<th>Intercept (n)</th>
<th>Slope (b)</th>
<th>Ceiling (K)</th>
<th>Year associated with ceiling level</th>
<th>Tractor density in 2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Haryana</td>
<td>0.09</td>
<td>232</td>
<td>2051</td>
<td>1992</td>
<td>147</td>
</tr>
<tr>
<td>Punjab</td>
<td>-1.52</td>
<td>0.15</td>
<td>127</td>
<td>2025</td>
<td>125</td>
</tr>
<tr>
<td>Maharashtra</td>
<td>-4.35</td>
<td>0.10</td>
<td>100</td>
<td>2056</td>
<td>24</td>
</tr>
<tr>
<td>Uttar Pradesh</td>
<td>-2.52</td>
<td>0.10</td>
<td>98</td>
<td>2048</td>
<td>64</td>
</tr>
<tr>
<td>Gujarat</td>
<td>-3.03</td>
<td>0.13</td>
<td>62</td>
<td>2045</td>
<td>48</td>
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<tr>
<td>Rajasthan</td>
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<td>0.14</td>
<td>45</td>
<td>2036</td>
<td>40</td>
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<tr>
<td>Madhya Pradesh</td>
<td>-3.62</td>
<td>0.14</td>
<td>44</td>
<td>2047</td>
<td>32</td>
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<tr>
<td>West Bengal</td>
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<td>0.15</td>
<td>7.4</td>
<td>2030</td>
<td>7</td>
</tr>
<tr>
<td>Kerala</td>
<td>-2.05</td>
<td>0.11</td>
<td>7.0</td>
<td>2044</td>
<td>6</td>
</tr>
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<td>All India level</td>
<td>-3.16</td>
<td>0.09</td>
<td>96</td>
<td>2058</td>
<td>42</td>
</tr>
</tbody>
</table>

**Conclusions and Implications**

- The state-specific ceiling rate and slope of diffusion of tractors hugely vary across the states (Table 1).
- Tractor uses in India would continue to grow, and may stabilize when about 15 million tractor uses are there at all India level. There are huge variations on tractor intensity across the states of India (Fig. 2 and 4), ranging from 6 to 150 tractor density in 2012.

- Tractor use may be expanded tremendously after liberalization of its economy in early 1990s, and liberalization of the tractor industry polices.
- Tractor diffusion curves across the states and at all India level suggest that tractor uses will continue to grow in India even in the coming few decades, with a more widespread adoption across the states.

**Reference**


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