HDFC BANK PARIVARTAN
A step towards sustainable progress

WASSAN

Innovation Guild

ASSESSING AND REVIVING AGRICULTURAL MACHINERY AT MANDAL LEVEL

A Case Study from Nallacheruvu

S Sai Mohan, T Harshitha, K Santosh Kumar, K M Likhitha,
B Nandini, M Chandrasekhara Rao

Written by: S Sai Mohan[1]*, T Harshitha[2], K Santosh Kumar[2], K M Likhitha[3], B Nandini[3], M Chandrasekhara Rao[4]

[1,2] Innovation Guild, WASSAN (Watershed Support Services and Activities Network), Hyderabad
[3] B.Tech Student, College of Agricultural Engineering, ANGRAU, Madakasira
[4] Senior Advisor, WASSAN, Hyderabad
**Corresponding Email: saimohan@wassan.org*

Published Date: January 2026

Supported by: WASSAN Kadiri Team (RS team)

Layout Design: Nemani Chandrasekhar (WASSAN)

ASSESSING AND REVIVING AGRICULTURAL MACHINERY AT MANDAL LEVEL

A Case Study from Nallacheruvu

Farm Mechanisation plays a critical role in improving agricultural productivity, reducing labour dependence, and enabling timely farm operations (Singh, 2006; Tiwari *et al.*, 2012). However, in many rural regions, a substantial proportion of farm machinery becomes non-functional due to inadequate maintenance, limited access to repair services, poor availability of spare parts, and the absence of structured post distribution monitoring. This study presents findings from a Gram Panchayat-level assessment of agricultural machinery conducted across 58 villages under eight Gram Panchayats in Nallacheruvu Mandal of Sri Sathya Sai District, Andhra Pradesh. A total of 549 machinery units were documented using a digital survey tool to capture information on machine type, ownership source, functional status, and social category of owners. Results indicate that nearly 31% of the machinery was either non-functional or partially functional, with higher failure rates observed among government-subsidized equipment compared to farmer-owned assets. Ownership patterns also revealed a concentration of machinery among OC and OBC farmers, with limited access among SC/ST households. To address identified gaps, a centralized repair camp was organized, demonstrating the feasibility of reviving idle assets through a decentralized repair and service model supported by Village Level Entrepreneurs (VLEs). The study highlights the need to complement machinery distribution programs with localized maintenance ecosystems, structured monitoring, and inclusive service models to ensure long-term sustainability and equitable access to farm mechanization.

1. INTRODUCTION

Farm mechanization is a cornerstone of modern agriculture, significantly improving productivity, reducing labor costs, and enhancing timely farm operations. However, a substantial amount of farm machinery in the villages become non-functional over time due to wear and tear, lack of timely maintenance, unavailability of spare parts, or inadequate technical expertise for repairs. This leads to reduced efficiency, increased operational costs for farmers, and underutilization of valuable assets.

Over the past decade, several agricultural machineries have been distributed to farmers under various government schemes (e.g., RKVY, SMAM, NFSM) and NGO-led rural development projects (MoAFW, Government of India; SMAM Guidelines; RKVY Guidelines; NFSM Guidelines). While the initial distribution of machinery is often well-intentioned and supported by subsidies or NGO programs, there is a concerning pattern of neglect in ongoing oversight and support mechanisms.

- Lack of service centres nearby
- Lack of technical manpower in the villages
- Non-availability of spare parts
- Negligence in Quality and Suitability Checks
- Lack of Structured Post-Distribution Monitoring
- Accountability and Data Management Issues

These issues directly impact the overall success of agricultural mechanization initiatives, limiting the return on public and NGO investments and ultimately affecting farmer productivity and livelihoods (Mehta *et al.*, 2014; NABARD, 2018). Addressing these negligence points through robust monitoring, responsive repair infrastructure, and better stakeholder coordination is essential for sustainable mechanization advancement.

Machinery Condition in Nallacheruvu Mandal

2. METHODOLOGY

To address this challenge in Nallacheruvu Mandal, WASSAN, via its Innovation Guild initiative and HDFC Parivartan, conducted a GP-level machinery survey followed by a centralized repair camp, with the aim of documenting the status of farm machinery and restoring non-functional equipment through a community-driven repair and service model facilitated by VLEs.

THIS SURVEY WAS DESIGNED WITH THE FOLLOWING OBJECTIVES:

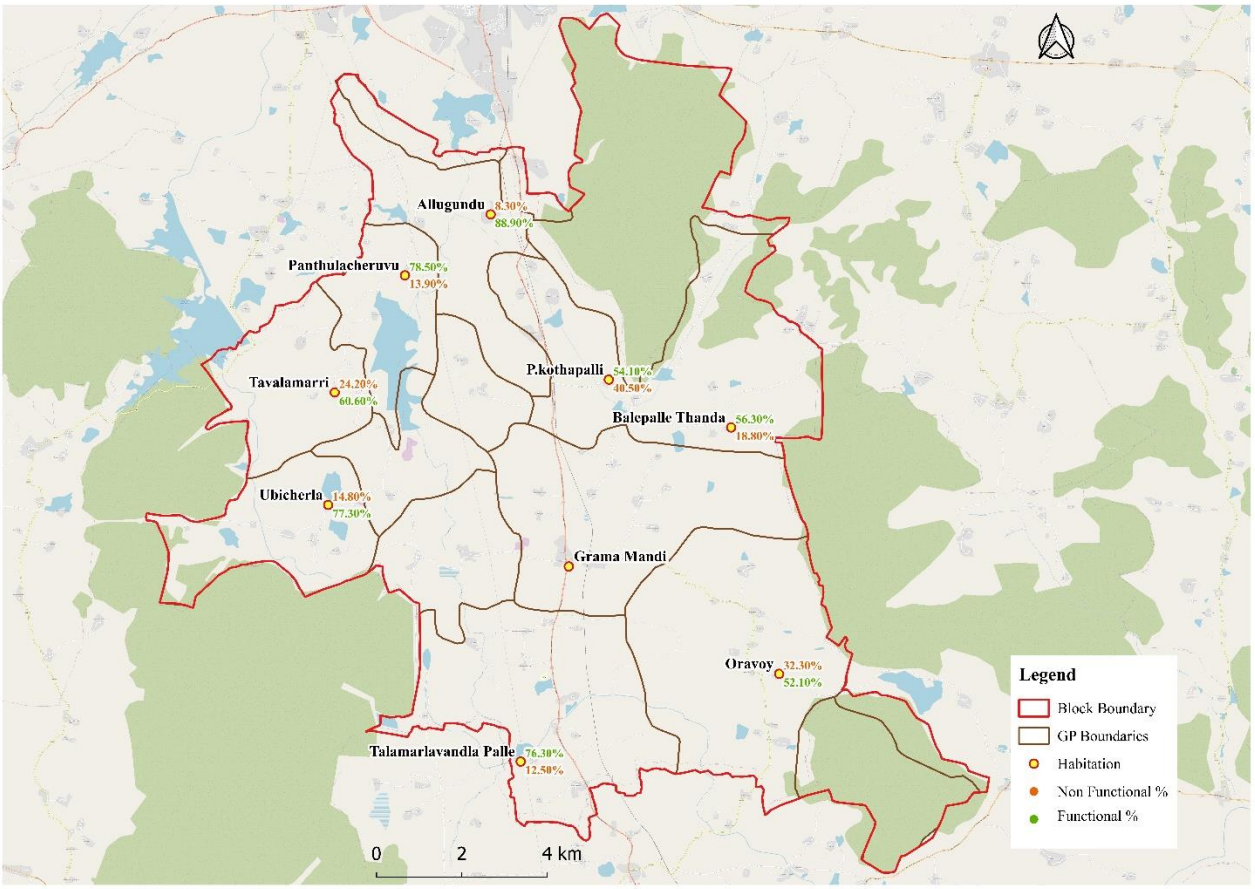
1. To enumerate all agricultural machinery units at the village and Gram Panchayat level across Nallacheruvu Mandal and assess the functional status.
2. To operationalise non-functional agricultural machinery through the creation of a decentralized, sustainable service, repair, and monitoring ecosystem driven by VLEs at Mandal level.
3. To develop an evidence base for improving agricultural mechanization policy at the mandal level.

SURVEY DESIGN AND IMPLEMENTATION

Table 1: Details of GP and villages under survey

District and Mandal	Gram Panchayat's	Number of Villages
Nallacheruvu Mandal, Sri Sathya Sai District, Andhra Pradesh	1. Allugundu 2. Balepallithanda 3. Oruvai 4. Panthulacheruvu 5. P Kothapalli 6. Talamarlavandlapalli 7. Tavalamarri 8. Ubicherla	58 Villages

The spatial distribution of the 8 GPs covered under the study i.e., Allugundu, Balepallithanda, Oruvai, Panthulacheruvu, P. Kothapalli, Talamarlavandlapalli, Tavalamarri, and Ubicherla along with Gram Mandi (Current ASC location) are spread across the mandal's geographic extent. This spatial heterogeneity has direct implications for machinery access, service delivery, and repair logistics, as distance to service points and inter-village connectivity influence both utilization and downtime of farm equipment.



Gram Panchayat (GP) map of Nallacheruvu Mandal

Two interns from College of Agricultural Engineering, Madakasira - Ms. Likhitha and Ms. Nandini as part of their internship with WASSAN conducted the survey. A Data Collection Tool i.e., ODK (Open Data Kit) survey form was developed with an objective to capture following information (Hartung *et al.*, 2010):

- Machinery type and model
- Year of acquisition
- Source of acquisition (Own / NGO / Government Subsidy / Loan)
- Owner details (name, contact, farmer category)
- Social category (SC/ST/OBC/OC) of owner
- Current functional status
- Last maintenance date
- Primary use pattern
- Perceived constraints to utilization
- Geo-location of machinery

VLEs and Interns conducting ODK survey in Nallacheruvu Mandal

DATA ANALYSIS

About 549 machines were surveyed around 8 GPs and 58 villages in Nallacheruvu mandal. Categorized units by functional condition, ownership type and identified critical types of machines frequently non-functional especially power sprayers and power weeders.

Based on survey results, a centralized repair camp was conducted on 6th and 7th November 2025 at WASSAN Office, Nallacheruvu. The camp includes on-site repair of identified machines, hands-on training for a designated VLE for future maintenance services.

LIMITATIONS

- Of the 549 machines surveyed, functionality status of around 42 Govt. subsidised machinery was not disclosed as the response from beneficiaries was very discouraging.
- Survey relied on owner's availability and willingness to participate; some machines could not be verified due to incorrect contact information.
- Functional status assessment was based on owner perception and visual inspection; detailed technical assessment was not conducted.

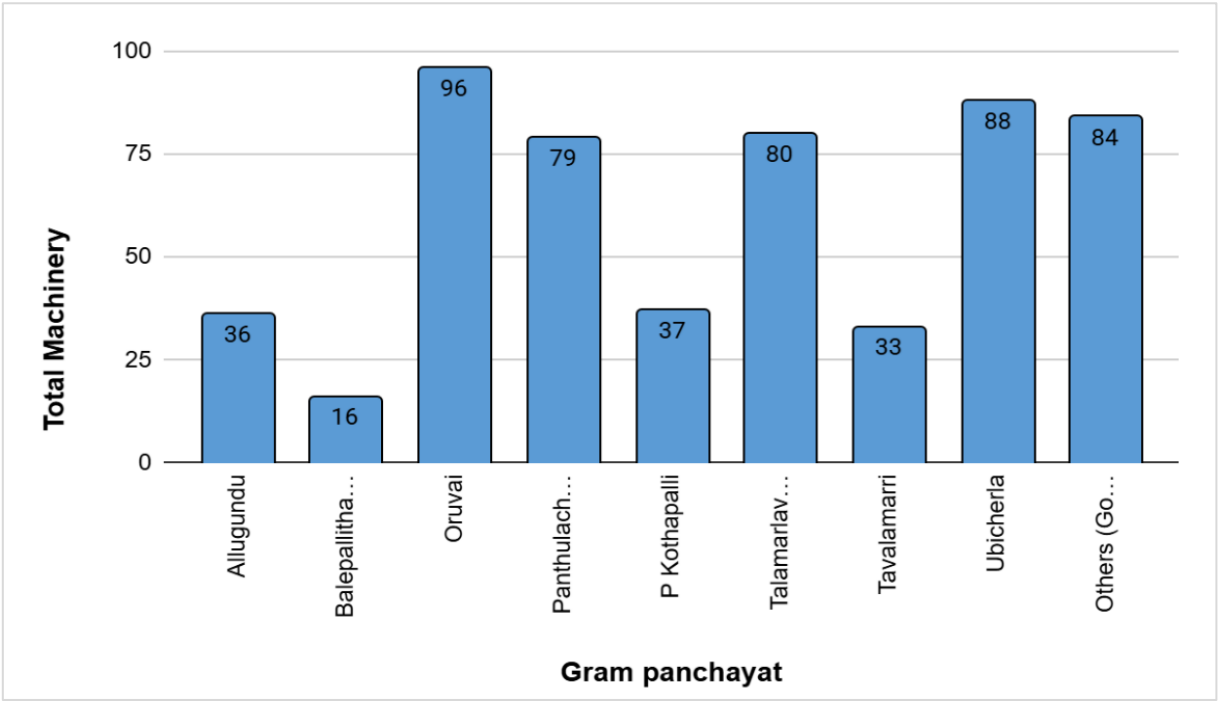
VLE Soma Ganesh doing Knapsack Sprayer repair

3. RESULTS AND DISCUSSION

A total of 549 machines have been surveyed across 8 Gram Panchayats in Nallacheruvu mandal and consolidated the data by location, type, functional status, ownership source, and social category. Examined the performance by analysing the functional, partially functional, and non-functional status, before exploring patterns of ownership by source (own purchase, NGO, or government subsidy) and by social category. The section also interprets how these quantitative patterns relate to questions of equity and programme effectiveness and uses them to justify the need for a more structured, VLE led repair and service ecosystem in the mandal.

3.1 SURVEY FINDINGS

Oruvai has the highest number of machines (96), followed closely by Ubicherla (88) and Talamarlavandlapalli (80). Together, these three GPs account for 264 machines, which is almost half of all surveyed machinery in the mandal. This indicates that mechanization is clustered in a few GPs, likely due to higher farmer investment, better access to schemes, or prior NGO/government focus (Birthal *et al.*, 2017).



Number of machines surveyed with respect to each GPs

3.2 OVERALL MACHINERY INVENTORY

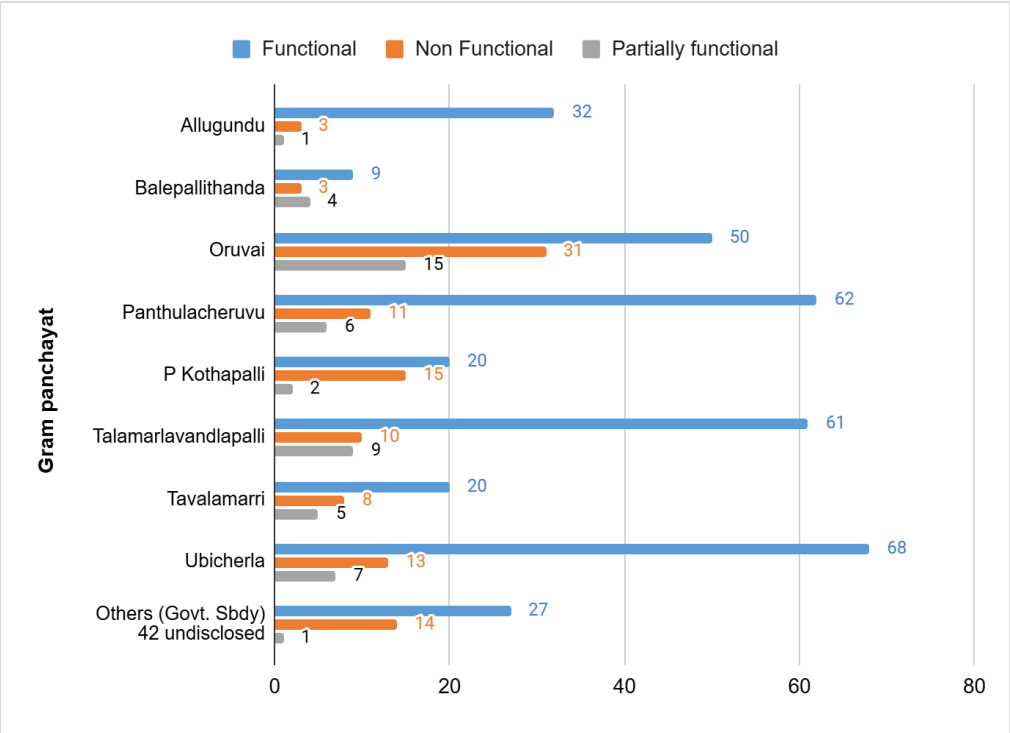
The table presents a consolidated inventory of all agricultural equipment documented in the Nallacheruvu mandal survey, showing 28 distinct machine types and the number of units recorded for each. It highlights the dominance of spraying equipment and core power units such as knapsack sprayers, tractors, rotavators, and various cultivator models which together account for the majority of machines in use, while also capturing medium-frequency post-harvest and processing tools like flour mills, grinders, and chaff cutters.

Table 2: Unique list of Machinery in Nallacheruvu mandal

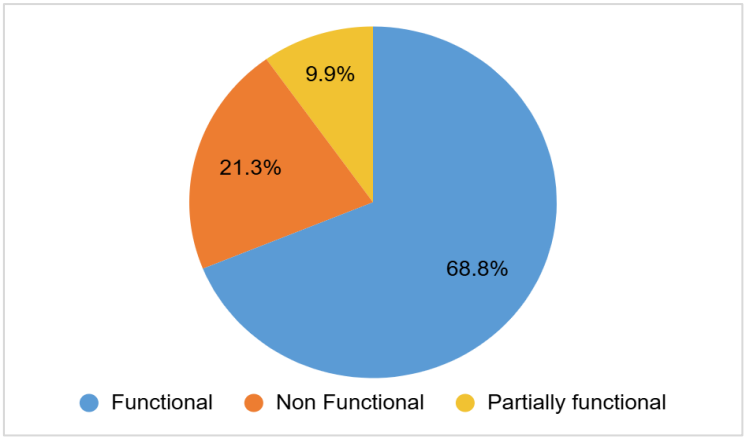
Machinery Name	No. of machines	Machinery Name	No. of machines
Knapsack Sprayer 4-Stroke Engine Operated	128	Groundnut Decorticator	6
Tractor	62	Guntaka	6
Cultivator	55	Thresher	5
Knapsack Sprayer - Battery Operated	51	Mini tractor	4
Rotavator	49	Post Hole Digger - Engine- Trolley Mounted	3
Portable HTP Spray Pump	28	Brush Cutter	2
Flour mill	23	Knapsack Sprayer - Manual	2
Masala Grinder	18	Oil Extractor	2
Chaff Cutter	17	Agni cart	1
Power Weeder	12	Combo Sprayer	1
Seed cum Fertilizer Drill	11	Irrigation Pump	1
Oil Engines	9	Pulverizer	1
Manual Tools -Cycle Mandava Weeders	8	Rain Gun	1
Bund Former	7	Soil Leveler	1

3.3 FUNCTIONAL STATUS ANALYSIS

Out of 549 units, 349 machines (about 68%) were functional, 108 (around 21%) were non-functional, and 50 (about 10%) were partially functional, meaning nearly one-third of the mandal's machinery pool was not fully operational at the time of survey. Breaking down by Gram Panchayat, Oruvai, Ubicherla, and Talamarlavandlapalli contribute the largest number of machines and also report substantial non-functional and partially functional units, making them priority clusters for repair support. This pattern indicates that mechanization is not only spatially concentrated but also that breakdowns are concentrated in the same high-mechanization Gram Panchayats.



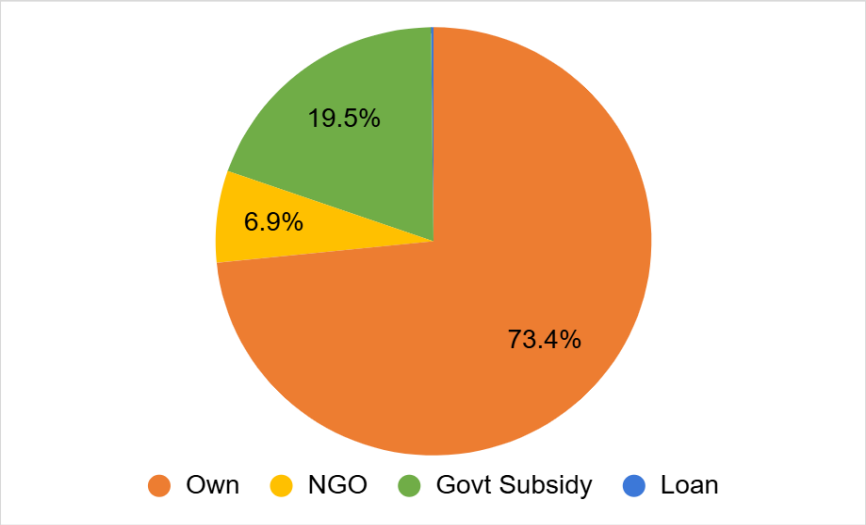
Functional status of machinery with respect to each GP



Overall percentage of functionality status

3.4 MACHINERY ACQUISITION SOURCE ANALYSIS

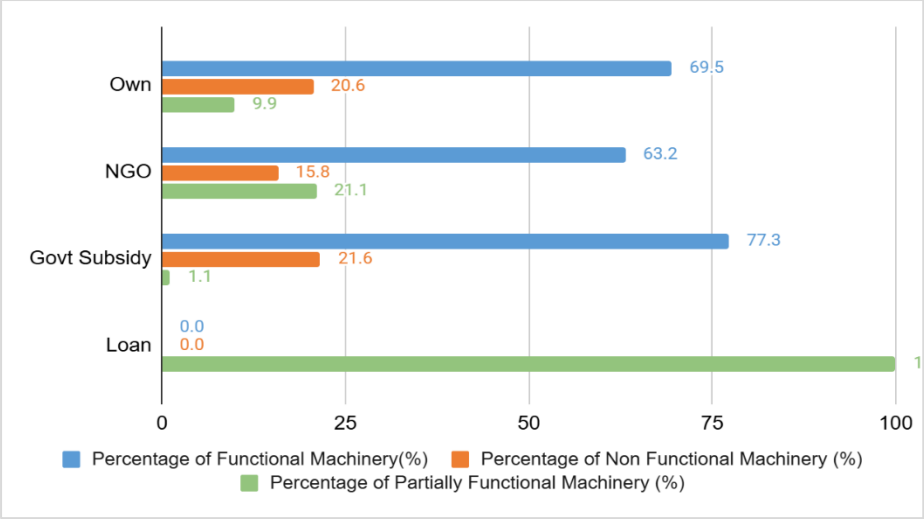
The majority of equipment was farmer-purchased, with own investment accounting for about three-quarters of all machines, while NGOs contribute roughly 7% and government subsidy programs about 19.5%, with loans representing a negligible fraction of the total stock. This implies that even in a context where many schemes exist, most of the capital stock has been built through direct household spending rather than institutional finance, underscoring both the willingness of farmers to invest and the need to protect these investments through stronger service and repair systems.



Overall percentage of machinery ownership status

3.5 SOURCE OF MACHINERY VS FUNCTIONAL STATUS

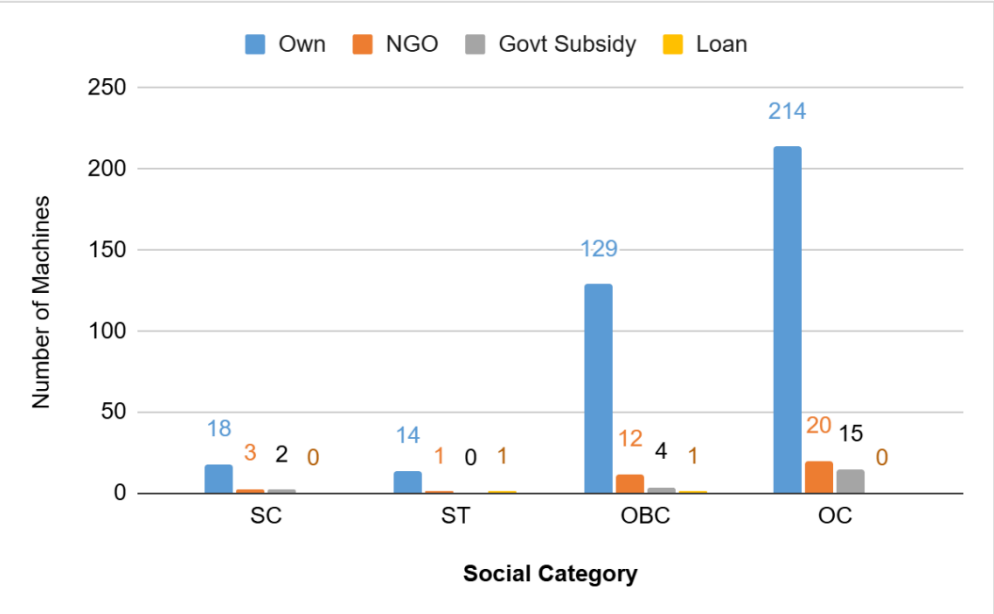
The correlation between sources of machinery to functional status reveals important performance differences between acquisition channels i.e., own, NGO, Govt. Subsidy and Loan. Among 403 directly owned machines, 83 units (20.6%) are non-functional, while NGO-supplied machinery has a smaller count but a relatively lower non-functional share (about 6 units or 15.8% of NGO machines). Government-subsidy machines have a higher proportion of non-functional units, i.e., 19 machines, or roughly 21.6% of all subsidized equipment despite being fewer in number, suggesting that subsidy-based distribution has not been matched by adequate after-sales support, training, or spare-parts access. The chart also highlights that own and NGO channels deliver most of the functional stock, while government-subsidized machinery was more prone to fall into disrepair, strengthening the argument for structured post-distribution monitoring and mandatory service mechanisms in public schemes.



Analysis of functionality status in relation to machine ownership

3.6 OWNERSHIP DISTRIBUTION WITH RESPECT TO SOCIAL CATEGORY

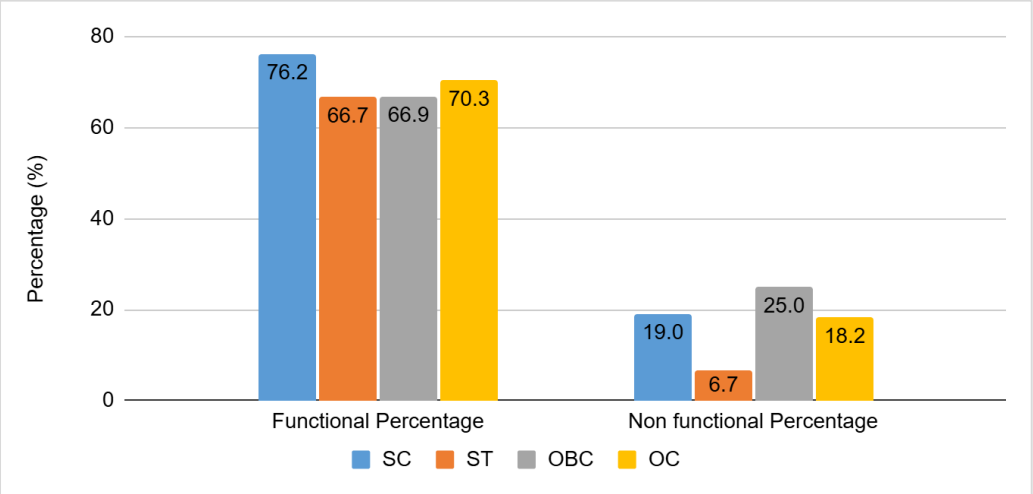
The ownership distribution chart shows that about 57% of all machines were owned by OC farmers, 34% by OBC farmers, and only a negligible share by SC and ST individuals, with similar decline seen in both government subsidy and NGO-supported assets. In other words, institutional programs that were expected to broaden access have not sufficiently corrected existing patterns of social advantage, because most subsidized and NGO-supplied machines have also gone to OC and OBC farmers rather than to SC/ST or landless households (Birthal *et al.*, 2017; FAO, 2016).



Relationship between social category and machine ownership

3.7 SOCIAL CATEGORY VS FUNCTIONAL STATUS

Analysing the individual social-category with respect to functional-status shows that OC farmers hold the largest machinery share and also the largest pool of functional, non-functional, and partially functional machines, followed by OBC, with SC and ST farmers appearing only in small numbers in every category. Because ownership itself was biased, even where machines are working the benefits were received disproportionately to OC and, to a lesser extent, OBC households, while SC/ST farmers have very limited access to either functional or repairable machinery. The fact that non-functional units are also concentrated among OC and OBC groups indicates that issues are not only about breakdowns but about access, and that repair-camp and subsidy design must explicitly target under-represented SC/ST segments if mechanization is to be socially inclusive.



Analysis of functionality status in relation to social category

3.8 KEY INSIGHTS FROM THE SURVEY

- Out of a total of 549 units surveyed, 349 were functional, 108 were non-functional, and 50 were partially functional
- The majority of equipment (76%) was owned directly by individuals, while 6.9% comes from NGOs, 19.5% was acquired through government subsidy programs, and only 0.2% via loans.
- Among 403 machines owned directly, 83 units (20.6%) were non-functional, while 6 units (15.8%) from NGO sources and 19 units (21.6%) from government subsidies were also non-functional.

- Machinery ownership remained highly with OC (57%), followed by OBC (34%) and negligible percentage with SC and ST individuals. A similar trend was recorded in terms of Govt subsidy and NGO programs.

3.9 REPAIR CAMP OUTCOMES

To address the large proportion of non-functional and partial functional machinery, a centralized Machinery Repair Camp was conducted at WASSAN Office, Nallacheruvu on 6th and 7th November 2025.

Farmers from the respective Gram Panchayats participated by bringing their non-functional machinery. Around 25 machines, including power weeders, knapsack battery sprayers, and 4-stroke petrol sprayers, were successfully repaired with two skilled technicians facilitating the repair process and providing hands-on training to VLE Soma Ganesh, enabling him to independently handle future repair needs.

Repair camp conducted at WASSAN Office on 6th and 7th November, 2025

Through the repair camp initiative, restored the functionality of machines that otherwise would remain idle or underutilized; built local capacity for future maintenance; demonstrated a model for decentralized repair and service delivery (MoAFW, 2019 – CHC Guidelines).

4. CONCLUSION

A comprehensive survey of 549 agricultural machinery units across Nallacheruvu Mandal reveals a mechanization landscape characterized by significant potential but constrained by maintenance challenges and geographic concentration. About 31% of the machinery was non-functional and partially functional representing both a challenge and an opportunity. The dominance of sprayer technology (43% of inventory) combined with high failure rates (29-43% in various sprayer categories) indicates that this technology has rapidly diffused, but maintenance systems have not kept pace.

Equally important was addressing equity dimensions: the concentration of machinery ownership among OC and medium farmer groups, and the significant underrepresentation of SC/ST and landless farmers, suggests that subsidy schemes and NGO programs have not effectively reached marginalized groups.

The current intervention via a community-based repair camp and VLE-driven maintenance model offered several economic advantages such as restoration of existing assets, improved utilisation, local service availability and timely availability in cropping calendar.

Thus, promoting village-level maintenance & service mechanisms, through VLEs or custom hiring centers (CHCs), can bridge the gap between machinery availability and functional utilization. This case demonstrates that subsidizing machinery was not sufficient, local after-sales support, spare parts access, training, and community-based service models are critical for the long-term success of mechanization efforts (MoAFW, 2019).

5. POLICY IMPLICATIONS AND OPERATIONAL LESSONS

The findings from this mandal-level assessment offer important policy and operational insights for improving the effectiveness of farm mechanization programs in rural India. While substantial public investment has been made through subsidy-driven machinery distribution schemes, the evidence from Nallacheruvu Mandal highlights that distribution alone does not ensure sustained utilization. Nearly one-third of the machinery stock being non-functional or partially functional represents a significant loss of productive capital, underscoring the need for policy frameworks that emphasize the full lifecycle of agricultural machinery rather than focusing solely on asset creation.

One of the most critical lessons emerging from this study is the absence of structured post-distribution support mechanisms in government subsidy programs. Although schemes such as SMAM and RKVY have succeeded in expanding access to machinery, limited attention has been paid to local repair infrastructure, operator training, spare-parts availability, and periodic monitoring. The higher proportion of non-functional machinery among subsidized assets compared to farmer-owned equipment suggests that beneficiaries may lack both incentives and institutional support to maintain machinery once it is delivered. Integrating mandatory service agreements and follow-up inspections into subsidy guidelines could significantly improve machinery longevity and return on public investment.

The study also reveals the importance of decentralized, community-based service models in addressing maintenance gaps. The centralized repair camp demonstrated that even short-duration interventions can restore functionality, build local capacity, and re-engage farmers with idle assets. More importantly, the involvement of Village Level Entrepreneurs (VLEs) in the repair process illustrates a scalable pathway for sustaining mechanization services at the grassroots level. By embedding repair, maintenance, and rental services within the local economy, VLE-led models reduce farmer dependence on distant service centers, minimize downtime during peak agricultural seasons, and generate local employment opportunities.

The ownership analysis indicates that machinery whether privately purchased, subsidized, or NGO-supported is disproportionately concentrated among OC and OBC farmers, with SC/ST households remaining largely excluded. This pattern suggests that existing institutional mechanisms have not sufficiently corrected structural inequalities in access to productive assets. Future mechanization programs must therefore adopt more targeted beneficiary identification, group-based ownership models, or community-managed Custom Hiring Centres (CHCs) to ensure inclusive access, particularly for smallholders, tenant farmers, and marginalized social groups.

From an operational perspective, the use of digital tools such as ODK for machinery mapping and monitoring proved effective in generating granular, geo-referenced data at scale. Such systems can serve as the foundation for a dynamic machinery registry at mandal or district level, enabling real-time tracking of functionality, repair history, and service demand. Institutionalizing digital monitoring within government and NGO programs can support evidence-based planning, early identification of breakdown trends, and better allocation of repair and training resources.

Overall, this case study demonstrates that policies that combine machinery distribution with decentralized repair ecosystems, trained local service providers, digital monitoring, and equity-focused targeting are more likely to deliver durable productivity gains and inclusive rural development outcomes.

WAY FORWARD

- Build a roster of trained VLEs per Gram Panchayat who can offer rental & repair services, with basic tool kits for minor repairs.
- Maintain a logbook/database of machinery status, repairs, and service history to monitor breakdown trends and plan preventive maintenance.
- Facilitate linkages for spare parts access within the region to avoid delays.
- Explore financing or incentive mechanisms (via subsidy or community-funding) for upkeep of machines, to ensure sustained operation.
- The current survey covers 8 GPs and 58 villages; broader coverage across mandal or districts will give better representation.
- The repair camp addressed only a subset of non-functional machines (≈25 units) due to less beneficiary participation. Many remain unattended, a systematic follow-up mechanism is necessary.
- Further research may examine utilization rates, service-demand patterns, and viability of rental/repair business models (via VLEs) under varying cropping and socio-economic conditions.

ACKNOWLEDGMENTS

Authors express their sincere gratitude to WASSAN for providing institutional support, guidance, and enabling environment necessary to undertake this study. Authors also acknowledge the support of HDFC Parivartan, whose partnership and financial assistance made the machinery repair camp possible. Sincerely thank the interns from the College of Agricultural Engineering, Madakasira - **Ms. Likhitha** and **Ms. Nandini**, for their committed fieldwork, meticulous data collection using digital tools, and active participation in the survey and repair camp activities.

REFERENCES

- Birthal, P. S., Khan, M. T., Negi, D. S. and Agarwal, S. (2017). Custom hiring services of farm machinery in India: Evidence from a field survey. *Indian Journal of Agricultural Economics*. 72(3): 365–378.
- FAO. (2016). *Sustainable Agricultural Mechanization: A Framework for Africa.* Food and Agriculture Organization of the United Nations.
- Hartung, C., Lerer, A. and Anokwa, Y. (2010). Open Data Kit: Tools to build information services for developing regions. *Proceedings of the ICTD Conference*.
- Mehta, C. R., Chandel, N. S. and Senthilkumar, T. (2014). Status, challenges and strategies for farm mechanization in India. *Agricultural Mechanization in Asia, Africa and Latin America*. 45(4): 43–50.
- Ministry of Agriculture & Farmers Welfare (MoAFW). (2019). *Operational Guidelines for Custom Hiring Centres (CHCs).* Government of India.
- Ministry of Agriculture and Farmers Welfare (MoAFW). *Sub-Mission on Agricultural Mechanization (SMAM) – Guidelines.* Government of India.
- NABARD. (2018). *Status of Farm Mechanization in India.* National Bank for Agriculture and Rural Development.
- Singh, G. (2006). Estimation of a mechanization index and its impact on production and economic factors. *Biosystems Engineering*. 93(1): 99–106.
- Tiwari, P. S., Gite, L. P., Dubey, A. K., and Kot, L. S. (2012). Agricultural mechanization in India: A review. *CIGR Journal*, 14(4): 1–15.