Study on

Machine Service Providers:
Reaching Last Mile Smallholders with Agro-Machinery Service in Bangladesh

CSISA-MEA, CIMMYT & iDE,

August 2024

Executive Summary

This study conducted by CSISA-MEA in partnership with CIMMYT and iDE, focuses on the operational landscape, challenges, and opportunities for Machine Service Providers (MSPs) in Bangladesh. MSPs are crucial for smallholder farmers as they provide access to key agricultural machinery, thus enabling enhanced agricultural productivity and sustainability. The study surveyed 2,608 MSPs across 21 districts, encompassing both coastal and non-coastal areas, to assess the status of these service providers and identify the key issues they face.

Key Findings:

1. **Functional Status of MSPs:** The study found that 54.75% of MSPs are active, while 45.25% are inactive. A significant disparity exists between coastal and non-coastal areas, with 86.90% of active MSPs located in the non-coastal regions (Area 1), compared to only 13.10% in coastal regions (Area 2).

2. **Challenges Faced by MSPs:** Key challenges include machine damage, unavailability of spare parts, and operational difficulties. Machine damage is the most significant issue, contributing to the inactivity of 938 machines. Area 2 faces a higher incidence of spare parts unavailability, indicating regional disparities in operational challenges.

3. **Business Viability:** Despite the challenges, 90% of MSPs in Area 1 and 83% in Area 2 report their businesses as viable, though Area 2 faces slightly higher financial and operational obstacles.

4. **Support Needs:** MSPs across both areas require stronger linkages with machine suppliers, financial support, and improved access to government subsidies. Training and access to reliable machinery are particularly critical in Area 2, reflecting a need for tailored interventions.

5. **Popular Machines:** The most commonly used machines include the Power Tiller Operated Seeder (PTOS) and Combined Harvester (CH). However, operational issues, especially with the PTOS and Axial Flow Pump (AFP), highlight the need for better maintenance support and operator training.

Recommendations:

1. **Enhance Machine Adoption:** Strengthen the value chain by improving access to quality spare parts, technical support, and operator training. Government and private sector initiatives should focus on integrating practical training for youth and women into existing programs.

2. **Support Infrastructure:** Develop sustainable local workshops for machine repair and maintenance. Encourage market assessments to ensure the availability of critical spare parts and promote domestic manufacturing where possible.

3. **Tailored Support Packages:** Address regional disparities by providing specific support based on the unique needs of MSPs in coastal and non-coastal areas. This includes financial aid, stronger customer linkages, and targeted training programs.

4. **Policy Interventions:** Encourage open market competition for machine services, with subsidies only in critical environmental areas. Improve machine distribution processes, focusing on quality assurance and operational sustainability.

This report highlights the importance of MSPs in supporting smallholder farmers and identifies critical areas for intervention to ensure the long-term viability of machine services in Bangladesh's agricultural sector.

Abbreviations:

AFP	Axial Flow Pump
CH	Combined Harvester
CSISA-MI	Cereal System Initiatives for South Asia- Agricultural Mechanization and Irrigation
CSISA-MEA	Cereal System Initiatives for South Asia- Agricultural Mechanization and Manufacturing Extension Activity
CIMMYT	International Maize and Wheat Improvement Center
FC	Fodder Chopper
iDE	International Development Enterprise
MSP	Machine Service Provider
PTOS	Power Tiller Operated Machines
RM	Reaper Machine
RT	Rice Transplanter
USAID	United States Agency for International Development

Contents

Tables

Figures

1.0 Introduction

The machine hiring service for key agricultural equipment, such as combined harvesters, reapers, irrigation machines, power tillers/tractors, seeders, threshers, and shellers, is predominantly operated by thousands of individual Machine Service Providers (MSPs). These MSPs typically acquire their machines from private lead firms- manufacturers or importers- often with government incentives and support from dealers, banks, and their own financial resources. Additionally, MSPs rely on local mechanics, commission agents, parts shops, and various metal workshops to sustain their operations.

Currently, the machine hiring business is primarily focused on activities such as ploughing/land preparation (90%), irrigation, pesticide spraying, combined rice harvesting, rice planting, threshing, potato harvesting, maize shelling, and fodder chopping (Rahman et al., 2021). However, there remains significant potential for expanding services in rice planting, harvesting, and post-harvest processing. There is also an opportunity for agrochemical dealers to transition into agro-machinery dealers, service firms, or cooperatives.

Despite their widespread presence, MSPs remain fragmented and unorganized, lacking a unified platform. Integrated, value-added service companies have yet to emerge in this sector. Moreover, many clients, service providers, and market actors do not fully understand the business aspect of machine hiring services. By offering integrated services, MSPs- or a private entity- could make agricultural machinery more accessible to smallholder farmers.

The commercialization of agricultural machinery hiring services for smallholders is vital for advancing agricultural productivity and sustainability. To successfully commercialize these services, it is crucial to deepen our understanding of the economic, social, business, and technical dimensions of the machine hiring industry. Key concerns include how Machine Service Providers (MSPs) can be effectively institutionalized and commercialized to deliver value-added, integrated services. This report presents findings from the CSISA-MEA's engagement with MSPs, highlighting their current challenges and providing actionable recommendations for future improvements.

The primary objectives of this research are as follows:

- Evaluate the Functional Status of MSPs: To assess the current operational status of Machine Service Providers (MSPs), distinguishing between active and inactive service providers within the study area.
- Identify Key Challenges in the Machine Hiring Business: To identify and analyze the major challenges faced by MSPs, including barriers to business operations, issues related to machine maintenance, and factors contributing to the inactivity of some service providers.
- Determine High-Demand Agricultural Machinery: To evaluate the types of agricultural machinery in highest demand among smallholder farmers and understand the factors influencing the adoption and use of these machines by MSPs.

- Assess the Effectiveness of Current Support Packages: To review the support packages currently available to MSPs, including training, linkages with suppliers, government subsidies, and after-sales services, and to identify areas for improvement.
- Explore Opportunities for Commercialization and Institutionalization of MSPs: To investigate potential strategies for the commercialization and institutionalization of MSPs, aiming to enhance their ability to provide integrated, value-added services to smallholder farmers.
- Provide Recommendations for Future Support and Policy Interventions: To develop actionable recommendations for stakeholders, including government agencies, donors, and private sector partners, to improve the sustainability and effectiveness of the machine hiring service sector.

2.0 Methods

In 2024, the CSISA MEA project management decided to conduct a comprehensive survey to update the list of Machine Service Providers (MSPs) and determine their functional status—whether active or inactive. While the initial plan was to conduct a census of the identified 4,483 MSPs, resource constraints led to a sample survey of 2,608 MSPs across 21 districts, encompassing both coastal and non-coastal regions.

For the purposes of data collection and analysis, the districts were divided into two distinct areas:

- Area 1 (Non-Coastal): Comprising twelve districts known for high agricultural productivity and riverine areas—Jashore, Kustia, Magura, Jhenaidah, Chuadanga, Faridpur, Rajbari, Gopalganj, Shariatpur, Madaripur, Narail, and Meherpur.
- Area 2 (Coastal): Including nine coastal districts—Satkhira, Khulna, Bagerhat, Patuakhali, Barguna, Barisal, Bhola, Jhalokathi, and Pirojpur.

A comprehensive survey questionnaire was developed to cover various aspects such as the demand for machines, reasons for MSPs being active or inactive in the service business, support packages received, new support needs, business nature, challenges faced, and future actions. The data collection process was carried out by well-trained enumerators, and the collected data was subsequently cross-checked, cleaned, and analyzed with support from an in-house monitoring team and experts.

The classification of MSPs as active or inactive was based on a direct question about their current business status. Additionally, respondents were asked if they had transferred ownership or sold their machines to new operators. MSPs were classified as inactive if they responded "no" to the question of being active.

The survey found that the largest proportion of the surveyed population operated Power Tiller Operated Seeders (PTOS) and Axial Flow Pumps (AFP), followed by Reaper Machines (RM) and Combined Harvesters (CH). Among female Machine Service Providers, the primary machines operated were PTOS, AFP, RM, Rice Transplanters (RT), and CH.

Table 1: Name, total number, percent of machine service provider by area and gender (N= 2608)[1]

Area(N)	Gender	Machine name	Number of machines used (n)	Machine used (%)
Area 1 (n=2005) (100%)	Male (1953) (97.41%)	Axial Flow Pump	60	2.99%
		Chopper Machine	5	0.25%
		Combine Harvester	196	9.78%
		Power Tiller/Seeder	1468	73.22%
		Reaper Machine	192	9.58%
		Rice Transplanter	32	1.60%
	Female (52) (2.59%)	Chopper Machine	17	0.85%
		Combine Harvester	6	0.30%
		Power Tiller/Seeder	21	1.05%
		Reaper Machine	2	0.10%
		Rice Transplanter	6	0.30%
	Total		2005	100.00%
Area 2 (n=603) (100%)	Male (590) (97.84%)	Axial Flow Pump	250	41.46%
		Combine Harvester	53	8.79%
		Power Tiller/Seeder	50	8.29%
		Reaper Machine	225	37.31%
		Rice Transplanter	12	1.99%
	Female (13) (2.16%)	Axial Flow Pump	11	1.82%
		Reaper Machine	2	0.33%
	Total		**603**	100.00%

Area and district wise total respondent number by gender:

Table 2: Area and district wise total respondent number by gender (N =2608)

Area	District	Number of Female MSP	Number of Male MSP	Grand Total
Area 1	CHUADANGA		34	34
	FARIDPUR	8	554	562

[1] AREA 1: CHUADANGA, FARIDPUR, GOPALGANJ, JASHORE, JHENAIDAH, KUSHTIA, MADARIPUR, MEHERPUR, NARAIL, RAJBARI, SHARIATPUR
AREA 2: BAGERHAT, BARGUNA, BARISHAL, BHOLA, JHALOKATI, KHULNA, PATUAKHALI, PIROJPUR, SATKHIRA
**N= Population Size and n = Sample size

(n=2005)	GOPALGANJ	4	103	107
	JASHORE	3	121	124
	JHENAIDAH	16	236	252
	KUSHTIA	4	67	71
	MADARIPUR		42	42
	MAGURA	7	283	290
	MEHERPUR	1	50	51
	NARAIL		17	17
	RAJBARI	9	437	446
	SHARIATPUR		9	9
Total	12	**52**	**1953**	**2005**
Area 2 (n=603)	BAGERHAT	1	73	74
	BARGUNA		53	53
	BARISHAL	7	86	93
	BHOLA	4	151	155
	JHALOKATI		6	6
	KHULNA	1	62	63
	PATUAKHALI		86	86
	PIROJPUR		6	6
	SATKHIRA		67	67
Total	9	**13**	**590**	**603**
Grand Total	**21**	**65**	**2543**	**2608(N)**

**N= Population Size and n = Sample size

Study Limitation:

Despite the comprehensive nature of this study, several limitations should be acknowledged:

1. **Sample Size and Scope**: Although the study aimed to survey 4,483 MSPs, resource constraints limited the sample to 2,608 respondents. While this sample provides valuable insights, it may not fully represent the diversity and variability of MSPs across all regions of Bangladesh, particularly in areas not included in the survey.
2. **Geographical Constraints**: The study focused on 21 districts, with data collection divided between coastal and non-coastal areas. However, the unique challenges and opportunities in other agro-ecological zones, such as the hill tracts or northern flood-prone regions, were not covered. This geographic limitation may affect the generalizability of the findings to these other regions.
3. **Temporal Scope**: The data collection occurred between December 2023 and February 2024, a period that may not fully capture the seasonal variability in machine usage and business operations. The seasonal nature of agriculture could mean that certain trends or challenges specific to other times of the year were not observed.
4. **Data Reliability**: The study relied on self-reported data from MSPs, which may introduce biases or inaccuracies. Respondents might have overstated or understated their business performance, challenges, or support needs, leading to potential distortions in the findings.

3.0 Results and findings

3.1 Popular Agricultural Machines

The analysis of the number of sold and distributed machines revealed the top six high-demand agricultural machines. These were:

- Power Tiller Operated Seeder (PTOS) - 137.37%
- Combined Harvester (CH) - 61.75%
- Reaper Machine (RP) - 29.62%
- Axial Flow Pump (AFP) - 24.64%
- Fodder Chopper (FC) - 16.21%
- Rice Transplanter (RT) - 9.5%

While the overall number of female Machine Service Providers (MSPs) is lower compared to their male counterparts, women predominantly operated the Fodder Chopper, AFP, and PTOS machines (Table 1).

Table 3: Popular Agricultural Machines mentioned by their users (N=2608)[2]

Number	Machine name	Recent users (%)	Irregular users (%)	Future users (%)	Average Popularity among users (%)
1	Power Tiller Op Seeder (PTOS)	59.01%	22.51%	55.85%	45.79%
2	Combine Harvester (CH)	9.78%	37.35%	14.62%	20.58%
3	Reaper Machine (RP)	16.14%	5.80%	7.68%	09.87%
4	Axial Flow Pump (AFP)	12.31%	11.14%	1.19%	08.21%%
5	Fodder Chopper (FC)	0.84%	8.35%	7.01%	05.40%
6	Rice Transplanter (RT)	1.92%	3.48%	4.10%	03.17%
7	Others	0	11.37%	09.55%	6.98%

[2]Note: The percentage data in the rightmost column represents the average of three categories: recent users, irregular users, and future users. Among the irregular users, 11.37% fell into the "other machine" category, which includes machines like Tractors, Mini Power Tillers, Scissor Machines, Shallow Machines, and others that were either newly purchased or intended for future acquisition. The sum of these percentages across the categories totals 100%. In the future user category, 9.55% were also in the "other machine" category, which primarily includes Mini Power Tillers, Irrigation Pumps, and similar equipment. These "other machine" percentages are not displayed in the table above: Irregular user n=431, future user n=1347).

3.2 Operational days of popular agricultural machines

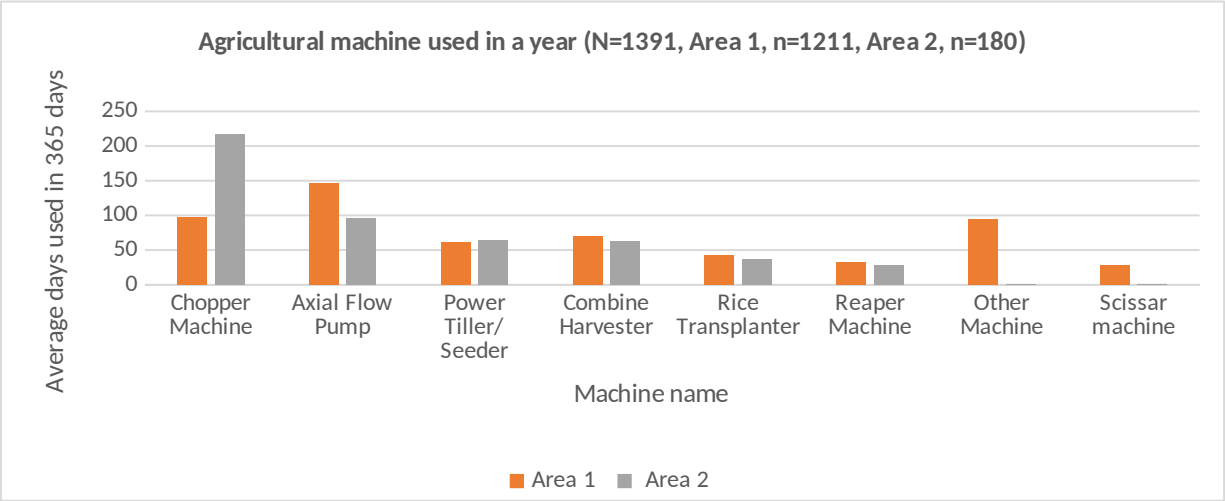

Figure 1: Agricultural machine used in a year

**N= Population Size and n = Sample size

Most of the popular machines were used between 50 to 100 days per year, indicating a significant opportunity for broader utilization or the integration of multiple functions. The Irrigation Machine (AFP) recorded the highest number of operational days, while the Reaper Machine (RM) had the lowest across both areas. The Power Tiller Operated Seeder (PTOS) and Combined Harvester (CH) had similar operational days in both regions. Notably, the Fodder Chopper Machine (CM) was used more frequently in Area 2 than in Area 1, with usage exceeding 200 days in Area 2 compared to around 100 days in Area 1. This suggests that the CM is a highly functional machine, especially at the household level.

Looking ahead, the machines in demand include Mini Power Tillers, Irrigation Pumps, Maize Shellers, Paddy Threshers, Power Threshers, Shallow Machines, Tractors, Spray Drones, Improved Seeders, Larger Reaper Machines, and Jute Fiber Extraction Machines.

3.3 Average fixed investment per machine by area

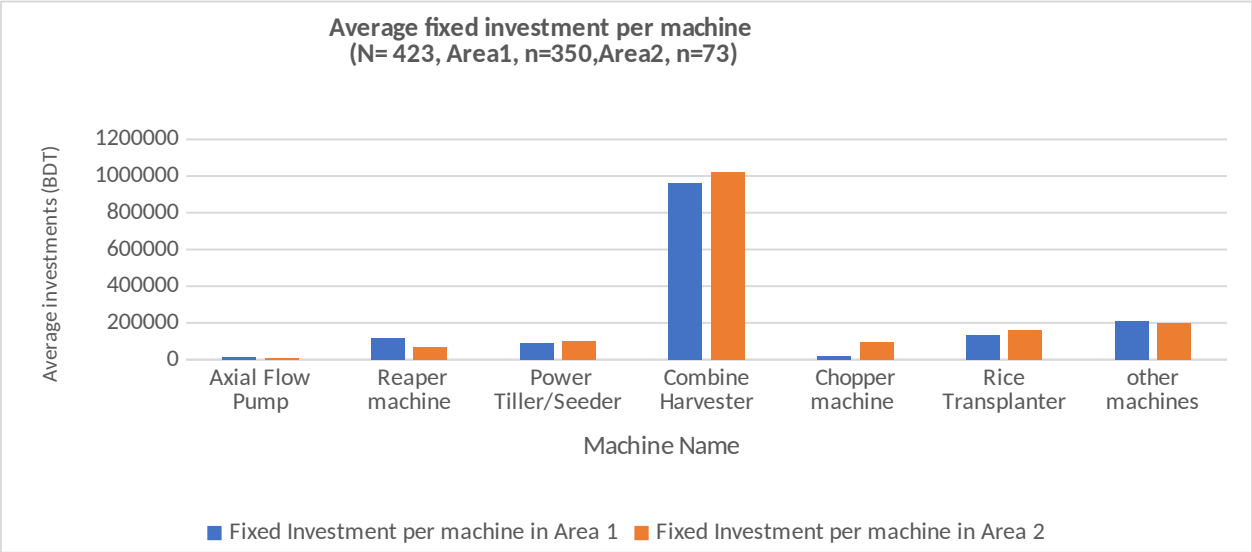

Figure 2: Average fixed investment per machine in Area 1 and Area 2

The Combine Harvester stands out with the highest investment in both areas. The Power Tiller/Seeder and Rice Transplanter also represent significant investments, with Area 2 generally showing higher averages. In contrast, machines like the Axial Flow Pump, Reaper Machine, and Chopper Machine involve much lower investments across both areas. Overall, the data suggest that larger, more complex machines like the Combine Harvester demand substantially higher investments, with some regional variation in costs.

3.4 Average investment per machine in percentage (%)

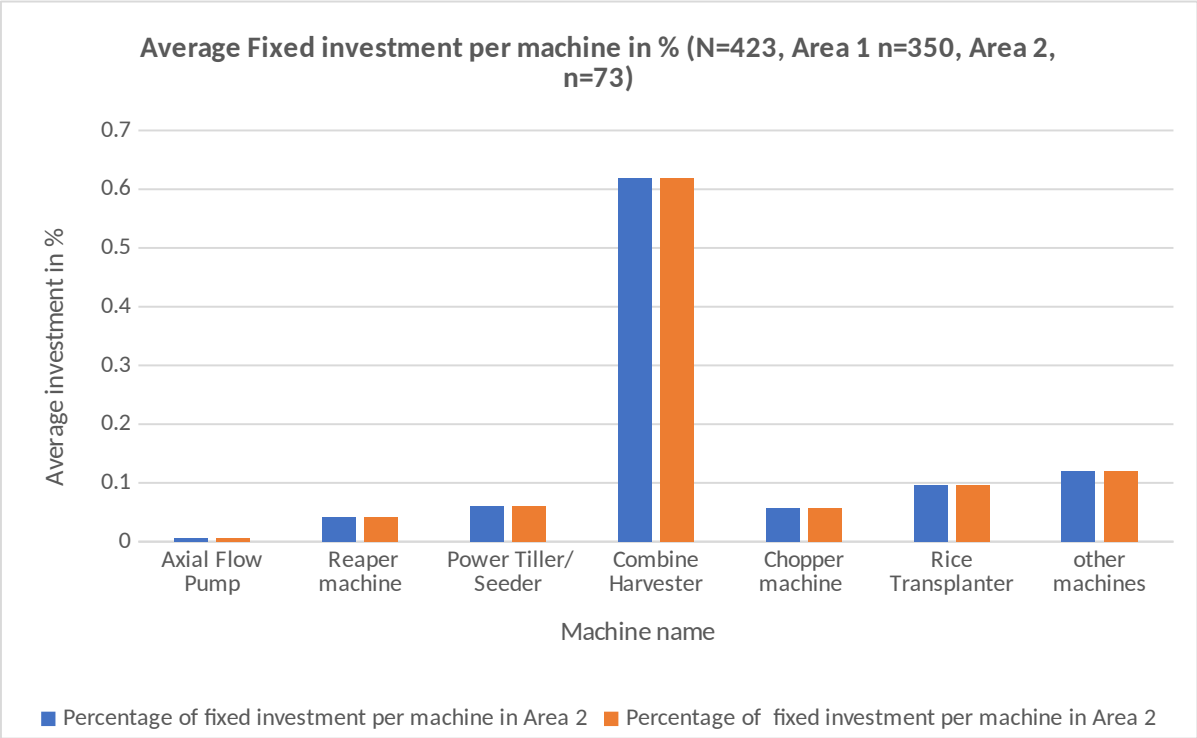

Figure 3: Average fixed investment per machine in percentage (%) in Area 1 and Area 2

The Combine Harvester accounts for the highest percentage of fixed investment in both areas, with Area 1 and Area 2 showing nearly identical investment levels. The Power Tiller/Seeder and Rice Transplanter also contribute to significant portions of the investment, although they are far less than the Combine Harvester. Machines like the Axial Flow Pump, Reaper Machine, and Chopper Machine reflect minimal percentages of the total investment in both areas. The "other machines" category shows similar investment percentages across both areas. Overall, the Combine Harvester dominates the investment profile.

3.5 Type of support received by the MSPs (%)

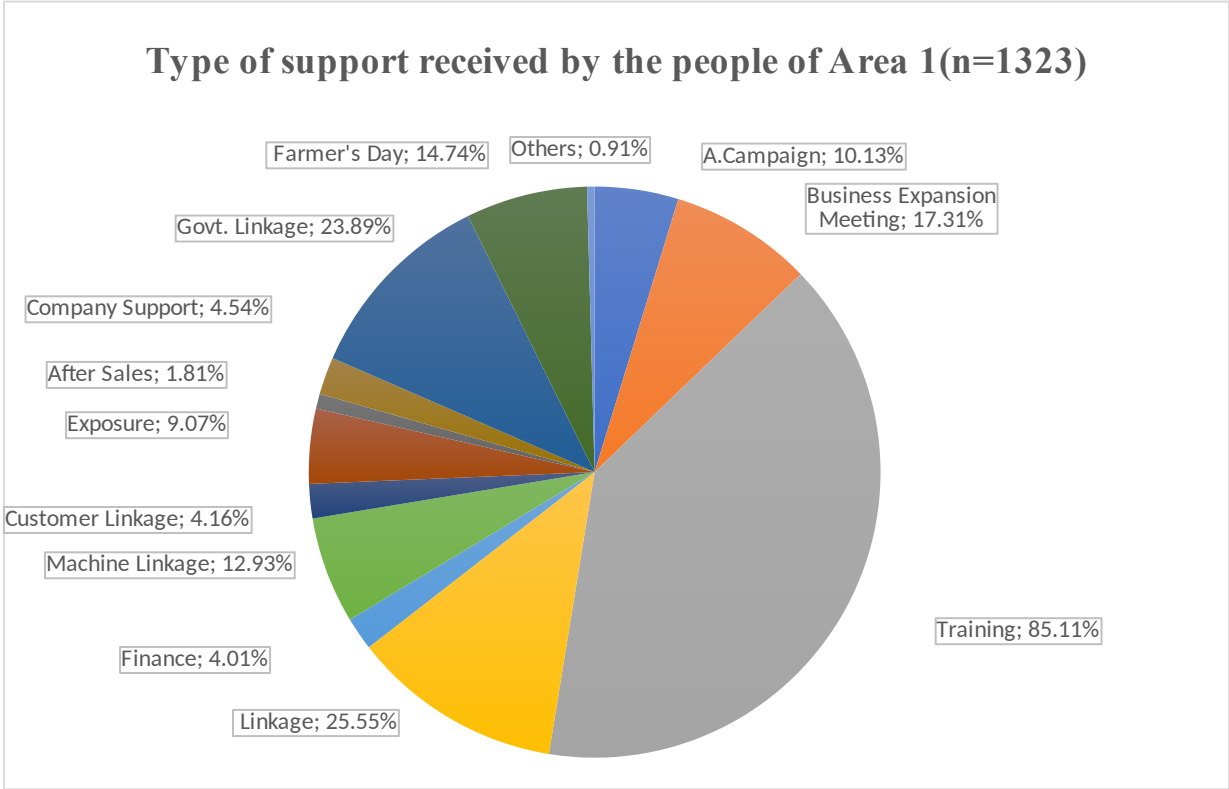

Figure 4: Type of support received by the people of Area 1 in percentage (%)[3]

For Area 1 the most significant form of support is **training**, which accounts for a substantial 85.11% of the total. This is followed by **linkage with machine suppliers**, which makes up 25.55%, and **government linkage for subsidies**, at 23.89%. Other notable types of support include **business expansion meetings** (17.31%), **Farmer's Day** events (14.74%), and **machine linkage** (12.93%). Smaller proportions of support were provided through **exposure visits** (9.07%), **awareness campaigns** (10.13%), **customer linkage** (4.16%), **company support** (4.54%), and **financial assistance** (4.01%). The least common supports were **after-sales services** (1.81%) and **other miscellaneous supports** (0.91%). Overall, training is the dominant support provided, with other forms of assistance playing supporting roles.

[3] **A. Campaign** = Awareness campaign event, **Business Expansion Meeting** = Business expansion/learning sharing meeting, **Training** = Relevant training, **Linkage** = Linkage event with machine supplier company, **Finance** = Linkage event with Fis, **Machine Linkage** = Linkage event with mechanics, **Customer Linkage** = linkage event with customers, **Exposure** = Exposure visit, **After Sales** = After-sales service support, **Company Support** = Support from the machine supplier company, **Govt. Linkage** = Linkage with Govt. Offices (to receive subsidy), **Farmer's Day** = Farmers Field Day, **Others** = Others

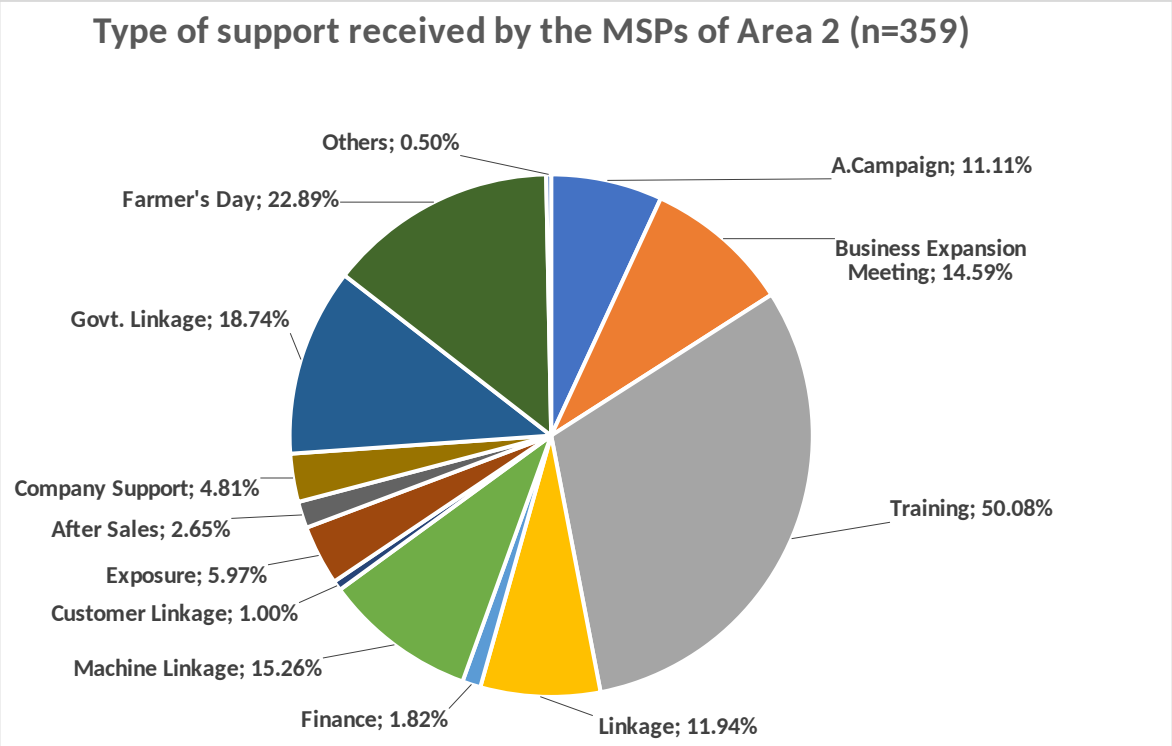

Figure 5: Type of support received by the people of Area 2 in percentage(%)[4]

Similar to Area 1 The largest portion of support, making up 50.08%, is for **training**, followed by **Farmer's Day events** at 22.89% and **government linkage for subsidies** at 18.74%. Other notable forms of support include **business expansion meetings** (14.59%), **machine linkage** (15.26%), and **awareness campaigns** (11.11%). Smaller percentages of support are attributed to **linkage with suppliers** (11.94%), **exposure visits** (5.97%), **company support** (4.81%), **after-sales services** (2.65%), **financial assistance** (1.82%), and **customer linkage** (1.00%). The "Others" category accounts for 0.50%.

Overall, while training remains the most significant type of support in Area 2, there is a more diverse spread of other types of support compared to Area 1, reflecting the specific needs and challenges faced by MSPs in this region.

[4] **N= Population Size and n = Sample size

Note: A. Campaign = Awareness campaign event, **Business Expansion Meeting** = Business expansion/learning sharing meeting, **Training** = Relevant training, **Linkage** = Linkage event with machine supplier company, **Finance** = Linkage event with FIs, **Machine Linkage** = Linkage event with mechanics, **Customer Linkage** = linkage event with customers, **Exposure** = Exposure visit, **After Sales** = After-sales service support, **Company Support** = Support from the machine supplier company, **Govt. Linkage** = Linkage with Govt. Offices (to receive subsidy), **Farmer's Day** = Farmers Field Day, **Others** = Others

3.7 Challenges faced by the people

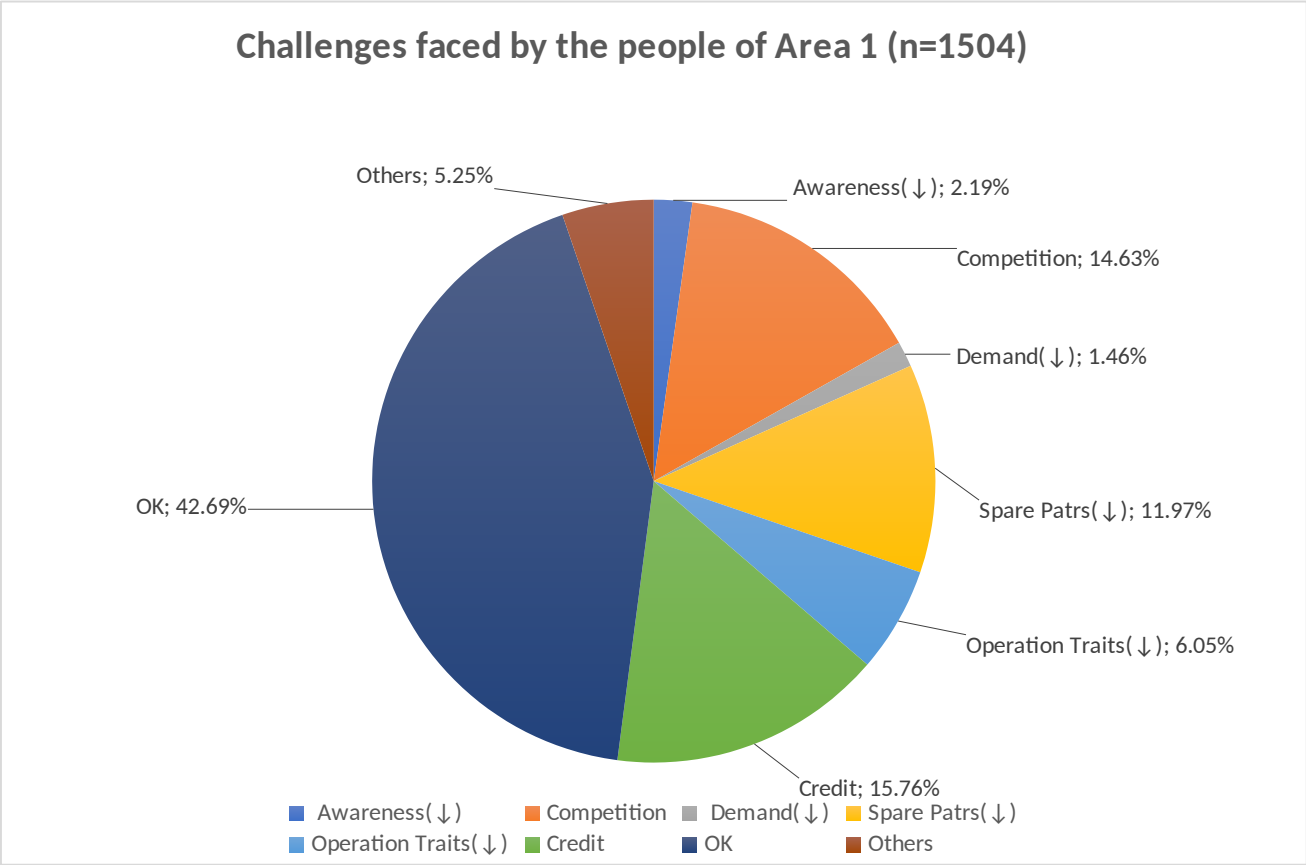

Figure 6: Challenges faced by the people of Area [5]

[5] Challenges faced by the people of Area 1 Here, N = 2005, n = 1504

Note: (Awareness (↓) = Less awareness among the service receiver about the machine service business, **Competition** = Many new service providers in the area result in lesser customer and income Demand (↓) **=** Less demand among people/ are not willing to take the services, **Spare Parts (↓)** = Machine parts are not easily available, **Operator Trained (↓)** = Lack of trained operator, **Credit** = Delay in receiving machine service charge, **OK** = There is no problem, **Others** = Others)

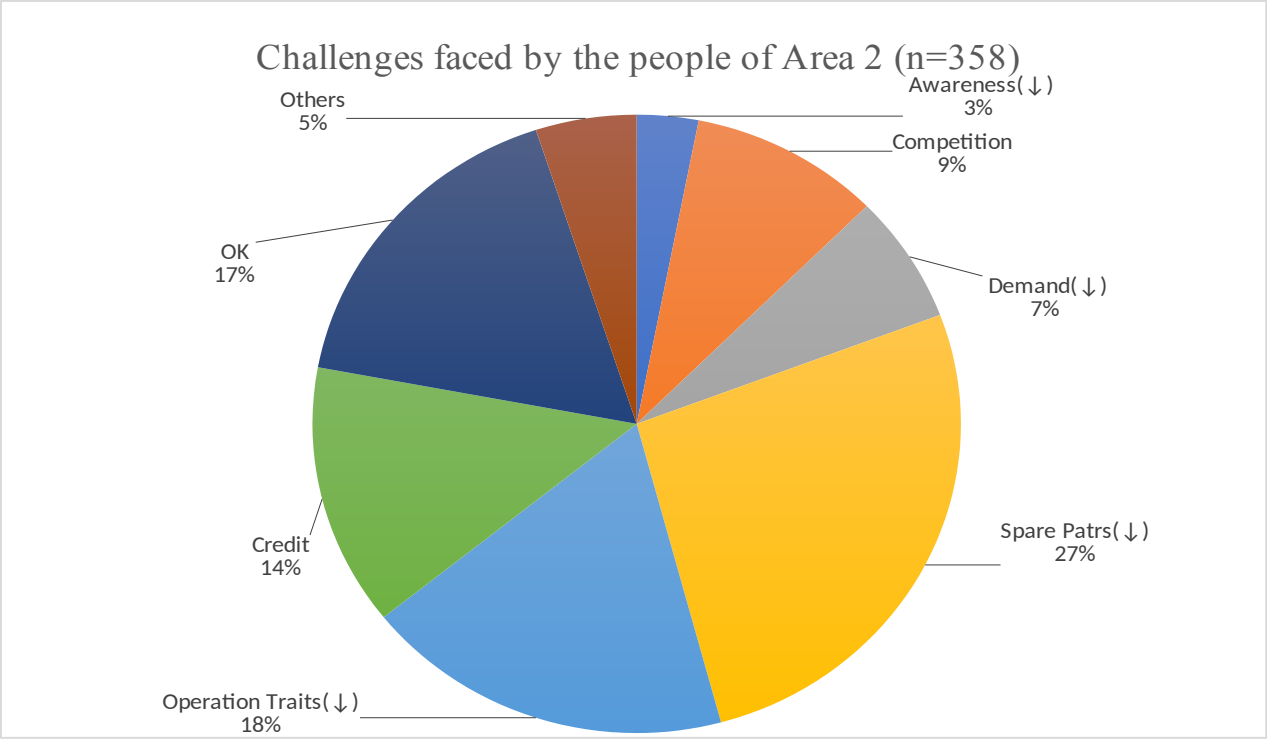

Figure 7: Challenges faced by the people of Area 2[6]

In Area 1, the most prominent challenge is competition, affecting 14.63% of respondents, followed closely by issues related to credit (15.76%), and the unavailability of spare parts (11.97%). Other significant challenges include operational traits (6.05%), awareness (2.19%), and demand (1.46%). Interestingly, 42.69% of respondents reported no significant problems ("OK"), indicating a relatively stable environment for a substantial portion of MSPs.

In Area 2, the most significant challenge is the unavailability of spare parts, which affects 27% of respondents, marking it as a critical issue in this region. Operational traits present the second most significant challenge at 18%, followed by credit issues at 14%. Competition (9%) and demand (7%) also represent notable challenges. Similar to Area 1, a small percentage of respondents reported no significant issues ("OK"), though the proportion is lower compared to Area 1.
Overall, while both areas face challenges related to competition, credit, and spare parts, Area 2 shows a higher concentration of issues related to spare parts and operational training, whereas Area 1 is more

[6] 6.b. Challenges faced by the people of Area 2 Here, N = 603, n = 358
**N= Population Size and n = Sample size
Note: Awareness (↓) = Less awareness among the service receiver about the machine service business, **Competition** = Many new service providers in the area result in lesser customer and income Demand (↓) **=** Less demand among people/ are not willing to take the services, **Spare Parts (↓)** = Machine parts are not easily available, **Operation Traits (↓)** = Lack of trained operator, **Credit** = Delay in receiving machine service charge, **OK** = There is no problem, **Others** = Others

affected by competition and credit-related problems. This suggests that tailored interventions are needed in each area to address the specific challenges faced by MSPs.

3.8 Active and Inactive Machine Service Provider

Table 4: Active and Inactive Machine Service Provider (N=2608)

Total Machine Service Provider in number	2608
Active Machine Service Provider in number	1428
Inactive Machine Service Provider in number	1180
Active Machine Service Provider in %	54.75%
Inactive Machine Service Provider in %	45.25%

**N= Population Size and n = Sample size

Table 5: Active and Inactive Machine Service Provider by Area (N=2608)

Description	Area 1	Area 2
Active Machine Service Provider in number	1241	187
Active Machine Service Provider in %	86.90%	13.10%
Inactive Machine Service Provider in number	764	416
Inactive Machine Service Provider in %	64.75%	35.25%

**N= Population Size and n = Sample size

Table 6: Active and Inactive Machine Service Provider by machine and by area (N=2608)

Area	Machine Name	Active Machine Service Provider	Inactive Machine Service Provider	Grand Total
Area 1	Axial Flow Pump	6	54	60
	Chopper Machine	22	0	22
	Combine Harvester	134	68	202
	Power Tiller/Seeder	891	598	1489
	Reaper Machine	57	137	194
	Rice Transplanter	29	9	38
Area 1 Total		1139	866	2005
Area 2	Axial Flow Pump	27	234	261
	Combine Harvester	48	5	53
	Power Tiller/Seeder	14	36	50

	Reaper Machine	61	166	227
	Rice Transplanter	10	2	12
Area 2 Total		160	443	603
Grand Total		1299	1309	2608

**N= Population Size and n = Sample size

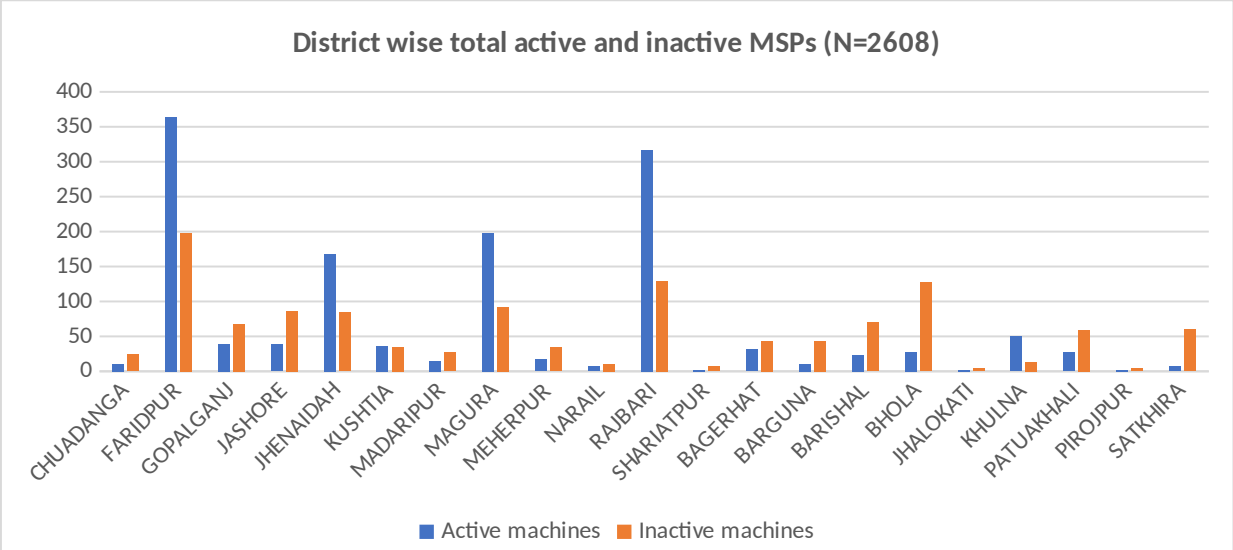

Figure 8: District wise total active and inactive machines, N=2608[7]

The analysis of Machine Service Providers (MSPs) across 2,608 respondents reveals significant disparities in the operational status of MSPs between different areas and districts. Overall, 54.75% of the MSPs are active, while 45.25% are inactive, highlighting a nearly balanced split that underscores the challenges many MSPs face in maintaining consistent operations.

Area-Wise Distribution: The data indicates a stark contrast between Area 1 and Area 2 in terms of MSP activity. Area 1, which includes regions with higher agricultural productivity, shows a dominant share of active MSPs (86.90%). In contrast, Area 2, encompassing coastal regions, has a much lower proportion of active MSPs (13.10%). The higher inactivity rate in Area 2 (35.25%) compared to Area 1 (64.75%) suggests that environmental, economic, or logistical challenges are more pronounced in the coastal areas, potentially due to harsher conditions, lower demand, or inadequate support structures.

District-Level Analysis: A deeper look at the district-level data reveals that districts like **Faridpur** and **Rajbari** have a significantly higher number of active MSPs. This could be attributed to better access to resources, stronger support networks, or more favorable market conditions in these areas. Conversely, districts such as **Barguna**, **Bagerhat**, and **Kushtia** exhibit higher inactivity rates, which

[7] **N= Population Size and n = Sample size
CHUADANGA =34, FARIDPUR = 562, GOPALGANJ = 107, JASHORE = 124, JHENAIDAH = 252, KUSHTIA = 71, MADARIPUR = 42, MAGURA = 290, MEHERPUR = 51, NARAIL = 17, RAJBARI= 446, SHARIATPUR =9, BAGERHAT = 74, BARGUNA = 53, BARISHAL = 93, BHOLA = 155, JHALOKATI =6, KHULNA=63, PATUAKHALI = 86, PIROJPUR =6, SATKHIRA=67

may reflect underlying issues such as poor market access, lower demand for machine services, or insufficient technical support.

Machine-Specific Trends: The analysis also highlights disparities in the operational status of specific types of machinery. For instance, the **Axial Flow Pump** and **Reaper Machine** have a higher proportion of inactive MSPs in both Area 1 and Area 2. This suggests that these machines may be more prone to operational challenges, possibly due to higher maintenance needs, lower demand, or a lack of skilled operators. In contrast, machines like the **Combine Harvester** and **Power Tiller/Seeder** tend to have a more balanced active status, particularly in Area 1, where they are widely used and supported.

3.9 Reasons of being "Inactive" in service

Table 7: Reasons of being "inactive" in machine service business by machine and by area

(N= 1309, Area1 n=866, Area 2 n=443)[8]

Machine Name	Ownership transfer	Waiting4season	Machine Damage	Owner died	Owner migrated	Machine expired	No operator	Demand changed	Business competition	Credit service	No parts	NoTech Service	Others	Number of Inactive Machines
Area 1	65	3	558	15	41	85	16	6	1	6	27	5	301	866
Axial Flow Pump			46			3							8	54
Combine Harvester	8		28	2	1	1	5	4		4	3	1	30	68
Power Tiller/Seeder	51		372	10	35	62	6	1	1	2	3	2	233	598
Reaper Machine	5	3	107	3	5	18	3	1			20	1	26	137
Rice Transplanter	1		5			1	2				1	1	4	9
Area 2	11	3	380	9	2	123	14	12	3	3	108	91	59	443
Axial Flow Pump			217	4	1	53		5			41	29	18	234
Combine Harvester			5				1	1	1		2	2		5
Power Tiller/Seeder			33	1		12			2	1	2	2	3	36
Reaper Machine	11	1	125	4	1	58	12	6		2	63	57	38	166
Rice Transplanter		2					1					1		2
Grand Total	76	6	938	24	43	208	30	18	4	9	135	96	360	1309

[8] **N= Population Size and n = Sample size

(OT= The machine's ownership was transferred to another MSP (sold to someone else), **NS** = Not get the machine using season yet, Damage = Machine was damaged, **OD** = Machine owner died, **Mgtn** = Machine owner migrated, **ML** = The machine's life span ended, **SDS** = Lack in availability of skilled operator/ driver, **NM** = New machines in the market result in demand for the existing machines, **MM** = Increase the machine number in the area, **DP** = Delay in paying machine service charges, **SPU** = Lack of machine spare parts, **TS** = Lack of technical services, **Others** = ownership process, profit risk, company took back, area mismatch, etc.)

The analysis reveals significant trends that highlight the operational challenges MSPs face across these regions.

Machine Damage as a Primary Cause of Inactivity: Machine damage is the most significant cause of inactivity across both areas, accounting for 938 instances. In Area 1, 558 machines were inactive due to damage, while Area 2 reported 380 such cases. The high rate of machine damage suggests widespread issues related to maintenance, handling, or possibly the quality of machines provided to MSPs.

Impact of Machine Type:

- The **Power Tiller/Seeder** is the most affected machine type, with 598 inactive cases in Area 1 and 36 in Area 2, mainly due to machine damage and other factors like machine expiration and lack of operators. This indicates that while the Power Tiller/Seeder is widely used, it also faces significant operational challenges, particularly in Area 1.
- The **Axial Flow Pump** also shows a high inactivity rate, especially in Area 2, where 234 machines are inactive primarily due to machine damage and the unavailability of spare parts.
- **Combine Harvesters** and **Reaper Machines** show moderate inactivity due to damage, operator shortages, and issues like parts unavailability, indicating they too face challenges but on a smaller scale compared to the Power Tiller/Seeder.

Other Contributing Factors:

- **Machine expiration** is another critical factor, with 208 machines across both areas becoming inactive due to their expired lifespans. This suggests that many MSPs are using older machines that may not be up to current operational standards.
- **Lack of spare parts** (135 cases) and **lack of technical service** (96 cases) are also notable contributors to machine inactivity. These issues highlight significant gaps in the support infrastructure for MSPs, particularly in ensuring that machines remain functional over time.
- **Credit service issues** (9 cases) and **business competition** (4 cases) are relatively minor contributors to inactivity but still indicate areas where improvements could be made, especially in financial support and market conditions.

Regional Differences:

- Area 1 reports more instances of machine damage and expiration than Area 2, which may suggest differences in operational conditions, machine usage intensity, or access to support services between these regions.
- Area 2, however, struggles more with spare parts availability and technical services, indicating that logistical or supply chain issues may be more pronounced in this region

4.0 Business viability according to investment and income

(N=1428, Area 1 , n= 1241, Area 2 ,n= 187)

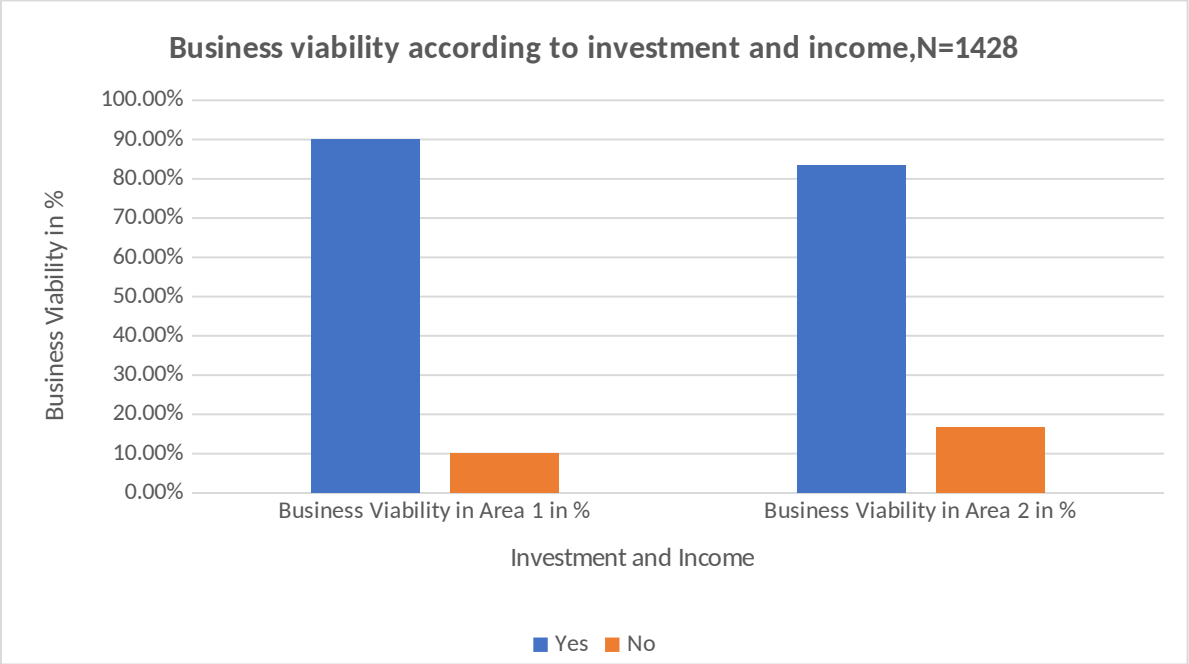

Figure 9: Business Viability according to investment and income, N=1428

**N= Population Size and n = Sample size

In Area 1, the majority of MSPs, approximately 90%, report that their business is viable ("Yes"), suggesting that the returns on investment are adequate to sustain their operations. Only a small percentage, around 10%, indicate that their business is not viable ("No"), highlighting a relatively stable and profitable environment for MSPs in this area. This high level of business viability reflects favorable conditions that enable MSPs to maintain their operations effectively.

Similarly, in Area 2, a significant majority of MSPs, around 83%, also report positive business viability ("Yes"). However, there is a slightly higher proportion of MSPs in Area 2 (approximately 17%) who consider their business to be non-viable ("No") compared to Area 1. This slight increase in non-viability could be attributed to various factors, such as higher operational costs, market challenges, or less favorable economic conditions in Area 2. Despite the overall positive outlook, the data suggests that Area 2 MSPs may face more obstacles in achieving and maintaining business viability, necessitating targeted interventions to address these challenges.

4.1 Types of support needed by the MSPs

(N= 608, Area1 n= 513, Area 2 n= 95)

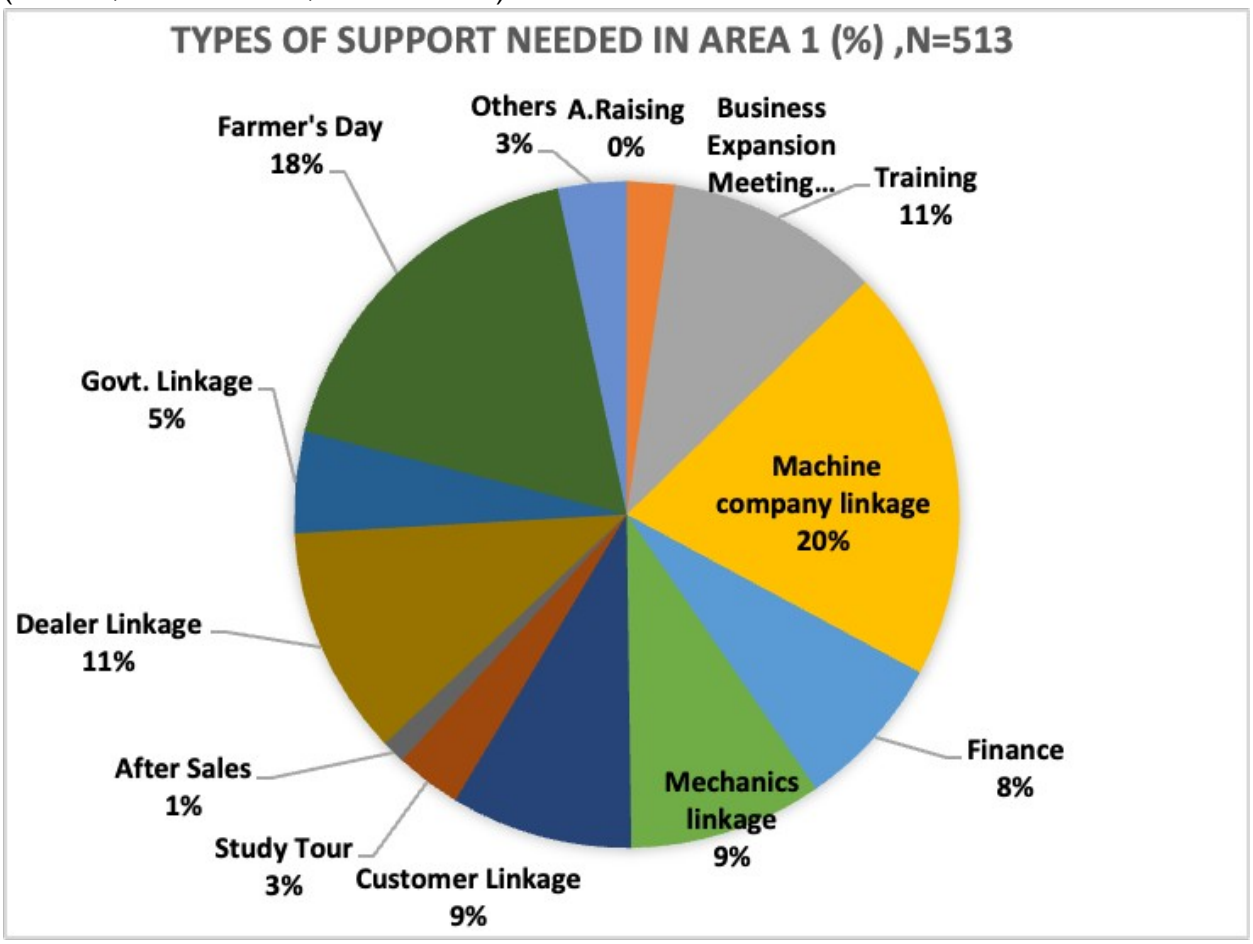

Figure 10 : Types of support needed in Area 1 in percentage (%), N=513

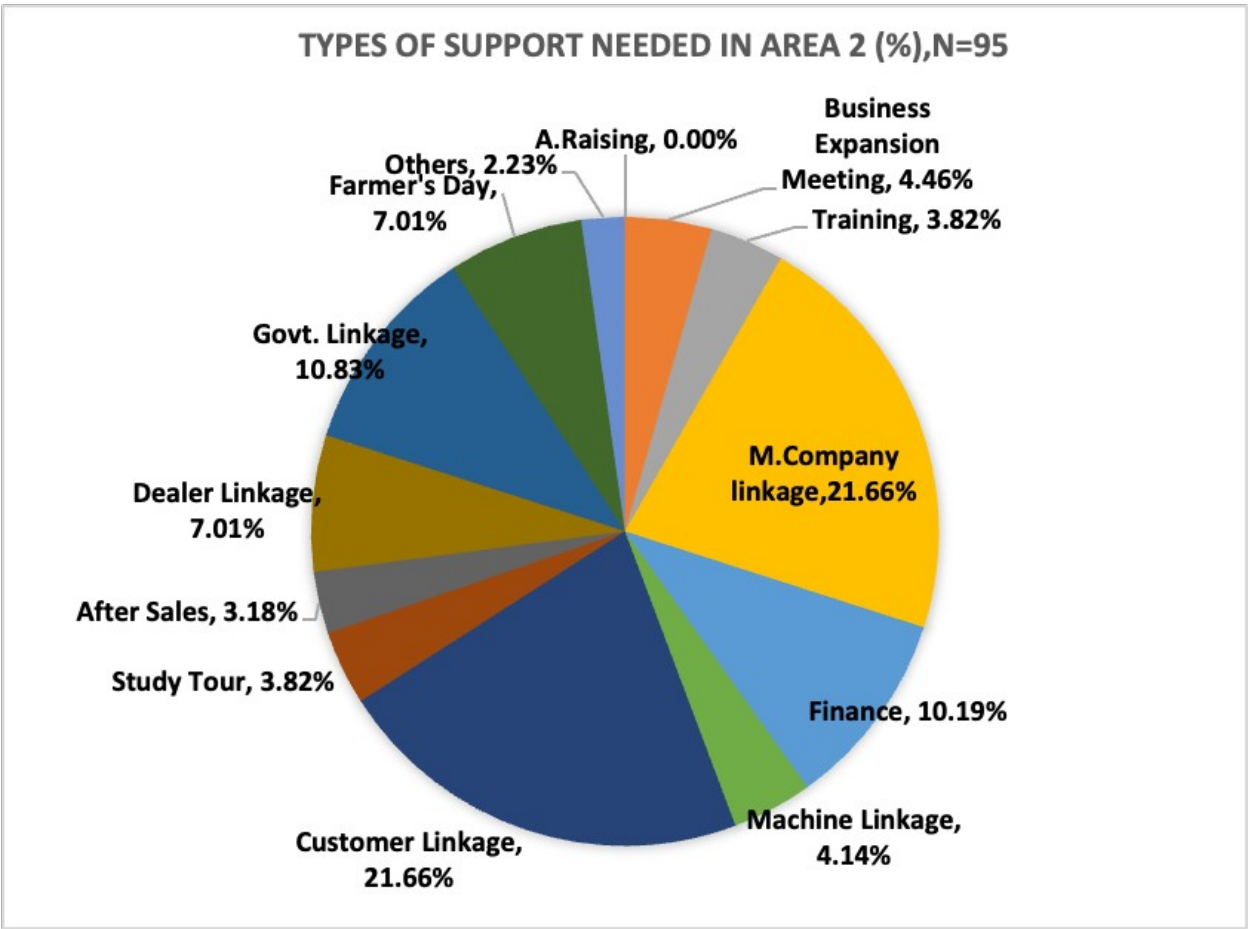

Figure 11: Types of support needed in Area 2 in Percentage (%), N=95

In Area 1, the most significant need for Machine Service Providers (MSPs) is linkage with machine companies, accounting for 20% of responses. This emphasizes the importance of access to reliable equipment. Farmer's Day events are also crucial, with 18% of MSPs highlighting them as essential for engaging with farmers. Training and dealer linkages each represent 11% of the needs, reflecting a demand for skill development and stronger dealer relationships. While financial support (8%) and mechanics linkage (9%) are notable, they are less critical compared to the primary needs. Other forms of support, such as government linkage (5%), business expansion meetings (2%), study tours (3%), and after-sales services (1%), are needed but are lower priorities.

In Area 2, customer linkage and machine company linkage are top priorities, each identified by 21.66% of MSPs. This highlights the importance of strong connections with both end-users and suppliers. Financial support (10.19%) and government linkage (10.83%) are also critical needs, reflecting the challenges MSPs face with financial stability and government support. Dealer linkage and Farmer's Day events are moderately important, each accounting for 7.01% of responses. Mechanics linkage (4.14%), business

expansion meetings (4.46%), study tours (3.82%), and after-sales services (3.18%) are part of the support landscape but are secondary needs.

Both areas show a strong need for better linkages with machine companies, indicating that access to quality equipment and reliable suppliers is a universal priority. However, Area 2 places a slightly greater emphasis on customer linkage, reflecting the importance of connecting with end-users in this region. In contrast, Area 1 prioritizes events like Farmer's Day and training more highly. Financial support and government collaboration are also critical in both areas but with varying degrees of importance. The data suggests that while there are commonalities in the types of support needed, regional differences exist, requiring tailored support strategies to address the specific needs of MSPs in each area.

5.0 Key Learnings

- **Machine Adoption:** The primary factors influencing machine adoption are the prevention of machine damage and ensuring the quality and longevity of machines. Our findings indicate that machine damage is often related to two key issues: the insufficient skills of operators, leading to mishandling, and the poor quality of critical machine components, which causes rapid deterioration. To increase adoption rates, it is essential to strengthen specific aspects of the agricultural machine value chain, such as technical troubleshooting services, the availability of quality spare parts, and the development of skilled operators. Simply focusing on rapid distribution through sales is insufficient. Moreover, adoption trends differ between subsidized markets and open markets, necessitating separate analyses for each.
- **High-Demand and Highly Available Machines:** Given the country's cereal farming practices and labor shortages, agricultural mechanization is crucial. While irrigation, plowing, and pesticide spraying are almost fully mechanized, there remains a significant gap in the mechanization of harvesting, threshing, and rice planting—areas with substantial potential for improvement. In neighboring countries like India, popular machines include tractors, combined harvesters, power tillers, drip irrigation systems, and spray pumps. The market availability, price, fuel efficiency, multifunctionality, climate adaptability, and spare parts availability, along with the preferences of different demographic groups, are key factors in determining the importance and demand for agricultural machines.
- **Power Tiller Operated Seeder (PTOS):** The Power Tiller is a widely used machine, with the seeder as an additional component. However, the seeder part is prone to damage, primarily due to a lack of technical expertise and the unavailability of spare parts locally.
- **Combined Harvesters (CH):** This multi-functional, fuel-efficient machine is larger than most popular machines and is associated with both high profit and high risk for MSPs. While subsidized in climate-affected areas, these machines often face operational challenges when used elsewhere, particularly with payment issues involving commission agents and local elites. The CH also encounters difficulties on fragmented small plots, and a lack of synchronized farming practices among farmers complicates its use. The introduction of half-feed and full-feed types has

addressed straw management issues, but future integration with a baler machine could enhance efficiency further.

- **Axial Flow Pump (AFP):** This machine, often added to existing diesel or electric engines, is prone to damage, with limited availability of spare parts and mechanics. Additionally, the availability of adequate surface water is a challenge for this machine's effectiveness.
- **Reaper Machine (RM):** While walking-operated reaper machines require significant physical effort, sitting-operated models are more popular. However, the introduction of larger combined harvesters has reduced the popularity of reaper machines, especially in larger plots.
- **Fodder Chopper (FC):** This machine is predominantly operated by women and is more commonly used at the household level, particularly in coastal areas. The demand for fodder choppers has led to significant advancements in domestic manufacturing, alongside the availability of imported Chinese and Indian models.
- **Support Package:** The major support components have included training, awareness programs, promotion, linkages, subsidies, after-sales services, and mechanic linkages. However, critical root causes of limited adoption, such as the quality of machines, spare parts availability, and the training of drivers and service centers, require greater emphasis to address these challenges effectively.

6.0 Recommendations

- **Machine Adoption:** To boost the adoption rate of machine hiring and service businesses, strong linkages with machine supplier companies, government incentives, customer and dealer linkages, and demonstrations during Farmer's Day events are essential. Additionally, the government and private sector should prioritize advanced, practical training for youth and women operators. Integrating such training into government and private technical training centers will be crucial. A market assessment of spare parts and incentives for domestic manufacturing or imports, as needed, should also be considered.
- **High-Demand and Priority Machines:** A detailed market study of priority machines should guide policymakers in designing supply chain incentives and tax mechanisms. Commercial banks should be encouraged to create special financing packages for these machines, particularly for those in rice planting, energy-efficient irrigation, harvesting, and post-harvest processing.
- **Support Packages from Government, Donors, and the Private Sector:** The government should reconsider continuing subsidies on machines, except in environmentally critical areas. Most machines should compete openly in the market, allowing for a more sustainable approach.
- **Machine Quality, Lifespan, and Spare Parts:** Both the government and private sector must enhance their capacity to assess and ensure the quality of machines and their components. Machine lifespan can vary depending on climatic conditions, supplier source, and environmental

factors like salinity. Strengthening the linkage between parts shops, lead firms/importers, and foundry workshops is necessary to increase parts supply at the grassroots level. Digitally accessible supply sources will also be crucial.

- **Actions Related to "Machine Damage":** Raising customer awareness about the quality of subsidized and non-subsidized machines is necessary. Skilled mechanics should assist MSPs and farmers in purchasing high-quality machines by inspecting key parts and functions. Establishing quality-check facilities at the Upazila level, or equipping dealers to demonstrate machine quality, can further mitigate risks. A helpline offering digital solutions, troubleshooting videos, and advisory services should also be made available.
- **Distribution Process and Ownership of Machines:** Ensuring the quality of machines and their key components, particularly in subsidized and private firm distributions, requires close monitoring. The ownership verification process, especially for machines with multiple owners or elderly owners, should be handled carefully by distributing agencies.
- **Making Technical Services Available:** The government and private sector should support the establishment of market-competitive, sustainable workshops at the Upazila level for repair and maintenance of new machines. Capital machinery facilities should also be provided for essential parts repair. Local foundries and manufacturers must be informed of spare parts demand and market linkage opportunities.
- **Future Value-Added Services of MSPs:** The future of mechanization lies in integrating multi-functional, advanced, and efficient machines. Gradual digitization, automation, fleet services, bundled services, and digital platforms are key to business sustainability. Strengthening linkages with commission agents, spare parts shops, machine lead firms/importers, mechanics, dealers, and farmers will be crucial for creating a robust and integrated service model. Online and offline marketing, enhanced service credit systems, improved payment systems, easy access to finance, and comprehensive repair and maintenance services should all be prioritized to ensure the long-term success of MSPs.