

Who are the entrepreneurs? A case for accelerated service economy for agricultural machinery in Odisha

Vartika Singh, Patrick S. Ward, and Shweta Gupta

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Motivation

Sustainable intensification of agriculture can be brought about rapidly by increasing mechanization of key activities that are both time and labor intensive. However, few farmers are able to purchase machines on their own, and fragmented landholdings are inefficient for machine operation and ownership (Mehta et al. 2014; Shambhu and Jha 2012). In Odisha, there is potential for the emergence of a custom-hire service economy. Custom-hiring services could generate revenue for machine owners (Sidhu and Vatta, 2012; Nissa et al. 2017)—allowing them to recover fixed costs quickly—and allow non-machine owners to reap the benefits of technology at only pay-per-use costs, without the need to purchase machinery. In addition to providing socially inclusive access to key agricultural machinery, custom-hiring services can also encourage the development of a rural service economy and livelihoods (Sims, Röttger, and Mkomwa 2012). Data from our survey of service providers in Odisha revealed that the business was profitable, with farmers making an average profit of INR 700 (\$11) per acre for renting out a tractor. For a mechanical rice transplanter, this profit was approximately INR 1,450 (\$23) per acre, and for a combine harvester, approximately INR 1,600 (\$25) per acre.

Why haven't functional private marketplaces emerged for machine rentals? High upfront costs for several of the machines and lack of awareness about potential rental opportunities are likely explanations. Consequently, most government-sponsored programs for machine purchases in India provide high subsidies. But these subsidy-based approaches, while arguably inexpensive to administer, are inefficient in delivering return on public investment. Inefficiencies arise in part because support programs are not structured in a manner that encourages an entrepreneurship-based service economy that would expand the coverage of mechanized technologies. The government of Odisha is interested in identifying policies that would encourage the emergence of entrepreneurs. In this note, we discuss the traits of machine owners that are associated with entrepreneurial behavior and ways in which information about these traits could be used to improve the targeting of mechanization subsidies to better foster the emergence of custom-hire services for farm machinery in Odisha.

Methods and Sampling

Our primary objective in this study was to determine the individual characteristics predictive of entrepreneurial behavior and to consider the potential impact of alternative



The Cereal Systems Initiative for South Asia (CSISA) is a regional initiative to sustainably increase the productivity of cereal-based cropping systems, thus improving food security and farmers' livelihoods in Bangladesh, India and Nepal. CSISA works with public and private partners to support the widespread adoption of resource-conserving and climate-resilient farming technologies and practices. The initiative is led by the International Maize and Wheat Improvement Center (CIMMYT), implemented jointly with the International Food Policy Research Institute (IFPRI) and the International Rice Research Institute (IRRI), and is funded by the US Agency for International Development (USAID) and the Bill & Melinda Gates Foundation.

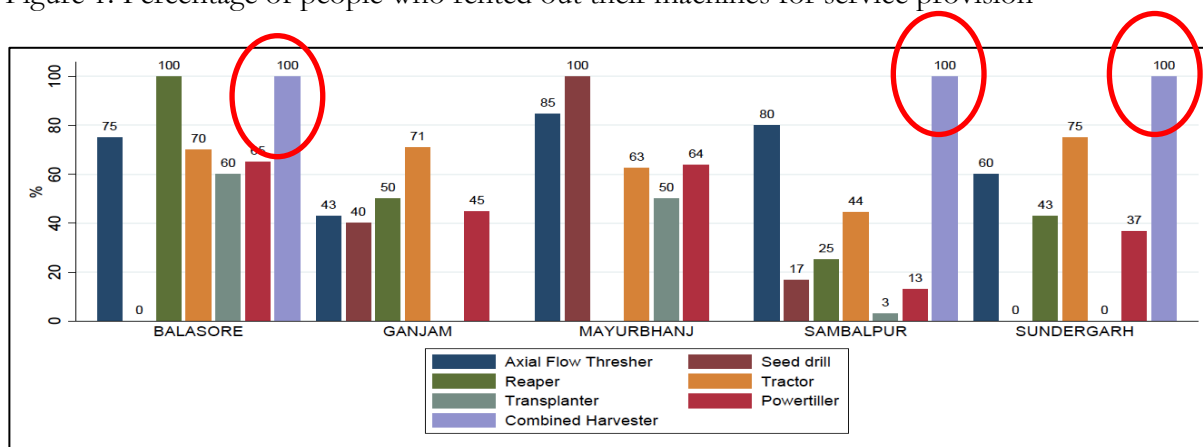
policy reform options to encourage machine-service provision. To that end, we collected primary and experimental data from current machine owners that allow us to assess current machine-use patterns as well as machine owners' assessment of their abilities and motivation to undertake tasks that require foresight, planning, and investment (entrepreneurial self-efficacy) and its effect on their provision of machine services. These data also provide preliminary evidence on the potential of two policy reform options.

Seven machines (tractor, power tiller, axial flow thresher, reaper, seed drill, mechanical rice transplanter, and combine harvester) were identified for study, based on consultations with the Department of Agriculture in Odisha. Our sampling frame was based on administrative data of subsidy beneficiaries from the state from the last three fiscal years. From this database, we identified the five districts with the highest concentration of at least one of the machines. Using probability proportional to size sampling, we identified the blocks (subdistrict administrative units) and villages from within the selected districts, with corresponding numbers of respondents within the selected blocks, resulting in our final sample size of 1,000 respondents.¹ Prior to traveling to participants' villages, enumerators secured appointments from machine-owners by calling their registered mobile numbers. Informed consent was secured before proceeding with the interviews, and survey and experimental data were collected using SurveyCTO, a computer-assisted personal interviewing interface.

Results

Based on the primary data from machine-subsidy beneficiaries, approximately 50 percent of respondents were found to be engaging in service provision in the past year (at least one of the two agricultural seasons) using at least one of the seven machines in consideration. In *Kharif* 2017, this percentage was 47 percent (475), and in *Rabi* 2016/17 it was over 11 percent (113). The typical service provider in our sample was a male, 43 years old, who had studied through middle school (seventh grade), belongs to the General caste, and owns 4.65 acres of land. This typical provider had provided services for an average of 48 farmers in the previous *Kharif* season, covering over 54 acres of land, and had rented out the machine for over 25 days in the season.

Figure 1: Percentage of people who rented out their machines for service provision



¹ For various reasons—e.g., practical concerns about locating individuals based on mobile numbers provided on subsidy applications years ago, concerns regarding non-participation, and concerns about “ghost beneficiaries” (persons who either do not exist or are not reachable)—our preliminary long-list oversampled (by a factor of 3) at the district level.

Power tillers, tractors, and combine harvesters were the most frequently owned and rented-out machines in the sample (Figure 1). Almost all farmers who had provided services in the previous year had also agreed to provide services in the future, and over 70 percent of farmers who provided services observed a significant increase in their incomes. “Not interested” and “no time” were the primary reasons for not providing services. Almost all service providers found renting profitable, although this varied to some degree by machine type (Figures 2 and 3).

Figure 2: Percentage of people who found renting profitable in *Kharif* 2017

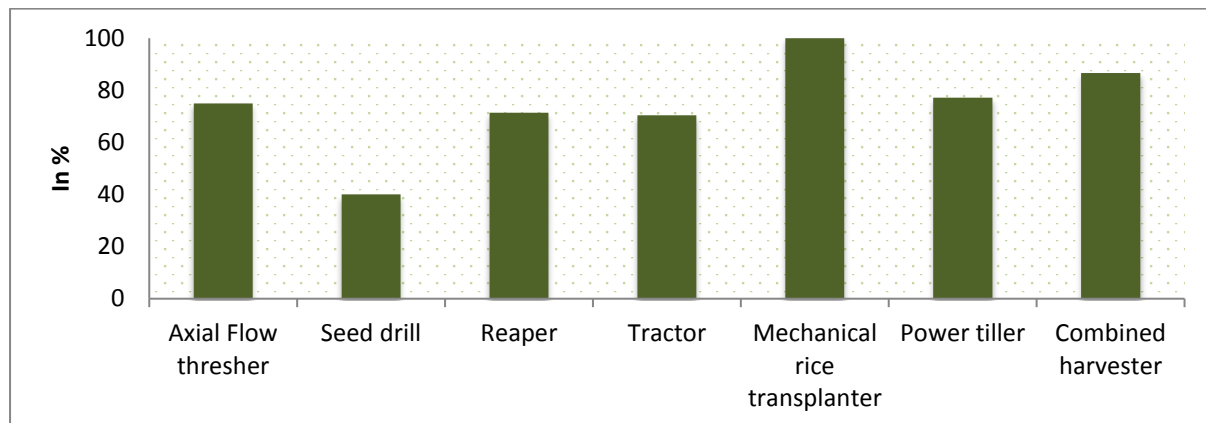
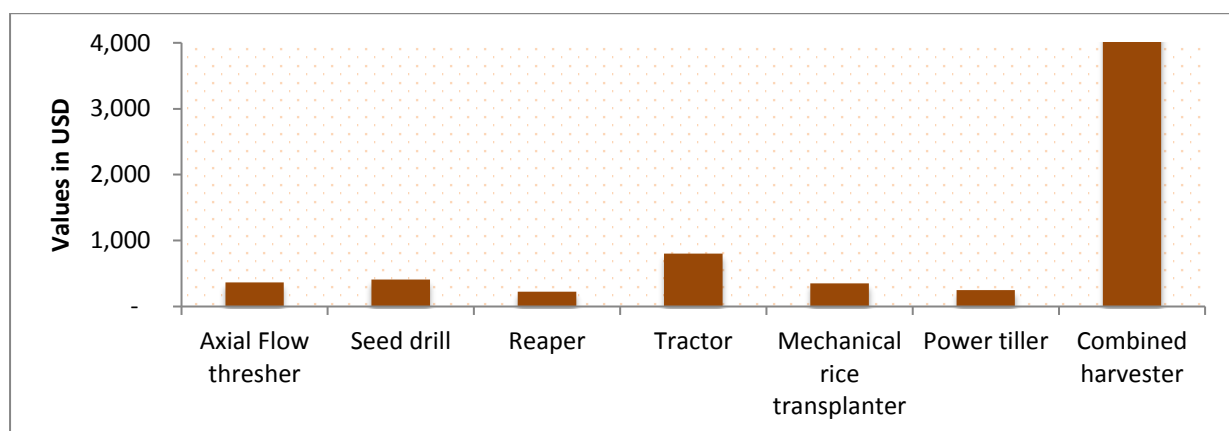


Figure 3: Average profits from machine rentals in a year (values in USD)



Entrepreneurship Index

Previous studies have shown that entrepreneurial self-efficacy plays an important role in determining entrepreneurial performance (Dalborg and Wincent 2014). Those with high self-efficacy in a field display greater entrepreneurial orientation or intention (Zhao, Hills, and Seibert 2005; Pihie and Bagheri 2013) and tend to achieve better outcomes (Mohd et al. 2014; Umoh et al., n.d.). An entrepreneurship index for our sample farmers that is based on their self-assessment of their self-efficacy would provide us a good measure of their entrepreneurial behavior if compared to actual outcomes of service provision. Based on questions related to machine-owners' confidence regarding several activities related to service provision, such as handling financial matters and innovativeness, we use principal component analysis, a data reduction

method that considers the correlation between observable characteristics and an unobservable, and construct an index that assigns each farmer a number between 0 and 1, such that a higher value indicates greater self-efficacy assessment.

The average value of this index for our sample farmers is 0.75, indicating that an average farmer in our survey rates their self-efficacy highly. This value is 0.71 for those who did not rent out any machines and 0.79 for service providers, a statistically significant difference (p value < 0.001). About 77 percent of the farmers in our sample have an entrepreneurship index value greater than or equal to 0.6. Of the service providers, about 82 percent scored at least 0.6, and almost 40 percent scored 0.9 or above, implying high self-assessment of their efficacy in becoming a service provider.

We test this relationship between the entrepreneurship index values and the likelihood of the respondent being a service provider and find a positive and highly significant correlation. Providing further confirmation, we find that service-related outcomes are better for those who have a high self-efficacy assessment. Table 1 highlights the service-provision outcomes, differentiated by the average value of the index (0.75) for our sample.

Table 1: Entrepreneurship index and service-provision outcomes

Outcome	Index < 0.75	Index ≥ 0.75	P value
Average no. of farmers serviced	30	60	0.0004***
Average no. of days serviced	20	29	0.0002***
Average land serviced (in acres)	37	65	0.0014**
Average entrepreneurship index	0.57	0.93	0.0000****
N	192	310	-

****significant at $\alpha=0.01$ percent; *** significant at $\alpha =0.1$ percent; ** significant at $\alpha =1$ percent

The evidence suggests that a more targeted and efficient machine-subsidy policy could be informed by gathering more information from potential beneficiaries on their perceived self-efficacy and using that information to prioritize future subsidy beneficiaries.

An alternative to targeting subsidies based on stated perceptions would be to subsidize entrepreneurs on an ex post basis, based on their demonstration of service provision. This could be formulated as a two-part subsidy. All applicants wishing to purchase machinery would receive a stipulated subsidy, and a complementary incentive scheme would be crafted to give service providers a bonus payment, contingent on submission of records of service provision or demonstration by other digital means.² The base subsidy under this scenario would be lower than present subsidy rates, but the bonus could be structured such that machine owners who act as service providers would be more than compensated for the smaller base subsidy.

To assess farmers' willingness to purchase machines and provide machine services under this alternative policy scenario, we included a short experiment in our survey. We first asked farmers to choose one of the seven machines in our study that they would hypothetically be interested in

² Data that could be used to demonstrate service provision include records of farmers who received services, with their contact details and information on the area serviced. These records could be verified by the Block Agricultural Officer, who could then recommend beneficiary names for the bonus. The entire process can be digitized to ensure transparency.

purchasing for the coming *Kharif* season. Once the machine was identified, several hypothetical base subsidy and bonus rates were proposed to farmers. Questions were asked regarding their interest in purchasing machines and in providing machine services under the different scenarios. This experiment had three rounds, with varied base subsidy and bonus values, but with the final cost of the machine remaining the same. The order of the scenarios was randomized to eliminate order effects.

Figure 4: Farmers' willingness to purchase machines

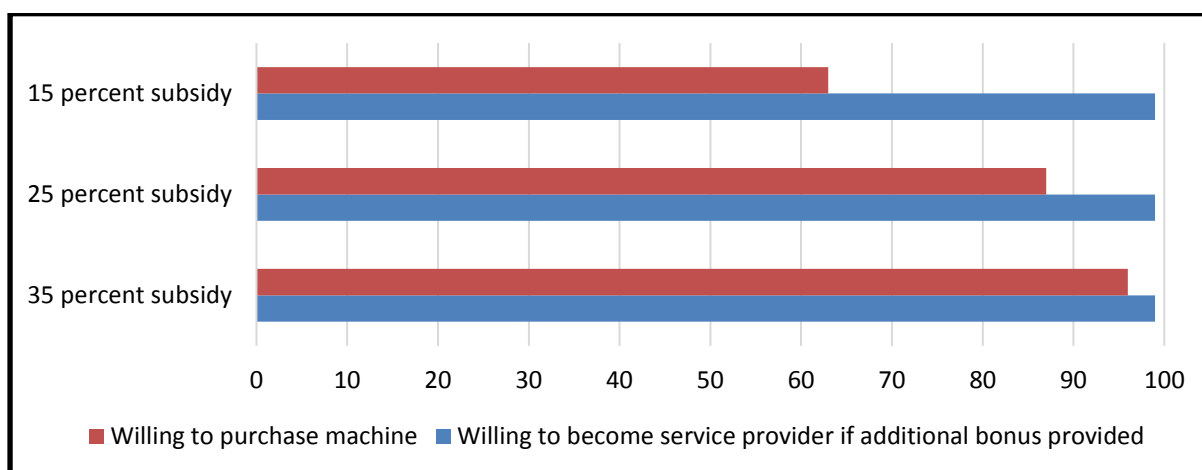


Figure 4 highlights the willingness of respondents to become service providers if a bonus component were added to the scheme. With decreasing subsidy rates, the willingness to purchase machinery declines, but even when the subsidy is only 15 percent of the total cost of the machine, about 63 percent of respondents are willing to purchase the machine and become service providers if there is a bonus. These trends were similar for all machines.

In the same experiment, we also randomized provision of business case information (that is, information on price of the machines, their functions, and the average profits from renting that machine out to other farmers). Roughly 50 percent of respondents were randomly provided information on the business economics of their chosen machine, while the others received no such information. Among the information recipients, 50 percent of respondents were randomly selected to receive information on all seven machines before making their choice of machine. The others were asked to choose the machine first and then, post-selection, were given information only on that machine. Overall, we find that at higher subsidy rates, providing full information on the business economics of machines resulted in higher willingness to invest among the farmers and this difference is significant.

Conclusion

Our findings point to two approaches to identifying and incentivizing potential entrepreneurs in Odisha. Option 1—using the entrepreneurship index—offers a low-cost means of screening potential beneficiaries. However, this approach creates little accountability on the part of subsidy recipients and the possibility of inclusion errors is great. Option 2—using a two-part subsidy scheme—would incentivize proven entrepreneurs *ex-post*. Results from the experiment are encouraging as we see that, despite administrative requirements such as documentation, many

respondents are willing to become service providers. Both options, with their caveats, could be tested in Odisha in the coming seasons to determine which alternative is more effective in encouraging entrepreneurial behaviour with regards to service provision using agricultural machinery.

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Author Details

Vartika Singh is project manager in the Environment Production and Technology Division (EPTD) of the International Food Policy Research Institute (IFPRI), New Delhi. Patrick S. Ward is a research fellow, EPTD, IFPRI, Washington DC. Shweta Gupta is a senior research assistant, EPTD, IFPRI, New Delhi.

This note has been prepared to promote discussion and has not been peer-reviewed. Any opinions stated herein are those of the authors.