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IMPACT ASSESSMENT BASELINE REPORT

India

Odisha Particularly Vulnerable Tribal Group Empowerment and Livelihood Improvement Project (OPELIP)

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Introduction

The Odisha Particularly Vulnerable Tribal Group Empowerment and Livelihoods Improvement Program (OPELIP) is a comprehensive program designed to enhance the livelihood of Particularly Vulnerable tribal communities as well as surrounding other tribal and non-tribal communities in the state of Odisha, India. The OPELIP project has been implemented in 12 districts of Odisha, starting in mid-2017 and it will continue to provide support through 2025. The project specifically targets particularly vulnerable tribal groups (PVTGs) in Odisha and aims to enhance livelihood of the tribal people through agricultural transformation (improved agricultural practices and enhanced production), drudgery reduction, food security and nutrition, education and community empowerment. According to the ST and SC Development Department of Odisha[1], OPELIP is the first project funded by an external developmental partner to reach the particularly vulnerable tribal areas in Odisha.

With support from the OPELIP's Project Management Unit (PMU), IFAD's country office in India, and the data collection service provider, Academy of Management Studies (AMS), the Research and Impact Assessment Division (RIA) of IFAD leads the impact assessment of the OPELIP project. In this report, we provide a baseline summary of outcome and impact indicators identified in the project logical framework, theory of change, and impact assessment plan for both the project and control sample. We assess the similarity of the project and control groups at the baseline, i.e., prior to the project interventions.

This impact assessment contributes to IFAD's effort to generate a critical mass of evidence on whether and how developmental interventions contribute to economic development and improved wellbeing, especially through enhanced rural transformation and improved livelihood of tribal and indigenous people. It is often claimed that despite a big investment in agricultural development interventions, little has been done to carefully assess the impact of such interventions (Winters, Salazar, and Maffioli, 2010; World Bank, 2011). It is no secret that rigorous impact assessments are critical to inform policy making as well as to identify problems in program implementation and continuously improve it and uphold accountability of the project (Gertler et al., 2016). Since inclusive rural transformation is one of IFAD's main goals, assessing the impact of interventions related to tribal development is undoubtedly a top priority. This impact assessment is part of the increasing efforts and commitments by IFAD and the wider development community to effectively measure the impact of rural development interventions on people's lives, especially tribal and indigenous people characterized by high degree of poverty and vulnerability.

The OPELIP program aims to reduce poverty and enhance living conditions of the particularly vulnerable tribal groups through increased income and improved food and nutrition security, primarily for 32,091 PVTG households, 14,000 other tribal households and 16,356 other poor households in the project area. The project aims to achieve these goals through capacity building, secured entitlements over land and forest, improved agricultural practices and enhanced production, promoting income-generating activities and providing access to education, health, roads and other services. As the impact assessment seeks to produce robust estimates of both direct and indirect impacts of the OPELIP project on various livelihood outcomes, this report highlights the baseline levels of the selected indicators.

[1] ST and SC Development Department a short name for Scheduled Caste and Scheduled Tribe Development, Minorities and Backward Classes Welfare Department

The existing body of development literature has assessed the impacts of multifaceted interventions on livelihood outcomes in different countries and contexts, but no rigorous evidence exists on the impact of agricultural development interventions on livelihood improvement of tribal communities. For example, Banerjee et al. (2015) assesses the impact of multifaceted interventions on wellbeing status of agrarian households in six different countries and finds a significant positive increase in household income and consumption expenditures. Assessing the impact of a livestock transfer and training intervention, similar results were reported by (Jodlowski, Winter-Nelson, Baylis, and Goldsmith, 2016; Kafle, Winter-Nelson, and Goldsmith, 2016; Rawlins, Pimkina, Barrett, Pedersen, and Wydick, 2014) from Zambia and Rwanda.

Among existing studies, some assess the impact of agricultural interventions on nutritional outcomes (Pandey, Mahendra Dev, and Jayachandran, 2016), others assess the impact on agricultural productivity (Davis et al., 2012), food and nutrition security (Banerjee et al., 2015; Fiorella, Chen, Milner, and Fernald, 2016; Jodlowski et al., 2016; Kafle et al., 2016) [2], and women's empowerment and intra-household decision-making (Alkire et al., 2013; de Brauw, Gilligan, Hoddinott, and Roy, 2014; Kafle, Winter-Nelson, and Michelson, 2016). In many cases, even though development programs transfer productive resources to women, men still control the income generated from the transferred resources (Yoong, Rabinovich, and Diepeveen, 2012). In sub-Saharan Africa, Kilic, Winters, and Carletto (2015) notes that women still have much less control and access over productive resources that are key to agriculture-based livelihoods. Recently, Lawry et al. (2017) find positive causal link between provisions of land tenurial instrument and agricultural productivity and income growth, but the impact differed by region greatly.

Relatively unexamined in the literature is the impact of agricultural interventions on child labor and schooling outcomes, rural-urban migration and potential reverse migration, intra-household decision-making and gender balance, local market development and local food economy, and resilience and income diversification. Since this impact assessment tries to fill the knowledge gap by assessing the impact of the OPELIP intervention on aforementioned outcomes, this report provides baseline statistics of the relevant outcome and impact indicators identified in the project logical framework, theory of change, and impact assessment plan. Table 1 presents the indicators we examine in this analysis. The analysis compares and contrasts the point estimates of the indicators across project and control areas as well as different tribal groups. In so doing, the analysis assesses whether outcome and impact indicators are similar across project and control households in baseline, an important aspect for assessing the attribution of project interventions to changes and observed differences in outcomes.

The rest of this report proceeds as follows. In section 2, we provide the theory of change which delineates the impact pathways for OPELIP. Section 3 provides an overview of the project coverage and sample size across districts and tribal groups. Next, we describe the impact assessment design including sampling strategy and data collection. Then, in the results section, we present descriptive statistics of the selected impact indicators and assess their statistical similarity between the project and control sample. Section 5 concludes.

[2] See Berti, Krasevec, and FitzGerald (2004) and Pandey et al. (2016) for review of earlier work on the impact of agricultural interventions on nutrition outcomes.

Table 1. Impact and outcome indicators assessed in the analysis

S.N.	Themes	Indicators
1.	Poverty and wellbeing	Income
		Consumption expenditure
		Asset (wealth) index
2.	Food security and nutrition	Food insecurity experience scale (FIES)
		Subjective food insecurity
		Dietary diversity score
		Child anthropometrics (stunting, wasting, underweight)
3.	Women's empowerment and gender balance	Women's and men's decision-making power
4.	Agriculture	Land ownership
		Farming practices (regular vs. shifting cultivation)
		Agricultural yield
5.	Livestock	Livestock ownership
		Livestock sales and income
6.	Child schooling	School attendance
		School performance
7.	Migration	Number of migrants
		Frequency and amount of remittances
8.	Loan and credit	Access to loan/credit
		Amount of loan/credit
		Source and use of loan/credit

Theory of change and main impact assessment questions

This impact assessment is entirely guided by the underlying theory of change which embodies the logical framework for OPELIP developed by IFAD. The theory of change provides a pathway for project inputs and activities to effectively lead to project impacts. The pathway from project inputs to impacts is mediated by immediate and more direct outputs which eventually lead to project impact thorough project outcomes.

The project consists three main components including Community Empowerment; Natural Resource Management (NRM) and Livelihood Improvement; and Community Infrastructure and Drudgery Reduction.[3] The Community Empowerment component includes capacity building of both individuals and VDAs in project areas. For individuals, the project will provide awareness training on gender balance, saving, micro-finance, nutrition, health as well as skill development training on home gardening and agricultural practices. At the village level, the project will capacitate VDAs by providing training, as well as expanding or enhancing facilities and services offered. Assuming that there will be sufficient demand for training and support services, the community empowerment component of the intervention is expected to lead to women's SHG formation, delivery of training on variety of themes including gender balance, saving, home gardening, nutrition, and reproductive health.

The second component, NRM and Livelihood Improvement also offers a menu of services and facilities. The most prominent service under this component is that all land-less households will be provided with a land title or land right certificate for the agricultural land they have been using or the nearby forest land used for shifting cultivation.[4] In addition, the project helps to construct irrigation structures, storage facilities, and land and water resource management techniques. It also supports local market development efforts such as '*haat bazaar*'. Assuming that there is sufficient free land available and sufficient support for infrastructure development and market development efforts, the NRM and livelihood component assures that beneficiaries have access to land for homestead and agriculture, irrigation structures and storage facilities are constructed, and sufficient local markets are developed or enhanced.

The third component provides services and facilities that directly or indirectly help improve work efficiency and increase productivity. Among other services, major activities under this component include installing rice hullers, food processing facilities, drying yards, smokeless stoves, fuel wood reserves, and providing easy access to drinking water. Assuming that there will be demand and sufficient support for drudgery reduction activities, this component of the project results into construction of food processing facilities, drying yards, fuel wood reserves, and safe drinking water structures in the project villages.

Assuming that the targeted villages and individuals respond to the intervention by taking up the services offered, the project also leads to wide variety of direct and indirect impacts both in household and village levels. In particular, beneficiaries are expected to see increased food and agricultural productivity compared to the project non-recipients. In addition, it is expected that the

[3] The project also includes a fourth compoent, Project Management, but we do not specifically assess the impact of the this component because it has more to do admisitration and budget management than directly providing services to the beneficiaries

[4] Tribal groups in Odisha are known for podu cultivation, a tradtional tribal practice of shifting cultivation.

intervention will lead to income growth, diversified income sources, enhanced access to nutritious food items, improved and diversified quality of the diet, increased resilience to economic shocks and other calamities, women's empowerment and gender balance, and increase in school enrollment and performance. In the community level, community groups and organizations are expected to be capacitated to identify and mobilize additional resources, local prices will likely fall and local food economy will be enhanced through easy access and availability of variety food items. Moreover, beneficiary villages are expected to have better access to community resources compared to non-project villages.

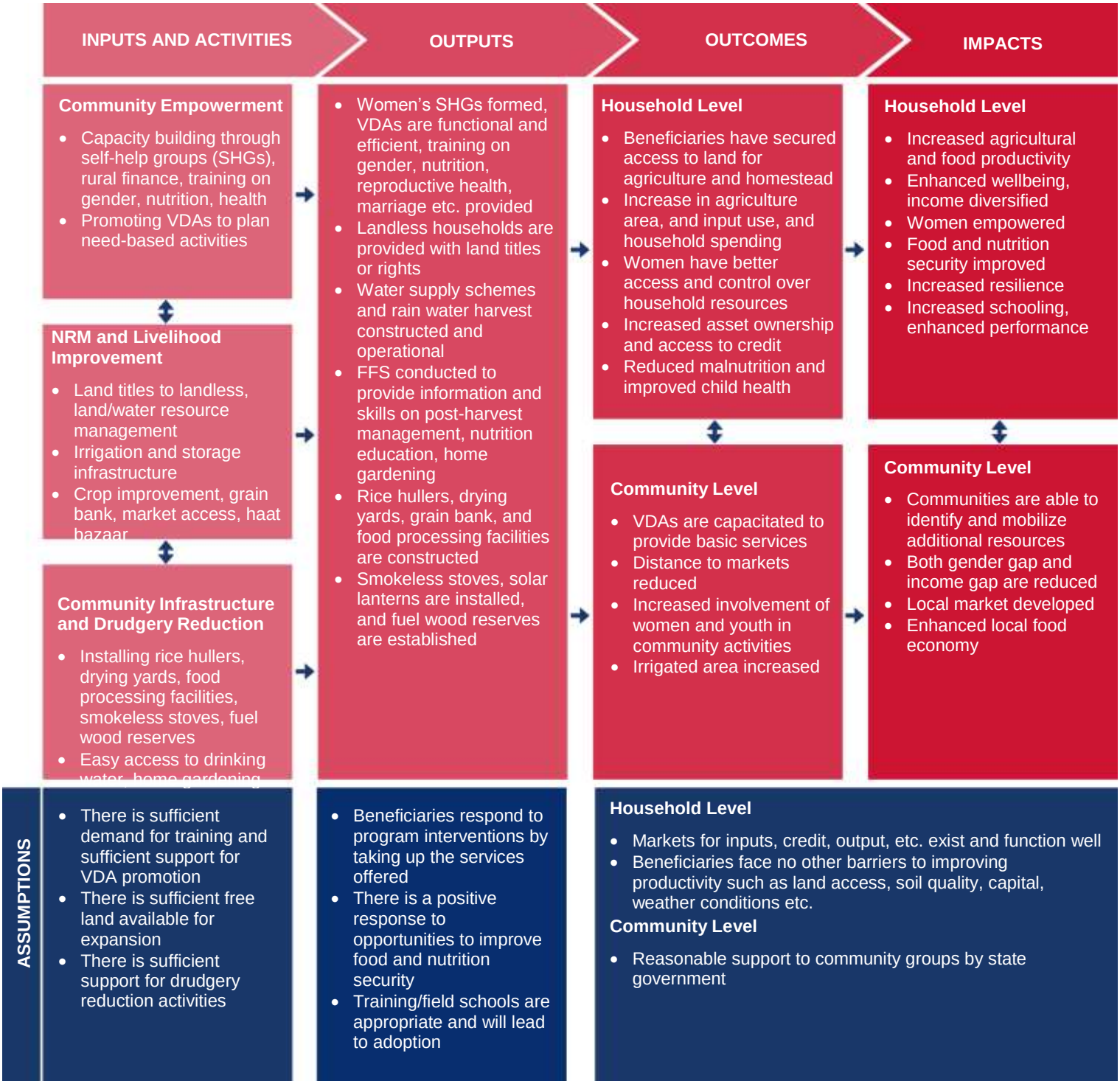
Figure 1 summarizes the theory of change for the OPELIP project. In essence, the theory of change illustrates the causal mechanism that shows how project impacts emerge from inputs and activities. The theory of change of the OPELIP project closely follows the project logical framework and has been widely discussed with field staff and the project management unit (PMU).

Impact assessment questions

As the intervention is aimed at targeting particularly vulnerable tribal groups (PVTGs) in rural areas and provides a menu of services related to inputs/activities on (a) Community empowerment, (b) NRM and livelihoods enhancement, and (c) Community infrastructure and drudgery reduction (see Figure 1), the project can have widespread impact in multiple dimensions of peoples' livelihoods. This impact assessment exercise will investigate the following questions:

1. Does the intervention (e.g. providing irrigation facilities, storage structures, harvest machines, and awareness training on input use, crop production, etc.) increase agricultural productivity? Especially, rice and other cereal productivity?
2. Do the PVTGs and other landless have secured access to land for agriculture and homestead?
3. Does the project contribute to poverty reduction, income diversification and household assets and income growth?
4. Does the project help improve child nutrition and improve the food security situation among PVTGs and other beneficiaries?
5. Has school enrolment increased and school performance improved among beneficiary children?
6. Does the project contribute to local market development and to an enhanced local food economy?
7. Has the project contributed to women's empowerment and gender balance in intra-household decision-making?
8. Does the project contribute in improving the services offered by the government service providers?

Figure 1: Theory of change



Impact assessment design

Constructing counterfactual groups

In this section we describe how we selected counterfactual groups for this impact assessment. The OPELIP intervention is implemented at the Gram Panchayat (GP) level. Each GP has multiple villages and all villages in project GP are covered by the project. Because the intervention specifically targets PVTGs, eligibility criteria for selection into the program are straightforward. All households in GPs with PVTG population are selected for the program – a GP saturation approach. There is no minimum number of PVTG households required for a GP to be considered eligible.

As the project does not employ a phased roll-out implementation approach and all eligible households are covered, finding a good counterfactual is challenging. Assuming each district has a pool of households and villages possessing similar characteristics with that of project villages, we use village-level propensity score matching to find counterfactual villages outside of the project area but within the same Block or Tehsil. A Block or Tehsil is an administrative unit smaller than a district but larger than a GP. A pool of potential control villages is restricted within the same Block to assure geographical similarity and spatial proximity between project and control villages.[5] We use the 2011 census data to perform the village-level matching which is based on 20 different variables about household demographic characteristics, asset ownership and living conditions (see the Impact Assessment Plan for details). Due to data unavailability, no agricultural variables are used in the village-level matching. Since we perform matching at the village level, all the variables are village level averages. For example, average number of households in the village with good quality of roof material such as corrugated galvanized iron (CGI). We perform propensity score matching with 3-nearest neighbors match with replacement. The caliper length is set at 0.1.

Sampling and data collection

Choosing the right sample size is very critical to a successful impact assessment, i.e., one that reliably measures the impact of intervention(s). Various factors affect the sample size but the expected or desired change in the outcome of interest is the key. We use a method developed by the World Bank that incorporates expected minimum change in the outcome variable, its standard deviation, the critical values of the confidence interval and statistical power, and the minimum number of units to be sampled within each cluster (Winters et al., 2010; World Bank, 2007). Based on the discussions provided in Winters et al. (2010) and World Bank (2007), we use the following formula to calculate the number of required sample size (N):

$$N = \frac{4\,\sigma^2\left(Z_a + Z_\beta\right)^2}{D^2}[1 + \rho(m-1)] \quad (1)$$

where σ is the standard deviation of the baseline outcome variable, Z_a is the critical value of the confidence interval, Z_β is the critical value of the statistical power, D is the minimum expected change in the baseline average of outcome variable, ρ is the intra-cluster correlation of the unit of analysis, and m is the number of units to be sampled within each cluster. The standard deviation

[5] Even though a distance variaable is not available for matching, restricting the pool of potential control villages with in the same Block still assures geographical similarity and spatial proximity between project and conrol villages

(SD) are calculated using relevant variables from 2011 census data and 2014 Odisha agriculture census data. The minimum expected change (D) was based on the previous research and key informant interviews with project officials. Among other parameters, we expected the analysis to have a 80% statistical power and 95% confidence level so Z_a =1.96, and Z_a=1.28. Following the standard practice in the literature, we expected to survey at least 15 units of observation per cluster (village in this case), and the intra-cluster correlation was assumed to be 0.05.

Even though the outcomes of interest for the OPELIP project includes several other variables, our sample size calculation was based on four potential variables only, due to data unavailability. The variables include food security index, cereal productivity, rice productivity, and proportion of irrigated area. Ideally, these calculations would be done for the program implementation unit, i.e. GP in this case, but, unfortunately, no data was available at the GP or village levels and our calculation is based on district level average. As a consequence, the minimum expected changes are relatively small because these expected changes are for the entire district. Replacing the parameter value in Equation 1, we calculated the required sample size (N) for each outcome variable. We adjust the sample size for 10% margin of error. In general, the largest required sample size is chosen for sampling to assure that the sample is sufficient to achieve the expected effects. In this case the largest required sample size to achieve the minimum expected change in food security index was 2,096. We divided the sample size to two equal halves giving us a treatment sample of 1048 households and a control sample of another 1048 households.

Sampling strategy

There are 17 micro-project agencies across the 12 project districts. Because the districts are widely spread across the state and differ in geographical and agro-climatic conditions, we employ a two-stage sampling. In the first stage, we used proportional stratified sampling to determine the number of households to be chosen from each MPA. Since each MPA differs with other MPAs in many dimensions including ethnicity and agro-ecological conditions, we believe the proportional sampling method assures the final sample to be representative of beneficiaries from all MPAs. As the proportion of households chosen is 1.09% (1,048) of 95,374 beneficiary households, we sampled 1.09% of households from each MPA, proportionately. In the second stage, the number of households for each MPA was divided by 12, the smallest number of households to be sampled from an MPA, in this case LSDA, Puttasing. Rounding up the number of villages gives us a total of 87 treatment villages across the 17 MPAs.

The final sample includes 1.09% of total beneficiaries from each of the 17 MPAs to adequately reflect the heterogeneity in MPA characteristics. For the control group, because there is no MPA area associated with them, we selected 1,048 households from 87 villages outside of project areas but within the same Block. The counterfactual villages were chosen based on propensity score matching; for each Block, best-matched villages outside of project areas but within the same Block were chosen.

Based on the number of villages to be sampled from each MPA, we produced three sets of project villages by randomly selecting the required number of villages from each MPA three times. Project villages in each random set were accompanied by three potential control villages chosen by using the propensity score matching approach. For each randomly selected project village, the best matched control village was identified with help from the Project Management Unit (PMU) and MPA staff. In this selection process, most MPAs organized a gram panchayat meeting in their locality to collect input from village leaders and other individuals.

Project coverage and sample size

The OPELIP project covers 12 districts across the state of Odisha as depicted in Figure 2, namely Anugul, Deogarh, Gajapati, Ganjam, Kalahandi, Kandhamal, Keonjhar, Malkangiri, Mayurbhanj, Nuapada, Rayagada, and Sundargarh. The project covers 1,243 villages[6] in 17 micro-project areas[7] across the 12 districts in the State of Odisha and it targets the particularly vulnerable tribal groups (PVTGs) in the most challenging and remote areas with persistent poverty (IFAD, 2014). Each micro-project area is covered by a micro-project agency (MPA), a governmental entity that implements special programs targeted to the PVTG pocket areas. These special programs have been in place since the late 1970s. In 2006, the Government of India classified the PVTGs into 13 different types (Laxmikanth, 2011). The 13 PVTG groups are: Bihor, Bondo, Chuktia Bhunjia, Didayi, Dongria Khond, Juang, Kharia, Kutia Khond, Lanjia Saura, Lodha, Mankidia, Paudi Bhuyan, and Sauura. All 13 types of PVTGs are represented in the 17 different MPAs across 12 districts. By design, MPAs are the implementing units for the OPELIP project. The project is designed to cover all villages previously covered by the MPAs as well as all other villages outside of MPA areas but within the same Gram Panchayat (GP)[8] – a GP saturation approach.

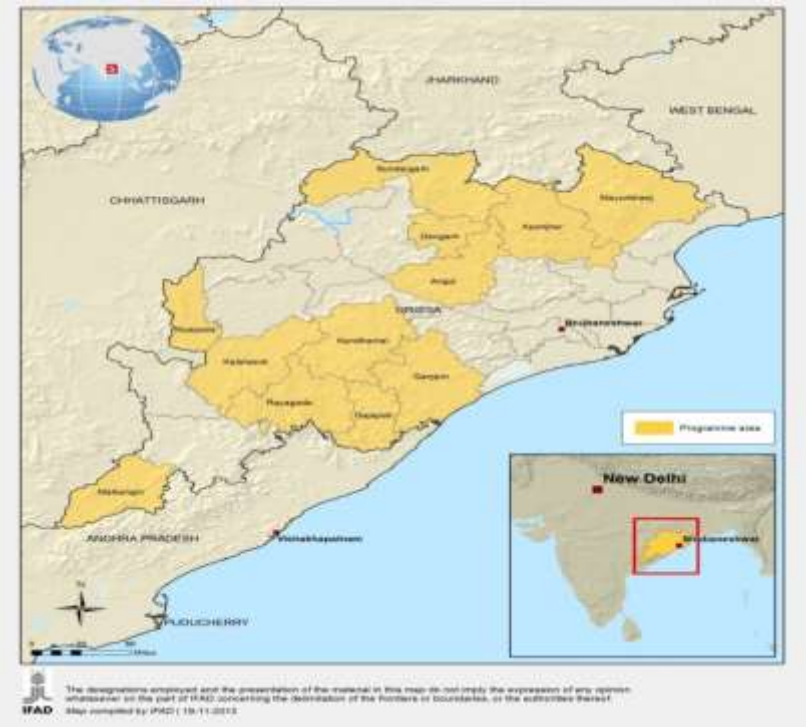


Figure 2. OPELIP project coverage areas

The OPELIP project covers 12 districts in the State of Odisha because only these districts have pocket areas of particularly vulnerable tribal groups. Table 2 presents the details of project and control sample by district. The project sample randomly selects 90 villages out of 1243 villages

[6] Note that, in the project design document, it is mentioned that the total number of villages to be covered by OPELIP is 1,020. However, based on the 2011 census, the updated number of villages in the target areas is 1,243.
[7] A list of micro project areas by district is presented in Appendix Table A1
[8] A Gram Panchayat (GP), also called village council, is a local self-governing body formed by local residents.

covered by the project. [9] The same number of control villages were selected randomly from the same 12 districts. Project and control sample were designed to be equal size at 1048 each, but three extra households were surveyed during data collection. Although the plan was to select 12 households from each village, for practical reasons, a total of 10 to 13 households were selected per village. In total, the sample size is 2099 1050 project households and 1049 control households. As expected, the sample size varies widely by the districts because population size varies by the district and our sample size for each strata (in this case district) is proportional to the overall population.

Table 2. Project and control sample coverage by districts

District	Project sample		Control sample	
	Villages	Households	Villages	Households
Anugul	4	42	4	42
Debgarh	10	123	10	124
Gajapati	10	116	10	116
Ganjam	3	35	3	35
Kalahandi	4	52	4	52
Kandhamal	2	26	2	26
Keonjhor	5	59	5	59
Malkangiri	9	97	9	97
Mayurbhanj	25	301	25	301
Nuapada	2	27	2	27
Rayagada	11	113	11	112
Sundargarh	5	59	5	58
Total	90	1,050	90	1,049

Notes: The listed districts exhausts all the districts with pocket areas of PVTG population. As the project is designed to cover all the villages only in the GPs with PVTG populations, most villages in each district are not covered by the project.

By design, OPLEIP targets all PVTG households in the state of Odisha and all the Gram Panchayats with PVTG pocket areas are supposed to be fully covered by the project. As a consequence, no PVTG population is expected to reside in areas outside of OPELIP coverage. However, baseline data indicates that more than one third of PVTG households live outside of the project areas. The full sample is composed of 47.1% STs, 33.5% PVTGs, 5.6% SCs, and 13.8% other tribal groups and among the 33.5% of PVTGs, 12% reside in control areas (Table 3). The population distribution of tribal groups in our data is much higher than the state-wise tribal population distribution because our sample is representative of only 12 districts that have the highest proportion of PVTG population. In our sample, households that do not identify themselves as a specific tribal group are labelled as

[9]The number of villages to be selected was calculated by dividing the number of required project sample by 12, the desired minimum number of households per village. The required total sample size was calculated based on existing data and minimum expected effects. The required sample for each Micro Project Area (MPA) was calculated based on proportional allocation to the respective population size.

'other tribes'. It is possible that the 'other tribes' group may consist some non-tribal households as well.

Table 3. Distribution of project and control sample by tribal groups

Tribal group	Sample		
	Project (%)	Control (%)	Full
Particularly vulnerable tribes (PVTG)	21.4	12.1	33.5
	(2.60)	(1.86)	(2.03)
Other Scheduled tribes (ST)	19.0	28.1	47.1
	(2.33)	(2.79)	(2.29)
Scheduled castes (SC)	2.2	3.4	5.6
	(0.58)	(0.90)	(1.00)
Other tribes	7.4	6.4	13.8
	(1.27)	(1.11)	(1.39)
Total	50.0	49.9	
	(3.95)	(3.95)	100
Observations	1050	1049	

Notes: Point estimates are percentages. Standard errors are in parentheses.

Table 4 presents project and control samples by prior MPA coverage. Having a prior MPA coverage means that the households have been covered by livelihood enhancement programs run the Government of Odisha through micro project areas (MPA). The OPELIP program is designed to extend the MPA coverage to also include all households in the Gram Panchayat that were not previously covered by the MPA. Our control sample comes from Gram Panchayats outside of the OPELIP targeted Gram Panchayats. By design, no households in control areas are expected to have prior MPA coverage because MPAs were created by the Odisha government to serve tribal areas only. However, baseline data indicates that about 22.6% of the full sample was previously covered by the MPAs and 3.6% of which is in control areas, where no households with prior MPA coverage was expected. This indicates that the current targeting for OPELIP includes 7.2% of the control sample (3.6% of the full sample) from areas previously covered by the MPAs. This implies that more than 7% of households from areas previously covered by the MPAs might have been migrated or displaced to areas outside of MPA and OPELIP coverage areas, current control areas. In total, only about 23% of our sample had prior MPA coverage and more than 60% of project sample (31.1% of full sample) had no prior MPA coverage.

Table 4. Project and control sample by Micro Project Agency (MPA) coverage area

Sample	Prior MPA coverage		
	Yes	No	
Project	18.9	31.1	50.0
	(2.59)	(3.11)	(3.95)
Control	3.6	46.4	49.9
	(0.89)	(3.75)	(3.95)
Full	22.6	77.4	100.0
	(2.47)	(2.47)	

Notes: Point estimates are proportions. Standard errors are in parentheses.
Full sample is 2099 of which project sample consists 1050 households and control sample consists 1049 households

In summary, baseline data indicates that the intended project coverage for OPELIP may have slightly deviated from the initial plan. Although having about 24% of PVTG households in control sample is favorable for the Impact Assessment for comparison purposes, it indicates a lack of consistency with project design report (IFAD, 2014). However, it is not advised to reconsider the current targeting because respondent's self-classification of their tribal group may not reflect the official classification. Similarly, presence of about 7% of prior MPA households in control areas may be due to the difficulty for the respondents to reconcile what prior MPA coverage actually means.

Results

In this section, we begin by providing descriptive statistics for household characteristics, household head characteristics, and housing characteristics for the full sample, project sample, and control sample. We then assess the similarity between these characteristics across the project and control samples using the two-sample t-test. The rest of the results section reports on the impact indicators identified in the introduction section (Table 1). We also use the two-sample t-tests to assess the statistical similarity of each impact indicator between project and control sample as well as PVTG and non-PVTG sample. The statistical similarity between project and control samples indicates a balance. A balanced sample in baseline is a critical requirement for a valid impact assessment.

Table 5 presents summary statistics on household demographics, household head characteristics, and housing quality characteristics. On average, each household in both project and control areas have about five members. Among the five household members are: two adults ages 30 to 64, about two children below 14, and one youth ages 15 to 29. In line with the government definition, we define youth as individuals in the age group 14 to 29.[10] Individuals in the age group 15 to 64 are defined as economically active population. More than half of the household members are of economically active age and there are very few adults above 65, probably due to lower life expectancy in the area. As a result, the dependency ratio is low at 0.66; for every three working age members, there are only two children and/or elderly.

Table 5. Baseline summary statistics, project and control areas

	Sample area			
Household characteristics	Full	Project	Control	Difference
Household size	4.81	4.83	4.78	0.05
	(1.81)	(1.87)	(1.75)	
Number of children below 14	1.46	1.49	1.43	0.06
	(1.36)	(1.37)	(1.34)	
Number of youth 15-29	1.39	1.40	1.39	0.01
	(1.19)	(1.20)	(1.18)	
Number of adults 30-64	1.74	1.73	1.75	-0.02
	(0.85)	(0.85)	(0.86)	
Number of adults 65 and up	0.21	0.20	0.22	-0.02
	(0.47)	(0.46)	(0.48)	
Dependency ratio	0.66	0.66	0.65	0.01
	(0.64)	(0.64)	(0.64)	
Literacy rate (%)	51.7	50.9	52.4	-1.5
	(30.2)	(30.8)	(29.5)	
Household head characteristics				
Female head(1=Yes, 0=No)	0.099	0.10	0.096	0.004
	(0.30)	(0.30)	(0.30)	

[10] The International Labor Organization (ILO) and the United Nations (UN) define youth as individuals between 15 to 24 years of age.

Age of head	46.3	46.2	46.4	-0.2
	(13.1)	(13.1)	(13.0)	
Education of head	2.60	2.64	2.55	0.09
	(3.91)	(4.00)	(3.82)	
Married head (1=Yes, 0=No)	0.86	0.87	0.86	0.01
	(0.34)	(0.34)	(0.35)	
Housing Characteristics				
Home ownership (1=Yes, 0=No)	0.98	0.98	0.99	-0.01
	(0.12)	(0.14)	(0.10)	
Roof material (1=Improved,0=else)	0.54	0.55	0.53	0.02
	(0.50)	(0.50)	(0.50)	
Wall material (1=Improved,0=else)	0.35	0.36	0.35	0.01
	(0.48)	(0.48)	(0.48)	
Floor material (1=Improved,0=else)	0.24	0.26	0.22	0.04
	(0.43)	(0.44)	(0.42)	
Number of rooms	2.33	2.32	2.33	-0.01
	(1.09)	(1.14)	(1.04)	
Source of water >30 mins, roundtrip	0.17	0.18	0.16	0.02
	(0.38)	(0.39)	(0.36)	
Drinking water quality (1=Safe,0=else)	0.75	0.74	0.76	-0.02
	(0.43)	(0.44)	(0.43)	
Source of energy (1=Improved,0=else)	0.26	0.31	0.22	0.09
	(0.44)	(0.46)	(0.41)	
Toilet (1=Improved, 0=else)	0.28	0.28	0.28	0.009
	(0.45)	(0.45)	(0.45)	
Cooking fuel (1=Traditional 0=else)	0.97	0.96	0.98	-0.02
	(0.17)	(0.19)	(0.15)	
Observations	2099	1050	1049	

Notes: Point estimates are sample means. Standard deviations are in the parentheses. A two-sample t-test is used for the test of mean differences. Level of significance $^{*}p< .10$, $^{**}p< .05$, $^{***}p< .01$

The literacy rate is assessed by an individuals' ability to read and write in any (at least one) language. Following international practice and based on the local context, the literacy rate is not assessed for children below six years of age because the school starting age in most Indian states is 6 (Government of India, 2014). The literacy rate at the household level is quite low; although the majority of household members are quite young, only about half of the household members are literate indicating a poor access to education in rural Odisha.

Characteristics of the household heads are presented in the second panel of Table 5. On average, household heads are about 46 years old, a vast majority of them are married (86%), and only about 10% of the households are reported as female headed. As one would expect based on the low literacy rate, on average, household heads have only completed second grade. None of these statistics are statistically different between project and control groups indicating a good balance on household demographics in baseline.

Housing quality characteristics are presented in the third panel of Table 5. No housing characteristics are statistically different between project and control groups. More than 98% of households own at least one home and each home has more than 2 rooms on average. However, the quality of dwellings may not be as great because only 55% of the houses are built using improved roof materials, 35% of the houses use improved wall materials, and just about 22% use improved floor materials. Among other features, only about 26% of households have access to improved sources of energy such as electricity or solar energy; 31% of households in project areas have access to improved energy sources compared to only 22% of households in the control areas, but the difference is not statistically significant. Similarly, more than two-thirds of households still have no access to improved toilets and more than 96% of households use traditional cooking fuels such as firewood. Although these statistics are not promising, a lot of the housing quality features are consistent with that of a typical tribal area in India or other developing countries

Poverty and wellbeing

The analysis uses three indicators to measure poverty: income, consumption expenditure, and an asset index. Income captures the monetary in-flow to the household in the last 12 months from self-employment, wage employment, social transfers or gifts, income from the sales of livestock and agricultural products, loans and credit received, and remittances. Consumption expenditure includes values of both food and non-food consumption in the last 12 months and is a good complement to the income measure to reflect the level of wellbeing. Asset index is a weighted index of number of durable assets, number of livestock, land holding size, and housing characteristics.[11] Unlike income and consumption that are essentially flows reflecting current/short term status, the asset index is more of a stock variable that captures the long run wellbeing status as well as the current socioeconomic status of a household.

Table 6 presents wellbeing indicators in three spaces; income space, consumption space, and asset space. Income measures the annual cash income flow into the household from wage employment, self-employment, crop produce, livestock, and animal product sales, amount of loans received by the household, and amount of social transfers or gifts over the past 12 months. Information about cash income was collected for the last 12 months, but for comparison and consistency with consumption expenditure, we present monthly income in Table 6. By definition, it is possible that many households have no cash income because most households in tribal communities have no regular wage employment, no self-employment microenterprise, have very limited access to loans or credit, and may have no enough crop or livestock products for sale. Unlike income, wellbeing status based on consumption may be more accurate and meaningful because despite zero or low income, all households consume food and non-food items, either from own production, gifts, or from purchases. Assets, on the other hand, by capturing a measure of stock rather than flow, represent the long-run wealth accumulation and socio-economic status of the household.

On average, a household in the OPELIP project areas and nearby villages has a monthly cash income of 444.3 Rupees per month per adult equivalent[12]. The income level of 444 Rupees per adult per

[11]Specifically, household durables include radio, television, cellphones, private transportation vehicles such as bicycle, motorbike, car etc., furniture, kitchen equipment etc., livestock includes cattle, buffaloes, goats/sheep, pigs, poultry etc., and housing characteristics include access to electricity, access to improved sanitation, good quality housing, improved sources of water, and improved cooking fuel. See Table A2 in Appendix for details.

[12]Income per adult equivalents is calculated by dividing total household income by adult equivalent size, instead of household size. Adult equivalent sizes are smaller than household sizes because children and elderly have lower weights than a young adult, male or female.

month is way below the Odisha poverty line of 695 Rupees per person per day.[13] The extremely low level of income is surprising but not unexpected because more than one third of the households (38%) report having no cash income at all. As a consequence, 77% of households fall below the state poverty line for Odisha (695 Rupees per person per month). As expected, the level of income is statistically not different between the project and control groups and about the same proportion of households reported to have no cash income in both groups. When the level of income is compared against state poverty line, slightly more people are poor in project areas than in control areas, but the difference is not statistically significant.

Table 6. Wellbeing indicators across project and control groups

	Sample			
Income space	Full	Project	Control	Difference
Income (Rupees)†	444.3	438.6	450.1	-11.5
	(669.6)	(680.1)	(659.2)	
Cash income (1=No, 0=Yes)	0.38	0.39	0.37	0.02
	(0.49)	(0.49)	(0.48)	
Income poor (1=Yes, 0=No)	0.77	0.78	0.76	0.02
	(0.42)	(0.41)	(0.43)	
Consumption space				
Consumption expenditure (Rupees)	795.5	780.0	811.1	-31
	(758.5)	(744.1)	(772.7)	
Consumption poor (1=Yes, 0=No)	0.59	0.62	0.56	0.06***
	(0.49)	(0.49)	(0.50)	
Asset space				
Asset Index	0.00	0.002	-0.002	0.004
	(0.96)	(0.98)	(0.95)	
Asset poor (1=Yes, 0=No)	0.40	0.41	0.39	0.02
	(0.49)	(0.49)	(0.49)	
Observations	2099	1050	1049	

Notes: Point estimates are sample means. Standard deviations are in the parentheses. A two-sample t-test is used for the test of mean differences. Level of significance $^{*}p< .10$, $^{**}p< .05$, $^{***}p< .01$
†Income and consumption expenditure are in Rupees per-adult equivalent per month.

The lack of cash income in more than one third of the sample reiterates the need for alternative approaches of measuring wellbeing. The second panel in Table 6 presents household wellbeing indicators based on consumption expenditure. Consumption expenditure is composed of both food and non-food expenditures. Food expenditures include the value of food consumption (home produced, purchased, or gift items) and non-food expenditures includes value of non-food

[13] 444 Rupees/person per month is equivalent to $0.35 per person per day, well below the international poverty line of $1 a day per person. However, our measure is not directly comparable to the international poverty line because, unlike the international poverty line, our measure is not adjusted for Purchasing Power Parity.

consumption items such as clothes, health and school expenditures, ceremonial expenses, etc. To avoid recall errors, food expenditure information was collected for the last 7 days and non-food expenditures information was collected for the last month. Food expenditure for the last 7 days is first converted to monthly amount and then combined with monthly non-food expenditure to calculate the total monthly consumption expenditure.

As expected, consumption expenditure per person per month is much higher than the value of income per person per month. Unlike cash income, no households have zero consumption. On average, the value of consumption for a household in rural Odisha was 795.5 Rupees per person per month, well above the state poverty line of 695 Rupees per person per month. Control households are slightly better off (811 Rupees per person per month) than project households (780 per person per month), but the difference is not statistically significant. The poverty indicator based on consumption expenditure shows that consumption poverty (59%) is much lower than income poverty (79%) in rural Odisha. Unlike income poverty, consumption poverty in project areas (62%) is statistically significantly higher than consumption poverty in control areas (56%).

In the third panel of Table 6, we present the results for the asset index measure – an aggregated index of household durables, housing quality characteristics, number of livestock held, and land holding size. Specifically, household durables consist of a total of 19 asset variables including radio, TV, car, bicycle, motorbike, cell phone etc., housing quality characteristics consists a total of 9 variables including quality of roof, wall, floor, access to electricity, access to safe drinking water etc., and livestock consists 6 different types of animals including cattle, goats, pigs etc. Table A2 in the Appendix provides a list of specific variables in each asset groups. By construction, the asset index has zero mean for the full sample. A negative value of asset index does not necessarily mean the household is poor but households with positive asset index are better off than households with negative asset index. The asset index is positive for project households and negative for control households, but the difference is not statistically significant. By construction, asset poverty line is 40% because households below the 40^{th} percentile of the asset index are considered poor. The fortieth percentile value corresponds to -0.39 suggesting that households with asset index greater than -0.39 are considered non-poor in this case. Like the income poverty, the intensity of asset poverty is not different across project and control households.

In Figure 2, we compare the asset and income poverty to assess the correspondence between the two indicators. If income poverty had one-to-one correspondence with asset poverty, that is a perfect correlation, then all income poor households would be poor in asset space too. However, many households below income poverty line are in the right side of the asset poverty line. Similarly, many households in the left side of the asset poverty line are above the income poverty line – not all asset poor are poor in income space. Specifically, 44.5% households are poor in income space but non-poor in asset space and about 7.5% households are asset poor but income non-poor. The proportion of households in each of the four quadrants are presented in Table A3 in the Appendix.

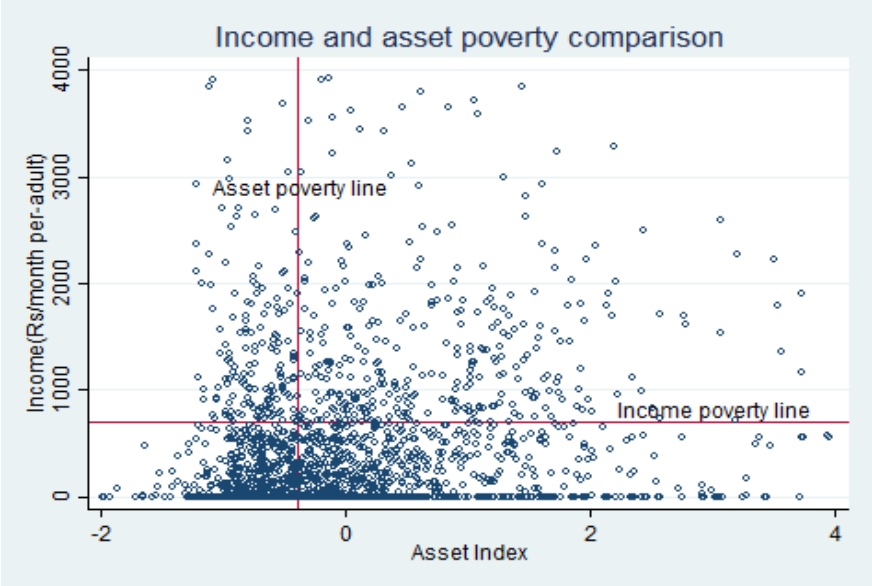


Figure 2. Asset vs. Income poverty in Odisha

Wellbeing indicators by tribal groups

In Table 7, we present wellbeing indicators in all three spaces, income, consumption, and assets across PVTG and non-PVTG groups. Unlike in the case of the treatment groups, wellbeing indicators across tribal groups are statistically significantly different. As expected, average income for the PVTG households is significantly lower than the average income for the non-PVTG households. As a result, income poverty is higher among the PVTG households. This pattern consistently holds in both consumption space and asset space as well. All three measures of wellbeing, cash income, consumption expenditure, and the aggregated asset index for the non-PVTG households are significantly greater than that for the PVTG households indicating that PVTG households are relatively worse off in baseline. While the asset poverty rate is much lower than income poverty, asset poverty for the PVTG households (50%) is about 15% higher than asset poverty for the non-PVTG households.

Table 7. Wellbeing indicators by tribal groups

	Tribal Groups		
Income space	PVTG	Non-PVTGs	Difference
Income (Rupees)†	400.9	466.3	-65.4**
	(663.3)	(671.9)	
Cash income (1=No, 0=Yes)	0.39	0.37	0.02
	(0.49)	(0.48)	
Income poor (1=Yes, 0=No)	0.80	0.76	0.04*
	(0.40)	(0.43)	
Consumption space			
Consumption expenditure (Rupees)	735	826	-91***
	(671)	(797)	

Consumption poor (1=Yes, 0=No)	0.63	0.57	0.06***
	(0.48)	(0.50)	
Asset space			
Asset Index	-0.25	0.12	-0.37***
	(0.78)	(1.02)	
Asset poor (1=Yes, 0=No)	0.50	0.35	0.15***
	(0.50)	(0.48)	
Observations	704	1395	

Notes: Point estimates are sample means. Standard deviations are in the parentheses. A two-sample t-test is used for the test of mean differences. Level of significance $^{*}p< .10$, $^{**}p< .05$, $^{***}p< .01$.
†Income and Consumption expenditure are Rupees per-adult equivalent per year.

Food security and child nutrition

Table 8 presents results on the food security status of both project and control samples. We use two measures of food security: food insecurity experience scale (FIES) and subjective food security indicators. FIES is a comprehensive tool to understand the food security and hunger status at the household level but it does not reflect child food security status(Ballard, Kepple, and Cafiero, 2013). The FIES score is based on 8 questions so it ranges from 0 to 8. Households with 0 scores are considered food secure (Or no food insecure). A FIES score between 1 and 2 indicates mild food insecurity, 3 to 5 indicates moderate food insecurity, and 6 to 8 indicates severe food insecurity (or hunger)[14].

Based on the FIES score, about 68% of our sample is food secure in 2017; 21% households experienced mild food insecurity, 7.7% households experienced moderate food insecurity, and 3.4% households experienced hunger. Even though the food insecurity score is not different between project and control households, more households in the project areas were severely food insecure (4.1%) compared to the control areas (2.8%).

The second panel in Table 8 presents subjective measures of food security. These measures assess the feeling of the respondents regarding the food security situation of the household and children in the household. A household that had no enough food to feed everyone anytime in the last 6 months is considered *food insecure.* Similarly, a household unable to feed all or one of its children is considered *child food insecure*. On average, about 85% of the households were food secure in 2017 in both project and control areas. However, about 96% of households were reported to be child food secure, meaning no children was food insecure in 96% of the households in project and control areas.

Table 8. Food security status in baseline by project coverage

Food security status	**Sample**			
	Full	Project	Control	Difference
Food insecurity experience scale (FIES)				
FIES score	0.84	0.86	0.82	0.04
	(1.63)	(1.72)	(1.54)	
No food insecurity	0.68	0.69	0.67	0.02

[14]For more on FIES score, see FAO's FIES page http://www.fao.org/in-action/voices-of-the-hungry/fies/en/

	(0.47)	(0.46)	(0.47)	
Mild food insecurity	0.21	0.19	0.22	-0.03*
	(0.41)	(0.40)	(0.42)	
Moderate food insecurity	0.077	0.074	0.080	-0.006
	(0.27)	(0.26)	(0.27)	
Severe food insecurity	0.034	0.041	0.028	0.013*
	(0.18)	(0.20)	(0.16)	
Subjective food security				
Household is food secured (1=Yes, 0=No)	0.849	0.846	0.852	-0.006
	(0.358)	(0.361)	(0.355)	
Children are food secured (1=Yes, 0=No)	0.959	0.957	0.959	-0.002
	(0.199)	(0.202)	(0.196)	
Dietary Diversity				
Household dietary diversity score	5.85	5.75	5.95	-0.20***
	(1.60)	(1.68)	(1.50)	
Observations	2099	1050	1049	

Notes: Point estimates are sample means. Standard deviations are in the parentheses. A two-sample t-test is used for the test of mean differences. Level of significance $^{*}p<.10$, $^{**}p<.05$, $^{***}p<.01$

The third panel in Table 8 presents results on the household dietary diversity score – our third measure of household food security. Dietary diversity score measures number of food groups consumed by the household in the last 24 hours. We follow FAO's guidelines (Kennedy, Ballard, and Dop, 2011) to construct the dietary diversity scores and categorized food items to 12 different groups, namely cereals, roots and tubers, vegetables, fruits, meat and poultry, eggs, milk and milk products, fish and seafood, pulses and legumes, oil and fats, sugar and sweets, and miscellaneous food items. So, the dietary diversity scores can range from 0 – 12. A higher dietary diversity score indicates household's increased access to quality food and nutrition. In rural Odisha, on average, households consume at least 5 different food items in the last 24 hours. In our sample, control households consume slightly higher number of food items than project households, but the difference is only 0.2. A dietary diversity score of 5.8 is very satisfactory, but one should be careful that more than half the score is made up of less nutritious food items such as oil and fats, sugar and sweets, and miscellaneous food items. Most households still have no access to nutritious foods such as meat, milk and milk products, and legumes.

Table 9 presents food security status for PVTG and other households. When food security status is compared across tribal groups, the difference seems to be greater than in the case of project-control comparison; PVTG households are more food insecure than non-PVTGs. Based on FIES score, about 70% non-PVTG households are food secure as opposed to 64% food secure PVTG households, a statistically significant difference. Similarly, all three types of food insecurity – mild food insecurity, moderate food insecurity, and severe food insecurity – are higher among PVTG households than among non-PVTG households. Based on the subjective food security measure, non-PVTG households feel more food secure (88%) than PVTG households (80%). When it comes to respondent's feeling about child food security situation, in contrast to higher malnutrition among PVTG children (Table 10), more PVTG children are reported to be food secured than non-PVTG children. The inconsistency may be driven by the subjectivity of the food security measure which is influenced by the lack of awareness on what food security actually means. Unlike subjective food

security, household dietary diversity scores are about the same for both PVTG and non-PVTG households suggesting a similar dietary pattern across different tribal groups.

Table 9. Food security status in baseline across tribal groups

Food security status	Tribal groups			
	Full	PVTGs	Non-PVTGs	Diff
Food insecurity experience scale (FIES)				
FIES score	0.84	0.90	0.81	0.09
	(1.63)	(1.64)	(1.63)	
No food insecurity	0.68	0.64	0.70	-0.06***
	(0.47)	(0.48)	(0.46)	
Mild food insecurity	0.21	0.23	0.20	0.03*
	(0.41)	(0.42)	(0.40)	
Moderate food insecurity	0.077	0.095	0.068	0.027**
	(0.27)	(0.29)	(0.25)	
Severe food insecurity	0.034	0.036	0.034	0.002
	(0.18)	(0.19)	(0.18)	
Feeling of food security				
Household is food secured (1=Yes, 0=No)	0.85	0.80	0.88	-0.08***
	(0.358)	(0.40)	(0.33)	
Children are food secured (1=Yes, 0=No)	0.96	0.97	0.95	0.02*
	(0.199)	(0.17)	(0.21)	
Dietary Diversity				
Household Dietary Diversity Score	5.85	5.78	5.89	-0.11
	(1.60)	(1.53)	(1.63)	
Observations	2099	704	1395	

Notes: Point estimates are sample means. Standard deviations are in the parentheses. A two-sample t-test is used for the test of mean differences. Level of significance $^{*}p<.10$, $^{**}p<.05$, $^{***}p<.01$

Table 10 presents child nutrition indicators by sample area and tribal groups. Relying on data on age, weight and height of kids aged 0-59 months, the analysis uses three measures of child nutritional status: stunting, wasting, and underweight. Stunting is an indicator of the height-for-age for children 0-59 months and it measures chronic malnutrition; it is coded as 1 for children with height-for-age Z-scores less than -2 (meaning 2 standard deviations from a WHO population of reference), and 0 otherwise. Similarly, wasting is an indicator for the weight-for-height for children 0-59 months and it measures children's acute malnutrition. On the other hand, underweight is an indicator for children's height-for-age and it measures chronic and/or acute malnutrition.

Table 10. Child nutrition indicators

	Sample				Tribal groups		
	Full	Project	Control	Diff.	PVTGs	Non-PVTGs	Diff.
Stunted (1=Yes, 0=No)	0.36	0.38	0.34	0.04	0.45	0.31	0.14***
	(0.48)	(0.49)	(0.47)		(0.49)	(0.46)	
Underweight (1=Yes, 0=No)	0.33	0.32	0.35	-0.03	0.38	0.31	0.07**
	(0.47)	(0.47)	(0.48)		(0.49)	(0.46)	
Wasted (1=Yes, 0=No)	0.28	0.28	0.29	-0.01	0.31	0.27	0.04
	(0.45)	(0.45)	(0.45)		(0.46)	(0.44)	
Observations	767	399	368		283	484	

Notes: Point estimates are sample means. Standard deviations are in the parentheses. A two-sample t-test is used for the test of mean differences. Level of significance $^{*}p< .10$, $^{**}p< .05$, $^{***}p< .01$

Results show that, on average, the rate of stunting in the areas to be covered by OPELIP and nearby comparison areas is 36%. Similarly, 33% of children were underweight and 28% children were wasted in the same areas. These statistics are more or less consistent with the official child nutrition indicators for the state of Odisha, presented in the Annual Health Survey report of India (Government of India, 2015). According to the 2014 Annual Health Survey report, the child anthropometric measures in the state of Odisha were: 34% stunting, 34.4% underweight and 20.4% wasting. Even though both intervention and control areas have high rates of child malnutrition, there is no statistical difference in anthropometric indicators between children in project and control areas. In 2017, 38% of the children were stunted in OPELIP areas compared to 34% stunting in nearby areas not covered by OPELIP. Although the difference is minimal, an opposite pattern exits in the rate of underweight and wasting; 32% (28%) children underweight (wasted) in project areas compared to 35% (29%) in control areas. As expected, children from PVTGs households have a higher rate of malnutrition than non-PVTG children. The rates of stunting and underweight among PVTG children are statistically significantly higher than those of non-PVTG children.

Women's empowerment and gender balance

We measure women's empowerment using intra-household decision-making dynamics. Decision making questions are embedded in multiple sections throughout the survey instrument. There is a total of 24 decisions being made across 7 domains of activities. The seven decision domains include agricultural input use, cash income use, crop and livestock sales, food items purchase, non-food items purchase, sending children to school, and other decisions which includes decisions about taking wage employment, joining social groups, and applying for loan (see table A4 in the Appendix for details). The proportions of women's and men's independent and joint decisions over total decisions made in the household are considered empowerment measures. Table 11 presents the empowerment measures across treatment areas, and by tribal groups. On average, only 10% of the household decisions are made by women independently whereas men controlled the majority of the household decisions as they make independent decisions on 86% of the household decisions. Unfortunately, only about 3% decisions are being made jointly by men and women. None of these statistics are different across project and control groups indicating that even though the intra-

household decision-making is lopsided in favor of men, the sample is fairly balanced across project and control areas in baseline decision-making.

Table 11. Proportions of women's and men's decisions

Decisions	Sample				Tribal groups		
	Full	Project	Control	Diff.	PVTGs	non-PVTGs	Diff.
Women's solitary decisions	0.101	0.106	0.096	0.01	0.118	0.093	0.025*
	(0.293)	(0.300)	(0.285)		(0.313)	(0.282)	
Men's solitary decisions	0.863	0.858	0.869	-0.01	0.861	0.865	-0.004
	(0.318)	(0.322)	(0.314)		(0.320)	(0.317)	
Joint decisions	0.035	0.036	0.035	0.001	0.021	0.043	-0.021***
	(0.138)	(0.137)	(0.140)		(0.079)	(0.160)	
Observations	2099	1050	1049		704	1395	

Notes: Point estimates are sample means. Standard deviations are in the parentheses. A two-sample t-test is used for the test of mean differences. Level of significance $^{*}p< .10$, $^{**}p< .05$, $^{***}p< .01$

The second half of Table 11 presents men's and women's decision-making participation by tribal groups. Women's independent decision-making is very low in both groups, but women in the PVTG households are statistically significantly more empowered than women in the non-PVTG households. Men in both groups control more than 86% of household decisions but women and men in the non-PVTG households make more joint decisions compared to the PVTG households.

We also examine women's and men's independent and joint decision-making over each of the 7 domains by treatment status as well as tribal groups. Figure A1 in Appendix presents women's decision-making participation by treatment status. Women in both project and control areas have sole control over only about 10% decisions in each of the sever domains and the difference is not statistically significant between project and control households. Figure A2 in Appendix presents women's decision-making participation across PVTG and non-PVTG households. PVTG women have sole control in about 10 to 12% decisions and non-PVTG women have sole control in about 8-9% decisions. Women's decision-making participation in all but crop/livestock sale domain is significant different across PVTG and non-PVTG households. Even though women have control over very few household decisions, PVTG women have more control in household decisions than non-PVTG women.

Land characteristics and farming practices

Table 12 presents summary statistics of land ownership, land holding size, and farming practices in OPELIP and nearby areas. The first panel of the table presents land holding characteristics. Land ownership is defined as possession of land title (Patta) in the name of one or more household members, leasehold contract, or other forms of ownership certificate that do not provide land title. On average, about 77% of households own agricultural or homestead land. A significant majority of land owners are men; women own land in only about 12% of households in both control and project areas. Although 77% of households own land, only 17% households possess land right certificate (Patta). Despite an extremely low possession of land titles, about 92% of households reported to have cultivated some types of crops in the last 12 months of the survey indicating that many households farm in rented land, forest land, or land areas that belong to the State. As expected, land holding size is quite small with about 1.5 Acres per household; land holding size in project area

(1.57 acres) is slightly bigger than in control area (1.42 acres) but the difference is not statistically significant.

Table 12. Access to land, land holding size, and farming practices

	Sample			
Land characteristics	Full	Project	Control	Difference
Land ownership (1=Yes, 0=No)	0.77	0.76	0.77	-0.01
	(0.42)	(0.43)	(0.42)	
Land owner is female (1=Yes, 0=No)	0.12	0.11	0.12	-0.01
	(0.32)	(0.31)	(0.33)	
Land title, *Patta* (1=Yes, 0=No)	0.17	0.17	0.16	0.01
	(0.37)	(0.38)	(0.37)	
Crop cultivation, last 12 months (1=Yes)	0.92	0.92	0.92	0.00
	(0.27)	(0.27)	(0.27)	
Land holding size (Acres)	1.49	1.57	1.42	0.15
	(2.27)	(2.20)	(2.34)	
Farming practices				
Slash and burn (1=Yes, 0=No)	0.07	0.08	0.06	0.02
	(0.26)	(0.28)	(0.25)	
Contour farming (1=Yes, 0=No)	0.13	0.14	0.12	0.02
	(0.33)	(0.34)	(0.32)	
Regular agriculture (1=Yes, 0=No)	0.78	0.77	0.78	-0.01
	(0.42)	(0.42)	(0.41)	
Observations	2099	1050	1049	

Notes: Point estimates are sample means. Standard deviations are in the parentheses. A two-sample t-test is used for the test of mean differences. Level of significance $^{*}p< .10$, $^{**}p< .05$, $^{***}p< .01$

The second panel of Table 12 presents self-reported farming practices in the project and control areas. More than three-quarters of households in both control and project areas reported to have used regular agriculture practices for farming. However, about 20% households practice conventional agricultural practices – 7% households practice slash and burn farming and more than 13% practice contour farming. The proportion of households using regular agricultural practices or conventional methods is not significantly different across project and control groups.

We also explored the characteristics of land access and farming practices for PVTG and non-PVTG households. Table 13 presents the details and Figure A4 in the Appendix provides an overview of land access, crop cultivation, and farming practices. Unlike the case of project-control comparison, land ownership is statistically different between PVTGs and non-PVTGs, albeit the difference is only 4%. Female land ownership is about 12% for both PVTG and non-PVTG households, but possession of land title (Patta) is statistically significantly different across tribal groups. Even though more than 74% PVTG households own some land, only 13% PVTGs possess a land right certificate. Similarly, while 78% of non-PVTG households own some land, only 18% non-PVTGs have land right certificate. However, land holding size is not statistically significantly different between the two groups.

As expected, a higher proportion of PVTG households practice conventional agricultural practices (13% practice slash and burn farming and 21% practice contour farming) compared to non-PVTG households. As a consequence, smaller proportion of PVTG households practice regular agriculture (67%) compared to non-PVTG households (83%).

Table 13. Access to land, land holding size, and farming practices by tribal groups

	Tribal groups			
Land characteristics	Full	PVTGs	non-PVTGs	Difference
Land ownership (1=Yes, 0=No)	0.77	0.74	0.78	-0.04*
	(0.42)	(0.44)	(0.42)	
Land owner is female (1=Yes, 0=No)	0.12	0.12	0.117	0.003
	(0.32)	(0.32)	(0.32)	
Land right *Patta* (1=Yes, 0=No)	0.17	0.13	0.18	-0.05***
	(0.37)	(0.34)	(0.39)	
Crop cultivation, last 12 months (1=Yes)	0.92	0.90	0.93	-0.03**
	(0.27)	(0.29)	(0.25)	
Land holding size (Acres)	1.49	1.60	1.44	0.16
	(2.27)	(2.87)	(1.91)	
Farming practices				
Slash and burn (1=Yes, 0=No)	0.07	0.13	0.05	0.08***
	(0.26)	(0.34)	(0.21)	
Contour farming (1=Yes, 0=No)	0.13	0.21	0.08	0.13***
	(0.33)	(0.41)	(0.28)	
Regular agriculture (1=Yes, 0=No)	0.78	0.67	0.83	-0.16***
	(0.42)	(0.47)	(0.38)	
Observations	2099	704	1395	

Notes: Point estimates are sample means. Standard deviations are in the parentheses. A two-sample t-test is used for the test of mean differences. Level of significance $^{*}p< .10$, $^{**}p< .05$, $^{***}p< .01$

Agricultural yields

Table 14 presents average yield of three major crops grown in the Kharif season – Paddy, Maize, and Mandia (Ragi). The baseline survey collected information about several other crops in all three major crop seasons – Kharif, Rabi, and Summer – but only a few households actually cultivated any crop during Rabi and Summer seasons. In the Kharif season, most households cultivated paddy and the three major crops cover about 95% of all crops cultivated. Therefore, we present yield statistics only for those three major crops grown in the Kharif season.

Yield statistics are presented in plot level and are in Kg per Hectare of area cultivated. In rhe case of inter-cropping, calculation of cultivated area for a specific crop can be tricky, but, in our case, none of these crops are inter-cropped. Paddy requires puddled field but Maize and Mandia do not. The later two crops are rarely intercropped, traditionally, and no household in the sample did so. Therefore, we use the whole plot area (farmer reported) as cultivated area to calculate crop yield. Crop yield results show that, on average, Paddy yield in rural Odisha is 1,530 Kg per Hectare, Maize

yield is 1,557 Kg per Hectare, and Mandia yield is about 988 Kg per Hectare. The average yield for each of the three crops is more or less consistent with the Odisha state-wise crop yield estimate of 2013-14 (Government of Odisha, 2015). In 2013-14 crop year, the official yield estimate for the state of Odisha was 1,697 Kg/Ha for Paddy, 1,633 Kg/Ha for Maize[15], and 864 Kg/Ha for Mandia.

Table 14. Average yield of major crops in the Kharif season

	Sample			
	Full	Project	Control	Difference
Paddy Yield (Kg/Ha)	1,530.5	1,518.8	1,541.9	-23.1
	(1,413.0)	(1,406.7)	(1,420.1)	
	[1,407]	[697]	710	
Maize Yield (Kg/Ha)	1,557.2	1,617.0	1,482.5	134.5
	(1,459.2)	(1,577.6)	(1,303.8)	
	[153]	[85]	[68]	
Mandia Yield (Kg/Ha)	988.2	1,046.4	939.9	106.5
	(1,227.5)	(1,296.8)	(1,170.4)	
	[214]	[97]	[117]	

Notes: Point estimates are mean. Standard deviations are in parentheses and the number of observations are in the brackets. A two-sample t-test is used for the test of mean differences. Level of significance $^{*}p< .10$, $^{**}p< .05$, $^{***}p< .01$
Yield statistics are presented for the three major crops only. Number of observations differ across crops because number of crops grown differs by household.

We compare the crop yields across project and control areas and find that while Paddy yield was higher in control areas, Maize and Madnia yield is higher in project areas. However, none of these differences are statistically significant suggesting that our baseline sample is well balanced across treatment groups.

We also compare the crop yield statistics across tribal groups. Results presented in Table 15 show that Paddy yield among the PVTG households (1,324 Kg/Ha) is significantly lower than Paddy yield among the non-PVTG households (1,617 Kg/Ha). However, Maize and Mandia yields are higher among the PVTG households, although the differences are not statistically significant. Interestingly, among the PVTG households, while the average Paddy yield is much lower than the 2013-14 official yield estimate, Maize yield is about the same with the official estimate, and Mandia yield is much higher than the official estimate. This indicates that PVTG households may be better in cultivating traditional grains like Mandia but they lack behind the state average yield when it comes to other cereals like Paddy and Maize.

[15] Note that the official Maize yield estimate for Odisha in 2013-14 was 1,633 Kg/Ha for local maize and 2,772 Kg/Ha for high yielding variety (HYV) maize.

Table 15. Average yield of major crops in the Kharif season by tribal groups

	Tribal groups			
	Full	PVTG	Non-PVTG	Difference
Paddy Yield (Kg/Ha)	1530.5	1324.3	1617.0	-292.7***
	(1413.0)	(1441.9)	(1392.3)	
	[1407]	[416]	[991]	
Maize Yield (Kg/Ha)	1557.2	1608.3	1536.0	72.3
	(1459.2)	(1644.5)	(1382.4)	
	[153]	[45]	[108]	
Mandia Yield (Kg/Ha)	988.2	1063.3	894.1	169.2
	(1227.5)	(1309.1)	(1116.5)	
	[214]	[119]	[95]	

Notes: Point estimates are mean. Standard deviations are in parentheses and the number of observations are in the brackets. A two-sample t-test is used for the test of mean differences. Level of significance $^{*}p< .10$, $^{**}p< .05$, $^{***}p< .01$
Yield statistics are presented for the three major crops only. Number of observations differ across crops because number of crops grown differs by household.

Livestock ownership

Table 16 presents summary of livestock ownership, number of animals owned, and an indicator of income from livestock. On average, 83% of households own at least one type of livestock and livestock ownership is more common among control households. Specifically, 85% of control households own at least one livestock type. Livestock ownership among project households is about 4% lower than in control households.

Different species of animals are classified as livestock. Specifically, we consider all types of cattle, buffaloes, goats, sheep, pigs, horses or mules, and different species of poultry. Comparing the number of different livestock species is difficult because their characteristics differ widely. For convenience in comparison, we calculate a weighted measure by combining different species and allocating specific weights – Tropical Livestock Unit (TLU). The Tropical Livestock Unit (TLU) is a widely accepted measure for counting livestock. It is a weighted average of the number of livestock species owned by the household. Following international standards, our weighting scheme varies by animal: 0.7 for cattle and buffaloes, 0.6 for horses, donkeys, and mules, 0.5 for calves, 0.2 for pigs, 0.1 for goats and sheep, and 0.01 for poultry. This implies, for example, that owning 10 goats is equivalent to owning 1 cattle and vices versa.

Table 16. Livestock ownership and animal product sales

		Sample		
Livestock ownership	Full	Project	Control	Difference
Own livestock, last 12 months (1=Yes, 0=No)	0.83	0.81	0.85	-0.04**
	(0.37)	(0.39)	(0.36)	
Tropical livestock Units (TLUs)	3.22	3.12	3.33	-0.21
	(4.11)	(4.08)	(4.14)	
Income from animal/product sales? (1=Yes, 0=No)	0.21	0.21	0.20	0.01
	(0.40)	(0.41)	(0.40)	
Number of animals				
Number of cattle	2.08	2.06	2.10	-0.04
	(4.26)	(4.03)	(4.48)	
Number of calves	1.12	1.04	1.20	-0.16
	(3.17)	(3.42)	(2.90)	
Number of buffaloes	0.85	0.90	0.79	0.21
	(2.71)	(2.43)	(2.97)	
Number of goats/sheep	1.35	1.48	1.21	0.27*
	(3.38)	(3.53)	(3.22)	
Number of pigs	0.71	0.48	0.95	-0.47***
	(2.30)	(1.49)	(2.88)	
Number of mules/horses	0.54	0.45	0.63	-0.18**
	(2.02)	(2.03)	(2.00)	
Number of poultry†	0.83	0.90	0.76	0.14
	(2.82)	(2.74)	(2.90)	
Observations	2099	1050	1049	

Notes: Point estimates are sample means. Standard deviations are in the parentheses. A two-sample t-test is used for the test of mean differences. Level of significance $^{*}p< .10$, $^{**}p< .05$, $^{***}p< .01$†Number of poultry includes number of chickens, ducks, and other similar birds

On average, households in the areas covered by OPELIP and nearby comparison villages have 3.2 units of livestock and the number of livestock units is not different across project and control groups. Even though more than 83% of households own at least one livestock species, only about 20% households have some income from the sale of livestock or animal products. This indicates that despite a high rate of livestock ownership, livestock keeping is still a part of subsistence agriculture and it has only a small contribution to income diversification. This is evident in the small number of livestock species owned by an average household; 2 cattle, 1 calf, 1 buffalo, and 1 goat or sheep.

In Table 17, we present livestock ownership, livestock related income, and number of livestock species owned. Despite a fairly balanced sample between project and control groups, livestock ownership and sales differ across PVTG and non-PVTG groups. Livestock ownership is significantly higher in non-PVTG areas. On average, 80% PVTG households own at least one livestock but livestock ownership among non-PVTG households is 85%. The average number of animals owned is also higher among the non-PVTG group. For example, on average, PVTG households own 1.6 cattle but non-PVTG households own more than two cattle. Among other animals, the number of all

animals but pigs owned is higher among non-PVTG households. Interestingly, and consistent with anecdotal evidence, PVTG households own more pigs than non-PVTG households.

Table 17. Livestock ownership and sales by tribal groups

	Tribal Groups			
Livestock ownership	Full	PVTGs	Non-PVTGs	Difference
Own livestock, last 12 months (1=Yes, 0=No)	0.83	0.80	0.85	-0.05***
	(0.37)	(0.40)	(0.36)	
Tropical livestock Unit	3.22	2.72	3.47	-0.75***
	(4.11)	(3.43)	(4.39)	
Income from animal/product sales? (1=Yes)	0.21	0.17	0.22	-0.05***
	(0.40)	(0.38)	(0.42)	
Number of animals				
Number of cattle	2.08	1.60	2.32	-0.72***
	(4.26)	(3.24)	(4.67)	
Number of calves	1.12	1.17	1.09	0.08
	(3.17)	(3.83)	(2.78)	
Number of buffaloes	0.85	0.66	0.94	-0.31***
	(2.71)	(1.73)	(3.08)	
Number of goats/sheep	1.35	1.31	1.37	-0.06
	(3.38)	(3.17)	(3.48)	
Number of pigs	0.71	0.91	0.61	0.30**
	(2.30)	(2.66)	(2.09)	
Number of mules/horses	0.54	0.38	0.63	-0.25***
	(2.02)	(1.07)	(2.35)	
Number of poultry†	0.83	0.81	0.85	-0.04
	(2.82)	(2.24)	(3.07)	
Observations	2099	704	1395	

Notes: Point estimates are sample means. Standard deviations are in the parentheses. A two-sample t-test is used for the test of mean differences. Level of significance $^{*}p< .10$, $^{**}p< .05$, $^{***}p< .01$
†Number of poultry includes number of chickens, ducks, and other similar birds

School enrollment

Table 18 presents school enrollment and school performance indicators for project and control households. School enrollment was measured with current school attendance rate and the proportion of household members that ever attended school. On average, in the OPELIP and nearby villages, only 50% of individuals above the age of 5 have attended school at some point in time. A significantly larger proportion of individuals have attended school in the control areas but the difference is minimal (2%). Among those who have attended school, about 46% are currently in school. We also examine the gendered difference in current school enrollment but find no statistically significant difference on boys' and girl's current school enrollment across project and control areas. However, school attendance is higher among girls (52%) than boys (42%) in both project and control areas.

Table 18. School enrollment and school performance

	Sample area			
Individual outcomes	Full	Project	Control	Difference
Ever attended school (1=Yes, 0=No)	0.50	0.49	0.51	-0.02*
	(0.50)	(0.50)	(0.49)	
If school attended…				
Highest grade completed	6.79	6.71	6.88	-0.17*
	(3.40)	(3.41)	(3.39)	
Currently attending school (1=Yes, 0=No)	0.46	0.45	0.47	-0.02
	(0.49)	(0.49)	(0.49)	
Currently attending school: Male	0.42	0.41	0.43	-0.01
	(0.49)	(0.49)	(0.49)	
Currently attending school: Female	0.52	0.51	0.52	-0.01
	(0.49)	(0.50)	(0.49)	
Household level outcomes				
Proportion of children(5-18) attending school	0.65	0.63	0.67	-0.04**
	(0.39)	(0.40)	(0.39)	
Observations				
Individual	10,086	5,067	5,019	
Household	1491	740	751	

Notes: Point estimates are sample means. Standard deviations are in the parentheses. A two-sample t-test is used for the test of mean differences. Level of significance $^{*}p< .10$, $^{**}p< .05$, $^{***}p< .01$
Among the 10,086 individuals, only 5,069 attended school; 2500 of them come from project area and 2569 from control area.

On average, individuals in our sample have completed 6th grade only. The highest grade completed is about the same for individuals from both project and control areas indicating a low level of school education in the sample areas overall. Some of these statistics are statistically significantly different, but they are practically the same in magnitude indicating that school enrollment and educational performance in project and control areas is balanced in the baseline. We also examine the rate of school enrollment at the household level by looking at the proportion of children (5-18) currently attending school. On average, 65% of children currently attend school in our sample area. The proportion of children currently attending school is about 4% higher in project areas (67%) than in control areas (63%), a difference that is statistically significant.

We also examine the school enrollment and school performance indicators for PVTG and non-PVTG children. Results are presented in Table 19. School attendance is significantly higher among non-PVTG households compared to PVTG households. Specifically, 56% individuals from non-PVTG households attended school at some point in time compared to only 39% school attendance among particularly vulnerable tribal individuals. However, among the children who have ever attended school, a higher proportion of the PVTG children currently attend school (56%) compared to the non-PVTG children (42%), probably due to easy access to residential school and a mandatory school attendance policy for tribal children. We find that current school enrolment across tribal groups also differs by sex. School enrollment is always higher for girls than boys in both PVTG and non-PVTG areas. Specifically, in PVTG areas, 65% of girls are currently enrolled in school compared to 47% of

non-PVTG girls. Similarly, 50% PVTG boys are currently in school compared to 39% non-PVTG boys. Both differences are statistically significant.

When it comes to school performance (measured by the highest grade completed), non-PVTG children do significantly better than PVTG children; on average, conditional on school attendance, non-PVTG children achieve 1.1 grade higher than PVTG children. That the rate of school enrolment is greater among PVTG children but the higher grade completed is greater for non-PVTG children implies that school dropout is higher among PVTG children.

Table 19. School enrollment and school performance across tribal groups

	Tribal groups			
Individual outcomes	Full	PVTG	non-PVTG	Difference
Ever attended school (1=Yes, 0=No)	0.50	0.39	0.56	-0.17***
	(0.50)	(0.49)	(0.49)	
If school attended…				
Highest grade completed	6.79	5.96	7.09	-1.13***
	(3.40)	(3.26)	(3.41)	
Currently attending school (1=Yes, 0=No)	0.46	0.56	0.42	0.14***
	(0.49)	(0.49)	(0.49)	
Currently attending school: Male	0.42	0.50	0.39	0.11***
	(0.49)	(0.50)	(0.49)	
Currently attending school: Female	0.52	0.65	0.47	0.18***
	(0.49)	(0.48)	(0.49)	
Household level outcomes				
Proportion of children(5-18) attending school	0.65	0.57	0.69	-0.12***
	(0.39)	(0.41)	(0.38)	
Observations				
Individual	10,086	3436	6650	
Household	1491	535	956	

Notes: Point estimates are sample means. Standard deviations are in the parentheses. A two-sample t-test is used for the test of mean differences. Level of significance $^{*}p< .10$, $^{**}p< .05$, $^{***}p< .01$
Among the 10,086 individuals, only 5,069 attended school; 1333 of them come from PVTG households and 3736 from non-PVTG households.

Migration and remittances

Migration and shifting cultivation are part of the tribal lifestyle. However, most migration is temporary and people migrate to nearby areas for food and hunting. In this analysis, we exclude the temporary movement for hunting and food gathering and try to capture both local and regional migration. Any movement of individuals out of the household for more than one continuous month in the last 12 months is considered migration. Table 20 presents a summary of migration and remittances. By design, household members who migrated before the last 12 months of the survey date are not part of the household and therefore are not counted as migrants.

Table 20. Migration and Remittances

	Sample area			
Migration outcomes	Full	Project	Control	Difference
Household has a migrant (1=Yes, 0=No)	0.27	0.27	0.27	0.001
	(0.44)	(0.45)	(0.44)	
If migrant household…				
Number of migrants	1.34	1.34	1.34	-0.006
	(0.63)	(0.63)	(0.63)	
Received remittances, last 12 months (1=Yes, 0=No)	0.41	0.42	0.41	0.01
	(0.49)	(0.49)	(0.49)	
Amount of remittances (Rupees/year)	13,256	14,474	12,042	2432
	(30624)	(36926)	(22670)	
Observations	573	286	287	

Notes: Point estimates are sample means. Standard deviations are in the parentheses. A two-sample t-test is used for the test of mean differences. Level of significance $^{*}p< .10$, $^{**}p< .05$, $^{***}p< .01$
Full sample consists 2099 households, of which 1050 are project and 1049 are control

On average, only about 27% households have at least one migrant and the prevalence of migration is not different between project and control households. As only a small proportion of households have one or more migrants, our examination of the number of migrants and remittances is restricted to the migrant households. Interestingly, the proportion of migrant households is the same across both project and control groups, indicating an extremely well-balanced migration pattern in project and control areas in baseline. In baseline, a migrant household in both project and control areas has about one member who has migrated out of the household in the last 12 months. Just about 41% of the migrant households received remittances from their migrant member(s) and the amount of remittances is about 13,256 Rupees/year. Migrants from project households remit more (14,474 Rupees/year) than migrants from control households (12,042 Rupees/year), but the difference is not statistically significant.

We also examine the pattern of migration and remittances across tribal groups. Results are presented in Table 21. It turns out that the migration pattern (migration rate and number of migrants) is statistically the same for both PVTG and non-PVTG households; about 27% households have at least one member who lived outside of the household for at least one month over the last 12 months. Among the migrant households, the number of migrants is slightly higher than one in both PVTG and non-PVTG groups. About 39% of PVTG migrant households received remittances from the migrant members and 43% non-PVTG migrant households received remittances, but the difference is not statistically significant. Interestingly, despite a similar migration pattern, the amount of remittances received by non-PVTG households is about 5,000 rupees higher than the amount received by the PVTG households. As the number of migrants is the same for both PVTG and non-PVTG households, the large difference in the amount of remittances implies that migrants from non-PVTG households remit more than migrants from PVTG households.

Table 21. Migration and Remittances across tribal groups

	Tribal groups			
Migration outcomes	Full	PVTG	Non-PVTG	Difference
Household has a migrant (1=Yes)	0.27	0.28	0.27	0.01
	(0.44)	(0.45)	(0.44)	
If migrant household…				
Number of migrants	1.34	1.33	1.34	-0.01
	(0.63)	(0.60)	(0.64)	
Received remittances, last 12 months (1=Yes, 0=No)	0.41	0.39	0.43	-0.04
	(0.49)	(0.49)	(0.50)	
Amount of remittances (Rupees/year)	13,256	9,980	14,972	-4,992*
	(30624)	(19406)	(35001)	
Observations	573	197	376	

Notes: Point estimates are sample means. Standard deviations are in the parentheses. A two-sample t-test is used for the test of mean differences. Level of significance *p< .10, **p< .05, ***p< .01
Full sample consists 2099 households, of which 704 are PVTGs and 1395 are non-PVTGs

Access to loans and credit

Access to loans and credit is measured with indicators for loan application, loan approval, and amount and use of loans. This breakdown is particularly important to understand the access to loan because all households applying for loans may not be approved and the households receiving a loan may receive different amount of loans.

Table 22. Access to loan and credit

	Sample			
In the last 12 months	Full	Project	Control	Difference
Household applied for loan (1=Yes, 0=No)	0.18	0.17	0.20	-0.03**
	(0.39)	(0.37)	(0.40)	
If applied for loan…				
Loan approved (1=Yes, 0=No)	0.96	0.94	0.97	-0.03
	(0.21)	(0.23)	(0.18)	
Amount of loan (Rupees/year)	16,870	17,311	16,505	806
	(16,668)	(18,736)	(14,773)	
Primary source of loan (1=SHG†, 0=else)	0.24	0.28	0.21	0.07
	(0.43)	(0.45)	(0.41)	
Primary use of loan (1=Consumption need, 0=else)	0.28	0.33	0.23	0.10**
	(0.45)	(0.47)	(0.42)	
Observations	384	174	210	

Notes: Point estimates are sample means. Standard deviations are in the parentheses. A two-sample t-test is used for the test of mean differences. Level of significance *p< .10, **p< .05, ***p< .01
†SHG stands for self-help groups. Full sample consists 2099 households, of which 1050 are project and 1049 are control

Table 22 presents indicators for access to loans and credit in the full sample as well as in both project and control areas. On average, only about 18% households applied for loans and credit from at least one source in the last 12 months of the survey. Given the spatial remoteness of the sample areas and lack of rural financial institutions, this finding is not that surprising. Among the loan applicants, 96% were approved for loans and the average loan amount is about 17,000 rupees over the last 12 months.

The loan application and approval rate is about 3% higher among households in control areas, but the amount of the approved loan is greater for project households, however the latter is not statistically significantly different. Despite a very low loan application rate, loans come from a wide variety of sources and are being used in multiple activities. The primary source of loans is Self-help Groups (SHGs) and, not surprisingly, the primary activity the loans are being used is household consumption. Use of the loan received on activities other than daily consumption is minimal indicating a low level of entrepreneurship in the area. Other major sources of loans include Commercial banks (14.3%), Local money lenders (13.8%), relatives (13.3%), Microfinance (8.4%), and Local merchants (7.1%). Similarly, other activities where the loans have been used include Health costs (19.6%), Agricultural investments (17.3%), Agricultural inputs (10.9%), Ceremonial expenses (7.4%), and Child education (6.4%).

Table 23. Access to loan and credit by tribal groups

	Tribal groups			
In the last 12 months	Full	PVTG	non-PVTG	Difference
Household applied for loan (1=Yes, 0=No)	0.18	0.19	0.18	0.01
	(0.39)	(0.39)	(0.38)	
If applied for loan…				
Loan approved (1=Yes, 0=No)	0.96	0.95	0.96	-0.01
	(0.21)	(0.22)	(0.20)	
Amount of loan (Rupees/year)	16,870	17,648	16,452	1196
	(16668)	(19866)	(14698)	
Primary source of loan (1=SHG†, 0=else)	0.24	0.12	0.31	-0.19***
	(0.43)	(0.33)	(0.46)	
Primary use of loan (1=Consumption, 0=else)	0.28	0.28	0.27	0.01
	(0.45)	(0.45)	(0.45)	
Observations	384	134	250	

Notes: Point estimates are sample means. Standard deviations are in the parentheses. A two-sample t-test is used for the test of mean differences. Level of significance $^{*}p< .10$, $^{**}p< .05$, $^{***}p< .01$
†SHG stands for self-help groups. Full sample consists 2099 households, of which 704 are PVTGs and 1395 are non-PVTGs

Like in the case of project and control groups, the access to loans and credit and the amount of loan and credit received is extremely low among PVTG and non-PVTG households too (Table 23). Only about 18% households have applied for a loan and the loan application rate is not statistically different across PVG and non-PVTG households. More than 95% of households that applied for loan are approved and the amount of the loan received by an average PVTG household is 17,648 Rupees per year and 16,452 Rupees per year for non-PVTG households, although the difference is not

statistically significant. Interestingly, despite similar pattern in loan application and amount of loan received, the primary source of loan differs across PVTG and non-PVTG households; 12% PVTG households take loan from self-help groups (SHGS) but about one third (31%) non-PVTG households take loan from the SHGs. However, unlike the project and control groups, PVTG and non-PVTG households are not different in the way they use the loan received.

Access to community services

We also assess and compare village level characteristics of project and control sample. In this analysis each village is considered a single unit and the center of village is considered as a reference point for all distance measures. The village level questions are asked to the current village leader. Table 24 presents project and control villages' access to markets, irrigation, and roads and public transportation. The fist panel presents statistics for the access to markets; input suppliers, output market or collection centers, and wholesale markets. In baseline, no village in both project and control area has a wholesale market and only slightly more than 10% villages have at least one input supplier and output market in the village. Specifically, 13.5% of project villages have a output market in the village compared to 11% control villages, a statistically insignificant difference. In contrast more control villages have at least one input supplier in the village (17%) compared to project villages (12.%), but the difference is also not statistically significant. On average, the distance to the nearest input supplier is about 9 km and the distance to the nearest output market is about 10 km. The access to wholesale markets is even worse; both project and control villages are about 14 km away from a wholesale market.

Apart from input suppliers, output markets, and wholesale markets, access to market has been assessed with an access to fair price shops (shops designated for public distribution system, PDS). On average, about 21% villages have at least one fair price shop in own village but the fair price shops are more common in control villages (24%) compared to project villages (17%). As expected, fair price shops are closer than other types of markets; on average the nearest fair price shop in project areas is 4 km away and it is 3 km away in control areas.

Access to irrigation is measured with the percentage of irrigated land in wet and dry seasons. In the wet season, more than 60% land in both project and control villages is irrigated, probably due to high water table and increased number of seasonal water springs. In the dry season, however, only about 10% land is irrigated – in both project and control areas – indicating a critical lack irrigation structure in the area.

We also examine project and control villages' access to paved roads and public transportation. We find that only about 9% villages have a paved road that passes by the village; about 8% project villages and 10% control villages. On average, a paved road is about 4 km away from most villages and which is about same distance to a fair price shop indicating that access to the fair price shops is directly correlated with access to paved road. Even though the average distance to a paved road is 4 km, distance to the nearest public transportation stop is even farther. Project villages are about 7 km away from the closes public transportation stop but control villages are about 5 km away. The difference is statistically significant.

Table 24. Access to markets, irrigation, and transportation

	Sample area			
Access to market	Full	Project	Control	Diff.
Village has a market to sell Ag. Produces (%)	12.2	13.5	11.0	2.5
	(32.8)	(34.3)	(31.4)	
Distance to the nearest output market (km)	10.1	9.5	10.7	-1.2
	(13.6)	(11.7)	(15.2)	
Village has a market to buy Ag. Inputs (%)	15	12.4	17.6	-5.2
	(35.8)	(33.1)	(38.3)	
Distance to the nearest input supplier (km)	8.5	9.2	7.9	1.3
	(6.68)	(6.80)	(6.53)	
Village has a *fair price shop* (%)	20.6	16.8	24.2	-7.4
	(40.5)	(37.6)	(43.1)	
Distance to the nearest *fair price shop*	3.5	4.1	2.9	1.2**
	(3.02)	(3.24)	(2.70)	
Distance to the nearest wholesale market (km)	13.9	14.0	13.8	0.2
	(10.9)	(11.8)	(9.95)	
Access to irrigation				
Land irrigated in wet season (%)	62.3	60.8	63.8	-3.0
	(36.2)	(37.1)	(35.5)	
Land irrigated in dry season (%)	9.8	10.1	9.5	0.6
	(22.3)	(20.6)	(23.9)	
Access to public transportation and roads				
Public transportation passes by the village (%)	8.9	7.9	9.9	-2.0
	(28.5)	(27.1)	(30.0)	
Distance to the nearest paved road (km)	4.0	4.1	3.9	0.2
	(4.43)	(4.43)	(4.44)	
Distance to the nearest public transportation (km)	5.7	6.6	4.8	1.8**
	(4.73)	(5.49)	(3.69)	
Observations	180	89	91	

Notes: Point estimates are sample means. Standard deviations are in the parentheses. A two-sample t-test is used for the test of mean differences. Level of significance $^{*}p< .10$, $^{**}p< .05$, $^{***}p< .01$

Since strengthening village development association's (VDA) capacity and service delivery was one of the goals of the project, we also assess VDAs' work and the respondents' view on service provided by these offices. On average, leaders from 47% villages believe people are satisfied with the VDA's work. When we ask the respondents to rate the respective VDA's work in a scale of 1 to 4, 1 being excellent and 4 being poor, about 10% respondents rated excellent followed by 36% very good, 21% good, and 33% poor. When we examine whether VDAs have a physical offices with minimal required furniture, we find that only 67% VDAs have a physical office. In project areas, only 49% villages have minimal requited furniture compared to 58% VDAs in control areas. Despite poor office structures, it is encouraging that majority of VDAs are providing good services.

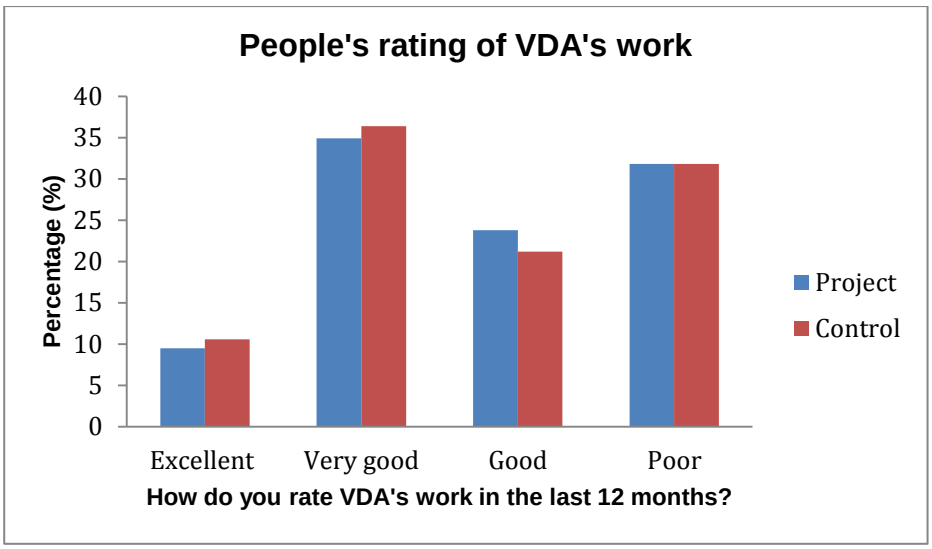


Figure 3. People's rating of VDA's work in project and control areas

Conclusion

This analysis presents descriptive statistics for outcome and impact indicators for the Odisha Particularly Vulnerable Tribal Groups Livelihood Empowerment Program (OPELIP). It reports on 20 major indicators and assesses the balance between project and counterfactual groups in the baseline based on the mean differences of the selected indicators. The selected indicators are taken from the project logical framework, theory of change, and impact assessment plan. Specifically, the analysis reports on cash income, consumption, asset index, food security, dietary diversity, child nutrition, women's empowerment and gender balance in decision making, land ownership, cropping patterns, agricultural yields, livestock ownership, livestock sales and income, school attendance, school performance, migration pattern, remittances, access to loan/credit, and sources and uses of loan/credit. We compare and contrast the indicators across project and control groups as well as PVTG and non-PVTG groups. By definition, the PVTG group consists of particularly vulnerable tribal groups and the non-PVTG group includes other scheduled tribes (STs), scheduled castes (SCs) and all other tribal and non-tribal households. Our assessment of baseline indicators reveals that the project and control samples are well balanced in baseline meaning no significant difference exists between project and control samples with respect to impact and outcome indicators. However, most indicators are statistically different between PVTG and non-PVTG groups indicating that socioeconomic status of the particularly vulnerable tribal households is different from other tribal and non-tribal households in the OPELIP project districts.

In addition to the assessment of the 'project versus control' and 'PVTG versus non-PVTG' households, we also examine project coverage and targeting. Based on the baseline data, we found that, in contrast to official report that OPELIP covers 100 % of PVTG households, there are about 24% of PVTG households outside of the project areas. Although having PVTG households in control sample is favorable for the Impact Assessment for comparison purposes, it indicates that the intended project coverage for OPELIP may have slightly deviated from the initial plan. However, it is critical to note that the MPA boundaries are based on the 2011 Census and there have been several changes after that Census. In addition, there is a possibility that some PVTG households previously

living in a certain MPA area might have been moved to a nearby village of the OPELIP target area. Recognizing that the respondent's self-classification of their tribal group may not reflect the current official classification, reconsideration of the current targeting is not advised. In addition, although no prior MPA households were expected in the control areas, we found a presence of about 7% of prior MPA households in control areas. While this observation raises some concerns about project targeting, there is no reason for reconsideration of current targeting because this inconsistency may be due to the difficulty for the respondents to reconcile what prior MPA coverage actually means or it may simply be a consequence of structural shifts of MPA boundaries or migration.

Overall, the baseline descriptive statistics and statistical tests for mean differences of outcome and impact indicators between project and control groups indicate that the project and control sample are well balanced and the control sample is statistically valid for further comparison with the project sample. Given a statistical balance of all impact and outcome indicators across the current project and control sample, it is advised that all follow up surveys make every effort to track the same households and new households that will be formed due to customary household splits. Apart from future impact assessment surveys, we advise OPELIP to follow all or part of the households surveyed in the baseline survey. Surveying the same units over time helps to establish a monitoring system to track progress over time at the level of smallest sampling unit, household or individual for some indicators.

Based on our results on PVTG and non-PVTG households, it is advised that any comparison between tribal groups may need additional care because socioeconomics and demographic characteristics do vary by tribal groups. The current analysis aggregates all tribal and non-tribal groups other than PVTG in a single category – non-PVTG – but it is suggested that future studies assess the project impact across different tribal groups including PVTGs, other scheduled tribes, scheduled castes etc. Despite significant baseline differences between PVTG and non-PVTG groups, a balanced distribution of different tribal groups across project and control areas sets a good stage for a reliable assessment of the impacts of the project interventions.

Our examination of community level data indicates that most project and control villages have poor access to markets, roads and public transportation, and irrigation. As the access to these services is statistically not different across project and control villages, our control villages, just like the control households, are identical to the project villages in many observable characteristics.

Finally, over the course of the analysis, we have identified several areas for improvement in the future impact assessment or any other surveys related to OPELP. The most critical component that is lacking in the current data and analysis is the cropping system and crops grown in seasons other than the Kharif season. For example, anecdotal evidence and field observation suggest that a large proportion of tribal households plant off-season paddy – *podu cultivation* – in the area, but the current survey fails to document that information. We suggest that future follow-up surveys collect information about major crops grown, quantity harvested, quantity consumed at home, and quantity traded in the market by seasons. Also, the use of non-timber forest products for home use and/or as income generating activities is not collected in the current survey. However, it has been observed in the field visits and also suggested by the local officials that tribal engagement in non-timber forest products collection and marketing is very common. It is suggested that future surveys (both impact assessment and annual outcome surveys) collect information on non-timber forest products and their uses.

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Appendix

Tables

Table A1. Distribution of tribal groups by district and project status

District	PVTGs		Other STs		SCs		Others	
	Project	Control	Project	Control	Project	Control	Project	Control
Anugul	38	16	1	21	0	3	3	2
Debgarh	45	29	19	17	19	23	40	55
Gajapati	54	44	61	56	0	9	1	7
Ganjam	32	35	3	0	0	0	0	0
Kalahandi	52	31	0	21	0	0	0	0
Kandhamal	26	16	0	6	0	4	0	0
Keonjhor	33	0	18	54	1	0	7	5
Malkangiri	37	12	45	73	1	0	14	12
Mayurbhanj	32	1	182	246	12	14	75	40
Nuapada	14	9	13	2	0	7	0	9
Rayagada	52	28	42	69	13	11	6	4
Sundargarh	34	34	15	24	0	0	10	0
Total	449	255	399	589	46	71	156	134

Notes: Full sample is 2099 of which project sample consists 1050 households and control sample consists 1049 households

Table A2. Asset variables used to create wealth index

Assets	Definition
Household durables	
1. Radio/Tape recorder	Number of radio/tape recorders
2. Television	Number of televisions
3. Bicycle	Number of bicycles
4. Motorbike	Number of motorbikes
5. Car or large vehicles	Number of car, trucks etc.
6. Phones	Number of mobile/fixed-line phones
7. Armorie	Number of armorie etc.
8. Musical instruments	Number of CDs, DVDs etc.
9. Bed/Khat	Number of beds, blankets etc.
10. Table/Chair	Number of tables/chairs
11. Sewing machine	Number of sewing machines
12. Stoves	Number of cooking stoves (all kinds)
13. Fridge/Refrigerator	Number of refrigerators
14. Microwave	Number of microwaves
15. Iron	Number of iron
16. Fan	Number of (electric) fans etc.
17. Rickshaw	Number of rickshaws
18. Van (tri-cycle)	Number of vans
19. Boat	Number of boats
Housing characteristics	
1. Home ownership	1 if home owner; 0 else
2. Number of rooms	Number of rooms
3. Quality of roof material	1 if iron sheets, tiles, concrete; 0 else
4. Quality of wall material	1 if burnt bricks, concrete, iron, blocks; 0 else
5.Quality of floor material	1 if smoothed cement, tiles, wood; 0 else
6. Improved drinking water	1 if source is tap, tube well, boring and within 30 minutes' walk; 0 else
7. Improved sanitation	1 if flush, covered pit, VIP and not shared with other households; 0 else
8. Access to electricity	Yes= 1, 0=No
9. Improved cooking fuel	1 if natural gas, electricity, biogas; 0 else
Livestock	
1. Cattle	Number of dairy cattle, oxen, calves
2. Goat/sheep	Number of goats, sheep
3. Pig	Number of pigs
4. Donkey	Number of donkeys, mules, horses
5. Poultry	Number of chicken, turkey, etc.
6. Others	Number of fishponds, beehives

Notes: All asset variables are number of item counts unless otherwise specified in the definition.

Table A3. Correspondence between income and asset poverty

Asset poverty	Income Poverty		
	Poor	Non-poor	Total
Poor	32.63	7.38	40.02
	(1.30)	(0.63)	(1.41)
Non-poor	44.55	15.44	59.98
	(1.26)	(0.94)	(1.41)
Total	77.18	22.82	100
	(0.99)	(0.99)	

Notes: Point estimates are sample means. Standard errors are in the parentheses

Table A4. Decision domains and individual decisions

Decision Domains	Decisions	Weights
1. Agricultural input use	Fertilizer use	5/23
	Pesticide use	
	Hiring labor	
	Machinery use	
	Livestock inputs/services use	
2. Use of cash income	Use of own-business revenue	6/23
	Use of wage income	
	Use of income from social transfers or gifts	
	Use of livestock income	
	Use of crop income	
	Use of loan or credit	
3. Sales	Crop produce sales	4/23
	Sale/rent of farm assets	
	Sale/rent of non-farm assets	
	Livestock or animal product sales	
4. Food items purchase	Small food items purchase	2/23
	Large food items purchase	
5. Non-food items purchase	Small non-food items purchase	2/23
	Large non-food items purchase	
6. Sending children to school	Sending children to school	1/23
7. Others	Taking a wage employment	3/23
	Joining social groups	
	Loan/credit application	

Figures

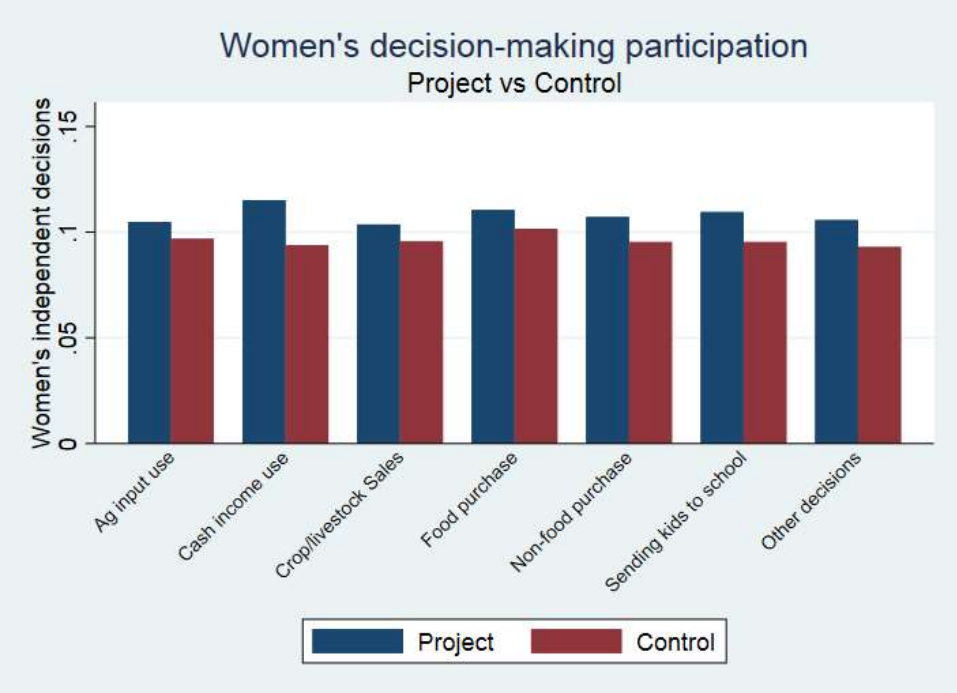

Figure A1. Women's decision-participation by treatment status

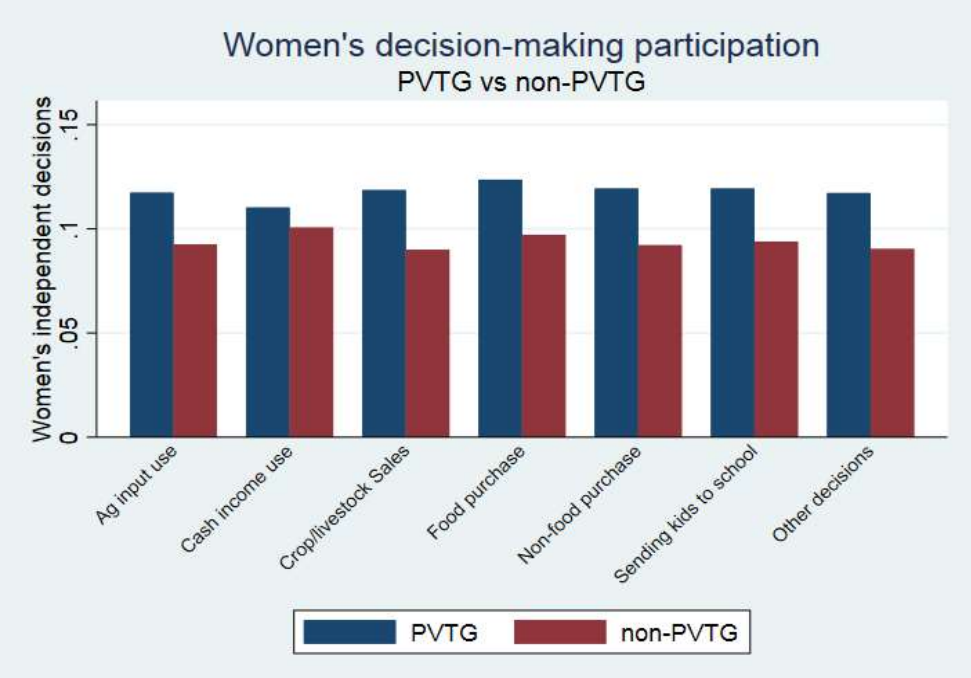

Figure A2. Women's decision-participation across tribal groups

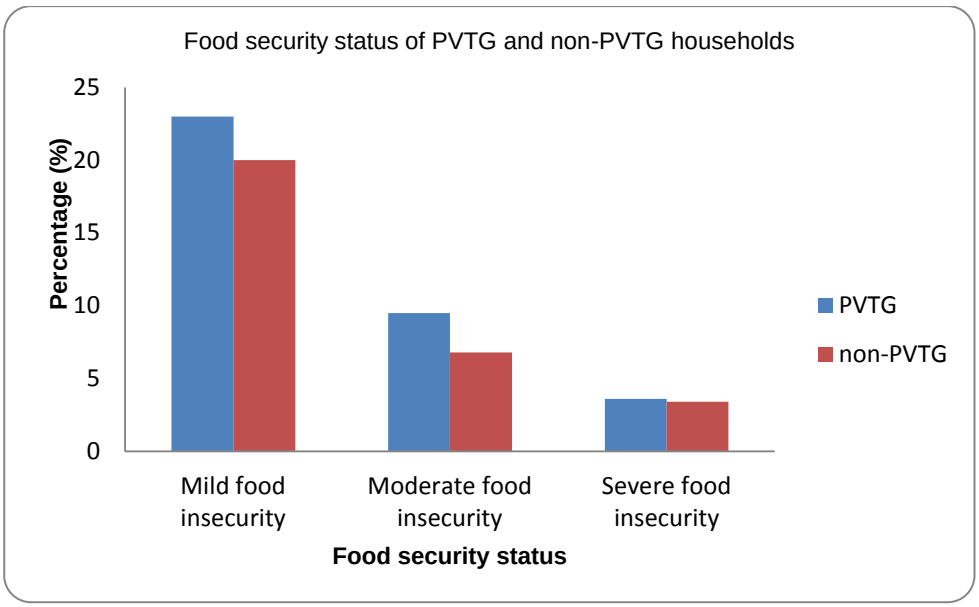

Figure A3. Food security status

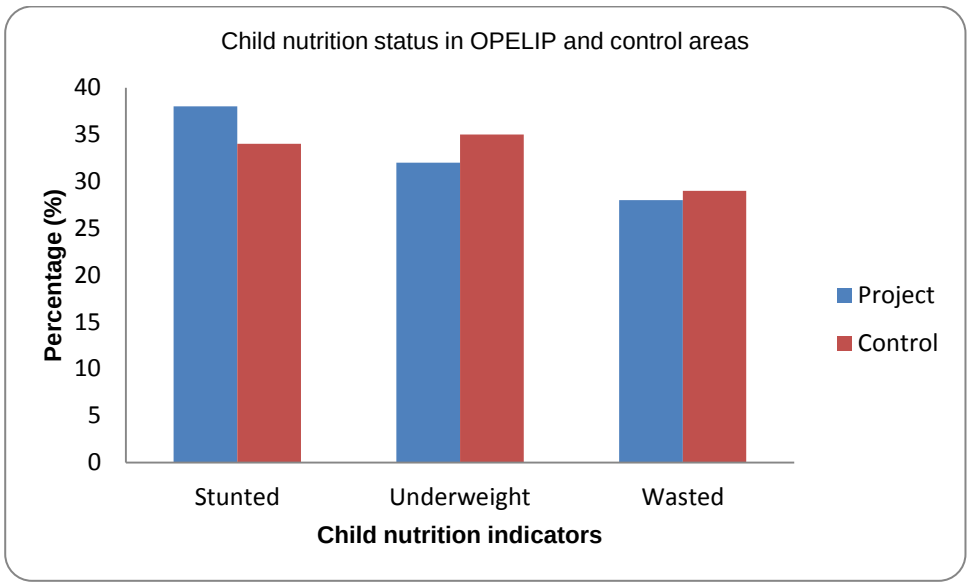

Figure A4. Child nutrition status in project and control areas

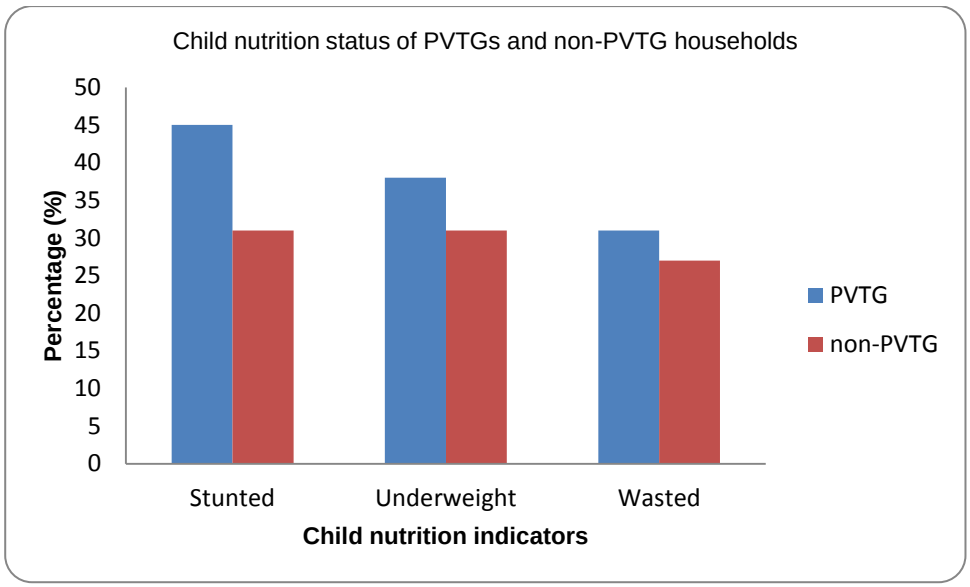

Figure A5. Child nutrition status in PVTG and non-PVTG sample

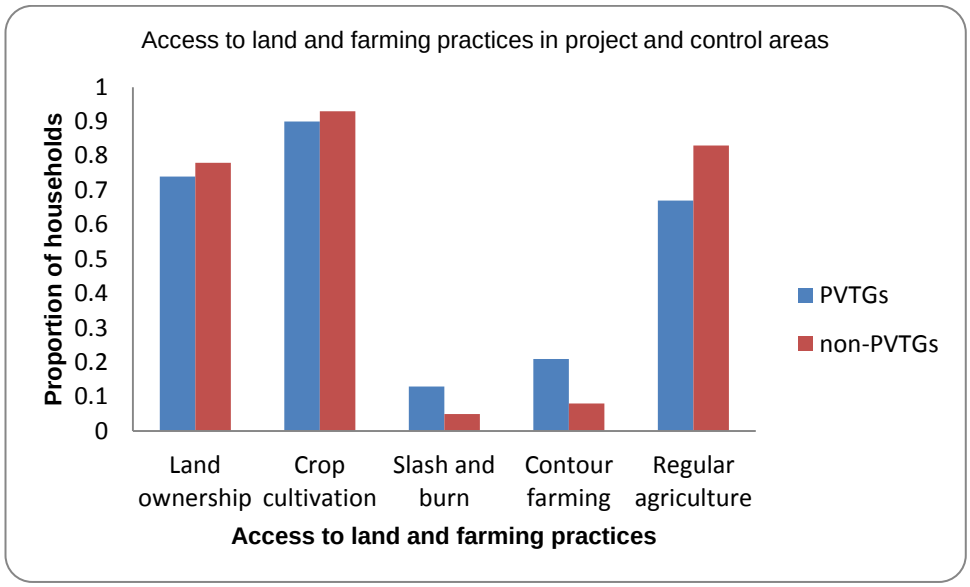

Figure A6. Access to land and farming practices by tribal groups

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