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Assessing the distributional impacts of development interventions - the Inequality Marker

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Abstract

Persistent economic and social inequalities constrain the inclusive development of nations. The internationally agreed Sustainable Development Goal 10 (SDG10) and its targets, aim to address these constraints through the promotion of equalising policies. This paper tests the validity of the Inequality Marker and Distributional Impact Assessment (DIA) tools that have been developed to assess the contribution of development projects to inequality reduction using as case studies four AFD and European Commission funded projects in Benin, Djibouti-Ethiopia, Uganda, and Vietnam. The DIA analyses have been carried out in two cases: in Benin (*ex-post*) and Uganda (*ex-ante*). Overall, the study shows how the Inequality Marker and DIA methodology can provide relevant information on the potential contribution of development projects to inequality reduction. The study identifies critical issues for the implementation of the DIA analysis that reflect both organisational constraints in donor agencies internal procedures, and external contextual factors. The study also provides a set of policy recommendations to mitigate these threats.

Résumé

Les inégalités économiques et sociales persistantes entravent le développement inclusif des nations. L'objectif de développement durable n°10 (ODD10), adopté au niveau international, et ses cibles visent à remédier à ces contraintes par la promotion de politiques d'égalisation. Cet article teste la validité des outils Inequality Marker et Distributional Impact Assessment (DIA) qui ont été développés pour évaluer la contribution des projets de développement à la réduction des inégalités en utilisant comme études de cas quatre projets financés par l'AFD et la Commission européenne au Bénin, à Djibouti-Ethiopie, en Ouganda et au Vietnam. Les analyses DIA ont été réalisées dans deux cas : au Bénin (ex post) et en Ouganda (ex ante). Dans l'ensemble, l'étude montre comment le marqueur d'inégalité et la méthodologie DIA peuvent fournir des informations pertinentes sur la contribution potentielle des projets de développement à la réduction des inégalités. L'étude identifie des questions critiques pour la mise en œuvre de l'analyse DIA qui reflètent à la fois des contraintes organisationnelles dans les procédures internes des agences donatrices et des facteurs contextuels externes. L'étude fournit également une série de recommandations politiques pour atténuer ces défis.

Mots clefs :

Inégalités, aide publique au développement, coopération au développement, institutions de financement du développement, 40% les plus pauvres, ODD.

1. Introduction

High levels of income and other forms of economic and social inequalities are well-established factors that constraint the development process of nations. This is captured by the internationally agreed Sustainable Development Goal 10 (SDG10), and its targets that aim to address persistent inequalities within and between countries. Addressing forms of social inequalities stem from two considerations. The first one is instrumental: The global goal of eradicating extreme poverty by 2030 cannot be reached without substantial reductions in income inequality within countries (Lakner et al. 2014; 2022). In addition, driven by the strong correlation between poverty and inequality through the distribution of income, poverty in any country can be reduced more effectively when accompanied by policies that tackle forms of inequality (Ravallion 2001; Ferreira, Galasso, and Negre 2020). The second reason is that current within-country inequalities are very high, and even rising in many countries and world regions (Niño-Zarazúa, Roope, and Tarp 2017; Jorda and Niño-Zarazúa 2019), and this is detrimental not only for the social pact and its necessary notions of social justice, but also for social development and political stability. Indeed, evidence shows that high income inequalities are associated with increased social instability, political and economic elite capture, and even shorter growth periods, among other societal ailments (World Bank, 2016).

It is therefore critical to assess how, and the extent to which, development interventions supported by various forms of official development assistance contribute to the goal of reducing inequalities. This is a challenging task due to a myriad of factors, including the effects that domestic redistributive policies, the structure of labour markets, and norms and institutions have on inequality. However, it is possible to analyse the potential contributions of development interventions to inequality reduction by looking at the distribution of beneficiaries and assessing the extent to which policies disproportionally benefit more the poorest and most vulnerable.

In a recent study (Morabito, Negre, and Niño-Zarazúa 2021) we proposed a set of analytical tools to assess the potential impacts of development interventions on inequality, with a focus on the share of the bottom 40% of the population benefiting from these interventions. This paper aims to extend the initial phase of a study on the potential impacts of development interventions on inequality, and to validate the methodology with respect to wealth and other forms of inequalities. The study also aims to develop the scoreboard into the Inequality Marker that was recently adopted by the European Commission. The Inequality Marker has been tested on four AFD and EU funded development projects in Benin, Djibouti-Ethiopia, Uganda, and Vietnam. The Distributional Impact Assessment (DIA) tools were conducted in two countries: Benin (ex-post) and Uganda (ex-ante) using the Equity Tool.

The ex-post DIA in Benin showed that although the project targeted poor rural communities to address inequalities in access to electricity, urban areas were the

prime beneficiaries of the intervention. This was likely due to the inclusion of localities that were closer to the grid and power networks, and probably also closer to urban areas. The ex-ante DIA in Uganda found that there are significant inequalities in access to and quality of water sources across the sub-counties, refugee settlements, and Town Councils in the Isingiro district. Water affordability is a key issue for the success of the project. It will be critical to explore alternative approaches for water supply, including subsidized schemes for the poorest households, and differentiated water rates for consumption and productive use, in particular for agricultural and livestock activities, to both tackle existing inequalities in water accessibility and address food insecurity.

Overall, the paper shows how the DIA can provide relevant information about the potential contribution of development projects to inequality reduction in partner countries. However, the paper also identifies critical issues for the implementation of the DIA analysis, such as organizational constraints and external contextual factors. In the case of programmes undertaken in Djibouti-Ethiopia and Vietnam, the DIA could not be conducted because information about the exact location of beneficiaries was not yet available, and surveys in the field were hindered by constraints imposed by local authorities. The paper provides a set of policy recommendations to mitigate these threats.

The remainder of the paper is organised as follows: Section 2 provides a background of the case studies, including a description of the AFD-EU development interventions and a discussion on the existing inequalities in income and the policy areas of the interventions, followed by an analysis of the selected policies interventions using the Inequality Marker and also a distributional impact assessment (for Benin and Uganda) based on the Equity Tool. Finally, Section 3 concludes with some recommendations for future work.

2. Country Case Studies

2.1. Electrification in Rural Benin

The objective of this project is to promote sustainable access to electricity for the unserved poor rural populations of Benin via:

- Increasing populations that access electricity in rural areas
- strengthening the management capacity of electrification services in rural Benin and,
- Introducing innovative approaches and techniques that can provide appropriate solutions for the poorest rural populations (prepayment).

The main goal of the programme has been to provide access to electricity to approximately 182,000 people in 59 villages. The programme meant to benefit 57,000 inhabitants living in the administrative perimeters of the same villages, but outside the areas covered by the project. However, the plan is to equip these areas with battery charging stations.

A large part of the beneficiary population is expected to be below the 1.90 dollar a day poverty line. AFD, as co-donor, funded the project with a grant of 39% of the budget. The European Union, through the Energy Facility programme, provided 38% of the budget, equivalent to 7.7 million out of a total of 20.1 million USD.

2.1.1 Inequalities in Benin

Benin in recent years has seen fairly stable real GDP growth rates and downward trending poverty levels in absolute terms. Its growth rate averaged 6.4% for the years 2017 to 2019 and, with a decrease during the intermittent years due to the Covid-19 pandemic, has recovered to a rate of 6.6% in 2021 (World Bank, 2022c). There only exists sporadic and fluctuating data on the country's overall inequality, with the World Bank Development Index noting a Gini coefficient of 38.6 for the year (2003) before rising to 43.4 (2011) and up to 47.8 (2015), though decreasing below the 2003 level to 37.8 (2018) in its most recent calculation, see Figure 1. At the same time, the country's poverty rate, even measured based on the international line, only decreased at a very slow rate in its most recent years, from a share of households in poverty at 18.8% in 2019, to 18.7% in 2020 and 18.3% at the end of 2021, with the reduction threatened to be slowed further through increased prices on food and energy (World Bank, 2022c).

Figure 1. Gini index of consumption per capita for Benin
Source: Author's elaboration based on UNU-WIDER WIID (2022).
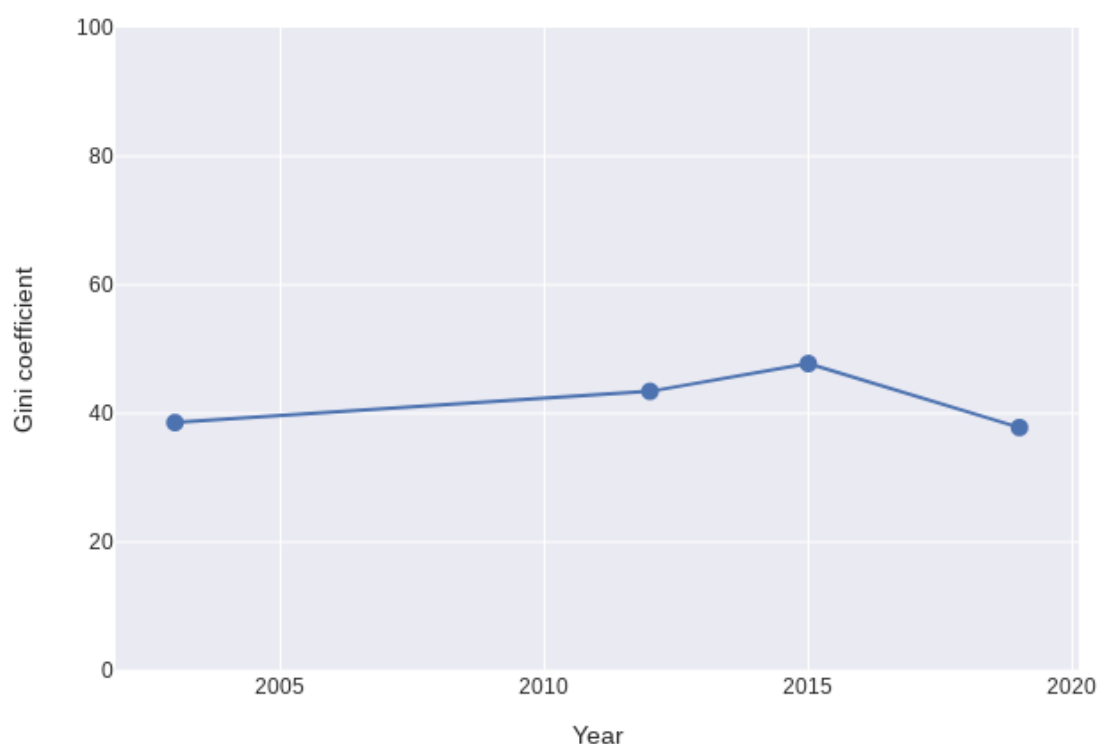
Based on its national poverty line, Benin's overall poverty rate is 38.5%, though it hides a strong spatial disparity in the incidence of poverty between rural (44.2%) and urban (31.4) areas (World Bank, 2022c). Looking at the effect of income growth on the time to exit poverty, studies have highlighted important heterogeneities and spatial disparities in pro-poor growth (Alia, 2017; Djossou et al., 2017), determined by a household's size, its available human capital and whether it is located rurally.

Access to electricity in the country especially underlies a large heterogeneity based on location. The overall level of electrification of Benin has been rising slowly — though outpacing population growth — from 22% in 2000 to 26% in 2005, 34% in 2010, a decline to 30% in 2015 and then a faster increase to 40% in 2019, which is a rate below the average of 47% in sub-Saharan Africa, although a broad difference in electrification levels between urban (65%) and rural (17%) regions remain (World Bank, 2021).

2.1.2 Inequalities in access to electricity

In rural areas there are generally three approaches to electrification that work outside of a connection to the main grid, individual installation of solar panels or generators for smaller electric appliances, collective solutions like kiosks offering electric charging for some cost, or autonomous mini grids powering a portion of a more densely populated rural area (though often requiring permits or licenses if above certain sizes) (Jaglin, 2019).

Rateau & Choplin (2022) see one of the primary reasons for off-grid electrification in either physical unavailability in rural areas or a prohibitively high cost for connection to the grid. However, these more individualized solutions are often only targeted at credit-worthy customers and can lead to a further increase in inequalities between income percentiles, leaving behind households which are already neglected within the field of energy access (Barry & Creti, 2020). The former, physical access, is argued by Djossou et al. (2017) as well, emphasizing the need for continued infrastructure expansion to more households, in order to provide access to more durable goods (fridges, mobile phones and internet) which can help decreasing income and wealth inequalities. The latter, prohibitively high costs, should not be disregarded in such an infrastructure expansion as well, however.

One of the major obstacles to main grid connection remains the high charge a customer is expected to pay with solutions requiring continued political commitment to identify, examine and implement more low-cost electrification processes as well as financing solutions. Golumbeanu & Barnes (2013) point out the main obstacles that need to be addressed here: the lack of incentives to increase electrical affordability, a weak utilities commitment toward providing broad electricity access with focus often lying more on high-consumption urban markets, often overrated technical specifications for low loads, too great distances between households and distribution poles in an area, and an overall lack of affordable financing solutions.

2.1.3 I-Marker Analysis

Analysis of trends and drivers of inequalities in the policy area of the intervention

There is very generic analysis with contextual information about the lack of electricity in rural areas, which are inhabited mostly by the poorest groups within the population of the country. The lack of electricity undermines capacities of increasing economic activities, and therefore income opportunities for these groups in rural areas. Conversely, there is not accurate analysis about drivers of inequalities in access to electricity in these areas, e.g., costs of provision, subscription rules applied by electricity supply companies etc. A large part of the beneficiary population is expected to be below the 1.90 dollar a day poverty line.

Objectives and activities of the intervention designed to directly benefit the bottom 40%

The general objective of the project is to expand the electricity network in unserved rural areas (villages), which are disproportionally excluded from the provision, in order to increase access to electricity for poorest households (identified as those living below the one dollar a day poverty line),

"The action is fully oriented towards improving sustainable access to electricity for poor rural populations that are currently unserved. It is also designed to contribute to the achievement of the Millennium Development Goals. The beneficiary population is nearly 90% below the poverty line of one dollar per day per capita"

One of the specific objectives (N.3) also aims at benefiting the bottom (poorest) 40 per cent or socioeconomically disadvantaged individuals, households, or groups,

1. *Significantly contribute to the achievement of quantitative objectives in terms of populations beneficiaries,*
2. *Implement an action to strengthen Benin's rural electrification management capacity and,*
3. *Introduce innovative approaches and techniques representing appropriate solutions for the poorest rural populations.*

However, selection of villages benefiting from the intervention, has not been done by considering the geographical distribution of poverty and/or level of income/wealth of inhabitants. On the contrary, villages selected are in proximity of main transportation infrastructure (and where, eventually, living standards are relatively higher).

"*In its current phase of implementation of the government program, the SBEE (Beninoise Electric Energy Company), in association with the ABERME (Beninoise Agency for Rural Electrification and Energy Management), has drawn up a list of 297 localities to be electrified in priority by network. Among this list, which takes into account the projects already in progress and the relative proximity of the existing transport network, the SBEE, in partnership with the GTZ, studied the feasibility of electrification, by connection to the national network, of 59 centers villagers, grouped into 14 "clusters", in various rural areas of the country. Each cluster actually corresponds to an extension of the MV transmission lines, from which the neighboring villages can be connected*"

In addition, the activities undertaken in order to ensure that innovative solutions are introduced, for poorest households, to access electricity, in the form of pre-payments, might not tackle important criticalities (not properly considered in the analysis, such as prices of electricity and therefore affordability of subscriptions to networks for poorest households).

Measurable indicators to assess targeting of the bottom 40%

The monitoring of the progresses of the project is carried out using indicators related to the expansion of the electricity network in villages where, according to the general objective, approximately 90% of the population leave below 1 dollar a day poverty line. In total, approximately 182,000 people who live in 59 villages. The project will also benefit 57,000 inhabitants living in the administrative perimeters of the same villages, but outside the areas that will be covered by the project. As a result, the effects of the intervention on the bottom (poorest) 40 per cent or socioeconomically disadvantaged individuals, households, or groups, is measured, indirectly, through the increase of coverage of electricity in the areas where supposedly, most of the poorest live.

Clear plan to evaluate results, including inequality-reduction targets

There is not, in the project document, a clear evaluation plan to assess progress in reducing inequalities by increasing access to electricity for poorest households. However, an evaluation study has been conducted, also investigating the effective intake of subscriptions to electricity services in rural villages benefiting from the intervention. Based on the desk review presented above, we mark the project as I-1 which denotes that inequality reduction is a significant objective.

2.1.4   Distributional Impact Assessment

For the distributional impact assessment (DIA) of the Benin's project, a questionnaire consisting of 12 questions, has been developed, to identify on one hand, possessions of respondents and then to establish their wealth quintile; on the other hand, to further investigate whether respondents have access to electricity, time of access, and eventual reasons for not accessing it. In addition to the wealth-related questions, 6 additional questions have been proposed, to collect information about respondents' gender, age, household size and family composition (number of siblings), main language of respondents and religion.

2.1.5   Data and sampling strategy

The main action carried out to achieve the expected objective, has been the expansion of the electricity network to reach out a number of villages, 105 in total, in the departments of: Alibori, Atacora, Atlantique, Borgou, Collines, Couffo, Donga, Mono, Ouémé, Plateau and Zou. For the purpose of study, a sample of 2,356 households, representing the population of the 97 villages benefiting from the intervention have been randomly selected to participate in the survey (see Table 2). The sample was estimated based on a 95% Confidence level. Eight villages located in the Department of Couffo were removed from the sample, since information about actual connection of households to the electricity network was unclear.

Table 1. Distribution of the survey sample size

Département	Nombre de Villages échantillonnés par département	Nombre de ménages échantillonnés par département
ALIBORI	11	393
ATACORA	8	232
ATLANTIQUE	13	107
BORGOU	12	519
COLLINES	15	308

DONGA	1	25
MONO	5	97
OUEME	14	252
PLATEAU	5	125
ZOU	13	299
TOTAL	97	2356

Data were collected randomly, following a sampling frame that adopted the following steps. First, four cardinal points were established for the village's territory and then they were divided into eight quadrants, and selected in each quadrant, one eighth of the number of households sampled in village. The survey company administered the questionnaire to the (present) head of the first household found in the quadrant, and following next households until completion of the estimated sample of questionnaires in each village.

2.1.6 Results of the Distributional Impact Assessment in Benin

Since the main objective of the project has been to improve access to electricity in unserved rural areas of Benin, we assumed that all villages benefiting from the interventions are located in rural areas. As a result, we firstly compared the wealth of the profile of population living in these villages to the wealth distribution of the rural population of Benin and that of the overall population of the country, expecting to find larger share of beneficiaries belonging to the bottom 40% wealth's quintiles in both comparisons, according to project's assumption (i.e., part of the beneficiary population is expected to be below the 1.90 dollar a day poverty line).

On the contrary, we found that no beneficiaries in the targeted villages belong to Q1 and a negligent amount (below 5%) to Q2 of the rural wealth distribution. Similar results have been found when comparing beneficiaries' wealth distribution with the national wealth distribution.
As a result, further information was collected, from Benin's authorities, revealing that almost all villages targeted by the intervention, in fact, were not officially classified, by as rural, but urban. To point out, an estimated 90.5% of beneficiaries of the project intervention actually live in urban areas according to the official classification of urban and rural localities. Consequently, a further analysis was conducted, but comparing the wealth distribution of these beneficiaries with that of the urban, and not rural, population of Benin.

Results are shown in Figure 6. Less than 1% of beneficiaries living in urban areas belong to poorest quintile (Q1) and around 33.54% belong to the bottom 40 per cent of the urban population, while over 35 percent of beneficiaries are around the middle of the wealth

11

distribution (Q3) and nearly 28 percent belong to the richest 40 percent households (quantile Q4 and Q5), which indicates that the intervention is unlikely to have an equalizing effect in terms of access to electricity.

Figure 2. Urban quintile distribution of targeted households
Source: The authors
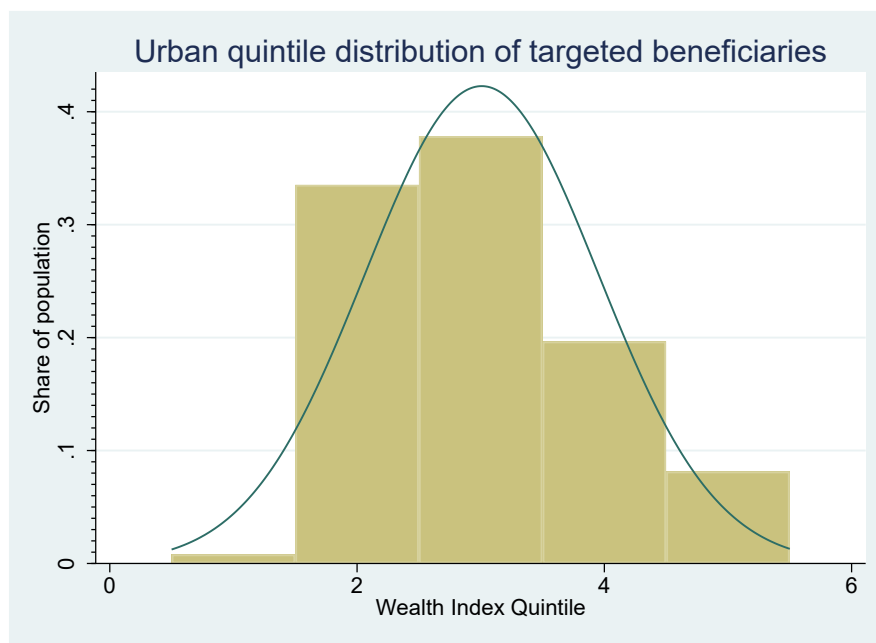
Results for Urban beneficiaries by Department and 'Commune'

An analysis was also carried out for each department, and lower administrative level the '*Commune*'. As outlined in Figure 7, the project has reached a more 'pro-poorer' targeting (Q1 and Q2) particularly in the Departments of Alibori and Donga (above 40% of Q2), in particular, and then Borgou, Collines, and Plateau.

Figure 3. Urban quintile distribution in Departments
Source: The authors
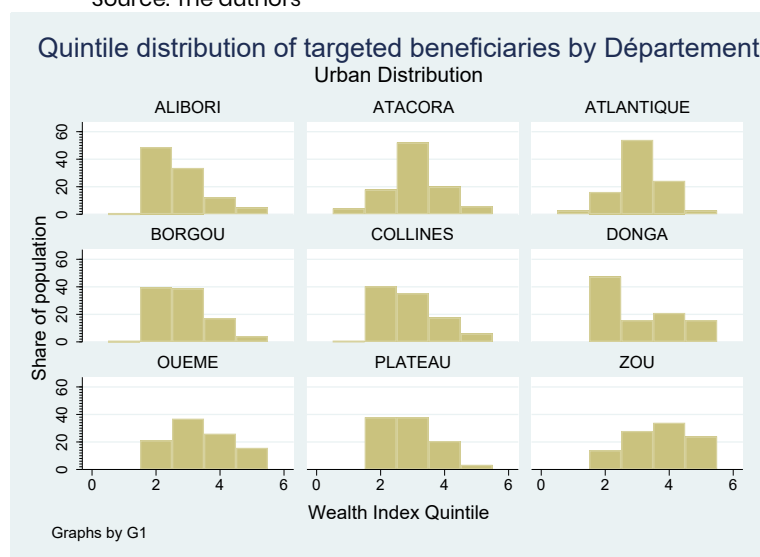
Looking at the distribution of wealth of intervention's beneficiaries at '*Commune*' level (see Figure 8), the project has been more effective in reducing inequalities in Banicoara, Djougou, Glazoue and N'Dali.

Figure 4. Urban quintile distribution in Communes
Source: The authors
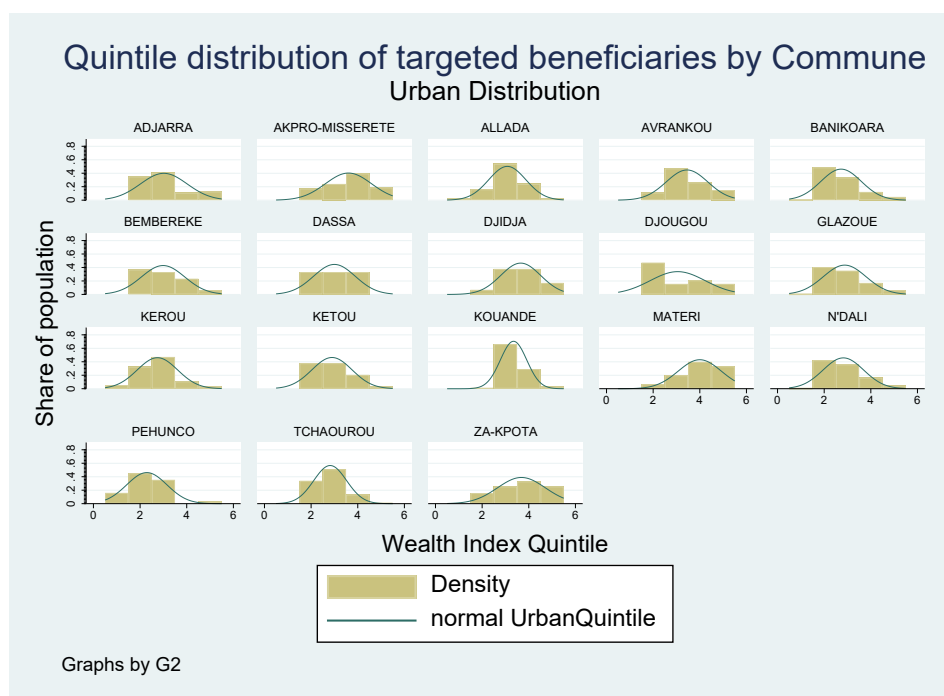
Results by gender and religion

Another important aspect to consider is the intersectional inequalities in terms of the gender and religion of the household head. Results disaggregated by gender show that households headed by women in the second (poorest) quintile (see Figure 9) relatively benefited more by the intervention (above 40% of beneficiaries belong to this category) than men, making the project more likely to be contributing to reducing gender inequalities in urban areas.

Figure 5. Urban quintile distribution by gender
Source: The authors
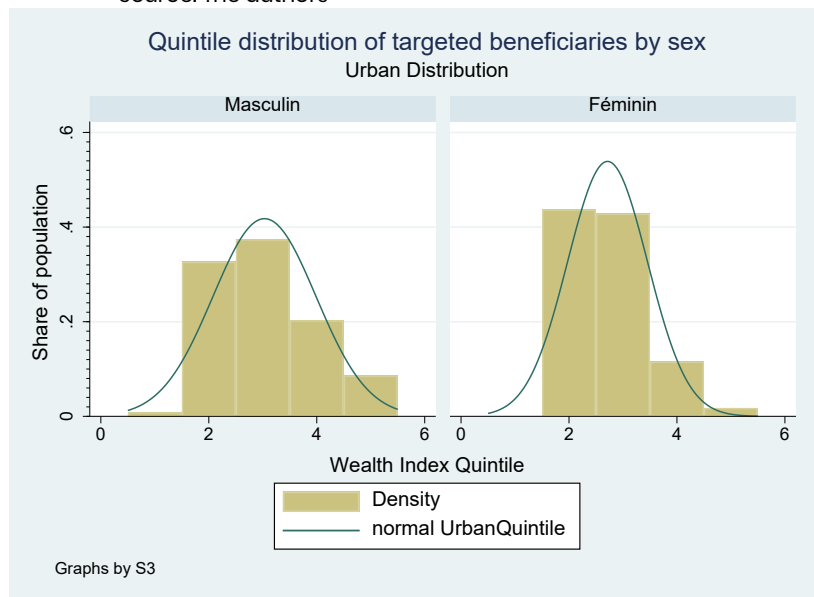
Small differences have been instead observed in terms of the wealth distribution of beneficiaries by religion. The intervention seems to have benefited a marginally poorer Muslim households (see Figure 10).

Figure 6. Urban quintile distribution by religion
Source: The authors
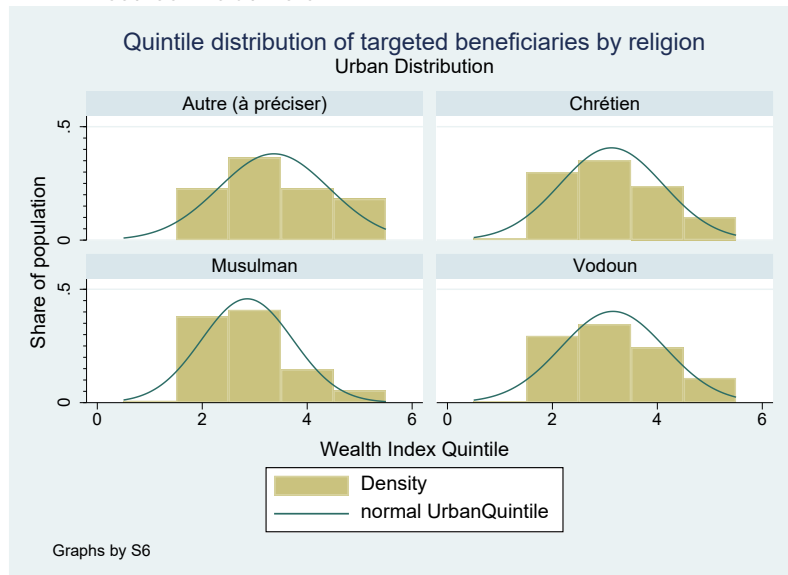
Results for the Rural Villages

Approximately 10% of population targeted by the intervention did actually live in villages located in rural areas, according to national classification. An analysis has been therefore conducted only on these beneficiaries to estimate their wealth distribution, but given the

sample, results should be treated with caution. Figure 11 shows that a small fraction of them, belong to Q2 (3.46%), and none to Q1, with more than 90% in the top two quintiles. The project seems to have contributed to enhancing, not reducing inequalities in rural areas, when considering rural areas involved. In none of the departments and communes, the share of poorest bottom 40% exceeds 10% (See Appendix 1 Benin, also for differences in terms of religion and gender).

Figure 7. Rural quintile distribution
Source: The authors
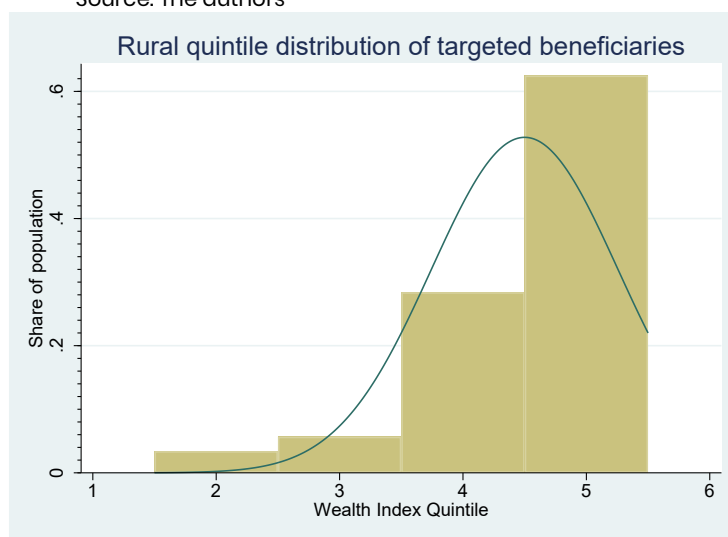
Results for the National distribution

A similar picture has emerged when analysing the effectiveness of the project in reaching the poorest bottom 40% wealth population, considering the national wealth distribution. As outlined in Figure 12, none of the beneficiaries belong to the poorest 20% of the national wealth distribution. And little less than 2% (1.38%) to the second quintile.

Figure 8. National quintile distribution
Source: The authors
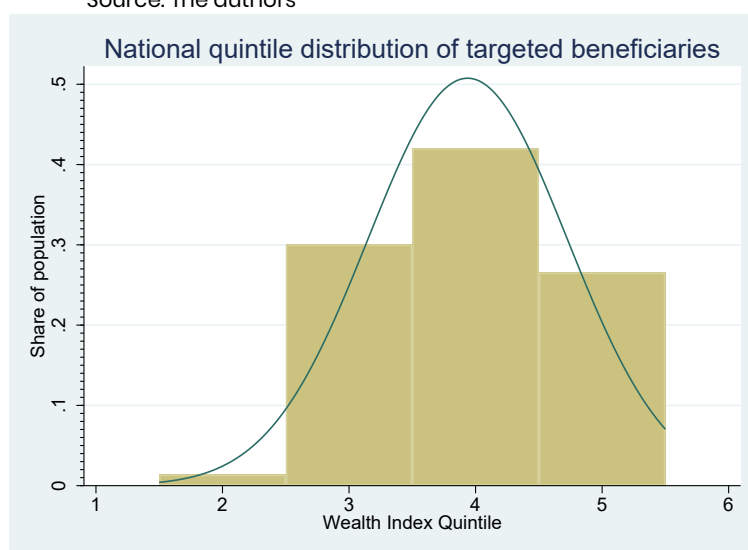
The middle-third quintile accounts for 30.04% of the beneficiaries, while the distribution is clearly skewed towards highest quintiles: 42.02% for Q4 and 26.55% for Q5. As a result, the project disproportionally benefitted more better off households, and therefore making inequality reduction, at national level, unlikely. Equally, looking at lower administrative levels, in none of the *Communes* considered, the project has effectively targeted the poorest (see Figure 13). No substantial differences are observed in terms of religion and sex (See Appendix 1 Benin).

Figure 9. National quintile distribution by *Commune*
Source: The authors
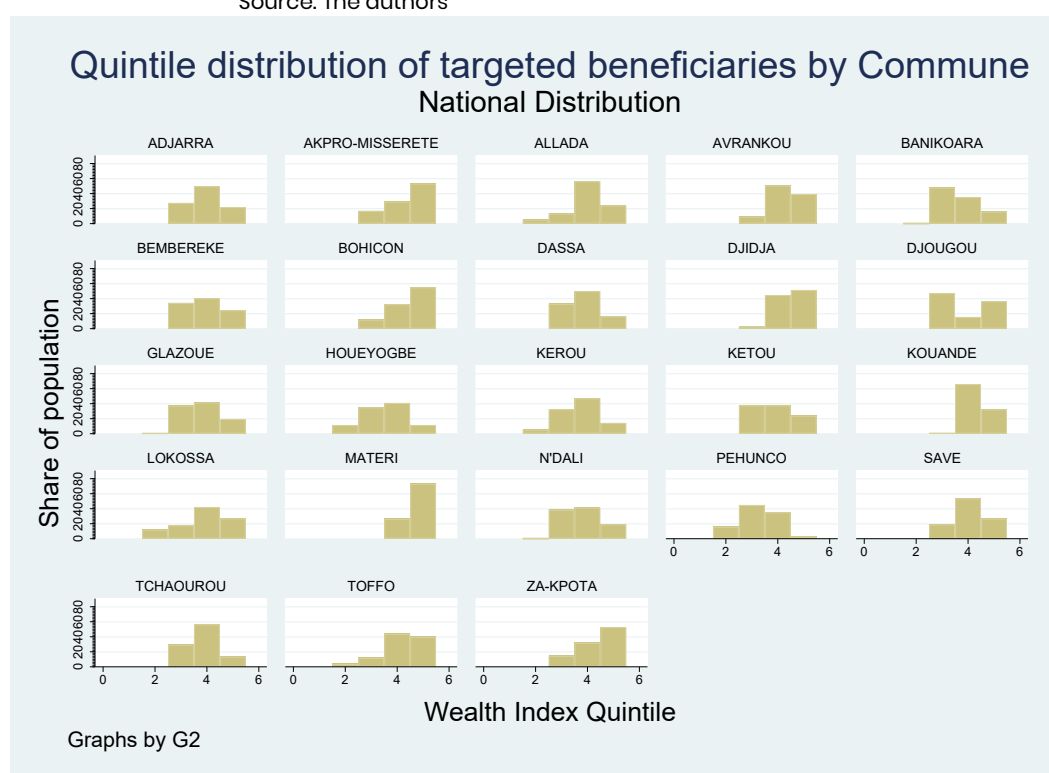
2.1.7   Discussion

Access to electricity in Benin is among the drivers of poverty and inequality. With disparities observed, in particular between urban and rural areas. The project "Electrification in Rural Benin" precisely aims at promoting sustainable access to electricity for the unserved poor rural populations in 105 villages of Benin, through electricity network. Inequality reduction is therefore a significant objective of the project (I-1 with the Inequality Marker).

Yet, from the Distributional Impact Assessment carried out, *ex post*, it emerged that most of villages targeted, according to the official administrative classification of Benin, are actually

located in urban areas, not rural. Hence, analysis of beneficiaries' wealth, in villages officially classified as urban, using the Equity Tool, has shown that around one-third of them belong to the poorest 40% of wealth distribution, and actually none of them to the bottom 20%. For a small number of 'Communes' involved in the intervention, a more pro-poor targeting has been made, and overall poorer women have been relatively better benefited. Looking instead at the few village's beneficiaries (less than 10% of the total beneficiaries' population) classified by the Benin's administration as effectively rural, the share of households' beneficiaries belonging to the poorest two quintiles of the wealth distribution, is extremely low (less than 4%). In addition, when comparing the wealth of all beneficiaries to national wealth distribution, the project did actually disproportionally benefit better off households.

The analysis seems to outline that, the project unlikely contributed to the proposed objective to expand electrification in rural areas as a way to reduce inequalities. The main reason might be ascribed to the criteria utilized to select the villages where to expand electricity networks, focusing on areas nearby existing connections, then likely closer to urban areas and with less incidence of poverty, rather than remote, rural areas where the presence of low income/wealth households is higher.

Nevertheless, it might be also possible that the limited share of bottom poorest 40% wealth households among the beneficiaries of the project is the result of an actual increase in access to electricity by the same beneficiaries (that represent a key asset to calculate wealth). In fact, data shows that 62% of households in villages benefiting from the AFD intervention have access to electricity (in line with national average connection to electricity in urban areas of Benin, which is approximately 65%), and almost all of them did so after the project was concluded. In this case, the project might have nevertheless contributed to reduce wealth inequalities, at least in urban areas, and potentially promoting positive social outcomes, such as improving production, earnings, and the quality of life. But since the assessment has been conducted only ex post, conclusions as such could not be confirmed, in the absence of analyses carried out also ex ante.

Finally, it is important to underline that the share of households accessing electricity, is substantially higher than that of subscription to networks officially reported, in villages targeted, at the conclusion of the project. This might imply that a number of beneficiaries did actually connect to electricity grids, but illegally and irregularly, most probably due to high costs of regular subscriptions. This is a common phenomenon in developing countries.

These results outline, on one hand the need of better targeting strategies aimed at reducing inequality, already planned at the time of the formulation of the project. This includes

conducting surveys such as the Equity Tool before formulation and implementation of the project in order to correctly identify poorest or socio-economically disadvantaged groups to benefit by the intervention, along with information pertaining main causes of lack of access, in order to plan appropriate responses. In the case of the project of Benin, this exercise, carried out ex ante, could have guided policy makers in appropriately selecting rural localities where most vulnerable households leave, along with developing schemes needed to favour affordability of subscriptions and regular connections to electricity grids.

2.2. Expanding **water supply in Uganda's Isingiro district and its refugee camps**

The objective of the project is to ameliorate the health and living conditions of the 550 000 inhabitants of the rural district of Isingiro, at the border with Tanzania to the Southwest of the country, including 110 000 refugees. Only 37% of inhabitants have access to water, half the average access in rural areas at national level. The programme should benefit around 350 000 inhabitants of the districts (both Uganda nationals and refugees).

The project includes works and accompanying measures to be carried out both in rural areas and in two refugee reception areas, the Nakivale and Orushinga camps. The works are conventional and relate to the laying of distribution pipes from the main supply, and the construction of associated small structures (pumping stations, reservoirs, standpipes). The accompanying measures relate to the development of sanitation services, the management of water resources, the capacity building of local stakeholders, as well as specific actions in the two refugee camps.

The main component of the programme consists of the steps:

- Increasing the rate of access to water for inhabitants of the Isingiro district (out of the refugee camps).
- Increasing the conditions of accessing water for refugees present in the district (in the refugee camps).

AFD funds the programme through a sovereign loan of € 52 million, a grant of € 2 million, and management of a grant delegated by the EU of € 8 million.

2.2.1 Inequalities in Uganda

Uganda generally observes fluctuations in the level of income inequality measured by the Gini coefficient, but over time the Gini index seems largely unchanged, as does the share of people below the poverty line. The long-term level of income inequality in the country stayed relatively stagnant, with a Gini coefficient for the consumption per capita of 0.36

calculated for the 1992/93 census and a World Bank calculation of 0.43 for the year 2019, with the coefficient rising slightly in the years 2002/03 and 2009/10 during its fluctuation (World Bank, 2022f, see also Fig. 3). hile Lwanga-Ntale (2014) finds a slight upward trend over time. However, the aggregation masks several important distinctions: Rural inequality overall is lower than urban inequality, with Lwanga-Ntale (2014) finding Gini coefficients of 0.35 and 0.41 for 2012/13 respectively. Additionally, he sees inequalities between income quintiles primarily driven by the highest (0.25) and lowest (0.14) quintiles, whereas middle-income show lower Gini coefficients (0.05-0.07). These inequality levels remained mostly unchanged between 2012/13 and 2019/20 but hide qualitative dimensions such as the shift out of a lower-income agricultural livelihood predominantly taking place among older men who have at least some levels of formal education and are from already more well-off households (World Bank, 2022f).

Figure 10. Gini index of consumption per capita for Uganda
Source: Authors' elaboration based on UNU-WIDER WIID (2022).
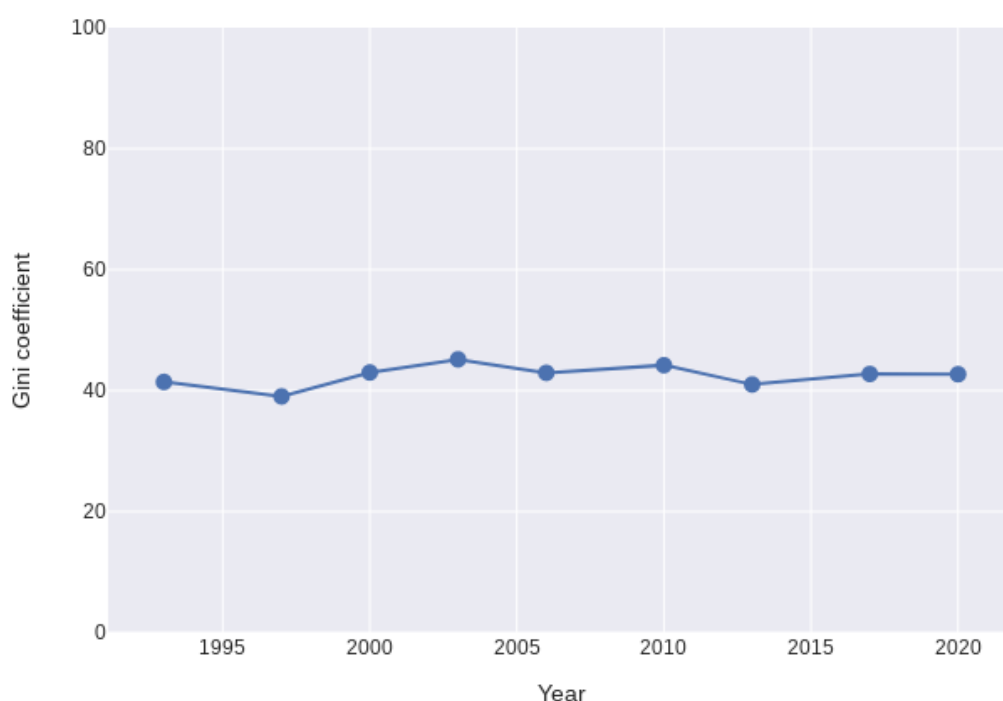
The World Bank (2022f) report goes on to examine the share of people below the poverty line in Uganda: around 30% of households are in a state of poverty in 2019/20, which once again fluctuated but roughly reflects the share of 30.7% households in poverty in 2012/13. Two surges in rural household poverty in 2012/2013 and 2016/17 can be linked to droughts in the country, with an improvement in 2019/20 conversely being linked to favourable weather conditions.

Cali (2014) finds that, already, one of the primary determinants of income disparity in more trade-exposed markets of Uganda in the 1990s were the increasing education differences leading to more disparate wage premiums. Additionally, slow structural change — further impeded by the onset of the COVID-19 pandemic, which pushed both urban and rural

residents back into poverty — leaves a low-productivity agricultural sector which becomes, in combination with a lack of education, the strongest predictor of poverty: the poverty rate in households with an uneducated household head (17% of all households) is 48% (2019/20), while already households with a household head possessing primary education (also 17% of all) nearly cuts this in half with 25% poverty rate (2019/20) (World Bank, 2022f).

The World Bank (2022e) calculated a Learning Poverty Indicator for Uganda which finds that 82% of children at late primary age are not proficient in reading, 81% of children do not achieve minimum proficiency level in reading at the end of primary schooling, and 4% of primary school-aged children are not enrolled in school at all.

2.2.2 Inequalities in access to drinking water

Such personal circumstances as access to a timely education play decisive role in life and human capital development — circumstances to which decent housing as well as access to clean water are equally fundamental building blocks (World Bank, 2022f). In 1990 a policy initiative to shift from a supply-driven to a demand-driven model for rural drinking water provision was enacted which, over time, improved rural safe water coverage slightly but also made operation and maintenance of improved water sources pose a challenge that could impede long-term access to safe water.

In the country, access to improved water sources rose from 44% in 1990 to 60% in 2004 and 66% in 2010 (Naiga et al., 2015). In 2019, access to improved sources of drinking water in the country is at a level of 87% in urban areas and 74% in rural areas, with relatively little inequality in rural regions between poor and non-poor households (World Bank, 2022f).

The same study found for the Isingiro district in Western Uganda on the other hand, in 2010, only 28% of households had access to improved water (Mulogo et al., 2018). Naiga et al. (2015) investigated the characteristics of improved water access in the Isingiro district, finding that whereas the national average distance to travel for a water source is 0.2km in urban and 0.8km in rural locations, in Isingiro it is 1.5km, and of the fewer existing improved water sources, only 53% were fully functional, with 24% being only partly functional (having only low or intermittent yield) and 18% not being functional at all. Additionally, they found blocked drainage channels in some of the sources which could in turn lead to a possible health risk due to contamination of the source.

Naiga (2018) argues that some reasons for the low access to working improved water sources is the absence of many of the organizational characteristics prescribed by the design principles of community-managed water infrastructure management — unclear social boundaries, missing collective-choice arrangements and a lack of sanctions or conflict resolution mechanisms — in other words, a policy failure resulting in lack of sufficient self-governance arrangements.

Such inequalities in water access often stand in direct relationship with other inequalities such as along gender, geographic or income dimensions, with fetching water traditionally

being a female care role, the cost of user fees to gain access to improved water being prohibitive to poorer households, while the remoteness of many households' location makes the trek to the source more time-consuming and replacement parts for repairs difficult to source in an adequate time (Naiga et al., 2015).

Access to water is also one of the primary reasons for both real and perceived food insecurity vulnerabilities, even more so during climate shocks. Both wealthier and poor farmers perceive themselves vulnerable to rainfall-based events such as droughts and extreme rainfall having more capacity to respond to rainfall variability and droughts (Cooper & Wheeler, 2016). In the Isingiro district, Twongyirwe et al. (2019) find that most farmers (68.6%) perceive food insecurity as a problem with the overwhelming majority seeing droughts as the major contributory issue to this food insecurity (95.6%).

Uganda houses around 1.3 million refugees in 13 refugee camps located in 11 districts across the country, including Nakivale refugee camp in the Isingiro district. In refugee camps, water continues to be a scarce resource: While concrete reports on refugee camps in the Isingiro district are scarce, the circumstances in neighbouring refugee camps have received more quantification, with only 67% of the Kyangwali refugee camp having access to improved water sources and only 46% access to sanitation service facilities (Calderón-Villarreal et al., 2022).
Such resource scarcity can also be a gendered problem, with predominantly girls and young women experiencing an increased amount of sexual and gender-based violence as access to resources (especially water, food and firewood) becomes scarcer (Logie et al., 2021).

Thus, while Uganda's poverty and inequality are not trending towards drastically worsening over the last years, hidden disparities bring its issues in focus once disaggregated. Inequality derives itself partly from this poverty, making it necessary for many to accept informal work which, taken at large, in turn fosters further national inequality.

The role education plays in Uganda's allocation of poverty cannot be overstated, with especially many rural children not having adequate opportunity to access timely education. This disparity could be exacerbated by poor quality access to clean water through improved water sources, which in turn worsens food securities, retrenches gender role inequalities, and precludes more children from their education. In the district of Isingiro in West Uganda access to water is considerably below the national average, with policy failures during implementation now leading to partly or non-functional water sources. The problem runs danger of deteriorating with an increased amount of climate shocks such as droughts threatening to exacerbate existing inequalities and drive further households into poverty.

2.1.8   Inequality Marker Analysis

Analysis of trends and drivers of inequalities in the policy area of the intervention

A very generic analysis is present, with contextual information about the limited water supply in the rural districts of the country, which are inhabited mostly by the poorest groups within the population of the country. The lack of access to water undermines the health and living conditions of populations, increasing socioeconomic inequalities. The analysis includes descriptive statistics about water supply across the country and considerations about performance of service providers, along with constrains towards expansion of the supply, mainly referring to infrastructure and maintenance costs.

Objectives and activities of the intervention designed to directly benefit the poorest

The general and specific objectives of the project is to ameliorate health and economic conditions of the inhabitants of the rural district of Isingiro, at the border with Tanzania to the Southwest of the country, including refugees living in two camps (Nakivale and Orushinga), by increasing access to water "*at a reasonable cost*" (at present only 37% of inhabitants of the district have access, among the lowest rates in the country). The Isingiro district, is mainly populated by poorest or most disadvantaged (including refugees).

"*The project will enable approximately 350,000 inhabitants, to benefit at a reasonable price from accessing clean water for their domestic uses. This will reduce the expenditures for households for purchasing water and also health-related expenditure, and it will contribute to the economic development of the district of Isingiro*".

1. *Increase in the rate of access to clean water for Ugandan populations in the district;*
2. *Improvement of the conditions of access to water for refugee populations in the district;*
3. *Improved sanitation;*
4. *Strengthening the sustainability of local water resources management;*
5. *Capacity building of local stakeholders.*

Activities planned are conventional and relate to the laying of distribution pipes from the main supply, and the construction of associated small structures (pumping stations, reservoirs, standpipes) in villages across the Isingiro district, including refugees' camps. Accompanying measures are also considered, related to the development of sanitation services, along with the management of water resources, the capacity building of local stakeholders, with the overall objective of ensuring affordability of access to water.

Measurable and relevant indicators to assess the targeting of the poorest

The monitoring of the progresses of the project is carried out using indicators related to the expansion of water supply and access (reaching out around 350 000 inhabitants of the districts both Uganda nationals and refugees). Although there is not a specific indicator related to access to the poorest and most socioeconomically disadvantaged groups (including refugees), effects on these beneficiaries will be indirectly measured through increase of 'affordable' water supply and access.

A clear plan to evaluate results, including inequality reduction targets

There is an evaluation plan which indirectly assess progresses in reducing inequalities by increasing access to affordable water supply. A specific study will be conducted about the 'willingness to pay' ("*consentement à payer*") of households in the Isingiro district and in refugees camps, in order to plan and evaluate specific measure aiming ensuring affordability of services.

Based on the desk review outlined above, we assigned an inequality market I-1, denoting that inequality reduction is a significant objective of the project

2.2.5 Distributional Impact Assessment

Data and Sampling Strategy

We collected a household survey in the Isingiro district between September and October 2022. The sampling frame followed a multi-step sampling approach to obtain a representative sample of 2301 households from 14 sub-counties, three town councils and two refugee settlements. Table 3 shows the distribution of the overall sample by subnational level.

Table 2. Distribution of the survey sample size

Name	Sub-county	Households 2020 (projection)	Population share	Share of population with access to drinking water	Sample size per Sub-County/Town Council
Birere	Sub-County	5,200	0.04	0.74	103
Endiinzi	Sub-County	4,100	0.04	0.36	81
Isingiro	Town Council	6,860	0.06	0.22	135
Kaberebere	Town Council	1,640	0.01	0.69	32
Kabingo	Sub-County	5,360	0.05	0.70	106
Kabuyanda	Sub-County	5,200	0.04	0.69	103
Kabuyanda	Town Council	4,000	0.03	0.57	79
Kashumba	Sub-County	4,000	0.03	0.30	79
Kikagate	Sub-County	12,400	0.11	0.33	245
Masha	Sub-County	6,400	0.06	0.24	126
Mbaare	Sub-County	8,220	0.07	0.28	162
Nakivale Refugee Camp	Refugee Camp	13680	0.12	0.37	270
Ngarama	Sub-County	8,220	0.07	0.35	162
Nyakitunda	Sub-County	10,200	0.09	0.44	201
Nyamuyanja	Sub-County	3,860	0.03	0.66	76
Oruchinga Refugee Camp	Refugee Camp	800	0.01	0.37	32
Ruborogota	Sub-County	4,300	0.04	0.56	85
Rugaaga	Sub-County	8,100	0.07	0.46	160
Rushasha	Sub-County	3,200	0.03	0.13	63
TOTAL		**115,740**		**0.37**	**2301**

Sampling Procedure

The refugee settlements were sub-divided based on geographical location (East, West, South, and North) and from each sub-division, two villages/zones were randomly selected. In each of the selected zones, an equal number of households was randomly selected to participate in the survey using a systematic sampling approach. Furthermore, in each of the host community sub-county/Town council, two villages were randomly selected with the help of the Sub-County/town Council Leaders. An equal number of households was randomly selected from the two villages to participate in the survey. At the village level, the household population was estimated using official records provided by local leaders or their committee member(s). Using estimated sample (denominator) and village household (numerator) an appropriate sample interval (kth) was determined and used to select the households for eventual participation in the survey. In Appendix 2, we provide a description of the sampled areas and populations.

In Appendix 3, we also present a statistical profile of the sampled population in terms of household characteristics and access to services. Before we move onto the discussion of the distributional impact assessment, it is important to underscore the existing inequalities in access to drinking water across subcounties, refugee settlements and Town Councils. While nearly all households in the Oruchinga refugee settlement reported having easy access to drinking water, followed by Nyamuyanja (88.9%), Masha (86%), Kaberebere Town Council (84.8%), Birere and Ruborogota at nearly 80% each, households in communities such as the Nakivaale refugee settlement and Rushasha reported having very limited access to drinking water, in the order of 14% and 7.8%, respectively (see Figure 14).

Figure 11. Household access to safe drinking water by subcounties, refugee settlements, and Town Councils
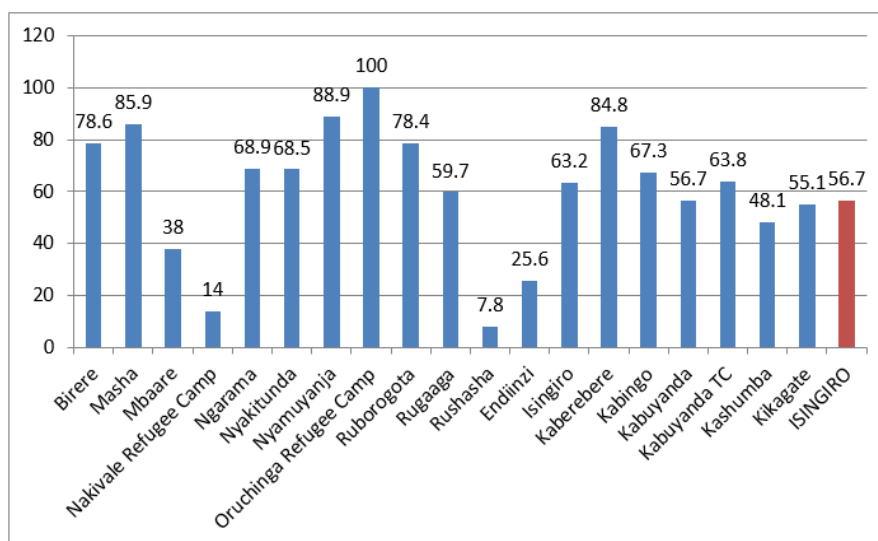
Regarding the main source of drinking water, 38.7% of the households obtained their drinking water from stand taps, followed by water reservoirs (23.7%), hand-pump systems (17.1%), tap water in dwelling units (8.8%) and other water sources (11.7%). Just 41.2% of all the urban dwellers reported using stand taps compared to 34.8% in rural communities. This means that nearly a third of the households collected water from unsafe water sources including reservoirs and valley dams (23.7%) and permanent surface water streams and rivers (7.8%) (see Table 6).

Table 3. Main sources of water by key categories
Source: The authors

	Indicator	Tap water in dwelling (%)	Hand-pump (%)	Reservoir (%)	Stand tap (%)	Other (%)
All	Isingiro (N=1327)	8.8	17.1	23.7	38.7	11.68
Rural/ Urban	Rural (N=965)	4.7	18.6	28..0	34.8	13.99
	Urban (town council (N=260)	27.3	10.0	13.9	41.2	7.69
	Refugee community (N=102)	0.98	21.6	7.8	69.6	0.0
Sex of HH head	Male (N=988)	8.2	17.4	23.5	38.2	12.75
	Female (N=339)	10.6	16.2	24.2	40.4	8.55
Age of HH head	18 and below (N=3)	0.0	33.3	0.0	66.7	0.0
	19-24 years(N=71)	4.2	21.1	21.1	43.7	9.86
	25-34 years(N=281)	10.0	18.5	18.9	40.6	12.1
	35-44 years(N=338)	8.0	20.7	21.6	37.6	12.13
	45-54 years(N=312)	7.1	15.7	27.6	38.5	11.22
	55 years and above (N=322)	11.5	12.4	27.0	37.3	11.8
Number of children per household	0 (N=122)	11.5	13.1	18.9	44.3	12.3
	1-4 children (N=868)	8.6	17.2	24.1	38.5	11.64
	5-9 children (N=326)	8.3	18.1	24.5	37.7	11.35
	10-14 children (N=5)	0.0	40.0	20.0	20.0	20.0
	15 and above children (N=6)	16.7	16.7	16.7	33.3	16.67

Among those households that reported not having access to drinking water (43% of the sampled population), 45.8% mentioned that not having water sources in their communities as the main reason, followed by 25.8% of households that refer to high prices of water, while 16.3% stated that the water supply points were very far, congested, and unreliable. In rural communities, 59% of households stated that sources of safe drinking water did not exist in their communities, while 17%, 20% and 11.6% reported, respectively, that water was expensive, distant, and congested and unreliable (see Table 7).

Table 4 Reasons for Reporting Lack of Access to drinking Water
Source: The authors

	Indicator	No water in the village (%)	Water is expensive (%)	Not allowed to use water in the village (%)	Others (%)
All	ISINGIRO (N=1014)	45.8	25.8	0.6	28.3
Rural/ urban	Rural village (N=634)	59.0	20.4	0.6	19.94

	Urban Village (N=143)	40.6	22.4	0.0	39.19
	Refugee community (N=234)	13.3	42.3	0.9	44.02
Sex of HH head	1. Male (N=988)	50.3	22.6	0.5	27.01
	2. Female (N=339)	33.9	33.9	0.7	31.67
Age of HH head	18 and below (N=5)	60.0	20.0	0.0	20.0
	19-24 years(N=71)	54.0	26.0	0.0	20.0
	25-34 years(N=281)	36.5	28.5	1.9	33.33
	35-44 years(N=338)	42.2	28.5	0.0	30.19
	45-54 years(N=312)	48.9	24.9	0.4	26.09
	55 years and above(N=322)	56.8	19.6	0.0	24.0
Number of children per household	0 (N=93)	39.8	30.1	1.1	29.03
	1-4 children (N=658)	46.8	24.8	0.8	27.88
	5-9 children (N=248)	45.6	26.2	0.0	29.48
	10-14 children (N=8)	37.5	37.5	0.0	25.0
	15 and above children (N=2)	50.0	50.0	0.0	0.0

While the descriptive analysis provides relevant information about the profile of targeted beneficiaries and key underlying causes of lack of access to safe drinking water, we do not know how well targeted the water project would be in terms of reaching the poorest 40%, which is critical to understand whether the intervention would be contributing to addressing inequalities. In the next section we present the results from the distributional impact analysis.

Results of the ex-ante Distributional Impact Assessment

We begin the discussion by discussing the results based on the unweighted distribution of respondents and then the weighted distribution by population density. Results based on the unweighted distribution capture the quintile profile of respondents from the sampled sub-counties and refugee settlements. The underlying assumption from these estimates is that the AFD water supply development project would be benefiting in equal proportions the targeted populations. The analysis based on the unweighted distribution is informative if we assume that regardless of how many people live in the sampled sub-counties, the development project would also benefit those who live in the proximities of the treated localities.

Alternatively, we can also assume that since the project aims to finance infrastructure development to improve accessibility to drinking water at sub-county level, the number of actual beneficiaries would be greater in more densely populated subcounties, which is captured by the population density of targeted localities measured by the number of inhabitants per squared kilometre. The rationale behind this assumption is that in more densely populated areas, development projects are more likely to achieve economies of scale and spillover effects. Thus, estimates under this assumption provide a better

understanding of the wealth profile across subcounties depending on the level of population density.

Results in rural areas

Since the AFD's water supply project focuses on Uganda's Isingiro district and the refugee settlements that are located, although not exclusively, in rural subcounties, we focus the analysis on rural areas as our benchmark. We look at the wealth profile of targeted beneficiaries in the targeted subcounties relative to the rural wealth distribution in Uganda. It is important to point out that rural subcounties in Uganda, as in most countries, tend to be poorer than urban areas (Quang Dao 2004; Heyer 1996; Mwabu and Thorbecke 2004). This merits the question of whether the quintile profile of targeted subcounties lies on the lower part of the national rural wealth distribution.

As Figure 15 shows, just above 27% of households living in targeted rural subcounties belonged to the bottom 40% of the wealth distribution, and Just 2% came from the poorest (bottom 20%) quintile, while 37% of the targeted populations belong to the richest households, those at the top 20% of the wealth distribution. This indicates that if the project is implemented in the targeted subcounties and refugee camps, it is likely to benefit the wealthiest populations in rural areas. When we weight the rural sample by population density, we observe that the project would marginally increase its reach among the richest 20% rural households, probably at the cost of reducing household coverage at the bottom 40%, in particular among those in the second quintile of the wealth distribution (see Figure 16).

Figure 12. Quintile distribution of targeted beneficiaries in rural areas
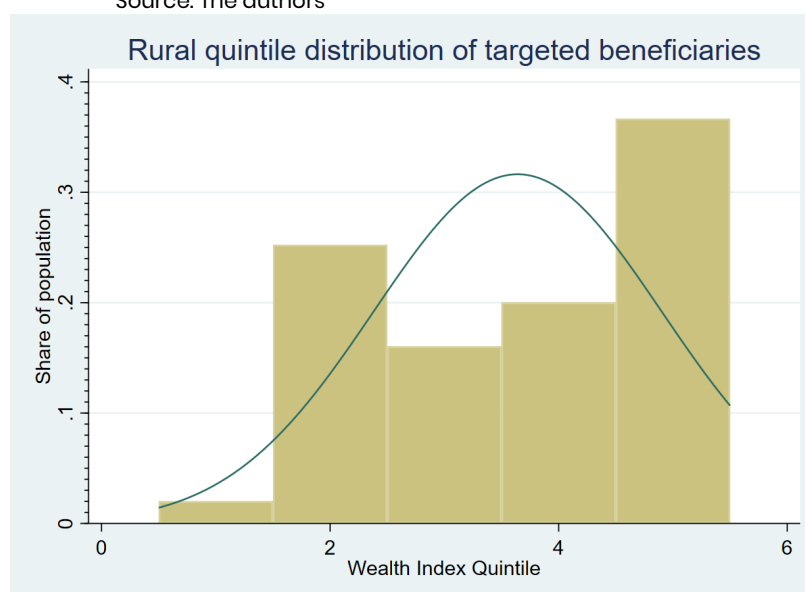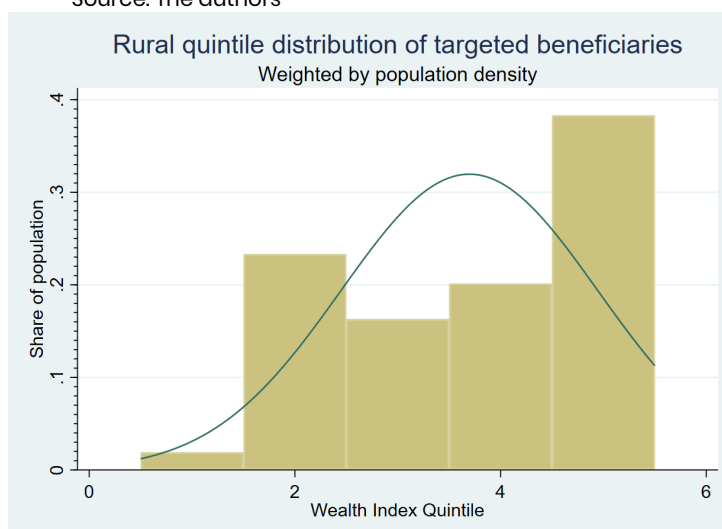Source: The authors

Figure 13. Quintile distribution of targeted beneficiaries in rural areas. Distribution weighted by population density

Source: The authors

Since the project targets rural subcounties within the Insigiro district, we expect a degree of variation in project coverage along the wealth distribution. Indeed, as shown in Figure 17, while the project is largely skewed towards the upper tail of the wealth distribution in most subcounties, including Birere, Endinzi, Kabingo, Masha, and Nyamuyanja, only in three rural subcounties (Nyakitunda, Ngarama and the Oruchinga Refugee Camp), the poorest 40% households, notably those at the second quintile of the wealth distribution, would proportionally benefit more than the richer 60% households.

Figure 14. Quantile distribution of targeted beneficiaries across rural subcounties

Source: The authors
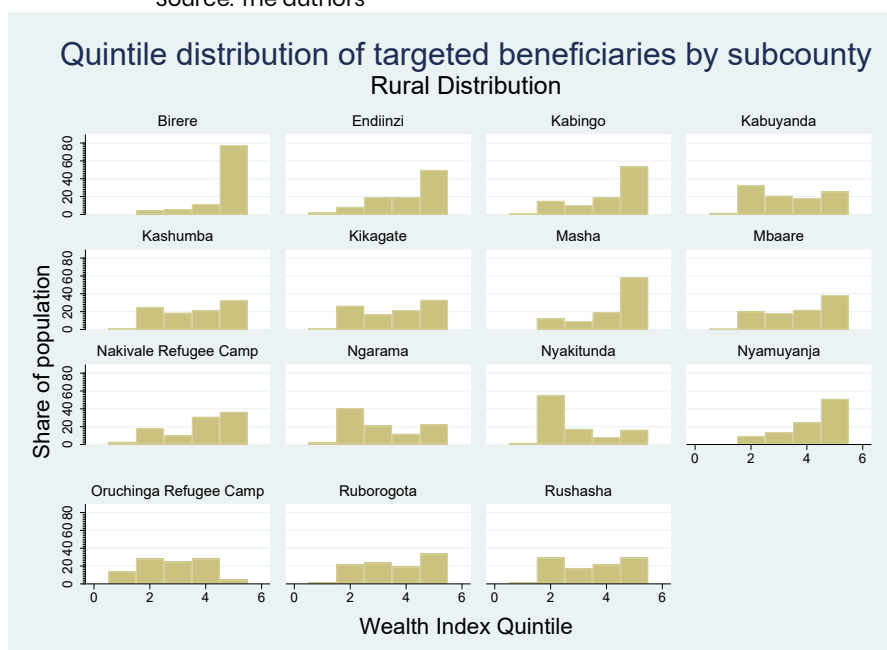
The limited pro-poor targeting by the project is also evident when we conduct the distributional analysis by age intervals and sex of household head. As shown in Figure 18 just about 30% of beneficiaries aged 18-24 where at the bottom 40%, and that share slightly declined to 27% among those aged 25-56 and 65 and older, whereas more than 50% of beneficiaries across all age intervals belong to the richest 40%, pushing the shape of the normal distribution line to the right. A similar pattern is observed when we divide the rural sample by sex of the household head in Figure 19, although the poorest 40% female headed households are slightly better targeted (approximately 30%) than male headed households (26%).

Figure 15. Quantile distribution of targeted beneficiaries by age intervals
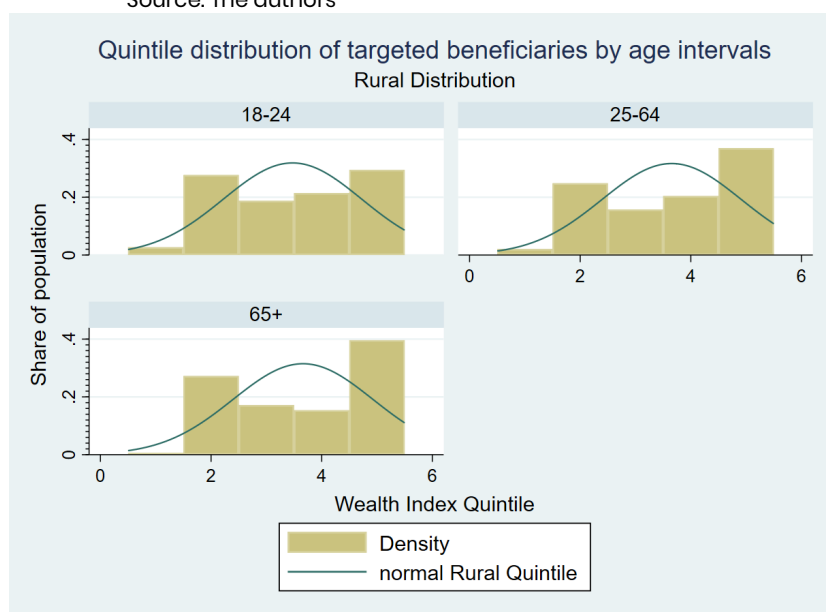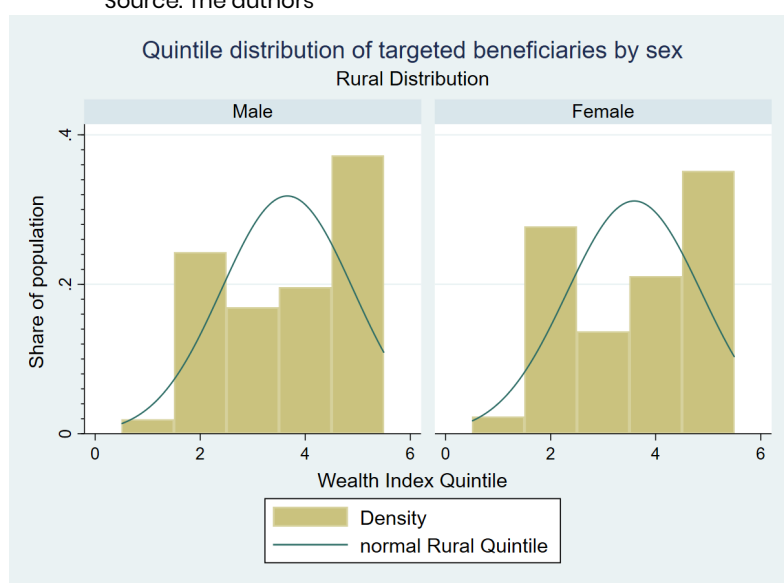Source: The authors

**Figure 16. Quantile distribution of targeted beneficiaries by sex**
Source: The authors

Important differences are also observed in terms of how effectively the project targets the poorest 40% when we take into consideration religious affiliations. For instance, while about 90% of the population in the targeted subcounties are Christians and just about 9% are Muslims, only 28% and 18% of targeted Christian and Muslim households are at the bottom 40% of the wealth distribution, respectively. This is stark contrast to the 55% and 71% of the richest 40% Christian and Muslim households, respectively, that would directly benefit from the development project (see Figure 20).

Figure 17. Quantile distribution of targeted beneficiaries in rural areas by religion
Source: The authors
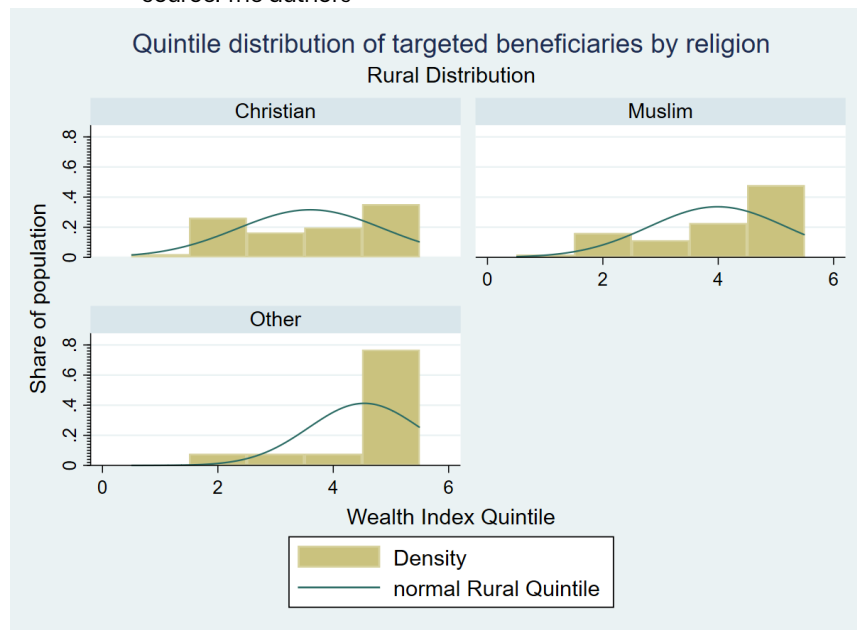
Results in urban areas

While just about 17.6% of the targeted population live in urban Town Councils, the analysis shows that the project was better targeted, although not significantly, in urban areas. Indeed, as seen in Figure 21, approximately 46% of beneficiaries belong to the bottom 40% of the wealth distribution, with about 24.5% belonging to the poorest 20%. Since we expect that the project in more densely populated areas would achieve economies of scale and spillover effects that would increase the beneficiary count, we estimate the quantile distribution of targeted beneficiaries weighted by population density. We find that the project would indeed achieve a higher project coverage (47.8%) at the bottom 40% (see Figure 22), which reflects the observed shift to the left of the normal distribution, and enhancing the inequality-reducing contribution of the project in urban areas.

Figure 18. Urban quantile distribution of targeted beneficiaries
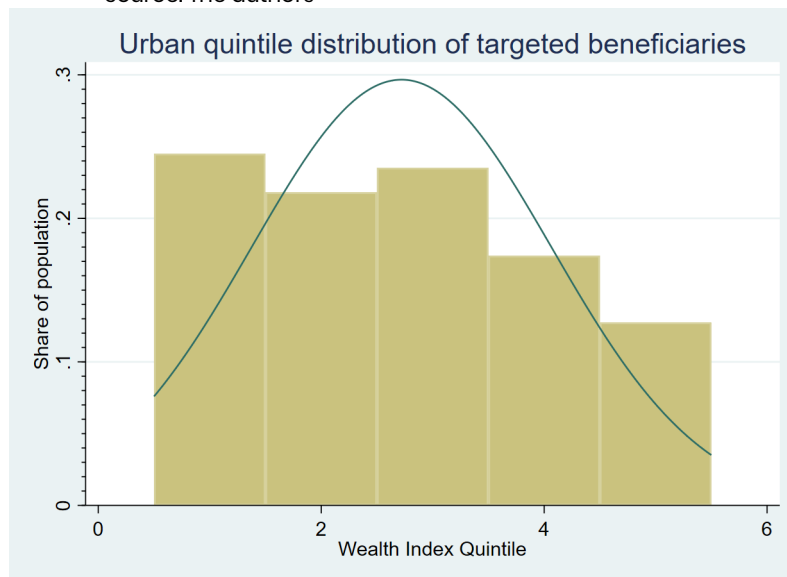Source: The authors

Figure 19. Urban quantile distribution of targeted beneficiaries. Weighted distribution by population density
Source: The authors
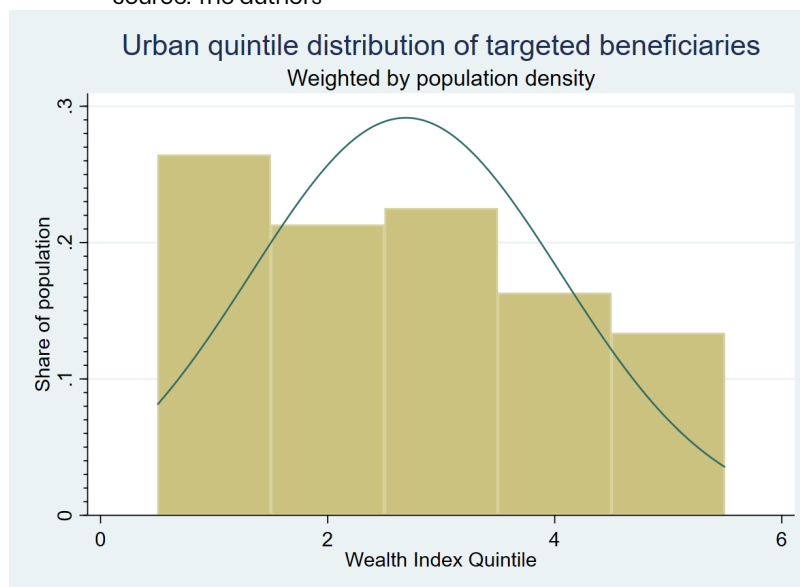
Nevertheless, there are marked differences in how the project would reach the poorest 40% households across urban areas. For instance, in Isingiro and Kabuyanda, 55% and 52% of targeted households belong to the bottom 40%, respectively, with nearly 34% and 39% belonging to the poorest 20%. In contrast, in Kaberebere just about 30% of the targeted households were at the bottom 40% of the wealth distribution while in Rugaaga, that share was just under the 40% threshold (see Figure 23).

Figure 20. Urban quantile distribution of targeted beneficiaries by Town Councils
Source: The authors
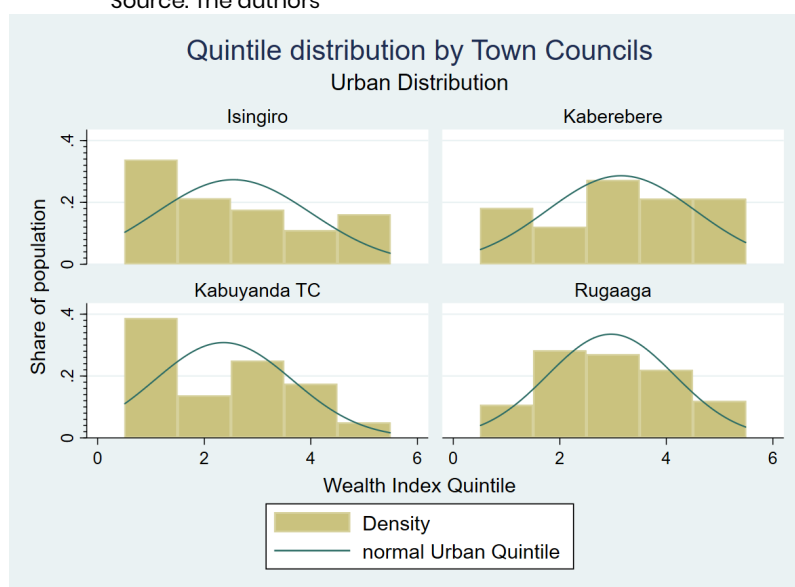
Interestingly, in urban areas, the water project would reach a larger share of female-headed households at the bottom 40% (approximately 55%) relative to male-headed households (about 43%), which is a positive outcome of the project, despite the fact that just about 26.5% of beneficiary households are headed by women (see Figure 24). In Uganda, as in other countries in the sub-Saharan region, women are responsible for the provision of water for domestic use. Thus, improving access to safe drinking water, in both urban and rural areas, can have important implications for female time allocation and consequently productive and social activities (Graham, Hirai, and Kim 2016; Ndikumana and Pickbourn 2017; Naiga, Penker, and Hogl 2017).

Figure 21. Urban quantile distribution of targeted beneficiaries by sex
Source: The authors
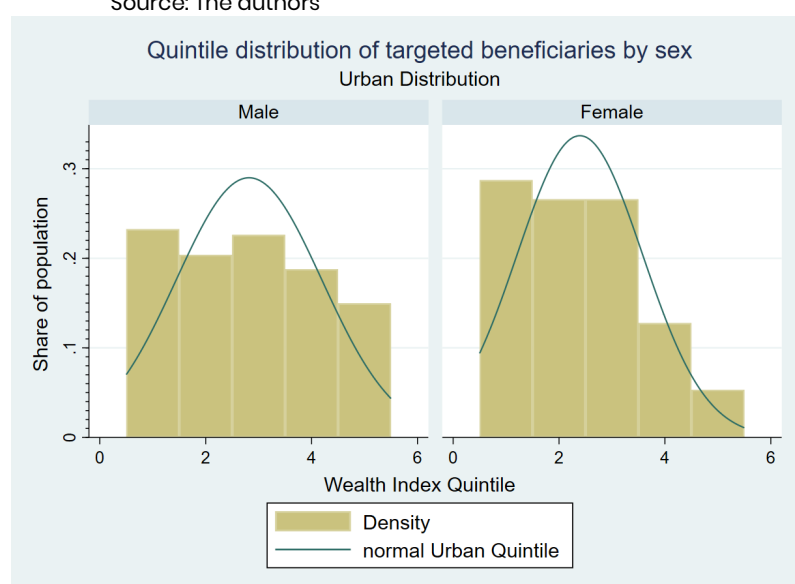
In terms of age, results also indicate that the project proportionally benefit more older poor households (approximately 55% of those with household heads aged 65 years or older) and younger poor households (about 50% of households with heads aged 18-24 years) than households with households heads in the 25-64 age interval (see Figure 25), although this findings should be taken with caution given the relative small sample from urban areas.

Figure 22. Urban quantile distribution of targeted beneficiaries by age intervals
Source: The authors
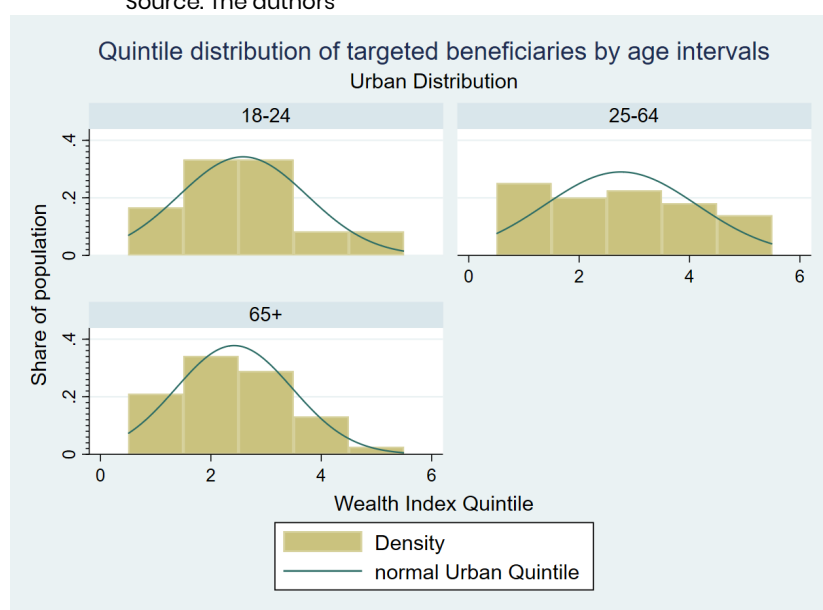
The distributional analysis by main religions show that in targeted localities, Christians are the majority religious group, accounting for 89% of the urban population, with Muslims representing just about 10% of the population. In these localities, the project seems to be better pro-poor targeted among Christians, as 52% of beneficiaries belong to the poorest 40% of the wealth distribution while just 28% are among the richest 40%. In contrast, only 22% of beneficiary Muslims are among the poorest 40% while 39% are among the richest 40% (see Figure 26). This seems to reflect a spatial clustering process within the targeted localities, possibly emerging from social stratification in which poorer (or richer) households with similar religious affiliations live in the same neighbourhoods. This could both facilitate or hinder (depending on how the project is implemented) the effective distribution of water infrastructure in urban areas, and the potential spillover effects of the project among the bottom 40% and its inequality-reducing impact.

Figure 23. Urban quantile distribution of targeted beneficiaries by religion
Source: The authors
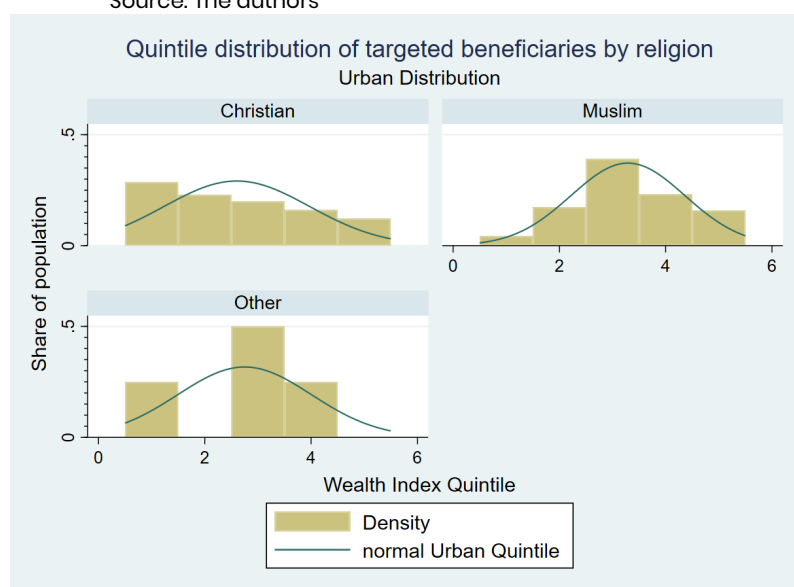
Discussion

In Uganda, the level of inequality and the share of people below the poverty line, have been significant and largely unchanged over time. Among the main determinants of inequalities, access to drinking water play a major role. Access to improved water sources has increased from 44% in 1990 to 87% in urban areas and 74% in rural areas in 2019. Yet, In the Western part of Uganda, and particularly the Isingiro district, less than one-third of households have access to improved water, mainly due to long distance between villages and available water sources, limited number of access points and generally low quality of water systems. These conditions make access to improved water particularly difficult for low-income households. The project aims precisely at expanding water supplies in the Isingiro district, including refugee camps, as a way to improve living conditions and reduce inequalities.

The project has been marked as I-1 with the Inequality Marker. Therefore, inequality reduction is a significant but not principal objective. There is a generic analysis about the limited access to water in rural districts, predominately inhabited by the poorest. The lack of water supply undermine health and living conditions of the rural populations. General and specific objectives focus on inequality reduction, by the mean of expanding the water supply in the rural district of Isingiro, in order to provide access to affordable water services to socioeconomically disadvantaged groups (including refuges living in two camps). Monitoring's indicators are set with reference to these objectives, and the evaluation plan include a specific analysis of affordability of water supplies. However, the lack of a detailed investigation about the actual status of water supply in the Isingiro district, along with main causes for inability, by the poorest, to access to water, might undermine the potential

inequality reduction effects of the intervention. In this respect, the ex-ante analysis, carried out as part of the current study provides relevant information for the project's implementation phase.

In particular, the distributional analysis has revealed the significant inequalities in access to safe drinking water across subcounties, refugee settlements and Town Councils in the Isingiro district. Such Inequalities are also observed across the wealth distribution of targeted localities, which often stand in direct association with other factors such as household assets, community and household characteristics, gender, and geography.

Female-headed households are in clear disadvantage in terms of water accessibility for domestic use, and this constrain is amplified by the fact that most available water sources, including valley dams and reservoirs, surface water streams and rivers, and stand taps and hand-pump systems require water fetching, which is an activity primarily conducted by women and children throughout the sub-Saharan African region (Graham, Hirai, and Kim 2016; Agesa and Agesa 2019). The distance to water sources makes water fetching very time-consuming (Naiga et al., 2015), and a health risk (Hyder et al. 2005; Pickering and Davis 2012; Porter et al. 2013). Thus, improving access to safe water sources can have important implications for female time allocation, health status, and consequently productive and social activities.

Furthermore, existing water sources differ substantially in terms of quality, reliability, and safety. Currently, nearly one-fourth of households collected water from unsafe water sources. The fact that AFD project focuses on improving water infrastructure through the distribution of pipes from the main supply, and the construction of pumping stations, reservoirs, and standpipes is a positive objective in itself, and the distributional impact analysis has provided relevant information to strengthen the potential positive social and inequality reducing effects of the project.

The project protocol includes indicators related to the expansion of water supply and access to monitor progress of the project. It would be desirable to include a specific set of indicators related to access to the poorest and most socioeconomically disadvantaged groups to better capture the impact of the project.

The issue of water affordability is key, as approximately one-fourth of interviewed households refers to water prices as prohibitive and the main constraint to access water resources. While there is an evaluation plan expected to assess the 'willingness to pay' ("*consentement à payer*") for water in the Isingiro district and refugees camps, it will be

critical to experiment with alternative approaches for water supply, including subsidized water schemes for the poorest households, and distinct water rates for both domestic use and productive (industrial, agricultural and livestock) purposes.

Furthermore, productive purposes of water use, together with sanitation and water management systems are of central importance, as the Isingiro district is a water-stressed region that has suffered from drought and food insecurity in recent years. Indeed, in 2016, the Isingiro district suffered one of the worst droughts in decades, with small holder farmers and cattle keepers specially affected by the draught.[1] Episodic weather shocks have also had an impact on food insecurity.

Since the demand for water experience limited variation during emergency situations, and households' capacity to pay for water is limited, the administration of water resources, as a public good may need to consider innovative approaches for financial sustainability, as the reliance of water fees as the primary source of revenue may reproduce existing inequalities in water access and exacerbate food insecurity and poverty in emergency situations caused by climate shocks (Sempewo, Mushomi, et al. 2021; Sempewo, Kisaakye, et al. 2021).

The distributional impact analysis provides relevant information about the wealth distribution of households in the targeted localities, and facilitate the identification of the poorest 40% households and relevant community and household characteristics that drive water access inequality in these localities. This information can be used by project implementers to design solutions that can facilitate access to affordable and safe water sources among the poorest and most vulnerable populations.

2.3. Djibouti-Ethiopia Support to the Djibouti-Ethiopia commercial corridor.

The objective of the project is to facilitate trade between Ethiopia and Djibouti (components 1 and 2) and to enable businesses and producers, as well as the most vulnerable populations, to benefit from these improvements (components 3 and 4). Component 1 focuses on logistics associated with trade along the Djibouti-Ethiopia corridor. It aims to reduce the transit times of goods at the port, the Galafi border post and the dry ports of Ethiopia. It will promote the simplification and rationalization of operational procedures, the widespread use of digital technology and the coordination and interoperability of information and management systems between the two countries and at the various

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[1] For journalistic accounts of the 201 draught, see https://infonile.org/en/2022/05/after-covid-and-water-scarcity-ugandas-isingiro-farmers-justifiably-dreaming-big/ and Cattle in Isingiro, Kiruhura starve to death - Uganda | ReliefWeb

transit nodes. Component 2 focuses on trade procedures associated with trade in goods. It aims to harmonize the standards and regulations governing trade between the two countries, making them consistent with the various trade agreements signed, with a view to their digitalization. This component will also target the actors in charge of inspection, accreditation, and certification to improve the capacity of companies to meet commercial obligations and / or private standards and to certify it. This should make it possible to increase the added value of exports through better certified quality of products.

Component 3 focuses on supporting businesses and producers in the logistics sector both in Ethiopia (support for private investment) and in Djibouti (increased training and professionalization) and in the export sectors (especially those that create the most jobs in national territories via spillover effects). Component 4 is dedicated to supporting the most vulnerable populations: small traders at the borders, women operating in exporting sectors. We focus on the fourth components as it targets vulnerable groups, notably women in Djibouti (where women unemployment reaches 50% rates), focusing on building their capacities to take advantage of the new opportunities arising from the project, through:

- studies and research to identify the main problems and capacity constraints facing women's associations.
- capacity building of women's associations for more effective advocacy and better access to finance, information and markets.
- improving the skills of microenterprises and SMEs owned by women, in particular in sectors with trade and export potential.
- improvement of the linguistic and literacy (including digital) capacity of women entrepreneurs.
- support for the participation of women's associations in fairs.
- And support for small traders at the border and the losers of facilitation reforms.

This project has an overall cost of € 32 million, with funds from the European Union to AFD.

2.3.1 Djibouti: inequality in the country

Although the programme I is undertaken in both Djibouti and Ethiopia, we focus the analysis on Djibouti, because specific actions to reduce inequalities have been planned in this country. Djibouti's GDP has averaged roughly 6% per year before the Covid-19 pandemic greatly reduced those growth rates (World Bank, 2022d). However, the country's inequality levels are high (Gini coefficient 41.6), and its poverty rates are extreme (21.1%, World Bank, 2022d). Additionally in many cases there is a lack of data or the data itself is lacking in several socio-economic dimensions, which hinders analysis and policy design.

Inequality in Djibouti is high, with the lowest decile only making up 1.9% of total consumption while the richest decile enjoys 32% of the total consumption, 16 times as much as those at the lowest decile (World Bank, 2019). The country has an estimated Gini coefficient for consumption per capita of 41.6 in 2017, making it one of the most unequal countries in the region (World Bank, 2022d, see also Figure 3). More of its inequality hides in a large spatial and gendered heterogeneity. Urban poor face high deprivation but higher access to public services and schooling compared to the rural poor, who have only 41% access to improved water sources, 10% access to sanitation, 3% access to electricity, and with only one third living close (under 1km) to a primary school (World Bank, 2020b).

Figure 24. Gini index of consumption per capita for Djibouti
Source: Author's elaboration based on UNU-WIDER WIID (2022).
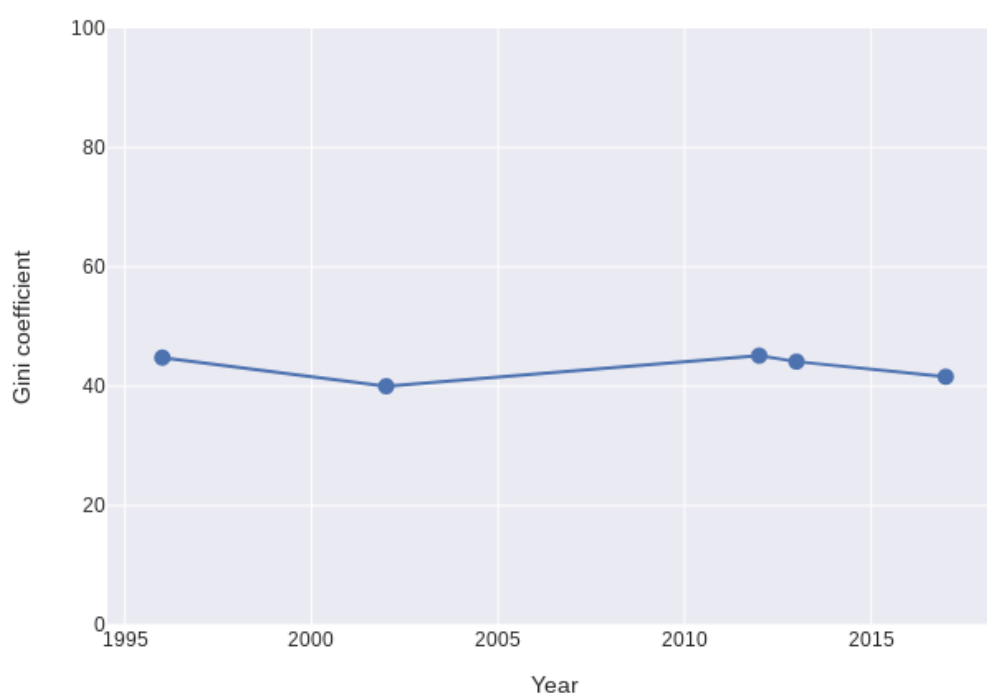
In addition, women have a lower participation rate on the labour market with an especially stark gender difference in the industrial sector — a sector of the economy in which women in Djibouti do not have the same rights to participate in as men, especially in jobs deemed dangerous (World Bank, 2022h) — with service being the sector that makes up the greatest share of female labour participation (71.1% of all female labour compared to 56.0% of all male labour 2019), a sector which is also driving the high share of women in vulnerable employment (41.4% of female labour in 2019) (World Bank, 2022g).

Djibouti's economy is primarily, and within its formal sector almost exclusively, driven by its strategic location and possession of a deep-water port so it can act as a regional refuelling, trading, and transport shipment centre (World Bank, 2022d). At the same time, this

interconnected economic nature and the country's heavy reliance on food and energy imports marks a key vulnerability and makes it immediately dependent on the stability of global trade and export markets, a stability which was recently disrupted through the global Covid-19 pandemic (World Bank, 2022d). Likewise, Djibouti depends on regional stability, since its economic growth is tightly coupled with the Ethiopian economy, sourcing around 70% of its port trade from this landlocked neighbour (World Bank, 2019). A series of droughts in the country threatened the livelihood of its nomadic and pastoralist population, with many fleeing to neighbouring countries, some becoming sedentary in village or city outskirts, and the overall nomadic population decreasing by nearly three quarters from 2009 to 2017 (World Bank, 2019, 2020b).

Overall, it seems, however, that past growth in the country's GDP is likely not favourable for an inclusive growth path, with its large-scale infrastructure investments mostly creating demand for skilled workers and neglect of social spending not allowing the buffers and social safety nets that prevent further drift into inequality.

2.3.2 Inequality Marker Analysis

Analysis of trends and drivers of inequalities in the policy area of the intervention

The project is a multi-country intervention, aiming at facilitating trade between Ethiopia and Djibouti and create conditions, for populations, in particular producers, business owners, to benefit from increase in trade activities. An accurate analysis is present, with detailed information about current limitations in trade, with specific reference to regulations and infrastructures, and overall capacities of economic actors. In addition, generic information is provided about the negative effects of trade limitations to most vulnerable groups, with specific reference to economically vulnerable women's traders at the border of the two countries. The document also mentions that a detailed investigation about effects and causes of underdeveloped women's business activities at the border, along with needs in capacity building to take advantage of enhanced trade between Ethiopia and Djibouti, will be undertaken during the initial phase of the project.

Objectives and activities of the intervention designed to directly benefit the poorest

The general objective of the project does not directly focus on reducing inequalities, but on facilitating trade between Ethiopia and Djibouti. Nevertheless, indirect effects of enhanced trading are expected to be an overall reduction of inequalities within countries. In addition, one specific objective does explicitly aim at inequality reduction, by the mean of lifting up trade capacities and, through that, income and living conditions, of Djiboutian women's traders at the border or in areas of transit of main trade routes (e.g., the PK12 district in

Djibouti city area), who are particularly disadvantaged in socioeconomic terms (women unemployment reaches 50% rates in Djibouti).

Measurable and relevant indicators to assess the targeting of the poorest

Indicators to measure progresses of the project, include the Gini coefficient to assess results against the overall objective. While the achievement of the specific objective related to the 4th component of the project will be monitored using indicators measuring, not only the number of disadvantaged women's traders benefiting from capacity building programs, but also the increase in their income, due to the enhanced trade opportunities and capabilities.

A clear plan to evaluate results, including inequality reduction targets

An evaluation plan (mid-term and at endline) is outlined to assess inequality reduction within the country and among vulnerable women benefiting from the intervention .

2.3.3 Discussion

The Djibouti-Ethiopia commercial corridor aims at contributing to enhance growth and economic opportunities in Djibouti, by the mean of expanding trade with Ethiopia as well as empowering most disadvantaged groups, in particularly women. The project is marked, undoubtedly, as I-1 according to the Inequality Marker. Thus, inequality reduction is a significant objective. There is a generic analysis about the effects of trade on inequalities, with a focus on income and living conditions of small women traders at the border, who are severely disadvantaged in socioeconomic terms. A specific objective is therefore devoted to increasing their capacities to take advantage of trade opportunities generated by the project, and increase their income. An indicator monitoring the results, in terms of both reaching out of most vulnerable women, and effects (income generation) is adopted, with an evaluation plan. However, it is not specified in the project criteria that will be utilised during the implementation phase, to select the most disadvantaged women traders and business owners, who will benefit from capacity building activities.

Based on the desk review discussed above, we assign a mark I-1 which denotes that the inequality reduction is a significant objective of the project.

2.4 Climate adaptation project in the Provinces of Ninh Binh, Ha Tinh and the city of Can Tho in Vietnam

The AFD funded project aims to contribute to the adaptation of the communities to climate change, in particular to changes in the rainfall regime, and increases in the frequency and violence of extreme climatic events and to the rise in sea level. Specific objectives of the three components of the project (construction of a Kim Dai dam-lock in Ninh Binh province, rehabilitation of the irrigation-drainage system in Thach Ha district in Ha Tinh province, and the banks of the Can Tho river) are the following:

- Secure the economy of the province and in particular its agricultural economy
- Guarantee the safety of people and goods in the target area
- Improve the sanitary conditions of the populations of the target area
- Strengthen the management capacity of public bodies
- and for the Can Tho sub-project to improve the general landscape environment

Beneficiaries of the project include the Province of Ninh Binh, District of Kim Son (Construction of a dam) with a beneficiary population of approximately 830 000 people; the Province of Ha Tinh, District of Thach Ha, and city of Ha Tinh (Rehabilitation of irrigation system), with an approximately beneficiary population of 36 000 people; and City of Can Tho, agricultural district of Phong Dien and urban districts of Ninh Kieu and Cai Rang. This project has an overall cost of € 52.5 million, and 1 million for capacity building, with funds AFD.

2.4.1 Inequalities in Vietnam

Vietnam's economy is now firmly in the third decade of ongoing economic reform (*Doi Moi*) as a market-based economy, which lead to remarkable growth phases through opening the economy to international trade while, seen over the bulk of its population, attempting to keep inequality rates managed through policies of controlling credit and reducing subsidies to state-owned enterprises (Bui & Imai, 2019).

The country's overall estimated Gini coefficient for income fluctuates between 0.42 and 0.44 between 2010 and 2018, with the highest levels of income inequality observed in the Central Highlands in 2016, though absolute income may be rising, with the top quintile having 9.2 times the income of the lowest quintile in 2010 and 9.8 times in 2016 (Q. H. Le et al., 2021). On the other hand, the bottom 40% experienced a slight absolute rise in mean daily income per capita from 4 USD (2011 PPP) in 2014 to 5 USD (2011 PPP) in 2018 (World Bank, 2022i).

For Gini coefficients estimated using consumption per capita, see Figure 4, which shows similar trends of increasing inequality, with 2010 constituting a significant increase. Economic inequality and poverty in Vietnam thus underlie an intersectional focus, between ethnic minorities, regional disparities, rural-urban divides and gendered lines, one which

exogenous shocks can rapidly exacerbate as the example of the COVID-19 pandemic has recently shown (Ebrahim et al., 2021).

Figure 25. Gini index of consumption per capita for Vietnam
Source: Author's elaboration based on UNU-WIDER WIID (2022).
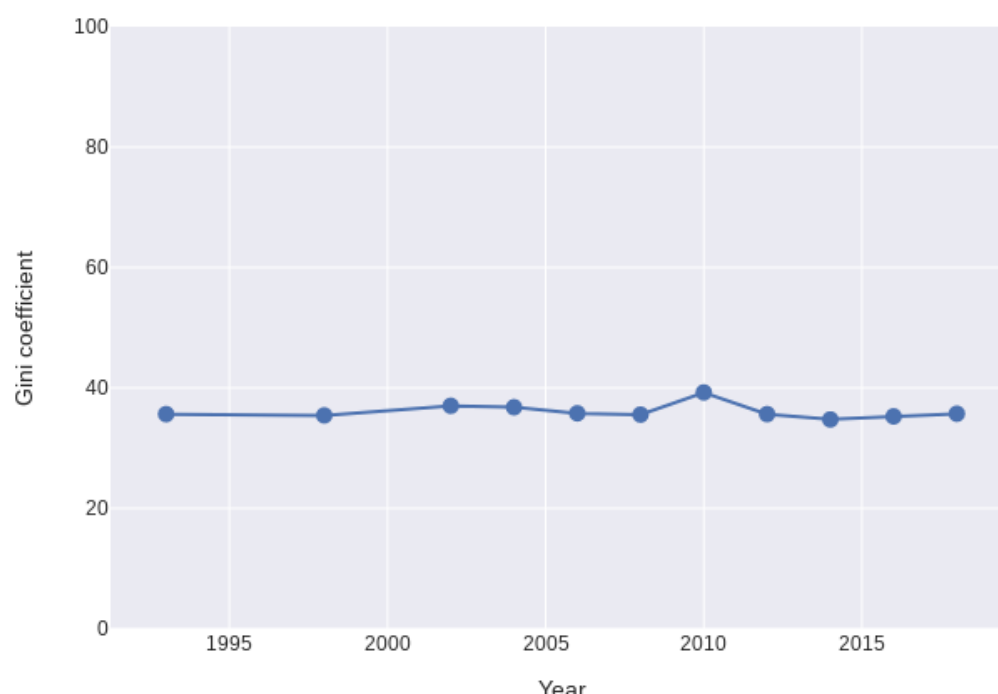
In the 1990s, as the initial stages of the Doi Moi reform bore fruit with economic growth, the first amplifications of inequalities along new rural-urban boundaries became visible.

The gap between urban and rural sectors grew, a gap which would continue to widen until 2002, when within-sector rural inequalities started to become more important for inequalities than those between the sectors (Fritzen et al., 2005; Thu Le & Booth, 2014). In the time of within-sector inequality becoming more pronounced many studies, while important contributions to continued inequality research, tended to mask those inequalities in favour of continued analysis of between-sector trends — often to the detriment of the high degree of heterogeneity depending on geographic characteristics such as remoteness or cultural factors, as Cao and Akita (2008) note.

2.4.2 Inequality-Marker Analysis

Analysis of trends and drivers of inequalities in the policy area of the intervention

The project aims at contributing to the adaptation of the communities to climate change, in particular to changes in the rainfall regime, and increases in the frequency and violence of extreme climatic events and to the rise in sea level. Contextual analysis of the project

refer to climate change events and effects on communities, but without including considerations about impact on socioeconomic inequalities.

Objectives and activities of the intervention designed to directly benefit the poorest

The overall objective is to reinforce adaptation of communities to climate change, in selected areas: the province of Ninh Binh, District of Kim Son; the province of Ha Tinh, District of Thach Ha, and city of Ha Tinh; the city of Can Tho, agricultural district of Phong Dien and urban districts of Ninh Kieu and Cai Rang. The specific objectives aims at securing the agricultural economy, and safety of people and goods, improve landscape environment and sanitary conditions of the population.

Activities basically focus on infrastructures' development: construction of a dam, rehabilitation of irrigation systems, and fiver banks. Positive effects of climate adaptation interventions in inequality reduction might eventually occur, through the increase of security of economic activities, production, and sanitation. However, there is only a mention about the possible indirect socio-economic benefits of the intervention and not specifically pertaining the bottom poorest 40 per cent of the population.

Measurable and relevant indicators to assess the targeting of the poorest

The monitoring of project's results is carried out via indicators that assess the actual finalization of planned infrastructures and number of beneficiaries reached out, with no mention about the share of beneficiaries belonging to the bottom poorest 40 per cent of the population, or most socioeconomically disadvantaged households, groups or possible increase in income or wealth derived from the action.

A clear plan to evaluate results, including inequality reduction targets

No evaluation of the distributional impact of the programme is planned.

Based on the desk review outlined above we assign a market I-0, denoting that Inequality reduction is not targeted

2.4.3. Discussion

The project for climate change adaptation in Vietnam does not target inequalities. There is not an analysis of the incidence of inequalities at either national or in the areas

beneficiaries, nor objectives to reduce inequalities due to climate change, and targets set to benefit in particular the bottom (poorest) 40 per cent or socioeconomically disadvantaged individuals, households, or groups. This does not necessarily mean that the project might not eventually reduce inequalities, or benefit, particularly the most vulnerable groups.

3. Concluding remarks

The objective of the study is to further assess the validity of the methodology, which includes a newly developed Inequality Marker, to assess the potential contribution to inequality reduction of development interventions funded by AFD and the European Commission. The study tests the methodology on four development projects implemented in Benin, Djibouti-Ethiopia, Uganda, and Vietnam.

The Inequality Marker provides a synthesis of whether a development project has inequality reduction as a principal objective, a significant objective, or is not part of its central goals. In order to 'mark' a project, specific criteria are adopted, with reference to the existence of an analysis of trends and drivers of inequalities in the policy area of the intervention; objectives and activities focusing to directly benefit the bottom (poorest) 40 per cent or socio-economically disadvantaged individuals, households or groups within the population; measurable and relevant indicators to assess progress in reaching out the poorest; with a specific evaluation plan that might include a Distributional Impact Assessment as source of data.

The I-Marker analysis has been complemented by a Distributional Impact Assessment (DIA) in two case studies, one ex-post (i.e., after completion of the project) in Benin and one ex-ante (i.e., before rolling out the project) in Uganda. To do so, we resort to the Equity Tool to estimate first whether more than 40% of beneficiaries from Benin intervention aiming at increasing access to electricity, belonged to the bottom (poorest) 40% of the wealth distribution, and second, whether the populations targeted by the water project in Uganda actually come from the poorest 40%.

Documentation analysis using the I-Marker has shown that projects carried out in Benin, Djibouti-Ethiopia, and Uganda, have inequality reduction as a significant, although not principal, objective (I-Marked = 1). The effect of the interventions on inequalities are expected to be indirect, resulting from expanding access to key services in rural or marginalized urban areas, where the percentage of the poorest 40% populations is relatively

high. For the case of the Vietnam project, documentation analysis indicates that inequality reduction is not an objective of the project and therefore, the inequality marker is equal to zero (I-Marked = 0).

This does not mean, however, that the intervention might not have an effect on reducing inequalities, but in order to ensure this outcome, distributional impact assessments should be conducted ex ante, with the aim of identifying areas with larger concentration of households at the bottom 40% and with more salient needs to climate adaptation.

The Distributional Impact Assessment was conducted for the development projects implemented in Benin and Uganda, although we were unable to implement the analysis in the case of Djibouti-Ethiopia and Vietnam. In the case of the (ex-ante) project in Djibouti-Ethiopia, project implementers were still in the process of identifying the targeted areas and populations for project implementation. In the case of Vietnam, local authorities from the targeted districts and communes did not grant permission to collect the household survey.

The Distributional Impact Assessment conducted in Benin, has revealed that, although the project's targeted on paper rural communities to address inequalities in access to electricity, urban areas were the prime beneficiaries of the intervention. In the treated localities, just about one-third of households belong to the bottom 40%. For the few rural communities that received treatment, less than 5% of beneficiaries belong to the bottom 40%.

Once we compared the overall sample of beneficiaries with the national wealth distribution, we observe that less than 5% of project beneficiaries belonged to the bottom 40%. Thus, by benefiting proportionally more households located at the top 60% of the wealth distribution, the project is likely to have contributed to reproducing existing inequalities in access to electricity. Among the possible reasons of this unintended outcome is the easier inclusion for treatment of localities that are closer to the grid and power networks and probably also closer to urban areas as opposed to rural communities. The implementation of the distributional impact assessment ex ante, prior to the actual implementation of the project, could have assisted project designers in the identification and selection of the poorest communities with the aim of improving targeting and enhancing potential inequality reducing impacts.

Further analysis also indicates that approximately 65% of households in targeted localities were able to access electricity after the project completion. This seems to indicate that the project may have contributed to expanding access to electricity, at least in urban areas, and this may also potentially contribute to inequality reduction, if prior to the project, the

poorest 40% were largely excluded from electricity services. This could have contributed to reducing other forms of inequality by facilitating economic activities, and improving health outcomes and in general, the quality of life. Unfortunately, with no baseline data, we are unable to confirm this potential outcome of the project, underscoring the importance of conducting a distributional impact assessment before and after the project implementation.

In the case of Uganda, we carried out the distributional impact assessment ex-ante, i.e., before the implementation of the water infrastructure project. The analysis has provided relevant information about the significant equalities in access to, and quality of, water sources across the subcounties, refugee settlements and Town Councils in the Isingiro district. Such inequalities seem to be associated with factors such as household assets, community and household characteristics, gender, and geography. Since results indicate that population density and access to electricity are strongly associated with safe water accessibility, a straightforward way of improving targeting among excluded populations would be to focus on localities with low population density and limited access to electricity.

The analysis indicates that the currently project seems to be better targeted in urban areas than in rural communities, as less than 30% of potential beneficiaries belong to the bottom 40% of the wealth distribution in rural subcounties. Nevertheless, we find marked differences in how the project would benefit the poorest 40% households across urban areas. Notably, the analysis reveals an important gender dimension, in the sense that the water project is likely to reach a larger share of female-headed households—relative to male-headed households—that belong to the bottom 40% of the urban wealth distribution. This would be a positive outcome of the intervention as women and children are primarily responsible for fetching water for domestic use.

Water affordability is a key issue for the success of the project, as one-fourth of the targeted population referred to water prices as the main constraint to access safe water resources. Thus, it will be critical to explore alternative approaches for water supply, including subsidized schemes for the poorest households, and differentiated water rates for consumption and productive use, in particular for agricultural and livestock activities, to both tackle existing inequalities in water accessibility and address food insecurity. Indeed, improving water infrastructure for agriculture and livestock is vital in this case, as the Isingiro district has suffered from severe droughts in recent years that threaten community livelihoods.

The DIA has provided relevant information about the wealth distribution of households in the targeted localities, and the community and household characteristics that are associated with inequalities in water accessibility. This information can be used by AFD, and other actors involved in the implementation of the project, including the Uganda government, to facilitate access to affordable safe water sources among the poorest and most vulnerable populations.

Despite the difficulties that can emerge in conducting the DIA using the Equity Tool, due to obstacles in collecting survey data (see discussion below), or because pre-existent household surveys are not available or updated, the proposed methodology has proved to be an effective straightforward, low-cost and less-time consuming analytical tool for assisting the design and implementation of certain types of development projects *ex-ante*, and support their monitoring and evaluation *ex-post* with the aim of benefiting proportionally more those at the bottom 40% of the wealth distribution.

Yet, it is important to point out that the DIA based on the Equity Tool is not applicate to all types of development projects. For example the Equity Tool would be ineffective in assessing industry- or sector-wide reforms that are supported by development cooperation via government budgets, or infrastructure projects that are expected to impact multiple sites or regions within countries over the longer term. In addition, external contextual factors can also constrain the ability of researchers to implement the DIA analysis. These factors can be related to adverse political conditions or security concerns.

Another constraint that can limit the implementation of the DIA analysis relates to survey data limitations in certain contexts (e.g., the absence of Demographic Health Surveys, UNICEF' Multiple Indicator Cluster Surveys, and World Bank's LSMS surveys) to estimate the Equity Tool and wealth distributions.[2] It is worth noting that the Equity Tool is sensitive to changes in the set of assets that underpin the wealth quintile distribution. This underscores the importance of conducting the DIA ex-ante, before project implementation, and also to explore alternative tools to conduct the distributional analysis.
In addition, in order to undertake the DIA analysis satisfactorily, it is critical that researchers and survey data collection organisations get full support and cooperation from AFD project's managers, including, although not exclusively, the following:

- Sharing relevant documentation and reports

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[2] We estimate that there exist survey data suitable for the Equity Tool in most countries, covering nearly 90% of developing countries populations.

- Providing accurate and timely information about the project's implementation
- Facilitate communication between researchers and survey data collection organisations, and national and/or local authorities responsible for approving data collection.

Ownership of the methodology by development agencies' officers is therefore key, to ensure commitment and cooperation between development agencies and external researchers. This can be done by increasing capacity building, through training for instance. In addition, it is critical to ensure that development agencies establish a dialogue and an effective informational flow with project counterparts in recipient countries to raise awareness about the scope and objectives of the DIA analysis and the potential social and economic outcomes arising from better targeting the poorest or most vulnerable populations.

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Appendices

Appendix 1. The Inequality Marker

The first step is the desk review of the development cooperation interventions. In this respect, an Inequality Marker (I-Marker) has been further developed and adopted by the European Commission. The I-Marker assesses whether inequality reduction is an objective of development interventions The I-Marker enables to assess whether an intervention has been designed to benefit, to a larger extent, the bottom (poorest) 40 per cent or other socio-economically disadvantaged individuals, households, or groups, and therefore fostering their opportunities to increase their income, wealth, or socio-economic position, as a prerequisite to likely have an impact on reducing within-country inequalities. A project (including investments, budget support), can be marked as:

I-0: If inequality reduction is not targeted
I- 1: If inequality reduction is a significant objective
I- 2: If inequality reduction is the principal objective

As shown in Figure 1 below, interventions are marked using the following criteria:

Whether an analysis of trends and drivers of inequalities in the policy area of the intervention (see below) is used to identify the bottom (poorest) 40 per cent or socio-economically disadvantaged individuals, households or groups to define the programme or project objectives and activities.

Whether the objectives and activities of the intervention are designed to directly benefit the bottom (poorest) 40 per cent or socio-economically disadvantaged individuals, households or groups within the population, which inter alia could have been disproportionally excluded from the provision of public goods and services.

Whether measurable and relevant indicators are in place (with baselines and targets) to assess progress in delivering the expected benefits to the bottom (poorest) 40 per cent or socio-economically disadvantaged individuals, households or groups.

Whether there is a specific evaluation plan (or component in the foreseen evaluation) to assess the impact on the bottom (poorest) 40 per cent or socio-economically disadvantaged individuals, households, or groups, including those identified by using the Distributional Impact Assessment tool (see below).

Figure 26. The Inequality Marker

(I-0) Inequality reduction is not targeted - None of the criteria are relevant for the intervention			
No analysis of the incidence of inequalities at either national or sectoral level is provided.	No objectives to reduce inequalities are set.	No targets are set to benefit in particular the bottom (poorest) 40 per cent or socioeconomically disadvantaged individuals, households or groups.	No evaluation of the distributional impact of the programme is planned.

(I-1) Inequality reduction is a significant objective - The following minimum criteria are met in full			
Generic contextual information on the levels of inequality in the country or sector[*] is provided and is used for the designing of the intervention.	The **general objective** or **at least one of the specific objectives** of the intervention is either to reduce inequality: i) in the country, ii) in a specific geographical area, or iii) in a specific sector.	**Inequality indicators**[**] are developed with targets set for measuring, **directly or indirectly**[***], the effect of the intervention on the **bottom (poorest) 40 per cent or socioeconomically disadvantaged individuals, households or groups.**	There is a clear plan to evaluate results, including inequality reduction targets.

(I-2) Inequality reduction is the principal objective of the intervention - the intervention is designed with the principal intention of reducing inequality; all of the criteria below are present, relevant, and thoroughly developed for the intervention			
Detailed analysis is provided on the levels, drivers, and determinants of inequality in the country and/or on the areas of intervention.	The **general objective of the intervention** is to reduce inequalities and **at least one of the specific objectives** is set to reach the **bottom (poorest) 40 per cent or socioeconomically disadvantaged individuals, households or groups**.	**Inequality indicators** are developed with targets set for **directly measuring** the effects of the intervention on the **bottom (poorest) 40 per cent or socioeconomically disadvantaged individuals, households or groups.**	An evaluation is planned to assess the intervention's impact on the **bottom (poorest) 40 per cent or on socioeconomically disadvantaged individuals, households or groups** and on the reduction in inequality.

[*] Analyses at country level may include subnational disaggregation by geographical divisions, or rural vs. urban areas. Analyses at sectoral level may include economic activities listed under the 'International Standard Industrial Classification of All Economic Activities (ISIC)', or sectors of public spending, as defined by the 'OECD Classification of the Functions of Government (COFOG)'.

[**] Inequality Indicators can include those measuring dimensions related to either horizontal inequality (e.g., opportunity, access, targeting of vulnerable groups) or vertical inequality (e.g., outcome, income level, etc.), and can include a level of disaggregation that identifies beneficiaries as belonging to the bottom (poorest) 40 per cent or socio-economically disadvantaged individuals, households, or groups.

*** For example, an indicator measuring the inequality-related outputs of a technical assistance intervention would count as an inequality indicator.

Appendix 2. Distributional Impact Assessment of development projects using Equity Tool

The second step of the methodology is to conduct a Distributional Impact Assessment (DIA), a statistical analysis of inequality reducing effects of AFD and EU funded interventions. The analysis can be conducted when the beneficiary populations are known and identifiable at individual or aggregate, geographical level. The DIA is carried out, using the Equity Tool enabling us to estimate whether beneficiaries at the bottom 40 per cent of the income or wealth distribution benefit proportionally more than the rest of the population.

The idea of benefiting the bottom (poorest) 40 per cent of the income/wealth distribution (or other socio-economic dimensions) can be linked to the notion of 'shared prosperity', i.e., the extent to which the promotion of economic and social progress is inclusive. The conventional way of measuring shared prosperity is to look at the income (or wealth) growth of the bottom 40 per cent across the welfare distribution of a population. If the income (or wealth) of the bottom 40 per cent grows at a rate higher than the national average, then economic progress has been overall inclusive, and consequently inequality is reducing. This is what the World Bank refers to as the "shared prosperity premium". The share prosperity premium can be seen as an analogous measure of (negative) change in inequality.[3] This notion is reflected in Target 10.1 of the SDG 10: "*By 2030, progressively achieve and sustain income growth of the bottom 40 per cent of the population at a rate higher than the national average*".

The EQT is a short questionnaire of 10-15 questions (see EQT questionnaire and additional information about surveys' implementation, in the Appendix), that allows to estimate the wealth quintile of the respondent, and therefore the share of interventions' beneficiaries that come from the bottom quintiles (bottom 20% and 40%). As a result, if an intervention aims to benefit the poorest, the tool provides valid information about the extent to which the targeting has been effectively done. In addition, the Equity Tool questionnaire has been integrated with questions that capture the distribution of project beneficiaries among vulnerable groups such as women, ethnic, racial, and religious minorities, forced displaced populations, along with main drivers of inequalities among selected or potential beneficiaries.

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[3] For a more technical discussion on the concept of share prosperity premium, see Lakner et al. (2022) and Ferreira, Galasso, and Negre (2020).

Appendix 3. Additional wealth distribution in Benin

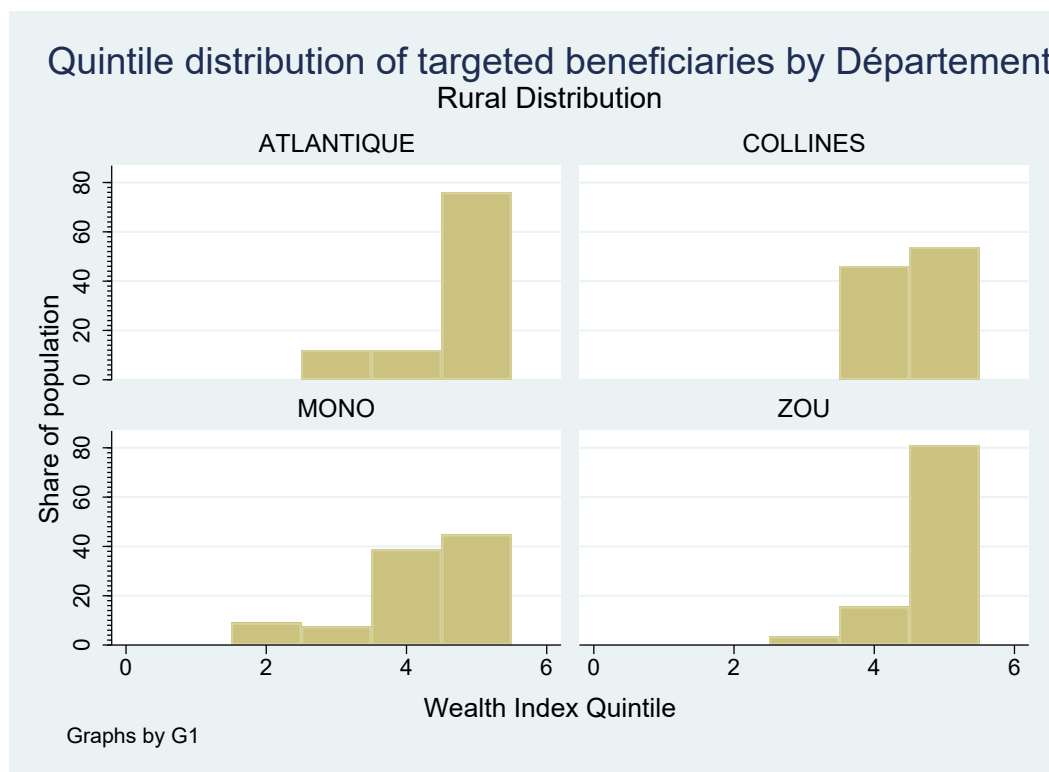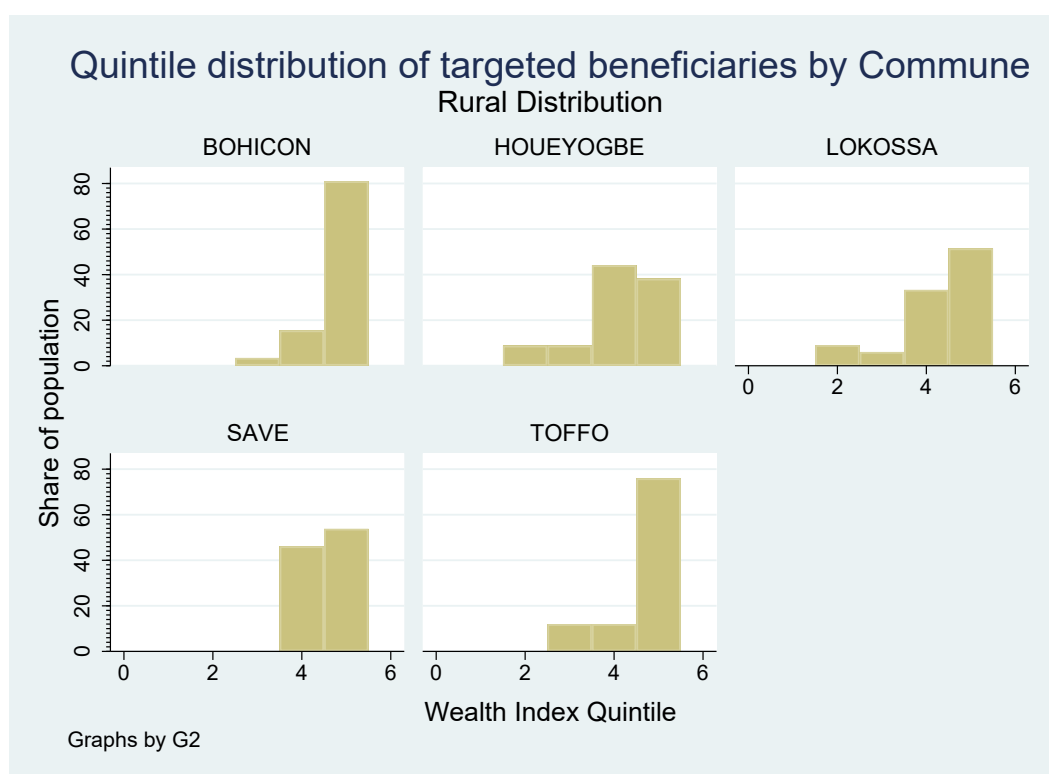**Figure A. 1. Rural quintile distribution by Département**

Quintile distribution of targeted beneficiaries by Département
Rural Distribution

Figure A. 2. Rural quintile distribution by *Commune*

Quintile distribution of targeted beneficiaries by Commune
Rural Distribution

Figure A. 3. Rural quintile distribution by religion

Quintile distribution of targeted beneficiaries by religion
Rural Distribution
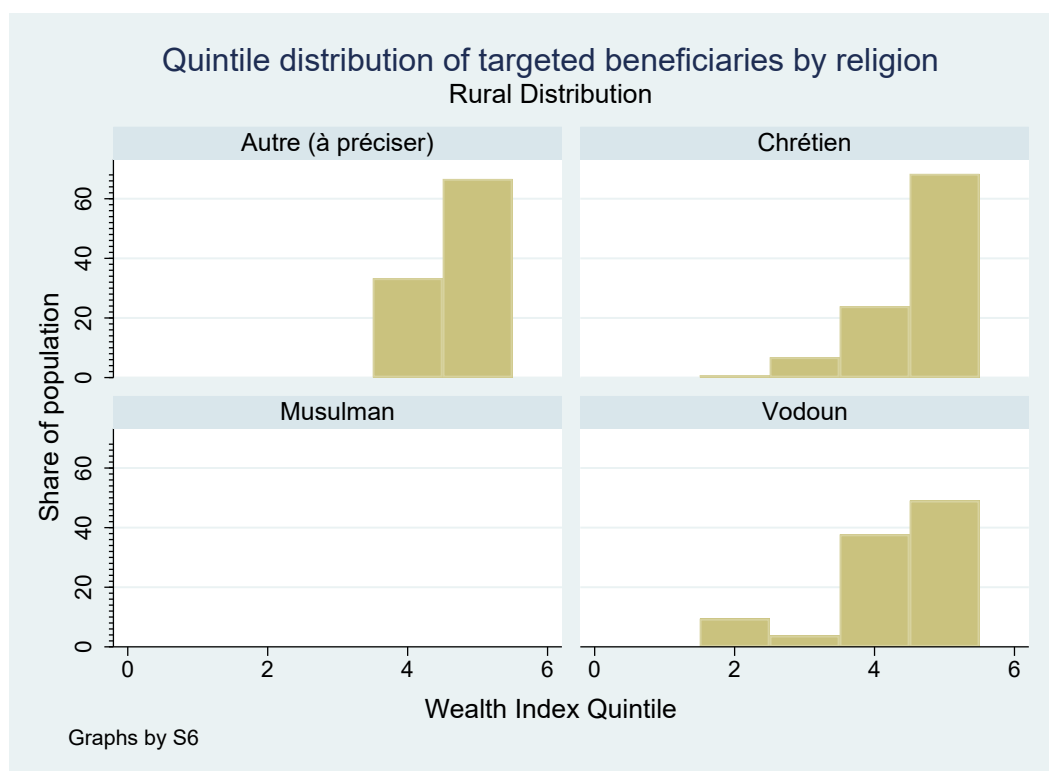
Figure A. 4. Rural quintile distribution by sex

Quintile distribution of targeted beneficiaries by sex
Rural Distribution
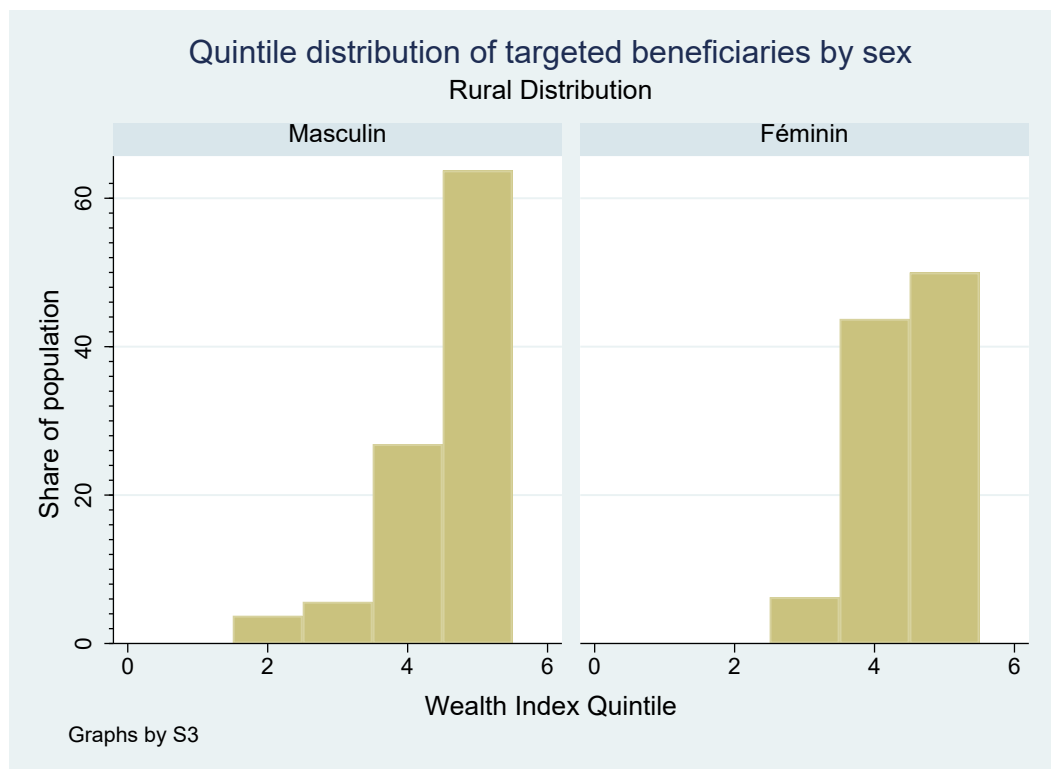
Figure A. 5. National quintile distribution by *Département*

Quintile distribution of targeted beneficiaries by Département
National Distribution
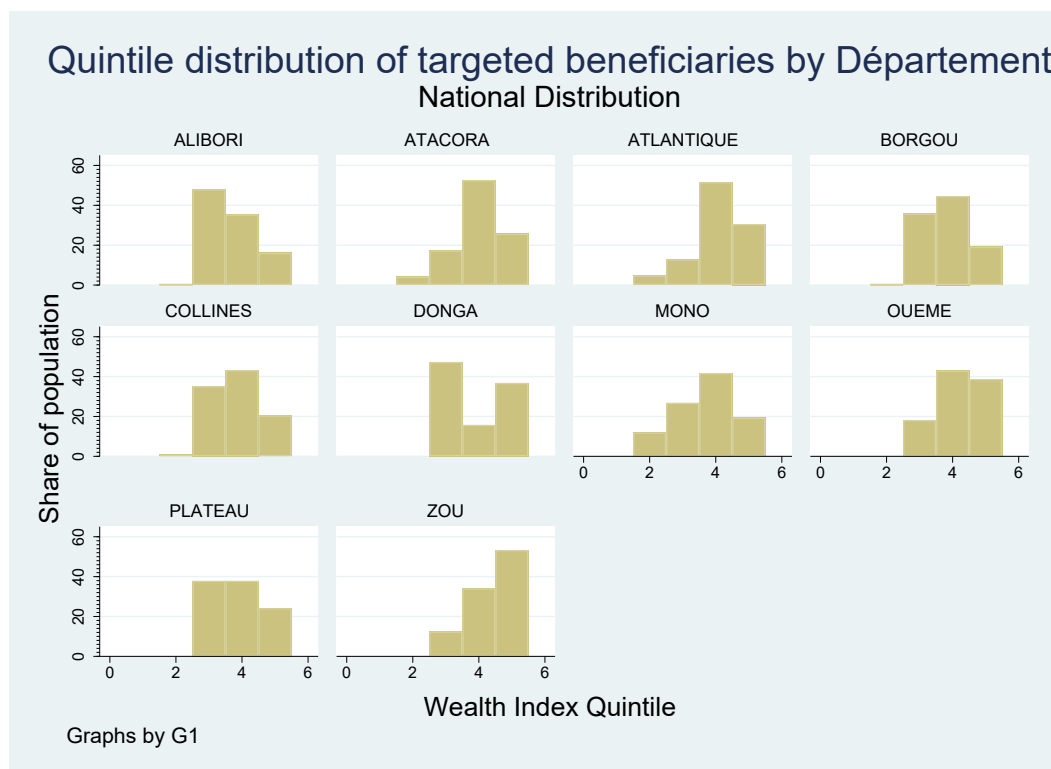
Figure A. 6. National quintile distribution by religion

Quintile distribution of targeted beneficiaries by religion
National Distribution

Figure A. 7. National quintile distribution by sex
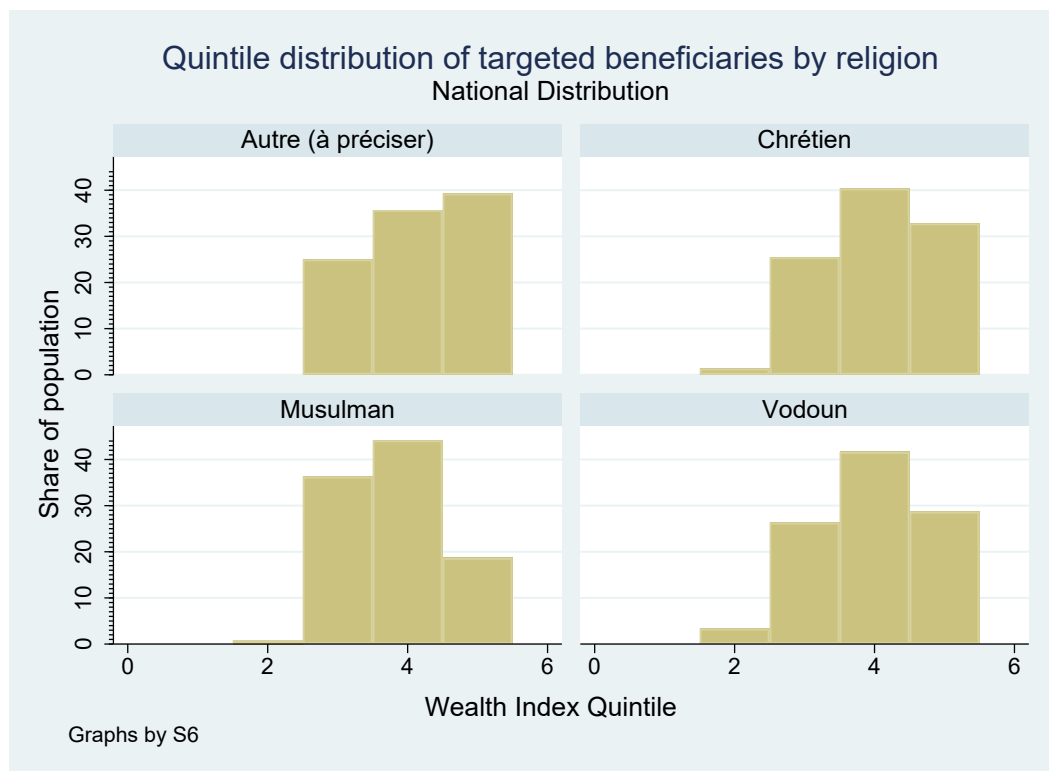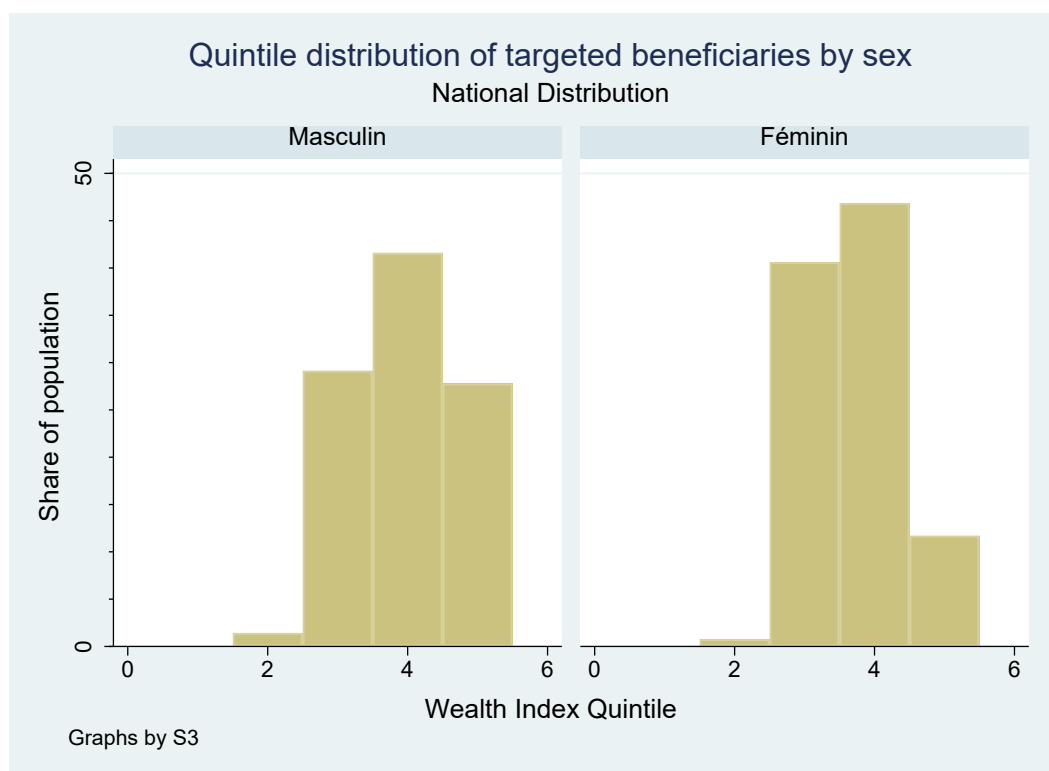
Quintile distribution of targeted beneficiaries by sex
National Distribution

Graphs by S3

Appendix 4. Uganda's Insingiro District National wealth distributions

Population and area size estimates for the sub-counties and refugee settlements

Estimates of population data were obtained from the Isingiro district revised sub-county population projections 2019-2030 provided by the district Chief Administrative Office (also based on the Uganda Bureau of Statistic). Population data from 2019/20 was used for sample estimates as shown in Table 4. As per the period 2019-2020, Oruchinga Refugee settlement had the lowest population projection (3800) in 2019-2020 compared to Ngarama (39800 people), Kikagate (33400 people) and Isingiro (33200) with nearly ten times more.

Table 5. Estimated population size (Based on Revised sub-County Population 2019-2030 population Projections)

Name	Description	Population
Birere	Sub-County	25200
Masha	Sub-County	26300
Mbaare	Sub-County	29100
Nakivale	Refugee Camp	28100
Ngarama	Sub-County	39800
Nyakitunda	Sub-County	10200
Nyamuyanja	Sub-County	18600

Name	Description	Size (Km2)
Oruchinga	Refugee Camp	3800
Ruborogota	Sub-County	20800
Rugaaga	Sub-County	22000
Rushasha	Sub-County	15500
Endiinzi	Sub-County	15500
Isingiro	Town-Council	33200
Kaberebere	Town-Council	8000
Kabingo	Sub-County	11300
Kabuyanda	Sub-County	25100
Kabuyanda TC	Town-Council	19400
Kashumba	Sub-County	19200
Kikagate	Sub-County	33400

Data to estimate the area of the sub-counties, town councils and refugee settlements to calculate population density was obtained from district estimates based on the Isingiro district development plan for 2015-16 and 2019-20. Table 5 provides the size estimates in kilometres.

Table 6. Estimated size of the sub-Counties/TCs/Refugee Settlements (based on Isingiro District Local Government Development Plan 2015-16-2019-20)

Name	Description	Size (Km2)
Birere	Sub-County	60.8
Masha	Sub-County	46.0
Mbaare	Sub-County	106.5
Nakivale	Refugee Camp	185
Ngarama	Sub-County	248.7
Nyakitunda	Sub-County	65.9
Nyamuyanja	Sub-County	129.4
Oruchinga	Refugee Camp	8.0
Ruborogota	Sub-County	25.8
Rugaaga	Sub-County	163.1
Rushasha	Sub-County	191.9
Endiinzi	Sub-County	376.8
Isingiro	Town-Council	229.2
Kaberebere	Town-Council	71.6
Kabingo	Sub-County	161
Kabuyanda	Sub-County	155.5
Kabuyanda TC	Town-Council	201.7
Kashumba	Sub-County	218
Kikagate	Sub-County	57.7

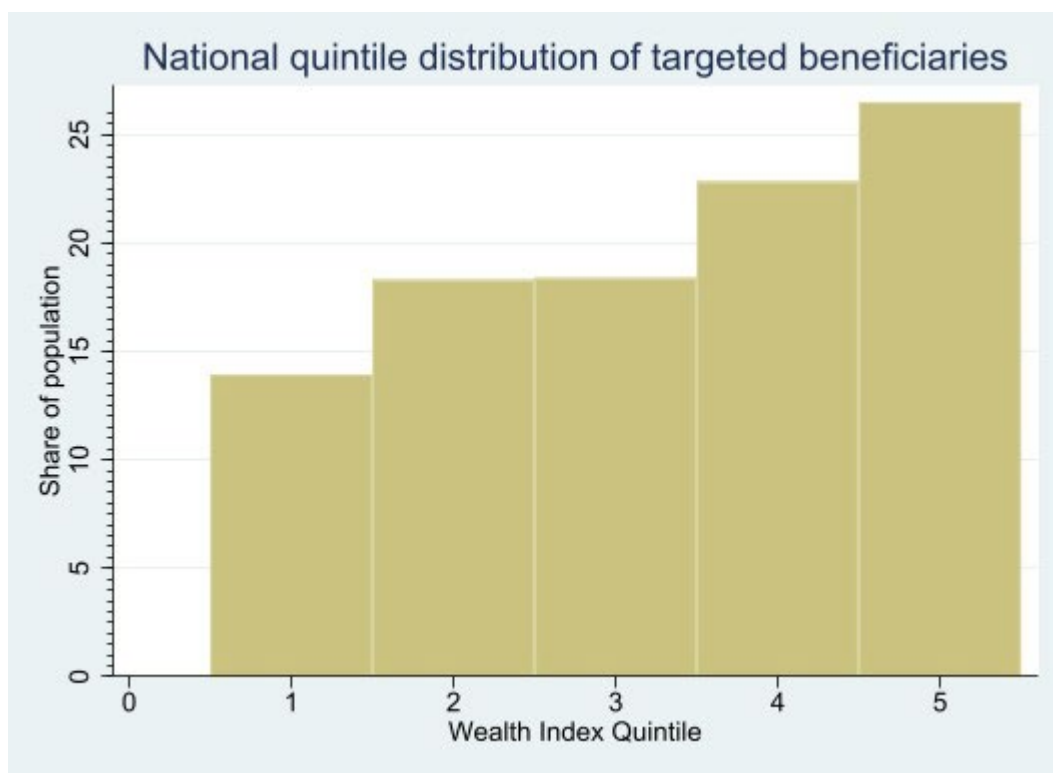**Figure A. 8. National quintile distribution of targeted beneficiaries**

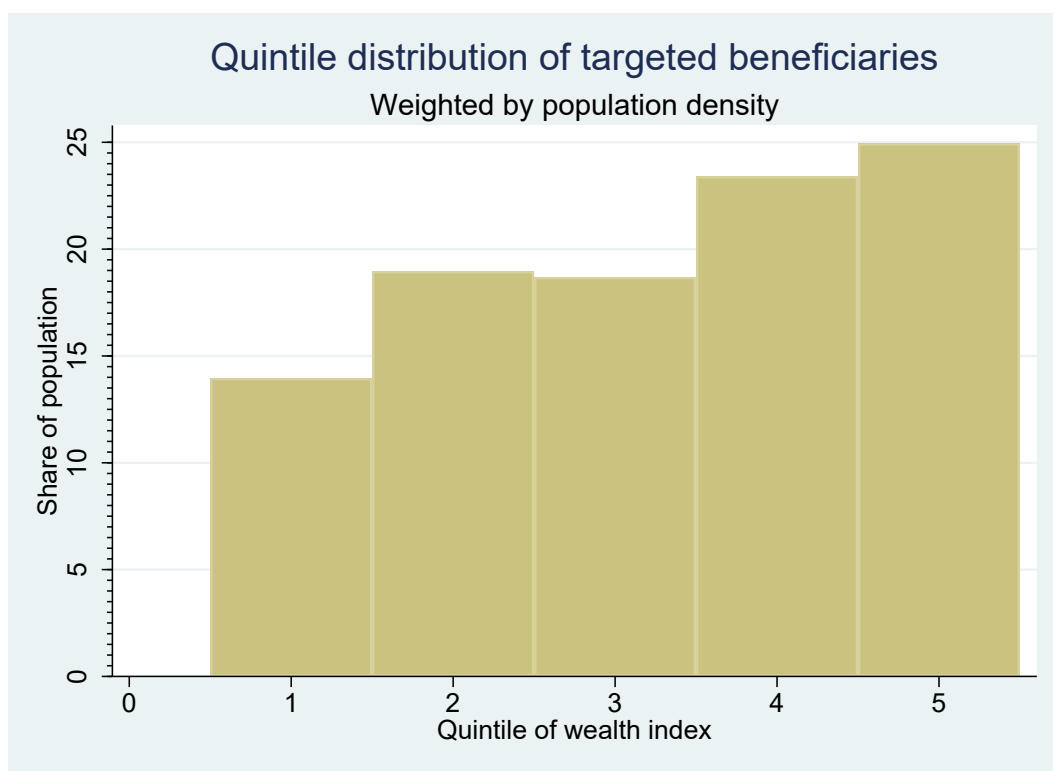**Figure A. 9. National Quintile distribution weighted by population density**

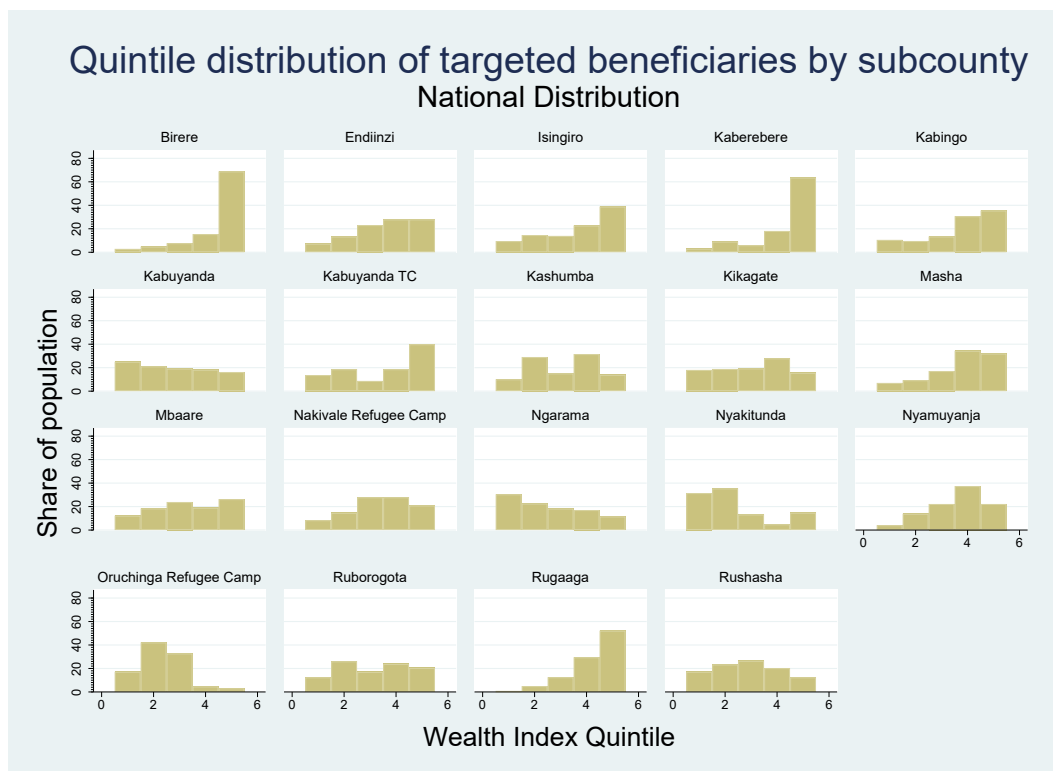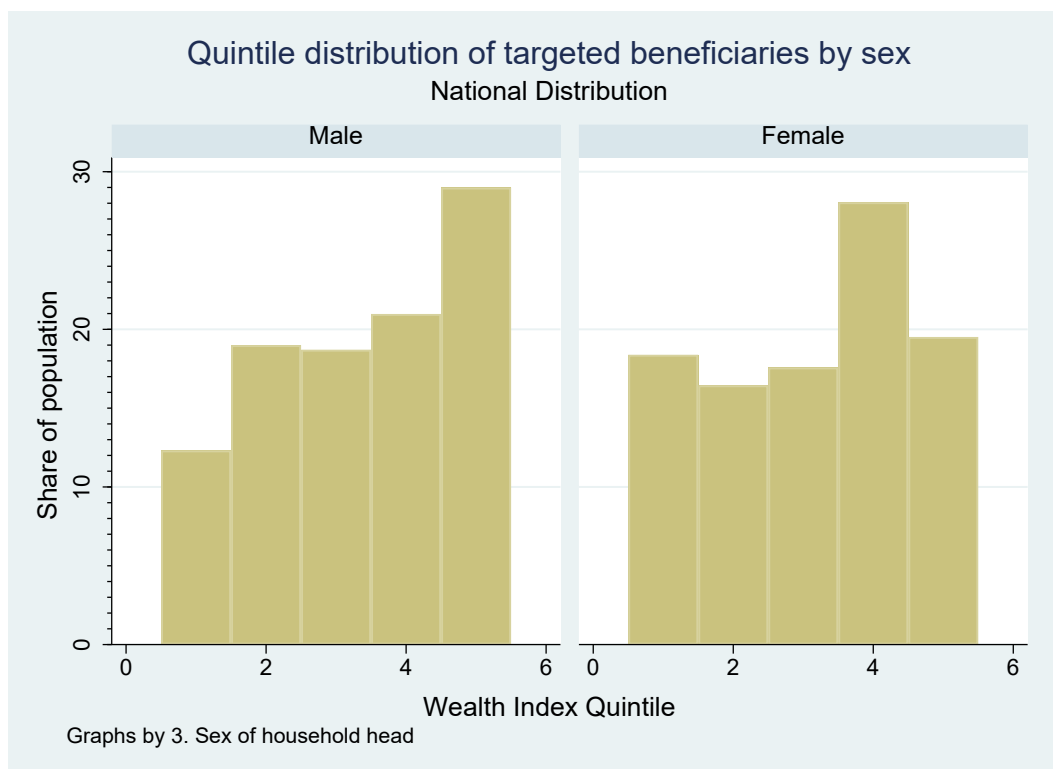**Figure A. 10. National quintile distribution by subcounties**

Quintile distribution of targeted beneficiaries by subcounty
National Distribution

Figure A. 11. National Quantile distribution by sex

Quintile distribution of targeted beneficiaries by sex
National Distribution

Graphs by 3. Sex of household head

Figure A. 12. National quintile distribution by region

Quintile distribution of targeted beneficiaries by religion
National Distribution
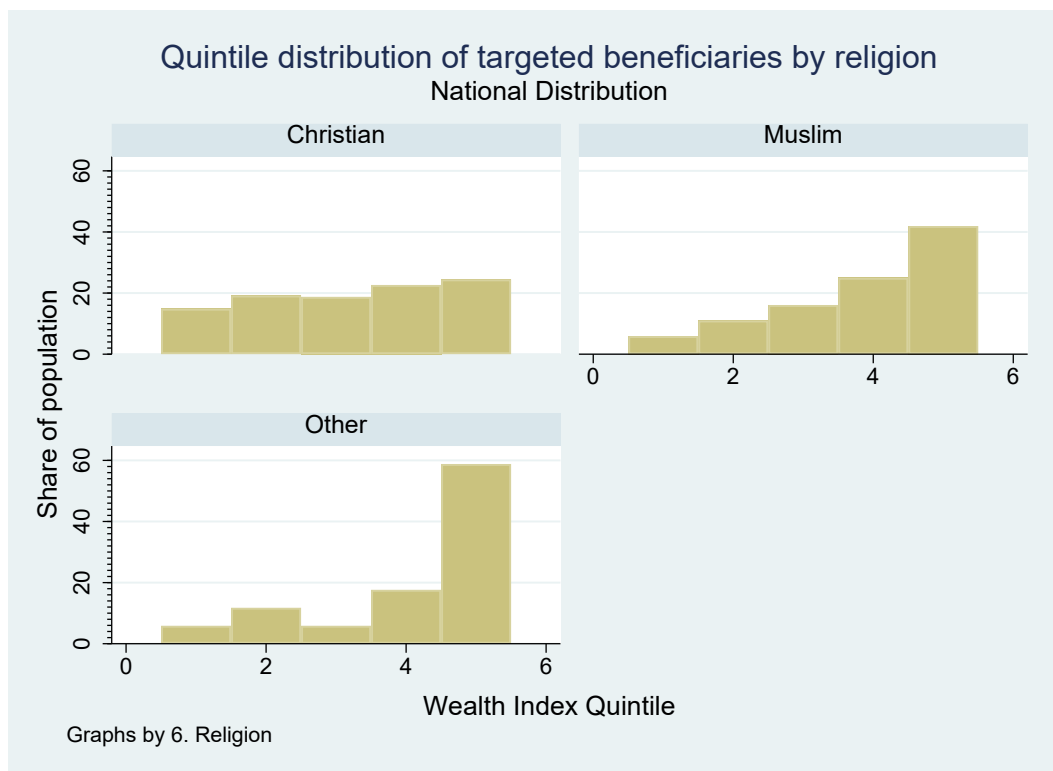
Appendix 6 Household characteristics in Isingiro District

By sex of household head, 73.5% (1721 households) and 26.5% (620 households) were male and female respectively. Majority of the households (56.5%; n=1322) had 5-9 members. Households with 9 members and above constituted only 12%, and those with 1-4 members constituted 32.1% (n= 751). Most of the households (65.3%) had between 1-4 children. A quarter of the participating households reported to have between 5 and 9 children in their house hold. Nearly a quarter (23.3%) and (23.4%) of the household heads were aged between 25-34 years and 45-54 years respectively. Household heads aged 55 years and above constituted 22.3%, and only 8 households were child headed.

By religion, most of the household respondents were Christians (89.2%; n=2088), followed by Muslims (10.1%; n=236) and 0.7% (n=17) who stated that they were either traditionalists or pagans. By Main language, the data show that survey participants mainly spoke Runyakitara (81.4%; n=1905 households). However due to heterogenous nature of the district, other languages used were: Kiswahili, Kirundi, Kinyabwisha, Lingala/kilembi, and English as indicated in Table A. 1.

**Table A. 1. Social demographic characteristics of participating household**

		FREQUENCY	PERCENTAGE
SEX OF HOUSEHOLD HEAD	Male	1721	73.5
	Female	620	26.5
NUMBER OF HOUSEHOLD MEMBERS	1-4 members	751	32.1
	5-9 members	1322	56.5
	10-14 members	250	10.7
	15 and above members	18	0.8
NUMBER OF CHILDREN (0 - 17)	No children	215	9.2
	1-4 children	1528	65.3
	5-9 children	577	24.6
	10-14 children	13	0.6
	15 and above children	8	0.3
AGE OF HOUSEHOLD HEAD	18 and below	8	0.3
	19-24 years	121	5.2
	25-34 years	545	23.3
	35-44 years	603	25.8
	45-54 years	542	23.2
	55 years and above	522	22.3
5.MAIN LANGUAGE	Kiswahili	175	7.5
	2. kinyabwisha/ kirundi/ kinyarwanda	127	5.4
	3. Lingala/ Kilembi	21	0.9
	4. Runyakitara (Runyankore/ Rukiga/Rutooro)	1905	81.4

|			
	5. English	7	0.3
	6. others	22	0.9
	Luganda	84	3.6
6. RELIGION	1. Christian	2088	89.2
	2. Muslim	236	10.1
	3. others	17	0.7

Household access to electricity

As indicated in figure 1, survey findings show that only 38% of the households are accessing electricity from solar, hydropower or generators and other sources. By sub-county, Kaberebere and Rugaaga Town Councils have the highest household access to electricity at 72.7% and 68% respectively. These are followed by Birere sub-county (68%) and Kabuyanda TC (60%). The lowest access was recorded in Rushaha at only 1.6% (see Figure A. 13).

Figure A. 13. Access to electricity by sub county
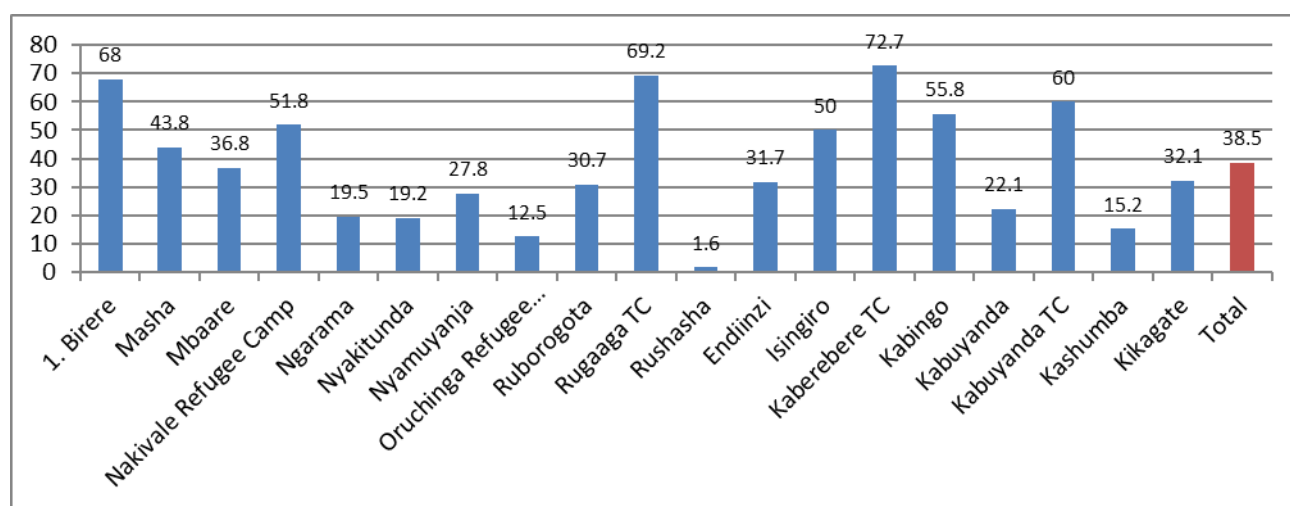
Overall, 38 percent of the households that participated in the survey had access to electricity. As expected, more households in the urban areas (Town-Councils) had access to electricity compared to those in rural areas (Sub-Counties) [see figure 4]. Over half (61.3%) of the households in Town Councils and 44 percent of the households in refugee settlements had electricity, and 31 percent of the households in rural areas (sub-counties) had access to electricity. Solar power was mainly used in Birere and Ngarama rural communities for domestic lighting and for pumping water for production in farms.

Figure A. 14. Access to electricity by location
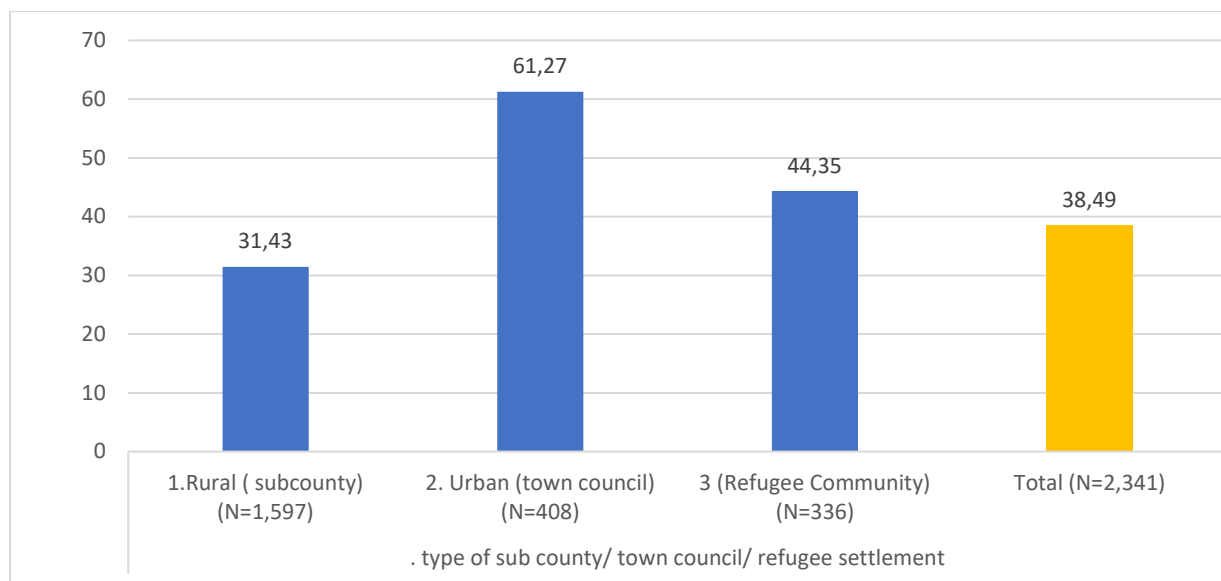
Access to electricity was also assessed in respect to household size. The findings as presented in figure 4 seem to suggest that the bigger the size of the household the more the household was likely to be connected to electricity. Half of the households with 15 or more members had access to electricity more than all other household size categories. Households with 1-4 members had a 37%, household with 5-9 member had a 39.2% access, and households with 10-14 members had a 38% access to electricity.

Related to the above, the findings on household access to electricity by number of children also seem to suggest that households with no, or fewer children were likely to have more access to electricity; 41.9% of household with no children had access to electricity compared to those with 1-4 children (39.8%), 5-9 children (34%) and 10-14 (30.8%). However, the number of households connected to electricity tended to increase at 15 and above children in the household, at 37.5%. (see Figure A. 15 and Figure A. 16).

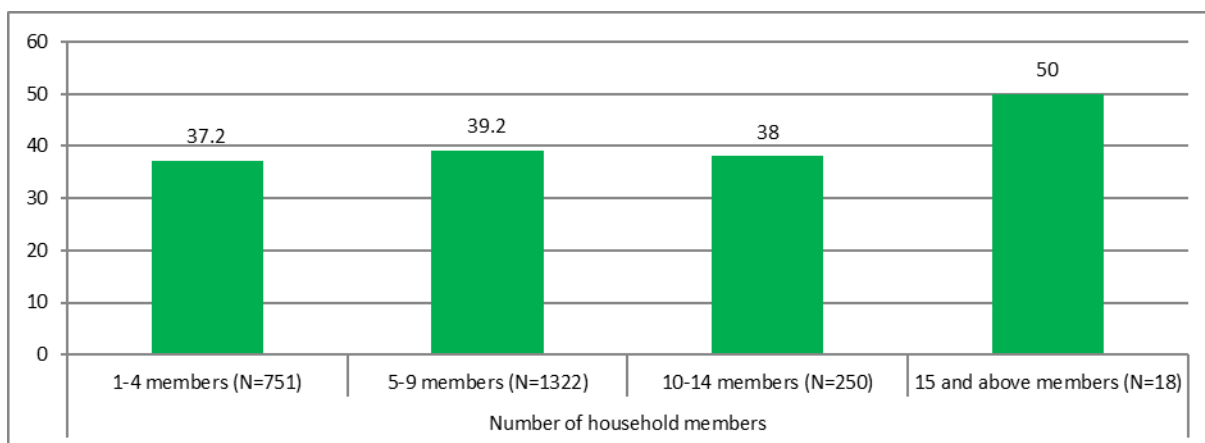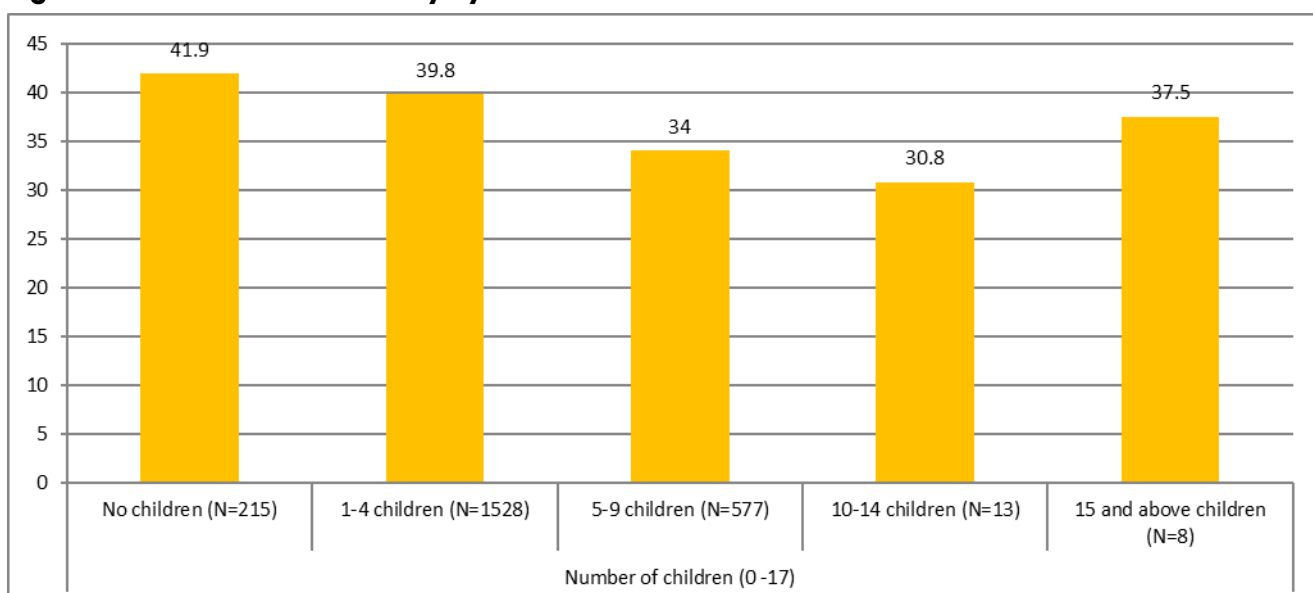**Figure A. 15. Access to electricity by Number of people in the household**

Figure A. 16. Access to electricity by Number of children in household

Household asset ownership

The survey findings on basic household items as presented in Figure A. 17 show that 15% of all household respondents mentioned that they own a radio cassette/DVD or a CD player. Slightly more than half (57%) owned a radio in their household, just over a quarter (28%) owned a television set in their household and a cupboard (29%), and a quarter (24.8%) owned a sofa set, respectively.

Figure A. 17. Access and ownership of household items
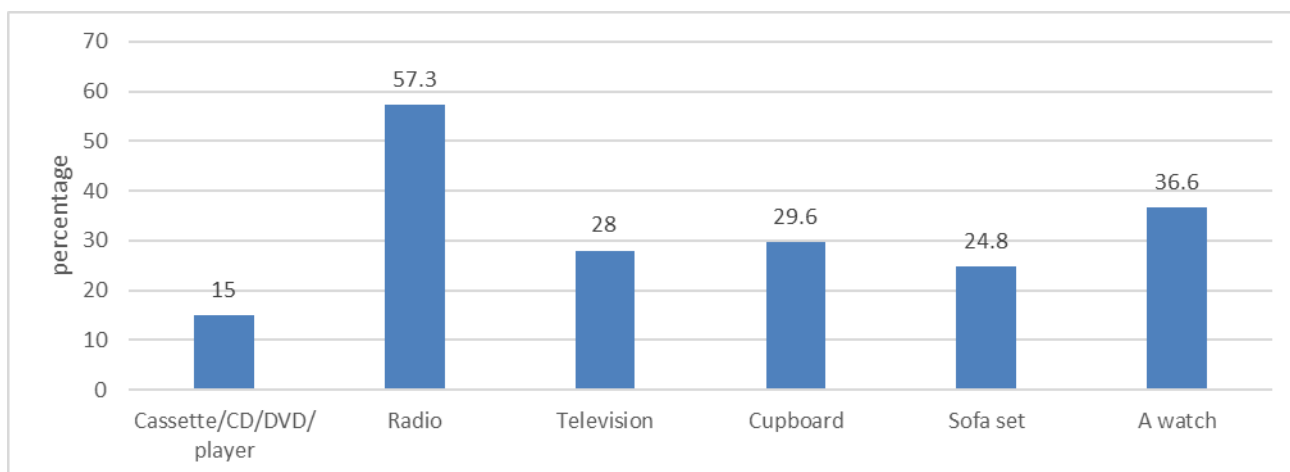
Bank accounts ownership

Survey findings on ownership of a bank account as presented in Figure A. 18 show that over 42% of household respondents mentioned that at least one member in their household held a bank account. Refugee participants in the survey in Nakivale refugee camp had the highest percentage of households with bank accounts (n=975 households), and Ngarama sub-county had the smallest proportion of households reporting to have at least a member with a bank account.

**Figure A. 18. Ownership of a bank account by Sub County**
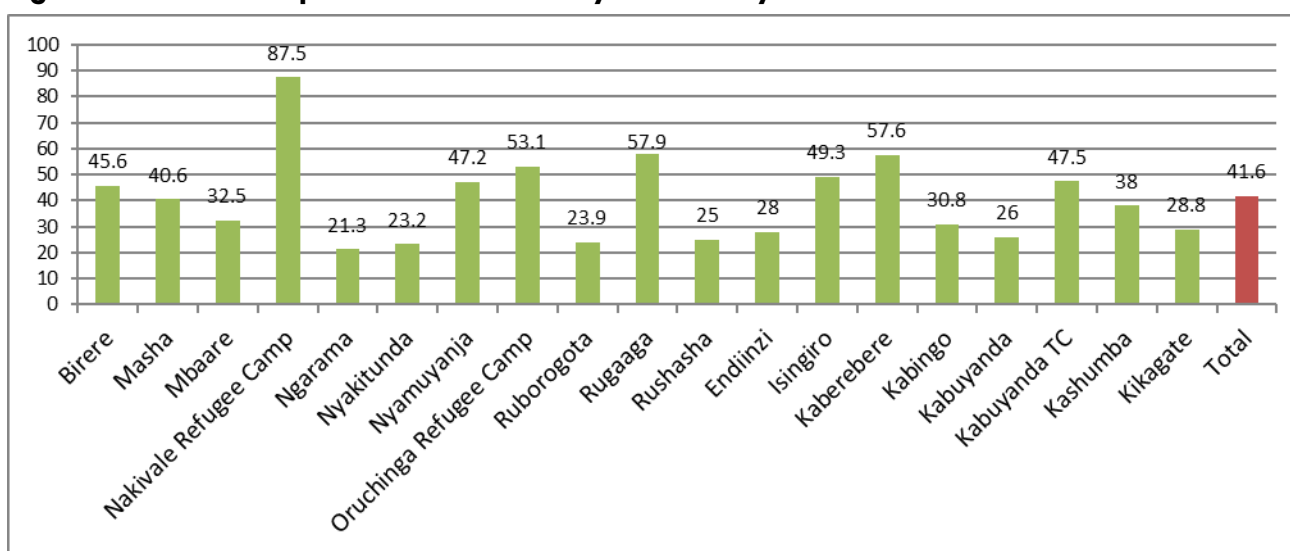
Ownership of a bank account was also somehow influenced by the age of the household head. The results as presented in Figure A. 19 suggest that middle aged household heads were likely to have at least one member of their household owning a bank account.

Figure A. 19. Ownership of Bank account by Age of Household
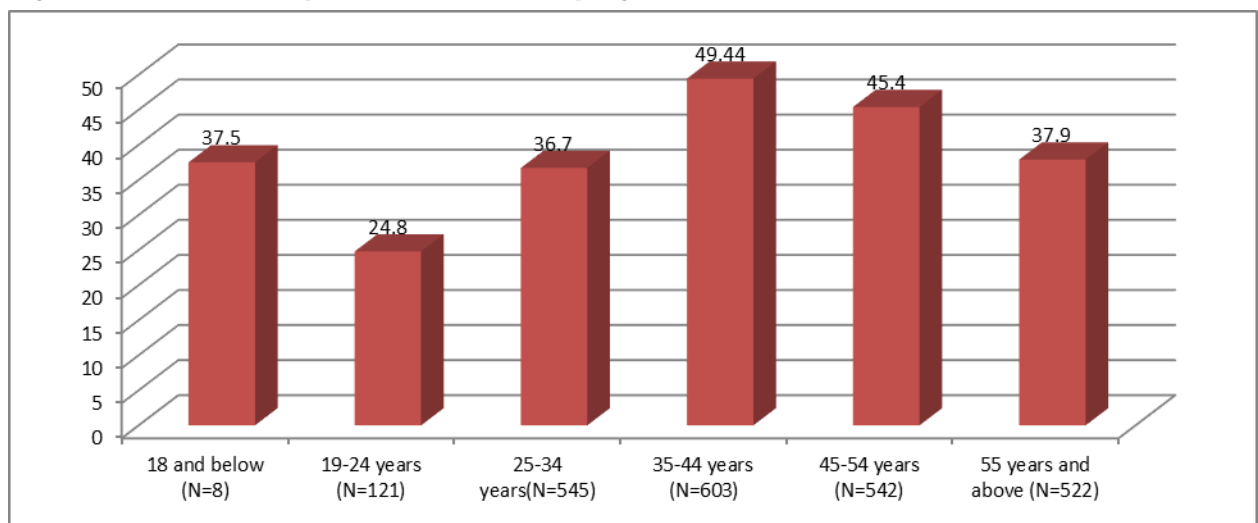
Overall, 41.7% of the surveyed households reported having bank accounts. More than half (53%) of all the households located in the urban areas had at least a member of their household with a bank account, compared to 34.5% rural areas with just over one third. Majority (81%) of the households in the refugee settlements reported having bank accounts (see Figure A. 20).

Figure A. 20. Ownership of Bank account by rural and urban household location
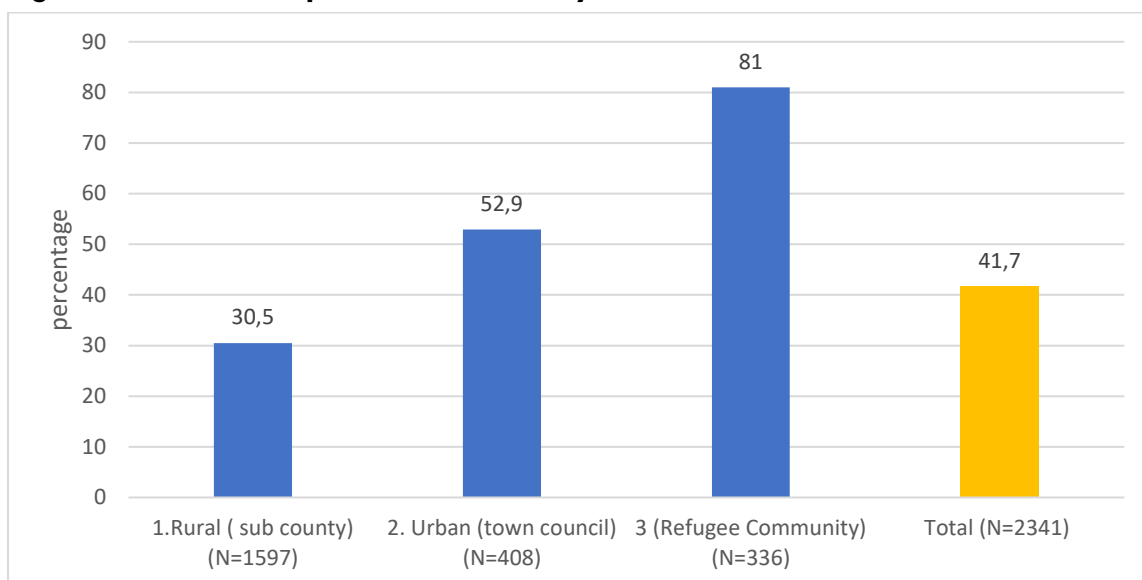
The findings also seemed to suggest that the more the household members, and the more the number of children a household reported to have, the more the household was likely to report having a member owning a bank account (see Figure A. 21 and Figure A. 22).

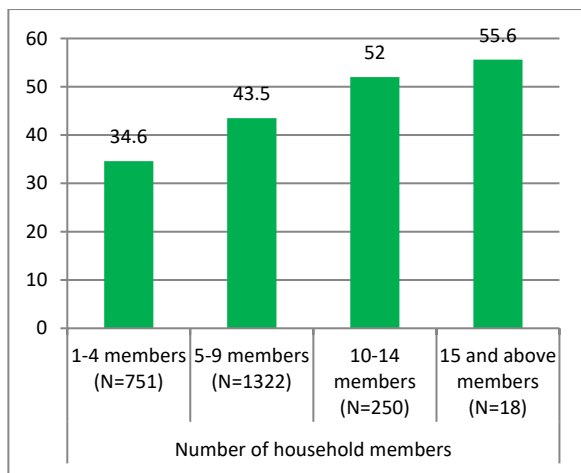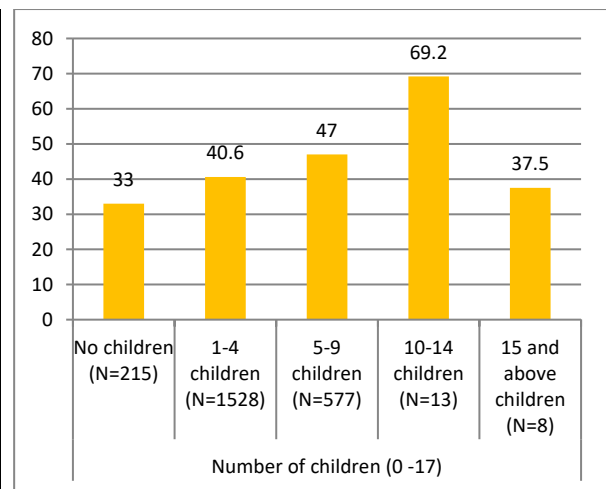**Figure A. 21. Ownership of Bank account by number of Household members**

Figure A. 22. Ownership of Bank account by number of children in household

Main sources of cooking fuel

The main source of energy used for cooking was wood (69.8%) and charcoal (29.6%). More households in rural communities (77%) reported using wood compared to charcoal (22.4%) or other forms of fuel (0.8%) (see Figure A. 24). The findings also suggest that female headed households were more likely to use charcoal (32.3%) compared to male headed households (28.6%) (see Figure A. 23).

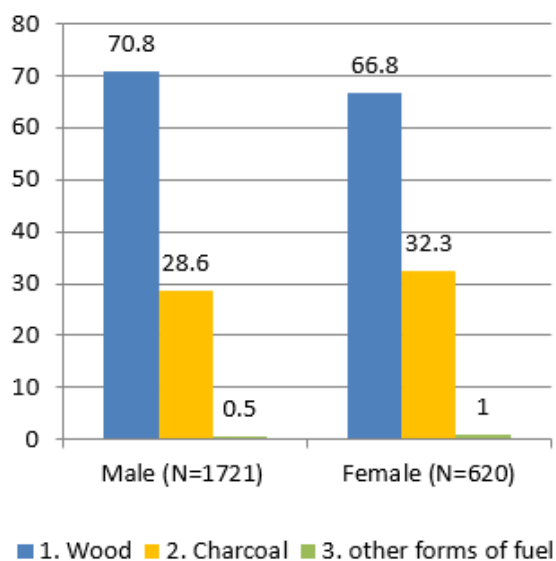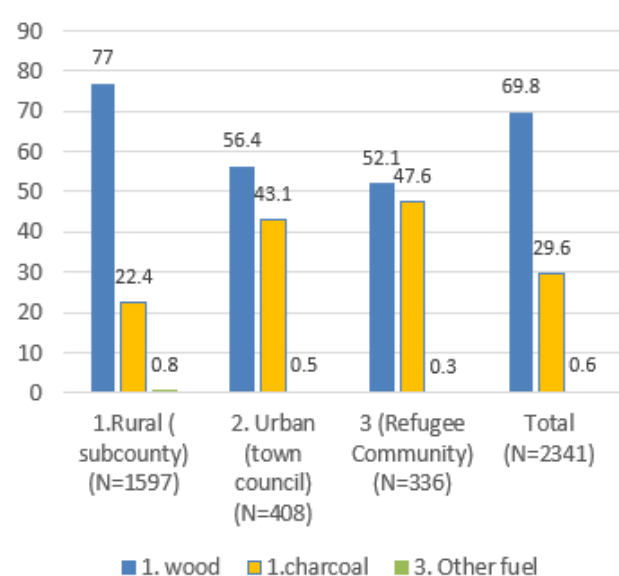**Figure A. 23. Type of cooking energy used by sex of household head**

Figure A. 24. Type of cooking energy used by household location

69

The findings further show that the bigger the household size, the more that household was likely to use wood fuel compared to charcoal (see Figure A. 25). Despite 61.1% of households with over 15 members reporting to use wood, 83.6% and 73.8% of households with 10-14 members and 5-9 members respectively mainly use firewood for cooking. Important differences are observed in terms of type of cooking energy when considering the number of children within households (see Figure A. 26).

Figure A. 26. Type of cooking energy used by number of children in the household
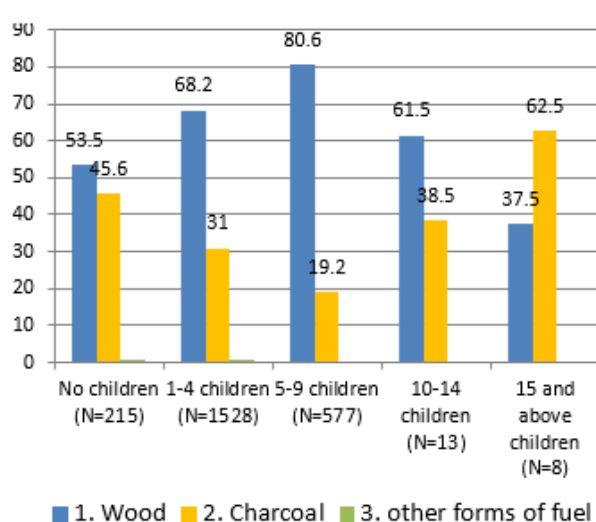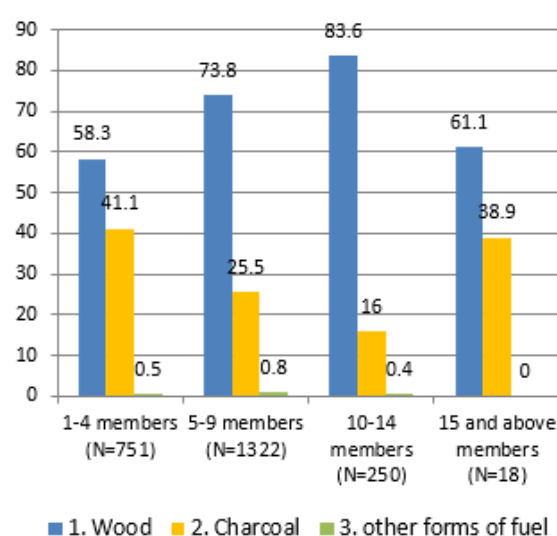

Figure A. 25. Type of cooking energy used by household size

Dwelling materials

Forty percent of the total number of households have dwelling units with cemented floors. Most people in the urban communities reported to have cement as the main material for the floor of their dwelling. With not much difference households in rural communities and refugee communities, i.e., 38.3% and 34.5% respectively cement as the main floor material of their dwelling unit. By gender about 40% of both male and female stated that they have cemented floors. The age of a household head did not seem to significantly influence the type of floor material for dwelling units, although the findings as displayed in Table A. 2. seem to suggest the younger the age of the household head the higher the likelihood the floor of a dwelling unit was likely to be made of earth/sand. Male compared to female headed households were also likely to have cemented floors, and not major variations are observable in respect to size of household or number of children in a household and the type of floor of dwelling unit.

Table A. 2 Main material of the floor of your dwelling by location, Age and Sex of household head, household size and number of children in household

	1. Cement (%)	Others (%)
All (N=2314)	40.5	59.46
Rural Urban status		
1. Rural (N=1,597)	38.3	61.74
2. Urban (N=408)	54.4	45.59
3. Refugee community (N=336)	34.5	65.48
Age of household head		
18 and below (N=8)	25.0	75.00
19-24 years (N=121)	38.0	61.98
25-34 years(N=545)	38.2	61.83
35-44 years (N=603)	43.0	57.05
45-54 years (N=542)	38.2	61.81
55 years and above (N=522)	43.5	56.51
Sex of household head		
Male (N=1721)	41.0	58.98
Female (N=620)	39.2	60.81
Number of household members		
1-4 members (N=751)	41.3	58.72
5-9 members (N=1322)	37.9	62.10
10-14 members (N=250)	48.8	51.20
15 and above members (N=18)	88.9	11.11
Number of children (0 -17)		
No children (N=215)	48.8	51.16
1-4 children (N=1528)	40.0	60.01
5-9 children (N=577)	38.1	61.87
10-14 children (N=13)	69.2	30.77
15 and above children (N=8)	50.0	50.00

Roof Materials

In Isingiro district, only 2.4% of the households surveyed had their main dwelling unit roofed with a thatch. Majority (97.6%) used other materials. Other roofing materials like iron sheets and tumplines were more commonly used (see Table A. 3).

Table A. 3. Roof Material of household dwelling unit by location of household, age and gender of household head and household size.

	1. Thatch (%)	Others (%)

	All (N=2314)	2.4	97.57
Rural/ Urban	1. Rural (N=1597)	1.6	98.43
	2. Urban (N=408)	0.3	99.51
	3. Refugee community (N=336)	8.9	91.07
Age of household head	18 and below (N=8)	12.5	87.50
	19-24 years (N=121)	2.5	97.52
	25-34 years(N=545)	2.9	97.06
	35-44 years (N=603)	2.8	97.18
	45-54 years (N=542)	2.2	97.79
	55 years and above (N=522)	1.3	98.47
Sex of household head	Male (N=1721)	2.5	97.50
	Female (N=620)	2.3	97.74
Number of household members	1-4 members (N=751)	2.7	97.34
	5-9 members (N=1322)	2.2	97.73
	10-14 members (N=250)	2.8	97.20
	15 and above members (N=18)	0.0	100.00
Number of children (0 -17)	No children (N=215)	1.4	98.60
	1-4 children (N=1528)	2.4	97.64
	5-9 children (N=577)	2.8	97.05
	10-14 children (N=13)	7.7	92.31
	15 and above children (N=8)	0.0	100.00

External walls

More than a third (42.6%) of the households have dwellings with external walls made of burnt bricks/blocks with cement, while 57.5% used other materials. Younger household heads (18 and below), female compared to male headed households were likely to have external walls of their dwelling units made of (other) mud and wattle. In addition, the findings show that urban areas were more likely to have external walls of their dwelling units made of burnt bricks and cement (66.2% versus 45.4%). Over 50% of households with no children lived in dwellings with brick/block and cement (see Table A. 4).

Table A. 4 External wall building material of household dwelling unit by location of household, age and gender of household head and household size

Indicators		1. bricks/blocks with cement (%)	Others (%)
	All (N=2314)	42.6	57.45
Rural/ urban	1. Rural (N=1597)	45.4	54.60
	2. Urban (N=408)	66.2	33.82
	3. Refugee community (N=336)	0.6	99.70
Age of household head	18 and below (N=8)	25.0	75.00
	19-24 years (N=121)	38.8	61.16
	25-34 years(N=545)	36.5	63.67
	35-44 years (N=603)	44.4	55.56

	45-54 years (N=542)	41.0	59.04
	55 years and above (N=522)	49.6	50.38
Sex of household head	Male (N=1721)	43.87	56.13
	Female (N=620)	38.87	61.13
Number of household members	1-4 members (N=751)	44.2	55.79
	5-9 members (N=1322)	40.8	59.23
	10-14 members (N=250)	44.4	56.00
	15 and above members (N=18)	83.3	16.67
Number of children (0-17)	No children (N=215)	51.2	48.84
	1-4 children (N=1528)	43.0	57.00
	5-9 children (N=577)	37.8	62.39
	10-14 children (N=13)	61.5	38.46
	15 and above children (N=8)	50.0	50.00

Appendix 7. Survey protocol in Benin

Training of investigating officers

On Friday, July 29, 2022, was held as part of the study entitled **"C**aractérisation du profil des ménages dans les zones d'intervention de l'AFD au Bénin", the training of investigative agents and supervisors involved in data collection. This training took place at the Martin Luther King College in Cotonou and was attended by sixteen (16) university-level investigative officers with experience in collecting socio-economic data from rural households. Their list is annexed to this report. Three trainers from the Institute were mobilized for the occasion. The training of field officers was conducted in the following steps:

- ❖ Presentation of the study
- ❖ Presentation of the collection application and its installation on tablets
- ❖ Review of the collection tool
- ❖ Field Manual Review
- ❖ Miscellaneous (Logistics and practical arrangements)

The aim of the training was to provide information, knowledge and skills necessary for investigating officers (Research Assistants) for data collection in this study. The study and its objectives, the field manual and the consent form were conducted there. In addition, the installation of the Survey Solution "Interviewer" application and the presentation of the questionnaire programmed on Survey Solution were carried out and helped to get started with the collection tool. A consistency test was conducted considering contextual realities, to ensure the quality of the data collected. In addition, during the training, each interviewing officer practiced administering the questionnaire, sending the questionnaires to the server. The practice of synchronizing the tool was also carried out to prepare the interviewers for situations of change of version of the questionnaire due to possible modifications.

The training allowed the investigating officers to familiarize themselves with the data collection tool, the questions to ask. They were also able to obtain explanations in practical terms on the methodological approach to sampling and identifying respondents in the field.

Participant identification of respondents

The collection proved to be a delicate operation, particularly with regard to the sampling and identification of respondents. The protocol developed as part of this data collection consisted in the fact that the data collection officers once in each village requested the

support of the village chief and/or his advisers to produce the map of the village territory by show of hands. It is a sketch that will serve as a base map. It will then be a question of finding the 4 cardinal points namely the North, the South, the East and the West to form the North-South and East-West axes on the sketch of the map of the village terroir. This allows to have the first four quadrants as illustrated in the figure below. The North - Northeast axes; South - Southwest; East - East North and West-West North will then be traced to subdivide the village into 8 quadrants. Each sample represents a sampling sub-area from which one eighth of the number of households sampled in each village will be selected. As such, if the interviewer is inside a quadrant, he administers the questionnaire to the first present household he will find. He will leave the next one he finds to administer the questionnaire to the next one and then leave the next one to take the next one, and so on until he covers the number of questionnaires required in the fourth. This is a systematic sampling that respects the steps of 1 in 2.

This method, which therefore consists in distributing over 8 quadrants equally the number of households planned to be sampled in each village, assumes a certain homogeneity in land use. However, there could be quadrants where the number of households varies. Thus, if the required number of households in a dial is not obtained, the missing number will be equitably distributed over the remaining quadrants until reaching the size of the sample of households required for the village.

Figure A. 27. Graphical illustration of the systematic sampling areas in each village
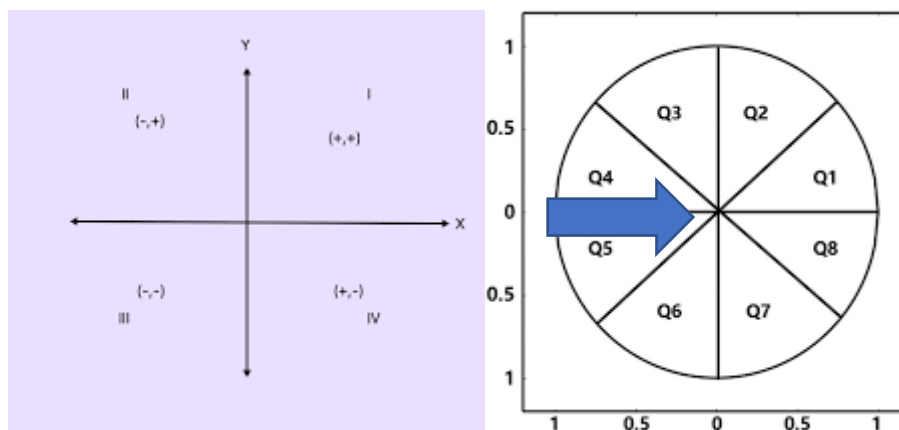
Use of "Survey Solutions" software for data collection

The tool used for this data collection is survey solutions software. It works with an Android system. As a result, smartphones/tablets with an Android system were used for data collection. The team of digitization and programming of questionnaires on tablet, ensured

the training of data collection agents and their supervision throughout the field period. Particular attention was paid to the navigation in the tool, the distinct functions of recording, synchronizing, saving and sending questionnaires. Below is an excerpt from the content of the material:

Survey Solutions User's Guide

When it comes to using Survey Solutions, data collection agents are expected to follow the steps below:

- Start the tablet by pressing the first button from the bottom to the top to the right of the smartphone.
- Click once on the *Survey Solutions* software icon on the tablet. Once inside the software, you will find the questionnaires that will be assigned in "***Assignment***".
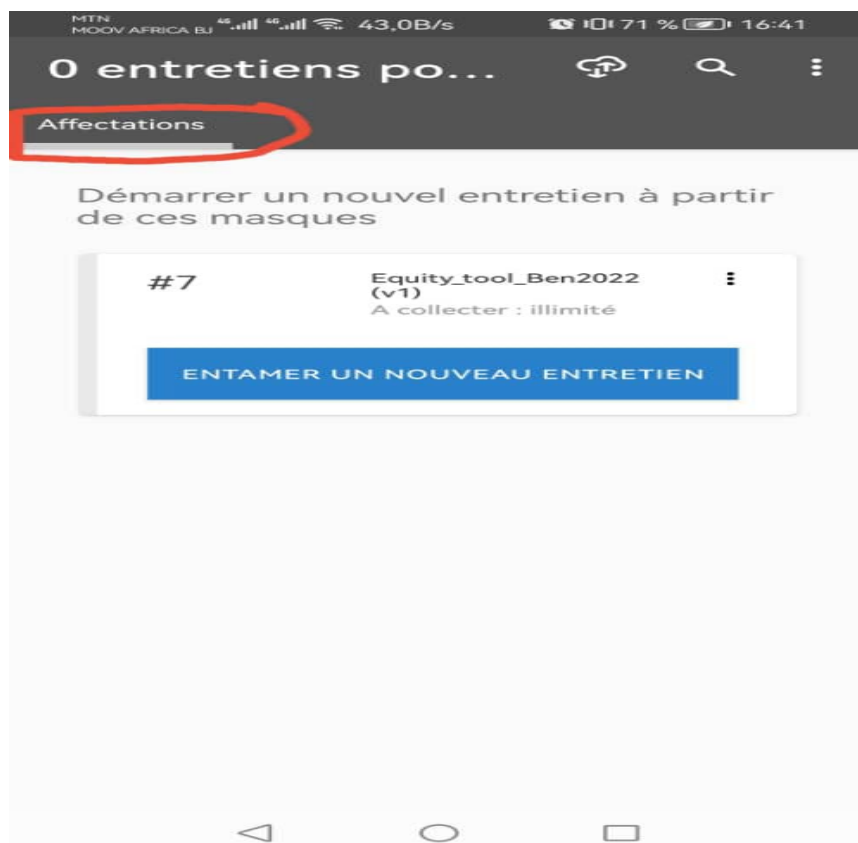

Figure A. 28. Assignment

A main step is necessary to start the interview: the start of a new interview.

- Click on "***Start a new interview*** " to administer the questionnaire to the respondent
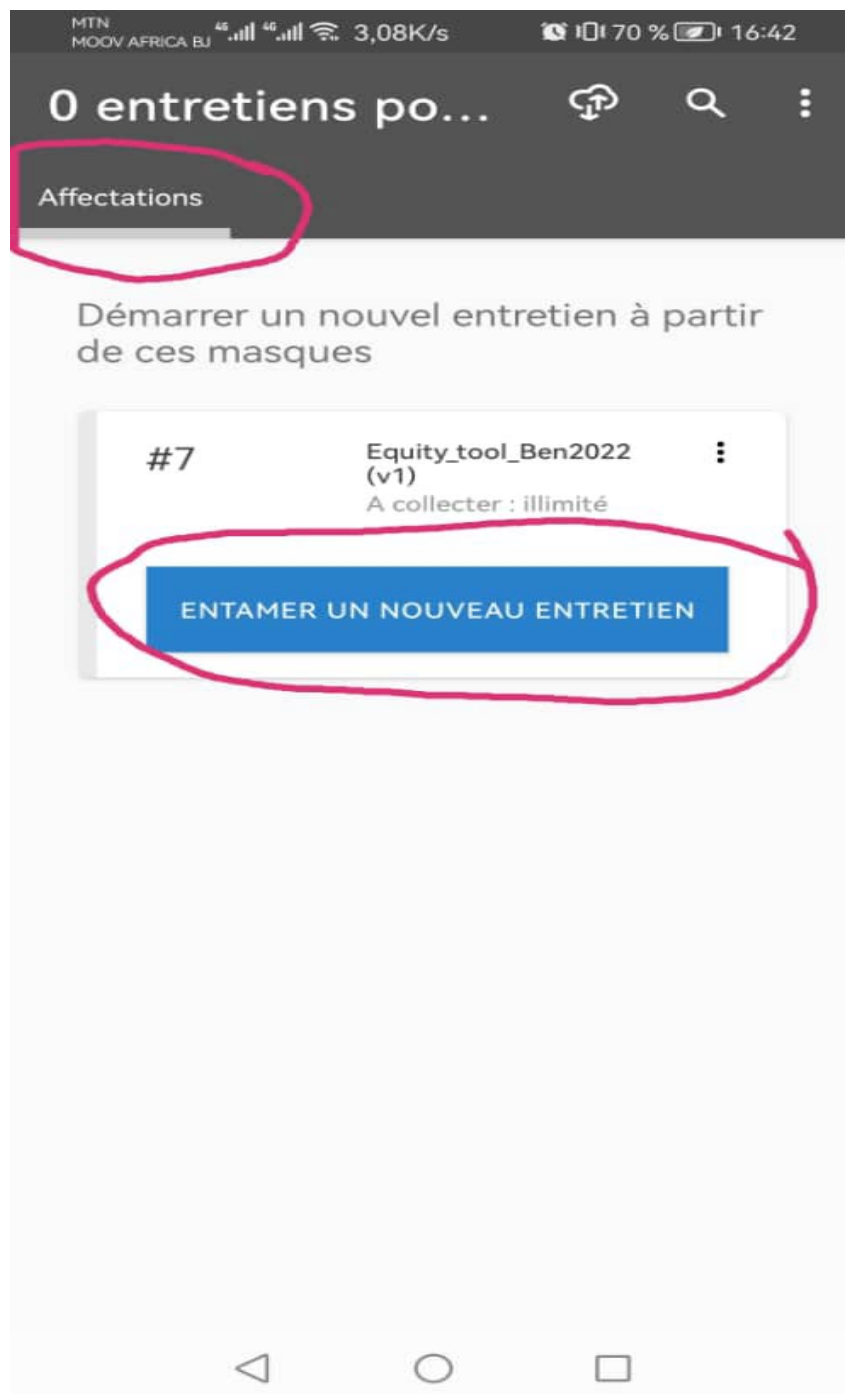
Figure A. 29. Starting a new interview

- When you are at the end of the last section of the questionnaire (after completing the last question), click on the "***Go to the summary screen***" section. You will see this message: "***You are about to complete the interview…   ».***   The status of the questionnaire is displayed in 03 parts: **Filled in / No answers / Error(s)**. To finalize click

on "**Finish**". As soon as you press "*Finish*", the program takes you back to the main menu and gives you the opportunity to start a new questionnaire (interview).

Figure A. 30. Completing an interview

Also, from the main menu, you can always go back to a form (questionnaire) already completed, to make changes when necessary. To make changes to a form, click on the "Completed" tab to access this questionnaire. Once the changes are complete, you need to go to the end of the questionnaire and select "*Complete*".

Survey Solutions usage

Collecting data with a tablet has the advantage of minimizing the risk of errors and facilitating the work in that question breaks are handled automatically, and filling instructions appear in the form.

- For proper use of the software the investigator must ensure that the sections entered are turned green before moving on to the next section.
- The questionnaire is programmed so that an error message is displayed to alert the interviewer when he fills in a wrong answer. For example, for questions whose answers require only numbers, an error message appears when the investigator enters letters. To prevent error messages from appearing in the form,

simply correctly read the instructions in the error message that is in red under each question.

Figure A. 31. Error Message

Types of questions

There are four types of questions:

- Multiple choice questions where the respondent is given the opportunity to choose several answers. For this type of question, a square is in front of each answer modality.
- Single-choice questions where the respondent can choose only one answer. A square is in front of each modality of answers.
- Questions where the answers are texts to be entered and finally,
- Questions where the answers are numerical values.

For multiple choice or single-choice questions, when the "Other" modality is chosen, you must ask the respondent to specify or describe their answer.

Overview of the work done

The investigator can have an overview of his work at any time. *Survey Solutions* shows the number of questionnaires completed and the number of questionnaires not finalized or started (see diagram below). Any form fully completed (all sections filled in) and saved can be found in the "Completed" tab. On the other hand, all forms that have not been completed and partially saved are saved under the "Started" tab.
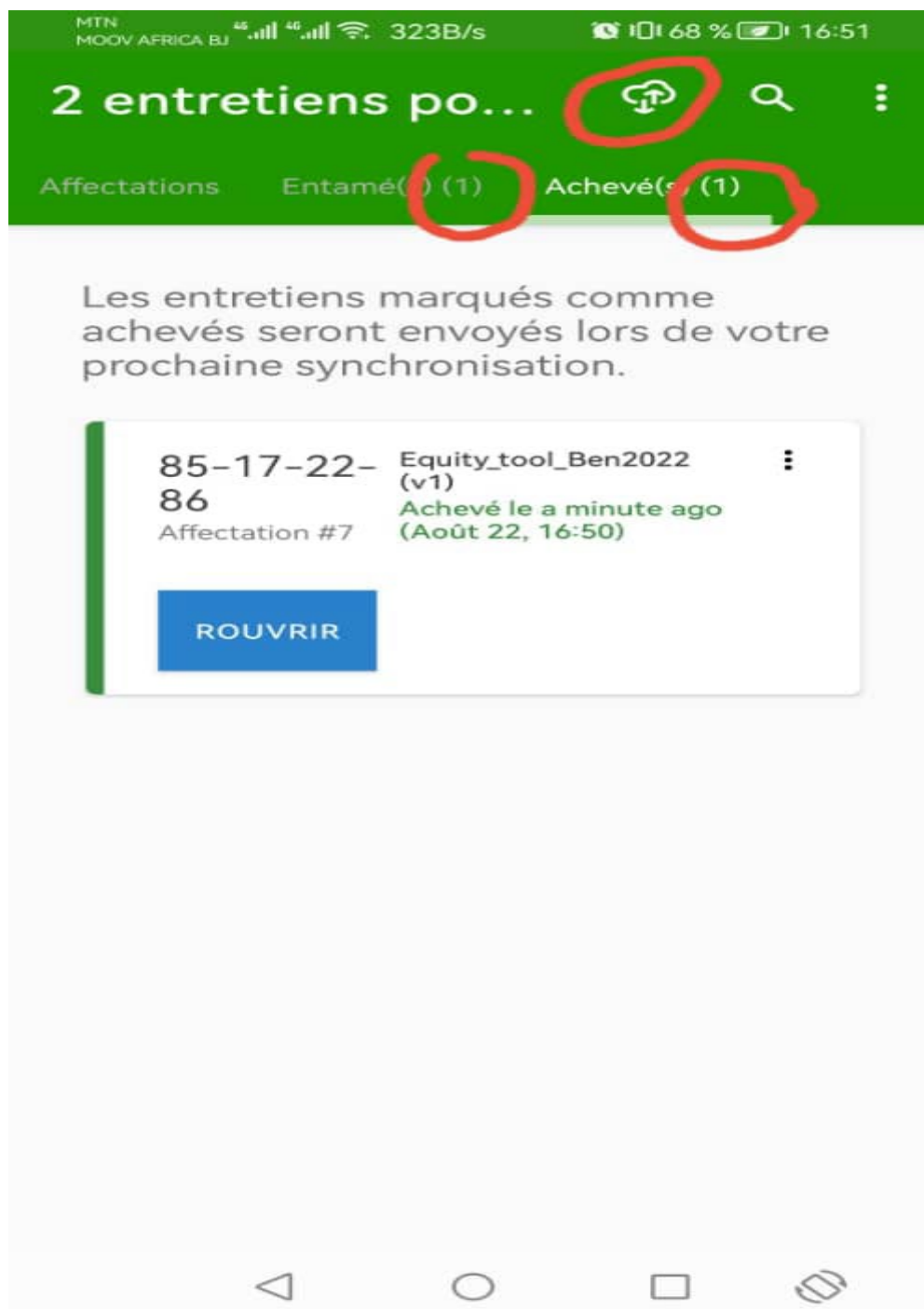
Figure A. 32. Synchronization

To send the data to the server, all the tablet is connected to the internet, and you click on the "Synchronize" tab in the shape of the cloud.

How to edit a partially started form

To edit a partially saved or started form:

- Click on the "*Started" tab*. After clicking on this tab, you will see all the forms that have been partially saved or started as shown in the diagram below. For each saved form, you will have the date and time the form was saved. This information is important because it allows you to quickly find your way around the form you want to edit.
- Choose the form you want to edit by clicking on "***Open***". Once you select the form to edit, the software takes you directly back to the cover of the "***Cover***" questionnaire,
- Click on the **03 horizontal dashes at the top left**, the software shows you the sections of the questionnaire. In green are the **finalized sections** and in blue the **unfinalized ones.**
- Click once to edit and finalize the section. A finalized section or heading changes to green otherwise it remains blue. When you finish the necessary changes, all sections will change to green.
- Click "***Summary***" to have the status of the questionnaire and finally finalized by clicking on "***Complete***". Thus, this form will no longer be under the "Started" tab but at the "***Completed"*** tab.

Reminder on how to write daily reports

The preparation of daily reports from the field is a tradition at BAROMETRE. Each agent is required to send the report of the day no later than 8 pm.

The components of the daily ratio include:

Date: __/__/2022
Commune:
District:
Village:
1/Number of Complete questionnaires completed:
2) Difficulties encountered: SAR
3) Solutions provided:
Name of Research Assistant:

Red tape

The administrative formalities concern:

- The signing of the service contract.
- The delivery of tablets and accessories.
- The delivery of the start-up advance.

Finalization of the programming of the questionnaires

The questionnaire programmed on tablet is the latest version that was sent by the research team. This questionnaire is subdivided into 3 parts, including the one relating to general information, the one containing equity issues and a final part for additional questions.

Data Collection

Composition of the teams

The data collection team consists of sixteen (16) investigating officers. Table A. 5 below shows the constitution of the data collection team by study area.

Table A. 5. Composition of the field team

Department	Study Coordinator	Data Manager/Programmer	Supervisor	Data Quality Controller	Investigators	# of days
ALIBORI			1		4	7
BORGOU						
ATACORA			1		2	4
DONGA						
Would	1	1	1	1	3	4
ATLANTIC						
MONO			1		1	3
HILLS					3	5
OUEME			1		3	4
PLATEAU						
TOTAL	**1**	**1**	**5**	**1**	**16**	

Roles and responsibilities of team members

Investigators

The interviewers went through the villages assigned to them with the objective of effectively administering the questionnaire to the number of households sampled in each village over the actual working time defined. Indeed, they are responsible for:

- Identify/Enumerate households by village.
- Ensure the conscientious and complete administration of the questionnaire in the field.
- Re-run the questionnaires before synchronization.
- Make a daily point of the number of households surveyed, the difficulties encountered, and the solutions provided.

Data Controllers

The role of the Data Controller is to:

- Check whether all the questions in the questionnaire are filled in without inconsistency by the interviewers.
- Return inconsistent questionnaires to investigators while they are still in the field.
- Verify and validate if applicable the questionnaires corrected by the interviewers.

Number of households sampled by department

A sample of two thousand three hundred and fifty-six households, provided by the United Nations University research team, is covered as part of this sample (see Table A. 6).

Table A. 6. Number of households sampled by department

Department	Number of Villages sampled by department	Number of households sampled by department
ALIBORI	11	393
ATACORA	8	232
ATLANTIC	13	107
BORGOU	12	519
HILLS	15	308
DONGA	1	25
MONO	5	97
OUEME	14	252
PLATEAU	5	125
Would	13	299
TOTAL	97	2356

Assignment of investigators

During this data collection, some surveyors were deployed to another municipality to meet the requirements of the number of households to be covered in each municipality.

Quality control of the data collected

The quality control of the data collected was carried out at two levels, namely the constraints introduced in the programmed questionnaire on the one hand and the real-time control of the data sent to the server by a programmer.

Data quality control with "Survey Solution"

Quality control of the quantitative data was done as the investigating officers synchronized the completed forms on the server. Data quality control included checking whether all sections of the questionnaires were properly populated without inconsistency, not to mention the abnormal skipping of questions. These were

- Pay attention to the four colors of Survey Solutions: Green is displayed when all the questions have been filled in, but not all are necessarily correct. So, you always have to check. Gray when sections are jumped by jumping. Blue when questions are not filled in and this must always be checked. Red when there is an error in the investigator's answer to at least one question.
- Check the activation conditions for unfilled questions (gray questions) to ensure that their jump is normal.
- Take a close look at the "Cover" section: Pay attention to the phone number of the head of household. The investigator must:
  - Put "*99999999*" if the head of household does not have a phone number that can be reached or specify in the comment at the end if the number entered is not actually for the head of household and say to whom it belongs.
  - Put the "*Not applicable*" modality for household members whose age is less than 15 years
- Make a general comment based on the colours noted in the questionnaire.
- Instruct the interviewer to look at comments specific to the questions whose answers are at issue.

Communication by TICS for collection management

Close contact is maintained with investigating officers through Information and Communication Technologies (ICT).

- We have set up a toll-free number to allow respondents to contact us directly with questions and other concerns.
- We have set up a WhatsApp group consisting of the Data Collection Coordination Unit, Data Controllers, and Investigators. The WhatsApp group is intended to recall the identification protocol and share experiences in the field
- We also exchanged by phone calls and emails.

Supervision and support of the coordination unit

Supervision of data collection was done through daily monitoring. Officers have been identified at the team level for supervisory purposes. This follow-up consisted of debriefing with each investigator. This daily and in-depth debriefing aimed to allow the investigating officers to take stock of the day in terms of the objective achieved and to report on the difficulties encountered. Strengths were shared with other officers and strengths were identified and corrected as data collection evolved. The investigating officers were also provided with resources to trace the slightest blockages of the progress of the collection. This upward flow of information made it possible to give the necessary instructions to the rest of the group.

Challenges in data collection

The major challenges encountered in data collection are of several kinds. These are:

- GPS location that does not sometimes work in some villages.
- The lack of a good internet connection during synchronizations by agents to send data and receive any rejected questionnaires.
- The reluctance of some households to participate in the survey.
- The great distance that separates the villages, especially the villages of the north.

Faced with these challenges, the solutions adopted are:

- The deactivation and reactivation of the location button.
- The retreat to well-covered areas with an internet connection.
- The support of a guide who is resident of the village.
- The use of community leaders, local councilors, heads of villages or wards, etc.

It should be noted that the impracticability of the tracks due to their degraded condition and the rainy season made data collection particularly difficult and longer than expected.

The overall data collection went very well despite the operational challenges on the ground.

Descriptive statistics of dataset

Response rate

Out of a total of 2357 households, 2356 gave their consent to participate in the interview, i.e., an adherence of 99.96% against a case of registered refusal (see Table A. 7).

Table A. 7. Response rates

Consent	Actual	Percentage	Cumulative percentage
Not	1	0.040	0.040
Yes	2,356	99.960	100.000
Total	2,357	100.000	

Data clearance

In order to facilitate the analysis and understanding of the different variables present in the different databases, we carried out a clearance of the raw data. Considering that what biases an average, will bias a regression, we conducted the clearance by focusing on outliers, missing values, input errors, erroneous survey codes, illogical values, duplicates, etc. Although other factors can also bias a regression, we believe that this conceptualization offers a good starting point for having an adequate database.

Descriptive statistics of key variables

This study was conducted in rural areas and therefore the households are all rural. To this end, the results showed that about two percent (62%) of the households surveyed have access to electricity while thirty-eight percent (38%) do not have it as shown in Table A. 8.

Table A. 8. Access to electricity

Access to electricity	Actual	Percentage	Cumulative percentage
Not	895	37.99	37.99
Yes	1,461	62.01	100.00
Total	2,356	100.00	

Among households that do not have access to electricity, eighty percent (79.78%) have as their main reason that they do not have electricity because of fees associated with the service while twenty percent say there is no electricity in their village. These results are illustrated in Table A. 9.

Table A. 9. Main reason for non-access to electricity

Why don't you have electricity?	Actual	Percentage	Cumulative percentage
There is no electricity in my village	181	20.22	20.22
I can't pay	714	79.78	100.00
Total	895	100.00	

With reference to Table A. 10, more than ninety-one percent (91%) of the households surveyed have a male head while eight (8%) have a female head.

Table A. 10. Sex of head of household

Gender of head of household	Actual	Percentage	Cumulative percentage
Feminine	193	8.19	8.19
Masculine	2,163	91.81	100.00
Total	2,356	100.00	

Table A. 11 shows 44.31% of the households surveyed are Christians, 38.20% are Muslim and 15.75% practice Vodoun.

Table A. 11. Main religion of households

Main religion practiced in the household	Actual	Percentage	Cumulative percentage
Other languages	41	1.74	1.74
Christian	1,044	44.31	46.05
Muslim	900	38.20	84.25
Vodoun	371	15.75	100.00
Total	2,356	100.00	

Table A. 12 shows that seventy-four percent (74.36%) of the households surveyed say they do not have a bank account, while twenty-six percent (25.64%) of the households surveyed do.

Table A. 12. Possession of bank accounts

Bank account ownership	Actual	Percentage	Cumulative percentage
Not	1,752	74.36	74.36
Yes	604	25.64	100.00
Total	2,356	100.00	

With reference to Table A. 13, about seventy-six percent (75.68%) of the households surveyed do not have a watch, while twenty-four percent (24.32%) say they own one.

Table A. 13. Possession of watches

Watch ownership	Actual	Percentage	Cumulative percentage
Not	1,783	75.68	75.68
Yes	573	24.32	100.00
Total	2,356	100.00	

Table A. 14 shows that eighty-two percent (81.71%) of the households surveyed say they own arable land and eighteen percent (18.29%) do not.

Table A. 14. Possession of arable land

Possession of arable land	Actual	Percentage	Cumulative percentage
Not	431	18.29	18.29
Yes	1,925	81.71	100.00
Total	2,356	100.00	

The study, which focuses on the equity and vulnerability of the poorest, collected data that reveals that about one-third of households residing in the study's coverage areas do not have electricity. Among this group of households, it appears that more than 80% say they do not have electricity because they do not have the financial resources to meet the expenses induced by this service. This means that even if electricity were available, accessibility will remain a major challenge for some households. It will therefore be necessary to find facilitating mechanisms to enable them to access this kind of convenience, which has a definite positive impact on the health, educational outcomes, income and overall well-being of households.

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