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Innovations, Technology and Time Allocation: Implications for Labour Productivity and Welfare in Ghana

Felix A. Asante, Martha A. Awo, Benjamin B. Bonzo, Ralph Sam and Sundus Saleemi

Abstract

This report investigates the dynamics of time allocation of men, women, and children in various types of work in rural households in Ghana. Using primary data and the Ghana Time Use Survey (GTUS) 2009, it examines gendered differences in time allocation and the interaction between income, various household types and time use. Moreover, women's time use patterns and their relationship to children's diets are analysed. We also assess patterns of time use and their relationship with productivity. Finally, domestic and agricultural technologies and time use patterns are assessed. The study finds persistent gender gaps, with women and girls disproportionately engaged in unpaid work across different household compositions and income groups. Household characteristics, such as single-adult households and income levels, shape time allocation, influencing the distribution of work among family members. Moreover, women's time on unpaid activities shows a positive association with children's dietary diversity, underscoring the importance of women's involvement in household chores and caregiving for nutritional outcomes. However, the study finds that women's time in unpaid work negatively impacts their labour productivity, suggesting potential trade-offs between domestic responsibilities and economic participation. Access to technologies and services, such as agricultural tools and markets, appears to play a role in shaping time use patterns and women's engagement in paid activities. The findings suggest policy implications for reducing the burden of unpaid work through technological interventions, redistributing household responsibilities, and promoting gender equality to enhance women's economic empowerment and household well-being.

Keywords: Time-Use, Unpaid Work, Gender Inequality, Children's Diets, Technology

JEL codes: J22, J16, B54

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All errors and omissions are our own.

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1 Introduction

In agricultural households in rural areas, women spend more hours per day in work than men. Women's roles as the caretakers of children, the elderly, and the infirm members of households and as managers of domestic tasks (cooking, cleaning, washing, provisioning water, etc.) add to their total work. Work, per the International Labour Organization's (ILO) definition, includes any activity performed by persons of any sex and age to produce goods or to provide services for use by others or for own use, i.e paid or unpaid1. Sustainable Development Goal Five (SDG 5)–achieve gender equality and empower all women and girls – also sets the target to "recognize and value unpaid care and domestic work" in its target 5.4. Even though this type of work is not compensated, it claims a significant amount of women's time and effort. Competing claims on women's time may render it inelastic to price signals and market incentives having potential implications for productivity and allocation of labour. For instance, women may not be able to participate fully in paid work or market activities.

Economic or non-economic factors, however, may shift the distribution of various types of work among household members. For example, interventions aimed to increase women's participation in paid work or market activities may lead to a shift in domestic work from women to children. This may have deleterious effects; children may have to drop out of school or reduce their leisure. Interventions, including institutional changes, agricultural and domestic technologies, and provision of services may, on the other hand, reduce the time needed for domestic work freeing up women's time for higher participation in paid work without increasing children's work. For example, access to piped water to the household may reduce the time required for the provisioning of water for the household, a task often attributed to women or children.

Studies quantifying the impacts of innovations and technology on women's overall work including domestic and care work are scarce. This is particularly true for countries in Africa. One reason is that the traditional (SNA) definition of work does not include unpaid care and domestic work in the production boundary. Data on this type of work is often not available in large-scale household surveys. In this regard, time-use data can be helpful. Time-use data provides an alternative measure of overall work (per the ILO definition) by indicating the time spent by individuals in various activities including the time spent on the provision of goods and services for household consumption.

This report addresses this gap by;

1. Analysing patterns of allocation of men's, women's and children's time in paid and unpaid domestic and care work, total work and leisure,
2. Analysing the relationship between time use and indicators of nutrition,
3. Analysing the relationship between time-use and household productivity,
4. Identifying technologies and infrastructure that reduce time burdens.

The research questions posed are as follows;

1. What is the time use pattern of men, women and children in rural areas of Ghana?
2. What is the relationship between women's time use and children's nutrition?
3. What is the relationship between women's time use and household productivity?
4. What technologies impact patterns of men's, women's and children's time use?

[1] https://ilostat.ilo.org/resources/concepts-and-definitions/forms-of-work/

The remaining part of the report is structured as follows. In section 2, the report reviews the literature on the time use patterns of both sexes, the relationships between time use and household welfare, time use and productivity as well as time use and technology. Section 3 discusses the data used and the methodology employed in the study. Section 4 presents the analysis of patterns of time use disaggregated by household types and income category. In section 5, we present analysis of the relationship between time use and the respective variables – household welfare, productivity, and technology. In section 6, a discussion of the results is provided. Section 7 concludes the study and proffers relevant policies for consideration.

2 Review of Literature

2.1 Time Use Patterns

Globally, men have increased the amount of time they spend doing unpaid work but women still spend more. In advanced economies, the gender gap in unpaid work hours has decreased overtime with women performing more paid work and less unpaid work (Bick *et al.,* 2018; Fang & McDaniel, 2017; Alonso *et al*, 2019). Patterns disaggregated by age groups show that gender differences in time use are lower in personal care, sleeping, and meals, followed by leisure time (including screen-based leisure and active leisure), and highest in housework, caregiving, and paid employment activities. There are, however, regional differences as well as differences in age groups (Roman & Gracia, 2022).

Women carry out more unpaid care and household duties and spend more time working than men in low- and middle-income countries (United Nations, 2020; Komatsu *et al.,* 2015; Feinstein *et al.,* 2013; Fontana & Natali, 2008; Katapa, 1993). There also are gender differences in types of activities; men spend more time on paid activities than women, and they spend about two times as much time as women on sociocultural activities and media consumption. Conversely, women spend over two times more time on household chores than men and more than four times as much time taking care of others (Mailumo and Ishaya, 2021; UBOS, 2019; GSS, 2012; Budlender, 2000).

For sub-Saharan Africa, women work an average of 6.9 hours per day (3.5 of which are spent on unpaid work and 3.4 on paid work), compared to men who work an average of 6.0 hours per day (1.2 is spent on unpaid work and 4.8 on paid work) (UN, 2020). There are differences across different geographic locations, cultural traditions, and socioeconomic classes. The average time spent on paid activities by both genders is higher for rural communities than urban areas and it is also higher for men than women. Rural women dwellers spend more time on unpaid work than those in urban communities and the time spent is about 3-4 times more than men. Men in urban areas spend a little more time on unpaid work than men in rural areas. On average, urban dwellers spent more time on learning and other non-work activities than rural dwellers and it was higher for men than women. The absence of domestic technology explains why unpaid labour accounts for a significant portion of time allocation to which women devote a lot of time to carrying out domestic duties, particularly when traveling to and from their homes (ElKhorazaty and Zaky, 2022; Leavens *et al.,* 2019; GSS, 2012).

In addition to the locality (urban/rural), household level factors also impact patterns of time use. For example, land area owned by the household, non-wage income, number of children (Rees, 2017; Rathnayaka and Weerahewa, 2015; Singer *et al.,* 2009; Hilbrecht *et al.,* 2008; Newman *et al.,* 2007; Larson & Verma, 1999; Skoufias, 1993). When the maximum weekly employment hours are regulated by law, time use patterns can only change to a limited extent (Lee *et al.* 2012).

Many factors explain shifts in the patterns of men's and women's time use overtime. These include access to natural resources, types of farm work, and domestic activity. Forest loss activities shift gendered labour; men devote more time to paid work than women on average, but women invest extra time in agriculture, forestry, and labour-sharing (Mishra and Mishra; 2012; Calvo, 1994). New industries also shift gendered patterns; men spend more time on unpaid housekeeping as a result of women working on cut-flower farms (Korovkin, 2003; Newman; 2002).

Studies on children's time use show that both in advanced and developing nations, female children devote longer time to domestic work than males (Gager *et al.,* 2009; Hilbrecht *et al.,* 2008; Larson & Verma, 1999; Lloyd *et al.,* 2008). According to Gager *et al.* (1999), disparities in the types of domestic chores may account for gender inequalities in the amount of time spent doing tasks. However, Hilbrecht *et al.* (2008) proposed that gender theory-supported expectations for traditional gender roles reflect how much time male and female kids spend performing chores. Research has also highlighted that children's leisure activities vary depending on their gender. Compared to girls, boys are more likely to engage in organized sports, video gaming, and outdoor play (Aguiar *et al.,* 2021;

Rees, 2017; Singer *et al.,* 2009; Hilbrecht *et al.,* 2008; Newman *et al.,* 2007). Nevertheless, there have been conflicting results about gender differences in children's television consumption (Rees, 2017; Singer *et al.,* 2009; Larson & Verma, 1999). In the study of Larson and Verma (1999), they found that boys devote as much time to watching television as girls. Some current findings discovered differences between the sexes to be insignificant (Rees, 2017; Singer *et al.,* 2009; Newman *et al.,* 2007).

2.2 Time Use and Household Welfare

Women and girls often face trade-offs in allocating their time to activities such as shopping, childcare, farming, preparing food, paid work, and many others (Jones *et al.,* 2012). This has implications both for their ability to reap the benefits of participation in income generating activities as well as for their ability to provide for their children and other members of the household (Ilahi, 2000). Underprivileged households tend to suffer when women devote less time to cooking as it is negatively related to dietary variety, particularly for young children (Komatsu *et al.,* 2018). Relatedly, women spending more time in agriculture reduces the chance of their children being vaccinated, medical reviews, and getting informed messages on health and nutrition because they may be able to seek medical attention outside of the home (Bhalotra, 2010). In addition, other related studies have found that women who spend more time on paid work have no positive effect on household welfare. With an additional income flow of the household in terms of wages from the woman's paid work, household expenditure remains the same and health expenditure on children continues to increase due to reduced time for childcare and health (Kadiyala *et al.,* 2014; Berman *et al.,* 1997). Notwithstanding, the trade-off can be complicated and dependent on several variables. The effects of women's time spent working in agriculture vary depending on whether the household is poor or not or if there are other members of the household undertaking unpaid work (Johnston *et al.,* 2018; Kadiyala *et al.,* 2014; Ruel & Alderman, 2013; Headey *et al.,* 2012; Lamontagne *et al.,* 1998; Engle *et al.,* 1999).

2.3 Time Use and Productivity

Women are less productive economically than men because they bear more responsibilities and spend more time in reproductive activities (Cawthorne, 2008). Time use may have implications for household and individual productivity as well. Spending more time in leisure has a positive impact on productivity. Women who have children tend to spend less time on leisure activities than men who have children, which may tend to reduce their productivity as the women suffer from psychological distress (Klaver & Lambrechts, 2021). An analysis of women's role in subsistence agriculture estimated using a national time-use survey conducted in 2018 in Egypt reported that the probability of household food security increased for women spending more time in subsistence farming than men suggesting higher productivity of women in agriculture (ElKhorazaty and Zaky, 2022).

2.4 Time Use and Technology

Labour-saving technologies appear to positively impact people's health. However, households' immediate response to the adoption of a labour-saving technology is unlikely to have a positive effect on their health. It rather focuses on saving time. Whether there is an increase in consumption will depend on how the extra time is used. Different dietary choices could also result in better health (Jalan & Ravallion, 2003; Gamper-Rabindran *et al.,* 2010; Yu, 2011; Kremer *et al.,* 2011; Hanna *et al.,* 2012; Grimm & Peters, 2012). Technologies also relieve women's unpaid work allowing them to increase their participation in the formal workforce (Alonso *et al.*, 2019; Mulligan and Rubinstein, 2008; Greenwood *et al.,* 2005).

Labour-saving domestic technology can help families with children spend more time together; piped water significantly reduces the amount of time spent on water collection and housework (Tsukada and

Dupur, 2016). Devoto *et al.* (2012) found that easier drinking water access tends to increase children's participation in leisure activities and school attendance, but not adult women's participation in waged employment in Morocco. In keeping with this, Koolwal and van de Walle (2013) examined surveys from nine developing nations and discovered no evidence of a consistent rise in the number of paid jobs available to households with access to water supply infrastructure. Similarly, the use of water pumps has been found to reduce the time spent fetching water, resulting in more time for other activities (Kassie *et al.*, 2018). Cookstoves also allow households to reduce the time spent gathering fuel giving women and girls more time for other useful and educational tasks (Prah *et al.* 2021; APT Action on Poverty, Uganda project evaluation, 2014). The use of improved stoves has been linked to a reduction in the time spent on cooking and collecting firewood (Quinn *et al.*, 2015).

3 Data and Methodology

The secondary data used in the analysis is the Ghana Time-use Survey (GTUS) 2009. Primary data on time use was collected from a sample in two (2) regions of Ghana. Time-use data was collected using a list of activities performed by an individual during the previous 24-hour period. The study was conducted in two regions in Ghana, the Eastern and Upper East regions. In the Eastern region, data was collected from Kwaebibirem and Denkyeambuor districts and in the Upper East region in Bolgatanga and Kassena-Nankana East municipalities.

3.1 Survey Design and Sample Size Selection

The study used a two-stage stratified sampling design. The sample frame was stratified into 16 administrative regions. The first stage involved the selection of the study area. In selecting the study area, considerations were given to regions that shared similar agricultural characteristics; Kwaebibirem and Denkyeambuor districts in the Eastern region and Bolgatanga and Kassena-Nankana East municipalities in the Upper East region were selected. Each selected district was then divided into clusters (EAs). Out of these clusters, thirty (30) enumeration areas (EAs) were selected to form the Primary Sampling Units (PSUs)[2]. A complete listing of households in the selected PSUs was undertaken to form the Secondary Sampling Units (SSUs). The second stage of the selection involved a systematic simple random sampling of 20 of the listed households from each selected cluster. The total sample size was 600 households from the two districts (see Table 1).

Table 1: Sample Size determination

Regions	Districts	Number of selected EAs	Selected households (20 each)
Eastern	Denkyeambuor	5	20 * 5 = 100
	Kwaebibirem	10	20 * 10 = 200
Upper East	Kasena-Nankana	9	20 * 9 = 180
	Bolgatanga	6	20 * 6 = 120
	TOTAL	**30**	**600**

3.2 Description of Study Areas

3.2.1 Kwaebibirem Municipal

The Municipality is among the 33 Districts in the Eastern Region, with Kade as its capital. The economy of the Municipality is predominantly agrarian with both subsistence and commercial production of food and cash crops. Oil palm, cocoa, and citrus are the major traditional cash crops cultivated. However, the rearing of livestock, poultry and fish farming is gradually catching up with farmers in the municipality. Non-farming activities in the district are small and medium-scale activities such as handicraft making, sawmilling, gari processing, palm oil extraction, distilling of alcohol, carpentry and repair works, trading, and many others. One large manufacturing company in the Municipality is the Ghana Oil Palm Development Company (GOPDC) at Kwae. There are three main occupational categories in the district: skilled workers in agriculture, forestry, and fisheries; services and sales; and crafts and allied trades. Agriculture, forestry, and fisheries are the highest employment sectors

[2] The number of EAs for each region was proportionately allocated based on the estimated 2021 population share for each region. The list of EAs from which the samples were drawn was based on the 2021 Population and Housing Census.

(39.6%), followed by service and sales personnel (19.0%) and crafts and associated trades (15.2%) (GSS, 2019).

3.2.2 Denkyeambuor District

Agriculture is the main economic activity of the district of Denkyeambuor. About three-quarters of the working population is involved in the production of both food and cash crops on subsistent and commercial levels. Some of the crops include cocoa, oil palm, orange, plantain, cocoyam, cassava, cereals (maize) and vegetables. Animal husbandry is also practised on a small scale. The processing activity is commonly found in oil palm but, on a small scale in areas like Kusi, Wenchi, Takorowase and Anweaso (GSS, 2019). The district has large oil palm plantations cultivated by individuals and corporate organizations such as the Ghana Oil Palm Plantation Development Company Limited (GOPDC). The Oil Palm Research Institute and the University of Ghana Agricultural Research Stations are all located in the district. The district also has a commercial diamond mining company called Great Consolidated Diamonds Limited at Akwatia with other small-scale mining concessions as well as small-scale timber-milling plants at Boadua. In terms of occupation, skilled agricultural, forestry and fishery employ 32.3% of the employed population, followed by service and sales workers (19.9%), crafts and related trade work (15.6 %) as well as plant and machine operators and assemblers (14.9%) (GSS, 2019).

3.2.3 Bolgatanga Municipal

More than half of the population of Bolgatanga municipal enages in subsistence agriculture. Food crops grown are millet, sorghum, maize, rice, groundnuts, cowpea, sweet potato, bambara beans and soybeans. There is also a large-scale cultivation of vegetables such as tomatoes, pepper, okro, garden eggs and onions, and a small-scale livestock production such as cattle, goats, sheep, poultry, donkey, and pigs. Non-farming activities include handicrafts such as straw weaving (baskets and hats), leather products and yarn production. One major industrial activity that provides high employment is the weaving of local textiles to produce the traditional smock. Other industrial activities such as the extraction of groundnut oil, shea butter, dawadawa and locally grown rice processing are mostly dominated by women.

3.2.4 Kassena Nankana Municipal

Kassena Nankana Municipality is primarily rural with a 71.2% of its population living in rural areas. The main economic activity is agriculture – employing about 82% of the working population. These include livestock farming, food cropping, and tree farming (GSS, 2011). The major food crops produced are maize, rice, millet, beans, groundnuts, sorghum, tomatoes, pepper and onions. There are also small-scale agro-processing activities such as fibre, cotton, groundnut paste and nuts, shea butter, Dawadawa, and rice among others.

3.3 Data Analysis

3.3.1 Descriptive Statistics

The questionnaire was designed to gather data on the demographic and socioeconomic traits of the household members, these include age, sex, education, housing and living conditions, assets, use of social services, household income and expenditure, as well as crop and livestock production. The Time Use section recorded the activities and duration of at most three members[3] of the household. Three members of the household, the main adult man, the main adult woman and the eldest child below the

[3] These individual members are primary male and female adult members and the eldest child aged 10-17 years old.

age of 18 were asked about their activities during the previous day. The time dairy was divided into slots of 30 minutes each. More than one activity could be entered into each time interval.

Table 2 shows the summary statistics of the two datasets. On average, each household had about 5 members. 66.2% of household members aged 10 years and above can read and write in any language (language literates). The proportion of household members who are language illiterate was lower in the Eastern region (30.4%) than in the Upper East region (36.6%). However, the proportion of language-literate people is almost double in the Upper East region in the primary data compared with GTUS 2009. The majority of the household members have had some level of education (76.7%); higher in the Eastern than the Upper East region. Overall, about 31.5% of household members are employed, lower than those in the GTUS 2009.

Table 2: Summary Statistics of households socio-economic/demographic characteristics

	Primary Data			GTUS 2009		
Indicators	**Eastern**	**Upper East**	**Overall**	**Eastern**	**Upper East**	**Overall**
Household size	4.2	4.9	4.5	3.2	4.3	3.7
Average age of household members (years)	28.9	26.5	27.6	26.2	25.5	25.9
Household members aged 10+ who can read and write in any language (%)	69.5	63.4	66.3	62.5	31.1	47.6
Household members aged 10+ who can perform basic numeracy (%)	87.1	86.1	86.6	—	—	—
Male household members (%)	50.3	46.1	48.0	46.5	52.0	49.2
Household members who had any educational attainment (%)	84.4	70.3	76.7	85.3	57.4	71.5
Household members who are employed (%)	38.7	25.3	31.4	44.8	56.6	50.6
Total (N)	1260	1487	2747	1584	1505	3089

Table 3 below indicates that interviewed households were largely male-headed (72.3%). On average, household heads were about 50 years old, compared to GTUS 2009, the average age of household heads is higher. About 52% of household heads in the study could read and write in any language, higher than GTUS 2009. Household heads who cannot read and write in any language were lower in the Eastern region than in the Upper East region, an improvement from GTUS 2009 for the Upper East region. Generally, about 18% of household heads could not perform basic numeracy. About 68% of household heads interviewed had ever attended school. Whereas there was an improvement in the Eastern region, a reduction occurred in the Upper East region when compared to GTUS 2009. Generally, about 65% of household heads interviewed were employed. However, household heads who were employed reduced by 24.6 ppts compared to GTUS 2009, and this was severe for the Upper East region (43.3%).

Table 3: Summary Statistics of households socio-economic/demographic characteristics

	Primary Data			GTUS 2009		
Indicator	**Eastern**	**Upper East**	**Overall**	**Eastern**	**Upper East**	**Overall**
Male household head	77.81	66.89	72.32	62.99	78.06	69.29
Age of household head (years)	52.89	47.87	50.36	47.7	49.3	48.4
Household heads who can read and write in any language (%)	59.27	43.93	51.57	60.57	26.69	46.62
Household heads who can perform basic numeracy (%)	82.78	81.31	82.04	—	—	—
Household heads who have ever attended school (%)	82.78	52.46	67.55	62.99	78.06	69.29
Household heads who are employed (%)	79.8	49.84	64.74	86.5	93.16	89.29
TOTAL (N)	302	305	607	489	351	840

3.3.2 *Patterns of Time Use*

This section presents the patterns of time use of men, women and children from the primary data and the Ghana Time Use Survey (GTUS) 2009. The aim is to analyse the gendered patterns of time use in different types of households and highlight differences in the overall patterns in GTUS 2009 and the primary data. Figure 1 displays the average activity time by gender in the two study regions. The patterns observed are that women spend more time in overall work in both regions and both datasets with a larger difference in the time in unpaid work. Compared to 2009, the time in overall work appears to have reduced for men the in two regions. This is not the case for women; there is a small decrease in their total work in the Upper East but an increase in the Eastern region. Interestingly, the time spent by women in unpaid work appears to have increased and that in paid work has decreased. Significant mean differences in the time spent by men and women in total work, paid work and unpaid work are confirmed by a t-test (Appendix Table 6).

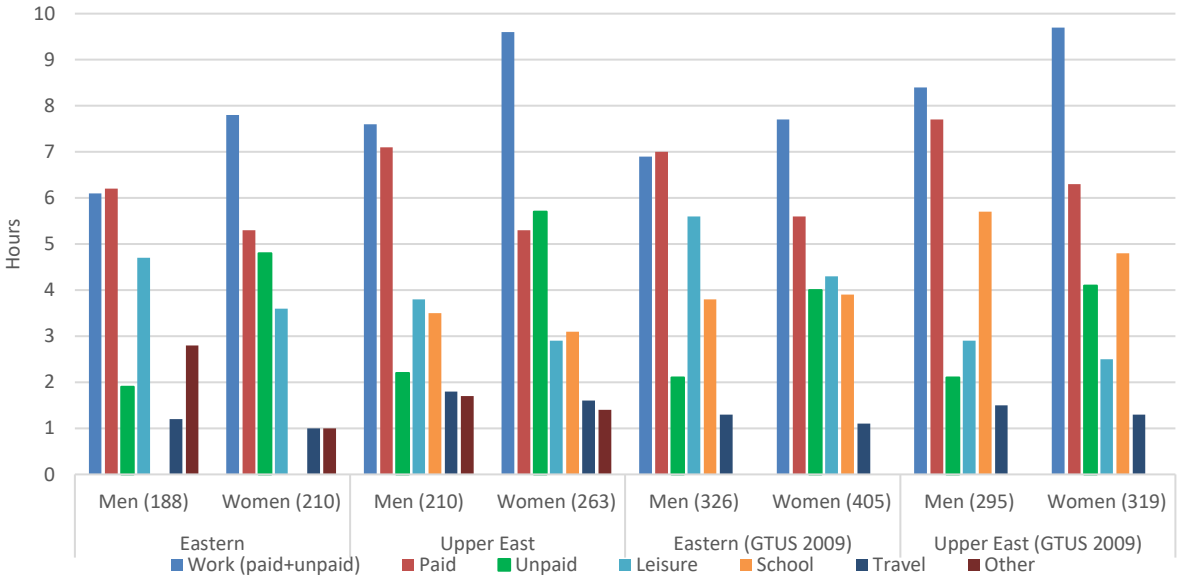

Figure 1: Average Time Spent on Activities of Men and Women (in hours), by Region

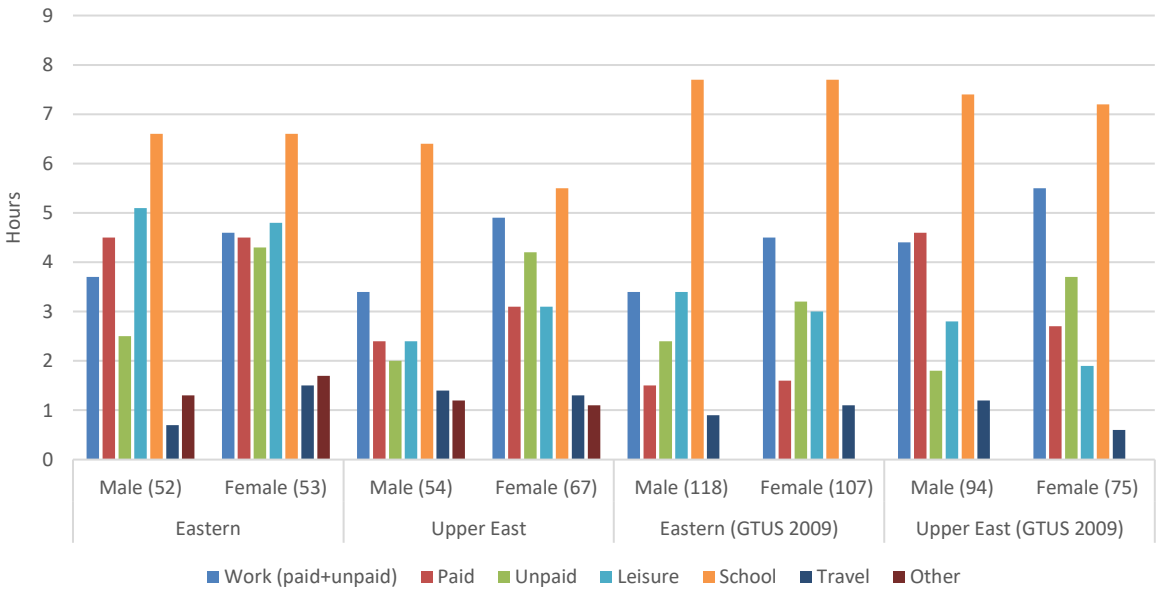

Figure 2: Average Time Spent on Activities of Children aged 10-17 years (in hours), by Region

Figure 2 shows the activity time for children aged 10-17 by region. The gendered patterns of time distribution are visible in children too; girls spend more time in overall work than boys in the two regions in both datasets. While the time spent in paid work by boys and girls is more comparable in the Eastern region, in the Upper East girls spend more time in paid as well as unpaid work. The mean difference in the time spent in unpaid work by boys and girls are statistically significant (Appendix Table 7) Compared to GTUS 2009, girls in the Upper East region allocated more time to paid and unpaid work. Additionally, in the Eastern region, they spent more time on unpaid and commuting activities than boys in GTUS 2009. In Figure 3 the average time spent on activities of children disaggregated by their age groups is shown. The data show that girls spend significantly more time in work and commuting among age groups 10-12 and 13-15, and unpaid activities across all age groups than boys (Appendix Table 12).

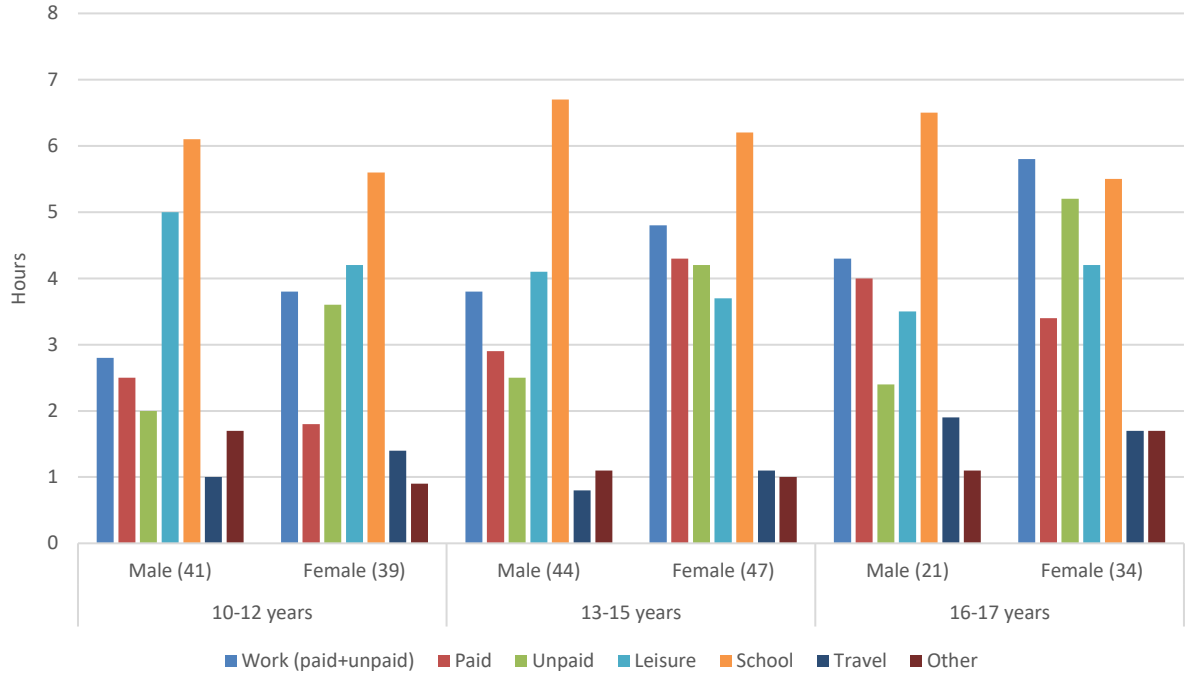

Figure 3: Average Time Spent on Activities of Children aged 10-17 years, by Age groups.

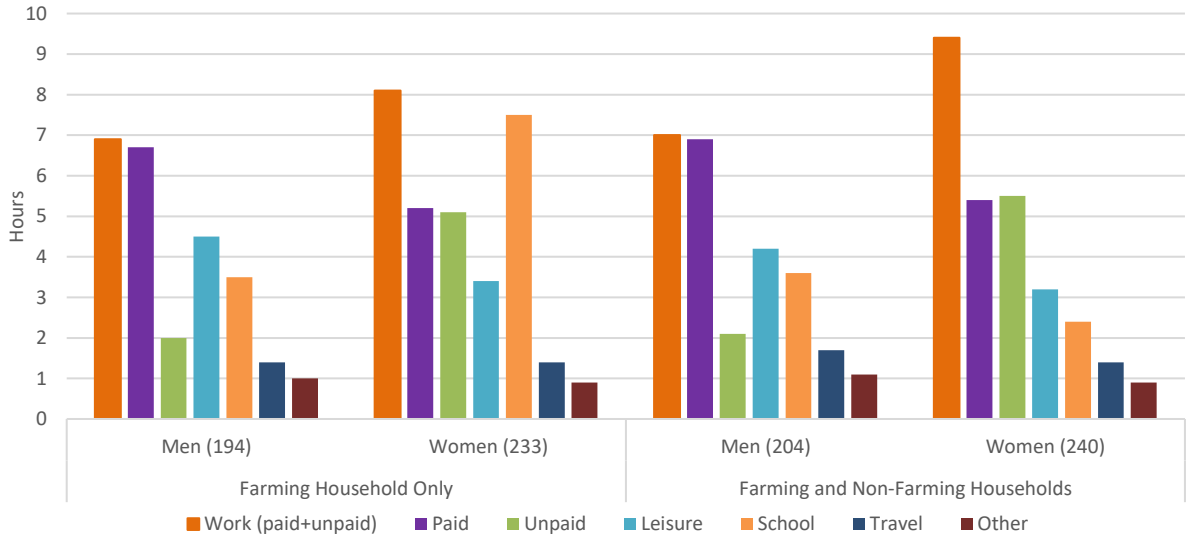

Figure 4: Average Time Spent on Activities of Men and Women (in hours), by Type of household (Farm only household vs Both Farm & Non-Farm household

Figure 4 shows the time men and women spent in various activities in farming and non-farming households. While the patterns of time spent on paid and unpaid activities remain consistent regardless of household type with women spending more time on unpaid activities and overall work, women in households that undertake both farming and non-farming activities work the longest hours. Statistical test show significant differences in time allocation between men and women across both household types, emphasizing the influence of gender on activity patterns within households (Appendix Table 11).

For children, we analyse the patterns of time use in only farming and both farming and non-farming households and in dual and single adult households to assess their burden of work (

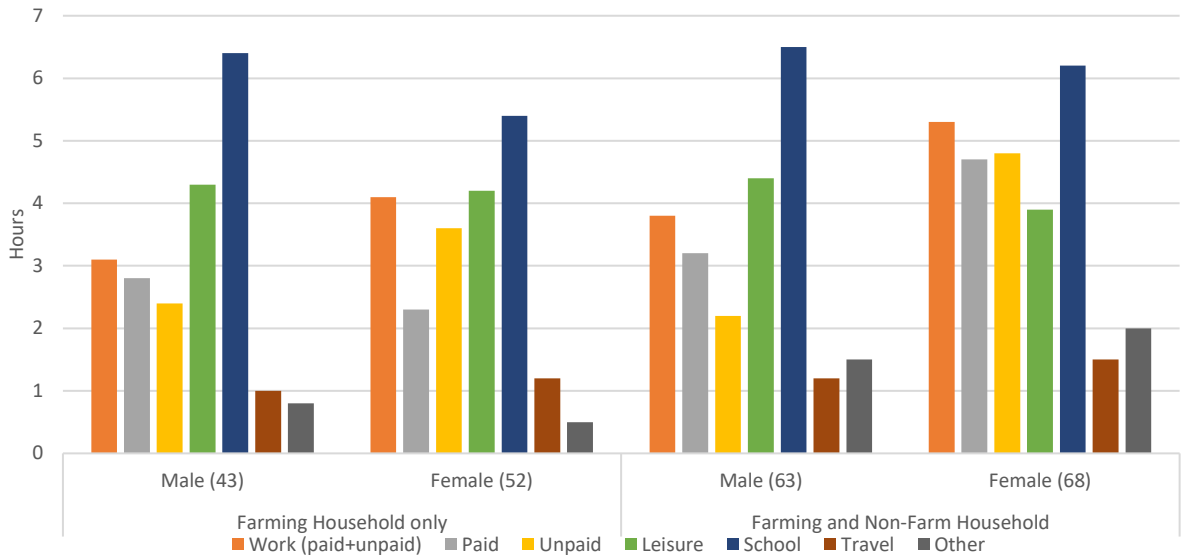

Figure 5 and Figure 6). Unsurprisingly, girls dedicate significantly more time to overall work and unpaid activities in households undertaking both farming and non-farming activities. This is observed in comparison to girls in farming-only only households as well as to boys in farming and both farming and non-farming households. Girls in both farming-only and both households spend notably more time on unpaid activities compared to boys (Appendix Table 11).

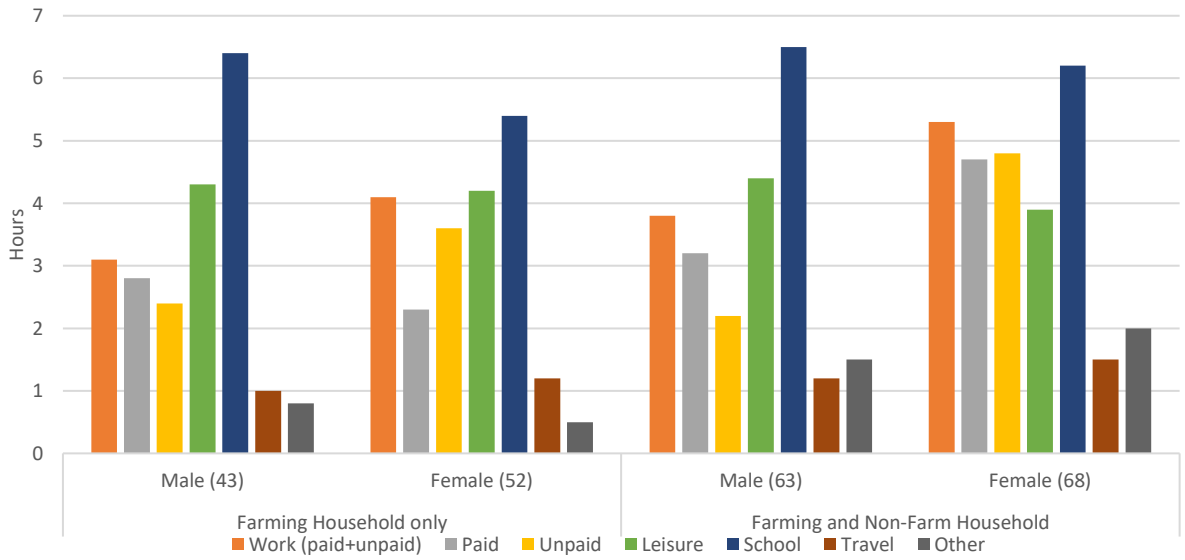

Figure 5: Average Time Spent on Activities of Children aged 10-17 years in Farm only household & Farm & Non-Farm household

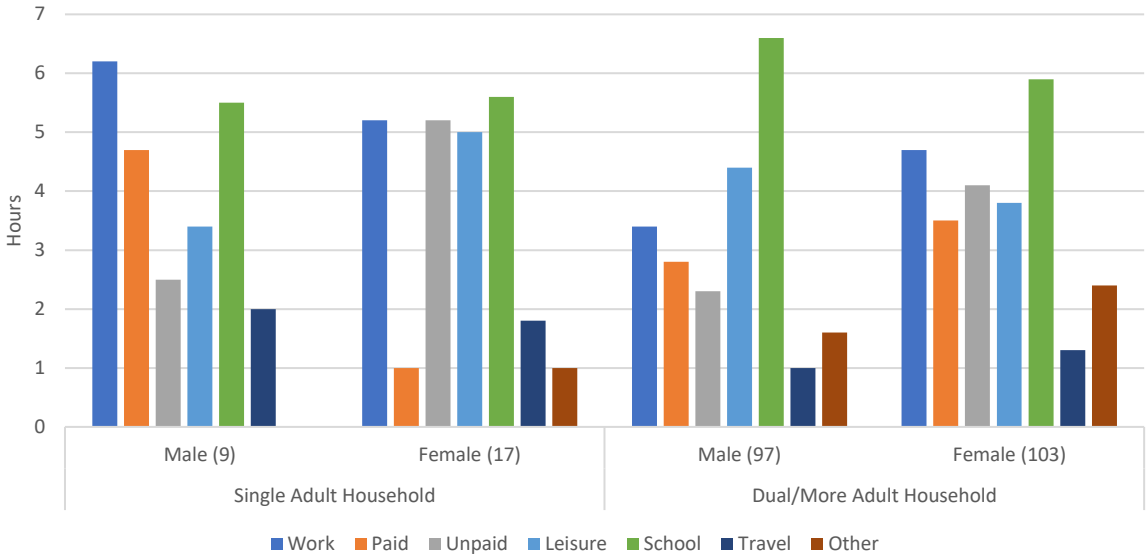

Figure 6: Average Time Spent on various Activities of Children aged 10-17 years (in Hour) in Single Adult households vs Dual or more Adult households)

Children in single-adult households spend more time working than those in dual or more adult households, girls in particular spend more time on work and unpaid activities. This is true even when compared to boys in single adult households. Boys in single-adult households spend more time in paid work than those in dual-adult households. (Appendix Table 9).

3.3.3 Household Income

To assess how income levels interact with individuals' time use patterns, we assess these patterns at varying income levels complementing it by classifying households into expenditure and wealth-based categories. The average income from all economic activities of households is presented in Table 4. The average total income is estimated at GH₵ 1,561.7 (USD 141.97)[4] it is translating into per-person income of GH₵ 362.8 (USD 32.98). The agriculture sector serves as the major contributor to the average income of the household. The income from agriculture of each household is estimated at GH₵ 1,117.0 (101.55). Non-farm self-employment activities also contributed much to the average total and per capita income of the household; this was followed by wage employment (Table 4).

Table 4: Households' average and per capita income

Source of Income (GH₵)	**Average Income** (GH₵)	**Average Income per capita** (GH₵)	**N**
Household Agriculture	1117.0	253.5	607
Wage	69.3	18.0	607
Non-farm Self-employment	372.6	90.7	607
Other	2.7	0.6	607
Total household income	1561.7	362.8	607

Figure 7 presents the time use patterns of men and women in various income groups. Women consistently spend more time in overall work than men across all income groups. They also spent more time in unpaid activities than men across all income groups. T-tests show a significant difference in

[4] This is done using the Bank of Ghana (BoG) exchange rates published on Wednesday, 05 July 2023. BoG's rate is given as ₵ 11.00 ≈ USD 1.00

means of time spent in work, paid, unpaid and leisure activities between men and women in the first and second income quintiles (Appendix Table 13). Overall, women in the poorest quintiles (1st and 2nd) spend the most number of hours in work. Furthermore, there is a significant difference in means of time spent in work, paid and unpaid activities between men and women in the third and fourth income quintiles, and only significant for work and unpaid activities in the fifth income quintiles. When disaggregated by expenditure and wealth categories, these patterns are confirmed. Women spent more hours in work-related activities than men across all. This is mainly influenced by the share of time spent in unpaid activities. Men spent more time in leisure than women.

Figure 10 shows the time pattern of children aged 10-17 years by income quintiles. The data indicate that girls spend more time in work than boys in all income categories. In most income categories, they spend more than in both paid and unpaid work compared to boys but this pattern is more consistent for unpaid work. Notably, the time girls spend less time on schoolwork compared to boys in all income categories except the third and the highest category (Appendix Table 14). It appears plausible that gender norms and social expectation assign house chores to girls' time allocation not just to unpaid work but to school work as well. Figure 11shows the time pattern of children aged 10-17 years disaggregated by expenditure quintiles. Female children spent a statistically significant amount of time in unpaid activities than male children across all expenditure groups except for the fifth quintile. Also, male children spent significantly more time in leisure activities than female children in the third quintile (Appendix Table 17). Figure 12 shows the time use pattern of children aged 10-17 years by the household wealth categories based on an asset index (quintiles). Female children relatively spent a statistically significant amount of time in unpaid activities than male children in the second, fourth, and fifth quintiles. In addition, female children spent more time in work related activities than female children in the fifth quintile (Appendix Table 19).

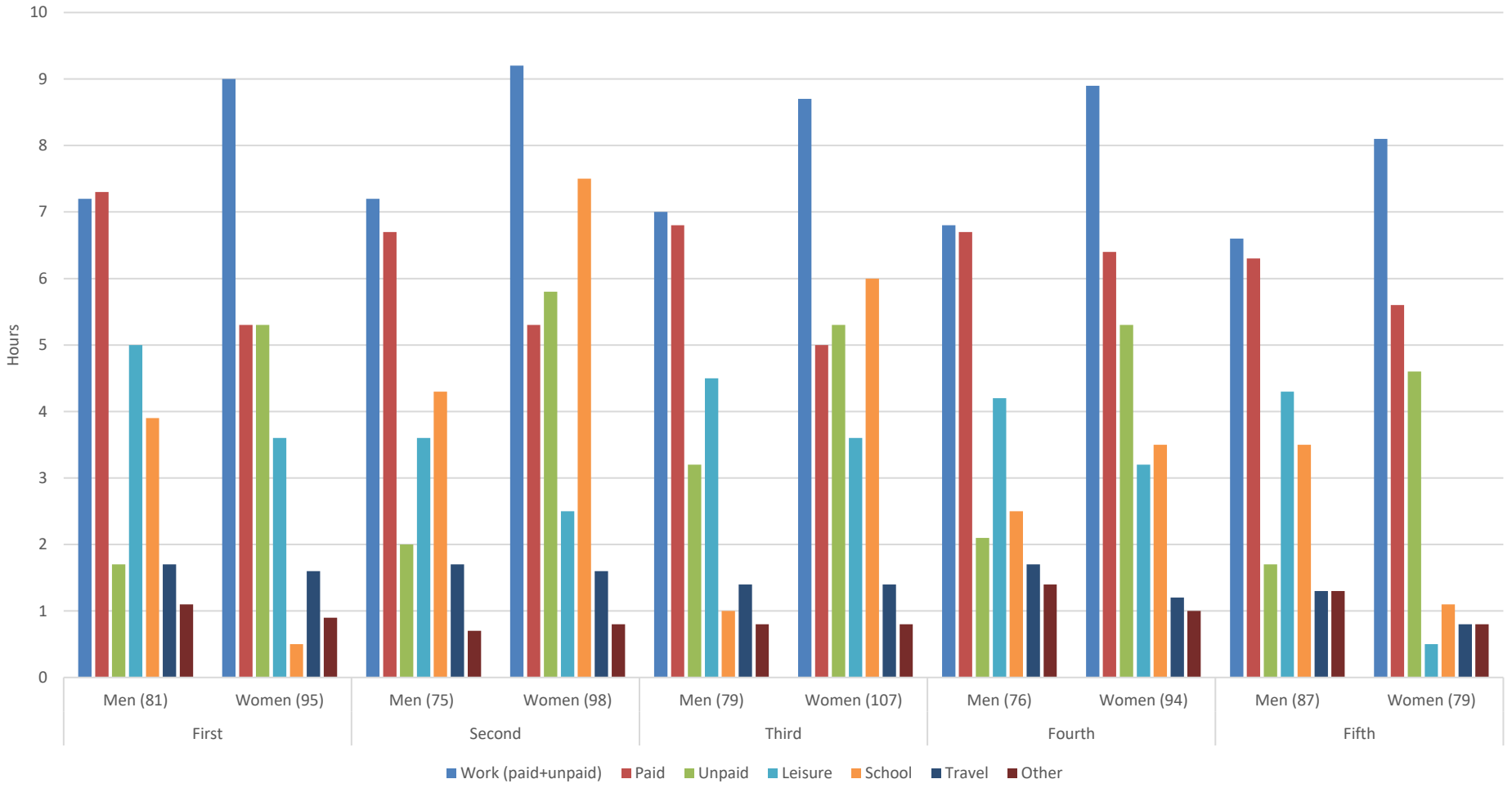

Figure 7: Average Time Spent on Activities of Men and Women (in hours), by Income quintiles

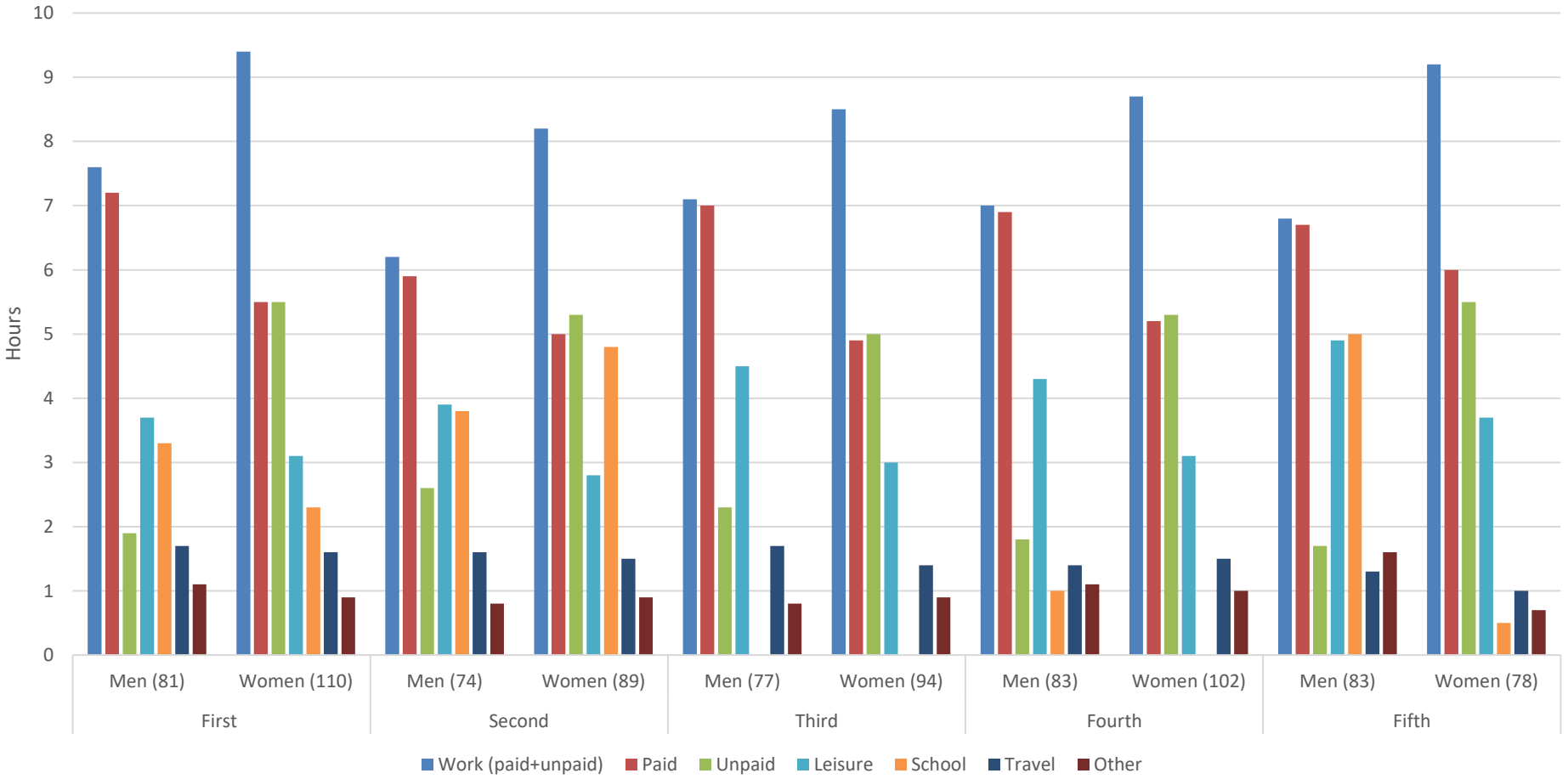

Figure 8: Average Time Spent in Activities of Men and Women (in hours), by quintile group of Expenditure per capita

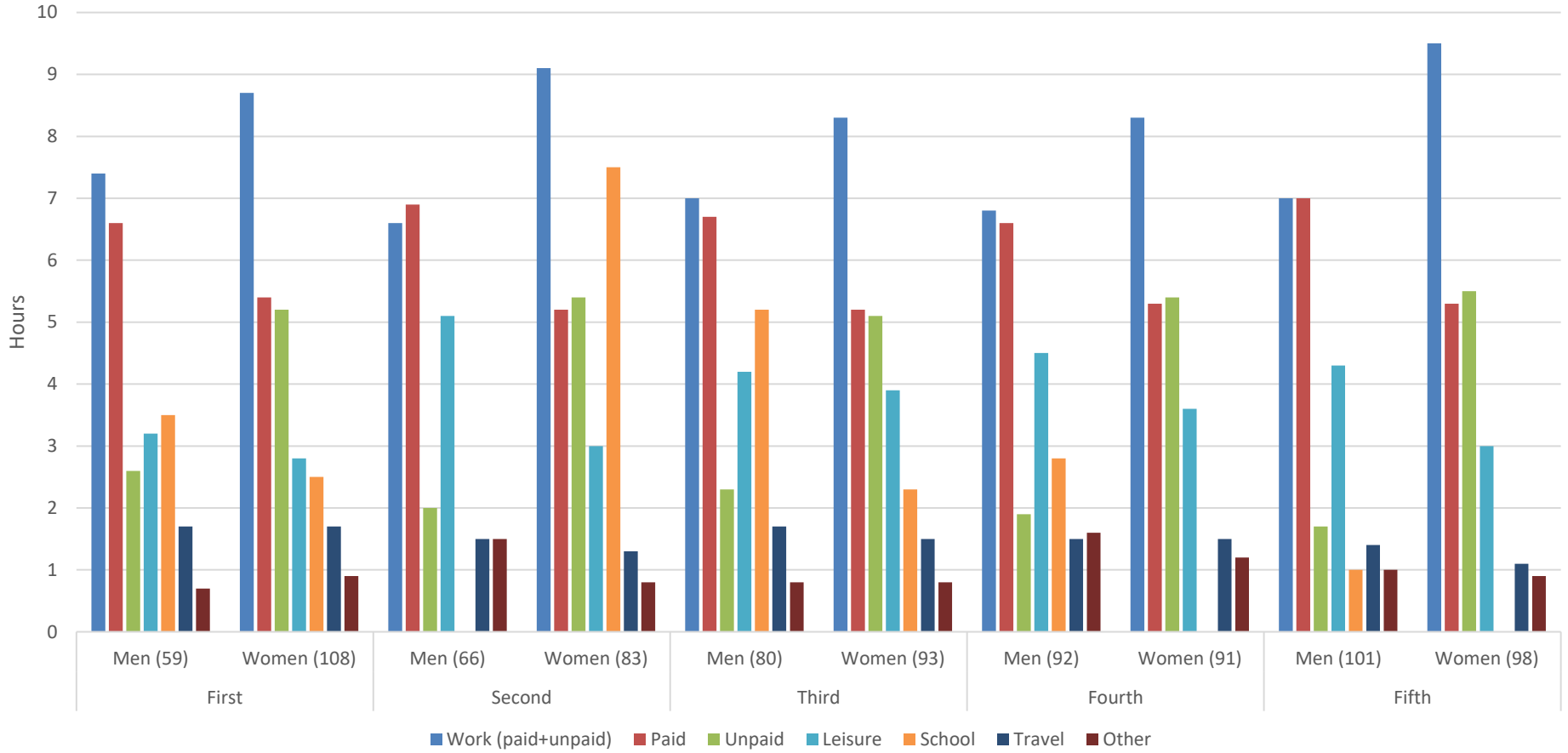

Figure 9: Average Time Spent on Activities of Men and Women (in hours), by Asset index

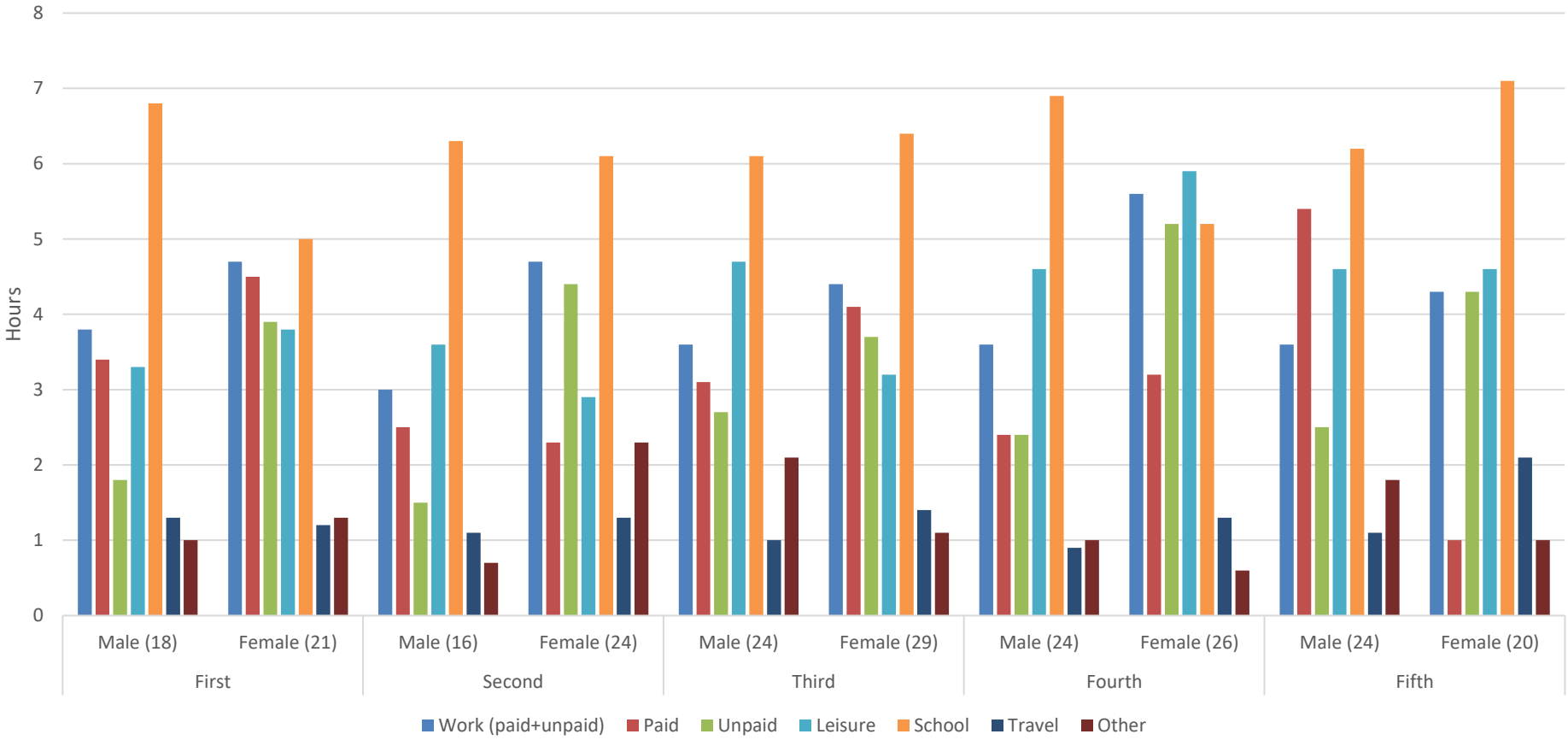

Figure 10: Average Time Spent on Activities of Children aged 10-17 years (in hours), by Income quintiles

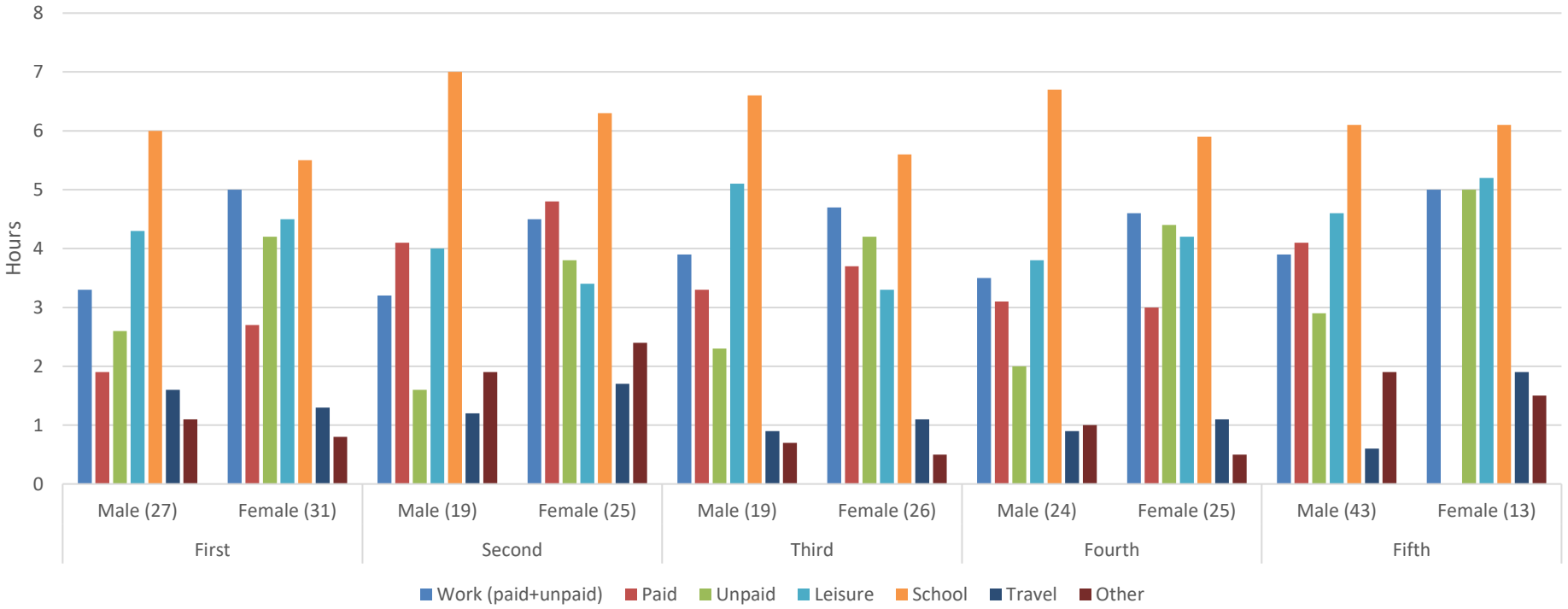

Figure 11: Average Time Spent in various Activities of Children, by Quintile of Expenditure per capita

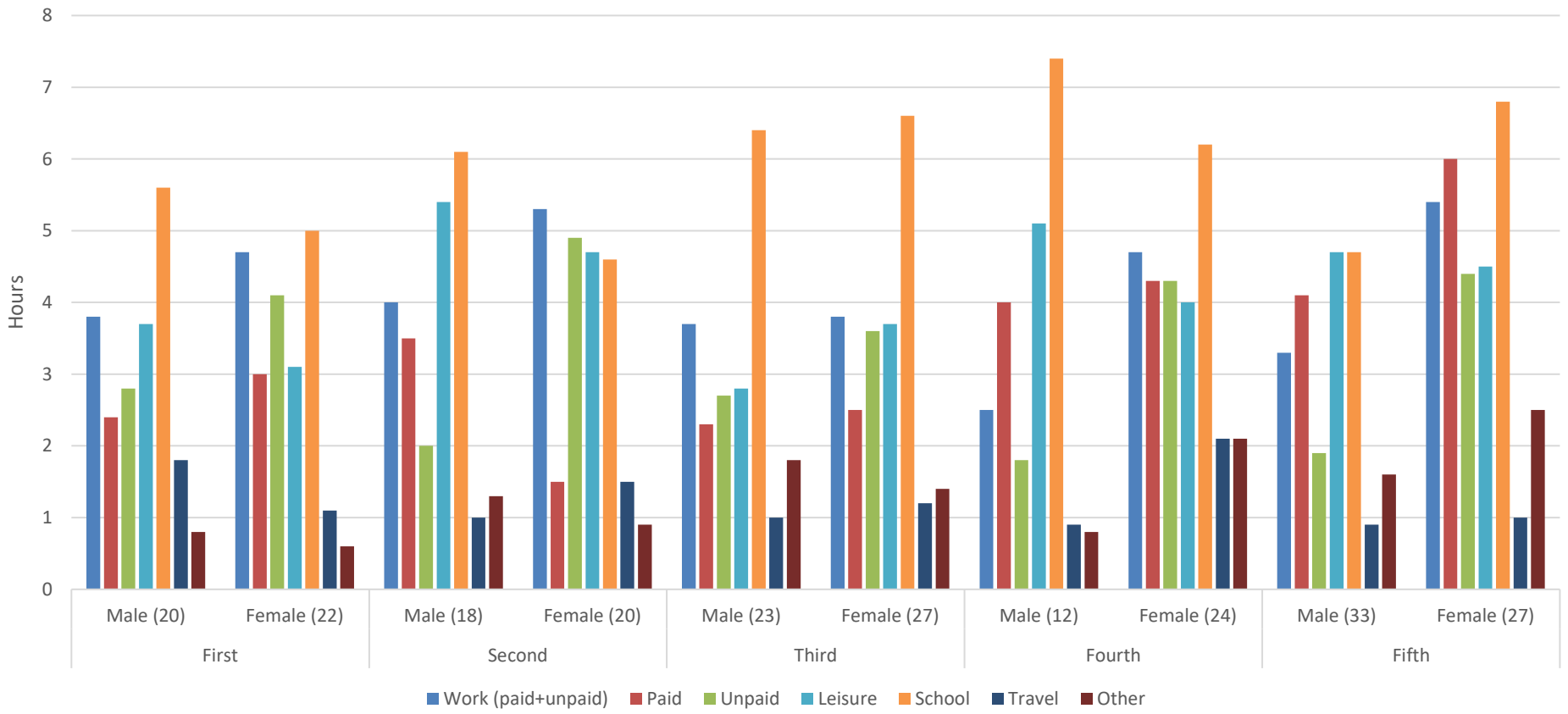

Figure 12: Average Time Spent on Activities of Children (in hours), by Asset index

4 Results

4.1 Time Use and Children's Diets

In this section, we analyse the relationship between women's time use and children's dietary diversity. Dietary diversity is computed from the eight specified food groups within the previous 24 hours prior to the survey (FAO, 2013). These food groups considered were: 1) cereals, roots, and tubers; 2) legumes, seeds and nuts; 3) flesh foods; 4) eggs; 5) vitamin A-rich plant food; 6) dairy products; 7) other fruits and vegetables; 8) Fats and oil. The summary description of diets and dietary diversity of children aged 6-23 months old in the sampled households are below. A child is considered to have attained minimum dietary diversity if they consumed at least four out of the eight food groups the previous day.

Table 5: Percentage of children aged 6-23 months who ate any of the food groups in the previous 24 hours.

Food Group	Eastern	Upper East	Overall
Cereal/roots and tubers	97.2	80.5	87.3
Legumes/Seeds/Nuts	20.3	25.7	23.5
Flesh foods (Meat, Fish, Poultry, liver or organ meat)	62.9	49.1	54.7
Eggs	22.4	25.2	24.1
Vitamin A-rich plant food	20.3	12.4	15.6
Dairy products (Milk, yoghurt, cheese)	18.9	27.1	23.8
Other fruits and vegetables	41.3	63.3	54.4
Fats and Oil (Foods cooked with Fats and Oil)	71.3	42.9	54.4

Table 6: Dietary Diversity of Children

Child Dietary Diversity Indicator	Eastern	Upper East	Overall
% of children who consumed food from >= 4 food groups during the previous day	36.4	36.7	36.5
Average Dietary Diversity Score	3.5	3.3	3.4
N	143	210	353

Except for food groups such as legumes/seeds/nuts, eggs, vitamin A-rich plant food, and dairy products, there is a gap of more than 10 percentage points of all other food groups of children aged 6-23 months in both regions (Table 5). Children in the Eastern region have more food groups (such as cereal, fresh foods, vitamin A-rich plant food, and fats and oil) and less of others in their diets than those in the Upper East region. On average, children in the Eastern region have relatively higher dietary diversity scores than their Upper East region counterparts. However, the Upper East region had only 0.3 ppt. more children who consumed 4 or more food groups in the previous 24 hours.

We use logistic regression to estimate the relationship between women's time use and children's dietary diversity. In the model, the dietary diversity score (DDS) of children aged 6-23 months is a dependent variable and women's time spent is measured in hours and defined by time spent on paid and unpaid activities. DDS is defined as a binary dummy variable with "1" if a child consumed at least four of the food groups in th previous 24 hours and "0" if otherwise.

Table 7 presents the results of logistic regression analysis investigating the relationship between time use and children's dietary diversity, and its variation by gender. Model 1 is the baseline model that estimates the relationship between of women's time use on paid and unpaid activities accounting for

children and adult females (women) characteristics such as the child's age and sex, the woman's age and education. The second model builds upon Model 1 by including additional control variables. These are household and community characteristics such as income, assets, and access to services like electricity, roads, schools, markets and so forth (*see* Model 2). We also include an interacted model. The inclusion of interaction terms allows for investigating potential moderating effects. Thus, the interaction terms examine whether the relationship between education level and dietary diversity is influenced by paid or unpaid activities.

Table 7: Logistic regression estimation of the relationship between Time Use and Children's Dietary Diversity

	Children's Dietary Diversity				
	Odd ratios				
VARIABLES	Model 1	Model 2	Interactive Model	Male Model	Female Model
Paid activities	0.958	0.970	0.909	0.980	0.678
	(0.0709)	(0.0838)	(0.136)	(0.188)	(0.263)
Unpaid activities	1.059	1.051	1.337*	2.393**	1.291
	(0.0620)	(0.0710)	(0.201)	(0.935)	(0.395)
Female children	0.924	0.744	0.788		
	(0.317)	(0.295)	(0.327)		
Child's age (in Months)	1.027***	1.031***	1.036***	1.048**	1.045**
	(0.00966)	(0.0115)	(0.0122)	(0.0215)	(0.0216)
Adult female's education (0= No education)					
Primary education	3.036**	2.298	0.293	12.02	0.0251
	(1.395)	(1.273)	(0.698)	(46.72)	(0.147)
Secondary education and above	4.818***	3.269**	27.91*	10,991**	14.53
	(2.228)	(1.913)	(52.35)	(41,430)	(55.54)
Asset Index (1=Lowest)					
Lower		2.269	3.378*	29.63**	1.926
		(1.514)	(2.411)	(40.27)	(2.414)
Middle		12.46***	15.35***	66.63***	15.57**
		(8.421)	(11.42)	(96.26)	(21.26)
Higher		3.966**	5.071**	11.87*	9.736
		(2.759)	(3.761)	(15.30)	(14.47)
Highest		1.665	1.757	19.92**	0.259
		(1.221)	(1.331)	(28.41)	(0.414)
Access to market for agricultural produce (1=Yes)		1.134	1.160	1.492	1.294
		(0.480)	(0.533)	(1.049)	(1.267)
Access to Primary School		0.518	0.470	0.317	0.656
		(0.232)	(0.225)	(0.253)	(0.621)
Access to supplies from nearest shop (1=Yes)		0.683	0.476	0.628	0.134*
		(0.333)	(0.258)	(0.510)	(0.153)
Access to electricity		2.193	2.699*	4.583	2.337
		(1.206)	(1.610)	(4.671)	(2.266)
Access to water in the house (1=Yes)		0.981	0.927	0.623	1.930
		(0.699)	(0.712)	(0.751)	(2.959)
Type of dwelling (1=separate/semi-detached/flats)					
Several rooms		1.970	1.857	1.732	2.151
		(1.079)	(1.045)	(1.504)	(2.309)
Several buildings		3.590**	3.007**	5.448**	5.180
		(1.843)	(1.592)	(4.563)	(5.384)
Interactive term1 (1=No education*paid activities)					
Primary education*paid activities			1.713*	1.726	2.427

			(0.509)	(0.765)	(1.848)
Secondary+ education*paid activities			0.992	0.845	1.073
			(0.215)	(0.292)	(0.487)
Interactive term2 (1=No education*unpaid activities)					
Primary education*unpaid activities			0.907	0.448*	1.197
			(0.195)	(0.194)	(0.588)
Secondary education+*unpaid activities			0.665**	0.286***	0.635
			(0.123)	(0.134)	(0.205)
Post-secondary education*unpaid activities			0.696**	0.295***	0.779
			(0.123)	(0.133)	(0.255)
Observations	174	174	174	90	84

seEform in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The results indicate a positive association between women's time spent on unpaid activities and children's dietary diversity. After running an interactive term of women's education and their time use, the odds ratio of children's dietary diversity increased with an additional hour of women's time spent on unpaid activities. In addition, when the model is interacted, households with access to electricity have a positive relationship with children's dietary diversity. This means that the presence of electricity in households increases the odds of children having diverse food options, compared to households without electricity. This relationship can be attributed to several factors, including improved food storage and preparation facilitated by electric appliances, increased availability of nutritious processed foods, and expanded access to information and education about diverse diets and cooking techniques. A study revealed that access to electricity led to changes in home production technologies and increased female participation in the labour market in rural South Africa (Dinkelman, 2019). These combined effects enable households with electricity to have a wider range of fresh ingredients, greater flexibility in cooking methods, and better knowledge about nutritious food choices, ultimately leading to increased odds of children having diverse and balanced diets.

4.2 Time Use and Productivity

The study analyses the relationship between time use and productivity of the household farm. Labour productivity, measured as the total man-day worked per hectare of agricultural farm-land[5], as a proxy of productivity of the household farm. This measure is used because of the sufficient amount of data responses as compared to using crop yield. Besides, it offers a simple labour productivity estimate to evaluate across various crops, farms, and geographical areas. It compares labour inputs and outputs and accounts for the variability in labour requirements across different types of crops and farming techniques. A description of the data shows that the average labour productivity of each household is estimated at 232.5 man-days worked per hectare with a regional differential of 140.6: that is, Eastern (161.8) and Upper East (302.4).

Table 8 represents the output of the OLS model estimating the relationship between women's time use and labour productivity. Model 1 is the baseline model that estimates the relationship between women's time use and characteristics such as age, education, and employment type and productivity. However, there are other factors of the household and the community such as income, assets, and access to services like electricity, roads, schools, and markets that help to explain dietary diversity. So, we include these factors in model 2. We also account for an interactive term in Model 3 to capture non-additive effects and complex relationships that cannot be adequately represented by simple linear

[5] Man-day worked per hectare is a measure of agricultural labor productivity that calculates the amount of work done by a labourer in one day, per hectare of land cultivated. The calculation is done by dividing the total number of man-days worked on the land by the total hectares cultivated.

or additive models. So, Model 3 is to account for more nuanced relationships between variables (women who are agricultural workers and owned hand insecticide pump).
Model 1 indicate that there is no significant relationship between women's time spent on various activities and labour productivity. In Model 2, women's time allocation to unpaid activities, has a significant negative effect on their productivity, indicating that women who spend more time on unpaid activities such as household chores and caregiving, decrease their labour productivity (Models 2 & 3). This finding is consistent with previous research that has shown that unpaid work can hinder women's economic opportunities and labour force participation (Kabeer, 2000).

Among the other variables, education has a positive relationship with labour productivity, although not significant for post-primary education. This finding aligns with earlier studies which concluded that increased educational levels increase productivity (Wang *et al.,* 2022; Oduro-Ofori *et al.,* 2014; Okpachu *et al.,* 2014). A positive significant association of wage and agricultural incomes on labour productivity is also found. This is because households may be inclined to spend money on supplies like better seeds, fertilizer, and other inputs that can boost crop yields and output. Overall, household asset index has a positive effect on productivity, with women from households with higher asset index having higher productivity levels. Households with higher asset index may have greater access to credit, information, and other resources that can improve their agricultural productivity. This may be because they have more assets to use as collateral or a better credit history, or because they are more likely to belong to supportive social networks that provide valuable information and resources. Nevertheless, the result was only significant for households in the third quintile (Models 3 & 4) and in the second quintile (Model 4). Moreover, access to all-weather roads is negatively associated with women's productivity levels. A plausible explanation with improved transportation, women may undertake paid work or market activity as opposed to work on their farm.

Table 8: Estimation of Women's time use and productivity

	Log of labour productivity		
VARIABLES	Model 1	Model 2	Model 3
Paid activities	-0.0196	-0.0699	-0.0784
	(0.0664)	(0.0577)	(0.0575)
Unpaid activities	-0.0863	-0.0998*	-0.105*
	(0.0574)	(0.0536)	(0.0547)
Commuting activities	-0.0122	-0.0336	-0.0441
	(0.111)	(0.123)	(0.123)
Self-care activities	-0.0421	-0.0744	-0.0835
	(0.0706)	(0.0656)	(0.0649)
Log of adult female's age (years)	-0.443	-0.168	-0.218
	(0.428)	(0.324)	(0.329)
Adult female's education (1=*No-education*)			
Primary	0.355	0.429*	0.406*
	(0.224)	(0.228)	(0.230)
Post-primary	0.0403	-0.0929	-0.0595
	(0.253)	(0.236)	(0.236)
Adult female Agric worker	0.0468	-0.0541	-0.409
	(0.204)	(0.217)	(0.337)
Household members		0.0679	0.0688
		(0.0432)	(0.0430)
Household wage income per capita		0.00256*	0.00253*
		(0.00148)	(0.00145)
Household non-farm income per capita		-0.000422	-0.00042
		(0.000377)	(0.000370)
Household Agric income per capita		0.000732***	0.000735***
		(0.000230)	(0.000233)
Household other income per capita		-0.00538	-0.00697
		(0.00894)	(0.00982)

Household Asset Index (1=Lowest)			
Lower		0.473	0.534*
		(0.293)	(0.298)
Middle		0.634**	0.705**
		(0.268)	(0.271)
Higher		0.301	0.350
		(0.311)	(0.309)
Highest		0.172	0.194
		(0.318)	(0.317)
Access to water in the house (1=Yes)		-0.442	-0.435
		(0.368)	(0.367)
Access to All-weather Road (1=Yes)		-0.644*	-0.672**
		(0.338)	(0.337)
Access to Market for Agricultural produce (1=Yes)		-0.0539	-0.0539
		(0.165)	(0.166)
Own hand insecticide pump (1=Yes)		0.0777	-0.0264
		(0.218)	(0.228)
Adult female Agric. worker and own hand insecticide pump (1=Yes)			0.655
			(0.405)
Constant	7.420***	7.059***	7.437***
	(1.971)	(1.593)	(1.642)
Observations	178	178	178
R-squared	0.045	0.248	0.258

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

4.3 Time Use and Technology

The section presents the relationship between access to infrastructure (markets, roads, electricity, water), technologies (domestic and agricultural technologies), and patterns of time use of household members. We analyse these associations to understand how domestic and agricultural technologies influence time spent by adult household members, particularly women. It uses the OLS regression estimation technique to establish the relationship. Table 9 illustrates the results of the multiple linear regression of the relationship between time spent and technology. The time use considered in this analysis is time spent in paid and unpaid activities in hours.

The results indicate that some agricultural technologies associated with owning an animal-pulled plough have a significant positive effect on men's time spent in paid activities while owning an agricultural water pump, and hand insecticide pump has a significant positive relationship with women's time spent in paid activities. One possible explanation for this phenomenon could be attributed to the fact that the animal-pulled plough is predominantly used for ploughing, a labour-intensive task that is traditionally carried out by male individuals. Having an animal-pulled plough may enhance the capacity of men to participate in remunerative pursuits that entail agricultural or other strenuous labour, thereby augmenting their duration of engagement in such activities. The other types of equipment are commonly used for agricultural activities such as crop irrigation and spraying, tasks that are frequently carried out by women. The possession of such equipment may potentially enhance women's capacity to participate in remunerative farming or other agricultural endeavours, thereby augmenting their duration of engagement in paid activities.

Owning a cutlass or matchet, and being an agricultural worker have a negative significant relationship with men’s time spent on paid activities. Access to market for agricultural produce has a positive relationship with women’s time spent on paid activities, being an agricultural worker has a negative significant relationship. This might be because women are more likely to engage in paid activities when they have access to marketplaces where they can sell their products and make money. This might also mean that women who have access to marketplaces have more chances to work for pay in sectors other than agriculture. In addition, it is possible that the possibilities available to women who work in agriculture may be restricted, which may also restrict their ability to participate in compensated activities outside of agriculture.

Households with at least two adults increases men’s time spent in paid activities. Men receive more help with domestic chores in households with at least two people, giving them more time for waged work. Furthermore, agricultural workers who had a cooking stove may have used more time-effective preparation techniques, which could free up more time for males to engage in compensated labour. Households with at least two adult members have a positive significant relationship with women time spent in unpaid activities. This can be attributed to several factors, including increased demands of larger households, women's workforce participation, caregiving responsibilities and the lack of external support systems. Also, there may be an increased need for caregiving, especially if there are children, elderly family members, or individuals with disabilities. These factors contribute to a higher allocation of time for unpaid activities among women in households with multiple adults.

For the unpaid activities model, the coefficient for age is negative for both men and women. This suggests that women, as they age, they spend less time on unpaid activities. A plausible reason is their children may become more independent or may take up certain responsibilities, freeing up time for their mothers or women may have more paid job options, reducing their unpaid time.

Owning a hoe is associated with more time spent on unpaid activities for both men and women. In agricultural communities where small-scale agriculture plays a significant role, owning a hoe may reflect a deeper engagement in subsistence activities which requires significant time and effort. As a result, they may allocate more time to unpaid activities associated with agricultural work, such as planting, weeding, and harvesting. In addition, women who are agricultural workers is associated with

more time spent on unpaid activities. Plausibly, household and caring duties may limit women's paid work time. Thus, unpaid tasks may take precedence over paid ones.

Table 9 also presents results from the multiple regression analysis that explores the relationship between technology and children's time spent on paid and unpaid activities. The age coefficient suggests that as children age, they tend to spend more time in both paid and unpaid activities. The coefficient of female children indicates that female children tend to spend more time in unpaid activities than male children and this is significant. The result for owning a hand insecticide pump suggests that households that own a hand insecticide pump tend to have children who spend more time in paid activities and less time in unpaid activities than those who do not own one. The results also show that households that own a cutlass or matchet tend to spend more time on unpaid activities than those who do not own one. Likewise, households that have access to market for agricultural produce tend to spend more time on paid activities than those who do not have access.

Table 9: Regression Estimations of Time Use and Technology

	Paid Activities		Unpaid Activities		Paid Activities	Unpaid Activities
VARIABLES	Men	Women	Men	Women	Children	Children
Age	-0.00687	-0.0116	-0.00416	-0.0611***	0.251*	0.180**
	(0.0112)	(0.0118)	(0.0152)	(0.0106)	(0.144)	(0.0818)
Female Children	-	-	-	-	0.590	1.994***
					(0.874)	(0.333)
Level of Education (1=None)	-	-	-	-	-	-
Primary	0.281	0.102	-0.169	0.0401		
	(0.462)	(0.385)	(0.732)	(0.380)		
Post-primary	-0.304	-0.490	-0.923	0.301		
	(0.471)	(0.402)	(0.576)	(0.371)		
Household Income Quintiles (1=First)	-	-	-	-	-	-
Second	-0.129	0.164	0.355	0.521	-1.761	0.293
	(0.575)	(0.434)	(0.590)	(0.472)	(1.131)	(0.510)
Third	-0.0825	-0.00278	1.732*	-0.0114	-0.544	0.541
	(0.506)	(0.428)	(0.959)	(0.415)	(1.293)	(0.490)
Fourth	-0.270	0.438	0.356	0.126	-0.896	0.925
	(0.596)	(0.469)	(0.495)	(0.419)	(1.056)	(0.598)
Fifth	-0.438	1.207**	0.237	-0.599	0.951	0.445
	(0.552)	(0.503)	(0.438)	(0.471)	(1.430)	(0.562)
Household Asset index (1=First)	-	-	-	-	-	-
Second	0.988	0.0270	-0.620	-0.0276	0.265	0.313
	(0.634)	(0.457)	(0.897)	(0.471)	(1.261)	(0.593)
Third	0.777	0.141	-0.366	-0.274	-1.003	-0.403
	(0.570)	(0.522)	(1.076)	(0.455)	(0.828)	(0.546)
Fourth	1.069*	-0.0649	-0.560	0.0880	-0.377	-0.0802
	(0.609)	(0.608)	(0.965)	(0.460)	(0.961)	(0.616)
Fifth	1.065	-0.355	-0.745	0.0821	-0.201	0.0619
	(0.756)	(0.706)	(0.919)	(0.527)	(1.041)	(0.692)
Access to water in the house (1=Yes)	-0.0420	0.716	0.481	-0.0156	0.735	0.473
	(0.582)	(0.456)	(0.563)	(0.394)	(1.104)	(0.498)
Owned Stove (1=Yes)	-0.617	0.100		-0.281		
	(0.591)	(0.471)		(0.425)		
Own Refrigerator (1=Yes)	-0.0675	0.0278			-0.584	0.220
	(0.550)	(0.470)			(1.232)	(0.475)
Owned Sickle (1=Yes)	0.283	-0.277	-0.287	-0.205		0.0772
	(0.383)	(0.370)	(0.394)	(0.326)		(0.394)

Owned Hoe (1=Yes)	0.117	0.136	0.668*	0.745**		0.135
	(0.410)	(0.382)	(0.388)	(0.323)		(0.447)
Own Animal-pulled Plough (1=Yes)	2.701***	-0.0861				-0.637
	(0.945)	(0.725)				(1.001)
Owned Motorized Insecticide Pump (1=Yes)	0.693	-0.110				
	(0.826)	(0.568)				
Owned Hand Insecticide Pump (1=Yes)	-0.154	0.968**	0.106	0.269	2.571**	-0.858*
	(0.425)	(0.412)	(0.495)	(0.339)	(0.973)	(0.437)
Owned Agric. Water Pump (1=Yes)	-0.372	2.082***				
	(0.576)	(0.783)				
Owned Agricultural land (1=Yes)	0.239	0.405	-0.228	-0.109		0.227
	(0.353)	(0.312)	(0.441)	(0.297)		(0.329)
Owned Cutlass/matchet (1=Yes)	-0.981**	-0.524	0.135	-0.494		0.723*
	(0.475)	(0.421)	(0.711)	(0.432)		(0.427)
Access to nearby Primary School (1=Yes)	0.179	-0.300	-0.514	0.0255	-0.744	-0.349
	(0.340)	(0.295)	(0.453)	(0.288)	(0.638)	(0.417)
Access to nearby Secondary School (1=Yes)	0.0300	0.145	-0.151	0.157	0.521	-0.0366
	(0.367)	(0.340)	(0.398)	(0.357)	(0.800)	(0.418)
Access to nearby market for supplies(1=Yes)	0.163	0.131	-0.679	-0.499	-0.0903	0.479
	(0.454)	(0.344)	(0.789)	(0.369)	(0.809)	(0.424)
Access to All-Weather road (1=Yes)	-0.630	-1.092	1.029	-0.418	0.154	0.221
	(0.899)	(0.712)	(0.824)	(1.006)	(1.037)	(0.599)
Access to Market for Agric Produce (1=Yes)	-0.0269	0.539*	0.0883	-0.0411	1.133*	0.582
	(0.363)	(0.318)	(0.467)	(0.308)	(0.617)	(0.389)
Agricultural worker (1=Yes)	-1.101**	-1.595***	1.035	0.758*		
	(0.484)	(0.432)	(0.949)	(0.414)		
Type of household (1=Dual/More Adults)	1.269*	-0.0148	0.288	0.852**		
	(0.746)	(0.473)	(0.702)	(0.371)		
Agricultural worker and own stove (1=Yes)	2.076*	-1.420		-0.578		
	(1.222)	(0.995)		(0.832)		
Observations	327	319	129	446	63	196
R-squared	0.113	0.125	0.167	0.181	0.375	0.280

Robust standard errors in parenthesis *** p<0.01, ** p<0.05, * p<0.1

5 Conclusion and Policy Recommendations

Data from widely different contexts globally show a disparity in time use between men and women. Women spend more time in unpaid care and domestic work than men. This disparity has implications for some outcomes. Women's time in unpaid work restricts their capacity to undertake paid work impacting their position and voice within households. Freeing up women's time from unpaid work or distributing the burden of unpaid work more equally between men and women can potentially be beneficial. The burden of unpaid work can be reduced with technologies, provision of services and infrastructure. A better sharing of unpaid work between men and women can be by changing gender norms.

This study sought to investigate Patterns of time use among men, women, and children in different types of households, drawing on both primary data and the Ghana Time Use Survey (GTUS) 2009. It analyzes gendered differences in time allocation and investigates how household income levels interact with time use patterns. The aim is to highlight variations in time use across gender, age, and household characteristics. Moreover, women's time use patterns and their relationship to children's diets are analysed. We also assess patterns of time use and their relationship with productivity. Finally, domestic and agricultural technologies and time use patterns are assessed.

Compared to Ghana Time Use Data 2009, overall work appears to have reduced for men in the study regions but not for women. Our analysis shows persistent gender gaps in time allocation, with women and girls shouldering unpaid work across different income groups and household compositions. Compared to men, women spend more time on overall work and unpaid activities, regardless of household income levels. Similarly, girls tend to dedicate more time to work and unpaid activities compared to boys. Household characteristics play a role in shaping time allocation. For example, girls in single-adult households tend to allocate more time to work and unpaid activities compared to those in dual or multi-adult households. Women in lower-income households spend more hours in work-related activities, particularly unpaid work. Women from wealthier households tend to spend more time in paid activities,. While the patterns of time spent on paid and unpaid activities remain consistent regardless of household type with women spending more time on unpaid activities and overall work, women in households that undertake both farming and non-farming activities work the longest hours.

There appears to be a positive association between women's time in unpaid work and children's dietary diversity, suggesting the significance of women's input in home production for children's outcomes; domestic work and caregiving positively influence the variety of food consumed by children. However, women's time in unpaid work interacts with their education in its relationship with children's dietary diversity. This suggests that other factors may counterbalance the potential benefits of unpaid work.

Women's time in unpaid work is negatively associated with our indicator of productivity, indicating that women who spend more time on unpaid activities decrease their labour productivity Notably, agricultural water pumps and hand insecticide pumps have a positive relationship with women's time spent in paid activities. Given the significance of access to water for domestic work, it is intuitive that easier access – even in terms of water pumps for the farms allows women to spend more time in paid work. Access to the market for agricultural produce has a positive relationship with women's time spent on paid activities. These observations underscore the importance of water infrastructure for women.

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Appendix

Appendix Table 1: Average annual household income by quintiles

Quintile	Average income per capita from Wage employment	Average income from Non-Farm Employment	Average Household agricultural income per capita	Average Other income per capita	N
First	0.0	0.8	-830.2	1.2	122
Second	0.0	0.1	-213.8	0.3	121
Third	0.1	0.0	-50.4	0.5	122
Fourth	0.5	0.8	45.5	0.8	121
Fifth	54.3	90.9	3075.8	0.0	121

Appendix Table 2: Average annual household and per capita expenditure by expenditure group

Expenditure group	Average household expenditure - Purchased	Average household expenditure - Imputed	Average household expenditure	Average expenditure per capita - Purchased	Average expenditure per capita - Imputed	Average household expenditure per capita	Share of Total	N
Food								
Food consumed at home	5003.5	2024.3	7027.8	1364.8	560.0	1924.8	33.5	607
Food and Beverages consumed in Hotels, Cafes and Restaurants	886.4	127.0	1013.5	238.5	27.5	266.1	5.1	607
Non Food								
Beverages and tobacco	768.3	72.7	841.0	189.3	16.1	205.4	4.0	607
Housing/House Rent	330.4	564.2	894.6	84.0	148.6	232.7	4.7	607
Water, electricity, gas and other utilities	843.0	91.4	934.4	232.0	21.3	253.3	5.3	607
Transport	2178.9	134.2	2313.0	575.5	34.5	610.0	11.0	607
Recreation and culture	196.7	47.6	244.4	47.7	9.8	57.5	1.2	607
Non-Durable and Personal Goods	1077.2	56.3	1133.5	264.9	14.7	279.7	6.3	607
Miscellaneous goods and services	807.2	62.1	869.3	191.1	14.7	205.8	4.9	607
Communications	797.4	28.0	825.4	213.4	6.1	219.5	4.5	607
Other expenditures	887.1	95.7	982.8	260.1	28.4	288.4	4.2	607
Education	1305.2	63.1	1368.3	317.8	14.4	332.2	6.5	607
Health	571.9	63.8	635.7	152.6	22.9	175.5	3.9	607
Clothing and footwear	636.2	44.2	680.4	164.4	14.0	178.4	3.9	607
Furnishings, and furnishing maintenance	133.2	9.8	143.0	33.0	3.2	36.2	0.8	607
Household equipment and Equipment maintenance	90.7	6.8	97.5	20.4	2.4	22.8	0.4	607

Appendix Table 3: Average annual per capita expenditure and share of expenditure capita by quintiles

	Quintile group									
	First (Lowest)		Second		Third		Fourth		Fifth (Highest)	
Expenditure group	Average expenditure per capita	Share of Total (%)	Average expenditure per capita	Share of Total (%)	Average expenditure per capita	Share of Total (%)	Average expenditure per capita	Share of Total (%)	Average expenditure per capita	Share of Total (%)
Food										
Food consumed at home	374.9	22.3	940.4	32.6	1441.4	35.1	2313.2	39.6	4570.8	38.0
Food and Beverages consumed in Hotels, Cafes and Restaurants	81.8	5.1	171.4	6.0	181.4	4.5	294.6	5.0	603.3	4.9
Non Food										
Beverages and tobacco	61.7	3.9	119.2	4.1	181.7	4.5	222.9	3.8	442.8	3.7
Housing/House Rent	88.7	4.7	181.4	6.5	177.5	4.4	157.9	2.8	559.4	4.9
Water, electricity, gas and other utilities	92.6	7.9	135.2	4.8	186.3	4.6	263.6	4.6	590.9	4.7
Transport	164.0	12.5	283.8	9.8	414.0	10.2	617.9	10.6	1575.7	11.8
Recreation and culture	22.8	1.3	43.4	1.5	58.7	1.4	48.3	0.8	114.6	1.0
Non-Durable and Personal Goods	124.2	8.7	174.7	6.1	260.0	6.4	308.2	5.3	532.6	4.8
Miscellaneous goods and services	87.7	6.5	150.6	5.3	194.5	4.8	268.9	4.6	328.3	3.1
Communications	68.7	5.7	123.2	4.3	181.9	4.5	215.4	3.7	509.6	4.0
Other expenditures	31.2	2.3	75.9	2.7	172.1	4.1	320.3	5.5	845.7	6.5
Education	104.2	6.8	185.6	6.5	292.6	7.1	349.6	6.1	731.3	5.8
Health	72.1	6.1	123.0	4.2	133.1	3.3	171.3	2.9	379.1	3.0
Clothing and footwear	63.4	4.8	120.3	4.2	152.8	3.7	211.3	3.6	345.5	2.9
Furnishings, and furnishing maintenance	11.6	0.8	24.7	0.9	40.0	1.0	38.4	0.7	66.7	0.5
Household equipment and Equipment maintenance	7.7	0.5	11.8	0.4	18.0	0.4	26.8	0.5	49.8	0.4
N	122	122	121	121	122	122	121	121	121	121

Test of difference in means of Time Use Patterns using a Two-tailed T-test

Appendix Table 4: Test of Difference in Average Time Spent of Adult Members, by Gender

Activity	t-value	df	p-value
Work (paid+unpaid)	12.5708	857	0
Paid	-6.9787	644	0
Unpaid	11.5792	573	0
Self care	-1.3505	869	0.1772
Leisure	-4.5006	607	0
School	-0.2855	16	0.7789
Travel	-1.2485	526	0.2124
Other	-1.4714	100	0.1443

Appendix Table 5: Test of Difference in Average Time Spent of Children by Gender

Activity	t	df	p-value
Work (paid+unpaid)	-2.9102	204	0.004
Paid	-0.4731	61	0.6378
Unpaid	-6.1696	194	0
Self care	0.7637	224	0.4458
Leisure	0.784	172	0.4341
School	1.6137	114	0.1094
Travel	-1.4649	137	0.1452
Other	-1.0185	23	0.319

Appendix Table 6: Test of Difference in Average Time Spent of Adult Members, by Region

	Eastern			Upper East		
Activity	t-value	df	p-value	t-value	df	p-value
Work (paid+unpaid)	4.8855	357	0	5.9512	456	0
Paid	-3.027	251	0.0027	-6.6058	391	0
Unpaid	7.9658	257	0	8.6872	314	0
Self care	-1.4126	396	0.1585	-0.6572	471	0.5114
Leisure	-3.7664	344	0.0002	-2.4329	261	0.0157
School	-	-	-	-0.2855	16	0.7789
Travel	-1.275	202	0.2038	-1.4322	322	0.1531
Other	-1.2965	45	0.2014	-0.9619	53	0.3405

Appendix Table 7: Test of Difference in Average Time Spent of Children, by Region

	Eastern			Upper East		
Activity	t	df	p-value	t	df	p-value
Work (paid+unpaid)	-1.47	92	0.1451	-2.543	110	0.0124
Paid	-0.04	14	0.9687	-0.824	45	0.4146
Unpaid	-3.701	90	0.0004	-5.077	102	0
Self care	-0.239	103	0.812	1.4193	119	0.1584
Leisure	0.4674	92	0.6413	0.4233	78	0.6733
School	0.0916	35	0.9275	1.6193	77	0.1095
Travel	-2.154	47	0.0364	0.4729	88	0.6375
Other	-0.468	4	0.664	-0.846	17	0.4093

Appendix Table 8: Test of Difference in Average Time Spent of Adult Members, by the Number of Adults in the Household

	Single Adult Households			Dual/More Adults Households		
Activity	t-value	df	p-value	t-value	df	p-value
Work (paid+unpaid)	1.3697	7	0.1753	7.6051	746	0
Paid	-0.2066	48	0.8372	-7.0224	594	0
Unpaid	3.524	62	0.0008	11.184	509	0
Self care	-0.1467	72	0.8838	-1.4657	795	0.1431
Leisure	-2.0121	51	0.0495	-4.1383	554	0
School	-	-	-	-	-	-
Travel	0.475	41	0.6373	-1.2727	483	0.2037
Other	-	-	-	-1.4333	94	0.1551

Appendix Table 9: Test of Difference in Average Time Spent of Children, by the Number of Adults in the Household

	Single Adult Household			Dual/more Adults Household		
Activity	t	df	p-value	t	df	p-value
Work (paid+unpaid)	0.6841	18	0.5026	-2.964	184	0.0034
Paid	-	-	-	-0.97	55	0.3365
Unpaid	-1.755	16	0.0984	-5.594	176	0
Self care	0.0536	24	0.9577	0.7789	198	0.437
Leisure	-1.014	18	0.3242	1.3878	152	0.1672
School	-0.081	10	0.9374	1.8192	102	0.0718
Travel	0.138	12	0.8925	-2.034	123	0.0442
Other	-	-	-	-	-	-

Appendix Table 10: Test of Difference in Average Time Spent of Adult Members, by the Type of Household

	Farming Households			Farming and Non-farming Households		
Activity	t-value	df	p-value	t-value	df	p-value
Work (paid+unpaid)	3.92	396	0.0001	6.4242	417	0
Paid	-5.5514	297	0	-4.6347	345	0
Unpaid	9.5601	285	0	7.2995	286	0
Self care	-0.1773	425	0.8593	-1.6089	442	0.1084
Leisure	-3.1486	286	0.0018	-3.2459	319	0.0013

School	-	-	-	-0.7342	11	0.4782
Travel	0.6598	257	0.51	-1.9387	267	0.0536
Other	-0.4512	29	0.6552	-1.7313	69	0.0879

Appendix Table 11: Test of Difference in Average Time Spent of Children, by the Type of Household

	Farming Households			Farming and Non-farming Households		
Activity	t	df	p-value	t	df	p-value
Work (paid+unpaid)	-2.42	115	0.0171	-1.779	87	0.0787
Paid	-1.369	34	0.1799	0.5841	25	0.5644
Unpaid	-5.865	113	0	-2.716	79	0.0081
Self care	-0.251	129	0.8022	1.617	93	0.1093
Leisure	0.9746	103	0.332	0.0336	67	0.9722
School	0.5552	61	0.5808	1.574	51	0.1217
Travel	-0.973	76	0.3338	-1.636	59	0.1072
Other	-1.043	18	0.311	1.5492	3	0.2191

Appendix Table 12: Test of Difference in Average Time Spent of Children, by Age group

	10-12 years			13-15 years			16-17 years		
Activity	t	df	p-value	t	df	p-value	t	df	p-value
Work (paid+unpaid)	-2.131	67	0.0368	-1.621	86	0.1086	-1.331	47	0.1898
Paid	0.5903	14	0.5644	-1.144	27	0.2626	0.5207	16	0.6097
Unpaid	-4.034	66	0.0001	-3.719	82	0.0004	-2.878	42	0.0063
Self care	-0.342	78	0.7834	0.5708	89	0.5696	1.1016	53	0.2756
Leisure	1.0407	64	0.3019	0.6916	64	0.4917	-0.765	40	0.4487
School	0.7487	38	0.4587	1.1034	52	0.2749	0.8695	20	0.3949
Travel	-1.335	46	0.1885	-2.184	57	0.0331	0.4149	30	0.6812
Other	0.6091	5	0.5691	-0.452	7	0.6647	-2.095	7	0.0744

Appendix Table 13: Test of Difference in Average Time Spent of Adult Members, by Income quintile

	First			Second			Third			Fourth			Fifth		
Activity	t	df	p-value	t	df	p-value	t	df	p-value	t	df	p-value	t	df	p-value
Work (paid+unpaid)	3.2034	163	0.0026	3.3155	165	0.0011	3.4201	174	0.0008	3.6481	157	0.0004	2.7295	148	0.0071
Paid	-4.031	130	0.0001	-3.238	130	0.0015	-4.407	135	0	-2.439	127	0.0161	-1.488	114	0.1395

Unpaid	5.982	117	0	5.2925	118	0	2.8739	119	0.0048	5.5821	106	0	6.2656	105	0
Self care	-0.395	174	0.6935	-0.693	171	0.489	-0.146	184	0.8844	-0.859	168	0.3914	-0.9938	164	0.3218
Leisure	-2.179	107	0.0315	-2.512	114	0.0134	-1.864	130	0.0646	-1.88	118	0.0625	-1.5984	130	0.1124
School													-1.5	2	0.2724
Travel	-0.256	117	0.7988	-0.33	118	0.742	0.453	97	0.6515	-1.784	93	0.0776	-1.065	93	0.2896
Other	-0.698	15	0.496	0.2868	17	0.7777	0.2752	14	0.7872	-0.853	18	0.4047	-1.4258	28	0.165

Appendix Table 14: Test of Difference in Average Time Spent of Children, by Income quintile

	First			Second			Third			Fourth			Fifth		
Activity	t	df	p-value	t	df	p-value	t	df	p-value	t	df	p-value	t	df	p-value
Work (paid+unpaid)	-0.823	34	0.4162	-2.254	38	0.03	-0.9299	44	0.1787	-1.763	43	0.085	0.4157	148	0.0071
Paid	-0.459	12	0.6544	0.1736	15	0.8645	-0.651	10	0.5297	-0.654	13	0.5248			
Unpaid	-3.8628	32	0.0005	-3.672	33	0.0008	-1.7198	42	0.0928	-3.31	42	0.0019	-2.26	37	0.0298
Self care	1.3101	37	0.1982	1.0283	38	0.3103	0.0715	51	0.9433	0.011	48	0.9913	-0.445	42	0.6586
Leisure	-0.4001	21	0.6931	1.0422	28	0.3063	1.7885	39	0.0815	-1.23	36	0.2265	0.091	40	0.928
School	1.9115	22	0.0691	0.2885	22	0.7756	-0.2949	27	0.7703	1.9183	20	0.0695	-0.837	15	0.4156
Travel	0.5874	27	0.5618	-0.771	27	0.4472	-0.7688	30	0.448	-2.742	25	0.0111	-1.001	20	0.3287
Other	-	-	-	-2.413	4	0.0733	0.5104	5	0.6315	-	-	-	-	-	-

Appendix Table 15: Average annual household and per capita expenditure by expenditure group

	Food		Housing		Overall			
Welfare Quintile	Average Expenditure	Expenditure per capita	Average Expenditure	Expenditure per capita	Average Expenditure	Expenditure per capita	Share of Food to Total	N
First (Lowest)	2379.4	456.7	455.3	88.7	7691.9	1457.3	27.4	122
Second	5708.1	1111.9	1008.9	181.4	14802.9	2864.8	38.6	121
Third	7799.2	1622.9	820.7	177.5	20042.5	4086.0	39.5	122
Fourth	10619.8	2607.8	562.5	157.9	23865.9	5828.6	44.6	121
Fifth (Highest)	13748.6	5174.1	1629.9	559.4	33720.8	12246.0	43.0	121
Overall	8041.3	2190.9	894.6	232.7	20004.5	5288.2	38.6	607

Appendix Table 16: Test of Difference in Average Time Spent of Adult Members, by Expenditure quintile

	First			Second			Third			Fourth			Fifth		
Activity	t	df	p-value	t	df	p-value	t	df	p-value	t	df	p-value	t	df	p-value
Work (paid+unpaid)	3.543	184	0.0005	3.4168	155	0.0008	2.5737	158	0.011	3.2728	168	0.0013	3.5675	142	0.0005
Paid	-4.094	156	0.0001	-2.082	113	0.0396	-4.704	131	0	-3.8	127	0.0002	-1.2134	109	0.2277
Unpaid	5.8175	128	0	3.8321	109	0.0002	4.366	104	0	5.4234	123	0	6.4649	101	0
Self care	-1.717	189	0.0876	0.215	161	0.8301	0.4611	169	0.6453	-0.974	183	0.3313	-1.3254	159	0.1869
Leisure	-0.899	90	0.3709	-2.528	112	0.0128	-1.722	130	0.0874	-2.798	140	0.0059	-2.1038	127	0.0374
School	-0.398	5	0.7069	0.4512	5	0.6708									
Travel	-0.435	110	0.6641	-0.484	98	0.6292	-1.057	118	0.2928	0.6836	104	0.4957	-1.6334	88	0.106
Other	-0.53	15	0.698	-0.352	15	0.7297	0.5126	16	0.6152	-0.064	26	0.9498	-1.9038	20	0.0714

Appendix Table 17: Test of Difference in Average Time Spent of Children, by Expenditure quintile

	First			Second			Third			Fourth			Fifth		
Activity	t	df	p-value	t	df	p-value	t	df	p-value	t	df	p-value	t	df	p-value
Work (paid+unpaid)	-1.8198	50	0.0748	-1.29	38	0.2048	-0.9965	41	0.3248	-1.386	44	0.1727	-0.821	23	0.4198
Paid	-1.1695	21	0.2553	-0.279	9	0.7869	-0.281	10	0.7845	0.0394	11	0.9692	-	-	-
Unpaid	-2.2921	46	0.0265	-3.322	35	0.0021	-3.3083	40	0.002	-3.803	43	0.0004	-1.672	22	0.1088
Self care	0.9146	56	0.3643	0.9245	42	0.3605	-0.7258	43	0.4719	1.1091	47	0.273	-0.539	28	0.5942
Leisure	-0.2364	42	0.8143	0.6223	36	0.5376	-2.1327	29	0.0415	-0.384	34	0.7036	-0.412	23	0.6843
School	0.5957	23	0.5567	0.9435	20	0.3567	0.8485	22	0.4053	1.2464	25	0.2242	0.0076	12	0.9941
Travel	0.6504	38	0.5194	-0.99	27	0.3309	-1.2013	27	0.2401	-1.345	28	0.1894	-1.137	9	0.2849
Other	-0.9492	4	0.3963	-0.268	8	0.7956	-	-	-	-	-	-	-	-	-

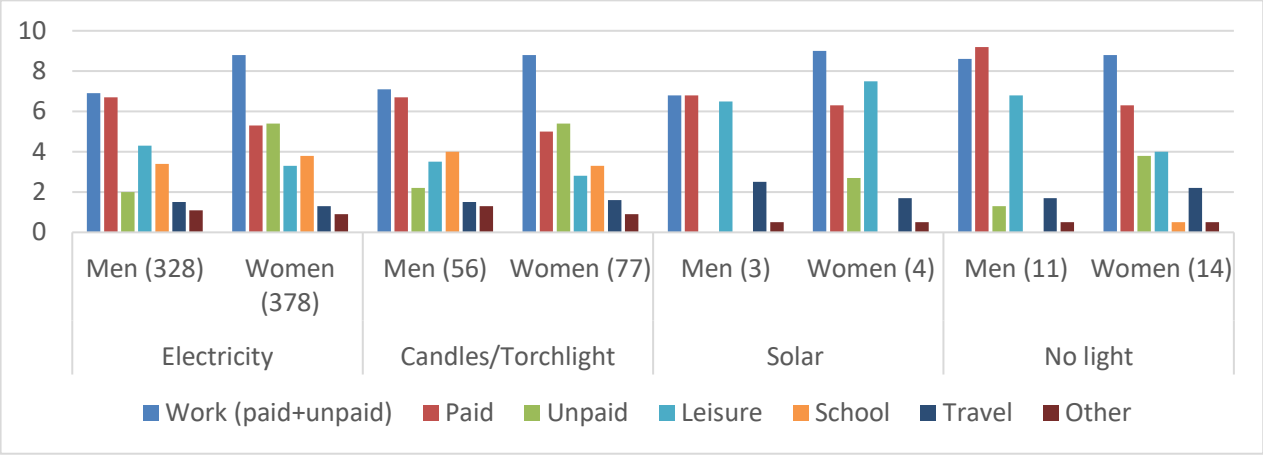
Appendix Table 18: Test of Difference in Average Time Spent of Adult Members, by Asset Index

	First			Second			Third			Fourth			Fifth		
Activity	t	df	p-value	t	df	p-value	t	df	p-value	t	df	p-value	t	df	p-value
Work (paid+unpaid)	2.1284	160	0.0348	3.8733	141	0.0002	2.6956	158	0.0078	2.8852	166	0	-2.4961	127	0.0138
Paid	-2.496	127	0.0138	-3.265	110	0.0015	-3.216	123	0.0017	-2.9	123	0.0044	-3.5634	153	0.0005

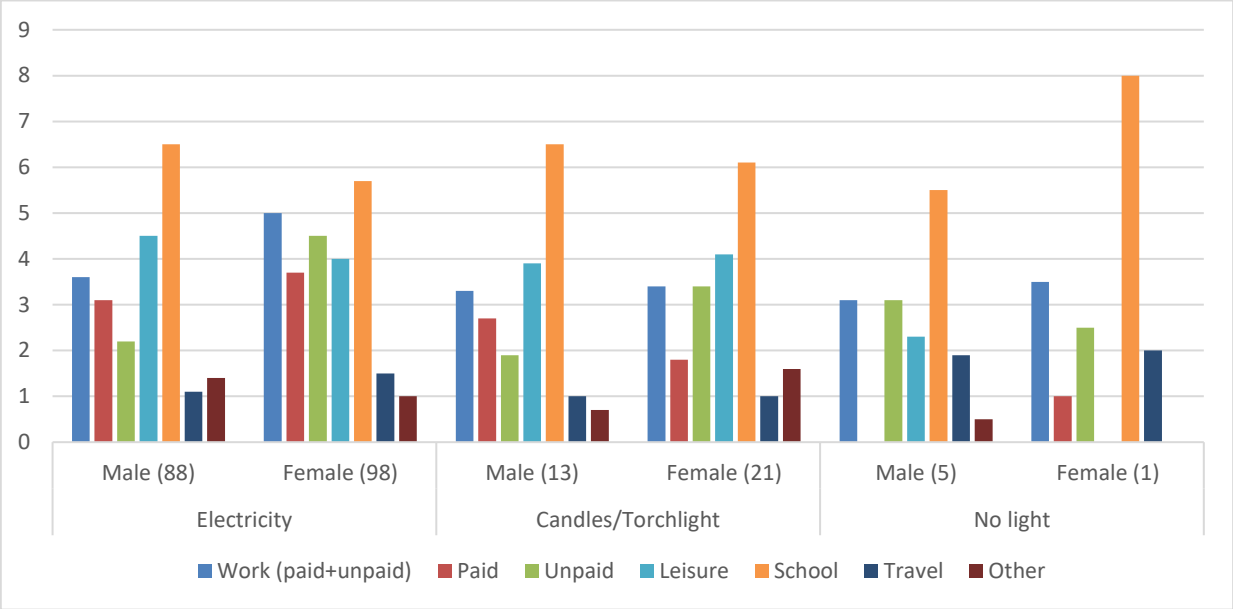
Unpaid	3.522	121	0.0006	4.7701	100	0	4.6252	107	0	6.62	116	0	6.0755	121	0
Self care	-1.548	165	0.1234	-0.177	147	0.86	0.104	171	0.9173	-0.223	181	0.8238	-1.6646	197	0.0976
Leisure	-0.655	87	0.5139	-3.577	97	0.0005	-0.656	116	0.5129	-1.732	141	0.0854	-3.0104	158	0.003
School	-0.414	5	0.696												
Travel	0.1412	92	0.8881	-0.807	92	0.4219	-1.063	113	0.2903	-0.363	102	0.7174	-1.6066	119	0.1108
Other	0.2942	11	0.7741	-2.023	10	0.0707	0.2887	12	0.7778	-0.93	27	0.3609	-1.0722	32	0.2917

Appendix Table 19: Test of Difference in Average Time Spent of Children, by Asset Index

	First			Second			Third			Fourth			Fifth		
Activity	t	df	p-value	t	df	p-value	t	df	p-value	t	df	p-value	t	df	p-value
Work (paid+unpaid)	-0.9092	36	0.3693	-1.274	31	0.2121	-0.2061	47	0.8376	-1.687	30	0.102	-2.296	52	0.0257
Paid	-0.4999	127	0.6262	1.2341	11	0.2429	-0.1759	16	0.8626	-0.149	2	0.8952	-1.039	12	0.3192
Unpaid	-1.9229	33	0.0632	-3.636	30	0.001	-1.4627	43	0.1508	-2.471	29	0.0196	-3.878	51	0.0003
Self care	2.1097	40	0.0412	-1.333	36	0.1909	-0.4751	48	0.6368	0.4363	34	0.6654	0.7899	58	0.4328
Leisure	0.7078	27	0.4852	0.5382	27	0.5648	-1.1186	35	0.2709	1.0287	28	0.3124	0.2995	47	0.7659
School	0.5826	24	0.5656	1.2282	14	0.2396	-0.343	28	0.7341	1.3283	15	0.1976	-0.148	25	0.8835
Travel	1.1442	23	0.2643	-1.92	21	0.0686	-1.0364	36	0.3069	-1.327	19	0.2004	-1.607	30	0.5447
Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-



Appendix Fig 1: Average Time Spent (in Hours) in various Activities and Source of Lighting by Adult Members



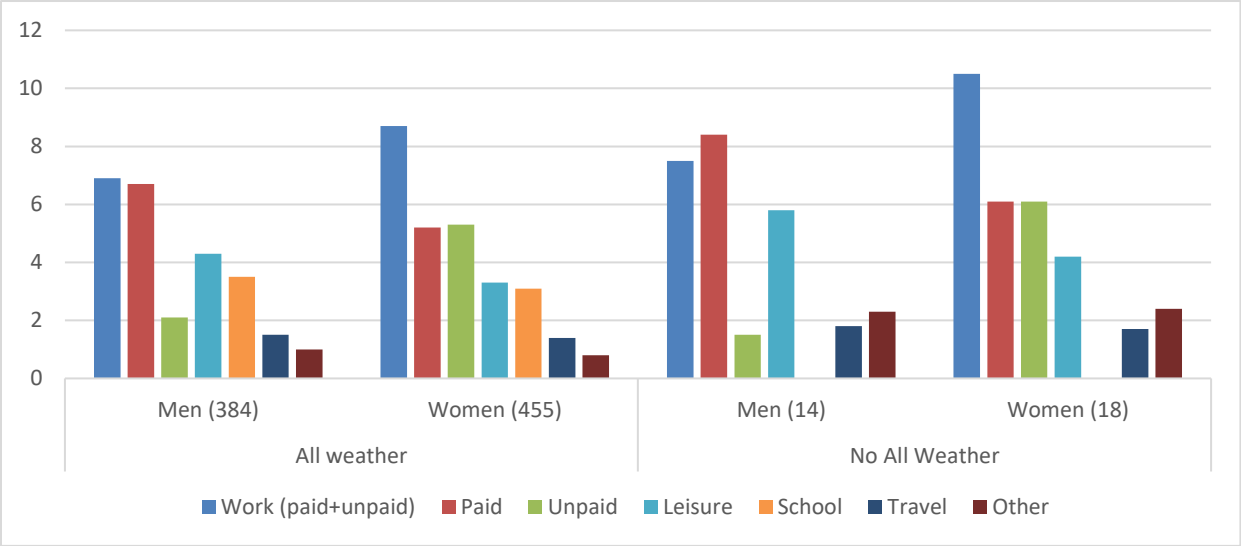
Appendix Fig 2: Average Time Spent (in Hours) in various Activities and Source of Lighting by Children aged 10-17 years

Appendix Table 20: Average Time Spent (in Hours) in various Activities and Source of water for households by Adult members

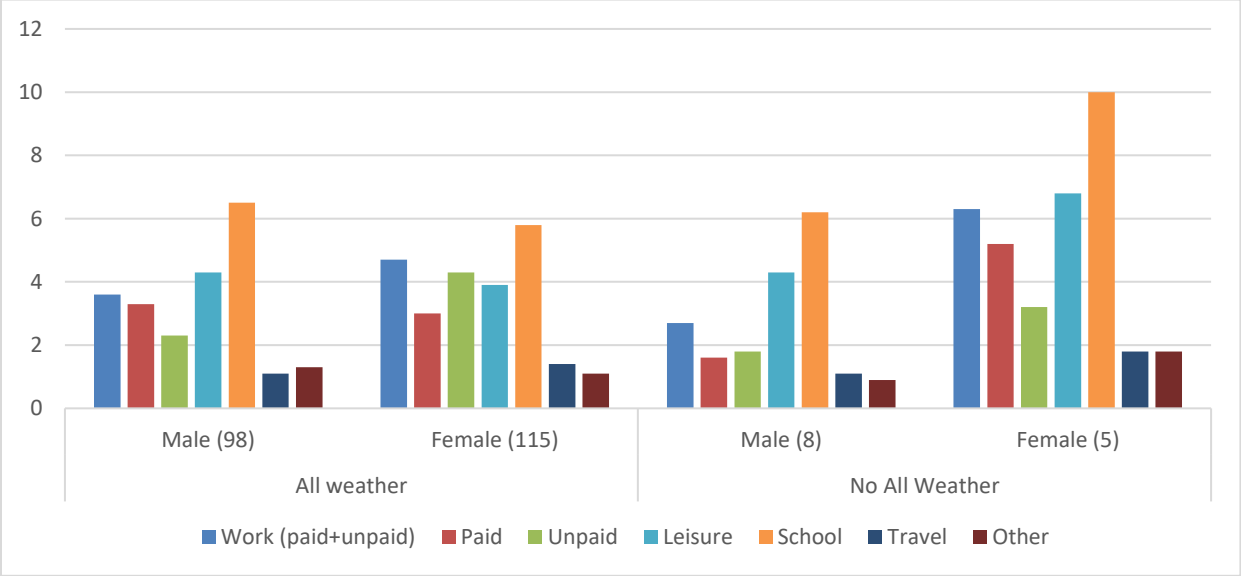
	Pipe into dwelling		Piped to yard/plot		Public Tap/Standpipe		Tube well or borehole		Piped into neighbour's yard		Protected Well (Inside the house)		Protected Well (Outside the house)		Unprotected Well (Inside the house)		Unprotected Well (Outside the house)		Surface water (Lakes, Rivers, Dams)	
Activity	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women
Work (paid+unpaid)	6.2	7.1	7.1	9.5	6.6	8.4	7.2	9.1	8.1	7.8	6.1	7.6	6.3	10.8	0	5.5	8.8	9.2	5.3	2
Paid	6.3	6.1	7	6	6.7	5.6	6.8	5.1	8	5.3	5.6	6.2	6.2	4.7	0	0	8.8	5.1	7.5	0
Unpaid	4	4.9	1.1	5.6	1.9	5	2.3	5.4	0.5	4.4	1.9	3.2	1.2	7.9	0	5.5	0	4.1	1.5	2
Self care	12.8	13.1	11.5	11.5	13.2	12.2	12.9	12.9	11.6	13.1	12.6	13.4	12.3	12	0	14.5	12.1	13	12	11.5
Leisure	6.1	4.3	4.3	2.6	5.2	4.3	3.3	2.5	5.2	4.4	4.3	2	5	2.9	0	3	2	1.3	6.8	8.5
School	0	0	2.5	0.5	0	6.5	3.7	3	0	0	0	0	0	0	0	0	0	0	0	0
Travel	1.8	1.1	2.1	1.8	1.1	1.1	1.8	1.6	0.5	0.5	1.2	1	1.2	0.5	0	0	1.3	1.4	0.8	1
Other	3.5	0.5	0.6	0.6	1.3	1.3	0.9	0.8	0	0.5	0.5	0.5	1	1	0	0	0.5	0.5	0.5	0
N	15	21	21	28	119	137	207	247	5	8	8	7	16	17	0	1	4	6	3	1

Appendix Table 21: Average Time Spent (in Hours) in various Activities and Source of water for households by Children aged 10-17 years

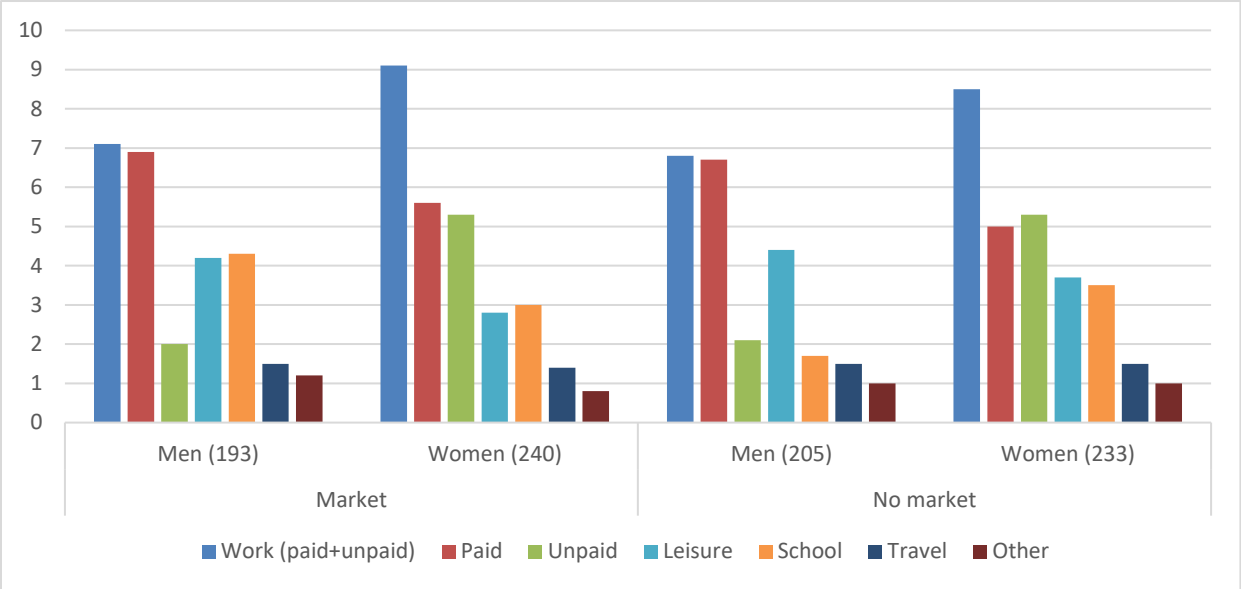
	Pipe into dwelling		Piped to yard/plot		Public Tap/Standpipe		Tube well or borehole		Piped into neighbour's yard		Protected Well (Inside the house)		Protected Well (Outside the house)		Unprotected Well (Outside the house)		Surface water (Lakes, Rivers, Dams)	
Activity	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female)
Work (paid+unpaid)	6.2	5.7	3.6	4.5	3.9	4.3	3.1	4.7	3.5	4	2.9	5.5	3	9.8	3	7	0	4
Paid	6.5	0	3.7	0	4.4	4.2	2	2.7	0	0	2.5	0	2.5	5	2	0	0	0
Unpaid	4	5.7	2.3	4.5	2.2	3.7	2.3	4.2	3.5	4	1.6	5.5	2	6.5	1	7	0	4
Self-care	10.7	11.8	12.9	12.5	11.8	11.5	12.6	12.2	10	12.5	11.9	10.8	12.1	12.3	13.5	10	0	13
Leisure	3.5	2.5	5.2	3.2	4.5	5.1	3.8	3.3	9	6.5	4.7	2.5	4.6	2.5	7	7.5	0	5
School	4.5	5.8	6.3	5	6.8	7	6.3	5.5	0	0	5.7	6.5	8	0	0	0	0	0
Travel	0.5	1.3	1.2	1	0.8	2.1	1.5	1.2	0	0	0.8	0.5	0.5	1	0.5	0	0	0
Other	3.5	0	2.7	0.8	1.1	2.5	0.8	0.9	0	0	0	2.5	0	0	0	0	0	0
N	3	3	9	3	39	34	44	72	1	1	4	2	5	3	1	1	0	1



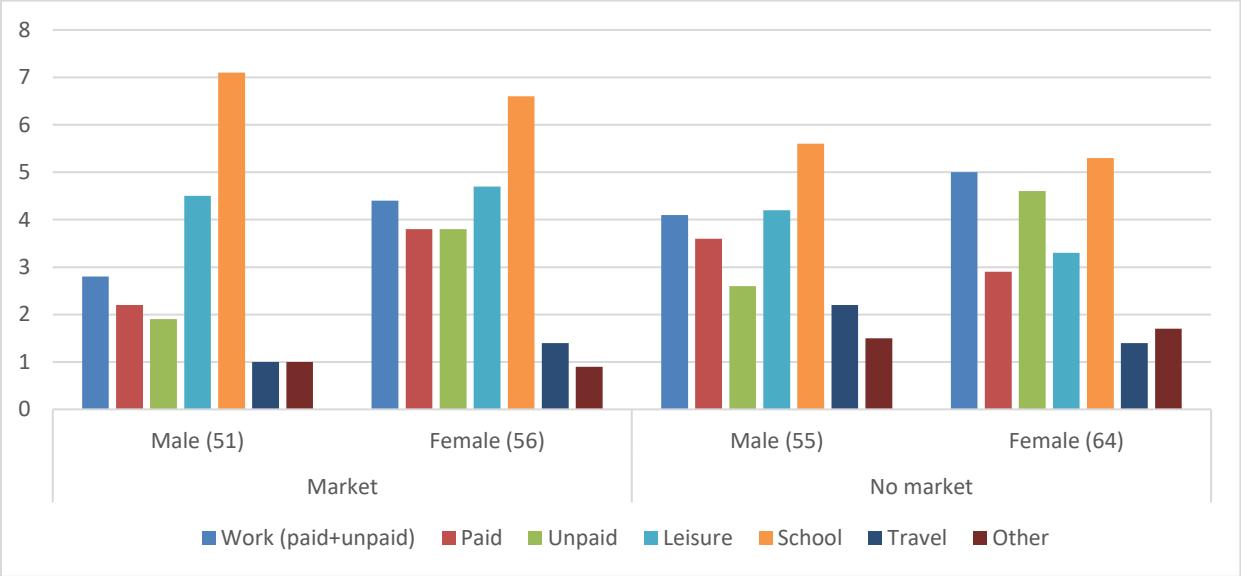
Appendix Fig 3: : Average Time Spent (in Hours) in various Activities and All-Weather Roads by Adult Members



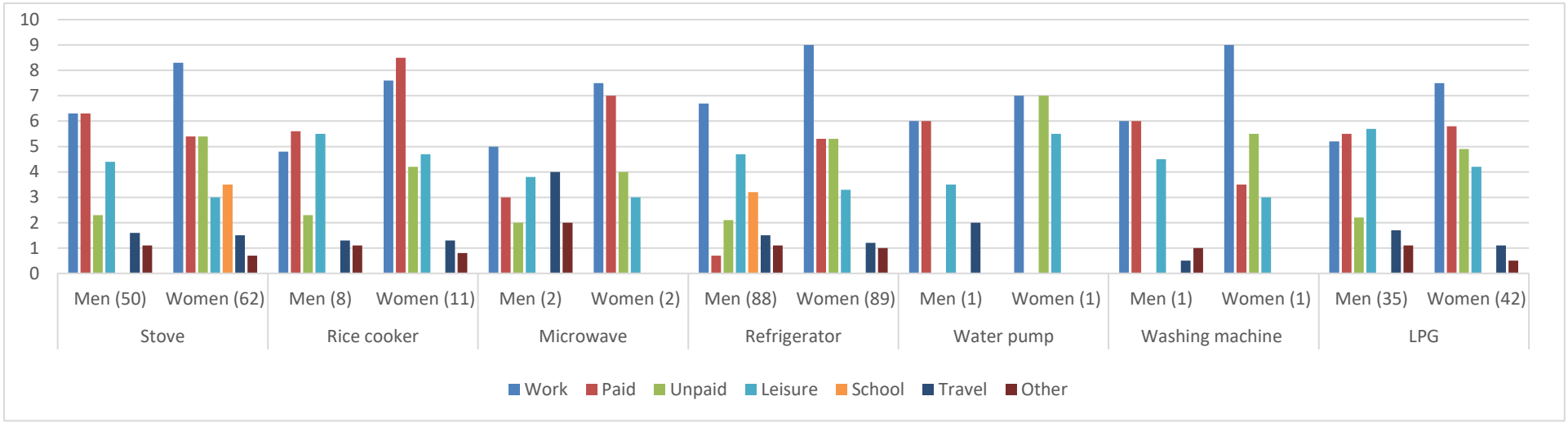
Appendix Fig 4: Average Time Spent (in Hours) in various Activities and All-Weather Road by Children aged 10-17 years



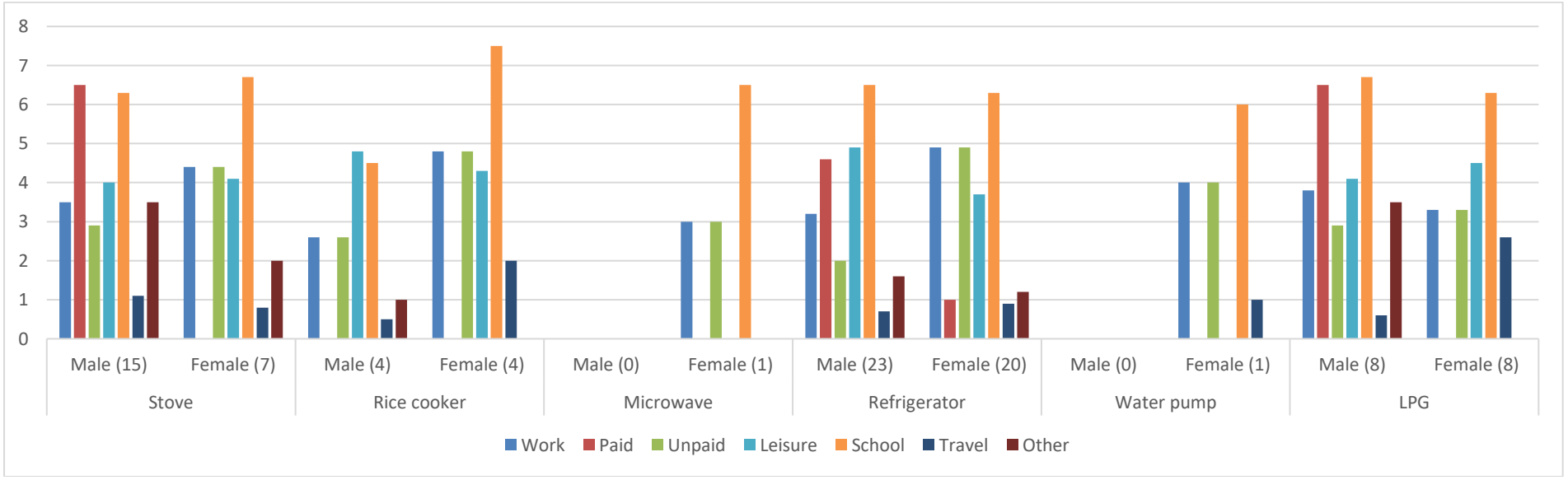
Appendix Fig 5: Average Time Spent (in Hours) in various Activities and Market for Agricultural produce by Adult Members



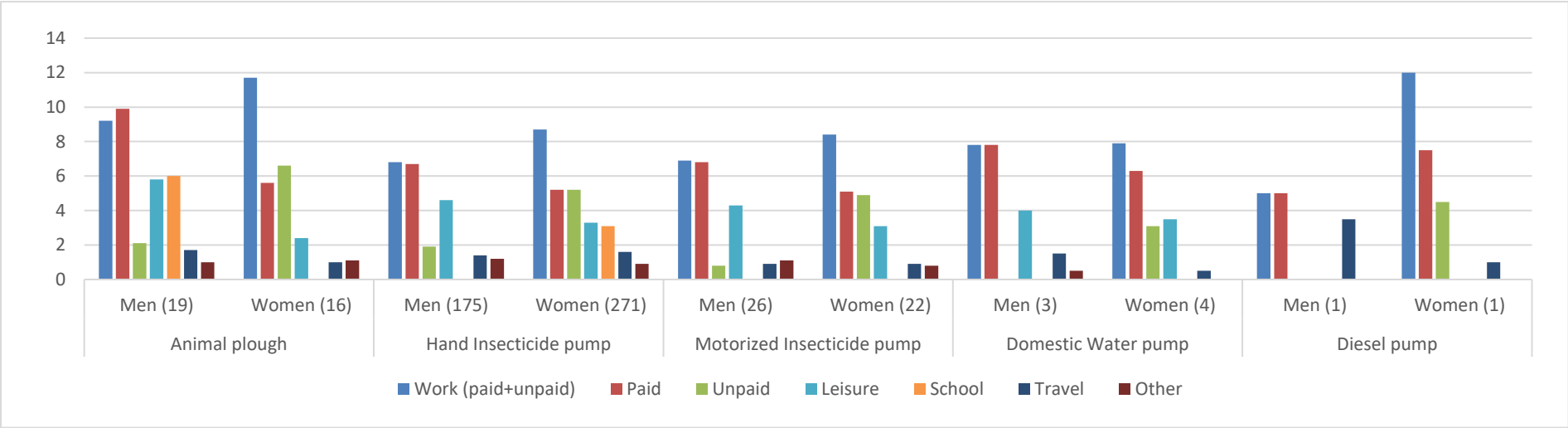
Appendix Fig 6: Average Time Spent (in Hours) in various Activities and Market for Agricultural produce by Children aged 10-17 years



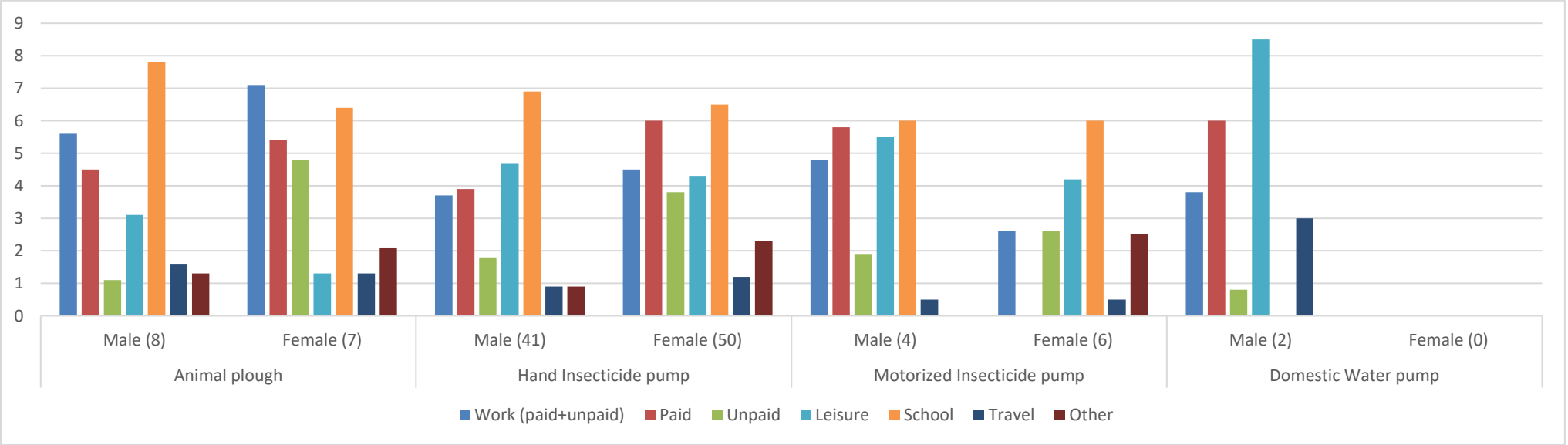
Appendix Fig 7: Average Time Spent (in Hours) in various Activities and Domestic Technologies by Adult Members



Appendix Fig 8: Average Time Spent (in Hours) in various Activities and Domestic Technologies by Children aged 10-17 years



Appendix Fig 9: Average Time Spent (in Hours) in various Activities and Agriculture Technologies by Adult Members



Appendix Fig 10: Average Time Spent (in Hours) in various Activities and Agriculture Technologies by Children aged 10-17 years

Post estimation results

Appendix Table 22: Model Specification test

					Number of obs =	174
					LR chi2(2) =	63.25
					Prob > chi2 =	0.0000
Log likelihood = -86.769757					Pseudo R2 =	0.2777
	FS Coef.	Std. Err.	z	P>z	[95% Conf. Interval]	
_hat	1.0084	0.1926	5.24	0.000	0.6310	1.3858
_hatsq	0.0100	0.1005	0.1	0.921	-0.1870	0.2070
_cons	-0.0100	0.2255	-0.04	0.965	-0.4519	0.4318

Appendix Table 24: Goodness-of-fit statistics test

Log-likelihood	
Model	
Intercept-only	
Chi-square	
Deviance(df=155)	
LR(df=18)	
p-value	
R2	
McFadden	
McFadden(adjusted)	
McKelvey & Zavoina	
Cox-Snell/ML	
Cragg-Uhler/Nagelkerke	
Efron	
Tjur's D	
Count	
Count(adjusted)	
IC	
AIC	
AIC divided by N	
BIC(df=19)	
Variance of	
E	
y-star	
Log-likelihood	
Model	
Intercept-only	
Chi-square	

Appendix Table 23: Multicollinearity test

Variable	VIF	1/VIF
paid	6.8	0.1470
unpaid	6.01	0.1663
Gender_chi~2	2.11	0.4750
Child_age_~s	5.18	0.1930
Adult_fema~e	15.41	0.0649
fedu		
2	2.07	0.4829
3	2.53	0.3957
lhhincome	64.17	0.0156
asset_index		
2	2.41	0.4154
3		2.15
4	2.35	0.4247
5	2.31	0.4334
dwelling		
2	2.6	0.3846
3	3.01	0.3323
1.C7	6.08	0.1644
1.Primary_~2	3.99	0.2506
1.C3_19	2.64	0.3786
1.C3_10	5	0.1999

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