

Hillesland, M. and Doss, C.R. 2024. Addressing intrahousehold dynamics, power and decision-making in household water portfolios. *Water Alternatives* 17(3): 669-687



Addressing Intrahousehold Dynamics, Power and Decision-Making in Household Water Portfolios

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ABSTRACT: Although an extensive literature focuses on gender and water, fewer studies focus explicitly on intrahousehold power dynamics and their consequences. This paper aims to understand the intrahousehold power dynamics that influence decisions such as who collects water from what source and how water is allocated across activities. Drawing on the rich intrahousehold literature from economics, we demonstrate how it would strengthen our understanding of the impacts of water policy and interventions. A review of intrahousehold bargaining models suggests that it is important to consider how policies and interventions in the water sector may affect the outside options of household members and thus shape their bargaining power. Social norms, property rights and water infrastructure all influence household members' bargaining power and shape the context within which household decisions are made. Analysing intrahousehold dynamics for water needs to go beyond just considering the dynamic between the spouses; it also needs to consider others in the household who may provide labour for fetching water and who require water for their personal care and productive livelihoods.

KEYWORDS: Gender, intrahousehold dynamics, decision-making, household models, water choices

INTRODUCTION

Households make complex sets of decisions regarding their water portfolios, particularly when they do not have a reliable clean water source connected to their home. There may be multiple sources of water to choose from that vary in quality, reliability and cost. As such, they may choose to serve the different household needs with water from a variety of sources (Mason, 2012). Households may, for example, purchase water for drinking and cooking through a vendor while using water from a community water pan for bathing. Water that is acquired through irrigation systems may be diverted for livestock or other domestic uses such as sanitation, cleaning and laundry. Still other sources may be used for agriculture or for income-earning activities such as hairdressing, selling food, making soap, brewing beer, making bricks, dyeing fabric or making pottery. The decisions about how to meet the basic water needs of the household intersect with decisions on water use for productive purposes.

A related set of decisions is whether to invest in water-related assets as a way to ensure greater water security for the household. These assets – which impact available options – can include water pumps, tanks, vehicles to transport water, stoves and pots, water filters and rainwater catchment systems. Pumps, tanks and vehicles reduce the time and physical burden of acquiring water; stoves and pots can be used to boil water to ensure it is safer for drinking and cooking; filters also improve water quality.

A household's priorities may be contested, even when its members share some vision regarding how to secure household water and how to allocate it between domestic needs and productive purposes. An extensive literature, particularly in economics, provides strong evidence that it is important to look at

intra-household dynamics to understand how households arrive at decisions (see, for example, Alderman et al., 1995; Haddad et al., 1998; Hoddinott and Haddad, 1995; Doss, 1996). Little of this literature, however, looks specifically at intra-household dynamics and water-related household decision-making.

In this paper, we consider how an intra-household lens – particularly intra-household models that are based in the economics literature – can be used to investigate how water-related intra-household dynamics impact household and individual outcomes. Understanding power dynamics and how decisions are made within the household is key to understanding household water choices and intra-household distributional consequences. These consequences include who bears the monetary and non-monetary costs of acquiring water, including the physical load and time burden of water collection. Intra-household dynamics also affect the distribution of benefits in terms of both meeting basic needs and determining who controls the output and income from productive uses of water. This may result in differences in water security among household members in the form of differential access to water for meeting basic needs or for their livelihood.

Issues of men's and women's roles and responsibilities regarding water are widely discussed in both policy debates and academic literature (see Dickin and Caretta, 2022). International development frameworks focused on water management are increasingly recognising the importance of women's central role in the use, management and safeguarding of water and their involvement in decision-making processes. Within the water literature, great strides have been made in quantitatively investigating gender equality, women's agency and women's decision-making (Dickin et al., 2021; Dickin and Gabrielsson, 2023), however there is less focus on the relational or intra-household dynamics and their consequences, particularly in the quantitative literature.¹

Several classic papers on intra-household issues highlight how irrigation schemes often designed to benefit women backfired and negatively affected women's well-being. The lack of understanding of intra-household dynamics was a key reason for the failure. Centralised pump irrigation schemes were introduced in the Gambia, for example, to improve the productivity of women's rice plots; however, the scheme resulted in a shift to growing rice on plots held communally by men, with women being expected to provide labour but relinquish control of output (von Braun and Webb, 1989). While not specifically aimed at women, the Kano River Irrigation Project in northern Nigeria had a similar impact, with women losing control of their land and being expected to contribute more labour to family farms and less to their own plots. Firewood and inputs into women's traditional beer-brewing also became scarcer, further disadvantaging them (Jackson, 1985). Within the household, women lacked the power to ensure that they could take advantage of the benefits of the new irrigation technologies.

This paper contributes to the literature on household water security by identifying how a spotlight on intra-household dynamics may provide insights into household water acquisition, allocation and use. We draw on Mason's (2012) idea of a household water portfolio consisting of multiple sources of water for multiple purposes. Households decide which sources water should be collected from and for what purpose. Many of these households use water in key productive activities for both home consumption and income generation, meaning the water portfolio is intertwined with the household's livelihood strategies. With this in mind, this paper explores the dynamics within the household and how these dynamics influence decisions regarding water for both basic household needs and productive purposes. Our approach is specifically designed to understand the decisions made by households that do not have a reliable source of water connected to their home and thus draw on multiple sources. These households typically engage in a diverse array of activities in their pursuit of adequate livelihoods. Most of the insights

¹ The few analyses of intra-household dynamics around water focus primarily on irrigation systems in South Asia (Theis et al., 2018; Meinzen-Dick and Bakker, 1999, 2001; Meinzen-Dick and van der Hoek, 2001b). Other qualitative and analytical studies explore social norms and power dynamics around water within the household and in the community (Jeil et al., 2020; van Houweling, 2015, 2016; van Houweling et al., 2012; Abu et al., 2019; Weeratunge et al., 2016; Leder et al., 2017). This literature focuses heavily on domestic uses of water.

are derived from studies of households in low- and middle-income countries, although some of our discussion may be more broadly relevant. Typically, the literature either uses the household as the unit of analysis or considers gender differences; it rarely considers intrahousehold dynamics.

Considering primarily economics-based literature, we begin by identifying insights that are key to understanding household water portfolios. We provide an overview of household bargaining models; we then discuss how these models can be used to conceptualise and measure bargaining power and the other issues relevant to an intrahousehold analysis of water.

CONCEPTUALISING INTRAHOUSEHOLD POWER AND DECISION-MAKING DYNAMICS

An extensive literature uses the household as the unit of analysis and analyses a range of decisions regarding water. One set of studies investigates households' water source choices (Gross and Elshiewy, 2019; Wagner et al., 2019; Mu et al., 1990; Nauges and Strand, 2007; Nauges and van den Berg, 2009; Madanat and Humplick, 1993; Basani et al., 2008; Cheesman et al., 2008). Others estimate the quantity demanded or the amount of water that households are willing to purchase based on a set prices (both monetary and non-monetary) at a particular point in time (Gross and Elshiewy, 2019; Wagner et al., 2019; Nauges and Strand, 2007; Cheesman et al., 2008; Basani et al., 2008). A third set focuses on other aspects that influence choices such as the costs of obtaining water, particularly the time costs (Wagner et al., 2019; Whittington et al., 1990). In all these analyses, the household is the unit of analysis; most use a single utility function for the household, thus implicitly characterising it as a single decision-making unit with a single set of constraints.

This approach corresponds with the unitary model of the household (Becker, 2009), which assumes either that one household member makes the decisions on behalf of everyone or that everyone's preferences are identical. It models the household as having a single household budget constraint, so only total household income (not who earns it) is relevant to outcomes. It also does not consider the time constraints of individuals, only an overall household time constraint.

Power dynamics and the decision-making processes within the household are not made explicit in these approaches. Yet, there is increasing evidence that the dynamics within households may shape the outcomes of their decisions (for a review, see Doss, 2013). While the economics literature on intrahousehold decision-making has not focused on decisions about water, it highlights a number of relevant issues.

First, while household members may share some goals and preferences, there is also scope for difference. It may be useful to model how individual preferences affect outcomes, which is evident in the literature on water. Household members may disagree on priorities for how water should be obtained and used (Zwarteveen and Meinzen-Dick, 2001). Social norms invariably influence who is responsible for which activities including cooking, cleaning, personal hygiene or livelihood activities. These different responsibilities will influence preferences regarding water quality and quantity and how best to meet the water needs of the household; for instance, purchasing assets that would ease the physical load and time burden of water collection may be more important to those who are responsible for collecting water. These different preferences may manifest in conflict, particularly when resources are scarce (Dickin et al., 2020; Jeil et al., 2020; van Houweling, 2016).

Second, the time burden and potential monetary costs of provisioning water as well as the claims over assets, such as pumps or jerrycans, may affect household members differently. Household members allocate their labour across a wide variety of activities, of which provision of water is only one. Each person bears a different opportunity cost of collecting water, that is, what a person gives up in order to do so. For children, the opportunity cost may be giving up schooling, while women may forfeit time that would otherwise be spent in productive activities at home or in the market. Access to financial resources for obtaining water will also differ among household members. There is increasing evidence that income

is not necessarily pooled within households, so the ability to substitute cash for labour will also differ among household members. This substitution may involve buying equipment to make water collection easier or purchasing water.

Third, the 'bargaining power' of individual household members will affect the extent to which their preferences are reflected in final outcomes. In empirical analyses, bargaining power is often proxied by individual income or asset ownership (Quisumbing and Maluccio, 2003; Hoddinott and Haddad, 1995; Thomas, 1990, 1993; Duflo, 2003; Phipps and Burton, 1998). The literature demonstrates that household members may have different preferences and that women's bargaining power can impact household outcomes, such as household expenditures, child schooling and health and nutritional outcomes (Doss, 2013).

Fourth, bargaining processes within the household may be explicit or implicit. A growing set of empirical analyses asks who makes decisions within the household on a range of topics (Donald et al., 2020). The answers to these questions may reflect prevailing gender norms about who is *expected* to make decisions, but the intrahousehold bargaining framework suggests the processes may also be implicit. If the prevailing norm is that the male household head dominates the decision-making process and other household members cannot disagree or negotiate their preferences, we would expect that the water costs and allocation within the household best fit the male head's preferences regardless of who is reported to be making the decision.

Fifth, households are sites of both conflict and cooperation. When asked survey questions about who within the household makes decisions, respondents often say the decision is made jointly.² This suggests a certain level of cooperation and we need to consider individuals within the context of their household to understand these dynamics. The literature also notes that when couples report joint decision-making, it does not necessarily mean that the husband and wife have an equal voice (Acosta et al., 2020). It may also be the case that when women report that they make decisions about the household's water portfolio, their decisions may be based more on meeting the preferences and needs of their husband or others than on addressing their own needs (Kabeer, 1999).

Finally, information is not necessarily fully shared within the household. Asymmetric information may result from husbands and wives having different responsibilities and knowing more about the arenas in which they operate; indeed, they may not even be aware of the decisions that the other spouse makes. A number of studies find that men and women have different understandings of who within the household makes decisions about agricultural activities (Twyman et al., 2015; Hillesland et al., 2020; Anderson et al., 2017). In Bangladesh, correspondingly, an analysis of responses to household survey questions about asset ownership and household decision-making argues that differing responses by husbands and wives are due to asymmetric information rather than to a different understanding of the questions or to random noise in responses (Ambler et al., 2021).

There may also be deliberate withholding of information. One strand of literature focuses on hiding financial resources (for example, Ashraf, 2009), but empirical evidence suggests that there may also be hiding of assets (Ambler et al., 2021; Hillesland et al., 2023a). Household members may appear to adhere to the decisions made; however, they may then conceal information, resources and activities in order to better meet their own preferences rather than sharing (and negotiating) with others in the household. Large water assets such as pumps and storage tanks are difficult to hide and, especially in small communities, water source choices and water uses are also not easily hidden from other community and household members. Those engaged in smaller productive activities, however, may be able to conceal the amount of water used or the amount of income earned from such activities.

² See Doss and Quisumbing (2020) for a more detailed discussion of jointness in household decision-making.

MODELS OF INTRAHOUSEHOLD DYNAMICS

A range of economic models have been developed to help understand the dynamics within the household; each incorporates different elements discussed above. They all go beyond a unitary model of the household to analyse how the different preferences, resources and bargaining power of respective household members affect outcomes. We discuss two main classes of household models and how they may be relevant to understanding issues of household water use and its consequences. They have been widely used to look at how intrahousehold power dynamics impact decisions made about agricultural production, health and education for children, household expenditure patterns and labour allocations, but not decisions regarding water source or water allocation in the household. In this section, we identify key elements of the intrahousehold models and in the subsequent section we discuss how they are relevant to the water sector.

These models could be used to consider how intrahousehold power dynamics and individual time and budget constraints affect a household's choice of water sources. They also provide a framework for analysing how power dynamics impact decisions on allocation of water across household members, the purchase of water assets, and the use of water in productive activities. There may be a large cyclical element in that individual income relative to other household member's income may affect the choices of water source and use, and these choices will, in turn, affect both household-level income and who earns and controls it. Most household models do not explicitly incorporate this cyclical effect and only look at one set of decisions,³ but these effects could be large over time.

Models in the first class are known as cooperative bargaining models.⁴ They characterise the household as a set of individuals (for ease of modelling, they usually include just a husband and wife), each with their own preferences who then bargain over the use of pooled resources (Chiappori, 1988, 1992; Manser and Brown, 1980; McElroy and Horney, 1981). Bargaining power affects intrahousehold distribution. There is little discussion of the actual bargaining and decision-making processes, but power dynamics are introduced with the idea that each spouse has a fallback position, which determines his or her relative power in the relationship. The fallback position is the person's potential well-being outside of the household and is shaped and influenced by various dimensions of that context. For example, the economic opportunities within the local economy for women, such as access to markets and employment opportunities, will influence their fallback position. Stronger rights and control over assets outside the household will strengthen their fallback position. But if divorced women are shunned by the community, this weakens their fallback positions. Those with weaker fallback positions will have less bargaining power in intrahousehold negotiations over water collection, allocation and use.

In the model, the distribution of the household's goods results from an assumption that the outcome is Pareto efficient, meaning that no one can be made better off without making someone else worse off. A second assumption is that each person will be at least as well off as they would be in their fallback position. It also assumes household members have full information about others' fallback positions and that resources are pooled.

The contribution of these cooperative bargaining models is that they demonstrate that policies that change the fallback position of individuals may have distributional impacts within the household. More broadly, these approaches suggest that policies that do not directly impact water may still affect water-related decisions within the household.

³ Empirical estimations often seek ways to eliminate the feedback; they use the potential income that a household could earn given its characteristics, rather than the income actually earned given the choices that they have made.

⁴ These models are referred to as cooperative models with the term 'cooperative' referring to game theory concepts rather than to a more conventional notion of cooperation.

A second class of models, known as non-cooperative models, relax many of the assumptions of the cooperative bargaining models.⁵ They do not necessarily assume that all resources are pooled or that information is fully shared. They also allow for the possibility that households may not necessarily achieve Pareto-efficient allocations (Carter and Katz, 1997; Katz, 1997; Lundberg and Pollak, 1994; Chen and Woolley, 2001; Browning et al., 2010). Each household member takes action based on the expected behaviour of other household members, and resources are provided and shared through an explicit or implicit negotiation process. Like the cooperative models, the non-cooperative models suggest that changes outside the household may have distributional consequences within it. How the distribution is determined depends on the dynamics within the household (which are built into the model). There are many variations of these models, depending on the particular question at hand and the context.

One variation is often called the separate spheres model (Lundberg and Pollak, 1993). In this model, the separate spheres are based on specialisation in assigned traditional gender roles. More recent work allows for allocations to be determined on the basis of individual preferences and the allocation of income (see, for example, Browning et al., 2010). In this approach, household members may not share all information, resources and activities with others in the household. This approach fits well when thinking about water decisions, since women and men typically have separate responsibilities towards water.

Another variation is Carter and Katz's (1997) conjugal contract model. This model explicitly includes shared or common goods within the household and does not assume incomes are pooled. The model also emphasises that gender norms influence the decision-making process. Negotiation within the household determines who expends more labour and who benefits. The negotiation process is shaped both by bargaining power and an individual's 'voice', where 'voice' takes into account that gendered social norms impact how decisions are negotiated (Carter and Katz, 1997). The implication is that in a strongly patriarchal social structure where women have little voice or influence in the negotiation process, improvements in access and rights to water may have less impact on women.

Within both the cooperative and non-cooperative variations, three broad categories of indicators are typically used in analyses to proxy bargaining power; these are income potential and income-earning opportunities, asset ownership and human and social capital (Doss, 2013). The economic opportunities available to different household members shape their ability to earn income and thus influence their bargaining power. Women often face more time constraints than men due to their responsibilities at home and the lack of provisions to support these responsibilities; this affects their opportunities and potential for earning an income. Cultural expectations may also dictate what is deemed appropriate for the respective household members, which may limit opportunities such as access to markets. It may not, for example, be appropriate for women to travel to large livestock markets such as those for cattle or camels. Thus, if they are to participate in these livelihoods, they may have to rely on men to take the animals to market. The distance to a market and the type of product that is sold not only influences who can go to the market, but also who has more control over income from sales (Njuki et al., 2011; McPeak and Doss, 2006).

Opportunities in wage labour are also influenced by gender and other social norms, which thus also shape the earning potential of household members in different ways. Labour markets are often gender segregated and social norms may make it difficult for women to access and participate in certain forms of wage employment; they may even be explicitly prohibited from engaging in particular types of work.

Employment opportunities in urban centres and abroad also affect household members in different ways (FAO, 2018). Men are often more likely to migrate out of rural areas, though women may also migrate either individually or as part of their families. Those who remain in the rural areas may benefit

⁵ These models are described as non-cooperative because they allow for the possibility of not fully securing the potential gains from the within the relationship.

from remittances sent back by migrating household members and may also be affected by the loss of labour at home. Migration patterns may also influence who in the household is involved in the governance of local water systems (Meinzen-Dick et al., 2022).

Ownership of assets such as land is also often used as a proxy for bargaining power within the household (Quisumbing and Maluccio, 2003; Quisumbing and de la Briere, 2000). Assets improve an individual's range of options outside the household (Deere and Doss, 2006) and thus also improve their bargaining power within the household.

Finally, both human and social capital may influence bargaining power. Human capital such as health and education affect one's outside options. Higher levels of skills and education increase the income that could be earned and can affect an individual's ability to negotiate with those outside the household for resources. Social networks will also affect one's outside options as they can provide support in times of need and may facilitate the acquisition of water (Bukachi et al., 2021; Wutich et al., 2018; Brewis et al., 2019; Hillesland et al., 2023b); they may thus directly affect bargaining power in water-related decisions.

Variations among the models offer different ways of considering intrahousehold dynamics. The details of the models will differ depending on the specific research question that is being addressed. They all suggest, however, that we need to go beyond simply treating the household as a single unit and beyond analyses that compare men and women to consider the dynamics among household members.

WHO IS BARGAINING OVER WHAT?

Bargaining models provide a structure for how we might think about water-related household decisions. They first encourage us to think about who is involved in the bargaining. While most of the empirical studies on intrahousehold decision-making focus on the bargaining power within the couple, the models typically model two decision-makers; these can be any two household members and can be extended to include additional individuals in the household.

Household structure and decision-making processes vary widely across contexts. Some households have more than two decision-makers while others may have only one. In South Asia, for example, the newly married couple often settles in the husband's family home, and the household may consist of parents, the young couple, children and unmarried daughters. In sub-Saharan Africa, polygamous marriages are prevalent; in Niger, Chad, Gambia, Burkina Faso and Guinea more than a third of marriages are polygamous (UN Women, 2019). In Latin America and the Caribbean, more than one-third of households include extended family; adult children may continue to live with their parents; grandmothers may provide childcare and support for their grandchildren and, as grandparents age, their children in turn care for them. Single-headed households are the norm in some contexts, especially in areas where men migrate out to seek employment. Globally, single-headed households with children make up 8% of households (ibid).

Thus, while it may be useful to consider the bargaining power among spouses – as much of the literature on household bargaining does – it may also be useful to consider the relative bargaining power of other household members. The power dynamics between mothers-in-law and daughters-in-law, for example, or between two co-wives, will influence who takes on more of the physical burden of water collection and who oversees its allocation. It may also be useful to include the power dynamics between more than two household members, such as co-wives and their husband (Rangel and Thomas, 2019).

While it may be useful to consider those who are explicitly involved in decision-making, there may be those who are not explicitly involved who, in effect, have a strong say in the decision that is made. For example, a wife may say she is responsible for making the decisions regarding where and how much water to obtain but, in fact, her husband may influence the decision by controlling the money needed to purchase water. His financial control will thus determine whether water can be purchased from a traveling vendor or from a safer water source. The husband may also influence the decision by expecting

she obtain water that meets his particular needs. In Nampula, Mozambique, for example, a 'good' wife is one who welcomes her husband home with a drink of water and provides water for his bath (van Houweling, 2016).

While household members may bargain over a wide range of outcomes, we are particularly interested in the decisions that relate to water. The first set of decisions is about the acquisition of water – who will fetch it and from which sources. A second set of decisions relates to the purchase of water-related assets. The third addresses how the water is allocated across individuals and activities.

Social norms influence who is responsible for provisioning the household with water. While they vary across contexts, social norms often designate domestic tasks such as cooking, laundry, cleaning and caregiving to women. Because of this, women are also more likely than men to be responsible for water collection for domestic tasks (for sub-Saharan countries see Graham et al., 2016; see also WHO and UNICEF, 2017). There may be bargaining between spouses regarding water collection particularly when water is scarce. There also may be explicit or implicit bargaining among the women of the household or between mothers and their older children regarding who will collect the water on a particular day.

The costs of water collection may vary across the respective household members, including the opportunity cost of time. Collecting water may also require a fee and access to cash or credit may vary from person to person. When it is collected from other households' water sources, collection may depend on the individual's social network and on their ability to negotiate for access to water on a given day (Hillesland et al., 2023b). Collecting water may also require involvement with water management groups wherein participation may vary and may depend on labour contributions. Individuals may be prohibited from accessing water if they have failed to follow the association's rules.

Vehicles – whether donkey carts, bicycles, motorcycles or trucks – alter how water can be accessed, and the respective household members may have different access to, and control over, these modes of transportation. The costs in terms of time will thus differ across household members. There are also differences among family members with regard to the risk of violence and physical safety in water collection, and women who must walk long distances for water are more at risk of violence than those who have access to vehicles (Tallman et al., 2023).

Household decisions about purchasing relevant assets are also important. Access to modes of transport will depend in part on previous decisions within the household regarding the purchase of these assets. Other water-related assets may include pumps, jerrycans, tanks and filters. These will shift the opportunity costs of collecting water for various members of the household, which will affect the allocation of both the work and the collected water. Owning assets, however, does not necessarily mean that one controls their use and benefits. Theis et al. (2018) find that spouses in Ghana and Tanzania do not have equal access to small-scale irrigation pumps. Men were more likely than women to claim the rights to their use, although the assets were provided to women through small scale irrigation interventions. Men justified limiting women's rights to use the more efficient water technology by drawing attention to their familial duties and time constraints (ibid).

The third set of decisions addresses the allocation of water across activities. Water may be needed for bathing and cleaning, livelihood activities, caring for livestock or irrigation. Intrahousehold power dynamics influence who takes a bath first and whose clothes are washed when water is limited. They will also influence whose livelihood activities are allocated water and who benefits most. This can mean that water interventions increase the income-generating possibilities for some household members and not for others. A qualitative study in Gujarat, India, for example, explored the impact of improved water supply on women's enterprises. It finds that the status of women and their control over income improved for many, but that younger women, particularly daughters-in-law and daughters, were not able to harness the same benefits from water as older women (Sijbesma et al., 2009).

SOCIAL NORMS AND INTRAHOUSEHOLD DYNAMICS

Social norms shape expectations about roles and responsibilities within the household, including what is acceptable and how decisions are negotiated. This, in turn, affects intrahousehold dynamics, shapes the context in which decisions are made and directly influences bargaining power.

The specificities of norms vary across contexts. In communities in Northern Ghana, for example, women and girls are expected to provide water for the household, including water for any productive activities their husbands undertake (Jeil et al., 2020). An ethnographic study in Mozambique finds that, "for men, it is a matter of pride and status not to collect water, and a sign that they have large, hard-working families" (van Houweling, 2016). In Uganda, community norms also deter men from fetching water; women and children collect water multiple times a day, hauling 20 litres of water per trip (Asaba et al., 2013). Mason (2012), in contrast, describes how women in the Philippines make the day-to-day decisions about where and how to secure and allocate household water, but that it is the man's job to carry five-gallon water jugs from the spring.

Expectations may also vary across men and women within the same household. In Kilifi County, Kenya, for example, the male household head may not collect water, but his adult son may collect it.⁶ Norms for mothers-in-law and daughters-in-law may also vary; one study in Kathmandu, Nepal, for example, found that a large share of water collectors are daughters-in-law, while their mothers-in-law may determine how the water is allocated (Chen et al., 2019). These norms thus go beyond gender but still affect the dynamics among both men and women within the household.

Decisions about who fetches water may be related to its use and to what are considered socially acceptable roles. In communities in Uganda, for example, men are ridiculed for engaging in daily household water collection, but not for collecting it to sell in the market (Asaba et al., 2013). Men's roles are also more prominent in the productive use of water in irrigation systems, where women are often excluded (Meinzen-Dick and Bakker, 1999, 2001; Zwarteveen, 1997); however, this is not always so clear cut. Water in irrigation systems may be used in multiple ways (Makoni et al., 2004; Meinzen-Dick and Bakker, 1999; Meinzen-Dick and van der Hoek, 2001a; Upadhyay, 2005; Zwarteveen, 1997), and both women and men may be involved in these different activities.

Social norms may also influence the use of assets. Assets generally make transportation easier, but larger assets are more likely to be owned by men than by women. Social norms about what is appropriate interact with patterns of asset ownership. For example, in Uganda, most women and girls carry water on their heads, whereas men and boys are more likely to use bicycles, motorcycles and wheelbarrows to haul water home (Asaba et al., 2013). In Northern Ghana, similarly, when men collect water in communities they tend to use bicycles, motor bikes or tricycles (Jeil et al., 2020), whereas women are more likely to collect it on foot.⁷ In some communities, women may also be socially prohibited from using some types of water pumps, particularly treadle pumps, due to social norms about appropriate women's clothing and activities (Njuki et al., 2014).

Access to assets that reduce the water-collection burden may need to be negotiated with others in the family. In the Philippines, for example, Mason (2012) describes how it is men who make the decisions around the purchase of water tanks or other assets that would improve the household's water security, and women must negotiate with their spouse if they would like the household to acquire these.

⁶ Fieldnotes from REACH/Alliance Bioversity-CIAT, Kenya, project in Kilifi County, Kenya, 2022-2024. Methodology is discussed in Hillesland et al. (2023b).

⁷ The choice of who collects water and the method of collection may be made jointly; when the distances are too far for women to carry the water themselves, men may use wheeled transport.

In Kilifi County, Kenya, women report owning water assets such as jerry cans, but say they could not take the asset with them if they left the household.⁸ If they left the household, they would no longer have a means to collect water. This affects their fallback position in the relationship.

Social norms may also limit women's ability to manage community-held assets or to participate in the labour and management. Adams et al. (1997), for example, describe how men and boys in Marakwet, Kenya, engage in maintenance of the community irrigation system, but that it is taboo for women to do this work for fear that breast milk would mix with the irrigation water. Indeed, in a neighbouring communal irrigation system, leaks and breakages in the banks are blamed on women touching the water (ibid). Because women cannot contribute their labour, they cannot claim rights of access to the water, which impacts their bargaining power within the household.

PROPERTY RIGHTS AND INTRAHOUSEHOLD DYNAMICS

A number of overlapping systems provide people with access and rights to water, but not all household members will hold the same rights. We conceive of property rights as being about the social relations of people regarding property, rather than as the relationships between people and property (Theis et al., 2018; von Benda-Beckmann et al., 2006).

Doss and Meinzen-Dick (2020) have developed a rights framework that draws from Schlager and Ostrom (1992) and Roman law. They recommend documenting six sets of rights over property or resources, including *usus*, *abusus*, *fructus*, exclusion, transfer and future interests.⁹ One person may hold all the rights for a particular resource or various rights may be held by different people. *Usus* is the right to use the resource. It includes both access and withdrawal rights. *Abusus* rights are the rights to manage and change the resource and they include the right to regulate use and access. *Fructus* rights are the economic rights over the resource, including control over the income earned through its use. Exclusion is the right to keep others from using the resource. Transfer rights are the rights to give, lend or sell the resource. Future interests, finally, is the right to claim the resource in the future, which may prohibit others from destroying the resource or contaminating the water.

A second way of classifying property rights is to consider whether the form of tenure is private property, common or community property, government property, or open access. With private property, the rights are held by individuals or individual entities. While it varies, a well on land owned by a person (or persons) may be considered that person's private property, and the owners would have the rights over the well and the water in it. Under a common property system, the property rights are held by a group and the collective would typically manage rules and regulations regarding rights to the resource; an example of this would be an irrigation system managed by farmers. Government property is managed by local, regional or state governments, and governments may manage water through a municipal water system. Open access refers to the absence of a functioning property management system and does not necessarily provide users with strong rights.

Across these property rights systems, individuals within a household may have different rights. In private property systems, water rights are often closely connected to land rights. Rights to ground water and water in wells are often tied directly to rights over land, and irrigation systems are also typically connected to land rights (von Benda-Beckmann and von Benda-Beckmann, 2000). Since the male household head is typically more likely to have rights to the land, they are also more likely to have stronger rights to the water than other household members.¹⁰ In Kilifi County, Kenya, for example, this

⁸ Fieldnotes from for a REACH/Alliance Bioversity-CIAT, Nairobi, project in Kilifi County, Kenya, 2022-2024. Methodology is discussed in Hillesland et al. (2023b).

⁹ Theis et al. (2018) use a similar framework when analysing the impacts of small-scale irrigation technologies.

¹⁰ Numerous studies document that, to varying degrees, men are more likely to have rights to land across contexts (Deere et al., 2012; Slavchevska et al., 2020; Kieran et al., 2015).

means that women's rights to the water on their household's land are likely to be via their male relations (Hillesland et al., 2023b). In common property systems, the associations of water users that govern common property resources are typically dominated by men. Water user organisations manage and enforce the rules regarding water distribution, and women are largely excluded from communal forums and water-governance organisations (Meinzen-Dick et al., 1997; von Benda-Beckmann and von Benda-Beckmann, 2000). When water rights are granted through the state (as government-managed property), the state may provide water rights to households, often identifying the male household head as the holder of the rights. In other circumstances, women may not have the same means as men to acquire these rights through the government because they may lack knowledge of these rights or lack the capacity to secure them (Meinzen-Dick et al., 1997).

Within a community, multiple property rights regimes may be at play (Meinzen-Dick and Nkonya, 2005). Formal institutions for water resource management may govern water rights broadly through state laws and regulations, but at the local level customary institutions may also govern bodies of water. Water rights may also be informally tied to a particular use. A study of communities in Kirindi Oya, Sri Lanka, for example, describes how formal water rights are connected to irrigated land. Water taken from irrigation canals for home gardens is formally prohibited but informally tolerated (Meinzen-Dick and Bakker, 1999).

Traditional community-managed systems may bestow rights based on labour investments or other eligibility criteria. Adams et al. (1997), for example, describe a communal irrigation system in Marakwet, Kenya, where rights and responsibilities are passed down through the lineage of the original builders. Rights to the water are interlinked with the supply of labour for canal maintenance. Women are prohibited from working on the canals and thus do not have full rights to the water; they can only obtain usufructuary rights through a husband or other male household member who is a full 'rights holder' (ibid). Women's dependence on particular men for access to water rights further underscores the need for analysis of intrahousehold dynamics.

INFRASTRUCTURE AND INTRAHOUSEHOLD DYNAMICS

Water infrastructure influences intrahousehold decision-making regarding water by potentially reducing the monetary and non-monetary collection costs and expanding the range of a household's water-collection options. Water infrastructure includes features such as piped water to houses, community pumps, wells and dams. It also includes water treatment processes and sanitation services.

Households in the community will not necessarily have equal access to infrastructure, and lack of infrastructure will also affect respective household members differently. The domestic work burden may be particularly high for women in poorer households who are responsible for securing domestic water in areas with poor infrastructure. Without a nearby tap, these women may be more likely to walk longer distances to water sources and may choose water from sources that are free or relatively low cost. These sources may be less safe, thus increasing the likelihood of waterborne diseases and the time spent caring for sick family members (Dickin et al., 2021). The longer distances can also mean a greater threat of violence (Kayser et al., 2019; Tallman et al., 2023).

Lack of infrastructure can mean that poorer households are particularly vulnerable to water insecurity in dry seasons and in periods of drought, which can in turn affect the livelihood strategies that individual household members may pursue (Jeil et al., 2020; Mason, 2012; van Houweling, 2015, 2016; van Houweling, et al., 2012). Jeil et al. (2020) find that in Northern Ghana water scarcity means longer lines for water and higher water costs; they observe that, as a result, women who are expected by social norms to secure water for the household may 'step up' their income-earning activities in order to purchase domestic water. Household members may also change their livelihood strategies in response to longer-term environmental changes. When water became scarce, some women who had been brewing 'pito' or

millet beer for the market switched to trading or sales and some younger women and men turned to seasonal migration (*ibid*). All of these factors change the intrahousehold power dynamics.

Water scarcity can mean there are difficult choices to be made within the household. As water becomes scarcer across seasons, Mason (2012) describes how women from poor households in the Philippines reported having to conserve water and to choose between purchasing water for the family or buying food. Household members may disagree about how to make these decisions. There may thus be conflicts around how to best meet the goals of sustaining the household. These conflicts can include disagreements about which crops to plant or the type of market activity to invest in, and this then impacts the household's water needs (Zwarteveen and Meinzen-Dick, 2001). In times of water scarcity, lack of water can lead to intensified intrahousehold disagreement. It can strain relationships and can be a source of conflict and domestic violence (Dickin et al., 2020; Jeil et al., 2020; van Houweling, 2016).

Studies suggest that improving water infrastructure improves people's quality of life (for a gendered review of infrastructure, see Small and van der Meulen Rodgers, 2023). It can improve health outcomes (Baker et al., 2018; Sedai, 2021) and it can free up the time of some household members, allowing them to engage in other activities or to have time to rest (Koolwal and van de Walle, 2013; Meeks, 2017). The impacts may depend on the extent to which individuals have agency over their time and can redirect it to activities that they prefer (see Sinharoy et al., 2023). Improving water infrastructure can also reduce the tension surrounding the negotiation of water-collection responsibilities. In a random control trial in Morocco, for example, Devoto et al. (2012) find that installing piped water to households reduced water-related conflicts within the family as well as between neighbours.

Yet, improving water infrastructure also can have unintended consequences. A water-related infrastructural intervention, for example, may reduce the distance walked to collection points, but it may also result in new uses of water or new expectations by different household members. After hand pumps were introduced in the Morni-Shivalik Hills of Northwest India, for example, cleaner water was brought closer to homes. Rather than bathing in a pond or common water source, men expected the clean water to be brought home for their bath, resulting in new water-collection duties for women (Narain, 2014). As a result of household power dynamics within the household, the new infrastructure shifted the benefits to men and made more work for women.

Interventions that do not take intrahousehold dynamics into account also may be more likely to fail. In Rajasthan, for example, a sanitation intervention failed in part because it created significant additional labour for women. The men had been responsible for choosing the type of toilet and they chose double-pit, pour-flush latrines that required water to be hauled and stored for flushing and cleaning (O'Reilly, 2010), expecting that women would perform these tasks. The intervention, however, did not take into account women's preferences and workload and, as a result, the containers for water were often empty and the latrines unused.

Policy-makers and engineers in the water sector frequently emphasise the physical aspects of infrastructure while neglecting the variability in social impacts. Local governance structures and water management organisations are also often led by powerful men in the local community who may not consider the social dynamics of potential interventions. As a result, decisions made on water infrastructure can favour the social hierarchy; it can become the means to securing access to and strengthening rights over water resources (Narain and Goodrich, 2024). Decision-making may often result in the existing power structures favouring men and wealthy community members (Coulter et al., 2019). These outcomes may increase the relative bargaining power not only across households within the community, but also within households.

For infrastructure interventions to work as intended, both women and men need to have adequate say in decisions around improvements. Laws mandating that women are included in governance and water management organisations aim to address this; however, they do not necessarily address all the barriers faced by women and marginalised members of families and communities. Inclusion is a first step

but does not guarantee that they can influence decisions (Narain and Goodrich, 2024; Meinzen-Dick and Zwarteveen, 1998). There is a need to address the structural constraints of the marginalised so that they have the agency to advocate for themselves within governance structures. Additionally, policy-makers and project implementers need, in the planning stages, to take into account and understand the socially differentiated impacts of infrastructure and how these interact with the relational power dynamics within households.

CONCLUSION

This paper provides a framework for mapping intrahousehold decision-making processes and the factors that impact water portfolios. While it is important to consider gender, it is also critical to embed gender analyses within the households where these men and women live. The outcomes are based not solely on the characteristics of the men and women themselves, but also on how they interact with others within their households. Within the same household, individuals will have different preferences and will face different opportunities and constraints based not only on gender, but also on their age and position.

Recognising the importance of intrahousehold decision-making has implications for data collection. Data needs to be collected not only on household characteristics and household water use; much more information is also needed at the individual level. Evidence from other domains suggests that one household member is unlikely to have full information about other household members; this has been shown regarding employment, decision-making and assets (Bardasi et al., 2011; Ambler et al., 2021; Kilic and Moylan, 2016). Asking only one individual for this information can thus result in noisy or even inaccurate data. It is therefore important to ask the respective household members themselves about their preferences, their access to water sources, the time they spend collecting water, and the uses that they have for water.

Household decisions to purchase assets, such as water tanks or cisterns for catching rainwater can improve household water security seasonally. If we are interested in such decisions, we need to better understand the power dynamics within the household. Who earns the income within the household will affect how it is spent. If we are interested in how power plays out within households and how it impacts source choices or decisions on water allocation across different activities, we need individual data on asset ownership as well as other data that could represent bargaining power within the relationship. If we want to understand how individual access to water sources can impact men's and women's investment in productive activities within the household, we need individual information on who does and does not have access to different water sources as well as on the opportunities that household members have for generating livelihoods.

It is critical to recognise how the collection and use of water for a particular purpose, such as domestic use, is related to other uses such as productive activities. Consideration of intrahousehold dynamics encourages us to think about the trade-offs between the use of water for these different purposes by different household members.

Social norms play a key role in household dynamics. They define roles and responsibilities regarding water, they impose behavioural roles, they shape expectations that define how household members negotiate and cooperate with each other, and they determine how cooperation is enforced. As highlighted by the household models, defining the household within its social and cultural context is key to understanding the distributional consequences, both in terms of costs and benefits of water use and improvements to infrastructure. To understand the context, it is useful to have information on social norms on water collection, source choice and allocation, as well as decision-making processes and power dynamics around water within the household.

Data collection may need to involve both quantitative and qualitative methods. Many of the models of intrahousehold dynamics are designed to use quantitative data; however, to fully understand the social norms, qualitative methods often provide better insights.

Much of the discussion in this paper has focused on the provision of water within the household; yet household members may also contribute labour and money towards the provision of public infrastructure. Participating in local water user associations may be a way for individual household members to strengthen their claims to water both in the community and within the household. Increasingly, there is an emphasis on gender dynamics among local stakeholders, including in local governments and water associations (Meinzen-Dick and Zhang, 2021); however, there is less of a focus on gender in the discussions about water for productive purposes outside of irrigation, especially for small farm households.

Policies around water rights and infrastructure will both directly influence the allocation of water within the household as well as indirectly influence the bargaining power of individuals and thus the outcomes of other household decisions. A second set of insights from the models is that access to, and rights over, water may be an element of the fallback position. If a lack of infrastructure means women need to walk long distances to water sources and wait in long lines to access water particularly during times of water scarcity, so that less time is available to invest in their productive activities, this too will influence their fallback position. Additionally, if water rights for women are secondary and are based on their husband's rights, this will indicate a weak fallback position in that they will lose the water rights if they leave the household; they may thus have less bargaining power with respect to other household outcomes. Understanding the dynamics of how decisions are made within the household is useful in understanding household water portfolios and their distributional consequences.

ACKNOWLEDGEMENTS

This work was supported by the UK Research and Innovation through the GCRF Water Security and Sustainable Development Hub (Programme Code ES/S008179/1) and the UK Foreign, Commonwealth & Development Office (FCDO), 2015-2024 through the REACH programme (Programme Code 201880).

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