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Katie Tavenner, Simon Fraval, Immaculate Omondi & Todd A. Crane

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RESEARCH ARTICLE



Gendered reporting of household dynamics in the Kenyan dairy sector: trends and implications for low emissions dairy development

Katie Tavenner , Simon Fraval , Immaculate Omondi  and Todd A. Crane 

The International Livestock Research Institute, Nairobi, Kenya

ABSTRACT

Within the Kenyan dairy sector, climate change mitigation interventions are striving to sustainably intensify milk production while addressing the gender dynamics that mediate farmers' ability to effectively participate in, and benefit from, low emissions development. In order to better understand these gender dynamics, household surveys were deployed by the East African Dairy Development (EADD) program to collect information on current practices of decision-making, resources, and labor dynamics within dairy farm households. Using the EADD survey results as secondary data, this study analyzes emergent patterns in these domains among cattle-keeping households in Bomet, Nandi, Uasin Gishu, and Kericho counties in Western Kenya. In analyzing these patterns, paired sample tests revealed statistically significant differences in results based on the gender of the respondent. While there were some categories that women and men reported on similarly, other areas were hotly contested. These results provide important challenges, both methodologically and programmatically, in interpreting gender dynamics across these domains. This paper reflects on the challenges and the opportunities of these data for informing gender-equitable low emissions development in the Kenyan dairy sector.

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Introduction

In global policy circles, there is an increasing interest in low emission development (LED) in the livestock sector, which would reduce the greenhouse gas (GHG) emissions intensity of livestock production so that rural smallholders can increase incomes while delivering high-quality protein with a lower per capita environmental footprint (Gerber et al., 2013). However, this objective is complicated by the fact that smallholders currently have few concrete or direct incentives to reduce GHG emissions. Instead, they are much more likely to be motivated by practices that improve production efficiency and/or profitability; with lowered GHG emissions intensity as a potential incidental benefit (Lipper, 2014). Successful reduction in GHG emissions intensity from

smallholder production will most likely come through changes in the farm-level technical practice of livestock keeping, such as those relating to feeding practices, herd management, and manure management (Mutoko, 2014; Osumba, 2015). Therefore, achieving global goals of lowering livestock's GHG emissions intensity are largely predicated upon changing practices in smallholder households. These are often characterized by highly gendered division of labor, resource control, and decision-making power. As such, technical interventions for climate change mitigation¹ in this sector must engage carefully with household gender dynamics if they want to achieve gender-equitable development outcomes and avoid the common scenario where intensification causes concentration of men's control over productive resources and monetary benefits, especially in scenarios where women contribute substantially to on-farm production. This risk is particularly acute in the Kenyan dairy sector.

While women make significant contributions to dairy labor in Kenya – particularly around the daily tasks of feeding, watering, and general care of the animals – their direct benefits from dairying are often tempered by cultural norms that privilege men in regards to cattle ownership (Njarui et al., 2012), decision-making associated with the livestock (Omondi, Zander, Bauer, & Baltenwelk, 2014), and with commensurate income from the sale of milk (Farnworth, 2015). These trends indicate that gender issues likely play a significant role in the uptake and impact of low emissions dairy development, particularly as they relate to choices regarding on-farm intensification practices. If there are differences in how men and women perceive the benefits of intensification, it is likely these perceptions will influence and potentially hamper the achievement of LED projects. Thus, an assessment of how household gender dynamics influence farming practices is necessary as an entry point for best practices in the Kenyan dairy sector.

Following on this connection between global mitigation efforts and household practices, this paper presents an analysis of gender dynamics in cattle keeping households in four East Africa Dairy Development (EADD) project sites in Western Kenya. The primary objective of this analysis is to generate a descriptive characterization of gender roles in semi-intensive dairy production and create a foundation for informing the identification of dairy practices suitable for gender-equitable low-emissions development. We pursue this goal by analyzing secondary data from the EADD project's 2014 baseline survey of 251 male-headed cattle-keeping households in Western Kenya.² The questionnaire covered a wide array of dairy production issues, with a portion of the survey focusing on intra-household dynamics around gendered asset control/ownership, decision-making, and labor allocation. In canvassing intra-household dynamics, it is crucial to note that multiple members of the same household were not sampled, but rather a single member who was considered 'in charge of farm activities' at the respondent's farm was sampled.

Preliminary analysis of the data using paired sample tests revealed gender respondent bias – statistically significant differences in results based on the gender of the respondent. The fact that men and women gave consistently different answers to the same questions about intra-household dynamics challenged our ability to create advanced regression models based on these data. However, it created a unique opportunity to interpret the data through the lens of gendered reporting, as well as to reflect upon the methodological challenges of gendered respondent bias in household surveys. In this way, our article serves as both an analysis of emergent trends in the

Kenyan dairy sector, as well as a reflection on survey methodologies in gender research. Our analysis addresses three key research questions.

- What are the emergent patterns of gendered decision-making, resource control, and labor allocation in the selected dairy development sites?
- What are the programmatic recommendations emergent from these data?
- What are the methodological implications of these findings, in light of the present gender respondent bias?

This paper offers two important contributions to the literature. First, it illuminates areas of convergence and divergence in the reporting of decision-making, resource control, and labor allocation by gender, among Kenyan cattle keepers in a mixed-crop livestock production system. The trends emerging from these data point to men and women contributions to dairying, and can be used to inform gender-sensitive mitigation interventions in Kenyan dairy development. Second, the paper contributes theoretical and methodological insights on the issue of gender respondent bias, which has largely been absent from livestock and agricultural survey research. The following sections speak of the substantive and methodological issues inherent in gender analyses using household surveys.

Gendered contributions to the farm household

For decades, studies on gender dynamics within farm households have illuminated the complexity of decision-making, control of resources, and labor allocation among different members of rural smallholder farm households (Doss, 2012; Farnworth et al., 2015; Mason, Ndlovu, Parkins, & Luckert, 2014; Njuki & Sanginga, 2013; Rao, 2016; Sen, 1987; Waters-Bayer, 1988). Women and men often have different roles and responsibilities within farm households – their gendered contributions – which are rooted in culturally sanctioned social norms and reinforced through everyday political economy. Globally, despite women often providing a large proportion of labor to the agricultural sector, they often have less access to and control of assets, income, and decision-making power compared to men (SOFA Team & Doss, 2011).

Inequities in these domains are present in the Kenyan dairy sector (Njuki et al., 2015). Recent literature reviews (Farnworth, 2015; Gallina, 2016; Katothya, 2017; Tavenner & Crane, 2016) show that gender roles and dynamics greatly influence the distribution of control and benefit in the Kenyan dairy sector. In Central and Western Kenya, women tend to be responsible for most daily management tasks around dairy animal husbandry, including fodder and water provisioning, manure removal, milking, milk equipment cleaning, and milk delivery (Farnworth, 2015). Men are often in charge of non-daily activities that include the construction of cow sheds, arranging veterinary services or artificial insemination (AI), and the collection of milk payments from formal marketplaces (Nyongesa, Mwirigi, Yongo, & Makokha, 2016). Despite women's substantial contributions to dairy labor, their direct benefits are often tempered by cultural norms that privilege men in terms of control of the resource (e.g., cow ownership), decision-making associated with the animals (buying/selling), knowledge of available

veterinary services, and with commensurate income from the sale of milk (Tavener & Crane, 2016).

More broadly, the ways in which these gendered inequities articulate with agricultural research and development has often caused women's participation in agricultural production to be under-reported (Twyman, Muriel, & García, 2015). A common example of this is the problematic construal of men as 'farmers' and women as 'farmer's wives' in household surveys, which obscures the possibility for joint decision-making and labor activities in farm households. There is growing recognition among the agricultural research and development communities that in order to accurately assess the influence of gender and social dynamics in farm households, researchers must engage with both male and female respondents. Within agricultural research and development, one of the most common modes of data collection is the household survey. Agricultural research and development has made great strides in collecting gender-disaggregated data, however, these are not without their problems. The next section highlights some of the challenges of using gender disaggregated survey data to interpret household dynamics.

Challenges of using survey data to interpret household gender dynamics

To quantify gender dynamics in agriculturalist and livestock keeping populations, three types of household surveys have become common practice. The first are inter-household surveys, whereby the sex of the household head, landholder, or respondent are compared in relation to the opposite sex in the survey (e.g., male-headed vs. female-headed households). The second type are intra-household surveys, which aim to explore gender dynamics within a household by interviewing multiple members of the same household (e.g., wives vs. husbands). The third type uses an inter-household level of analysis (e.g., male landholders vs. female landholders) to explore intra-household questions (e.g., who in your household is responsible for x agricultural activity?). This paper analyzes data from the last type of survey, whereby respondents were asked a series of questions regarding the intra-household distribution of resources, decisions, and labor regarding cattle keeping. While the acknowledgement of the importance of intra-household dynamics is an important departure from gender blind surveys, research using intra-household data are likely to encounter some level of gender respondent bias – that is, researchers are left with a 'he said, she said' (Kamo, 2000) dilemma when interpreting survey results.

There are at least three mechanisms that may explain gender respondent bias in household surveys. The first mechanism is that men and women may have the same objective information about the household's production practices, but report it differently for strategic gain (real or imagined) or for social acceptability, as raised in (Matheson & McIntyre, 2014). This mechanism, also known as social desirability bias, has been widely confirmed in intra-household surveys (Becker, Fonseca-Becker, & Schenck-Yglesias, 2006; Fisher, Reimer, & Carr, 2010; Kamo, 2000; Twyman, Useche, & Deere, 2015).

A comparative case study of spousal perspectives on women's autonomy in Uttar Pradesh and Tamil Nadu found considerable differences in reporting between quantitative and qualitative approaches to data collection (Jejeebhoy, 2002). In surveys, male participants tended to display more liberal attitudes towards women's autonomy in

decision-making, outlining responses that are seen as more socially acceptable for researchers. However, in focus group discussions, where their responses were made in front of peers, the same male participants outlined positions that were more conservative with regards to women's autonomy. This study suggests that participation in research is itself socially performative and that participants may strategize their responses, raising important questions about how to ensure validity in research on intra-household gender dynamics.

The second mechanism to explain gender differences in reporting is that men and women simply have different information available to them when they report on practices. Intra-household sharing of information is patterned by gender differentiated roles in the agricultural production process, and influence the level and types of information women and men have access to (Tall, Kristjanson, Chaudhury, McKune, & Zougmore, 2014). While countless development projects over the last 30 years have endeavored to engage women through interventions that prioritize women's participation, structural social inequities in relation to formalized information channels for agricultural information remain a challenge (Carr, Fleming, & Tshibangu, 2016). Information sharing related to internal dynamics in the household division of labor (e.g., being aware of who does what in the household) may also be hindered by the reporting bias known as 'telescoping' – whereby the respondent includes events that occurred prior to the recall period (Deaton & Grosh, 2000). These dynamics can directly influence reporting practices in household surveys in respondents' ability to give accurate estimates for their spouses and/or other members of the household. The area that has been most hotly contested in intra-household surveys is the issue of reported household income and decision-making power (Becker et al., 2006; Tao, 2013). A recent study in Malawi by Fisher et al. (2010) found that in comparing husbands' and wives' estimations of each other's income, spousal agreement on income estimation occurred in just 6% of 130 households surveyed. The authors conclude that the multiple gender-based economic activities that constitute household income make it difficult for a single household member to report on the totality of a household's income sources.

The third mechanism involves non-sampling errors. These can arise due to conflicting contextual interpretations of survey questions and interviewer decisions in the data collection process (Kriel & Risenga, 2014). Non-sampling errors can also be produced depending on the gender of the interviewer (Ghuman, Lee, & Smith, 2006). It seems then, that not only who participates in decision-making matters, but also who is asked about decision-making and how those questions are posed.

Altogether, these issues suggest considerable caution in interpreting gender dynamics from household surveys. Yet, if we take gender respondent bias into account when analyzing survey data, can emergent patterns in the gendered contributions of farm households be identified? Using the lens of gendered reporting, this paper explores whether men's and women's accounts of dairying can offer indicative trends useful to inform gender-sensitive mitigation interventions in Kenyan dairy development.

Methods

This study uses secondary data from the East Africa Dairy Development (EADD) project's 2014 baseline face-to-face survey of 251 male-headed cattle-keeping households

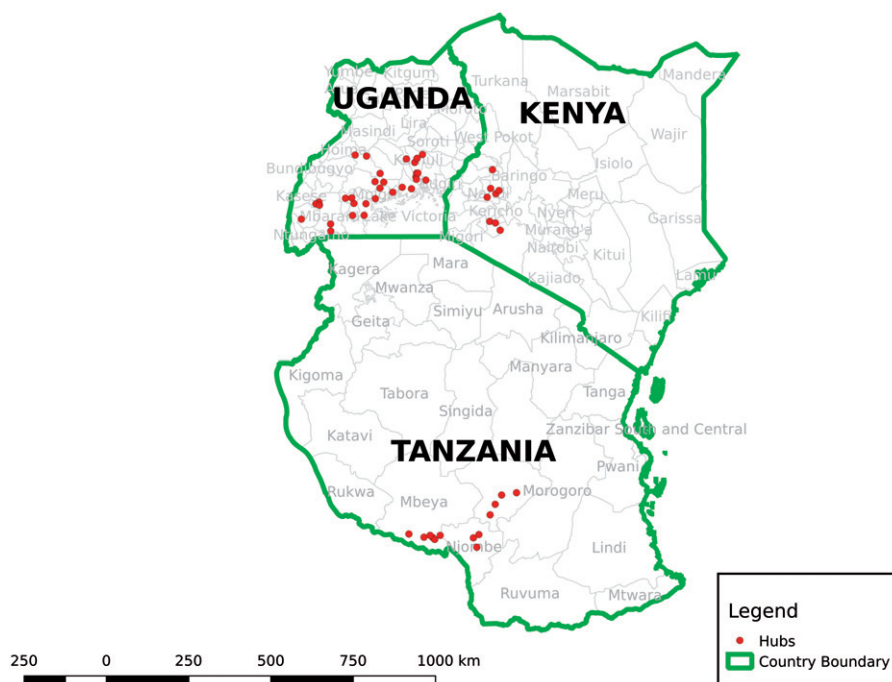


Figure 1. Map of EADD Sites in Kenya, Tanzania, and Uganda (adapted from EADD, 2015).

in Western Kenya.³ The EADD project was a livestock-based development program that ran from 2008–2016 in selected areas of Kenya, Tanzania, and Uganda, with the overall goal of increasing the productivity of smallholder dairy farmers to boost dairy-related income (Figure 1). Promotion of a variety of on-farm technologies, such as genetic improvement of local cattle, improved feeds, and feeding practices (for instance cultivation of improved fodder and forages, and feed conservation practices e.g., silage making), and animal health were coupled with strengthening farmers' relationship to formal markets through a 'dairy hub' approach (EADD, 2015). In this way, farmers would ideally have healthier and more productive cows (in terms of milk yield) and increased or new access to a formal market to sell their milk (Mutinda, 2011; Mutinda, Baltenweck, & Omondi, 2015).

Each household sampled was located within a 10 kilometer radius of an EADD dairy hub that is managed by producer organizations in Bomet, Nandi, Uasin Gishu, and Kericho counties. The sample design incorporated both EADD-supported dairy hub and non-EADD-supported dairy hub affiliated cattle keeping households using a random point-based geospatial sampling technique. The target population for the household baseline survey was identified as 'cattle keepers' because they have the potential to sell milk through the dairy hubs and/or purchase dairy-related inputs and services through hub-coordinated interventions. The term 'cattle keepers' was used instead of 'dairy farmers' to avoid misinterpretations that could lead to the exclusion of farmers that do not engage in formal milk markets or cattle keepers who keep cows that produce low-milk volumes relative to exotic or hybrid 'dairy' cows (EADD, 2015).

The survey population was largely part of the Kalenjin ethnic community and characterized as mixed livestock and crop farmers. While the agro-ecology varies between the counties, the region is characterized by high levels of rainfall and agricultural productivity (Owino, 2016). Across these counties, there were high levels of diversity in farm characteristics (Fraval, 2015). Most of the households in the survey kept less than five cows, of which most were cross-bred Holstein, Fresian, and Ayrshire cows with local breeds. On average, cows produced 8 liters per day at calving (Fraval, 2015). Most farmers kept these cows on small parcels of land – usually just one to five acre plots – which were used for cattle grazing and mixed crop-livestock production (Fraval, 2015). Although farmers in this area engage in a diverse array of livelihood strategies, cattle keeping remains a prioritized component of household income, cultural identity, and as an economic ‘safety net’ for those involved in wage employment (Weiler, Udo, Viets, Crane, & De Boer, 2014).

The survey protocol focused on one member of each sampled household, and sought to survey the person who was considered ‘in charge of farm activities’ at the respondent’s farm. There were a total of 251 ‘male with spouse’ (male-headed households) and 50 ‘single female headed’ households. For male-headed households, there was a 111–140 split in men and women respondents, and in female-headed households, an 11–39 split. Female-headed households were omitted from analysis in this paper because of the relatively low number of male respondents from these households.

While enumerators for the survey were selected by project staff based on their educational background, experience, and ability to conduct interviews, gender and ethnicity were considered in hiring process (i.e., a balance of both female and male enumerators with the ability to administer the survey in Kalenjin). In implementation, there was no strict rule that the enumerators must be paired with respondents by gender, however, care was taken to ensure respondents were comfortable with the interviewers (for instance, most female respondents who were alone in a household at the time of the interview were interviewed by female enumerators, while most male respondents were interviewed by male enumerators) (Rao, Omondi, Karimov, & Baltenweck, 2016). Moreover, the enumerators’ education and ethnicity was important to ensure that they were highly versatile in conducting the interviews in Swahili (Kenyan national language) and Kalenjin (local language in the study area) due to the comparatively low-literacy levels and advanced ages of the respondents (persons in-charge of dairy activities). As such, in each interview, the enumerators used a language that the respondent was comfortable with, mostly Kalenjin (Immaculate Omondi, personal communication, 23 January 2018).

To analyze sex disaggregated labor allocation responses, paired sample tests using the Wilcoxon-Mann-Whitney rank sum test were run to examine differences in central tendency in male vs. female respondents. The Wilcoxon-Mann-Whitney test was chosen as a non-parametric test based on the survey parameters that the sample was randomized, ordinal, and had assumed independence within the samples. For analyzing aspects of control and decision-making, the log likelihood test with William’s continuity correction (otherwise known as the G-test) was used to identify cross-tabulations that are unlikely to have arisen by chance. These tests were run in R, using the Deducer package.

Results

Gendered reporting of cattle ownership, sales, and purchases

The first part of the analysis explored trends in cattle ownership and household decision-making on cattle sales and purchases (Table 1). The EADD questionnaire sought to identify cattle owners within households, as this was a qualifying factor for participating in the survey. For answering the question, 'Who owns cattle within the household?' both men and women respondents reported men as being the dominant cattle owners (83.7% of male respondents and 70.3% of female respondents; G-test, $p \leq .05$ level). No men reported women as owning cattle, while 2.3% of women respondents reported self-ownership (significant at $p \leq .05$ level). Women reported joint ownership of cattle more often than men (27.3% of women respondents vs. 16.3% of men respondents), though this difference was not significant.

In reporting decisions made regarding the sale of cattle, there was near homogeneous convergence on household trends. Both men and women respondents reported men as being the decision-makers on cattle sales (69% of male respondents and 77% of female respondents), followed by joint decision-making (31% of male respondents and 23% of female respondents). No respondent from either group listed women as being the sole decision-maker for cattle sales.

For decisions made regarding the purchase of cattle, both men and women reported men as being the decision-maker (92.3% of male respondents and 69.7% of female respondents). This was followed by joint decision-making, where women reported higher levels of joint decision-making (30.3% vs. male respondents' 7.7%; G-test, $p \leq .05$). Interestingly, no respondents from either group listed women as being the sole decision-maker for cattle purchases.

As points of convergence, both women and men reported higher levels of men's ownership of cattle and decision-making over cattle sales and purchases than women's or joint ownership of cattle. It was interesting that women were not listed by either group of respondents to make sole decisions on cattle sales or purchases. As points of divergence, women were more likely to report joint ownership of cattle, and joint decision-making on cattle sales and purchases than were male respondents.

Gendered reporting of control of milk income

The second part of the analysis focused on gendered reporting of control of milk income for the morning and evening sales⁴, and on decision-making for whether the

Table 1. Gendered reporting of control of milk income and cattle ownership for male headed households.

	Male Respondents				Female Respondents				Tests for Significance		
	Total	Male	Female	Joint	Total	Male	Female	Joint	G-Test	df	p value
Cattle ownership	98	82	0	16	128	90	3	35	7.1413	2	<.05
	100%	83.7%	0%	16.3%	100%	70.3%	2.3%	27.3%			
Cattle sales	58	40	0	18	74	57	0	17	0.78248	1	Not sig
	100%	69%	0%	31%	100%	77%	0%	23%			
Cattle purchases	26	24	0	2	33	23	0	10	5.0109	1	<.05
	100%	92.3%	0%	7.7%	100%	69.7%	0%	30.3%			

Table 2. Control of milk income and decision making on milk sales versus consumption for morning and evening milk.

	Male respondents				Female respondents				Tests for significance		
	Total	Male	Female	Joint	Total	Male	Female	Joint	G-Test	df	p value
Control of income from morning milk sales	68	54	9	5	81	32	30	19	25.192	2	<.001
Control of income from evening milk sales	15	8	4	3	16	2	12	2	7.583	2	<.05
Morning milk sales versus consumption	100	56	24	20	130	45	55	30	11.787	2	<.01
Evening milk sales versus consumption	96	36	38	22	125	28	65	32	6.2098	2	<.05
	100%	79.4%	13.2%	7.4%	100%	39.5%	37%	23.5%			
	100%	53.3%	26.7%	20%	100%	12.5%	75%	12.5%			
	100%	56%	24%	20%	100%	34.6%	42.3%	23%			
	100%	37.5%	39.6%	22.9%	100%	22.4%	52%	25.6%			

milk was consumed or sold (for morning and evening sales; see Table 2). The question on control of income was specific in the survey questionnaire, and asked, 'Who makes the decision on how the money is spent?'

Reporting on control of income from morning milk sales varied greatly between men and women respondents (G-test, $p \leq .001$). As a point of convergence, both men and women reported men as most often controlling income from morning milk sales (79.4% of men and 39.5% of women reporting). However, women reported much higher levels of women's and joint control of income than did men. Thirty-seven percent of women respondents reported women-controlled income from morning milk sales, compared to 13.2 percent of male respondents. Women reported higher levels of joint decisions on control of income from morning milk sale (23.5% of respondents vs. 7.4% of men respondents).

Reporting on control of income from evening milk sales was significantly different between respondent groups (G-test, $p \leq .05$). For evening milk sales, 53.3 percent of male respondents reported that the male head controlled the income, compared to 12.5 percent of female respondents reporting male control. Women respondents reported a majority of control of evening milk sales (75%) compared to 26.5% of male respondents reporting this trend. Male respondents reported higher levels of joint control of income from evening milk sales than did women (20% by males, and 12.5% for female respondents, respectively).

Gendered reporting on decision-making on consumption or sale

For decisions related to morning milk sales vs. consumption by household members, there were significant differences in reporting between men and women (G-test, $p \leq .01$). Men reported themselves as the head decision-maker on whether to sell or to retain more often than did women (56% of male respondents vs. 34.6% of female respondents). Women reported themselves as the main decision-maker, giving greater decision-making power to themselves than men (42.3% females vs. 24% men). Women were also more likely to report joint decision-making on morning milk sales vs. consumption, with female respondents reporting jointly 23% vs. men's 20 percent. While there was only a slight difference in joint decision-making reporting, there was complete divergence with both men and women respondents saying they themselves were the decision-makers.

For decision-making on evening milk sales, there was a significant difference between respondent groups on the number of decisions attributed to men (G-test, $p \leq .05$). Male respondents claimed they themselves made decisions on evening milk (37.5%), while female respondents claimed men as the decision-makers in 22.4% of cases. There were similar levels of joint decision-making on evening milk sales, with women reporting slightly higher levels of joint decision-making (male respondents 22.9% vs. female respondents 25.6%). Women were more likely to report women as being the decision-maker (52%) compared to men reporting women as decision-makers in 39.6% of cases. For female and joint categories, there were no statistically significant differences. However, female respondents attributed more decisions to women and joint categories than did male respondents.

Gendered reporting of dairy labor allocation

Results for labor allocation in male-headed households are displayed in Table 3. Labor allocation was measured in hours per week allocated to each cattle-related task, based on a recall period of the previous week. Results indicate gender respondent bias for labor allocated to herding, feeding, fodder cultivation, selling cattle, and tick management. Yet, these differences cover areas of both divergence and convergence in labor trends.

For herding, male respondents reported that they themselves spent 16 hours per week on herding, while females reported that the majority of men spent far less time on the task (6 hours; Mann-Whitney U -test, $p \leq .01$). There were also significant differences in reporting for female herding, with men attributing minimal contribution from women against men (6 hours vs. 10 hours). The labor trend for herding was divergent, as both women and men respondents reported that they themselves did the bulk of the associated labor.

For labor allocated to feeding, the majority of male respondents attributed more hours to themselves than women (9 hours for men vs. 4 hours for women). Female respondents attributed 4 hours to themselves and 4 hours to men. Differing responses to feeding labor were statistically significant (Mann-Whitney U -test, $p \leq .01$) between male and female respondents for both male and female labor. For fodder cultivation, male respondents reported a greater number of hours attributed to themselves

Table 3. Gendered reporting of intra-household dairy labor dynamics (avg. hours).

Dairy activities	Male respondents		Female respondents	
	Men	Women	Men	Women
Herding	16**	6**	8**	10**
Feeding	9**	4**	4**	4**
Milking	1	3	4	3
Fodder	4**	1	3**	2
Selling	2	1**	2	2**
Tick Management	3	0**	3	2**

**<.01 Wilcoxon-Mann-Whitney rank sum test p value for difference in central tendency, male respondent vs. female respondent.

(4 hours) than female respondents (3 hours Mann-Whitney U -test, $p \leq .01$). Men reported less women labor hours (1 hour) than did women (2 hours). For labor allocated to selling, male respondents and female respondents reported men as spending 2 hours per week. Female respondents reported slightly more labor hours for women (2), than did male respondents (1 hour). For tick management, women and men both reported men spending an average of 3 hours per week on the task, while women respondents reported higher levels of female labor (2 hours vs. 0 hours reported by men). Interestingly, women respondents reported men as spending more hours a week milking than women (4 hours for men vs. 3 for women), whereas men reported spending just 1 hour per week vs. 3 hours for women.

Discussion

Following on the dual objectives of this paper, the discussion is divided into two sub-sections. It first outlines the key findings and general patterns that emerge from the data and their relevance to mitigation initiatives in the Kenyan dairy sector. To discern these patterns, areas of convergence and divergence among respondents are identified. The second sub-section reflects upon the methodological implications of analyzing data with gender respondent bias, and offers some recommendations for future research on gender dynamics in low emissions development.

Implications of findings for low emissions dairy development

In interpreting these data, it is clear that there are convergences and divergences in reporting based on the gender of the survey respondent. For cattle ownership, men and women reported that men owned most of the cattle, although there were differences in the percentage of cattle reportedly owned by women, with women reporting ownership in three cases vs. zero cases by men. For control of income from morning milk sales, there was consensus that men controlled the majority of morning milk income, but again, women reported having a larger piece of the earnings (37% reported by women compared to 13.2% by men). Women also reported higher levels of joint control for income from morning milk sales (23.5% by women vs. 7.4% by men). There were large divergences in the category of income from evening milk sales, with both men and women reporting they themselves controlled the majority of income. In short, while women and men agreed that men have greater control than women over cattle ownership and morning milk sales, women reported significantly higher levels of female control. Additionally, female respondents were significantly more likely to report “joint control” of morning milk income than male respondents.

The fact that women respondents reported greater levels of control in individual autonomy and joint ownership across decision-making categories than reported by men leaves us with some questions, which unfortunately cannot be conclusively answered by available data. Why are there such significant discrepancies in reporting across these categories? Were respondents conditioned through the interview process to report greater levels of autonomy through social desirability bias? Or, are these ‘biased’ responses in fact, representative of the gendered realities of cattle keepers in the region? Are structural gender norms, including the traditional gendered division of

labor and knowledge in cattle keeping households, mediating factors in respondents' perceptions of, (or socially acceptable reporting on) labor, decision-making, and resource allocation?

Triangulating the available data with other information about the study area helps clarify the situation. For example, in the region, cows are generally milked twice daily. The morning milk is often sold in the 'formal' marketplace (sold for a profit to a farmer's cooperative, cooling plant, or dairy processing company), while evening milk is often used for home consumption or is sold 'informally' to friends, neighbors, or 'milk hawkers'/middlemen that sell the milk to markets further afield. Qualitative research in the region (Basu, Galiè, & Baltenweck, manuscript in preparation; Farnworth, 2015; Shreenath et al., 2011; Tavenner & Crane, 2016) has emphasized that income derived from the formal market is often given directly to the head of the household (as this is often the person who is officially registered with the co-operative, and traditionally identified as the male head of house), while milk sold informally is less likely to be accounted for by the household head. This lack of formal accounting of evening milk could mean that men may not know how much their wives are earning from evening sales. This explanation could account for the vast difference in control reporting over evening milk between genders.

Another explanation could be the issue of social desirability bias. Social desirability is likely to be a biasing factor in situations where individuals experience conflict between their true preference/experiences and the socially desirable answer (Tao, 2013). It is possible that in order to appear more autonomous to enumerators, respondents overstated their own contributions to dairy activities and underestimated their spouses'. If respondents felt that there was something to be gained by appearing more 'in control' (financial opportunities, new technologies or interventions in their neighborhoods, etc.), they may have been inclined to exaggerate their contributions.

Non-sampling errors might also contribute to our study's results. For example, control of milk income and resource ownership is a subjective and complex topic in many households, regardless of the cultural context (Orr, Tsusaka, Kee-Tui, & Msere, 2016). If not specified by the enumerator, the interpretation of what is meant by 'control' could vary from who physically handles the money to the full autonomy of utilization and disposal. Within this study, the survey was designed to counter this non-sampling error by making the question very specific, such that 'control' was explicitly defined to mean the decision-maker on income utilization (e.g., who decides how the money from the sale of milk is spent).

Understanding how dairy income is distributed at the intra-household level is critical if LED interventions are to achieve gender equitable outcomes, particularly as LED interventions are generally oriented on sustainable intensification and greater formal market integration. As women become more integrated into the formal dairy value chain (e.g., the sale of morning milk to cooperatives who resell to commercial processing plants), the control of income – and whether it is commensurate with the amount of labor put into production – will be a key issue. Research by (Omondi et al., 2014) found that women in married households in Kenya typically control minor income sources (for instance, daily milk sales to hawkers and direct consumers), with the major incomes controlled by the male household heads. Under the cooperative approach, where milk is centrally marketed and the proceeds bulked in larger payments, women

could lose out on their independent income stream, regardless of whether or not they are the ones registered for cooperative membership.

Across all decision categories, there were statistically significant differences in the reported extent of that decision-making power between male and female respondents. Across all decision-making areas, (with the exception of control of income from evening milk sales) female respondents claimed higher rates of joint decision-making in their households, and higher rates of female participation in decision-making. Perhaps, this is due to differences in the perception of the decision-making itself, where women view decision-making more as a collaborative process and men defining decision-makers as ‘who has the final say’. These results align with a new intra-household study on decision-making and gender from Ecuador (Alwang, Larochelle, & Barrera, 2017) that found women were more likely to report joint decision-making on chemical use in agriculture than men. Because enumerators administered the survey in the local language, Kalenjin, it is possible that developmentalist assumptions associated with ‘control’ (individual vs. collective decision-making) may not have resonated with survey respondents. Indeed, recent studies (Anderson, Reynolds, & Gugerty, 2017; Colfer et al., 2015) have highlighted the considerable power women yield in influencing men’s ‘final decision’, further complicating the meaning of these domains.

For labor allocation to dairy tasks, areas of convergence occurred as male and female respondents reported greater levels of male participation in labor related to tick management and fodder cultivation. There were, however, significant differences in the amount of labor reportedly allocated to herding, feeding, selling cattle, and fodder cultivation with more hours attributed to the responding gender.

Regardless of the precise reason for these differences in reporting, a farmer’s ability to make on-farm decisions is vital to the success of low-emission development interventions. If a key portion of the household labor force has limited decision-making power, they may be less motivated to intensify dairy production and subsequently miss out on training opportunities. Regarding intra-household labor, because women perform the majority of daily dairy labor with regards to milking (generally occurring twice daily at the study sites), interventions should plan trainings accordingly around this schedule so women can attend meetings. The divergent reports of labor in the categories of herding, feeding, watering, and selling of cattle may reflect the contested patterns of these dynamics. To address these dynamics, actively engaging both women and men in participatory assessment of low-emission technologies – including their implications for gendered labor dynamics, resources, and decision-making – will be important in achieving gender equitable low-emission development.

Methodological implications for gender respondent bias in household surveys

The results of this analysis highlight the challenges associated with interpreting gender bias in household survey data. What are the mechanisms to explain gender respondent bias in this survey? Was reporting based on the perceptual lens of the respondent, or strategic (mis)representation? A perspective grounded in critical feminist theory (Haraway, 1988; Harding, 2016) suggests that men and women have, fundamentally, different knowledge systems based on socializations that mediate how they perceive the world. Indeed, gender and gender relations are a complex web of multi-

dimensional and dynamic social positions that are situated in time and place. Thus, the binary construction of gender (male vs. female) in surveys obscure how gender takes its meanings from its intersection with other identities, roles, and responsibilities (Ravera, Martín-López, Pascual, & Drucker, 2016). As such, surveys are generally not the best tools for capturing nuanced gender dynamics. However, they can shed light on general trends through the interpretation of areas of convergence and divergence in reporting.

While the prioritization of collecting intra-household data on gender dynamics has assisted in bringing these issues to the forefront of climate research (Farnworth et al., 2015; Kohler-Rollefson, 2012; Perch & Byrd, 2015; Vermeulen, 2015), who is surveyed and how that data are analyzed matters a great deal. While ideally, multiple members of the same household should be interviewed, individual respondent categories can be used to analyze intra-household dynamics. This can be done by disaggregating data by the units of household headship and gender of respondent. In this way, at least four categories of respondents can be tested for statistically significant differences in each household type. This combination allows for a more nuanced view of intra-household dynamics than breaking down only by 'head of household/'head of farm operations' or respondent categories alone. Analyzing this type of data, it is likely to encounter areas of 'convergence' and 'divergence' in gendered reporting. These areas can then be discussed in light of the contextual information around gender norms/relations in the study sites.

The results of this study indicate that respondent's estimates of labor allocation are often highly variable. This can be explained, at least in part, by the fact that the respondent has partial information about 'who does what' in the household, especially in contexts where participants have limited numeracy or cultural contingent estimations of time. Thus, using a Likert scale to measure labor allocation (e.g., who milks the cow (1) always; (2) mostly; (3) sometimes; (4) almost never; (5) never; (6) I do not know), may provide more accurate measures of labor dynamics as opposed to recalling specific number of hours. Finally, studies on joint decision-making should use a decision-making scale that could range from unilateral/singular decision by one spouse to equal voice and agreement on the decision by both spouses. This would better capture the nuances of household decision-making, and potentially account for the issue of gender respondent bias. This type of scale has been integrated in gender and agricultural research using the Women's Empowerment in Agriculture Index (WEAI) (Alkire et al., 2013; Sraboni, Quisumbing, & Ahmed, 2013), as well as the Women's Empowerment in Livestock Index (WELI) (Galie, 2017).

Conclusions

Low-emission development interventions in the dairy sector will inevitably interact with intra-household gender dynamics. If gender equitable outcomes are a priority, there is a need for nuanced understanding of gendered divisions of labor, resources, and decision-making power. Analyzing intra-household survey data can help identify the key aspects of these domains. Indeed, not considering the gender dynamics in low-emissions development risks exacerbating existing inequities to the detriment of women. Any successful LED intervention in the Kenyan dairy sector will need to use

these as starting points to planning interventions, but also remain sensitive to context-specific variability.

In interpreting these data, it is clear that there is wide variability in how men and women report distributions of income, resources, and power within their households. While in some cases, men and women report the same general trends, there are still significant differences in the details of those trends. The most divergent responses are in the domains of control and decision-making around the morning and evening milk sales. The choice of interviewee in any given household affects research findings because survey respondents may have different perceptions or valuation about 'who does what' compared to other members of their households. Future research on gender and climate change mitigation can use household surveys to identify trends in gendered reporting to highlight areas of divergence and convergence that require analysis through qualitative research methodologies.

Notes

1. Climate change mitigation in dairy is related to lowering the GHG emissions intensity in the sector so as to reduce the causes of climate change. Climate change adaptation, which is outside the scope of this paper, in dairy is related to the adoption of social and/or technical practices that buffer production/profitability against climate driven shocks (i.e., drought, flood), so as to reduce the impact of climate change.
2. While there were 50 female-headed households surveyed in the EADD project baseline, these households were omitted from discussion because of the relatively low number of male and female respondents, 11 and 39, respectively, compared to male-headed households, 111 and 140, respectively.
3. Data used in the study was derived from a larger baseline survey of cattle keeping households in EADD-supported hubs catchment areas for the second phase of EADD project (EADD phase II). The baseline survey was designed as part of the project's evaluation process, with the aim of establishing baseline levels of key performance indicators.
4. Evening milk includes afternoon milk, in cases where a household milks 3 times a day i.e., morning, afternoon, and evening.

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Notes on contributors

Katie Tavenner, PhD, is a post-doctoral fellow in gender research at the International Livestock Research Institute (ILRI) in Nairobi.


Simon Fraval is a researcher in livestock systems and environment at ILRI.


Immaculate Omondi, PhD, is a monitoring, learning, and evaluation (MLE) scientist at ILRI.


Todd A. Crane, PhD, is a senior scientist at ILRI working on climate change adaptation and mitigation issues.

ORCID

Katie Tavenner  <http://orcid.org/0000-0002-6070-5921>

Simon Fraval  <http://orcid.org/0000-0002-2936-2537>

Immaculate Omondi  <http://orcid.org/0000-0002-0967-1252>

Todd A. Crane  <http://orcid.org/0000-0002-4395-7545>

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