



Smallholder goat production and marketing: a gendered baseline study from Inhassoro District Mozambique



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ABSTRACT

Despite emerging public and donor attention on women and agriculture, relatively few studies are based on gender analysis of sex-disaggregated quantitative data, particularly on women's involvement in marketing of livestock products. The objective of this article is therefore to investigate gender roles and processes of smallholder goat production and marketing in Inhassoro District, Mozambique, by analysing sex-disaggregated baseline data for women in male-headed households (W-MHH), men in male-headed households (M-MHH) and women in female-headed households (FHH). The paper draws on baseline data from the imGoats project, which aimed to diversify smallholder goat producers' livelihood options by supporting the commercialization of goat production. Building on the sustainable livelihoods framework, adapted for gender and assets, this paper demonstrates that women in male-headed households rarely have control over income from goat sales and that meanings of "joint" ownership, decision making and asset control differ by gender. Results also showed that the primary goal of selling goats is to cover emergencies and household needs, and that goat meat consumption is linked to market access and agro-ecological zone. Despite the challenges of undertaking robust gender studies in a real-life developing country setting, this study provides a practical technical example of how one can implement gendered quantitative analyses in the context of the livelihoods framework.

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1. Introduction

Over the past decade there has been emerging public and donor attention on women being recognized as major contributors to agricultural production and marketing in developing countries [1–3]. At the same time there has been an increasing interest among practitioners, policy makers and researchers to link smallholders to markets to reach development objectives of increased income and food security [4,5].

In this article, gender is defined as “the economic, social, political, and cultural attributes and opportunities associated with being man or woman” ([6], p.2). It is often argued that commercialization of crop and livestock production can lead to women losing out, whereby as production commercializes, women work more but benefit less, for example, by controlling less income [7–9]. Such negative outcomes can be avoided by integrating gender

in the full research and development cycle and by conducting a gendered baseline analysis that will inform the integration of transformative measures in the project cycle [10]. The importance of gender integration in the full research-for-development process – in baseline studies, interventions, monitoring, learning and impact assessments – is more and more acknowledged as good practice [11–13].

Although an increasing amount of quantitative data has informed the gender literature on crop production and marketing [14,15,53], the understanding of gender roles within livestock production and marketing is still largely qualitative in nature. Relatively little quantitative sex-disaggregated data are currently available on women's involvement in the marketing of livestock products despite its being increasingly essential to inform and influence interventions by development partners, policy makers and donors [16–18]. Moreover, gender roles vary between socio-economic contexts, regions and countries, which make it difficult to generalize gender dynamics [13,19]. Owing to this variation, the validity of assumptions regarding gender roles needs to be tested carefully in each specific context [18,20].

Taking the above arguments into account, the objective of this article is to provide a practical example of how development practitioners interested in “doing gender” can implement gender analysis

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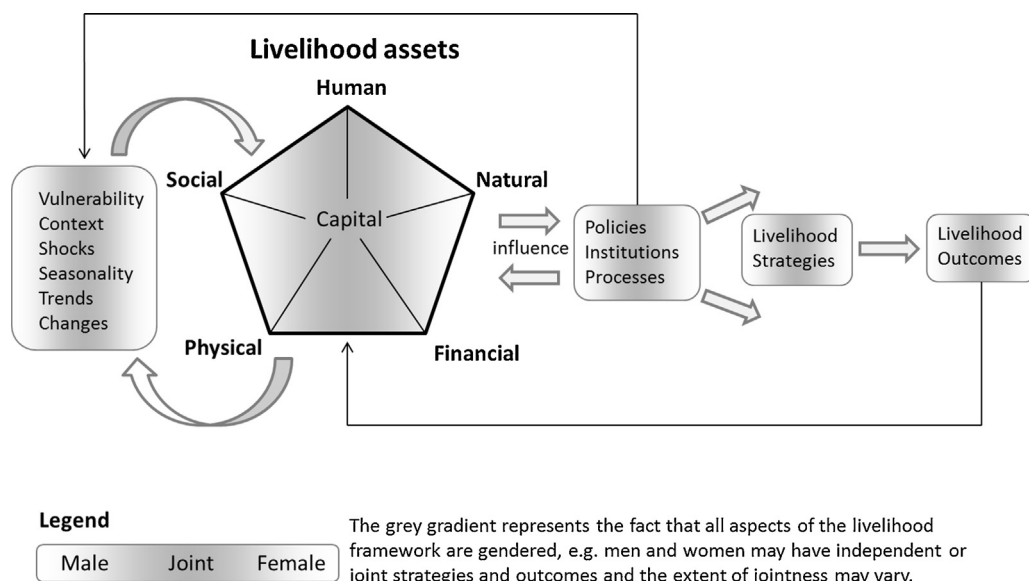


Figure 1. Sustainable livelihood model adapted for gender and assets (adapted from [22] and [18]).

of sex-disaggregated quantitative data within the context of their projects following the sustainable livelihoods framework. It draws on data and experiences from a Research-for-Development (R4D) project focusing on goat production and marketing, imGoats, which was led by the International Livestock Research Institute (ILRI) and implemented by CARE in Inhassoro District, Mozambique. The project focused on gender integration at the beginning of the project cycle by analysing quantitative sex-disaggregated baseline data. As such, the current study represents an initial step towards using quantitative baseline data to try to prevent a widened gender benefit gap as a potential outcome of the project.

The following section presents the conceptual framework based on the sustainable livelihoods model adapted for gender and assets; the context of goat production and marketing in Inhassoro District is also described. Section three presents materials and methods for data collection and analysis of quantitative sex-disaggregated data from different goat smallholder farmers and for additional qualitative information. Section four shows the results in line with the selected gender areas, followed by a discussion in section five. The paper concludes with recommendations for research and development projects wanting to have a transformative influence on gender roles in smallholder livestock production and marketing.

2. Conceptual framework

2.1. The sustainable livelihoods model adapted for gender and assets

The current study builds on the sustainable livelihoods framework adapted for gender and assets. In the sustainable livelihoods framework, a pentagon is used to represent the five capitals – human, natural, financial, physical and social – necessary to sustain livelihoods individually and collectively ([21], [22]). Policies, institutions and processes influence assets and the available livelihood strategies; these include for example market access and norms of mutual assistance in times of need [18]. The livelihood strategies then determine outcomes such as increased income, improved wellbeing, reduced vulnerability, more reliable food security, and more sustainable use of the natural resource base, which in turn participate to the enhancement or depletion of men's and women's asset bases. Livestock can contribute to livelihood outcomes in multiple ways, e.g. sale of livestock products to increase incomes,

increased food security through higher consumption of home-produced livestock products [23,24].

Gender integration in the livelihoods framework, as recommended by the World Bank [6], enables the constant consideration of gendered differences in the multiple components of the framework. Identifying these differences, their underlying causes and ways of addressing the causes in order to narrow the gender outcome gap thus leads to adapting the sustainable livelihoods framework so that each of its elements can be viewed through a gendered lens (Figure 1).

This article provides a practical technical example of how gender-disaggregated data can be collected and analysed within a real-life development project so as to provide some empirical evidence of the gendered gradient of all aspects of this sustainable livelihood model adapted for gender and assets.

2.2. Gender roles in livestock production and marketing

The following section highlights frequently mentioned gender–livestock arguments in relation to women's access to and control of production assets and incomes in developing countries. They contribute evidence to the relevance of using a gendered sustainable livelihoods framework to understand better the livelihood strategies involving livestock and their potential outcomes.

First, small stock like poultry, sheep and goats are often considered women's animals and are, therefore, a suitable entry point to improve livelihood and food security of households and especially for women and children [17]. The concept of "women's animals" is more complex than it may appear at first sight because owning small stock and crops does not necessarily mean that women own goats or land [25]. The type of livestock species owned by women is context-specific and ownership patterns may change over time [17]. Ownership patterns can be determined by intra-household allocation rules as well as by the broader sociocultural context [18]. For example, Saghir *et al.* [26] found that there is a culture against women ownership of goats in Tanzania. Other studies have demonstrated that assets are often owned by individual household members – instead of being pooled – as defined by intra-household allocation rules [27]. As such, men and women can own different assets and assets may be unequally distributed within a household [18]. For these reasons, women's ownership of small stock should not be considered as given.

However, looking only at ownership can misrepresent reality, as ownership does not guarantee control or decision making power over the assets or income [20]. Women may not be the owners of livestock and land but may have access to their products, e.g. milk [23], and part of the income from their sales. Owing to this complex “ownership” situation, Meinzen-Dick *et al.* [18] have suggested looking at “use or access” rights and “control or decision making” rights together in order to establish the nature of asset ownership. For example, land rights in patrilineal social systems, like many Sub-Saharan African countries, are often determined by inheritance through the male line, whereas women can gain access through marriage and lose access on death of their husband [28,29].

Likewise, women may face insecure rights over livestock [17], which can subsequently reduce their bargaining power in household decisions over their sales and incomes [18]. Access to an asset, therefore, does not always represent ownership of the asset as it may be without decision making ability over the asset or rights on death of their husband.

A household consists of diverse members with different characteristics, perspectives and influence, and who make different decisions; all these components determine the allocation of resources among the household members [27]. These characteristics make an individual – or a collective of multiple individuals – dependent on the type and the extent of consultations and negotiations conducted among the individuals within the household. In this case, an individual’s bargaining ability among others is crucial. Thus, household decisions – such as when to use livestock for home consumption, when to sell livestock and how to use the money – strongly influence the way livelihood assets are put to use within livelihood strategies. Livestock sale decisions are gendered; Saghir *et al.* [26] found that in Tanzania there is a strong tradition against women’s decision taking over goats, whereas in other studies goats are considered specifically suitable for women, because they fall under their decision domain [30,31]. Moreover, women may use money from livestock and their product’s sales differently from men [18]. Women’s ownership of small ruminants can enable them to increase food security through access to animal products and income as well as enhance their bargaining power within the household. However, these abilities can be undermined if the marketing decision making and control of the income from these animals remains under men [32]. Hence, it is crucial to understand which household decisions are made individually and collectively, by men and women alone or jointly, as this will determine whether desired livelihood outcomes like increased income and food security will be realized through a livestock-based intervention.

Another important gender concern is that with increased income from commercialization men take over control of the decision-making relating to income and women lose control as the business becomes profitable [7,9,23]. Njuki and Sanginga [32] showed that this can also be the case for livestock products as low-income commodities constituted a higher share of women’s income whereas men had a higher share of high-income commodities. Women can clearly only lose control over (part of) the income, if they had some control in the first place. Moreover, in case women have limited control, it might be more difficult for them to maintain it [17]. Hence, a crucial first step in livestock development projects is a gender-sensitive analysis to assess the level of control women actually have over income from livestock and other assets.

To conclude, sex-disaggregated data are a prerequisite to interrogate gender assumptions. However, the availability of quantitative data on this topic is especially limited. Moreover, sex-disaggregated data are often only disaggregated by gender of the household head, leaving women in male-headed households invisible. Taking the above arguments into account, the current paper looks at differences among men in male-headed households (M-MHHs), women in male-headed households (W-MHHs) and the

heads of female-headed households (FHHs) in Inhassoro District, Mozambique, on the following topics: livelihood strategies, ownership of land and livestock, goat meat consumption within the household, market participation, control of incomes from goat sales and other livestock, and income expenditure.

2.3. Goat production and marketing in Mozambique and in the study area

The current section describes the context of goat keeping and marketing in Inhassoro District, Inhambane Province, Southern Mozambique (Figure 2).

Mozambique is one of the poorest countries in the world ranking 185 out of 187 countries in the 2012 UN Human Development Index [33]. With a score of 0.58 on the Gender Inequality Index, Mozambique also ranks 125 of 148 countries, which means there is relatively high inequality in achievements between women and men in reproductive health, empowerment and labour. About 80% of the Mozambican population depends on agriculture for their livelihoods [34]. It is estimated that only 11% of the arable land area is cultivated, mainly by smallholders, and about 60% of the agricultural labour force consists of women [35]. Land is owned by the Government of Mozambique and consequently land ownership usually entails use right [36]. Moreover, many regions in Mozambique are characterized by a patriarchal social system, which means that after marriage women move to their husband’s village and can use the land [12]. Within this social system, however, women can have a substantial level of autonomy in relation to crop production (Wright 1984 in [37]). The Mozambican livestock population was severely depleted during the civil war (1977–1992), after which the Government of Mozambique – supported by the international donor community and non-governmental organizations – started restocking activities, which focused mainly on cattle and goats for smallholders.

The goal of the “small ruminant value chains as platforms for reducing poverty and increasing food security in dryland areas of India and Mozambique (imGoats)” project was to increase incomes and food security in a sustainable manner by enhancing pro-poor small ruminant value chains in India and Mozambique [38]. The project had two objectives: first, to pilot sustainable and replicable organizational and technical models to strengthen goat value chains that increase incomes, reduce vulnerability and enhance welfare amongst marginalized groups including women; and second, to document, communicate and promote appropriate evidence-based models for sustainable, pro-poor goat value chains.

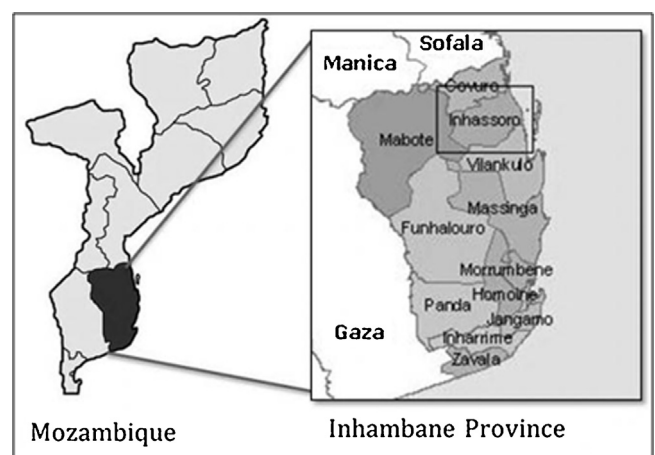


Figure 2. Study area: Inhassoro District, at the northern part of Inhambane Province, Mozambique.

Table 1
Selection criteria of baseline communities and households.

Community name	Agro-ecological zone	Market access ^a	SEED project participation ^b	Number of selected households
Vulanjane	Interior	High	No	14
Nhapele	Interior	High	Yes	14
Mabime	Coastal	High	No	14
Rumbatsatsa	Interior	Low	Yes	14
Cachane	Interior	High	No	14
Chichangue	Coastal	Low	No	14
<i>Total households</i>				84

^a High market access – less than 10 km from a tarmac road; low market access – more than 10 km from a tarmac road

^b Sustainable Effective Economic Development (CARE project)

The imGoats project intended to diversify smallholders' livelihood options by supporting commercialization of goat production to enable increases in incomes and asset accumulation. Inclusion of women was important to the project to ensure that they benefited in terms of access to and control of incomes generated through the project. The project used value chains and innovation systems approaches for its technology transfer; a baseline study was conducted at its start.

In Mozambique, the target zones of the imGoats project were semi-arid areas of Inhassoro District (Figure 2). Inhassoro District covers about 4,746 km² holding 52,275 inhabitants. Only 13% of the population lives in urban areas [39]. The district consists of two agro-ecological zones: a coastal and an interior zone. The interior zone is relatively dry with brown-red relatively fertile soils whereas the coastal zone is more humid with less fertile sandy soils. In both zones, livelihoods are based on subsistence agriculture; in the coastal zone livelihoods are also based on fishing [39]. In Inhassoro District, about 10,000 households have arable land with an average area of 1.6 ha per household, 11% of which are headed by women [39]. Most multiple-plot smallholdings, called *machamba*, are used for subsistence production of multiple crops based on manual labour and low inputs [35].

The main agricultural products in Inhassoro District are maize, cassava, beans, peanuts, sweet potatoes and sunflower [39]. It is estimated that 65% of the people who cultivate these plots are women and that the large majority (92%) of the women in the district are involved in agricultural labour. Very few women (5%) are involved in sales or employed in formal and informal commercial sectors [39]. The majority of the crops are consumed at home but sales of cassava and maize are also the main source of rural household income [36].

In 2010 Inhambane Province had almost 416,000 goats, which is about 11% of the national flock [40]. It is known that smallholders rarely keep goats for commercial purposes, but mainly for subsistence roles, such as meat and milk production, manure production, insurance against emergency, social status, and ceremonies [19,41–43]. Similarly in Inhassoro District, it was estimated that only 9% of goats produced were marketed through either formal or informal chains [39]. It should be noted that goats in Inhassoro District are not milked. In addition, goat production in Inhassoro District is characterized by a number of challenges, such as low number of goats per household, limited access to animal health services, lack of organization of producers, limited use of communal grazing areas, lack of infrastructure and livestock markets, and limited knowledge about improved husbandry practices [44].

3. Materials and methods

3.1. Baseline study

The baseline study consisted of a household survey with five parts: a) household characteristics, b) goat keeping practices, c)

cost, returns and marketing, d) knowledge and training of smallholders and e) food security.

One of the factors strongly influencing the level of market access for smallholders in Inhassoro is their distance to a tarmac road; the closer the community is to a tarmac road, the better the market access. Market access in this study was therefore defined in terms of distance to a tarmac road, with less than 10 km representing "high" market access and more than 10 km representing "low" market access. Another factor is "Project participation", which is related to earlier CARE activities in several communities. Sustainable Effective Economic Development (SEED) is a CARE project, which – at the time imGoats started – had already operated actively for 2 years in Inhassoro District providing access to loans and fostering handicraft business opportunities for the farming households. It was expected that communities that had worked before with this project might have had different practices and attitudes compared with communities that had not previously worked with CARE.

Baseline communities were selected using three criteria that might affect smallholders' goat production and marketing practices: agro-ecological zone in Inhassoro (interior; coastal), market access (high; low), and history of participation in CARE development projects (imGoats project; SEED project) (Table 1). The household survey covered six project communities in Inhassoro District, with 14 respondents per community resulting in a total of 84 household interviews. Key informants estimated that on average a community consisted of 1,413 people in 472 households. Corresponding to only 3% of a community's households, the baseline survey sample can in hindsight be criticized as too small.

The initial questionnaire was developed in English and then translated to Portuguese (both are available upon request from the corresponding author). The questionnaire was pre-tested in the field and revised to enhance clarity. Household interviews were conducted in the local language *Xitswa* and responses documented in Portuguese by eight enumerators. A week before the survey, the enumerators employed by CARE and the imGoats project received a 2.5-day training on the objectives of the project and baseline study, interviewing techniques, and content of the household survey. The training also included field-testing of the survey. The training did not address gender specifically. Data were collected over nine days (8–17 August 2011). Each interview took about 1.5 hour. There were four female and four male enumerators; no effort was made to match the sex of the enumerator and the sex of the household respondent. One person was interviewed from each household selected; this could be the person who took care of goats, the head of household or his spouse. Sex of the respondent and that of the household head were documented, which enabled the following gender categorization: male respondents from male headed households (M-MHHs), female respondents from male headed households (W-MHHs), and female respondents from female headed households (FHHs).

In case a male respondent was also head of household, he was not asked about the presence or absence of his wife, which implies in the current study that male respondents from male headed

households (M-MHHs) can be married men as well as widowers. Moreover, it is known that polygamous marriages exist in Mozambique [45] and might be an influencing factor for our study, but this was not looked at in the current research.

Additional respondents' characteristics included age, years of goat keeping, level of education, main and second occupation, and level of income. Unfortunately, data on income level were too scarce for robust statistical analysis. No data were collected on social status and class difference.

A week before data collection each community received an official letter announcing the visit, explaining the purpose of the visit and requesting goat keepers to come to the centre (*sede*) of the community to participate in the interviews. The *sede* is a village meeting place and is the traditional mode of meeting and consulting communities that are widely spread out. Most interviews were therefore not conducted at respondents' homes. For interviews not conducted at the *sede*, respondents were selected purposively according to whether they were present at, or close to, the centre of the community to have equal numbers of men and women from each community. However, in some communities hardly any women showed up at the time of the interviews. In these communities therefore, more men were interviewed. Hence, the survey data may inherently contain sample bias in terms of differences between those goat keepers who showed up at the *sede* and those who did not. These differences were not measured (e.g. if they lived far from the *sede*, if they were unavailable due to other obligations, or if they were uninformed by the community leader) and as such could not be included in the analysis. It is thus possible that this sampling protocol has led to missing out the more marginalized or vulnerable households who could not send representatives to be interviewed.

3.2. Statistical analysis

Given the importance of the interaction among household members in ascertaining access and control over household assets, and taking account of the method of sex disaggregation chosen for data collection, the unit of analysis in the current study is the household. Data for the 84 households were entered by CARE monitoring and evaluation staff into Excel. One observation, a male child respondent from a FHH was removed because no other child respondents were surveyed. Hence, final statistical analysis was conducted on 83 respondents with IBM SPSS Statistics 20. Table 2 shows the baseline variables that were selected for the gender analysis.

There was a clear difference between the number of respondents for each gender and community combination, meaning that male respondents from male headed households (M-MHHs), female respondents from male headed households (W-MHHs) and female respondents from female headed households (FHHs) were not equally distributed over communities (Table 3). Instead, FHHs were mainly represented by respondents from three of the six communities: Chichangue, Nhapele and Vulcanjane. Consequently, gender differences may in some cases be confounded with community differences; so all response variables have been tested for community effect as well as gender. In the case of categorical variables, separate Chi-square tests were conducted for gender and community.

Additional analyses were conducted incorporating community and gender (M-MHHs, W-MHHs and FHHs), using linear and logistic regression. Overall comparison between the gender categories was made, followed by least-significantly different (l.s.d) specific comparisons between pairs of gender categories, i.e. M-MHH vs. W-MHH, M-MHH vs. FHH and W-MHH vs. FHH.

Continuous response variables that were not normally distributed were transformed to natural log prior to analysis. Log-transformed normally distributed data were used for statistical comparison of results, whereas raw data are presented and used to

Table 2
Selected baseline variables for statistical gender analysis.

Variable	Type	Categories (if applicable)
Gender	Nominal	M-MHH; W-MHH; FHH
Community	Nominal	Cachane; Chichangue; Mabime; Nhapele; Rumbatsatsa; Vulcanjane
Market access	Binary	Low access (>10 km from tarmac road); High access (<10 km from tarmac road)
Agro-ecological zone	Binary	Coastal zone; Interior zone
SEED project participation	Binary	No; Yes
Age	Continuous	Normal distribution
Years of education	Continuous Binary	Non-normal distribution – recoded into binary variable No education; One or more years of education
Main occupation	Nominal	Crop production; Livestock; Monthly salaried job; Business; Handicraft; Other
Second occupation	Nominal	Crop production; Livestock; Business; Handicraft; Agricultural labour; Other
Land ownership	Nominal	Husband; Wife; Joint; Other relative
Goat ownership	Nominal	Men only; Women only; Jointly; Children
Goats per household	Continuous	Non-normal distribution – transformed to natural log
Years of goat keeping	Continuous Nominal	Non-normal distribution – recoded into nominal variable 1 to 3 years; 4 to 8 years; 9 to 14 years; 15 or more years
Market participation (goat sales)	Binary	No; Yes
Income control	Nominal	Household male; Household female; Joint household; Other
Expenses covered	Binary	No; Yes (Education; Food; Health; Housing; Clothing)
Goat meat consumption	Binary	No; Yes

provide the interpretation of differences. A significant community effect in itself does not give insight into the meaning of any differences; instead the regression model included variables that could explain the community effect (agro-ecological zone, market access, and SEED project participation). Other variables that – in addition to gender – might have an effect, like first and secondary occupation, years of goat keeping and goat herd size, were also included. For both linear and logistic regression models, effects were evaluated when fitted into the model using a Wald chi-squared test. Model fit was evaluated by comparing the change in log-likelihood between the null and current model to a chi-squared distribution with change in degrees of freedom between the models. Residual plots were checked to confirm the assumptions of independence and normality. Two variable interactions were tested although sample size limited the ability to test higher level interactions.

Table 3
Respondents per community for three gender categories (M-MHHs, W-MHHs, FHHs).

Community name	M-MHHs	W-MHHs	FHHs	Total
Vulanjane	6 (7.2%)	2 (2.4%)	6 (7.2%)	14 (16.9%)
Nhapele	4 (4.8%)	3 (3.6%)	7 (8.4%)	14 (16.9%)
Mabime	11 (13.3%)	2 (2.4%)	0 (0.0%)	13 (15.7%)
Rumbatsatsa	8 (9.6%)	5 (6.0%)	1 (1.2%)	14 (16.9%)
Cachane	8 (9.6%)	4 (4.8%)	2 (2.4%)	14 (16.9%)
Chichangue	7 (8.4%)	2 (2.4%)	5 (6.0%)	14 (16.9%)
Total respondents	44 (53.0%)	18 (21.7%)	21 (25.3%)	83 (100%)

Table 4
Age of household survey respondents, disaggregated by gender.

Gender category	Respondents		Age (years)					
	N	%	n	Mean	s.e.	95% CI	Min	Max
M-MHH	44	53.0	43	52.1	1.8	48.4 – 55.8	34	83
W-MHH	18	21.7	18	42.9 **	2.6	37.5 – 48.4	19	67
FHH	21	25.3	21	50.1	3.4	43.1 – 57.1	18	80
Total	83	100	82	49.6	1.4	46.7 – 52.4	18	83

** Significant difference with M-MHH at $p < 0.05$ level

3.3. Explanatory qualitative information

In order to understand trends identified from the analyses of the quantitative baseline data in view of the social, cultural and historical context of goat keeping and marketing in Inhassoro, 18 in-depth face-to-face interviews of selected respondents of household surveys were conducted after the data analysis. Although gender was not the specific focus of the household interviews, the interviews revealed some gender insights that helped explain the quantitative baseline findings. The 18 respondents, three from each of the six baseline communities, were selected to reflect a wide range of situations in terms of gender, age, herd size, and involvement in goat sales. The in-depth interviews consisted of nine M-MHHs, five W-MHHs, and four FHHs. These interviews were conducted over 13 days (14–26 May 2012).

In addition, a post-doctoral researcher lived close to the project area for a period of two years and frequently visited the communities, thus observing local social interactions. This extended field experience has been used to illustrate several quantitative findings. Further details on all the data collection tools and methods are available upon request from the corresponding author.

4. Results

4.1. Respondent group

Eighty-three household interviews were analysed: 44 M-MHHs, 18 W-MHHs and 21 FHHs (Table 4). W-MHHs were significantly ($p = 0.013$) younger than M-MHHs. There was a significant association ($p < 0.001$) between education levels and gender categories with fewer educated FHHs (25%) and W-MHHs (33%) than expected compared with educated M-MHHs (79%).

4.2. Livelihood strategies

Most M-MHHs, W-MHHs and FHHs stated crop production (*machamba*) as their main occupation (64%). About one-third of the households had livestock keeping as their secondary occupation and another one-third had crop production as their secondary occupation (Table 5).

Table 5
Main and second occupation of respondents disaggregated by gender.

Gender categories	Crops	Livestock	Monthly salaried job	Business	Handicraft	Agricultural labour	Other
Total Main occupation							
	N	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
M-MHH	44	28 (63.6)	1 (2.3)	3 (6.8)	4 (9.1)	4 (9.1)	4 (9.1)
W-MHH	18	10 (55.6)	4 (22.2)	1 (5.6)	2 (11.1)	0 (0)	1 (5.6)
FHH	21	15 (71.4)	2 (9.5)	1 (4.8)	2 (9.5)	0 (0)	1 (4.8)
Total (%)	83 (100)	53 (63.9)	7 (8.4)	5 (6.0)	8 (9.6)	4 (4.8)	6 (7.2)
Total Second occupation							
	N	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
M-MHH	41	14 (34.1)	13 (31.7)	-	6 (14.6)	4 (9.8)	1 (2.4)
W-MHH	18	6 (33.3)	4 (22.2)	-	3 (16.7)	0 (0)	4 (22.2)
FHH	20	5 (25.0)	5 (25.0)	-	4 (20.0)	1 (5.0)	1 (5.0)
Total (%)	79 (100)	25 (31.6)	22 (27.8)	-	13 (16.5)	5 (6.3)	6 (7.6)

The qualitative interviews also showed that crop production was people's main occupation whereas goat keeping was mainly a side activity for subsistence reasons. A parallel study conducted within the project on the multi-functionality of goats in Inhassoro District revealed four different functions of goat keeping: sale in times of need (e.g. for food, school and in case of illness), exchange for services and products (e.g. agricultural labour), as contribution to social life (e.g. for ceremonies, bride wealth and to help family members), and consumption of goat meat (mainly for special occasions) [46].

There were no significant differences between gender categories for main and second occupation. After combining occupation to form four main categories (crops, livestock, agricultural labour and other/off-farm work), there were still no significant differences between gender categories for main and second occupation. The qualitative interviews included two women who produced and sold local drinks as a way to earn some money. Our field experience confirmed that this activity can be considered a typical women's activity.

There was evidence for a relationship between communities and first and second occupation ($p = 0.051$ and $p = 0.074$, respectively). To explore this community effect further, first and second occupations were tested (Chi-square) for an association with agro-ecological zone, market access and participation in SEED project. For first occupation there was a significant association with agro-ecological zones ($p = 0.018$): none of the respondents in coastal communities had livestock-keeping as first occupation (compared with 12.5% of interior communities), but more respondents in coastal communities had handicraft (11.1%) and other activities like fishing (14.8%) as first occupation. There was evidence of a relationship between first occupation and participation in SEED project ($p = 0.059$): more respondents in a SEED-community having livestock keeping (17.9% vs. 3.6%) and business (14.3% vs. 7.3%) as first occupation compared with respondents in non-SEED communities.

For second occupation there was evidence of a relationship with participation in SEED project ($p = 0.099$) and there was a significant association with market access ($p = 0.040$): more respondents in communities far from a tarmac road had agricultural labour as secondary occupation compared with respondents in communities close to a tarmac road (19.2% vs. 1.9%). Instead, more respondents

Table 6
Livestock ownership by women.

Animal species	Households (hh)		Animals					
	hh with animals	hh where women own animals	Total	Animals owned by women	Animals per household			
	n (%)	n (%) ^c			n	n (%)	Mean	s.e.
Goats ^a	83 (100)	41 (49)	727	279 (38)	8.8	0.77	6	7.2 – 10.3
Poultry	70 (84)	42 (50)	1278	513 (40)	18.3	1.68	14	14.9 – 21.6
Pigs	12 (14)	2 (14)	36	5 (14)	3.0	0.43	3	2.1 – 3.9
Sheep ^b	6 (7)	3 (50)	37	12 (32)	6.2	2.2	5	0.4 – 11.9
Cattle	7 (8)	1 (13)	31	2 (6)	4.4	1.2	3	1.5 – 7.4

^a In 3 households, children owned goats. On average, children owned 2 goats per household.

^b In one MHH, a man owned 70 sheep; this number is considered an outlier relative to the local average of goat ownership by households and deleted from the presentation of the summary statistics in the table above.

^c Percentages calculated over households with animals (i.e. households which do not have the specific animal have been excluded)

in communities with good market access had livestock keeping as their secondary occupation compared with respondents in communities far from a tarmac road (34.0% vs. 15.4%).

4.3. Access to and ownership of land

Respondents were asked about the ownership of the homestead and crop land area (*machamba*). There was a significant association ($p < 0.001$) between ownership of homestead and crop land area and gender categories, with a large majority of women in FHHs owning the homestead (91%) and crop land area (86%). There was also a significant association with ownership of homestead ($p = 0.014$) and crop land ($p = 0.030$) areas and women and men in MHHs. A much higher number of W-MHHs (83%) reported that their husband owns the homestead, whereas 44% of the M-MHHs reported that the land was owned jointly (compared with only 11% of the W-MHHs). For crop land, the general pattern in MHHs was “joint ownership” (resp. 72% in M-MHHs and 89% in W-MHHs), but more than expected M-MHHs (21%) reported that the husband owned the crop land given that none (0%) of the W-MHHs reported the husband owning the crop land.

At the time the project started in 2011 there were hardly any grazing areas for goats. Instead, a majority of the respondents ($64/83 = 77.1\%$) tethered their goats. Goats were tethered mainly to protect the agricultural plots (*machamba*). Sometimes, goats were left untethered once the crops have been harvested and there is no agricultural production. A few households kept goats in traditional kraals constructed on the ground.

4.4. Access to and ownership of livestock

Respondents were asked how many cattle, goats, sheep, poultry and pigs they owned. Livestock ownership by women can be evaluated using the percentage of households where women own livestock, the percentage of total animals owned by women and the average number of livestock owned by women per household. Table 6 shows that women owned about 40% of the poultry and 38% of the goats, which concurs with the pattern of livestock ownership of women identified in Tanzania, Kenya and Mozambique [32]. About 84% of the households kept poultry and in half of these households ($n = 42$) women owned these. On average, the number of poultry owned by women per household was eight. When including only households where women owned poultry, the average number of poultry owned by women per household was 12. Other livestock such as pigs, sheep and cattle were rarely kept.

On average, respondents have kept goats for about ten years. Years of goat keeping were non-normally distributed, natural log transformation was not able to normalize the data and therefore the data were transformed into a nominal variable with four categories, based on quartiles: 1–3 years (27%), 4–8 years (23%), 9–14 years

Table 7

Years of goat keeping for three gender categories (M-MHHs, W-MHHs, FHHs).

Years of goat keeping	M-MHHs	W-MHHs	FHHs	Total
1–3 years	8 (18.6%)	4 (22.2%)	10 (47.6%)	22 (26.8%)
4–8 years	8 (18.6%)	6 (33.3%)	5 (23.8%)	19 (23.2%)
9–14 years	11 (25.6%)	5 (27.8%)	5 (23.8%)	21 (25.6%)
15 > years	16 (37.2%)	3 (16.7%)	1 (4.8%)	20 (24.4%)
Total	43 (100%)	18 (100%)	21 (100%)	82 (100%)

(26%), 15 years or more (24%) and chi-square tests used to look for associations. There was a significant association ($p = 0.039$) between years of goat keeping and gender categories: 47% ($n = 10$) of FHH kept goats for less than 3 years compared with only 18.6% and 22.2% of respectively M-MHHs and W-MHHs. Conversely, 37.2% ($n = 16$) of M-MHHs kept goats for 15 years or more, in contrast to only 16.7% of W-MHHs and 4.8% of FHHs. One-third ($n = 6$) of W-MHHs kept goats between four and eight years, compared with 18.6% of M-MHHs and 23.8% of FHHs (Table 7).

Hence, M-MHHs kept goats for the longest period, followed by W-MHHs, whereas FHHs kept goats for the shortest period. It might be possible that FHHs only started goat keeping after their husband had passed away, as a 49-year-old FHH explained in the qualitative interviews: “When my husband died [15 years ago] I had to start agriculture. The *machamba* was not enough, so I started goat keeping in 2002 [10 years ago]. I saw in the community that one can sell goats in time of need and earn money”. Results from the qualitative interviews showed that many other respondents started goat keeping after they saw from their neighbours or family members that goats “can help in times of need”. Hence, it might also be possible that FHHs were last to keep goats because they were more risk averse and wanted to see what might happen if one kept goats before they kept any themselves.

On average a household had 8.8 goats (Table 8). Distribution of herd size per household was skewed: of the total 727 goats, almost one third of the total goats ($n = 226$) was owned by 11% of the goat keepers ($n = 9$); to obtain a normal distribution data were transformed to natural log. To understand better the differences in

Table 8

Goat herd size for each gender category.

Gender categories	Goat herd size					
	n	Raw data		Natural log transformed data		
		Mean	s.e.	Mean	s.e.	95% CI
M-MHH	44	9.0	1.1	1.91	0.12	1.66–2.15
W-MHH	18	10.1	1.8	2.06	0.17	1.70–2.42
FHH	21	7.1	1.4	1.66	0.17	1.29–2.02
Total	83	8.8	0.77	1.88	0.09	1.70–2.05

Table 9
Significance of main effects for goat herd size per household.

Independent variables	df	Dependent variable Goat herd size
Gender	2	0.643
Agro-ecological zone	1	0.129
Market access	1	0.779
SEED project participation	1	0.779
First occupation	5	0.264
Second occupation	5	<0.001***
Years of goat keeping	3	<0.001***
Goat herd size	1	-
Model parameters		
Change in log-likelihood		52.297
Df		18
Significance		<0.001***

^a Excluding outlier with 70 sheep (n=82)

* Significant at the 10% level, ** Significant at the 5% level, *** Significant at the 1% level

average goat herd size per household, the full model (linear regression) included gender, agro-ecological zone, market access, SEED project participation, first and second occupation and years of goat keeping (Table 9). Secondary occupation and years of goat keeping were significantly related to goat herd size ($p < 0.001$ for both). Respondents with livestock keeping as secondary occupation had significantly ($p < 0.001$) larger goat herd sizes (12.8). Despite the absence of statistical relationship between gender and goat herd size, the qualitative findings illustrate that FHHs may have smaller herd sizes due to labour restrictions. As one 56-year-old FHH said: "I am on my own and I can't keep more than 10 goats. It is not possible to work on the *machamba* and keep many goats at the same time."

Respondents were asked who owned the goats: there was a significant association between gender categories and ownership of goats ($p < 0.001$), showing that a majority 71% of FHHs answered that goats were owned by only the women (Table 10). There was no clear association between men and women in MHHs and who owned the goats; 56% of women and 39% of men answered that goats were owned jointly. It was not entirely clear what respondents meant by "joint ownership". Qualitative results from the in-depth interviews showed that it can be interpreted in different ways: either all goats are owned by the man (husband or male relative) and woman together or a few goats (e.g. two) are owned by the woman and the other goats (e.g. six) are owned by the man.

4.5. Goat meat consumption

Respondents were asked if goat meat was consumed in their household. The majority (75.9%; n=63) of the respondents ate goat meat in their household. It should be noted, however, that the qualitative findings showed that goat meat consumption was ranked as one of the least important reasons for goat keeping. Although many producers mentioned that they ate meat, they only did so about 2–3 times per year, and only on special occasions such as end-of-the-year festivities and ceremonies.

Table 10
Ownership of goats disaggregated by gender.

Gender categories	N	Men only	Women only	Jointly	Children
		n (%)	n (%)	n (%)	n (%)
M-MHH	41 (100)	18 (44)	5 (12)	16 (39)	2 (2)
W-MHH	18 (100)	5 (28)	3 (17)	10 (56)	0 (0)
FHH	21 (100)	2 (10)	15 (71)	3 (14)	1 (5)
Total (%)	80 (100)	25 (31)	23 (29)	20 (36)	3 (4)

Table 11
Significance of main effects for goat meat consumption.

Independent variables	df	Dependent variable Goat meat consumption
Gender	2	0.039**
Agro-ecological zone	1	0.099***
Market access	1	0.016**
SEED project participation	1	0.109
First occupation	5	0.699
Second occupation	5	0.582
Years of goat keeping	3	0.152
Goat herd size	1	0.243
Model parameters		
Change in log-likelihood		30.933
Df		19
Significance		0.041**

* Significant at the 10% level, ** Significant at the 5% level, *** Significant at the 1% level

To understand differences in goat meat consumption, a logistic regression model was applied including independent variables for gender category, agro-ecological zone, market access, SEED project participation, first and second occupation, years of goat keeping and goat herd size (Table 11).

Market access and gender were significantly related to goat meat consumption ($p = 0.016$ and $p = 0.039$, respectively). More respondents (n=46; 84%) with better market access reported consuming goat meat in their household compared with respondents with limited market access (n=17; 61%). The question did not differentiate between consuming own-production goats and buying goat meat for consumption. The qualitative findings showed that some producers consumed goats from their own flocks, but some did not because they opted to keep them for emergencies, as was explained by another W-MHH: "I don't eat my own goats, because it's an '*animal de ajuda*' [animal of help]". It might be possible that respondents with better market access had better options to buy goat meat at the road side than those respondents living far from a tarmac road. There was evidence of a relationship ($p = 0.099$) between goat meat consumption and agro-ecological zone: in the coastal area a smaller percentage of respondents (n=19; 70%) consumed goat meat compared with respondents in the interior zone (n=44; 79%). Most likely, respondents in the coastal area consumed fish rather than goat.

With regard to gender, significantly fewer FHHs (52%; n=21) reported that they consumed goat meat in their household compared with M-MHHs (86%; n=44; $p = 0.011$). Differences between W-MHHs (77.8%; n=18) and FHHs were not significant. Reasons why fewer FHHs consumed goat meat are unclear, but may be qualified by the following account from a 45-year-old head of a FHH: "I will not slaughter a goat for food, because I can't eat a whole goat on my own, I need family".

4.6. Market participation

Respondents were specifically asked if they sold goats. Fifty-five respondents (66%) sold goats. This could mean selling one goat per year, as well as more frequent sales of several goats. To understand differences in market participation, the full model (logistic regression) included gender, agro-ecological zone, market access, SEED project participation, first and second occupation, years of goat keeping and goat herd size (Table 12). Interestingly, only gender was significantly related to market participation ($p = 0.013$). Significantly fewer FHHs (43%; n=9) were involved in goat sales than M-MHHs (73%; n=32; $p = 0.005$) as well as W-MHHs (78%; n=14; $p = 0.007$).

It is unclear why fewer FHHs were involved in goat sales compared with women and men in MHHs. It might be possible that

Table 12
Significance of main effects for market participation.

Independent variables	df	Dependent variable Market participation
Gender	2	0.013**
Agro-ecological zone	1	0.314
Market access	1	0.211
SEED project participation	1	0.600
First occupation	5	0.994
Second occupation	5	0.135
Years of goat keeping	3	0.393
Goat herd size	1	0.513
Model parameters		
Change in log-likelihood		41.984
Df		19
Significance		0.002***

* Significant at the 10% level, ** Significant at the 5% level, *** Significant at the 1% level

FHHs had smaller goat herds, with insufficient numbers to sell. However, findings of the current study showed that FHHs did not have significantly fewer goats and, moreover, goat herd size was not related to market participation.

Another suggestion is that FHHs faced specific barriers to their market participation; for example Waithanji *et al.* [4] reported that women may be less mobile and more occupied with household tasks, giving them fewer opportunities to sell goats. On the other hand, (male) family members might be helping FHHs to sell an animal, e.g. by transporting it to a sales location. Based on field experience, this latter option indeed occurred when women were selling their goats to markets set up by the project. In fact, there was a FHH project participant – with many goats and a large machamba – who joined practically every project meeting and each goat market, where she sold goats. She was a respected community member, by both men and women, and shared her experiences and livelihood strategies with other project participants. As such, she was a positive deviant who could be used as a role model in future interventions.

In addition, a study related to the project on the multi-functionality of goats showed that goats were often kept for a variety of subsistence roles [46]. Hence, it could very well be possible that FHHs mainly keep goats for subsistence roles, like a means of exchange for products and services and the use of goats for ceremonies, rather than sales.

4.7. Income control

Respondents were asked if anyone in the household earned an income in the last 12 months from a) goats, b) other livestock, and c) agricultural products. They were also asked who controlled the income. For all three types of income there was a highly significant association ($p < 0.001$) between income and gender categories with 100% of women in FHHs controlling the income from goats, livestock and agricultural products (Table 13). Forty-six respondents (55.4%) gained an income from goats. There was a significant association between control of income and gender ($p < 0.001$). It can be

Table 13
Control over income for goats and other livestock disaggregated by gender.

Gender categories	Control over goat income				Control over other livestock income			
	Men n (%)	Women n (%)	Jointly n (%)	Sub total n (%)	Men n (%)	Women n (%)	Jointly n (%)	Sub total n (%)
M-MHH	12 (46)	5 (19)	26 (35)	26 (100)	7 (25)	7 (25)	14 (50)	28 (100)
W-MHH	3 (23)	3 (23)	7 (54)	13 (100)	3 (25)	2 (17)	6 (50)	12 ^a (100)
FHH	0 (0)	7 (100)	0 (0)	7 (100)	0 (0)	11 (100)	0 (0)	11 (100)
Total	15 (33)	15 (33)	16 (35)	46 (100)	10 (20)	20 (39)	20 (39)	51 ^a (100)

^a Includes 1 women in MHH responding that another household member had control over income.

concluded that W-MHHs hardly controlled the income from goats on their own; it was mainly controlled by men or jointly.

Fifty-one respondents (61.4%) said that they earned an income from the sale of other livestock, which could be chicken or, rarely, other larger livestock. There was a significant association between control of income from the sale of other livestock and gender ($p < 0.001$). However, there was no significant association in control over income from other livestock with men and women in MHHs. About 50% of respondents in MHHs said it was controlled jointly. Joint control of income can be ambiguous and require a further exploration of what joint income control really means to men and to women.

To summarize, income from goats and livestock sales in MHHs seems to be controlled either by the men or jointly by men and women. It is unclear what women and men mean by “joint income control” and if it means the same thing to both men and women. In addition, what “control” means to the scholars in this study might be different from what it means to the community.

Qualitative results from the in-depth interviews conducted for this study showed that W-MHHs consulted their husband or another male relative (e.g. father) before selling a goat, as one female goat keeper from a MHH explained: “I speak with my husband when I want to sell goats, when he agrees to sell, I sell goats.”

4.8. Use of income

The fifty-five respondents who had sold goats were asked what main expenses were covered with money from goat sales. In general, food was most frequently mentioned (28% of responses), followed by education (25%), human health (22%), clothing (11%) and housing (5%) (Table 14). There was no significant association with gender categories, except for clothing ($p = 0.027$): more W-MHHs (43%) and FHHs (33%) spent the money from goat sales on clothing compared with M-MHHs (9%).

Our qualitative results also showed that most respondents reported keeping goats to sell for cash in case of “emergency”. “Emergency” was a rather broadly defined term by respondents and referred to sale in times of need including food shortage, transport to the hospital or payment of a *curandeiro* (traditional healer) in case of illness, school costs and other household needs like clothes. As a 45-year-old FHH explained “school and food are all emergencies, because a child needs to go to school”. Hence, it seemed that respondents did not differentiate between household “needs” and “emergencies”; most needs were considered an emergency even if they occur every year at a regular moment. Other studies also mention that goats are sold when smallholders are in need of cash to pay fees for children’s education, clothes and books and, as such, goats provide (medium-term) savings for smallholders [47,48].

5. Discussion

The current section relates the findings from this study back to the conceptual framework and previous results from gender research so as to provide evidence to the existence of a gender

Table 14
Expenses covered with money from goat sales disaggregated by gender.

Expenses covered	Responses (n=114) %	Respondents (n=55) n (%)	Gender categories		
			M-MHH n (%)	W-MHH n (%)	FHH n (%)
Food	28.1	32 (58)	17 (53)	9 (64)	6 (67)
Education	24.6	28 (51)	15 (47)	8 (57)	5 (56)
Human Health	21.9	25 (46)	13 (41)	8 (57)	4 (44)
Clothing	10.5	12 (22)	3 (9)	6 (43)*	3 (33)*
Housing	5.3	6 (11)	3 (9)	2 (14)	1 (11)
Cropping	1.8	3 (4)	2 (7)	1 (7)	0 (0)
Family event	2.6	2 (6)	1 (3)	1 (7)	0 (0)
Other	5.3	6 (11)	5 (16)	0 (0)	1 (11)
Total (%)	100				

* Significant at P<0.05 level

gradient for various aspects of sustainable livelihoods. The unit of analysis chosen for the study was the household; this discussion will, therefore, also broaden our findings to encompass a broader institutional environment. Finally, we will reflect on the challenges of undertaking robust sex-disaggregated quantitative data collection and analysis in the real-life context of an agricultural development project.

5.1. Gender roles in household goat production and marketing

Our findings from Inhassoro District of Mozambique are largely in line with other gender studies showing that women are given less equitable conditions than men. For example, there was a significant association between education levels and gender categories: fewer educated FHHs and W-MHHs than expected compared with educated M-MHHs. These findings are in line with official statistics and findings from other studies [32,40] and lead to the conclusion that women seem to be more disadvantaged than men in terms of the human capital component of livelihood assets. However, some of our qualitative findings also identify positive deviants: women who have managed to improve their social status. Future development projects operating in the area could study the cases of those role model women who managed to break out of the mould.

In hindsight, one major limitation of this study methodology was its lack of analysis of age and status of the women within their household and community. Indeed, Buhl and Homewood [16] showed how power in decision making within the household changed over time for women according to their age and status in Fulani herder families. Younger women, second and third wives, daughters had less freedom in decision making over assets than older women, first wives and mothers in law. Future projects with gender-aware objectives, and especially those intervening in polygamous society settings like the one in Inhassoro, should complement their gendered baseline study by gathering data that will allow an understanding of the gendered social dynamics related to age and status, and how these vary over time for men and women within their household and community.

Furthermore, the current study did not include additional indicators on wealth stratification, whereas it is recognized that FHHs are often far poorer compared with MHHs [49], which could hamper their possibilities of benefiting from project interventions. Hence, inclusion of wealth stratification data is needed for future sex-disaggregated baseline studies.

5.2. Evidence of the gender gradient in livelihood decision making

The conceptual framework – as illustrated in Figure 1 – posited that all aspects of the sustainable livelihoods framework can be viewed with a gender lens that should reveal different perceptions and decision making options among various gender groups. Understanding these gender roles and processes at an early stage

then becomes an integral part of the intervention pathway of a research or development project. Our findings on “joint” ownership of assets and “joint” decision making on the use of these assets back this assumption of a gender gradient within the sustainable livelihoods framework.

With regard to land ownership (as reported in Section 4.3), even though women technically do not own the crop land in terms of titled or legal rights, it seems that a majority of W-MHHs and M-MHHs labelled access or usufruct rights to *machamba*, as “joint ownership”. In the case of FHHs, Kachika [50] noted that even after the death of a husband, a woman can maintain access to her husband’s land, which might explain the high percentages of FHHs “owning” *machamba* (86%) and homestead land (91%). However, the discrepancy between men’s and women’s responses in MHHs over joint ownership of homestead land was especially large whereby 44% of the men claimed joint ownership and only 11% of the women from MHHs claimed joint ownership. Such discrepancy should not be seen as one member is telling the “truth”, which is contested by the other, but instead each person emphasizes their perspective of the truth ([28]: p269). For example, other studies in Mozambique [50,51] showed that some women owned the assets only as long as they were married to the men and lost ownership with dissolution of the marriage. The women, therefore, did not consider ownership contingent upon marriage as true ownership, but as a lack of ownership. This might have been the case for the homestead land. These results therefore provide further evidence of the complexity of land ownership and land use decision making as related to gender categories within households, and thus to a gendered gradient in the sustainable livelihoods model as far as natural capital is concerned.

In addition, the findings showed a relatively large occurrence of joint ownership of goats (Table 10), which differs from a study in Tanzania [26], where joint ownership was a large exception and mainly men owned the goats. It could also be that respondents in the current study used “joint goat ownership” similarly as “joint land ownership”, which would entail that women claim that they jointly own goats by virtue of being married to the men who own them. Moreover, as mentioned before, large livestock like cattle are largely absent in Inhassoro District, which might explain men’s interest in and ownership of goats. Based on these findings it can be concluded that – except for FHHs – women hardly own goats on their own. If they own goats, this is jointly with their husband or a male relative. The results from the regression on the variables affecting goat herd size (Table 9) also contributed to validate a gender gradient to the sustainable livelihoods model as aspects of physical (market access), human (years of goat keeping), social (place of respondent within the household) and other livelihood strategies (second occupation) all influence the decision to carry out the livelihood strategy of keeping goats.

The findings also showed a gender gradient in the livelihood strategies in terms of goat meat consumption and goat sales

(Sections 4.5 and 4.6), i.e. what to do with the household goats. The decision to consume or not to consume goat meat is linked to a choice between achieving various livelihood outcomes of increases in food security, income or in social status (e.g. participating in village festivities).

Our findings on joint income control in Section 4.7 are in line with results from other studies that women in male-headed households have little control over income even when they are involved in generating the income [32]. Although Oboler [28] found that even women who did not own animals could have a voice in livestock sale decisions, in our study women's voice in goat sales decisions was limited in the sense that women may have a say in the discussion, but in the end it is the man who approves the goat sale. The strong culture of patriarchy in the study area may explain that women need permission from their husband or a male relative to sell a goat [26]. It can be concluded that "control" in the current study appears to be predominantly by men and "joint control" appears not to be egalitarian. This conclusion provides further evidence of a gender gradient in the social and human capitals of the sustainable livelihoods framework.

5.3. Beyond the household: the institutional environment's impacts

In this study, the household was chosen as unit of analysis. However, our findings also hint to impacts on decision making within the household from other larger factors that are part of a wider institutional environment.

Section 4.2 reported evidence of a relationship between first occupation and participation in SEED project: more respondents in a SEED-community had livestock keeping and business as first occupation than respondents in non-SEED communities. To explain this, one can consider that the target intervention of the SEED project was to work with groups involved in crafts, saving and loans. These groups focused on using money saved or borrowed through SEED to build a business. Thus, the saving and loan groups also attracted people who already had businesses and saw the value of having access to credit. As such, one might say that participation in the SEED project was likely to have increased the social and financial capital of respondents, leading to different choices in livelihood strategies.

Furthermore, natural and physical capital, represented by market access and agro-ecological zone, also had an impact on the decision by the household to consume goat meat (Table 11) and as such choice of livelihood strategies. These findings provide evidence that a larger institutional environment beyond the household unit also contributed to shaping livelihood strategies.

5.4. The challenges of undertaking quantitative sex-disaggregated data collection and analysis

The increasingly large literature on gender studies and heavy how-to-do-gender manuals (like [6]) rightly highlight the complex and multi-faceted nature of gender in agricultural development. However, our experience of undertaking a gender analysis of sex-disaggregated quantitative data in a goat development project in Mozambique reveals that it is very difficult to capture all the components of gender while staying statistically relevant given the limited resources and challenging environment for robust data collection. In addition, the fuzziness of gender as a variable, whose construction stems from hard-to-measure social discourses, makes it difficult to identify empirical data to demonstrate gender differences. This notwithstanding, we have attempted to demonstrate gender differences with quantitative and qualitative data, while identifying challenges associated with such a venture. Similarly to other fields of research attempting to model a complex

phenomenon, assumptions, simplifications and shortcuts will still be part of the trade-offs between quantification and explanation. For example, interesting insights could have been added had we disaggregated our sample further by age, marital, social or wealth status of the respondents, or by collecting data on the households' class status and overall gender composition. However, to keep a minimum number of respondents within each sub-category to stay statistically representative, this would have required expanding the total number of interviews beyond the resources available for data collection.

For this study, comparing our findings with the gender literature highlights limitations in our original research design. First, the small size of the sample and the selection method of respondents by inviting them to travel to the interview location could have skewed the sample in favour of men or women with relatively more free time and liberty to meet the project team. Second, this study used mainly quantitative data to respond to criticisms that most gender studies rely mainly on qualitative data. Because of this approach, a lot of the explanatory power of qualitative data, that is always useful to triangulate with findings from the statistical analysis of quantitative data, was lost.

Finally, the baseline data were collected by enumerators employed by CARE and the imGoats project, which respondents knew would also be undertaking development interventions later; this interaction between development and research components of the projects involved could have influenced the way respondents answered questions during interviews.

Nevertheless, it is worth pursuing attempts to quantify gender studies with sex-disaggregated data like the one gathered here. The confrontation of these statistics with the concrete problems faced by development projects and policy makers striving to make agricultural development more gender equitable will lead to relevant lessons learned from past mistakes [52].

6. Conclusion

This study used sex-disaggregated quantitative data supplemented by qualitative findings from in-depth interviews to identify gendered differences in the ownership of, access to, and control of income from land and goat assets in various household settings in the rural district of Inhassoro, Mozambique.

The gender-disaggregated patterns identified can be interpreted by results of past gender studies and some results from the qualitative data from in-depth interviews also gathered during the study. Beyond further evidence that sex-disaggregated data is crucial at the start of a project cycle to understand the local situation being intervened on, the main contribution of this study is to provide a real-life technical example of how a development project can undertake sex-disaggregated quantitative data collection and analysis in order to identify gender-related issues that are more relevant in explaining household decisions on livelihood strategies concerning livestock keeping and marketing. For example, the project from which this research is taken has tried to address the lack of access to grazing areas as a result of the current baseline study [44].

This study has shown that women and men in Inhassoro District of Mozambique had different interpretations of "joint" ownership, "joint" access to and "joint" control of land and goat assets. In particular, it transpires that women in male-headed households very rarely have the control over the incomes from goat sales, despite goats being seen as livestock that is appropriate and empowering for women. This finding should be placed back in the perspective of a gendered sustainable livelihoods framework: it is not just the asset base that is gendered, the decisions taken within households on livelihoods strategies and the impact pathways towards livelihoods outcomes are also gendered. Thus, research

and development projects wanting to introduce livestock as a gender transformative strategy to women empowerment should also understand the gender relations that impact on decision making processes over control of income from livestock by women within households and communities; this better understanding would lead to the development of context-specific and relevant strategies for transformative changes in these processes.

This study also showed that women were less involved in goat marketing than men, thus putting in question the development of market linkages for livestock products as a livelihood strategy to empower women. Nevertheless, the qualitative data gathered from in-depth interviews points to women in Inhassoro District using goats to increase their social capital through contributing goats to community festivities [46]. Therefore although livestock products might not be contributing directly to increasing the income disposable by women, development projects might consider intervening on the other pathways that livestock products can use to improve non-financial but equally important livelihood assets, which can help women achieve meaningful livelihood outcomes in developing countries.

The discussion of the findings from this study pinpoints some limitations in its research design. These methodological limitations illustrate the difficulty of undertaking robust and all-encompassing quantitative gender studies in a real-life context. This conclusion adds weight in favour of a more systematic use of mixed research methods to investigate the complex issue of gender.

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References

- [1] OECD (Organisation for Economic Co-operation and Development) (2008). Gender and sustainable development: maximising the economic, social and environmental role of women. OECD Horizontal Programme on Sustainable Development.
- [2] FAO (Food and Agriculture Organization of the United Nations) (2011). The state of food and agriculture: women in agriculture: closing the gender gap.
- [3] G. Conway, T. Arnold, J. von Braun, H. Carsalade, L. Fresco, P. Hazell, N. Ngongi, D. Radcliffe, L.M. Sibanda, R. Tabo, P. Pingali, and C. Toulmin, (2012). Women in African agriculture: farmers, mothers, innovators and educators. The Montpellier Panel.
- [4] E. Waithanji, J. Njuki, N. Bagalwa, *Gendered Participation in Livestock Markets*. Chapter 4, in: J. Njuki, P. Sanginga (Eds.), *Women, livestock ownership and markets: Bridging the gender gap in eastern and southern Africa*, Routledge, London and New York, 2013.
- [5] B. Vorley, E. del Pozo-Vergnes, A. Barnett, *Small producer agency in the globalised market: Making choices in a changing world*, IIED, London; HIVOS, The Hague, the Netherlands, 2012.
- [6] World Bank, FAO (Food and Agriculture Organization of the United Nations), and IFAD (International Fund for Agricultural Development) (2008). *Gender in agriculture sourcebook*. World Bank, Washington D.C.; FAO, Rome; IFAD, Rome.
- [7] J. Von Braun, P. Webb, *The impact of new crop technology on the agricultural division of labor in a West African setting*, *Economic Development and Cultural Change* 37 (3) (1989) 513–534.
- [8] R.A. Schroeder, *Re-claiming" land in the Gambia: gendered property rights and environmental intervention*, *Annals of the Association of American Geographers* 87 (3) (1997) 487–508.
- [9] J. Njuki, S. Kaaria, A. Chamunorwa, W. Chiuri, *Linking smallholder farmers to markets, gender and intra-household dynamics: does the choice of commodity matter?* *European Journal of Development Research* 23 (2011) 426–443.
- [10] S.K. Kaaria, and J.A. Ashby, (2001). *An Approach to Technological Innovation that Benefits Rural Women: The Resource-to-Consumption System*. Working Document No.13. PRGA Program, Cali, Colombia.
- [11] IFAD (International Fund for Agricultural Development) (2002). *Operationalizing the strategic framework for IFAD, 2002–2006. Mainstreaming a gender perspective in IFAD's operations*.
- [12] E. Gotschi, J. Njuki, R. Delve, *Equal numbers, equal chances? A case study of gender differences in the distribution of social capital in smallholder farmer groups in Buizi district, Mozambique*, *European Journal of Development Research* 21 (2) (2009) 264–282.
- [13] R. Meinzen-Dick, A. Quisumbing, J. Behrman, P. Biermayr-Jenzano, V. Wilde, M. Noordeeloes, C. Ragasa, N. Beintema, *Engendering agricultural research*, in: global conference on agriculture and rural development, 28–31 March 2010, Montpellier, France.
- [14] D. Olney, A. Pedehombga, M. Ruel, A. Dillon, *A 2-year integrated agriculture and nutrition and health behavior change communication program targeted to women in Burkina Faso reduces anemia, wasting, and diarrhea in children 3–12.9 months of age at baseline: a cluster-randomized controlled trial*, *Journal of Nutrition*. (2015), <http://dx.doi.org/10.3945/jn.114.203539>.
- [15] F. Santos, D. Fletschner, V. Savath, A. Peterman, *Can government-allocated land contribute to food security? Intrahousehold analysis of West Bengal's microplot allocation program*, *World Development* 64 (2014) 860–872.
- [16] S. Buhl, K. Homewood, *Milk selling among Fulani women in Northern Burkina Faso*, in: D. Hodgson (Ed.), *Rethinking Pastoralism in Africa*, James Currey, Oxford, 2000.
- [17] P. Kristjanson, A. Waters-Bayer, N. Johnson, A. Tipilda, J. Njuki, I. Baltenweck, D. Grace, and S. MacMillan, (2010). *Livestock and women's livelihoods: a review of the recent evidence*. Discussion Paper No. 20. Nairobi, Kenya.
- [18] R. Meinzen-Dick, N. Johnson, A. Quisumbing, J. Njuki, J. Behrman, D. Rubin, A. Peterman, E. Waithanji, *Gender, Assets, and Agricultural Development Programs: a Conceptual Framework*, CAPRI Working Paper No. 99, International Food Policy Research Institute, Washington D.C, 2011.
- [19] FAO (Food and Agriculture Organization of the United Nations) (2012). *Livestock sector development for poverty reduction: an economic and policy perspective – livestock's many virtues*, by J. Otte, A. Costales, J. Dijkman, U. Pica-Ciamarra, T. Robinson, V. Ahuja, C. Ly and D. Roland-Holst. Rome, Italy.
- [20] C. Doss, *Data Needs for Gender Analysis in Agriculture*. IFPRI Discussion Paper 01261, IFPRI, Washington, DC, 2013.
- [21] A. Bebbington, *Capitals and capabilities: a framework for analysing peasant viability, rural livelihoods and poverty*, *World Development* 27 (12) (1999) 2021–2044.
- [22] DFID (Department for International Development.) (1999). *Sustainable livelihoods guidance sheets*. Section 2. Framework. <http://www.enonline.net/pool/files/ife/section2.pdf> (accessed March 2013).
- [23] R. Huss-Ashmore, *Livestock, nutrition, and intrahousehold resource control in Uasin Gishu district, Kenya*, *Human Ecology* 24 (2) (1996) 191–213.
- [24] M. Herrero, D. Grace, J. Njuki, N. Johnson, D. Enahoro, S. Silvestri, M.C. Rufino, *The roles of livestock in developing countries*, *Animal* 7 (s1) (2013) 3–18.
- [25] S. Shen, and J. Qian, (2009). *Livestock projects in Southwest China: women participate, everybody benefits*. *Leisa Magazine*, 25, September 3rd 2009.
- [26] P. Saghir, J. Njuki, E. Waithanji, J. Kariuki, and A. Sikira, (2012). *Integrating improved goat breeds with new varieties of sweet potatoes and cassava in the agro-pastoral systems of Tanzania: a gendered analysis*. ILRI Discussion Paper 21. Nairobi, Kenya.
- [27] L. Haddad, J. Hoddinott, H. Alderman, *Intrahousehold Resource Allocation in Developing Countries: Models, Methods and Policy*, Johns Hopkins University press, Baltimore and London, 1997.
- [28] R.S. Oboler, *Whose cows are they, anyway?: ideology and behavior in nandi cattle "ownership" and control*, *Human Ecology* 24 (2) (1996) 255–272.
- [29] S. Lastarria-Cornhiel, *Impact of privatization on gender and property rights in Africa*, *World Development* 25 (8) (1997) 1317–1333.
- [30] C. Valdivia, *Gender, livestock assets, resource management, and food security: lessons from the SR-CRSP*, *Agriculture and Human Values* 18 (1) (2001) 27–39.
- [31] N. De Haan, *Of goats and groups: a study on social capital in development projects*, *Agriculture and Human Values* 18 (2001) 71–84.
- [32] J. Njuki, P. Sanginga (Eds.), *Women, livestock ownership and markets: Bridging the gender gap in eastern and southern Africa*, Routledge, London and New York, 2013.

- [33] UNDP (United Nations Development Program) (2013). Human development report 2013. The rise of the south: human progress in a diverse world. New York.
- [34] C. Donovan, and E. Tostão, (2010). Staple food prices in Mozambique. Comesa policy seminar “variation in staple food prices: causes, consequence, and policy options”, 25–26 January 2010, Maputo, Mozambique.
- [35] FAO (Food and Agriculture Organization of the United Nations) (2010). Special Report. FAO/WFP; 1; crop and food security assessment mission to Mozambique. Rome, Italy.
- [36] T. Walker, D. Tschirley, J. Low, M. Pequeno Tanque, D. Boughton, E. Payongayong, and M. Weber, (2004). Determinants of rural income, poverty, and perceived well-being in Mozambique in 2001–2002. Research Report no 57E. Mozambique.
- [37] R. Jacobson, *Mozambique and the construction of gendered agency in war*, *Women's Studies International Forum* 29 (2006) 499–509.
- [38] ILRI (International Livestock Research Institute) (2010). Small ruminant value chains as platforms for reducing poverty and increasing food security in dryland areas of India and Mozambique. Full grant document. Nairobi, Kenya.
- [39] MAE (Ministério da Administração Estatal) (2005). Perfil do distrito de Inhassoro província de Inhambane. Serie: Perfis Distritais. Mozambique.
- [40] INE (Instituto Nacional de Estatística) (2010). Anuário Estatístico 2009 Moçambique (Statistical Yearbook 2009 Mozambique). Maputo, Mozambique.
- [41] S.H.B. Lebbie, *Goats under household conditions*, *Small Ruminant Research* 51 (2004) 131–136.
- [42] L.H. Dossa, C. Wollny, M. Gaulty, *Smallholders' perceptions of goat farming in southern Benin and opportunities for improvement*, *Tropical Animal Health and Production* 39 (2007) 49–57.
- [43] I.S. Kosgey, G.J. Rowlands, J.A.M. van Arendonk, R.L. Baker, *Small ruminant production in smallholder and pastoral/extensive farming systems in Kenya*, *Small Ruminant Research* 77 (2008) 11–24.
- [44] K. Swaans, B. Boogaard, R. Bendapudi, H. Taye, S. Hendrickx, L. Klerkx, *Operationalizing inclusive innovation: lessons from innovation platforms in livestock value chains in India and Mozambique*, *Innovation and Development* 4 (2014) 239–257, 2.
- [45] UNDP (United Nations Development Program) (2001). Mozambique. Gender, women and human development: an agenda for the future. Maputo, Mozambique.
- [46] B.K. Boogaard, S. Moyo, *The multi-functionality of goats in rural Mozambique: contributions to food security and household risk mitigation*. ILRI Research Report 37, International Livestock Research Institute, Nairobi, Kenya, 2015.
- [47] H.G. Bosman, H.A.J. Moll, H.M.J. Udo, *Measuring and interpreting the benefits of goat keeping in tropical farm systems*, *Agricultural Systems* 53 (1997) 349–372.
- [48] C. Devendra, C. Chantalakhana, *Animals, poor people and food insecurity: opportunities for improved livelihoods through efficient natural resources management*, *Outlook on Agriculture* 31 (2002) 161–175.
- [49] M. Buvinic, G.R. Gupta, *Female-headed households and female-maintained families: are they worth targeting to reduce poverty in developing countries?* *Economic Development and Cultural Change* 45 (2) (1997) 259–280.
- [50] T. Kachika, *Women's land rights in southern Africa. consolidated baseline findings from Malawi, Mozambique, South Africa, Zambia and Zimbabwe*, Niza & ActionAid International, 2009.
- [51] E. Waithanji, J. Njuki, N. Marinho, E. Hutchinson, J. Kariuki, P. Saghir, N. Johnson, *Qualitative gendered assessment of the Manica smallholder dairy development project*, in: *Mid Term Evaluation Report, Gender, Agriculture and Assets Project (GAAP)*, 2012.
- [52] J. Cadilhon, (2015). Hard numbers and soft stories: reaching policymakers and empowering women in Africa's agrifood value chains. ILRI Livelihoods, Gender and Impact Blog. <http://livelihoods-gender.ilri.org/2015/05/12/hard-numbers-and-soft-stories-reaching-policymakers-and-empowering-women-in-africas-agrifood-value-chains/> (accessed on 23/07/2015).
- [53] A.R. Quisumbing, D. Rubin, C. Manfre, E. Waithanji, M. van den Bold, D. Olney, N. Johnson, et al. (Forthcoming). Gender, assets, and market-oriented agriculture: learning from high-value crop and livestock projects in Africa and Asia. *Agriculture and Human Values*. <http://link.springer.com/article/10.1007/s10460-015-9587-x>.