Intra-household gender division of labour and decision-making on rice postharvest handling practices: A case of Eastern Uganda

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Abstract: Gains in increasing productivity of grain in Sub-Saharan Africa are greatly undermined by the high postharvest losses (PHLs), which compromise the food and income security of households. Rice is one such important food and cash crop experiencing high PHLs. Given the limited mechanization of smallholder farms, PHLs result from practices influenced by knowledge, decision-making power in the household and cultural norms. Gender is an important consideration in the interaction of these factors especially for a dual purpose crop like rice serving both food and income security interests of households. A descriptive cross-sectional survey informed by qualitative focus group discussions was conducted in two major rice producing districts in Eastern Uganda to establish how gender division of labour and decision-making influence PHLs at the household level. The intra-household gender structure, division of labour and decision-making determine the postharvest losses of rice at the household level. Men and boys perform the labour intensive postharvest activities where postharvest losses are high. They also dominate decisions on the practices and technologies used. Due to labour intensity and cultural norms, households without men rely on hired labour, which increases their PHLs resulting from late access to and inadequate supervision of the hired labour. Interventions for reduction in PHLs among smallholder farmers must target the men with knowledge and change in practices as opposed to promotion of labour saving technologies.
reduction of PHLs at the household level must target men with better practices and simple cost-effective technologies.

Subjects: Social Sciences; Behavioral Sciences; Communication Studies; Development Studies; Education

Keywords: intra-household; gender division of labour; postharvest practices; rice; decision-making; postharvest losses; Uganda

1. Introduction
Most of the efforts aimed at enhancing food and income security among farming households in the Sub-Saharan Africa (SSA) have focused more on increasing production and productivity (Affognon, Mutungi, Sanginga, & Borgemeister, 2015; Nijbroek & Andelman, 2016). However, less matching efforts have been put on reduction of Post-Harvest Losses (PHLs) that undermine the gains in increased production and productivity (Affognon et al., 2015; Hodges, Buzby, & Bennett, 2011). The need to reduce PHLs is even more critical given that annual growth in food demand in SSA stands at 3% against 1% growth in food production (Lotter, 2015). Investing in postharvest loss reduction is a quick impact intervention for enhancing food security (Affognon et al., 2015; GIZ-Deutsche Gesellschaft für Internationale Zusammenarbeit, 2013). In Uganda, PHL are estimated to average 19% in cereals (Hodges, 2012). Rice is a priority crop in Uganda’s National Development Plans of 2015/16–2020/21 to enhance food and income security because of its comparative market advantage and high rate of return over other cereal crops (Candia & Masette, 2012). Introduction of the high yielding varieties (HYVs) and New Rice for Africa (NERICA) have nearly doubled production of rice between 2003 and 2011 (Food and Agriculture Organization [FAO], 2014), however, high PHLs remain a key challenge (Candia & Masette, 2012; Ministry of Agriculture, Animal Industry and Fisheries, 2012; Nakazi & Sserunkuma, 2013). In 2012, it was estimated that PHLs accounted for 13% of total rice produced in Uganda (African Postharvest Loss Information System [APHLIS], 2012). In terms of quality, up to 64.3% of the locally produced and processed rice is broken grains and contains up to 6% of foreign matter such as stones, dust and straws (Candia & Masette, 2012).

PHL refer to changes in availability, edibility, wholesomeness and quality of rice that occurs after separation from the medium and site of production to the moment of human consumption (Harris & Lindblad, 1978; World Bank, 2011). The losses result from the practices and their labour demands and technologies used at the household level right from harvesting in the field to storage and consumption. Rice postharvest handling activities are manual, labor intensive, tedious, slow and time consuming compared to other crops such as maize; thus, making labour availability a key requirement in reduction of PHLs (Mohapatra, 2012). It is therefore assumed that intra-household division of labour in terms of roles and responsibilities, gender dynamics and diversity are likely to influence the availability of labour to perform critical tasks (Browning & Chiappori, 1998). Interventions for reduction of PHLs therefore must target the people who perform specific activities in the postproduction processes. Gender division of labour in agriculture remains an issue of concern in Sub-Saharan Africa. Women provide most of the labour in rice production and postharvest handling (Agboh-Noameshie, Kabore, & Michael, 2013; Global Rice Science Partnership [GRiSP], 2013) although it is also known that as the crop attracts commercial benefits, the men get more involved and tend to take more control (Hadiyanto, 2013). Gender here refers to the socially determined division of roles, responsibilities and power between men and women (Manda & Mvumi, 2010).

There is a direct link between intra-household gender division of labour and levels of poverty and food insecurity (FAO, 2012). It is also reported that gender based inequalities along the food chain impede food and nutritional security and agriculture sustainability (Adeyemi, 2010; Jahan & Sarker, 2015). Sustainable food and income security can only be achieved if gender roles and responsibilities are fully understood and considered in policy, planning, research and extension (GRiSP, 2013). In this paper, we adopt a gender-based approach to understanding practices and decision-making at household level in relation to PHLs in rice in Uganda. Women and men manage postharvest handling
processes but in different ways depending on the cultural and social status (Agboh-Noameshie et al., 2013). Beyond men and women, we consider the roles of boys and girls within a household to project the reproduction of gender roles in future. Gender roles are usually shaped by gender role development and functioning in society (Bussey & Bandura, 1999). This guides appropriate entry points for innovations aimed at reduction of PHLs in rice. Technologies and practices for mitigation of PHL need to be tailored to the social, cultural and economic context in which they are to be implemented (Affognon et al., 2015), and gender is one of such social contexts. Gender is embodied in power relations, and in this paper, we link the intra-household division of labour and practices in postharvest handling of rice with decision-making power at household level.

There is evidence in literature that men dominate decision-making, ownership and control of key resources needed in agricultural production and postproduction processes (Adeyemi, 2010; Agboh-Noameshie et al., 2013; Zossou, Van Mele, Vodouhe, & Wanvoeke, 2010) but how the gender division of labour and decision-making influence PHLs at the household level is less understood. Women have less access to such resources and assume a subordinate position to decisions (Jahan & Sarker, 2015), which are essential for learning and innovating in postharvest handling among other things. Interventions for reduction of PHLs in rice have tended to over-emphasize labour efficient technologies, which have not been widely adopted by smallholder farmers and hence sustaining the high PHLs. The underlying salient social issues related to gender division of labour, decision-making and cultural norms have not been much considered in the interventions and yet they strongly influence the uptake and use of the technologies and practices for reduction of PHLs. Some scholars argue that when outcomes are accessed by both men and women, activities such as rice postharvest handling becomes more efficient and thus reduce PHLs (Overholt, Anderson, Cloud, & Austin, 1984); but this is only possible if the interventions take into account gender related responsibilities and cultural context are taken into account. This study explores those dimensions for purposes of better targeting of interventions to significantly reduce PHLs and hence increase household income and food security. Motivation factors such as participation in household decision-making and access to outcomes influence proper use of practices (Seline, Delia, Oluyede, Gudeta, & Maarten, 2015). We avoid generalization of decision-making to the postharvest process as cautioned by Manda and Mvumi (2010) and focus on decisions for specific practices and activities in rice postharvest handling (PHH) at household level. Given that technologies are developed for specific tasks, focusing on broader activities conceals some of the essential details that would otherwise aid in developing gender sensitive and context specific interventions. Unlike other gender related studies in post-harvest handling that have tended to focus either purely on cash crops (Hadiyanto, 2013) or food crops (Okonya & Kroschel, 2014), rice is a duo purpose crop servicing both income and food security interests of the household. This paper therefore highlights how intra-household gender division of labor, decision-making power relations and culture influence PHLs in rice and the implications of this phenomenon on targeting of interventions for reduction of PHLs among smallholder rice farmers.

2. Methods
The study was conducted in two major rice growing districts of Eastern Uganda; Iganga and Namutumba where government and non-state agencies have targeted interventions for reduction of postharvest losses among smallholder farmers. The non-state agencies include Sasakawa Global 2000 (SG 2000) and the Japanese International Corporation Development Agency (JICA). It is estimated that the Eastern region accounts for 60% of the rice produced in Uganda (APHLIS, 2012). In particular, APHLIS (2012) reports that, 63% of the PHLs in rice occur in Eastern Uganda. This therefore, makes the region more appropriate for conducting the study on PHLs. Particularly, Namutumba and Iganga districts combined contribute 30% of all rice produced in Eastern Uganda. In the two districts, farmers grow a variety of crops but rice is the priority crop grown by 90% of the households (Odogola, 2006; Tokida, Haneishi, Tsuboi, Asea, & Kikuchi, 2014) who are involved in different post harvesting handling processes including harvesting, heaping, threshing, drying, winnowing and storage using different practices and technologies. A descriptive cross-sectional survey was preceded by qualitative Focus Group Discussions (FGDs), key informant interviews and field observations which were conducted from April to September 2015. The FGDs were conducted at Nsinze, Buyanga,
Namalemba and Kibale sub-county headquarters to understand the post-harvest processes, activities and the roles men, women, boys and girls perform in those activities. To give space for free expression of gender issues, three FGDs comprised of women only, three were for men only and three were mixed both men and women. In addition, key informant interviews were conducted to get full explanation of emerging issues from the FGDs. The emergent issues from the FGDs were the basis for development of the semi-structured interview schedule for the survey. In this way, the FGDs offered validity assurance of the semi-structured interview schedule. The survey aimed at quantification and distribution of the gender roles in the post-harvest activities and decision-making across households in the study area. The process and practices in postharvest handling, and intentions of rice production at the household level do not vary much among smallholder farmers, making the study area and sample adequate for painting a general picture for the Eastern region of Uganda.

In each district, two sub-counties were purposively selected and in each sub-county (Buyanga and Namalemba from Iganga District, Nsinze and Kibale from Namutumba Districts); four major rice-producing villages were purposively selected as the study sites with guidance from Sub-Country Extension Workers. Eighty-three farmers (43 males & 40 females) were purposively selected to participate in the FGDs. These were selected based on their knowledge and experience in rice production as advised by the farmer group and village leaders. In each village, a list of rice farming households was compiled by the local leaders and formed the sampling frame for the survey. A total of 802 households that grew rice in the first season of 2015 from the sixteen villages were listed. Using villages as strata, a proportionate stratified sampling strategy was employed to determine the number of households from each of the villages to participate in the study. Within each village, a simple random sampling strategy was employed and a sample of 150 households was selected for face-to-face semi-structured interviews.

To deepen understanding of intra-household gender roles beyond male and female, the study sought further disaggregation of roles among men, women, boys and girls. A panel of four experts (scholars from Makerere University) checked the survey instruments for content validity. Before its use, the survey instrument was pre-tested with 15 farmers (8 males and 7 females) from Namuwondo village in Namutumba sub-county (not included in survey) for reliability. Based on experiences of the pre-test, adjustments were made for clarity and sequencing of questions.

The labour requirements were measured using a six ranking scale (1 = Most labour intensive to 6 = Least labour intensive). Regarding labour sources and distribution, farmers were asked to give a proportion out of 100 work done by family and hired labour. On intra-household division of labour in rice post-harvest activities, respondents were requested to give a proportion out of 100 work done by men, women, boys and girls at the specific activities of the different stages of rice postharvest handling processes. The proportion of work done by each gender at each stage is summed and divided by the total number of respondents to get the average proportion of work done. Participation in decision-making was measured using a four-level ordinal scale: 0 = no input in the decision; 1 = some input in the decision; 2 = most input in the decision; and 3 = all input in the decision. Decision-making was in relation to postharvest handling technologies and practices used; marketing; consumption and access, use and control of resources for rice postharvest handling.

The qualitative data from FGDs were analyzed using content analysis to synthesize the emergent issues. The detailed explanations gained from the FGDs were used (including anecdotal evidence) to elaborate on the quantitative data from the survey. The quantitative survey data were analyzed using Statistical Package for Social Scientists (SPSS) version 16 to generate descriptive and inferential statistics. Descriptive statistics including averages were obtained for the respondents ranking labour requirements, mean proportions of work done by family and hired labour. In addition, average proportions of work done by men, women, boys and girls for specific activities at the different stages were obtained. For decision-making of postharvest handling processes for rice, frequencies and percentages were generated for men and women and how they provide input in decision-making at different stages and activities of rice postharvest handling. A paired samples t-test was performed to test significance of differences in roles performed by males and females at the different stages.
3. Results and discussions

3.1. Description of respondents

The socio-demographic characteristics of the respondents and households involved in the study are presented in Table 1.

The age of the respondents ranged between 30 and 54 years with a mean of 43 years. Ninety percent of the households sampled were male headed while only 10% were female headed. The average household size was 8.8 persons, nearly double the national average of 4.7 (Uganda Bureau of Statistics, 2014). The large household size implies higher demand in terms of food security and other needs. Majority of the respondents had attained some formal education and only 11% had not had any formal education. Rice is the first priority crop for 90% of the households involved in the study. Of the 4.2 acres (average) of total land cultivated by the households, about 35% was allocated to rice production. Most households grew paddy rice (Kaiso and Supa varieties), only 10% of the households reported growing upland rice (NERICA varieties) in addition to lowland rice. Rice was more of a commercial than food security crop and the households sold over 70% of what they produced. On average, respondents had experience of 17 years in rice production. Majority of farmers (38 and 56%) had accessed extension and credit services respectively for rice postharvest handling in the past one year. About 37% of the households in both districts belonged to farmer groups where rice postharvest handling was one of the issues of concern.

3.2. Rice postharvest handling process and practices

The postharvest activities in rice at household level start from the time of harvesting up to storage (also see Harris & Lindblad, 1978). Chronologically, the process comprises harvesting, heaping, threshing, drying, winnowing and storage. Each of these stages involves several activities. The

| Variable                          | Categories | Sample statistics (n = 150) |
|-----------------------------------|------------|-----------------------------|
| Age (years)                       | Mean       | 42.9                        |
| Gender (%)                        | Male       | 60.7                        |
|                                   | Female     | 39.3                        |
| Highest level of education (%)    | No schooling | 11.3                        |
|                                   | Primary    | 58.0                        |
|                                   | Secondary  | 30.0                        |
|                                   | Tertiary   | 0.7                         |
| Marital status (%)                | Married    | 89.3                        |
|                                   | Others     | 10.7                        |
| House hold type (%)               | Male headed | 90                          |
|                                   | Female headed | 10                         |
| Household size (number)           | Mean       | 8.8                         |
| Total land cultivated (acres)     | Mean       | 4.2                         |
| Total land allocated to rice (acres) | Mean   | 1.5                         |
| Average paddy rice production (kg) per acre | Mean | 943                        |
| Experience in rice production (years) | Mean | 16.5                       |
| Proportion of rice for sale       | Mean       | 70.5                        |
| Access to credit for rice production and PHH (%) | 56.0 |
| Access to extension services on rice PHH (%) | 38 |
| Membership to farmer groups engaged in rice Post-harvest activities (%) | 37.3 |
gender-based division of labour in the respective activities to a large extent is influenced by physical energy requirement and socio-cultural values. The respondents ranked the labour requirement for each of the stages in the post-harvest processes as indicated in Table 2. The table also presents the proportion of work done by hired and family labour at each stage in the process.

The field-based activities of harvesting, heaping and threshing are perceived to be more labour intensive thus requiring more physical energy and it is at these stages that labour is mostly hired to supplement family labour (also see Jahan & Sarker, 2015). The home-based activities of drying; winnowing and storage require less physical energy and are largely performed by family members.

Harvesting, starts once maturity of the crop is established. Based on the FGDs, farmers were aware of the PHLs associated with early harvesting (before it fully matures) or late harvesting (long after maturity). If harvested late, losses occur through shattering in the field and usually late harvested rice ends up with more broken grains at milling. If harvested before maturity, losses occur through non-uniform grain size due to incomplete grain filling, more grains lost during threshing because immature grains do not separate easily from panicle, and the grains are chalky at milling. The harvesting process was perceived to be the most labour intensive by 89% of the respondents. The high labour intensity also explains why 54% is hired labour at this stage. Most of the farmers (91%) harvest rice by bundling and cutting it using a sickle. Though it requires more physical energy and bending for long, this method of harvesting was perceived to be faster and most suited for varieties with uniform maturity. The alternative way of harvesting using a knife to only reap mature panicle was used by only 25% of the respondents and mainly for varieties that do not mature uniformly such as Supa, which also have a higher commercial value. Harvesting is usually a full-day activity in the field to ensure that rice is harvested as quickly as possible.

Heaping is the collecting and hauling of the cut rice and piling it where it is threshed. The heaping sites are carefully selected within the rice field and are usually on raised ground and must not be waterlogged or muddy. The rice once heaped can stay up to three days before threshing depending on availability of labour. This stage was ranked the third most labour intensive by 47% of the respondents and in most cases done by family labour (64%).

Threshing was ranked the second most labour intensive activity by 52% of the respondents and about 45% of the households hire labour. All farmers used manual threshing though about 6% had experimented using motorized and pedal threshers alongside the manual. After threshing, rice is transported from the field to the farmers’ homes for the subsequent home-based processes of drying, winnowing and storage. Drying is perceived to be a lighter in terms of labour intensity and 92% of the households use family labour. It is recommended (by NGOs and extension) that for quality, rice should be spread at a thickness of 3 cm and left in the sun for three hours per day until it dries.
However, 82% of the households dried their rice for four or more hours per day. The reason for deviation from the recommendations is that farmers do not have enough tarpaulins or polythene sheets to spread rice to the recommended thickness. To ensure even drying, which later reduces the amount of broken grains at milling; the rice should be turned every one hour for the duration it is drying in the sun. Most farmers (92%) determine dryness of rice by biting the rice grain. Properly dried rice grain makes a cracking sound. While the ideal way to determine the right moisture content (proper drying) is to use a moisture meter, none of the farmers could afford it and farmers did not think it was necessary. The post-harvest losses at the drying stage are both in terms of grain spillage and quality deterioration. In addition to spillage, consumption by domestic birds increases grain loss. About 36% of the households dried rice on tarpaulins and 21% polyethylene sheets, but 39% dried the rice on bare ground, 3% smeared surfaces with cow dung and 1% on clothes. Drying on bare ground increases foreign matter in rice. When the rice is dry it is winnowed before storage. Winnowing is the process of cleaning up the rice grain, i.e. removing the chaff and other foreign matter before consumption, sale or storage. Traditionally, this was an exclusive activity for women who used the winnowing basket locally known as Oułagali. Women have the skills of using the tool, and these are passed on to girls from generation to generation. This was intended for processing rice for domestic consumption. This method is slow and tedious especially when large quantities of rice are to be processed. Currently, 85% of the farmers use the basin and with the assistance of wind, the chaff and other lighter materials are separated from the grain. However, this wind-assisted winnowing practice does not remove the stones and other heavy materials. Only 15% still use the winnowing basket (Oułagali). In addition to the manual methods, only 6% of the farmers were using electric fans to blow out the chaff from the grain.

After winnowing, 96% of the households' store rice in polyethylene bags while 4% reported keeping rice in heaps on the floor of their houses because they lacked the bags. Keeping rice in heaps on the floor is common for households that do not store rice for a long period. About 74% of the households stacked the bags on either wooden pallets or bricks for proper aeration and to avoid moisture migration while 26% placed the bags of rice on the floor. Apart from reducing further loses of grain, storing rice in bags also enables the farmers to quantify and ascertain what they have in store and thus estimate income. In the FGDs, men revealed that if rice is not bagged immediately after drying, sometimes spouses, mainly women could sell some of the rice in small quantities to meet their personal needs. This has implications on innovations in postharvest practices as men therefore prefer that the rice is bagged immediately after drying. This practice of bagging rice immediately after drying saves rice from further spillage and thefts and thus reduction in PHLs at the stage. Storage was perceived to be the easiest among post-harvest activities and thus was ranked as the least labour intensive activity by the majority (89%) of the respondent. This partly explains why storage was mainly done by family labour (94%).

3.3. Intra household labour division in rice postharvest activities

Table 3 shows the intra-household division of labour for the different post-harvest activities described above. For each activity, respondents estimated the proportions of labour input by men, women, boys and girls.

Overall, men and boys performed most of the labour intensive field-based post-harvest tasks particularly harvesting and threshing. The men and boys performed about 70 and 9% of harvesting compared to 28 and 4% by women and girls respectively. Even where labour was hired, most of the supervision was done by men for conformity with cultural values. The t-values (t = 12.51, p < 0.01) indicate a significantly higher labour input in harvesting by men than women at 1% level of significance; while that of boys (t = 2.05, p < 0.05) is also significantly higher than for girls. This is different from Agboh-Noameshie et al. (2013) and Jahan and Sarker (2015) who found out that woman dominated rice postharvest handling activities (field and home-based) in Cameroon and Bangladesh respectively. The difference could be explained by the difference in context and culture with regard to gender-based division of labour. A major role for women and girls in harvesting was preparing meals for the workers - a responsibility of the women and it is passed on to girls. From this study, the
pattern of division of labour at household level between men and women is similar to that between boys and girls, indicating how current pattern of gender-based division of labour is perpetuated and sustained in the next generations. Kibwika (2007) argues that involvement of men, women and children in farm work fosters complementary use of knowledge and expertise; a key aspect for enhancing sustainability. As explained by Bussey and Bandura (1999), gender roles arise from and are transmitted through the interplay of both broader social structures and routine family/household level interactions between members. This therefore implies that interventions for reduction of PHLs at the harvesting stage need to target men and boys who perform the activity.

For heaping, labour was nearly equally shared between men (35%) and women (36%) and between boys (16%) and girls (12%). It was explained in the FGDs that women participated more in heaping because they did not have to stand for long in the waterlogged parts of the rice field. When the rice is cut mainly by men, it is bundled and placed in the relatively dry parts where the women pick it and carry to the heaping place. The boys participated more in heaping than girls largely because the field conditions are not very convenient for girls.

### Table 3. Intra-household division of labour in rice post-harvest activities

| Process | Specific tasks | Average proportion of work done | Comparison of means of work done by gender |
|---------|----------------|---------------------------------|------------------------------------------|
|         |                | Mean | Mean | Mean | Mean | Mean | Mean | t-static | t-static |
| Harvesting | Cutting & bundling | 69.99 | 16.03 | 9.07 | 4.91 | 12.51*** | 2.05** |
| | Cooking food for laborers | 4.66 | 77.45 | 1.84 | 16.05 | −17.20*** | −4.84*** |
| | Overall supervision | 69.50 | 28.53 | 1.00 | 0.97 | 6.18*** | 0.05 |
| | Carrying rice to the heap | 35.49 | 35.67 | 16.72 | 12.11 | −0.04 | 2.33** |
| | Spreading tarpaulin | 51.56 | 33.93 | 9.32 | 5.19 | 2.88*** | 2.32** |
| | Beating | 59.63 | 24.11 | 9.98 | 6.28 | 7.51*** | 2.18** |
| | Feeding rice into thresher | 56.11 | 14.44 | 23.89 | 5.56 | 1.750 | 1.160 |
| | Transporting rice home | 75.88 | 9.83 | 8.51 | 5.78 | 16.31*** | 1.35 |
| | Spreading rice in the sun | 43.70 | 44.80 | 5.93 | 5.57 | −0.18 | 0.26 |
| | Constant turning and scare crowing | 18.60 | 40.44 | 22.61 | 18.36 | −3.99*** | 1.71* |
| | Checking rice for dryness | 65.57 | 33.62 | 0.57 | 0.23 | 4.64*** | 1.00 |
| | Actual winnowing | 46.64 | 44.80 | 5.91 | 2.65 | 0.32 | 2.31** |
| | Bagging | 63.58 | 25.28 | 7.17 | 3.97 | 7.16*** | 1.87* |
| | Stacking | 65.00 | 27.11 | 4.96 | 2.93 | 6.45*** | 1.29 |

*Significant level at 10%.
**Significant level at 5%.
***Significant level at 1%.
In threshing, the men and boys again performed significantly more work both manually and with equipment than women and girls. The difference between men and women was significant ($t = 7.51$) at $p < 0.01$ and so was that between boys and girls was $t = 2.18$, $p < 0.05$. The men and boys combined did 67% of the work compared to 30% for women and girls combined. The dominance of men and boys in threshing is because it requires a lot of physical energy, skill and experience to ensure that all grains are removed from the panicles with minimal spillage. However, this has implications on the use of innovations to reduce PHLs. On one hand, the dominance of men and boys in the use of technologies such as the motorized and pedal threshers may demonstrate appropriate targeting of technologies and innovations to those who normally perform the tasks. But on the other hand, it may also mean insensitivity of the technologies and innovation to gender especially if women and girls have to perform similar tasks. It is also important to consider here the caution from Agboh-Noameshie et al. (2013) that even in instances where technologies are introduced to reduce drudgery associated with women’s operations, males tend to dominate such technologies.

In transporting the threshed rice from the field to home, the men and boys combined accounted for 85% of the work compared to 16% for women and girls combined. The difference between work done by men and women in transporting rice from the field to home was significant ($t = 16.31$, $p < 0.01$). Apart from the intensity of labour requirements in the field-based processes where the males did more work than females, the conditions in the rice field were less favourable to women both physically and culturally. Rice is harvested when the fields are still marshy. Under those conditions, the men have to fold their trousers high or dress in shorts. This also exposes them to lichens and sometimes snakebites. Culturally, in the study communities, it is not normal for women to expose their legs above their knees, as it is perceived to be indecent regardless of the nature of activity they are involved in. In an FGD, a woman participant at Nsinze sub-county said:

We women find it difficult to harvest rice in the wetlands because we fear being ridiculed for being indecent. Only a desperate woman can do that. But for upland rice, we can harvest it because the fields are dry, we do not need to pull our clothes high.

The above phenomenon on gender division of labour has implications on innovations for reduction of PHLs in small holder farming. Firstly, it constrains the female-headed household’s full engagement in rice production, as they would have to hire men to provide the labour for such activities. Even in instances where women can hire the labour, cultural norms and time constraints due to their household roles may affect their ability to supervise such hired labour for effectiveness (World Bank, 2014). Secondly, because of the labour challenge, the female-headed households may harvest late, which leads to higher post-harvest losses both in quantity and quality. Almera (1997) for example found out that physical grain losses increased from 3.35% when rice was harvested exactly at its maturity date to over 60% when rice was harvested four weeks after its maturity period. The upland NERICA rice varieties offer more opportunities for women engagement in the field-based post-harvest activities but the uptake of such varieties is still low, partly because it competes for land with other food security crops grown in the upland. In the study area, only 11% of the respondents were growing the upland NERICA varieties despite their promotion by various agencies for over a decade. Rice being more of a cash crop in the area, women are unlikely to easily sacrifice the area for food crop production to rice production and hence their income from rice is limited.

There is a marked change in division of labour patterns as one moves from the field-based to home-based processes of drying and winnowing. Drying involves two main tasks; (1) putting out the rice in the sun to dry and taking it out of the sun, and (2) regularly turning the rice to ensure uniform drying. Men and women performed equally at about 40% with regard to putting out the rice to dry in the sun, and so did the boys and girls at about 6%. However, women took more care to regularly turn the rice to dry uniformly and to scare domestic birds from eating the rice (40%) as compared to the men (19%). Children were also involved in constant turning of rice. However, boys did slightly more work (23%) than girls (18%) with regard to regular turning of the rice and scaring away birds. The higher women engagement in turning rice and scaring domestic birds ($t = 3.99$, $p < 0.01$) is
attributed to women’s availability at home to undertake the activity than men who usually go to engage in non-farm or leisure activities. Moser (1993) and Karubanga (2013) continue to argue that women stay more hours at home because of their productive, reproductive and community roles. Thus, assigning key home based activities to women who are already overburdened with domestic chores compromise their inefficiency in performing activities such as adequate drying which is critical for reduction of PHLs. Scholars such as Moser (1993) argue that a part from the productive roles such as farming, women play other reproductive roles such as child bearing, caring for the children, food preparation, collection of water and firewood and family care. High post-harvest losses during drying due to domestic animals and birds have been documented by Rugumamu (2009) and Kong, Nanseki, and Chomei (2015) in Tanzania and Cambodia respectively. Leaving this task to women who are already burdened with many other household chores may only increase such losses. The men were more responsible for determining the appropriate moisture content to end the drying activity. They did a significant 66% ($t = 4.64, p < 0.01$) on this responsibility compared to 34% by women. This is possibly because men were more aware of the market quality requirements and conditions for milling quality than the women. The boys and girls performed minimally in determining the right moisture content possibly because they lacked the relevant experience.

Traditionally, winnowing has been women dominated activity. This is changing over the years as men discover convenient methods for their engagement in the activity. The men and women equally shared the tasks of winnowing at about 45% each. The boys did about 6% while girls did about 3%. This is due to improvising to use a plastic basin and wind-aided separation of the chaff from the grain instead of the traditional winnowing basket known as olugali. The former is more convenient to use by men while the latter remains a preserve for women due to the art and posture while using the tool, which for a long time have been passed on from women to girls. Indeed, the boys performed more of the winnowing than the girls indicating a shift in gender division of labour in this particular task as affirmed by Overholt et al. (1984). The driving factors behind equal involvement of men and women in the winnowing activities are the monetary value men attach to rice as a cash crop and the delay by women if they used the traditional tool (olugali). Winnowing precedes storage or marketing and is of particular interest to the men. This could be one of the drivers to their innovation to take charge of the end processes at the household level. This shift in roles at winnowing has implications on innovation for reduction of PHLs. For example, the winnowing basket being used by women is a good PHL reduction technology. However, men consider it inappropriate and too slow. The increasing involvement of men in winnowing implies that such a good technology might be abandoned in preference for faster alternatives which results in PHLs. The men do over 60% of the storage work (bagging and stacking) and women do 25%. Similarly, the boys do more than girls. This is a stage close to the market value and the men have to ascertain the final outputs in terms of number of bags stored and estimated weight. This helps to estimate the anticipated income, possibly as Singh and Tewari (2013) argue, for strategic positioning by men to control marketing.

3.4. Decision-making on postharvest practices for rice

Merely looking at who does what is inadequate to fully understand power relations at the household and how these influence innovations for reduction of PHLs. Gender relations are integral to power relations in the household particularly with regard to decision-making power. This study attempted to estimate the extent to which men and women contributed to making decisions with respect to how the post-harvest activities are performed (Figure 1).

As illustrated in Figure 1, in most households, the men either make the decisions alone or provide more input in the decisions than the women on how the post-harvest activities are performed. In 55% of the households, men provide all the input in decisions and in 25% of the households they provide most of the input in decisions about the tools and practices for harvesting. While the women participate more in heaping than men, in 44% of households, the women provide no input in decisions and in 35% of the households; they only make some input in the decisions on how long rice stays heaped before threshing.
In 76% of the households, men solely make the decisions while in only 24% of the households; women solely make decisions on how the threshing of rice should be done. Whereas women performed 40% of the work in drying rice compared to 19% by men, in 72% of the households, the men solely make decisions or provide most of the input in decisions on how rice should be dried. It is only in winnowing where equal proportions of households (30%) have either men or women solely making decisions. However, even at winnowing, the proportion of households in which men provided more input in decision-making was higher (33%) than that for women (8%). In 75% of the households, the men either solely make decisions or provide most of the input in decisions on the quantity of rice to be sold. Following the same trend, in 80% of the households, men either solely or provide most of the decision input on the use of revenue from rice. Consequently, the ultimate benefits from the rice enterprise are skewed to the men at the disadvantage of women. The women however sometimes also find clandestine ways of accessing the benefits like one woman said in an FGD at Namalemba sub-county:

> When men sell the rice, they do not bring the proceeds home. Sometimes they reward our efforts by marrying another wife. We also sometimes find ways to pay ourselves by stealing some of the rice during drying and storage to sell and get money to meet our needs.

The men dominate all decisions related to post-harvest practices and this progressively increases as rice tends towards the market value. In one of the FGDs held at Namalemba sub-county in Iganga district, one man asserted that **culturally, once rice has reached home, it becomes a property of the man and he has to decide what to do with it**. This dominance of men in decision-making has implications on the innovations for reducing PHLs. Jahan and Sarker (2015) argue that women’s low input in decision-making denies them opportunities to express their ideas for execution. On one hand, dominance of men in decision-making may also discourage and reduce women’s commitment to participate in and undertake practices that may reduce post-harvest losses. On the other hand, it implies that knowledge and practices for PHL reduction must substantially involve the men for uptake.

4. Conclusion

Rice is one of the labour intensive and emerging commercial crops in Uganda but with high PHLs at the farm level despite interventions by government and non-state actors to promote technologies and practices for reduction of PHLs. Beyond the technological focus, persistence of high PHLs in rice point to less understanding of underlying social factors at the household level where the PHLs occur most. Some scholars such as Hadiyanto (2013), Singh and Tewari (2013), Jahan and Sarker (2015) over generalized that women in Sub-Saharan Africa provide most of labour in agriculture and that men’s involvement is more at marketing to control household incomes but this is not entirely true for rice in Uganda.
The intra-household division of labour in post-harvest practices of rice in Eastern Uganda is not driven by interest to control income but rather the intensity of labour required at the different stages of the process and associated cultural values. The men and boys perform most of the field-based activities of post-harvest practices such as harvesting and threshing which also require more physical energy and working in marshy conditions. Working under such conditions by women and girls would require that they raise their clothes above the knees, which culturally depicts indecency for females. The women and girls participate more in the home-based post-harvest activities such as drying and winnowing, which also require less physical energy. This gender pattern of responsibilities in postharvest process is culturally perpetuated into the next generation as boys and girls perform activities alongside men and women respectively. Interventions to address the PHLs in rice therefore have to take into account the intra-household gender division of labour.

Dominance of most post-harvest activities by men due to labour intensity of activities and cultural norms constrains female-headed households as they have to hire men to perform those activities and may access labour late leading to more PHLs. Further, the women may not effectively supervise hired labour (by men) due to cultural restraints. Men also make most of the decisions regarding post-harvest activities including those activities that are performed by women. This puts men at the core of influence of PHLs in rice in Eastern Uganda. Labour is not the most limiting constraint for small-holder farmers, so instead of focusing on efficient and labour saving technologies which are not taken up due to costs and relevance, significant reduction of PHLs in rice is possible if men are targeted with the relevant knowledge and change in practices. The underlying intra-household division of labour and cultural norms are central to PHLs in rice in Eastern Uganda.

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