Gender Roles in the Wheat Production of Sudan: Strengthening the Participation of Women

Case Study Report Prepared for the Support to Agricultural Research for Development of Strategic Crops in Africa (SARD-SC) Wheat Project

Dina Najjar, Ishtiag Abdalla, and Eileen Alma

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About the Authors

Dina Najjar is the Social and Gender Specialist, Social, Economics and Policy Research Theme, Sustainable Intensification and Resilient Production Systems Program (SIRPS), International Center for Agricultural Research in the Dry Areas (ICARDA), Amman, Jordan.

Ishtiag Abdalla is an Economist and Gender Specialist, Agricultural Economics and Policy Research Center, Agricultural Research Corporation, Khartoum North, Shambat, Sudan.

Eileen Alma is the Director, International Centre for Women's Leadership, Coady International Institute, St. Francis Xavier University, Antigonish, Canada.

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Executive Summary

The SARD-SC project, funded by AFDB and led by the International Center of Agricultural Research in the Dry Areas (ICARDA) in partnership with local stakeholders, aims at reducing wheat importations while simultaneously enhancing the income generation capacities of men and women farmers in wheat systems. A study of existing literature reveals that gender inequalities in rural Sudan are attributed to prevailing gender ideologies, power imbalances, and biased distribution of resources, particularly difficulties in land and credit attainment, as well as the lack of training and technology opportunities for women. Despite agriculture being a dominant employer for 80% women in rural areas, substantial gender gaps exist with regard to women's access to land, technologies, and information.

The SARD-SC project employs action research using an extended case study approach in three Sudanese sites (Gezira, River Nile and Northern) to integrate women beneficiaries into SARD-SC project. As of August 2016, women constitute 65% (n=1508) of the beneficiaries in the three IP sites. The objectives are to increase women's income generation potential and their contributions to food security, while also addressing structural gender inequalities in access to inputs and services (information, training, and microcredit in wheat systems). The project employed context-specific interventions related to grain growing, technology demonstration, value addition, and microcredit provision.

Activities in this project are implemented in two ways: the first is in enterprises in which women are leading and acknowledged with a focus on value addition; the second is in enterprises which are led by men despite significant contributions from women in wheat farming. The case study overcame barriers often cited in development literature as shortcoming in gender and agricultural development. These included the targeting of gender relations, the comprehensive involvement of project team members, and addressing strategic gender needs (particularly limiting gender norms and barriers to accessing credit and inputs).

Three main impacts at the institutional level ensued through the integration of gender into SARD-SC Wheat Project in Sudan. The first was flexibility in responding to differing gender roles and needs in the different Innovation Platform (IP) sites including unprecedented focus on value addition and involving women in hosting and generating technologies. The second achievement was increased awareness on the importance of integrating women through increased knowledge about existing gender gaps and inequalities. The third impact was increased experiences in involving women through collaborations with multiple stakeholders (through the IP approach).

Institutional norms related to a sustained focus on urban areas and limited involvement of women in agricultural interventions were challenged by finding new avenues to involve women

in wheat programing including in value addition, roughing, and hosting of technologies. The project focused on improving gender relations at the household, community, and institutional levels in a safe and culturally appropriate way.

For example, the experiences of Rural Women's School, value addition, women grain growers, and micro-credit provision, challenged institutional and community gender norms which seldom see women as farmers or as a target for agricultural extension programs as well as gained some acceptance of male leaders and household members. Women in all IP sites also gained skills and knowledge on value addition, and additionally sometimes acquired oven and gas micro-credit, which reduced the costs of consuming bread and pastries and in many cases led to income generation opportunities for women.

Overall Sudanese women in the Gezira, River Nile and Northern sites benefitted from an increased ability to generate income (for 50% of those who participated in the value addition training and for the women from the poor class who now can work for a pay in roughing); and a reduction in workload through the introduction and/or increasing the availability of five main interventions (mechanization, clean planting seeds, pesticide use, gas ovens, and expedited value addition recipes). They have also seen an increase in decision-making power through leadership strengthening in field days and key meetings, sustained control over income related to wheat value addition profits, and more informed decision-making in adoption of new agronomic practices and wheat varieties.

Introduction to the SARD-SC Wheat Project

Sudan currently spends over 1 billion dollars on food imports, with the highest proportion being allocated to wheat (Mahgoub, 2014). It is only able to produce 0.3 out of the 2.7 million metric tons of its consumption (Siddig & Grethe, 2015; Famine Early Warning Systems Network, 2015). According to the FAO (2016), about 2.1 million tons of wheat are imported yearly (FAO, 2016). Farmers in general lack adequate access to extension advice, quality seeds, and incentives to grow wheat. Agriculture, accounting for 41 percent of employment means in the country, comprises the primary source of livelihoods in rural communities and is a source of employment for 80 percent of rural women (IMF 2013; UN Statistics Division 2016; the World Bank Group 2016; FAO 2016).

Despite their significant contributions to farming, women farmers are particularly marginalized due to their limited access to land, inputs, extension advice, and technologies; low levels of participation in leadership positions; and limited income generation opportunities, such as access to credit and jobs (Grawert 1998, FAO 2015, African Development Bank (AfDB) 2014a). Gender inequalities are one of the main hindrances for development in Sudan (UNDP 2016; Elnagar et al. 2011; Aldehaib 2010). This is particularly true in rural areas where gender inequalities are more pronounced (Elnagar et al. 2011). Empowering women through agricultural production is one of the most effective strategies for closing the gender gap in economic participation and achieving sustainable development more broadly in Sudan (Elnager et al. 2011).

To address these gender inequalities and deficits in wheat supply, the Sudanese government has been collaborating with the International Center of Agricultural Research in Dry Areas (ICARDA) and the Agricultural Research Corporation (ARC) on an African Development Bank (AfDB) funded project entitled *Support to Agricultural Research for Development of Strategic Crops in Africa Wheat* project (hereinafter noted as SARD-SC Wheat). The project aims to implement along with the government and key stakeholders an effective strategy for import substitution and achieving food security while promoting the economic participation of women. The current report presents the case study of integrating gender into the SARD-SC Wheat Project in Sudan.

The report first outlines the project objectives then moves to an overview of gender and agriculture in Sudan with a focus on the areas of project intervention, namely the states of Gezira, River Nile, and Northern (Figure 1) which differ in levels of wheat production as well as technological, socio-economic, and gender norms dynamics. The theory of change, methodology, and impacts at the beneficiaries and institutional levels then follow. The report ends with lessons learned and out scaling potential of promising approaches.

Objectives of the SARD-SC Wheat Project

The SARD-SC Wheat project is led by ICARDA and works in partnership with local stakeholders. The project's overall goal is to improve national wheat production and reduce wheat imports in 13 countries: Sudan; Kenya; Eritrea; Ethiopia; Mauritania; Niger; Mali; Nigeria; Sudan; Tanzania; Zambia; Lesotho; and Zimbabwe. It has four main objectives:

- to enhance wheat yield by 25 percent through adoption of improved varieties and production technologies;
- to increase annual household incomes from an average of $360 to $600;
- to reduce wheat imports from 57 percent to less than 40 percent; and
- to reduce post-harvest losses from 30 percent to less than 15 percent.

This case study focuses on gender issues and considerations for the project and how women benefit and simultaneously contribute to achieving these four objectives. The project's premise is that enhancing wheat yield and adoption of improved varieties and technologies can be achieved better through the involvement of women who contribute to wheat production, participate in adoption decisions, and are responsible for wheat value addition and consumption choices. Furthermore, when both men and women have increased income, the target of achieving increases in annual household incomes can be strengthened. Finally, the project considers the importance that women play in reducing post-harvest losses (both in the fields and in storage). The project employs a participatory approach using Innovation Platforms (IPs). These IPs allow both men and women to communicate their needs and priorities, and participate in the development and implementation of the project (ICARDA, 2015).

To explore the potential of three different types of environments, three major wheat producing countries are chosen given their potential of out-scaling and lesson-sharing for other similar countries. These include: Sudan, which has irrigated arid and semiarid areas; Ethiopia, which has rain fed tropical highlands; and Nigeria, which has the warm tropical environment of western Africa. In these countries, the project aims at enhancing the income generation capacities of men and women farmers in wheat systems with a focus on: agricultural technologies and innovations generation; agricultural technologies and innovations dissemination; and capacity building.

Methodology of the Case Study

The project employed an extended case study approach (Burawoy 1998) to integrate women beneficiaries into the SARD-SC project. The approach was interactive and adaptive to the varying local contexts and emerging opportunities (Nelson, 1991). The action research

dimensions focused on studying how women's income potential could be increased and ways in which to address inequalities in access to inputs and services. It considered context-specific interventions and examined the effects of integrating gender in activities related to farming and value addition in wheat systems of rural Sudan, documenting what worked well and what were the obstacles faced and how were they surmounted? The research focused on identifying promising practices with out-scaling potential in wheat systems in which the capacities of women to generate income are increased and gender inequalities reduced. The extended case study approach was multi-local and multi-scale, and used for gaining a better understanding about enhancing the income and food security potential of women in wheat systems.

Evaluating the activities involved qualitative and quantitative approaches. The minimum standards for collecting sex disaggregated data (Doss and Kieran 2014) were followed in designing the quantitative survey. Questions aimed at understanding who in the household instead of the head of households were incorporated to understand how both men and women participated and benefitted from the project. Women enumerators were also hired and trained to carry out the survey. The qualitative methods employed questions to understand gender relations, men's acceptance and involvement in women-related activities, and approaches which worked well in enabling women to benefit from the project, and the respective benefits. Interviews and focus groups were then transcribed and analyzed for understanding institutional and local impacts.

A quantitative survey in the Rive Nile State conducted with 18 women farmers and 82 male farmers aimed at understanding the yield differences between men and women farmers and benefits from the SARD-SC project, with a special focus on the extent of mechanization for workload reduction.

Qualitative interviews and focus groups were conducted (as per Appendix, Table 3 below) for understanding the type of involvement for different stakeholders, the impact on men and women farmers, institutions, the community, and regions more broadly.

Literature Review on Gender and Agriculture in Sudan

In this section, we establish linkages among gender, poverty, wheat production, and agriculture more broadly. We pay attention to obstacles faced by women in agriculture as the SARD-SC Wheat Project aims to address these obstacles through targeted interventions. The obstacles and opportunities differ between the four targeted states, and we account for these differences in our interventions.

In Sudan, the most impoverished and underserved communities can be found in rural areas which constitutes 66% of the population (26 million people) (FAO, 2016; World Bank 2016). The

International Monetary Fund's Interim Poverty Reduction Strategy Paper (2013) estimates rural household poverty levels at 58%, in comparison to 27% in urban areas. The issue is further complicated with an economic crisis and ongoing civil war that has contributed to the regression of Sudan's agricultural sector and led to widespread poverty (JICA, 2012).

The government along with international development organizations have placed sustained focus on transforming the agricultural sector from subsistence production to market-oriented production while reducing the importation bill for wheat (IMF 2013; Rose 2012; Siddig & Grethe, 2015; Mohamed & Abdalla, 2014). Most notably, the Sudanese government launched the Agricultural Revitalization Program in 2008 and the National Development Plan in 2012 (FAO, 2016). With a budget of 10.1 billion SDG, the Sudanese government plans to strengthen the commercialization of subsistence farming and modernize the sector by introducing novel technologies, improved seed varieties and agricultural support services. Developing the wheat sector not only reduces poverty but also reduces importation costs and provides protection against market volatility. In 2010, the price of wheat increased up to 80% in international markets (Sudan Integrated Food Security Information for Action (SIFSIA) 2010).

About 30% of the food in the country is produced by women with women accounting for 49% of farmers in the irrigated sector and 57% in the traditional sector (Bezner Kerr 2011). In many rural communities, women participate in all aspects of agricultural life, including household and family maintenance, wage labour, trading and marketing, as well as crop and animal management (JICA, 2012). However, despite their significant roles in crop production, female participation is often limited to subsistence farming and more commonly unpaid labour, as no monetary value is applied to their reproductive work (Elnager et al. 2011). Their contributions within and outside the household are often overlooked due to gender inequalities that undermine their status (FAO, 2011). This is particularly evident in River Nile and Northern State which depend largely on manual labour and experience male outmigration. Many women farm wheat for subsistence production on smaller plots of land yet have limited access to inputs and economic opportunities, such as credit (JICA 2012; AfDB 2014b; USAID 2015). The country experienced a 20 percent increase in female-headed households, currently at 17.3%, with a growing need to feed their families (IMF 2013; United Nations Statistics Division, 2016).

Other dimensions for inequality in agricultural support are the limited number of women extension agents and subsequently limited number of women participants in demonstration plots and on farm experimentation resulting in exclusion of women's needs and priorities (Bezner Kerr 2011). In particular, women-related domains of post-harvest processing and needs for workload reduction technologies tend to be systematically neglected by the extension system (ibid). Since women are increasingly left behind to farm the land, gender equality in resource attainment, workload reduction, and economic participation should be a priority, as it has the potential to build social and physical capital for the rural poor (IMF, 2013).

Over 50 percent of Sudan's wheat is produced on public irrigations schemes, such as the New Halfa Scheme in Kassala State and the Gezira Scheme in the Gezira State (Mahgoub, 2014). The states of Gezira and Kassala are considered to have the greatest economic and yield potential for closing the wheat yield gap, due to their pre-existing irrigation infrastructure, vast arable lands, and experienced workforce, and many agricultural interventions target these states (World Bank 2010). In these large-scale mechanized and irrigated schemes, however, women experience extreme difficulties accessing land (i.e. formal tenancies) due to their perceived inability (physical or otherwise) to manage large plots (JICA 2012).

The increase in number of women with higher levels of education and the mechanization of farming more broadly has led to a decrease in middle class women's contribution to farming (United Nations Education, Scientific and Cultural Organization 2012; Grawert 1998). In all states, nonetheless, women with lower levels of education are employed as seasonal wage labourers during planting, harvesting, cleaning, and packaging of wheat (Elnagar et al. 2011).

Women generally have low participation in key decision-making positions, low participation in the economy, and low landownership rates at 5% (FAO 2016; AfDB 2014b; Mahgoub 2014). Female participation in the workforce is 48% while male participation is 73% due to deeply seated cultural norms (AfDB, 2014b). The North African and Middle East region more broadly has one of the lowest women land ownership rates in the world which has negative implications on women's ability to access credit and profit from their farming. Moreover, inheritance is determined by Sharia system, which stipulates that daughters get half the share as compared to the allotment of sons. However, due to cultural norms, women rarely get inheritance in the form of land and when they do, they leave the management to a male relative (FAO 2016). Because men are perceived to be the breadwinners in families, own land, and as such can also access agricultural credit, many agricultural projects largely target men (Elnagar et al. 2011; JICA 2012; AfDB 2014a; Mahgoub 2014). Women's (married, single or as heads of households) contributions and need for agricultural support is often undermined (ibid).

In households where both men and women farm wheat, men are primarily responsible for the managerial and technical aspects of production (i.e. land preparation and fertilization), as well as marketing (JICA, 2012). In contrast, all of the time aspects (i.e. planting, weeding and harvesting) fall under the responsibility of women (JICA 2012). As such, women's share of the workload tends to be significantly greater, while the benefits from production tend to be less.

If the gender deficit in the wheat system continues to be overlooked, the economic participation of women will continue to decline with failures in production, while poverty and hunger levels rise. On the other hand, reducing the gap between men and women in access to agricultural land could raise yields on women's farms by 20 to 30 percent according to the UN

Food and Agricultural Organization's (FAO) State of Food and Agriculture (SOFA) report of 2011. This would raise total agricultural yields in developing countries by 2.5 to 4 percent, reducing the number of hungry people in the world by 100 to 150 million. Also, studies conducted by Abdalla et al. (2013) have shown that female involvement in agriculture, has a greater impact on crop productivity and household income, as they are more likely to stay in the village, pay closer attention to crops, and invest in their families (i.e. health and education).

The revitalization of the agricultural sector in Sudan through site-specific interventions is an opportunity to both increase and develop agricultural production while also eliminating gender inequalities, which in turn increases production (FAO 2011). The data suggests that the current gender gap in higher education is in favour of females, especially in the field of agriculture with enrolment at 68 percent, in comparison to the 32 percent for male students (JICA, 2012). This in turn is reflected in high number of staff in the Agricultural Research Center in Sudan. Women account for 36 percent of researchers and 52 percent of women extension agents (Ministry of Agriculture and Forests 2016). These considerations are important for targeting more women farmers in agricultural interventions. It is more acceptable for women farmers to interact with women extension workers.

Theory of Change of SARD-SC Wheat Gender Mainstreaming in Sudan

Recognizing the significance of addressing the gender gap in agriculture, the AfDB developed an integrative and action-oriented (2014-18) Gender Strategy, which is anchored to their overarching strategy for supporting transformation in Africa (AfDB 2014). The AfDB places specific focus on the inclusion of women in development projects for increasing their participation in decision-making processes and income generation activities. In collaboration with the Sudanese government, and in context of AfDB project regulations which stipulate the inclusion of 30 percent of women beneficiaries in projects, SARD-SC project team planned and followed up on the ground to ensure that women along with men are benefitting from SARD-SC Wheat activities.

The interventions were designed to tackle both women's strategic and practical gender gaps[1] in agricultural production (Moser 1989, Agarwal 1994). The activities differed for different types of women and in different areas (Table 1). Gender analysis of roles and needs provided a clear understanding of the social and cultural realities in the different target communities. By

[1] Practical gender are needs of subsistence such as food, health care, water supply etc.). Satisfying these needs does not challenge women's position in labour, political power or property ownership (Moser 1989, Agarwal 1994). By contrast, strategic gender needs are those needs that would help overcome women's subordination (ibid).

understanding the challenges and opportunities faced by different types of men and women, the project developed and implemented effective strategies, which covered a wide range of wheat production levels and technologies as well as socio-economic and cultural variations. By covering as diverse experiences for women with wheat production interventions as possible the study strengthens its outscaling potential to areas with diverse set of conditions.

Table 1 Overall activities, number and ratio of women beneficiaries in SARD-SC Wheat Project in Sudan during between 2014 and 2016.

Activity	**Location(s)**	**Female Participants**	**Male Participants**	**Percentage ratio of women to men**
Value addition over 2-3 days (training on different recipes for making wheat products with better quality and less time using locally produced wheat)	Gezira (900) Kassala (115) Northern (128)	1,143		100
Sixteen field days during different stages of wheat production (seed cleaning, seed dressing, land preparation, planting, fertilizing, irrigation, weeding and harvesting, before which men and women farmers are asked to rank various improved varieties)	In all IP sites especially Gezira state	759	1420	34.8
Technical trainings (for extension agents, farmers, and workers) in designing a trial, following up, and analyzing data	Gezira	11	88	11.1
Oven microfinance provision in collaboration with Microfinance Institute concurrently with value addition training	River Nile State	750		100
Providing wheat seeds for cultivating one acre of land and continuous technical support to the Zahraa Women Association (Productive Group)	River Nile	24		100
Providing continuous technical support (Rural Women School) to the Dibtod Women Association with a focus on value addition (Voluntary Group)	Northern State	36		100
Providing continuous technical support (Rural Women School) to the Agadi Women Village Group with a focus on value addition and seed production (Informal Group)	Northern State	22		100
Microcredit provision to the Alfadlab Women Group on livestock and fodder production (Voluntary Group)	River Nile State	33		100
Overall		**2778**	**1508**	**65**

Adequate funds were also allocated for each gender activity with clear responsibilities, persons responsible, and approaches (see Appendix, Table 2 for the workplan developed and adapted over the project life cycle) (Parpart 2014). The actors involved in the gender activities included the Country Project Coordinator, IP Facilitators, Gender Focal Points in each IP Site, Country Gender Focal Point, and Gender Specialist at ICARDA. Assigning responsibilities at different levels is an important step for this project to actualize its gender mainstreaming objectives (Parpart 2014). More precisely engaging with opportunities and barriers at multiple levels is key in gender activities as gender issues are contextual, hierarchical, and complex (Agarwal 1994).

The Case Study Locations and Characteristics

In this section, we discuss the differing roles of women in wheat production and processing which varied by the location, social class, and ethnicities as well as other descriptive data such as the local biophysical context. This understanding helped design context-specific interventions. We focused on four locations for our gender targeted interventions including Gezira, Northern, River Nile, and Kassala (Figure 1). We placed emphasis on Gezira state as wheat production in this state constitutes 60% of the total wheat produced in the country with a harvested area of 67,000 hectares (Ministry of Agriculture and Forests 2013).

In Gezira State, middle class women have limited involvement in farming activities and are rather mostly involved in value addition. For the most part, many women use imported wheat in their cooking and baking of wheat products. Agriculture is highly mechanized and covers large areas of land of at least 10 acres and wheat is mainly cultivated for commercial purposes. Women settlers from Darfur, on the other hand, are of a lower class in the community and highly participate in wheat production, most notably as agricultural labourers. Some of these women are also main participants in wheat production along with their husbands who sharecrop farming of wheat with the original landholders. Women from all classes often reared livestock in their households which contribute significantly not only to household income but national export revenue more broadly (Intergovernmental Authority on Development, 2013).

In River Nile State women of all classes are responsible for farming as the area has high male out migration rates who work in gold mining, and it is culturally acceptable for women to farm. Agriculture is characterized by poor soil fertility as these are newly cultivated lands, locally known as ‘high terraces’, and require up to four years of reclamation. Wheat cultivation is fairly mechanized and land holdings are relatively large (6 acres). Wheat is mainly grown for consumption and excess is often sold. Women from urban areas are the largest consumers of wheat and, for the most part, consume imported wheat.

In Northern State women are also highly involved in farming. Contrary to what the literature pointed out, the area in which the project was operating of Dibtod and Agadi had low male outmigration rates. Many households farmed wheat collaboratively between man and women. While men prepared the land, both men and women planted and harvested the fields as well as stored wheat seeds. Women were additionally responsible for the cleanliness of the planting seeds, the weeding of the fields, and reducing pot-harvest losses by collecting shattered seeds after the completion of harvesting. About 60% of the farming is mechanize and land sizes are smaller than the other two state and range between one and 4 acres. Farmers grow wheat mainly for self- sufficiency and the excess is sold. Women are an important source of income and livelihood diversification and many cultivate vegetables for sale and/or home consumption, in addition to horticulture and livestock rearing.

It is important to also mention that in all three states women are involved in adoption decisions of new wheat varieties. Based on the baking quality, women often made recommendations to their husbands on which variety to grow. This is especially true in areas of the River Nile State and Northern State whereby smaller parcels of land are farmed with wheat focusing on meeting household consumption needs of wheat. Women preferred flour which was lighter in colors and had high elasticity.

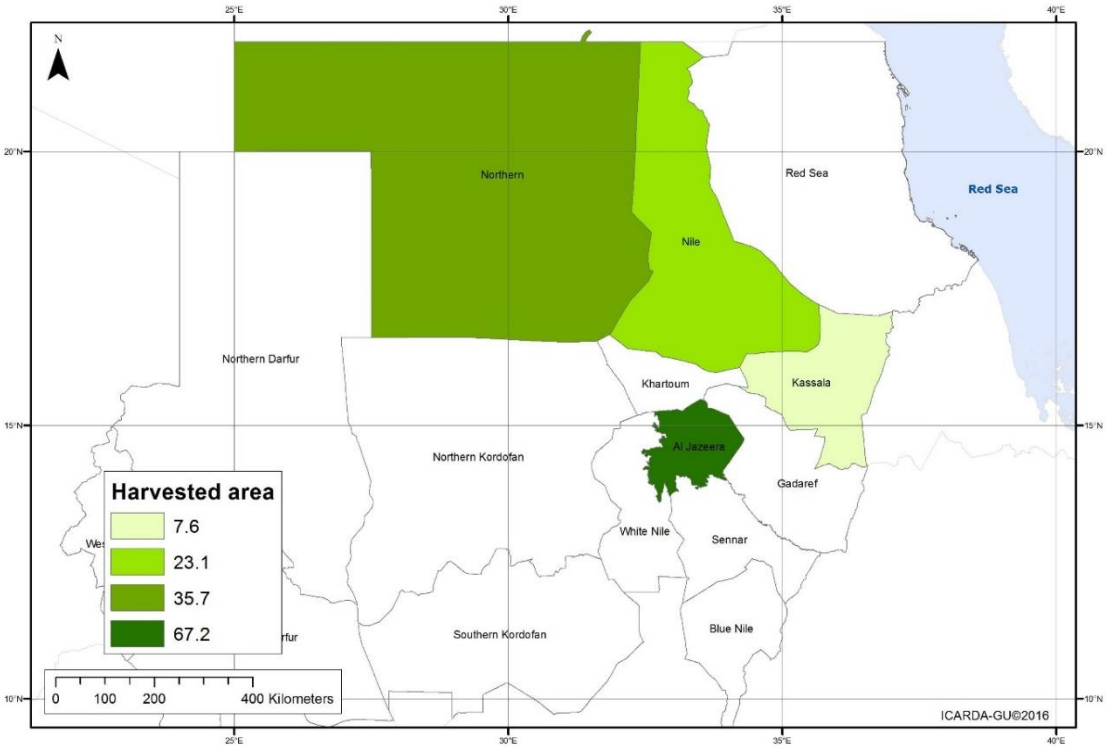

Figure 1 Case study areas and respective wheat total harvested areas.

Source: ICARDA GU Unit 2016.

Gender Activities Implemented

The SARD-SC Wheat Project employed context-specific interventions in Sudan related to grain growing, technology demonstration, value addition, rural women schools, and microcredit provision. Activities in this project are implemented in two ways: the first is in enterprises in which women are leading and acknowledged with a focus on value addition; the second is in enterprises which are usually led by men despite significant contributions from women in wheat farming. The premise is that targeting women through traditional enterprises would lead to their direct control over income and is far easier to implement at a larger scale (low hanging fruits). Involving women, on the other hand, in non-traditional enterprises, particularly in wheat production, challenges gender norms and stereotypes at multiple levels for services providers and local communities (Classen at al. 2008). This has multiplying effect on other women in the community. Women growing grain or hosting SARD technologies encourage and spread the information to other women in the area. As one of the Gezira IP facilitator puts it, "the project aimed at creating role models in the community: that a woman can grow wheat and depend on herself."

Indicators sought out due to the interventions are qualitative and quantitative and include:

- changes in perception related to consumption of local wheat varieties;
- number and quality of enabling institutional relations;
- number of women beneficiaries in value addition and production of wheat crop;
- number of interventions/technologies which reduced the workloads of women;
- changes in attitudes and behaviors of men and women (at the local and institutional levels) in favor of increasing women's economic and leadership potential in local wheat systems (e.g., control over income and decision-making in local agriculture); and
- the degree of flexibility for the inclusion of women from different ethnicities, classes, generations, and locations as beneficiaries in the project activities.

In Gezira, some 900 women were trained on value addition with the aim of encouraging the use of local wheat and increasing the income generation potential of women and their contributions to food security. Job opportunities in wheat farming, particularly, roughing[2] were created for women belonging to the landless poor who are, for the most part, migrants from Darfur. In Gezira, women were employed for this job in farmers' fields who were participating with SARD as well as on sites where SARD-SC Wheat scientists carried out their breeding

[2] Roughing is the removal of off types (weeds) on fields aimed for the production of planting seeds.

programs in the ARC branch in Medani, Gezira, the headquarters of the wheat breeding program in Sudan.

Women of different generations, social class, ethnicities, and educational backgrounds were also largely targeted for attending field days which cover wheat farming during all its life stages and involves strategic interactions among men and women farmers as well as key stakeholders. Field days are community events during which participant farmers exchange experiences of SARD-related interventions (such as cultivating a new wheat variety, application of certain agronomic practices, value addition techniques, and participatory varietal selection) with non-participant farmers. During these events farmers and other stakeholders, such as SAYGA (the main milling company in Sudan) and microcredit institutions from the Ministry of Agriculture and Forests, also brainstorm about future interventions. Women who attended these trainings were wives of male participants, some of which are renters of land from Darfur, middle class women involved in value addition, and women laborers hired to demonstrate roughing.

In River Nile state, specific interventions included the value addition training which aimed at promoting local wheat consumption, increase income generation potential of women, and their contributions to food security. Some 750 women (from rural and urban areas) were trained on value addition and simultaneously provided with oven microcredit. In addition to that, 24 women farmers were provided with wheat seed and technical backstopping over the wheat season in the New Manaseer area. A group of 33 women was also provided with microcredit access in order to rear livestock and fodder.

In Northern State, women were targeted to form two Rural Women Schools and trained on seed production and value addition with the same aims mentioned above. In addition to wheat production and value addition, women in the Rural Women Schools were keen on income diversification topics, which included vegetable and horticultural production. Women were also targeted for seed growing. Women were also trained for roughing of wheat and in cleaning of planting seeds during field days and Farmer Field School meetings.

More recently, for each of the six IP sites in the four states, large-scale baking equipment were purchased with the purpose of group-oriented income generation activities. Group-oriented production activities for women are often praised for enabling women producers to access resources and markets, develop relationships, and overcome gender constraints (see for example, Jones and Wills (2012) for their global study on the subject). Women groups are being formed for operating this machinery and to subsequently generate income.

In all states, the study aimed at including women in strategic stages of implementing activities, such as at the stage of identifying and designing the interventions in venues where key project decisions are made (on IP during field days and other key meetings). Kabeer (2010) argues that

the timeliness of women's involvement in projects is key to shaping whether and the extent of women's abilities to benefit from interventions. In Gezira state, the value addition training itself was suggested by concerned women during a field day. SAYGA milling company was present and agreed to train women on various value addition activities.

This involvement of women in strategic stages included value addition intervention design, facilitating microcredit access, Women Rural Schools' location, timing and subjects covered. Furthermore, conscious raising and sensitization through both formal training (e.g., gender integration training held in Sudan March 3-4) and informal approaches (e.g., discussions) with farmers (men and women), extension agents, IP facilitators, and others involved was a continuous process in this project. Women's opinions and needs were taken very seriously by SARD IP leaders and extension agents. This simultaneously involved overcoming biases in norms at many levels (community and organizational), particularly those related to 1- what women can or should do and 2- involving women in agricultural programs related to both production and value addition. For example, during a field visit in August 2016, a male farmer in Gezira scheme explained that the lack of women farm managers in the area is attributed to their inability to manage large farms. The SARD country gender coordinator responded that a man too cannot manage a large farm by himself and will need to depend on family or hired labour.

The project took a relational approach to gender and sought out the approval and involvement of husbands and male leaders in the community. Attention was paid to these relations in implementing the respective activities. In field day invitations, for example, farmers were encouraged to bring along their wives, neighbors, and other women members in the community as it is easier for women to come to meetings if the husbands were coming along.

The project also focused on institutional relations which were strategically targeted to create an enabling infrastructure for women's participation particularly in wheat production and processing. Collaboration with SAYGA enabled the training of many women in value addition in the Gezira State. Women groups from the Sudanese Women Council were active players on the IP platforms of River Nile and Northern States. Through these groups, women were recruited and voiced their needs thereby ensuring their participation in the program. In River Nile and Northern states, women expressed their need for wheat seeds and participation in wheat production activities which often target men. The value addition activity in River Nile State simultaneously worked with the River Nile Micro-Credit Institution and the Sudanese Women's Union not only to train women in value addition but also enable them to access microcredit in the form of an oven and a gas cylinder. Such opportunities are especially important for rural women who seldom access credit. The microcredit institution itself credited SARD-SC project for aiding them in expanding to rural areas.

The project took a win-win approach to both achieving income and production increases as well as reducing structural barriers to women's participation in production and income generation activities. The practical needs addressed in States of River Nile, Gezira, and Northern included provision of information and skills on wheat production. Strategic needs aimed at addressing women's limited access to information, microcredit, and decision-making power in participating in and designing agricultural interventions. The two approaches are not mutually exclusive. For example, in the River Nile State women who were trained on baking were also trained on how to carry out a project, profit, and commercialize for selling.

Through accounting for strategic and basic needs as well as gender relations, the project addresses on-going criticisms related to integrating gender into development projects in different parts of the world which pay limited attention to strategic needs and gender relations (Quisumbing, A. R., & Pandolfelli 2010; Baruah 2005).

Gender Impacts of SARD-SC Wheat Project in Sudan

Key impacts of the case study are described in this section at the institutional and individual beneficiary levels which are interconnected. The institutional context affects or shapes the services provided. On the institutional front, the case study looks at impact achieved with ARC, the General Sudanese Women Union, Ministry of Agriculture and Forests, and the Rive Nile Microfinance Institution. The purpose of the interventions at this level included establishing an enabling institutional context to introduce interventions/technologies which reduced the workloads of women and increased women's economic and leadership potential in local wheat systems. They have led to changes in attitudes and behaviors of men and women in favor of achieving the former, as well as demonstrated inclusion of women beneficiaries from different ethnicities, classes, generations, and locations. Similarly, the purpose at the local level was to empower women in their abilities to generate income, contribute to food security in their households and societies more broadly, increase their decision-making power and leadership potential, and reduce their workloads.

Impact at the Institutional Level

Three main achievements at the institutional level through the integration of gender into the SARD-SC Wheat Project in Sudan were realized:

1. high degree of flexibility in designing the interventions based on the local contexts;
2. increased awareness of stakeholders on the importance and means for integrating women as beneficiaries in agricultural research for development; and
3. involved institutions gaining experience in integrating rural women in greatest need of services into their programming.

The Country Coordinator based at ARC Medani explained that since the onset of the project they had tried to involve women in SARD activities in all IP sites of Gezira, New Halfa (also referred to as Kassala), River Nile, and Northern using an open and adaptive approach. He explained that this was difficult in New Halfa and Gezira. They found women farmers and involved them in grain growing of improved varieties but the number of women was very small.

To increase the number of women beneficiaries especially in the largest wheat production region of Gezira, the Coordinator explained, they looked for landowners which again proved challenging because while the women owned the land, most were not involved in its management and direct farming practices: "We noticed that involving women in farming was not real involvement. We did not stop trying."

The limited involvement of women as farm managers in large-scale mechanized farming such as in Gezira scheme, as explained earlier, is also reported in the literature. As such, women of Gezira were targeted to participate in field days as contributing family workers (especially the case of migrant women as explained earlier) and as participants in adoption decisions of new wheat varieties. Women's role in adoption decisions was fully recognized. As the Country Coordinator, who is also a breeder, explains: "We need to involve women in our interventions: if a variety is high yielding but the taste and baking quality were poor, we will not get adoption."

The Country Coordinator also noted that by soliciting the involvement of women from poorer backgrounds, a success was achieved through job creation, namely in roughing both on station and on farm especially in Gezira state where wheat production (grain and seed) is the highest, and roughing is an important practice on the Medani wheat station. The project team trained local women workers on these tasks since some of them thought that, "the big spikes are good ones. We explained these are off types and they should be removed," explained one of the IP facilitators in Gezira.

In 2014, when soliciting collaboration with SAYGA and based on women's requests, the project started to involve women in value addition training and in testing local wheat varieties for preparing multiple wheat-based products. This was considered a major success: "When we started the value addition training, we could not stop the women from coming. We tested new varieties in local recipes with women. By the end of the day, women decide which variety is good and for what," explained the Country Coordinator. The testing for the local varieties (which differ between IP sites) was done in River Nile and in Medani (Gezira). In total, 1,893 women participants were trained on value addition with the largest number being based in the Gezira state (Table 1). These types of trainings are pioneering since value addition is often neglected in agricultural intervention programs yet is an important income generating option and contributes to food security (Bezner Kerr 2011). The project targeted women as the end users to use local rather than imported wheat which is widely known for a superior quality and preferred over local wheat.

The gender integration goals were clarified, solidified, and owned by the main local partner ARC during a two-day gender integration into SARD-SC Wheat workshop held in Khartoum with multiple stakeholders (SARD-Project core team, Country Coordinators, Country Gender Focal Points, IP facilitators, and extension agents). The workshop focused on how can women become enabled to achieve the goals of increased production and income generation, who do we need to involve, what evidence would we use, and who is responsible in the respective activities. Table 2 in the Appendix depicts the work plan which was co-produced and owned in the gender workshop by ARC, the primary implementer of the interventions.

It is also important to mention that 33 percent of the SARD team in Sudan are women when including extension agents and IP facilitators. The Country Coordinator emphasized that the involvement of women in recruiting and training women was key to the project's success in integrating women beneficiaries. Nonetheless, he also pointed out that the most notable gender-integration efforts belonged to an IP whose facilitator is a man. Many of the project leaders explained that the scale of gender integration in SARD-SC, particularly the 30 percent target of women beneficiaries, is unprecedented in their career and required improvisation and high degree of flexibility. The Country Coordinator explained that flexibility was key to actualizing the 30 percent target:

> "We know our Goal, our target. We should look for different approaches: we have to look for options where have comparative advantage in the different IPs and we try to explore that. We aimed for where women can be included and involved better. That was our strategy to see where and how we can involve women and increase their participation."

In the River Nile Site, the team went out of the IP site and included women grain growers in the New Manaseer area and women end users in Atbara city, who are the largest and main consumers of wheat. The IP Facilitator and the Rural Women School[3] coordinator involved women participants according to their roles in farming: "women are responsible for ensuring cleanliness of planting seeds. As such, we focused on that element with women in our interventions in the Farmer Field Schools." This flexibility in adapting interventions to the local context and involving areas outside the IP should not be understated. Quisumbing, A. R., & Pandolfelli (2010) note that this approach of engaging in the inherent variations in gender roles and needs across sites is particularly lacking from gender-related and agricultural interventions in many areas in Africa.

[3] Rural Women Schools are Farmer Field Schools which comprise of women groups. These were formed in the Northern State, namely two groups Dibtod (36 women) and Aghaday (22 women). The group meets once every 15 days over practical learning on topics of choice.

Partners were also sought at the community level. The Country Coordinator and one of the IP facilitators in the River Nile State reiterated that their role was also to build trust and convince male husbands and leaders in the community that the involvement of women is important for the family. “We first worked with the husband and that is key,” explained the Country Coordinator. The Country Coordinator and one of the IP facilitators in Gezira explained that when local people saw that SARD team were serious about the project (i.e. in delivering results on the ground), they become more trustworthy of the project and its objectives. When approached from bringing along their women, men were responsive and indeed women from the IP sites came to field days and value addition trainings. The Country Gender Coordinator explained, “here in Sudan if someone invites a woman to attend a project, it is difficult for her to attend and she may not attend. But if the husband is also coming, then it is easy for her to also come along.” Along the same lines, the Coordinator of Women Rural Schools in Northern State explained that the participant women were often cousins and relatives (e.g., wives) of participant male farmers. This family-oriented approach comes back to the win-win approach followed by the project in which women benefit economically and politically while also the family and the nation more broadly benefits.

The SARD-SC in River Nile simultaneously involved River Nile Microcredit Institution and the General Sudanese Women Union for enabling the provision of oven microcredit and value addition training. The General Sudanese Women Union had extensive experience in facilitating both the provision and repayment of microcredit as well as in recruiting women participants. They also contributed to resources for the training. They provided rural women trainees with housing and meals during their stay for the two-day training. Their approach included targeting impoverished women, entrepreneurial women, and the housewives. They often assigned a leader to ensure that members of the participating group are repaying on time. The microcredit institutions preferred these group approaches, and the involvement of the General Sudanese Women Union in organizing women into groups was essential.

Another example of synergies in providing services to women included collaboration with the Ministry of Social Affairs which similarly preferred providing services to groups of women. The Ministry of Social Affairs provided the Dibtod Rural Women School with credit in the form of a water pump, SARD-SC Gender Focal Point (a female extension agent) formalized the school group and facilitated their registration: “You cannot hold individuals accountable, but you can hold groups accountable. You can ask the group what have you done with the funds, but individuals they are more difficult to deal with.” The Sudan Rural Development Group, also through the fine coordination of SARD-SC, provided credit to a group of women (33 in Alfadlab village) rearing livestock and growing fodder, which is usually provided to men.

Through this group approach, SARD-SC was also able to facilitate the provision of land to women. There are two types of registered groups or associations in Sudan: Voluntary and

Productive. Productive associations require that the member owns land. As explained earlier, women rarely own agricultural land in Sudan. "A woman cannot ask for her rights in land. She leaves it with her brothers. Conjugal relations are not eternal but the big original family will always be there for you," explained the Gender Focal Point. Al Zahraa Association in New Manaseer who has an original membership of 23 women is a Productive Association. SARD-SC encouraged this association of women farmers in their cultivation of wheat and provided access to oven microcredit and value addition training. Some of these women hosted SARD-SC technologies for men and women to learn about during field days. As a result, other women in the community joined the association, and by doing so, they also became owners of land. Currently the membership stands at 60 women. Their husbands agreed to write off land in their names in order for the whole family to benefit. The advantage of Productive Associations is that they can access services not available to the Voluntary Associations such as larger loans.

Both the General Sudanese Women Union and the Nile River Microcredit Association confirmed that through SARD-SC they were able to expand their area of coverage to include women in rural areas, which is usually an underserved population. The shared objective with these institutions for creating job opportunities for women and men in rural areas enabled the collaboration.

These activities have opened cracks for challenging institutional norms related to a sustained focus on urban areas and limited involvement of women in agricultural interventions by opening up new ways to involve women in wheat programing including in value addition, roughing, and hosting of technologies (Classen et al. 2008). Through these interventions, the respective institutions now have the experience to integrate gender into their programing and as such sustain and reproduce these interventions.

Impact on Beneficiaries

It is through the targeted institutional support mentioned above that interventions were designed and delivered to women beneficiaries. The impacts on the beneficiaries, particularly women farmers, are divided into three main categories: field days, value addition, and wheat production. The outcomes for the beneficiaries will be discussed in the following order: impact at the household level, then regional/community level, and finally at the national level. Other means to ensure sustainability of income and livelihoods are also presented as the project targeted these domains based on the interests of the women farmers.

In determining the impacts of the SARD-SC gender activities, we pay attention to gender relations, women's decision-making power (at the household and community level), level of understanding/acceptance of women's economic roles, and level of women's access to factors of production (land, credit, training, and inputs) and workload reduction. As mentioned earlier,

women were involved in the designing of project interventions, implementing it, as well as evaluating it. Table 3 in the Appendix details the number and type of women involved in evaluating the project.

Field Days

The field days led to increased access for women to wheat production information which usually only men can access; sharpened their leadership skills by speaking in public and addressing high level officials; and provided a venue for women to voice their opinion in Participatory Varietal Selections (PVS) and in designing interventions, such as value addition. Some 759 women participated in field days in all 6 IPs, mostly in Gezira State, which amounts to 35% of field day participants (See Table 1 above).

About 20 women during a focus group in Gezira reported learning during field days about the schedule of planting, fertilization rate and schedule, harvesting schedules to avoid shattering, pesticide use, new hybrid varieties and disease identification. All of them were satisfied with the information that they received. According to the Country Coordinator, even men noted that "now our wives know as much as us on improved wheat production." As mentioned earlier in this report, some women are also involved in farming as well as participate in decision-making related to what type of wheat variety to grow. As such the adoption of improved varieties and agronomic practices inherently should involve them and requires that they access the relevant information. This information was also sometimes passed on to women in their own houses, as described by a female IP facilitator in Gezira State, as some women shy away from public spaces.

During a field day in River Nile State, which are often attended by high level officials, the women were encouraged to approach the local Minister of Agriculture for providing them with a water pump. "We approached the Minister. The Coordinator of Rural Women School encouraged us. 'We told him we are irrigating from potable water in the community. This should not be the case: wasting of potable water.' He told us 'come to my office and we shall resolve this'." The women were then provided with a water pump (Figure 2). They were also promised land to farm on with access to good water. Women in Gezira State as mentioned earlier voiced their interests in value addition training which was then actualized.

Figure 2 Pump provided by the local Minister to the Dibod rural school during a SARD field day.

The field days offered job opportunities for women whereby they were constantly hired on the demonstration sites for roughing as "we discovered that women are better at doing roughing," explained the Country Coordinator.

Figure 3 Photo to the left shows women in Gezira state participating in PVS. The middle photo shows women from Dongola University in River Nile State practicing roughing. The photo to the left shows women during a field day in the Northern State.

In general, at the community level the field day activities in the four states acknowledged women in their own right as farmers who are provided with extension advice and voice in decisions related to intervention design and PVS for gaining their buy-in into the adoption of new agronomic practices and wheat varieties.

Value Addition

In total 900 women were trained in value addition in Gezira, followed by 750 in Rive Nile, 128 in Northern, and 115 in Kassala states. The Gezira state had the biggest share of the value addition training as it had the highest proportion of wheat harvested area (Figure 1), and wheat contributed to 70% of its population's diet. The impact of the value addition led to increased potential for women to generate income (for about 50% of the 61 women participants interviewed for value addition), persuaded women end users to consume local rather than

imported wheat varieties, and enabled women to meet the household requirement for wheat-by products thereby reducing costs of purchasing from outside.

In Gezira, women mentioned learning how to bake different types of pastries at a large scale and using fewer ingredients. Some 80% of the respondents appreciated a recipe called “guest at the door” in which dough is prepared in ten minutes reducing their workload in preparing dough. Almost all the respondents explained that through their training they learned how to make recipes which they usually buy from shops, including bread. As a result, they were able to save money in their households. About 5 exhibitions were held in Medani in which women sold their bakery products (Figure 4). This also increased their self confidence in making and selling baked goods. Four of the 20 women participants interviewed in a focus group in Gezira, were also selling from the recipes that they have learned at the training.

These trainings created changes in perceptions for the communities more broadly with regards to locally grown wheat being suitable for bread and pastry making. Focus groups with different classes conducted earlier in 2015 revealed that the most preferred flour for baking was SAYGA which is imported wheat. These trainings clearly created acceptance for using local wheat in baking among the women trainees. Many women explained that they had trained their daughters, daughters-in-law, neighbors, and friends on the new recipes, products, and approaches for baking using local wheat. Various wheat recipes were matched to the optimal wheat varieties (Table 2). At the policy level, the chair of the wheat varieties release committee agreed to include a mandatory component for testing the baking quality of new varieties using both criteria and for recipes deemed important by local women.

Table 2 Local Vareities Testing Results for Optimal Wheat By-products

Variety	Wheat By-products	Location
Zakiya	Sanasil and Fateera	Northern
Imam	Bread	Northern
Zakiya	Biscuits	Gezira

Figure 4 Exhibit for selling value added product in Medani, Gezira State.

Focus groups with 25 women in Atbara city revealed that they were also able to save money through gaining skills on how to make bread and pastries. Most notably, they could access microcredit consisting of an oven and gas cylinder. The beneficiaries included a diverse type of women: the widowed, young, older, working women, and housewives. The repayment amount was 80 SGP per month for a total amount of 700 SGP. Up to a third of the women we met in the focus groups, were selling wheat byproducts. From those women who were selling, some explained that through their training they refined their skills, while others mentioned selling baked good for the first time after gaining the skills. Such was the case of one young lady. Her mother encouraged her to bake for selling and she even repaid the loan of her daughter's oven during lean seasons of baked good sales. Almost all involved women mentioned that the two-day training along with the oven microcredit allowed them to reduce the money spent on baked goods, particularly daily needs of bread, to a half saving 9-20 SDG per day depending on the size of the family.

It is important to mention here that baked good consumption, apart from bread, is mostly during festivities. All women of the 25 women explained that they were very happy with the value addition training and oven microcredit. Repayment periods and amounts were relatively affordable; also, many mentioned this is the first intervention of its kind. About 30%, explained that the oven was also a source of income and benefitted the community more broadly through increasing access to ovens. Few households in the area had an oven. As such, many could rent out their ovens which they obtained through the microcredit for a fee. It is important to note here that the oven required less work in cooking than other traditional methods (see Figure 5).

Figure 5 Atbara value addition training along with the oven and gas cylinder microcredit.

One lady, the women in the focus group reported, could repay two months of her loan and buy material for selling baked goods through renting the oven for 10 SDG per tray of baked goods. This woman is a widower. The demand on this microcredit and trainings continues to be enormous, as explained by the respective microfinance coordinator, and the repayment rates are very high "only 20 out of the 750 microcredit beneficiaries have not repaid their loans." Rural areas were also targeted in the value addition training and credit provision in the form of groups. Some of the training for rural areas was also conducted in the villages.

The women participants were also sensitized on the need to consume locally produced wheat instead of imported wheat. As one participant puts it, "why use Australian wheat when we can consume our own wheat and keep the money in our communities." Furthermore, through their involvement in value addition training, they could overcome a crisis in flour availability. Reduced subsidies have impacted the import potential of major wheat companies, namely Sayga, Weeta, and Seen, and has led to record levels of price increases of wheat flour in the local markets (Siddig & Grethe, 2015). This led to reduced availability of baked goods in the country. Thus, many women trainees had to depend on their baking skills to meet their household needs. A few of the trainees increased their sales at the level of the community due to the crisis of wheat flour.

The training was advertised on local television, and the trainees were given certificates and microcredit (Figure 5). Officials at a very high level were invited to inaugurate the training program. The women appreciated the political support that they received from the *Wali*, local mayor, in the area. This raised their self-confidence and faith in their entrepreneurial abilities to repay the loan. Like value addition activity in Gezira, a local exhibit of the baked goods aimed at the selling of the products (Figure 5). Almost all women participants in the focus groups mentioned controlling the income from the resulting sales. They used this income mainly for repaying the loan, investing in household items, or providing their children with extra income. Those whom did not sell, explained that they repaid through their husbands as they saved money by meeting household consumption of baked goods through baking inside the house and initially gained the support of their husband to obtain the microcredit.

In all focus groups related to value addition in the three states, women mentioned feeling safer about the bread their families are consuming. Sometimes, despite it being illegal, bakeries added potassium bromide (a carcinogen) to bread and pastries for increasing the volume of the dough.

Wheat Production

Our findings reveal that men were more likely to appreciate their wives' work in wheat production when their wives became participants in a SARD-SC training program. This was reported elsewhere in Africa (see Friis-Hansen et al. 2012). One husband in River Nile as well as another in Northern State both appreciated their wives work and, unlike other husbands, did not attribute a '*helper'* role to their wives in wheat production.

Fatima[4] has 18 acres of land. She inherited her land from her father who had no sons and no brothers to also inherit with her. She cultivated SARD wheat seeds in the past year which were provided to her by the Rural Women School coordinator. She does not plant wheat for sale but

[4] Name changed for confidentiality

for home consumption (Figure 6). Wheat cultivation is manual in her area due to many reasons including the hilly terrain. She is experiencing water shortages but hopes to resolve this problem through deepening the well in the field. She saved planting seeds from the Imam variety for next season, and her neighbors requested that she sells them planting seeds. She had agreed to do so.

Figure 6 Fatima and her husband are evident in the photos as well as the water well.

Another woman farmer in River Nile, is Jameela[5] (Figure 7). She produced 13 bags of wheat grain per acre (which is a high number in the high terrace lands). She sold 6 bags (each bag is a hundred kilos) already. Jameela is a typical example of women farm managers in the area. Her husband works in gold mining. He helps her with farming when he is around but she is the main farm manager. Many women pointed Jameela to us as the best woman farmer in their village. She explained that she has higher yield than others because "I work hard. They stay in the shade and watch T.V. I stay here, weed, and take care of the land all day." Jameela also hosted demonstration of technologies for both SARD and the Ministry of Agriculture, which many women and men farmers also visited during field days. She gained an award for her dedication to farming from the local Ministry of Agriculture. She is a role model and visible symbol that women are farmers in their own right at the community level.

Figure 7 Jameela working her land. Her husband and land she plants with wheat is evident.

[5] Ibid.

Both women reported that obtaining the permission of their husbands by the project enabled their participation. The project made available improved varieties of wheat (planting seeds) early in the season which was key for improving wheat production. The World Bank (2010) reports that delays in input provision in Sudan is one of the key obstacles to agricultural production. For Fatima, seed dressing with Gaucho was also important as termites and birds are significant threat to wheat production in her area.

We visited Alzahraa Farmers Women group (Figure 8). We found that the membership of the Zahraa association almost tripled (from 24 to 60) due to SARD activities, particularly due to the seed distribution activity and especially due to the value addition training along with the provision of oven and cylinder microcredit. As mentioned earlier, the Zahraa is a Productive Association meaning that members in this group need to have land to join. Thus, new members who joined for gaining planting seeds or the training and oven microcredit had their husbands write land in their name. The project indirectly led to an increase in the number of women who own land. The women mentioned that their husbands did not mind that they transfer land ownership to their wives if the household more generally benefits from the activity.

Figure 8 SARD-SC provides improved seeds and technical backstopping to Al Zahraa Women Farmers Association in the New Elmanaseer, River Nile State.

Twenty-four women farmers and land owners were provided with one acre worth of wheat seeds by the SARD team. Most of the 24 women who were provided with wheat seeds kept the produce for their household consumption. One woman, however, explained to us that she controls the product coming out of her land as her own surplus income: “My husband does not depend on my wheat. I can sell it if I please. I shall wait to see the market prices.” In addition to seeds, the women were also provided with information about the technological package (see Figure 8), which included appropriate planting and irrigation schedule as well fertilization doses.

Most notably the women in Al Manaseer could access machinery through the project for ploughing the land and harvesting. The Agricultural Bank which provided mostly men with microcredit, through the SARD-SC Project, introduced machinery in the area for farmers’ use.

Women were encouraged to use this machinery by the SARD-SC team. This considerably decreased their workloads. Many of the women reported using this machinery for the first time. Along the same lines, in Gezira state, the women reported that the SARD-SC Wheat Project led to increased use of pesticide which has decreased their workload in weeding. Also, in River Nile State, the women, who are often responsible for the cleanliness (purity) of the planting seeds, reported a decrease in their workload because the seeds distributed by SARD were clean already.

The quantitative survey in River Nile area revealed that there is a 1.6 bag difference in yield per acre between men and women with the men experiencing the higher yield. Women's top three approaches for befitting from the SARD-SC interventions in order of priority included additional wheat production for consumption (75%), increased household income (12.5%), and increased knowledge (12.5%). Women compared to men also revealed an equal dependence on agricultural machinery the provision of which was facilitated by the project.

Other means to ensure sustainability of income and livelihoods

In addition to women's involvement in value addition and wheat production activities, their involvement in other livelihood enhancement opportunities through SARD-SC were also unique and enhanced the food security of their households. Many extension agents explained that vegetable production through the Rural Women Schools in Northern State (which also focused on wheat value addition) is a pioneering experience in Sudan. The women in Dibtod Rural School (36 members) worked together on exchanging vegetables in the year 2014. They were divided into nine groups and each group was responsible for cultivating a crop, including zucchini, *molokhia* (leafy vegetable), watercress, *ajour* (dry land cucumber), okra, onions, and eggplant. The women picked this topic for learning during the initial stage of Rural Women School formation. The women exchanged these vegetables between the sub-groups and a few (10% of the 36) also sold vegetables. The following year in 2015, the group cultivated okra on family land belonging to one of the women which was largely used for home consumption.

Another Women Rural School, called Aghaday (22 members), also formed more recently in 2015 in the area based on the success of Dibtod Women Group. The school similarly meets every 15 days, and women expressed interest in learning about horticulture and value addition. All of those interviewed (22 women) praised the information and applications that they go in the school. As they used to lose many of the fruit flowers but learned how to avoid that through irrigation. Most notably, the women explained that they picked the location of the school to be inside a deserted house which made their gatherings possible. "We cannot learn in the 'street' like men. We have to be inside, in a walled venue," explained one of the members in Aghaday women school. In both rural schools of the Northern State about one third of the women also attended the value addition training. Some (5%), sold value added wheat products to local

shops. One woman who started selling after the value addition training told us that the local culture does not encourage women to sell, “people keep telling me. Your husband works in Saudi Arabia and you are selling. But I want to sell for making money: I want to build my son a nice house for his marriage.” These women challenged gender norms related to entrepreneurship.

“In the beginning the men mocked us, ‘so you will grow onions in this Women Rural School’ [onion is considered an inferior crop]. But then they came to respect the group and in fact many men learned and benefitted from the approaches taught at the Women Rural School,” explained the coordinator of the Rural Women School in Northern State. One member of the Dibtod School further explained that “my brother in law. He was impressed in our planting approach. He asked me to use the okra seeder. I let him use it. He benefitted because he did not have to hire manual labour for planting.”

A micro-credit was provided to women in River Nile State and also targeted a group of 33 women in Elfadlab village. The group were divided into three sub-groups with a leader for each, responsible for repayment and coordinating three entrepreneurial activities: a group cultivating 4 acres of *berseem* fodder, another group fattening 13 sheep, and a third group fattening 2 calves. The Sudan Rural Development Company provided microcredit through stakeholder engagement in the respective SARD IP. Through growing *berseem* on a 4-acre farm, the women felt that they challenged gender norms as women are not encouraged locally to manage a four-acre farm. The success of these women who also sold surplus *berseem* led to changes in perceptions to what women are capable of in farming. The women were also provided with technical backstopping in raising livestock, irrigation, and planting the *berseem*.

Lessons Learned and Recommendations for Out-scaling Potential

This case study from Sudan outlined specific examples of how agricultural research can try to address gender inequalities (in access to information, inputs, recognition, decision-making power, and land) in the approach and method of action research (development interventions).

Findings reveal that tailoring interventions to the varying local contexts and strategic collaboration with partners improved levels of access to factors of production (land, information, inputs, credit, and job opportunities) for different types of women (in different locations and of different generation, social backgrounds, and marital status). Involving women, through gaining trust and approval of male kin, in strategic stages of intervention design was also important and led to innovative interventions. This included value addition and baking quality testing, and interventions which elevated the position of women rightfully as farmers and clients institutionally. At the community level, they included women hosting

demonstrations and technologies as women are often perceived as helpers by local male relatives and institutional bodies alike.

Advocating for women's involvement as beneficial for the whole family was particularly successful. Some men ceded land to their wives, who more generally have one of the lowest rates of property ownership in the world, due to the belief that the whole family will benefit from doing so. Women benefitted through:

- an increased ability to generate income (for 50% of those who participated in the value addition training and for the women from the poor class who now can work for a pay in roughing);
- a reduction in workload through the introduction and/or increasing the availability of 5 main interventions (mechanization, clean planting seeds, pesticide use, gas ovens, and expedited value addition recipes); and
- an increase in decision-making power through a-leadership strengthening in field days and key meetings, b-sustained control over income related to wheat value addition profits, and c-more informed decision-making in adoption of new wheat varieties and agronomic practices.

Both the interventions themselves and the approach for engaging with local beneficiaries and institutions offers valuable outscaling potential due to covering a wide range of contexts (mechanized, labor-intensive, different degrees for male outmigration rates, and for different types of women) and with various types of institutions (microcredit, training, women-focused, gender-mixed, agricultural, and urban) all in the context of alleviating poverty, increasing yield, and enhancing food security by improving self-sufficiency in wheat production. Taken together, SARD-SC interventions take a multi-relational approach which is essential to resolving gendered obstacles in agricultural production which are hierarchical and complex.

It is thus recommended that this multi-scalar and multi-sectorial approach is replicated to other areas in Sudan and AFDB projects. AFDB's gender strategy which focuses on both instrumental gains and addressing gender inequalities meshes well with this integrative approach. To strengthen these improvements in participation and institutional and local capacity building in overcoming gender inequalities in wheat production and processing, the following is recommended based also on consultation with the women beneficiaries and other key stakeholders. Specific research questions are also outlined.

Facilitate the provision of mills in the local communities. Women in both rural and urban areas explained that the lack of mills limits them in their abilities to use local wheat and increases their dependence on imported "white" wheat. The current mills are far from their communities and produce "dark" wheat flour. The mills must be able to grind at a very fine level after dehulling (to gain white flour). Furthermore, women recommended that both men and women

benefit from the operation of these mills. The project should investigate the extent to which women can access new mill infrastructure, as well as the leadership roles that they play in their management and function.

Involve a higher number of women in production interventions (grain growing and hosting of demonstrations), particularly in Gezira State. Women and men participants in the focus groups in Gezira explained that women farmers in other villages and of lower class are leading farming activities in wheat production. It is important that the project also supports this category of women given its inclusive approach also to increase the visibility of women farmers as capable of managing large scale farms and as role models for others.

Increase linkages between IP sites for strengthening the potential of in-country out-scaling. It is important to determine the successes in individual IP sites and examine the replication potential in other IP sites and projects in the country, for example, by fostering interactions between women leaders from each IP site to share best practices. What are promising successes in each of the IP sites? What are possible approaches for out-scaling these successes to other IP sites and other projects in the country?

Facilitate the provision of credit to women wheat farmers, especially in the New Manaseer area in the River Nile State. Women in this area are highly involved in wheat production. Women farms, as seen earlier, however, experience lower yields than men due to a limited ability to purchase inputs. Furthermore, most of these women are only able to cultivate 2 acres of the 6 acres received also due to limited ability to purchase inputs. As such, for the most part they cultivate wheat for home consumption. These women already own land and their access to agricultural credit should not be a problem and would enable them to expand their farming area and move into commercial wheat farming. The crediting bank also buys their wheat as is the case currently with men landowners.

More focus is required on value addition interventions, in particular technologies which reduce women workload, post-harvest losses, and improve product quality. What technologies are promising in reducing women's workload and post-harvest losses and in improving product quality? What are the appropriate approaches for their dissemination?

Provide markets for women for selling value added products, especially in Gezira. Lack of markets was identified as an obstacle for entrepreneurship by also the youth trainees. The women, also recommended that SARD provides them with ovens and markets in order to generate income. Indeed, as mentioned earlier the project has purchased large scale baking equipment with the purpose of income generation for women in groups. It is important to also focus and identify market niches where there is promising consumer demands (for example specialized pastries in Gezira).

Actualize at the policy level the inclusion of a baking test, using criteria derived by the local women, before the release of a new wheat variety. This has adoption implications as many farmers, especially in the River Nile and Northern States, mainly grow for household consumption. This also strengthens women's leadership roles and decision-making power.

Consider the progress of women farmers relative to male beneficiaries of this program, particularly in meeting the objective of increasing domestic wheat production. How will this program consider the sustainability of its activities in the long return on women's farming and value addition activities as well as women's participation? How can the project continue to increase the numbers of women involved? What access to land and resources is possible at larger scales? Who can support and leverage these efforts in the long term?

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Appendix

Table 3 List of activities and the respective objectives, approaches, stakeholders involved, location and indicators.

SARD-SC activities	What do you want to achieve	How it will be achieved	Who should be involved	Who is responsible	Obstacles you for see and how will you surmount it	Location	Indicators (sex disaggregated)
Technology generation (adapting technologies to the local context of Sudan)	-Women voices and preferences included in PVS processes -At least 30 percent of participants are women	-Hiring women extension agents -Hold the PVS during time good for women	-Breeders -IP facilitator -Women extension agents	-Country coordinator (budget, power to actualize) -Gender Focal Point (expertise)	Recruit women to participate which have a busy schedule by getting buy in and support from their husbands and male leaders	Northern -Gezira	-Collect sex-disaggregated data -Women preferences are delivered to the breeder -Baking test included in the process of PVS
Capacity building	Training female/male research staff	Conduct a training in different aspects related to wheat projects	-IP facilitator	-Country coordinator (budget, power to actualize) -Gender Focal Point (expertise)			- percent of female (research/ extension staff) trained
Capacity building	Training of female household member in food processing	Conduct a training for women in food processing for income generation and/or increased contribution to food security	-IP facilitator -Food processing specialists	-Country coordinator (budget, power to actualize) -Gender Focal Point (expertise)	Determine a suitable place and time for this training	-River Nile -Gezira	-100 percent of beneficiaries in training are women -Timing of training relevant to women - Benefits of training on food variability and heath
Capacity building	Increase HH income	Involvement of microfinance institutions to support agric-small enterprises as food processing	-IP facilitator -Micro finance institution (MFI)	-Country coordinator (budget, power to actualize)	To identify market needs and bringing women and fund	-Rive Nile State	-Number of business identified by MFI to be financed -Number of women involved in business - percent of inc. in HH income.

				-Gender Focal Point (expertise)	institute in one place		
Capacity building	Raising awareness of project staff on gender integration	One day meeting to enhance knowledge on gender issues as roles, needs, collecting disaggregated data, ….		-Country coordinator (budget, power to actualize) -Gender focal Point (expertise)		2 IPs	-50 percent of SARD team sensitized on gender issues. -50 percent of SARD colleagues include gender in their interventions

Table 4 Type of stakeholders and type of interactions employed for data collection during June and August 2016.

Location	**Type of stakeholder**	**Type of Interaction**
Gezira state	Country coordinator	1 Interview
	IP Facilitator	1 Interview (female)
	Value Addition Coordinator	1 Interview
	A group of women trained on value addition	1 Focus group with about 20 participants
	Men involved in grain growing	2 Interviews
River Nile State	Women hosting SARD technologies	1 Interview
	Husband of women hosting technology or growing grain	1 Interview
	Women growing grain (Alzahraa association)	2 Focus group with about 10 participants in the first and 4 participants in the second
	Women fattening livestock and growing fodder (*berseem*) through group microcredit from the Sudan Rural Development Companies	2 interviews with 2 women beneficiaries in Elfadlab village
	Women trained on value addition in rural areas who also received oven micro-credit	1 Focus group with about 6 women
	Women trained on value addition in urban areas who also received oven micro-credit	2 Focus groups with about 10 participants in the first and 15 participants in the second
	Soil scientist working on improving the fertility of high terrace soils via chicken manure	1 Interview
	Female extension agents	2 Interviews
	Male extension agents	1 Interview
	River Nile Microfinance institution	2 Interviews one with the head of the bank and another with the coordinator of oven micro-finance
Northern State	Women Rural School in Dibtod	2 Focus groups with about 10 participants in the first and 26 participants in the second
	Women Rural School in Aghaday	2 Focus groups with about 10 participants in the first and 12 participants in the second

	Female extension agents	2 Interviews
	Male extension agents	1 Interview
	Female grain grower	1 Interview
	IP Facilitator	1 Interview (male)
	Husband of women hosting technology or growing grain	1 Interview
	Woman involved in large oven group production activity (one oven per IP)	1 Interview