

# **Gendered Perspectives on Agricultural Innovations Adoption in Egypt**



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# Introduction

Innovations both social and technological are important for increasing agricultural production. Innovations, however, that do not consider social and gender norms and practices may not optimally effective and can be detrimental especially if the technology involved displaces manual labour and results in losses of income or increases workloads. This study was designed to collect sex-disaggregated data on the effectiveness and usefulness of agricultural innovations that have been introduced in the Old and New Lands in Egypt in the past decade. Two hundred surveys (100 unrelated men and 100 women) were carried out in the Old Lands of Egypt, which were originally cultivated by the inundation of the Nile River. An equal number of surveys of men and women was carried out in the New Lands, which have only become cultivable since the construction of the High Aswan Dam. These surveys were carried out to collect sex-disaggregated data on usefulness and perceptions of usefulness of the most useful innovations, sex-disaggregated data on reasons for adoption of identified innovations; sex-disaggregated data on problems faced in agricultural production; sex-disaggregated data on most and least useful sources of information about agricultural innovations, sex-disaggregated data on adaption of adopted innovations; sex-disaggregated data on broader impacts (if any) of adopted innovations upon household and the communities at large; frequency and nature of interactions with extension agents and water engineers; types of information needed from these officials; sex-disaggregated data on roles and decision-making in agricultural production. Survey data was complemented with semi-structured interviews with 50 women and 50 men in order to provide more nuanced explanations for the survey findings.

# Methodology

The research employs an extended case study approach to understand women's and men's experiences with different types of innovations (Burawoy 1998). Case studies are used for in-depth exploration of a tangible theme such as a process or an event where researchers collect detailed information using a variety of data collections methods (Creswell 2002).

The primary fieldwork for this study was conducted with a total of 550 respondents. We conducted a survey with 200 men and women in each of the Old and New Lands in order to understand the experiences with innovations (adoption, adaption, interactions with extension agents) as well as problems faced in agriculture and needs for having thriving agricultural enterprises. Survey data was complemented with semi-structured interviews with 50 women and 50 men in order to provide more nuanced explanations for the survey findings. The interviews lasted between two hours and an entire day. The interviews were aimed at understanding in more nuance preferences for innovations, underlying reasons for adoption and impacts.

The literature on agriculture policies as well as our empirical primary findings from this study reveal that structural adjustment policies which have been implemented since 1991 led to a dramatic increase in price of agricultural inputs and land rentals which fueled landlessness and increased rural inequalities (Bush 2007; Bush and Broomley 1994; Bush 2004). By 1997, landowners who had been evicted from their lands in previous decades and their families made up 10 percent of the Egyptian population (ibid). Only 1.5% of farmers who had been evicted from the Old Lands were given 2.5 acres of land each and a house in the New Lands (Saad 2000). This group of farmers had previously been awarded land in other areas in the 1950s when President Nasser introduced land distribution schemes by imposing land ceilings on large

landowners. President Mubarak introduced ‘Law 1992’ in the 1990s to return some of this land to the original owners (Bush 2007).

Another policy of relevance to our work and case study areas is that of distributing land to women in the New Lands, particularly in the Mubarak Resettlement Scheme (MRS). Land reclamation and redistribution efforts in the past in Egypt have always been gender-blind, resulting in extremely male-biased titling of land in the names of male “heads of households.” Our fieldwork revealed that the World Food Program provided food aid to settlers in the Intilaq settlement (one of 24 settlements of the MRS) in Noubariya on the condition that women receive 20 percent of the distributed land titles. Settlers accessed land and housing in nearby villages. Each distributed parcel of land was either 2.5 or 5 acres. Settlers who held a university degree or diploma were allowed to access 5 acres of land and a homestead in a nearby village. The rationale provided for this in the MRS was that endowing educated unemployed people with land might motivate them to take up farming or to open businesses in order to support themselves. Women in rural Egypt have limited access to credit, inadequate land rights and are often reported to be largely excluded from agricultural extension services (Larson 1991; El-Tobshy 2005; Barnes 2013). This is because women are always relegated to ‘helper’ status and not understood to be farmers in their own right (Badran 1993; Jensen 1994; Larson 1991). Barnes (2013), for example, finds that although many women irrigate the land in the absence of a male head of household, extension agents and engineers still refuse to acknowledge the fact that women are involved in irrigation and often actively undermine their contributions. We wanted to see if women landowners in the New Lands fared differently with regards to access to extension services and adoption of innovations.

The Sustainable Agriculture Development Strategy 2030 (2009, SADS) aims to fulfill several relevant objectives to be met during the period 2010-2030, including increasing the productivity of both the land and rural units, increasing the competitiveness of agricultural products in local and international markets, improving the living standards of the rural inhabitants, and reducing poverty rates in the rural areas. It is worth noting that the agricultural strategy has indicated a number of policies and programs that would address rural women directly, e.g. through provision of income generating activities (dairy products, meat production, poultry production and fisheries) as well as linking them to markets and facilitating access to finance.

The uprising of 2011 led to important social and policy changes which are affecting the agricultural context in both the Old and New Lands. In the Old Lands of Kafr Sheikh irrigation development projects were halted and in the New Lands of Noubariya additional land distribution programs were also halted. It was also reported in Noubariya that the government stopped subsidizing export of oranges which led to sharp income losses for the many men and women farmers who cultivated oranges that are now as a result sold locally at much lower and unprofitable prices. The cotton produce in Kafr Sheikh was similarly affected by the loss of export markets. This was partially attributed to mixing different varieties (long and short) of cotton back in 2006. The resulting planting material was also mixed which made export of cotton and its use in local textile factories difficult.

We collected data in two areas in rural Egypt, which have common socio-cultural, historical and economic characteristics but differ significantly in socio-cultural norms, economic

and political context for women's roles, responsibilities, social status and land ownership rates. We worked in the Noubariya area (the Intilaq settlement) in the New Lands, and Kafr Sheikh (Sidi Salem) in the Old Lands. The New Lands are desert lands that have been reclaimed since the Revolution of 1952 and the building of the High Aswan Dam. The Intilaq settlement in Noubariya was only reclaimed in the 1990s by the Mubarak Resettlement Scheme (MRS) under the Ministry of Agriculture and Land Reclamation.

In Kafr Sheikh (in the Old Lands) the parcels of land are smaller (one acre<sup>1</sup> on average) and large, extended families typically work the land. Plot sizes are smaller in Kafr Sheikh, averaging less than an acre. Consequently, farmers in Kafr Sheikh tended to farm on multiple parcels of land (2-3 on average). By contrast, in Noubariya (in the New Lands) settlers typically have larger farms (between 2.5 to 5 acres) and they typically relocate to the area and farm the land as nuclear families. Some of the farmers who had previously been awarded land in the 1950s but were evicted in the 1990s were compensated with desert lands in Noubariya. The larger areas of cultivable land in Noubariya (compared to Kafr Sheikh) and the smaller number of family members, especially in the Graduate category, created wage labour opportunities in Noubariya on a regular basis for the landless poor, who also migrate (temporarily and seasonally) as families to the New Lands from other areas of Egypt in search of wage employment. Kafr Sheikh (in the Old Lands), on the other hand, has better established access to basic services such as government offices, health care and transportation.

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<sup>1</sup> The most commonly used unit of land in the MENA region is feddan, which is a unit of area measurement that originated in Syria, Sudan and Egypt, and is equivalent to 1.038 acres. Feddans will be reported as acres for simplification purposes. Each feddan is made up of 24 kirats. Kirats will be reported as kirats.

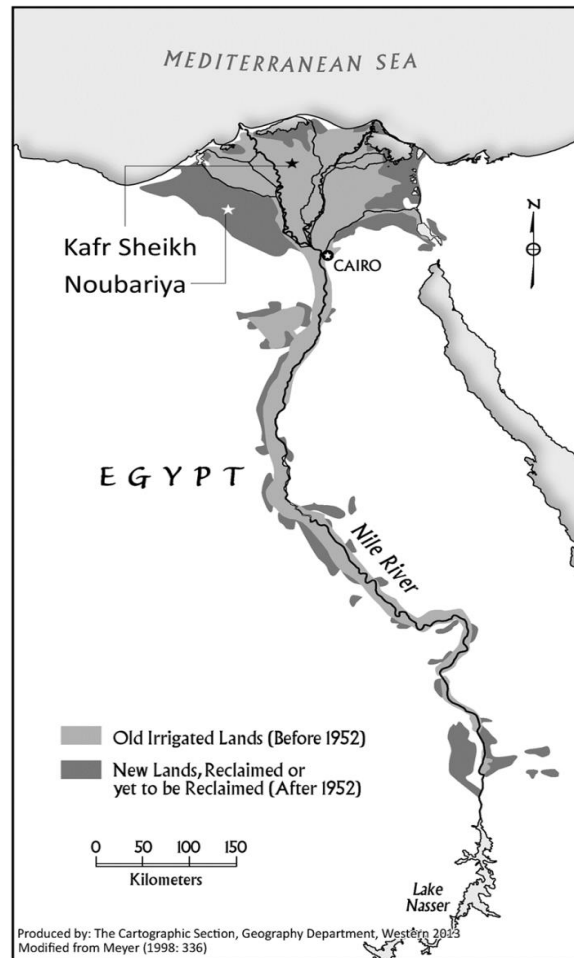


Figure 1. Case Study Locations in the Old and New Lands. Noubariya and Kafr Sheikh (adapted from Meyer 1998).

In rural Kafr Sheikh the production is primarily focused on field crops such as wheat, rice, cotton, alfalfa, and corn. Sugar beet cultivation and livestock production are among the most profitable in this area. The Intilaq settlement in the New Lands, on the other hand, is more actively focused on commercial fruit production and less on annual crops, such as vegetables, potatoes, peanuts, wheat and beans. Some villages which are inhabited by the ‘evicted tenants’<sup>2</sup>, however, also engage in horticulture, but primarily rely on annual crop production (such as

<sup>2</sup> As previously described, this category of farmers lost their lands due to the Tenancy Law of 1992, which was applied in 1997 (Bush 2007). It gave back original landowners their lands, which Nasser had initially seized for landless peasants in the 1950s.



wheat, peanuts and alfalfa) due to inadequate funds for commercial fruit production and smaller plots of land.

## **Findings and Discussion**

We draw on findings from the survey and qualitative interviews in this section to highlight the most important innovations identified for men and women in the two study areas and the underlying reasons. In this study we define innovations in rural livelihoods as technical changes in crop or livestock production and processing (e.g., a new seed varieties or animal breeds, new irrigation technologies, or new machinery), institutional changes (new lending or extension mechanism) and/or social changes (e.g., labour arrangement or collective action to gain market access) (Badstue et al. 2018). We then move to examine gendered access to information in the two areas and information needs, adoption of innovations, the nature and sources of these innovations as well as the underlying reasons for adoption. We also examine which of these innovations led to broader changes in the society and whether participants improved these innovations to better suit their needs. We end by examining pending needs for enhancing existing agricultural enterprises.

### *Most Important Innovations*

For both men and women, in both regions the most important innovations for men were largely related to new machinery, including harvesting machinery and seeders. Both men and women reported the following reasons for their ranking: reduction in workload, reduction in money spent on hiring labourers, more yield (as post-harvest losses are reduced), reduced use of fertilizer, more income from the crop and less time needed to complete tasks (e.g., harvesting and planting). Following, in both locations and both men and women mentioned new seed varieties as most important innovation for men. While new rice varieties featured prominently in

Kafr Sheikh, new wheat varieties featured more prominently in Noubariya. Kafr Sheikh is a rice zone, with an alternating ‘dry and wet’ crop rotation enforced by government policy through Local Agricultural Cooperatives (LAC), which oversees also the distribution of planting material and inputs at slightly subsidized rates, often rice is alternated with corn and/or cotton in the summer season. Underlying reasons for choice of new seed varieties that were identified by both men and women included resistance to disease, more yield, more income, less water consumption, household consumption, subsequent saving of purchasing costs, better taste, and early maturity.

Next in number of mentions in Noubariya, fruit tree introduction was deemed most important innovation for men by both women and men with the following reasons mentioned by both genders: income generation, increased production, disease resistance, different maturity dates (this can ensure production over longer periods of time when different fruits which mature on different dates are planted), household consumption and subsequent cost savings. This is not surprising given that fruits are cash crops in Noubariya for both export and nearby tourist markets. Irrigation was next in mention by both men and women in both regions as one of the most important agricultural innovations for men. The new irrigation technologies, however, differed between the two regions. While drip and sprinkler irrigation has enabled the cultivation of fruits and other cash crops in Noubariya, *tatweer*—underground system of drainage and irrigation, which women and men farmers in Kafr Sheikh said requires less time and saves water. Similarly drip and fixed sprinkler irrigation in Noubariya was ranked as important for these same reasons by both genders. The following reasons were reiterated for men’s and women’s choice of irrigation technologies: reduced effort and time, more water availability, and increasing production. In Kafr Sheikh men and women also mentioned additional reasons related to

improved soil fertility and quality of land. *Tatweer* also controlled for harmful impacts of salinity through better drainage via underground pipes.

Table 1. Most important innovations for men in the study areas.

Innovations	Location				N
	Kafr Sheikh		Noubariya		
	Women	Men	Women	Men	
New wheat varieties	3	14	17	21	55
Combine and other harvesting machines	47	38	13	16	114
Other big machineries	4	19	15	3	41
Seeder (settra) / driller	19	2	5	7	33
Pulp hatching machine	9				9
Development of irrigation systems	11	13	5	11	40
Media				3	3
New varieties of seeds		3	1	1	5
New varieties of rice	4	10			14
Fruits			18	14	32
Training			3		3
Inorganic and organic fertilizer (silage)	3				3
Pesticides-yellow trap -herbicide			4	5	9
New breeds of big ruminants			9	1	10
New breeds of small ruminants				2	2
Cultivation of vegetables		1	5		6
New varieties of vegetables				3	3
Feeding big ruminants			1		1
Loans			1		1
No innovation for men			5		5
N	100	100	102	87	389

Men and women felt that the most important innovations for women were largely related to poultry. Both men and women gave the following reasons for their choice: source of meat, source of income, good taste, rapid growth rate, increase home consumption, and save costs. Similar reasoning was given for new livestock breeds: more yield, generating income and saving of money. Women in both regions often engaged in selling surplus of dairy and poultry in the

market or locally from their homes. Men, on the other hand, were responsible for selling live animals (reported elsewhere in Egypt see Sharp et al. 2003). A milk collection point in Noubariya along with the simultaneous introduction of Holstein cows, which produced much more milk than buffalo (the local breed), were considered important innovations for women as they provided income generation opportunities for women. However, the middlemen determined the price of the milk and women complained it was low. Next in ranking in Kafr Sheikh were storage structures for seeds, seed drums. This protected consumption and planting seeds, particularly wheat, from pests. The storage structure was also deemed important for sustainability of planting material. Following women and men felt that harvesting and seeding machinery in both areas are important for women which they explained is, similar to justifications provided for why these innovations are important for men, related to saving time, effort, crop loss, and money in hiring labourers. For the most part, in KFS farmers, especially women (72%), resorted to exchange labour to save up on costs of hiring labourers during peak seasons of harvesting, weeding and planting (Table 3). Cotton crop was especially reported to be labour intensive during the harvesting season and rice during the planting season.

Table 2. Most important innovations for women in the study areas.

Innovations	Location				N
	Kafr Sheikh		Noubariya		
	Women	Men	Women	Men	
New wheat varieties	4	6	4	5	19
Combine and other harvesting machines		14	2	2	18
Other big machineries		7	10		17
Seeder (settra)/ driller	2	9	9		20
Oven and other small machines	5	2	4	10	21
Development of irrigation systems		1	1		2
New varieties of seeds		1			1
New varieties of rice	3	2			5
Fruits			3		3
Poultry breeding	55	13		4	72
New varieties of poultry	3	11	37	16	67
Rabbits		1	1		2
Storage of crops	11	21			32
Inorganic and organic fertilizer (silage)	7				7
Pesticides-yellow trap -herbicide		1	4		5
New breeds of big ruminants	10	2	14	6	32
Cultivation of vegetables			1		1
New food recipes		5			5
Day care and schools				1	1
Dairy processing		2	3		5
Field work		1			1
Home equipment's				1	1
Village development				1	1
Feeding big ruminants		1			1
Feeding small ruminants			1		1
Loans			2	1	3
No innovation			5		5
N	100	100	101	47	348

Labour exchange, locally known as *zamala*, was reported as a social innovation which have increased in the past two decades due to reduced profitability of agriculture. This was

attributed to a decrease in subsidization of agricultural inputs, decrease in land size, and loss of land titles due to law 1982. In Noubariya, respondents reported that labour exchange considerably decreased in the past few years due to sharp increase in the profitability of farming in their area. They explained that as they have resettled the desert lands they were cultivating field crops for livestock feed, pumpkin, and wheat. With time, and after the introduction of drip irrigation and with abundant bank loans linked to land titles, they started producing fruits. This change in crop type also meant that farmers in Noubariya gained substantially more income which now they can use to hire labour instead of depending on *zamala*. These findings suggest that structural adjustment policies in subsistence areas have increased the workloads of women and demands on their ‘free labour’. Along the same lines, men renters in Kafr Sheikh repeatedly reinforced that landowners should also pay for the wages of hired workers. Their refusal to do so had placed significant demand on women’s collective reciprocated labour in the community, as many considered it to be “free.” Our findings reveal very unequal relations between renters and owners under sharecropping regimes in the Old Lands with regard to decision-making as well as input and labour cost sharing. We also found that farming in the Old Lands of Kafr Sheikh is unprofitable due to land fragmentation and expensive inputs. These factors have led to increased workload for women who are wives of farmer renters or renters themselves.

Some, however, felt that *zamala* has decreased due to male-outmigration and reluctance of youth to be involved in farming as well as shrinking in land size. Most notably this group also felt that mechanization has decreased the need for *zamala*. It is worth mentioning here that mechanization was perceived negatively by wage workers as it has led to job losses. A peanut thresher in Noubariya is reported to reduce labour opportunities for wage workers. Peanut crop

wages are one of the highest paid wage salaries in Noubariya and mostly men are hired for harvesting this crop.

Table 3. Labour exchange in the two study areas.

Use of Zamala	Location				N
	Kafr Sheikh		Noubariya		
	Women	Man	Women	Man	
Yes	72	62	31	16	181
No	28	38	71	84	221
N	100	100	102	100	402

These findings for dairy, livestock and poultry related innovations being ranked as most important for women by both genders are not surprising given that women contribute significantly to the related labour. Women also reported to control income from poultry and dairy domains. Along the same lines, associating men with machinery by both genders is also not surprising, as machinery is often perceived as a masculine domain. In agricultural contexts, hegemonic masculinity and associated norms are also connected with the dramatic qualities and visual allure of technology, machinery and infrastructure (Brandth and Haugen 2005; Oldenziel 1999; Zwarteveen 2008)<sup>3</sup>.

However, compared to men's innovations who were introduced more recently 2012-2014, most of the women's innovations were introduced well before 2010, starting in 2000. This suggests that innovations related to women's preferences are not as frequently improved, made available and renewed. These considerations are important as women-related innovations contribute to a significant proportion of income. Our survey findings reveal that these

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<sup>3</sup> Brandt and Haugen ( 2005) and Pini (2005) demonstrate how agricultural leadership in Norway and Australia, for example, is perceived as masculine by drawing credibility from masculine notions of on-farm technical expertise, mechanical competence and physical strength.

enterprises contribute to about third income of households in Kafr Sheikh and to a lesser extent in Noubariya due to the more dominant fruit production cultivation.

Table 4. Meat, poultry and milk proportion of household income in the two study areas.

Gender	Location	MLK		MT		PLT	
		Average	N	Average	N	Average	N
woman	Kafr Sheikh	22,17	59	16,39	18	12,08	50
	Noubariya	5,38	26	14,44	18	4,85	27
	Total	17,04	85	15,42	36	9,55	77
man	Kafr Sheikh	10,67	67	18,76	66	9,96	56
	Noubariya	5,95	19	29,2	5	4,06	17
	Total	9,63	86	19,49	71	8,59	73
Total	Kafr Sheikh	16,06	126	18,25	84	10,96	106
	Noubariya	5,62	45	17,65	23	4,55	44
	Total	13,31	171	18,12	107	9,08	150

#### *Interaction with Information Services*

Both men and women renters in both areas had limited opportunities for training. The agricultural extension system, village engineers (4) explained, is not replacing older generations of retirees. In sharp contradiction to the literature, which emphasizes that women farmers do not seek out or meet extension agents, in our gender and innovations study we found that women in Kafr Sheikh were more likely to meet with extension agents than men. This is because women tend to work on farms on a more permanent basis than men who often have day jobs elsewhere. Women reported interacting with extension agents 16% more than men in NBR and 48% more than men in KFS. Women tend to meet with extension agents more than men due to men's greater involvement in off-farm occupations. More generally, we found that neither men nor women farmers in both areas were currently served well by the agricultural extension system, which was in desperate need of an overhaul and reinforcement in both areas. Extension agents



reported that they are not happy with their role of enforcing crop rotations. They explained that they require more trainings on providing farmers with the most up-to-date information. Extension agents complained that farmers see them in a negative way due to their policing role. On the other hand, men reported more interactions with water engineers. As water was deemed a masculine domain that even women engineers explained that is was not culturally appropriate for them to do fieldwork and were more likely to focus on office work.

When asked about the type of information needed, both men and women in both regions reported wanting to know mostly about different pests and mitigation measures as well as different seed varieties. These findings suggest the possibility for targeting women and men farmers in group trainings as well as men as their needs are quite similar in extension advice. At the moment, women and men are provided with different trainings. Najjar et al. (2019) finds that women are targeted in the case study areas for hygiene-related topics whereas men are targeted for irrigation when both men and women are engaged in irrigation practices (see Barnes 2013 also for similar findings in a different area in Egypt). When asked about what problems women and men face in local agriculture. Pests and diseases figured out more prominently in Noubariya (Table 5). Some extension agents explained that this could be due to limited knowledge about desert pests by local extension system which is more or less used to pests that are available in the Old Lands. We were also told by farmers that the local agricultural cooperatives were far more effective in providing advice and inputs (e.g., pesticides and herbicides) in the Old Lands than they are in the New Lands, which are underserved when it comes to public services more generally. Lack of irrigation water, high costs of inputs and labour were most prominent problems reported by men and women in both regions. Extension programs are well advised to

include agro-ecological approaches, such as IPM, integrated farming, and organic compost, for reducing input costs and enhancing ecosystem services. Indeed, *silage*—the fermentation of corn residue for livestock feed—being mentioned as an important innovation in Kafr Sheik is a case in point. However, women explained that this has increased their workloads. As such, workload reducing technologies are also needed in order to also reduce dependence on hired labour, reported to be a cost prohibitive problem in both regions. Simultaneously, policies need to anticipate job losses due to mechanization and arrange for training in skills that are under high demand in the market.

Table 5. Problems faced in agriculture reported by women and men respondents in the two study regions.

Problems	Location				N
	Kafr Sheikh		Noubariya		
	women	men	women	men	
Lack of adequate irrigation quantity	16	27	30	36	109
Pollution of irrigation water	8	12			20
Poor drainage	5				5
Lack of sanitation in homes				1	1
Limited availability and high cost of labour	10	4	9	3	26
High cost of inputs	39	31	21	11	102
Limited availability and high cost of agricultural machinery		2			2
Inadequate public extension system	0	2	3	5	10
Limited quality and availability of seeds	0	1	1	0	2
Limited quality and availability for fertilizer and pesticides	8	9	8	15	40
Diseases and weeds			11	11	22
Low and unstable crop prices	2	4	0	3	9
Rising prices of poultry feed		1			1
Power (electricity prices and outages)			3	4	7
Marketing difficulties	0	2	11	7	20
Deterioration of cotton seed productivity		2			2
Land productivity limitations	10		2		12
Agricultural policies			2		2
Difficulty of product transportation				1	1
Not cleaning of canals and drains		1		1	2
Lack of adequate income from agriculture	2	2	0	2	6
N	100	100	101	100	401

### *Adoption of Innovations*

When asked whether survey respondents have adopted any of the top innovations that they have mentioned, the majority in both regions, especially in Kafr Sheikh said yes (Table 6). Noubariya scored less perhaps because the area is more commercial and hence more dynamic in technology introduction. As such, there is more likely to be a lag period in adoption. The innovations which were adopted by women were mostly related to poultry and livestock. For men the highest reported adoption of innovations was related to machinery (Table 7). These findings coincide with women's and men's reported innovation preferences.

Table 6. Use of innovations by men and women respondents in the study area.

Use of Innovation	Location				N
	Kafr Sheikh		Noubariya		
	Women	Man	Women	Man	
Yes	100	100	77	62	339
No			25	38	63
N	100	100	102	100	402

Table 7. Most important innovations used by men and women respondents in the study area.

Innovations	Location				N
	Kafr Sheikh		Noubariya		
	Women	Man	Women	Man	
New wheat varieties	8	12	10	24	54
Combine and other harvesting machines	21	44	3	0	68
Other big machineries	5	21	6	3	35
Seeder (settra)/ driller	0	1	10	4	15
Oven and other small machines		1			1
Development of irrigation systems	0	8	6	12	26
New varieties of seeds		3		2	5
New varieties of rice	4	8			12
Fruits			16	4	20
Poultry breeding	43	0	0	2	45
New varieties of poultry	3		9		12
Storage of crops	14				14
Inorganic and organic fertilizer (silage)		1			1
Pesticides-yellow trap -herbicide			3	3	6
New breeds of big ruminants	2	0	12	1	15
New breeds of small ruminants				2	2
Cultivation of vegetables				1	1
New varieties of vegetables				3	3
Field work		1			1
Feeding big ruminants			1		1
Loans			1		1
N	100	100	77	61	338

We were also interested to know about the sources of innovation adoption in order to understand the gender-specific pathways for innovation adoption. Expectedly, men had a larger network of sources to learn from and access new innovations, and some sources were exclusive to men, such as machinery stations. Men had higher access to extension services, private sector and government projects. Surprisingly, in Noubariya women had higher access to traders. This can be attributed to land being distributed to women graduates, many of which farmed the land

themselves due to their husbands having government jobs. Their husbands are not allowed to apply as only the unemployed can apply for land under the MRS in an effort to curb unemployment in the country.

Table 8. Sources of innovations adopted.

Source of Information	Location				N
	Kafr Sheikh		Noubariya		
	Women	Man	Women	Man	
Local agricultural community	23	8	22	1	54
Agricultural machineries station/farms	0	8	6	4	18
Agricultural researcher/ center		1		1	2
Extension unit/ veterinarian	5	30	4	0	39
Family/ relatives/ friends/ neighbors	49	38	36	27	150
Government institution/ project		8			8
Media			1		1
Other villages			1	5	6
Owners of private agricultural propertie		7		10	17
Traders	23	0	0	12	35
Training course			7	1	8
N	100	100	77	61	338

We were also interested to learn why these innovations were adopted. The highest mention for both men and women was related to increase in yield (crop, milk, etc.) (Table 9). Following women were interested in generating income from new agriculture innovations, many of which was done from their homes such as sales of poultry and dairy productions. Women were keen on the white chicken breed which reached maturity faster and had higher weight than the local breed. Men were more interested in saving water and number of hired labourers probably because men are traditionally in charge of both tasks.

Table 9. Reasons for adopting innovations.

Reasons	Location				N
	Kafr Sheikh		Noubariya		
	Women	Man	Women	Man	
Clean and hygienic (environment, crop)		1			1
Easy use and care of the new innovation	0	1	4	0	5
Facilitate/ regulate agricultural work (planting, harvesting, levelling, irrigating)		2			2
Feed livestock	3	3	1	0	7
Food source for home consumption	1	0	3	1	5
Generate money	15	0	1	3	19
Healthy	8				8
Improve quality of food/ crop/ production/ land	0	2	1	0	3
Improve soil fertility		5			5
Improve varieties (seeds/ strains)		1			1
Increase crop/ meat productivity	23	21	38	29	111
Increase dairy productivity			2		2
Early maturity	19		3		22
Provide labor force	3				3
Resistance to disease				2	2
Save (provide) water	0	11	6	11	28
Save effort			2	5	7
Save number of laborers	0	15	4	7	26
Save time	19	37	11	2	69
Seed storage	9	1			10
Support in time of crisis			1		1
Others adopt it				3	3
N	100	100	77	63	340

Farmers were also asked whether they have adapted these innovations (Table 10). We were interested in exploring whether men and women farmers are able to take the innovations further and adapt it to suit their own preferences and needs. We found that women used the following approaches to improve on the innovation of new poultry or livestock breed: changing the composition of the diet of the animal (for animal health or production purposes), following

immunization, and ensuring proper heating of animals. Women also mentioned drying of seed crops properly to ensure long-term storage of the seeds. Men reported switching their irrigation machine from diesel to electricity, grafting new tree varieties with more disease or drought tolerant varieties, selecting seeds for storage, and ensuring proper vitalization, space and care of livestock in barns.

Table 10. Measures taken by women and men in the two study sites to adapt adopted innovations.

	Location				N
	Kafr Sheikh		Noubariya		
	Women	Man	Women	Man	
Change food composition	11				11
Clean pulp		1			1
Continue feeding livestock	5				5
Dry crops by exposing them to the sun	35				35
Expand the use of innovation		1			1
Facilitate/ regulate agricultural work (planting, harvesting, irrigating)	4	11			15
Feed livestock				1	1
Follow recommendations to increase production			1	1	2
Good seed storage		5			5
Grafting				1	1
Immunization	10				10
Improve quality of food/ crop/ production/land	0	1	21	0	22
Increase the use of innovations		1			1
Initiate a new project such as library			1		1
Initiate places and means for children's entertainment/ education				1	1
Modify a machine for crops storage		1			1
Salt feed		1			1
Select good seeds		1			1
Sieve seeds		2			2
Switch a machine from diesel to electricity		3			3
Increase number of livestock		1			1
N	65	29	23	4	121

When asked about which innovations have led to social change in the community, men and women mentioned machinery the most which they explained has reduced significantly the workloads of farmers in the community (Table 11). Men also mentioned nurseries and schools for children and justified that this has decreased the workloads of women in the community. Women additionally preferred oven for the same reason. Fruits were also ranked highly by women for better health of household members, seed drums also for better seed health and longevity.

Table 11. Innovations which have led to broader social change in the community.

	Location				N
	Kafr Sheikh		Noubariya		
	Women	Man	Women	Man	
New wheat varieties	1	4	0	12	17
Combine and other harvesting machines	37	47	9	1	94
Other big machineries	31	20	4	1	56
Seeder (settra)/ driller	0	2	3	0	5
Oven and other small machines			7		7
Development of irrigation systems	4	15	4	3	26
Media			8		8
New varieties of seeds	4	8	4	0	16
New varieties of rice	3	2			5
Fruits			6	3	9
New varieties of poultry			1		1
Training				2	2
Storage of crops	14				14
Inorganic and organic fertilizer (silage)	3				3
Pesticides-yellow trap -herbicide			4	1	5
New breeds of big ruminants	3		5		8
New breeds of small ruminants				2	2
Cultivation of vegetables	0	2	1	0	3
New varieties of vegetables				1	1
Day care and schools				9	9
Home equipment's			3		3
Drinking water			5	1	6
Village development			1	6	7



Loans			5		5
Transport vehicles			2		2
N	100	100	72	42	314

When asked about what do women and men need to improve their agricultural enterprises, women and men in Kafr Sheikh largely mentioned better immunization and services for their poultry and livestock. This is not surprising given that livestock is the mainstay of rural households in Kafr Sheikh. Non-traditional forage was also mentioned by men and women in Kafr Sheikh as feed is the highest cost of production. Interestingly women in Kafr Shiekh mentioned wanting land. Women who were renting land and male land owners told us that they prefer to rent land to men as they believed that men would take better care of their lands: “even if the wife is farming, I prefer to give the land to a man. He would know how to clean it better.” Cleaning of irrigation canals is perceived as a task which is better done by men as it is physically demanding. Women are also limited in their ability to inherit land which is largely passed on to men through a patrilocal inheritance system (see Najjar et al. forthcoming on inheritance practices and patterns of asset ownership in these two regions). In Noubariya women also mentioned poultry and livestock services but to a lesser degree, plant protection and production services figured most prominently for both men and women. This is not surprising given that fruit tree production as well as field crops dominate the agricultural production system in Noubariya.

Table 12. Men's and women's needs for improving agricultural projects in the two areas.

	Location				N
	Kafr Sheikh		Noubariya		
	Women	Man	Women	Man	
Livestock and dairy products and sheep and goat and barn		2			2
Agricultural land	3	1	1	0	5
Machinery	0	1	1	0	2
Irrigation		2		5	7
Funds/location		1			1
Marketing and export	0	1	1	6	8
Non-traditional forage	6	6			12
Increase the space		7			7
Improving animal production nutrition and cleanliness and immunization for poultry and livestock and strains	79	40	10	1	130
Improve fruit production			4	1	5
Improving plant production	0	10	75	70	155
Take care of farmers				1	1
Attend training and courses				1	1
Asking for information		1			1
Money	2	1			3
Feeding fish farms	1				1
Land and space		4		4	8
N	91	77	92	89	349

## Conclusions

Our findings concur with much of the literature on gender and agricultural innovations.

Women reported receiving less encouragement from extension services, and there was an overall difference in the type and network of men's and women's interactions with external partners (Badstue et al. 2018). While preferences such as yield shape adoption of seed, the decision of a farmer to adopt an innovation y is also determined by many other factors, such as the labour and agricultural inputs required to grow, tend, and harvest the crop or rear livestock (Badstue et al.,

2017; Doss, 2001; Petesch et al., 2017). Broadly, women also found that farmers face barriers to farming due to inequalities in access to land, equipment, agricultural inputs, labour, information and credit (Akudugu et al., 2012; Ali et al., 2016; Burke et al., 2018; Doss, 2001; Galiè, 2013; Gladwin et al., 2001; Jayne et al., 2018; Quisumbing & Pandolfelli, 2010; Sheahan & Barrett, 2017; Kinkingninhoun-Médagbé, et al., 2010). These barriers affect women's ability to access agricultural technologies, which has led to a gender gap in adoption that is observed in contexts throughout the world (Ragasa, 2012). Understanding norms is vitally important, not only to encourage the adoption of appropriate and beneficial agricultural innovations, but to avoid increasing the burden of work placed upon women and thereby possibly exacerbating their poverty and eroding their decision-making power and wellbeing (Baruah, 2005; Bezner Kerr, 2012; Bezner Kerr, 2008; Doss, 2001). Our findings reveal preferences for innovation and their adoption reported by men and women might reflect "adapted preferences," — people systemically convincing themselves of preferences which suit their predetermined cultural roles (Gammage et al. 2016). Women and men are socialized to believe that land, agricultural equipment, and vehicles, for example, are masculine. Albeit women's significant contributions to irrigation in the study areas, they seldom asked for receiving information on irrigation technologies (see Najjar et al. 2019). A nuanced understanding of social norms also allows for a critical look at gendered power relations where paying attention to agency becomes a way to recognize the ways that harmful norms can be subtly challenged or provide avenues for marginalized people to act (Boudet et al., 2013).

## References

- Akudugu, M. A., Guo, E., & Dadzie, S. K. (2012). Adoption of Modern Agricultural Production Technologies by Farm Households in Ghana: What Factors Influence their Decisions? *Journal of Biology, Agriculture and Healthcare*, 2(3), 1–14.
- Ali, D., Bowen, D., Deininger, K., & Duponchel, M. (2016). Investigating the Gender Gap in Agricultural Productivity: Evidence from Uganda. *World Development*, 87, 152–170.
- Badran, H. (1993). Women's rights as a condition for sustainability of agriculture. In Faris, M. A., and Hassan Khan, M., eds. *Sustainable Agriculture in Egypt*, pp. 197-206.
- Badstue, L., Lopez, D., Umantseva, A., Williams, G., Elias, M., Farnworth, C., Rietveld, A., Njuguna-Mungai, E., Luis, J., Najjar, D., and Kandiwa, V. (2018). What drives capacity to innovate? Insights from rural men and women in Africa, Asia, and Latin America. *Journal of Gender, Agriculture and Food Security*, 3(1): 54-81.
- Badstue, L., Petesch, P., Williams, G., & Umantseva, A. (2017). Gender and Innovation Processes in Wheat-Based Systems. Mexico.
- Barnes, Jessica. "17 Who is a water user?." *Contemporary Water Governance in the Global South: Scarcity, Marketization and Participation* (2013): 185.
- Bezner Kerr, R. (2010). Groundnuts as “economic crop” or “wife of the home” in Northern Nyasaland. *Journal of Historical Geography*, 36(1), 79–89.
- Brandth, Berit and Marit S. Haugen. 2005. “Doing Rural Masculinity - From Logging to Outfield Tourism.” *Journal of Gender Studies* 14(1):13–22.
- Bromley, S., and Bush, R. (1994). Adjustment in Egypt? The political economy of reform. *Review of African Political Economy*, 21(60): 201-213.
- Burawoy, Michael. "The extended case method." *Sociological theory* 16, no. 1 (1998): 4-33.
- Burke, W. J., Li, S., & Banda, D. (2018). Female access to fertile land and other inputs in

- Zambia: why women get lower yields. *Agriculture and Human Values*, 35(4), 761–775.
- Bush, R. (2004). Civil Society and the Uncivil State: Land Tenure Reform in Egypt and the Crisis of Rural Livelihoods. United Nations Institute for Social Development, Civil Society and Social Movements Programme, Paper Number 9.
- Bush, Ray. "Politics, power and poverty: twenty years of agricultural reform and market liberalisation in Egypt." *Third World Quarterly* 28, no. 8 (2007): 1599-1615.
- Creswell, John W. Research design: Qualitative, quantitative, and mixed methods approaches. Sage publications, 2013.
- Doss, C. R. (2001). Designing agricultural technology for African women farmers: Lessons from 25 years of experience. *World Development*, 29(12), 2075–2092.
- El-Tobshy, Z. (2005). Gender and agriculture in Egypt. In Motzafi-Haller, P., ed., *Women and Agriculture in the Middle East: Perspectives on Rural Policy and Planning*, pp. 115-139. UK: Ashgate Publishing Limited.
- Galiè, A. (2013). Governance of seed and food security through participatory plant breeding: Empirical evidence and gender analysis from Syria. *Natural Resources Forum*, 37(1), 31–42.
- Gammage, Sarah, Naila Kabeer, and Yana van der Meulen Rodgers. 2016. "Voice and Agency: Where are We Now?" *Feminist Economics* 22(1): 1–29.
- Gladwin, C. H., Thomson, A. M., Peterson, J. S., & Anderson, A. S. (2001). Addressing food security in Africa via multiple livelihood strategies of women farmers. *Food Policy*, 26(2), 177–207.
- Jayne, T. S., Mason, N. M., Burke, W. J., & Ariga, J. (2018). Taking stock of Africa's second-generation agricultural input subsidy programs. *Food Policy*, 75, 1–14.
- Kerr, R. B. (2014). Lost and found crops: agrobiodiversity, indigenous knowledge, and a feminist political ecology of sorghum and finger millet in northern Malawi. *Annals of the*

- Association of American Geographers*, 104(3), 577–593.
- Kinkingninhoun-Mêdagbé, F. M., Diagne, A., Simtowe, F., Agboh-Noameshie, A. R., & Adégbola, P. Y. (2010). Gender discrimination and its impact on income, productivity, and technical efficiency: evidence from Benin. *Agriculture and Human Values*, 27(1), 57–69.
- Larson, Barbara K. "Women's work and status in rural Egypt." *NWSA Journal* 3, no. 1 (1991): 38-52.
- Najjar, D. Baruah, B., and Al Garhi, A. (2019). Women, Irrigation and Social Norms in Egypt: “The more things change, the more they stay the same?”. *Water Policy*, 21 (2), 291-309.
- Najjar, D., Baruah, B., and Al Garhi, A. (in press). Gendered Patterns of Asset Ownership and Control in Egypt. *Feminist Economics*.
- Oldenziel, R. 1999. *Making Technology Masculine: Men, Women, and Modern Machines in America, 1870-1945*. Amsterdam: Amsterdam University Press.
- Petes, P., Badstue, L., Williams, G., Farnworth, C., & Umantseva, A. (2017). *Gender and Innovation Processes in Maize-Based Systems*. Mexico.
- Pini, B. (2005). The third sex: Women leaders in Australian agriculture. *Gender, Work & Organization*, 12(1), 73-88.
- Quisumbing, A. R., & Pandolfelli, L. (2010). Promising approaches to address the needs of poor female farmers: Resources, constraints, and interventions. *World Development*, 38(4), 581–592.
- Ragasa, C. (2012). *Gender and institutional dimensions of agricultural technology adoption: a review of literature and synthesis of 35 case studies*.
- Saad, R. (2000). Agriculture and politics in contemporary Egypt: The 1997 tenancy crisis. In *Discourses in Contemporary Egypt: Politics and Social Issues*. Hill, E., ed. *Cairo Papers in Social Science*, 22(4): 22-35.
- Sharp, J., Briggs, J., Yacoub, H., & Hamed, N. (2003). *Doing gender and development:*

understanding empowerment and local gender relations. *Transactions of the Institute of British Geographers*, 28(3), 281-295.

Sheahan, M., & Barrett, C. B. (2017). Ten striking facts about agricultural input use in Sub-Saharan Africa. *Food Policy*, 67, 12–25.

Zwarteveen, Margreet. 2008. “Men, Masculinities and Water Powers in Irrigation.” *Water Alternatives* 1(1):111–30.