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Effect of Agricultural Interventions on Rural Labourer Women's Livelihood: A Perspective of Growth and Sustainability

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Abstract
The objective of this research article is to investigate the implications of modern agricultural interventions on the female labor force in the agricultural sector of Pakistan. A large portion of rural women depends on agriculture for their livelihoods, but they have become increasingly vulnerable due to the introduction of modern agricultural interventions. The adoption of these interventions is influenced by various bio-physical and socio-economic factors. The study was conducted in seven villages in the rice cultivation sector of the Sialkot District in the upper Punjab region of Pakistan, employing a cross-sectional quantitative research design. The methods used included a structured interview schedule administered to 200 female respondents. The study revealed that the adoption of agricultural interventions in rice cultivation was determined by age, education level, and the ability to operate technology. The study concluded that the introduction of gender-friendly agricultural interventions in rice cultivation could lead to a reduction in unemployment among rural women and an enhancement of household income, with further implications for gender empowerment.

Key words: *Technology, Interventions, Women, Gender, Sustainability, Pakistan*

Introduction

The agriculture sector plays a key role in the Pakistani economy, earning a significant portion of the nation's foreign exchange, employing approximately 42 percent of the workforce, and contributing 18.9 percent to GDP (Rehman, 2016; Mohiuddin, et al., 2020; Majid, 2020). A large portion of the rural population relies on agriculture for their sustenance. Recognizing its potential to stimulate development across various sectors, the government has introduced innovative technologies to support small-scale and marginalized farmers, particularly women, in fighting poverty and hunger (Zafar et al., 2018). These efforts are based on the belief that science and technology can revolutionize the agricultural sector and reduce rural poverty (Yousaf et al., 2018; Bellon, 2006). Additionally, the government is focusing on increasing agricultural credit, reducing bank interest rates, and subsidizing inputs such as fertilizers and electricity for agricultural tube-wells. A modest improvement in the agriculture sector's performance over a 13-year period was attributed to these efforts, as reported by the Pakistan Economic Survey of 2017-18. Studies have indicated that agricultural interventions can change societies both positively and negatively (Javed et al., 2010). Some researchers argue that these interventions can foster agricultural development and sustainability when all farmers, regardless of gender, have equal opportunities to participate in the adoption process (Pandey et al., 2016; Castine et al., 2013; Masset et al., 2012). However, in Pakistan's agriculture sector, farmers with large landholdings often have direct access to innovative technologies, while small-landholder farmers face limited access. These findings highlight the social and cultural dimensions of technological interventions, suggesting that the success of these interventions should be evaluated based on their impact on all social groups within targeted communities (Fiorella et al., 2016). In this research, agricultural interventions are defined broadly as all actions aimed at improving the agricultural sector, encompassing policy changes, governance reforms, management practice modifications, and the adoption of new technologies (Herrero et al., 2014). These interventions address constraints limiting access to productive resources such as inputs, financial services, advisory services, and markets, including extension services, tenure reform, natural resource management, credit, investment grants, improved seeds, hybrids, and fertilizer subsidies (Aslam, 2016). The implementation of agricultural

mechanization often requires an educated and skilled labor force. Unfortunately, many women in rural Pakistan lack the education and skills required to operate modern farming equipment, which are typically developed for male use. This has led to an increase in male-dominated control over farming technologies, further marginalizing women in the agricultural labor force (Quisumbing et al., 2015).

Significance and Research Gap

This research fills a significant void in comprehending the gender-specific effects of agricultural interventions on rural women in Pakistan, especially within the rice production sector of the Sialkot District. Women play a big part in farming, but current programs don't always take into account their specific requirements and problems, which makes them more likely to be unemployed and pushed to the side (Rehman et al., 2015). Modern agricultural technologies are meant to boost productivity, but they tend to help males more since they have better access to skills and resources (Mottaleb et al., 2016; Mangheni et al., 2019). This study adds to the body of knowledge by showing how agricultural interventions may be made more inclusive and gender-friendly, which will help women get more involved in the industry and help reduce poverty and empower women (Zafar et al., 2018). A significant study deficiency exists about the insufficient comprehension of how gendered access to technology influences rural women's employment and household incomes. While previous research has explored agricultural interventions in a general context, there is a paucity of studies concentrating on the nexus between gender, technology, and the labor force participation of rural women in Pakistan (Fiorella et al., 2016; Castine et al., 2013). This study seeks to address this deficiency by examining how gender-sensitive interventions can facilitate sustainable agricultural growth while mitigating gender disparity in rural Pakistan.

Methodology

This study uses a cross-sectional quantitative research design to examine the adoption of agricultural interventions among rural women in the rice cultivation sector of the Sialkot District in the upper Punjab region of Pakistan. A multistage sampling technique was used,

with 200 female farmers from seven villages selected to participate. The data collection method involved a structured interview schedule, which collected demographic information such as age, educational background, and household income. The interview schedule also included questions about women's awareness of modern agricultural interventions, their experiences, and perceptions of their impacts on their work and livelihoods. The data was both descriptive and inferential, allowing for the analysis of factors influencing the adoption of agricultural interventions. Key variables included respondents' educational levels, age, perceived ability to operate new farming technologies, and access to resources like credit, fertilizers, and machinery. Statistical analysis was performed using SPSS software, using descriptive statistics to summarize demographic characteristics and inferential statistics to assess relationships between socio-economic factors and agricultural intervention adoption. The study aims to provide insights into how gender-friendly agricultural technologies can impact rural women's participation in the agricultural sector, particularly in rice cultivation, and how these interventions can be made more accessible for greater gender equity and sustainability.

Results and Discussions

Table-1 Univariate analysis

Statement	**Response**	**Frequency N = 200**	**Percentage N = 200**
Age group (years)	Less than 25	31	15.5
	25-40	71	35.5
	Above 40	98	49.0
Marital Status	Single (never married)	54	27.0
	Married	146	73.0
Formal Education	None	135	67.5

	Up to Primary		46	23.0
	Primary to Matriculation		19	9.5
Family Size	1-4		133	66.5
	5-8		53	26.5
	9-12		14	7.0
Nature of occupation	Agriculture	Yes	9	4.5
		No	191	95.5
	Agriculture and Business	Yes	5	2.5
		No	195	97.5
	Agriculture and Services	Yes	10	5.0
		No	190	95.0
Land holding size	1-5 (Acres)		137	68.5
	6-10 (Acres)		49	24.4
	11-15 (Acres)		14	7.0
Tenancy Status	Owner		44	22.0
	Owner-cum-tenant		95	47.5
	Tenant		61	30.5
Type of labour work	Operator		12	6.05
	Helper		83	41.5
	Labourer		105	52.5

Source: field data (2019)

The contents of the table represent and indicate that majority of the respondents (49.0 %) were above 40 years. Age has been regarded as a decisive factor which contribute to the decision-making about the adoption of modern agricultural intervention (Akhtar et al. 2018). The female and male of younger age have the potential to join technical and vocational institutes to learn how to operate agricultural interventions. During the investigations it was found that men have comparatively more opportunities to learn about the modern agricultural machinery as compared to women. It is because men have the freedom of social mobility as compared to the women. As far as marital status of the respondents is concerned, majority of the respondents 73.0 per cent were married. It was found out that married women have less opportunity to learn operation of the modern agricultural tools because they are to work in the fields as well as in the household spheres. The data shows that single (never married) women can join the technical and vocational institute if they are given an opportunity. Literacy plays an important role in the adoption of advanced .However, agriculture related innovations has the data to reveal that majority of the respondents 67.5 % were illiterate. It was found that illiteracy was the major reason of the unemployment among the womenfolk. Illiterate women cannot read the operative manuals of the modern agricultural tools, as such it becomes difficult for them to take part in the training workshops conducted by different agriculture and related institutions. Table 1 reveals that major.ity of the respondents 66. 5 per cent had 1-4 family members. Data shows that in Pakistan, the small families are trending. The people have become aware that if they have smaller families (indicate the family numbers in most of the families), they can feed them well, get them admitted in the standard schools, and will be able to provide them better standard of living.

The discussions by smaller families enable them grant more freedom to women to devote on more time to work in the fields. It can provide them an opportunity to participate in the training workshops to learn about the operation of the modern agricultural interventions.

It was found that the wages are typically higher and working conditions are better in the traditional agricultural employment. The data indicated that majority of the respondents 68.5 % had 1-5 acres of land. The female labour force has more scope of employment in terms of small farms as compared to the large ones because the former depends on manual labour and the latter on the mechanical one. As far as the land ownership status is concerned only 22.0 %

of the respondents were owners. Data indicated that majority of the respondents 47.5 % were owner cum tenants. Furthermore, table 1 discloses that majority of the respondents 52.5 % were working as a laborers, 41.5 % were working as helpers, and a minor friction 6.05 % were working as operators. Due to the non-technical nature of work the women perform they are usually paid less as compared to men in this field.

Table 2: Awareness of existing agricultural technological intervention

Sr #	Technological intervention	Frequency N = 200	Percentage N = 200
1	Rotator	200	100.0
2	Sugar cane harvester	200	100.0
3	Roller	200	100.0
4	Tractor	200	100.0
5	Sprayer	198	99.0
6	Rice huller	196	98.0
7	Rotavator	192	96.0
8	Harrow	170	85.0
9	Combine Harvester	150	75.0

Source: Field data (2019)

Table 2 reveals the level of awareness about the technological intervention in the agriculture sector. It was found that all respondents knew about some existing technology in the agriculture sector. It indicated by the respondents that 100.0 % of the respondents were familiar about the utilization of combine rotator. Furthermore, 100.0 % of the respondents were familiar about the utilization of sugarcane harvester, 100.0 % of the respondents were familiar about the utilization of roller, 100.0 % of the respondents were familiar about the utilization of tractor, 99.0 % of the respondents were familiar about the utilization of sprayer,

98.0 % of the respondents were familiar about the utilization of rice huller, 96.0 % of the respondents were familiar about the utilization of rotavator, 85.0 % of the respondents were familiar about the utilization of harrow, and 75.0 % of the respondents were familiar about the utilization of combine harvester. The data for table 2 unfolds that a significant majority (100.0 %) of the respondents were aware of the agricultural interventions such as rotator, sugar cane harvester roller, tractor, and sprayer while more than half of the respondents were aware of the agricultural interventions such as sprayer, rice huller, rotavator, harrow, and combine harvester.

Table 3: Have you observed farmers of your area who have adopted these technological interventions in agriculture?

Technological interventions in the agriculture sector	**Regular**		**Occasional**		**Never**	
	F	**%**	***F***	**%**	***F***	**%**
Combine harvester			200	100		
Tractor	200	100.0				
Sugarcane harvester					200	100.0
Roller					200	100.0
Rotavator			161	80.5	39	29.5
Sprayer	200	100.0				
Rice huller	15	7.5	154	77.0	31	15.5
Farm trolley	200	100.0				
Disc harrow	2	1.0	186	93.0	12	6.0

Source: Field data (2019)

The table 3 discusses the different types of technological interventions well in agriculture. The observations of the respondents have been categorised into the following three categories such as they have observed the technological interventions regularly, occasionally, and never.

Data was collected from 200 women laborers in 7 villages of district Sialkot revealed that the women laborers did never observed sugar cane harvester and roller. A significant majority of the respondents is part of the i.e. 100.0 % replied that they had never observed roller and rotavator being use d by the farming community as a technological intervention in their area. A small number of the respondents i.e. 15.5 % replied that they had never observed rice huller being used by the farming community as a technological intervention in their area while 6.0 % of the respondents replied that they had never observed disk harrow being used by the farming community as a technological intervention in their area. An enormous majority of the respondents especially 100 % told that they have occasionally observed combined harvester being used by the farming community as a technological intervention n in their area, 80.5 % told that they have occasionally observed rotavator being used by the farming community as a technological intervention in their area, 77.0 % told that they have occasionally observed rice huller being used by the farming community as a technological intervention in their area. Furthermore, 93.0 % told that they have occasionally observed disk harrow being used by the farming community as a technological intervention in their area. A significant majority 100.0 % of the respondents indicated that they have often observed tractor, sprayer, as well as farm trolley being used by the farming community as a technological intervention in their area. A small majority 7.5 % and 1.0 % indicated that they have often observed rice huller and disk harrow being used by the farming community as a technological intervention in their area.

Table 4: Impact of agriculture technological adoption on women labourers

	Low		**Medium**		**High**	
	F	***%***	***F***	***%***	***F***	***%***
Increase in wages/salary					90	45.0
Easy to work					85	42.5
More work in less time					75	37.5
Less tiredness			130	65.0		
Work satisfaction					120	60.0
Easy access to work			160	80.0		

Provision of health safeguard			170	85.0		
Extra leisure moments					145	72.5

Source: field data (2019)

The study found that 33.5% of women lose their jobs, 20% lose their jobs, and 46.5% reduce their job duration. The researchers surveyed women who retained their jobs through technological interventions in agriculture, focusing on the impacts of these interventions on women laborers. The questions included wages, work facilitation, tiredness, work satisfaction, access to work, health safeguards, and leisure moments. The researchers used three scales: high, medium, and low to measure the impact on women after adopting technological interventions in the agriculture sector. The frequency distribution of the data showed that 45.0% of respondents believed that if they retained their jobs, the adoption of technological interventions would have a high impact on the salary, 42.0% on work facilitation, and 36.0% on leisure. Interestingly, 65.0% of respondents believed that if they retained their jobs, the adoption of technological interventions would have a medium impact on the provisions of health safeguards for women laborers. This aligns with Akhtar et al.'s (2018) research, which revealed that women have no other option but to work as laborers, which has implications for health and safety for themselves and their family members.

Table 5: Bivariate Analysis

Hypothesis	**$\chi 2$**	**D. F**	**P-value**	**Λ**
Association between age of the respondents and impacts on women workers' employment opportunities due to adoption of the technological interventions in agriculture by the farmers.	0.038	4	.000**	.188
Association between education of the respondent and impacts on women workers' employment opportunities due to adoption of technological interventions in agriculture by the farmers.	0.019	4	.000**	0.002

Association between type of labour work of the respondent and impacts on labour employment opportunities due to adoption of technological interventions in agriculture by the farmers.	0.03	4	.000**	0.367

$\chi 2$ = Chi-square λ = Gamma Value D. F. = Degree of freedom

** = highly significant

Table 5 discusses very well as the association between the independent and dependent variables involved in this research study. Each hypothesis shows the association and direction of relationship between the dependent and independent variable. It was found that there was a highly significant relationship (*p*-value .000) between age of the respondents (independent variable). Impacts on women workers' employment opportunities (dependent variable) due to adoption of the technological interventions in agriculture by the farmers. λ value (1.88) showed a significant and positive relation between above discussed variables. It tells that majority of the aged women laborers had been affected by the adoption of technological intervention by the farmers in the agriculture sector. The association between education (independent variable) of the respondent and impacts on women workers' employment opportunities (dependent variable) due to adoption of technological interventions by the farmers in the agriculture sector showed a highly significant relationship between the variables. $\chi 2$ value (0.019) displayed a highly significant (p = .000) relationship between the independent and dependent variables. λ value (0.002) showed a significant and positive relationship between the above discussed variables. It indicates that majority of educated women labourers had been affected by technological intervention in the shape of retained, reduced duration, and lost job. Moreover, $\chi 2$ value (0.03) displays a highly significant (p = .000) relationship between type of labour work (dependent variable) of the respondents and its impacts on the labour employment opportunities (independent variable) due to adoption of technological interventions in agriculture by the farmers. λ value (0.367) shows a significant & positive relation between above discussed variables. It tells that majority of women farm workers skilled, semi-skilled and unskilled are effect by technological intervention in the shape of retained, reduced duration and lost job.

Conclusion

Agriculture is a crucial sector in Pakistan's economy, with both men and women in rural areas heavily engaged in it. Women, who contribute significantly to agricultural productivity, often face challenges in accessing and adopting modern technologies. The introduction of gender-responsive agricultural interventions can enhance the employment opportunities and economic status of rural women. This research underscores the importance of ensuring equal access to agricultural technologies for all segments of society, emphasizing the need for skill development and vocational training to improve women's participation in the sector. By incorporating women into the agricultural workforce, Pakistan can achieve sustainable agricultural development and reduce the economic burden on rural families.

Suggestions

Technological interventions must be made available to all farmers, regardless of their landholding size. Vocational and technical institutes ought to implement agriculture-focused courses for women in rural regions. Agricultural extension agencies ought to prioritize gender-responsive training for rural women. Modern agricultural machinery must be engineered to meet the requirements and talents of women.

Prospective Recommendations: Agricultural universities in Pakistan ought to provide short courses to educate women on the appropriate use of agricultural instruments. Stakeholders should collaborate to establish a gender-inclusive farming environment. Government policies ought to facilitate the incorporation of women at every phase of agricultural mechanization. Future research should investigate the socio-cultural impediments to women's use of agricultural technologies.

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