



INTERNATIONAL  
FOOD POLICY  
RESEARCH  
INSTITUTE

IFPRI

PACE Project Working Paper: Model Farm Services Centers (FSC) in Khyber Pakhtunkhwa: Evaluation and the Way Forward

July 2023



PACE Project Working Paper:

## **Model Farm Services Centers in Khyber Pakhtunkhwa: Evaluation and the Way Forward**

*Prepared as part of the Technical Assistance to Department of Agriculture,  
Government of Khyber Pakhtunkhwa*



# **Model Farm Services Centers in Khyber Pakhtunkhwa: Evaluation and the Way Forward**

*Prepared as part of the Technical Assistance to Department of  
Agriculture, Livestock and Cooperatives  
Government of Khyber Pakhtunkhwa*

July 2023

Abdul Wajid Rana

Dr. Zahoor-ul-Haq

Dr. Javed Iqbal

Dr. Muhammad Faisal Shahzad

Syed Zeeshan Haider

Prepared by

**Pakistan Agricultural Capacity Enhancement Program (PACE)**

in collaboration with

**Pakhtunkhwa Economic Policy Research Institute (PEPRI)**

implemented by

**International food Policy Research Institute – Pakistan (IFPRI)**

Funded by

**United States Agency for International Development (USAID) Pakistan**



## INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

The International Food Policy Research Institute (IFPRI), established in 1975, provides research-based policy solutions to sustainably reduce poverty and end hunger and malnutrition. IFPRI's strategic research aims to foster a climate-resilient and sustainable food supply; promote healthy diets and nutrition for all; build inclusive and efficient markets, trade systems, and food industries; transform agricultural and rural economies; and strengthen institutions and governance. Gender is integrated in all the Institute's work. Partnerships, communications, capacity strengthening, and data and knowledge management are essential components to translate IFPRI's research from action to impact. The Institute's regional and country programs play a critical role in responding to demand for food policy research and in delivering holistic support for country-led development. IFPRI collaborates with partners around the world.

## AUTHORS

**Abdul Wajid Rana** ([A.W.Rana@cgiar.org](mailto:A.W.Rana@cgiar.org)) is the Program Leader of Pakistan Agriculture Capacity Enhancement project (PACE) in the Development Strategy and Governance Division of the International Food Policy Research Institute (IFPRI), Islamabad, Pakistan

**Prof. Dr. Zahoor ul Haq** ([zahoor.haq@awkum.edu.pk](mailto:zahoor.haq@awkum.edu.pk)) is the Vice Chancellor and Head of PEPRI, Abdul Wali Khan University, Mardan, Khyber Pakhtunkhwa, Pakistan.

**Dr. Javed Iqbal** ([javediqbal@awkum.edu.pk](mailto:javediqbal@awkum.edu.pk)) is the Associate Professor, Department of Economics, PEPRI, Abdul Wali Khan University, Mardan, Khyber Pakhtunkhwa, Pakistan

**Dr. Muhammad Faisal Shahzad** ([faisalshahzad@awkum.edu.pk](mailto:faisalshahzad@awkum.edu.pk)) is the Assistant Professor in PEPRI, Abdul Wali Khan University, Mardan, Khyber Pakhtunkhwa, Pakistan

**Syed Zeeshan Haider** ([szh223@nyu.edu](mailto:szh223@nyu.edu)) was a Research Analyst in the Development Strategy and Governance Division of the International Food Policy Research Institute (IFPRI), Pakistan.

## Notices

IFPRI Discussion Papers contain preliminary material and research results and are circulated in order to stimulate discussion and critical comment. They have not been subject to a formal external review via IFPRI's Publications Review Committee. Any opinions stated herein are those of the author(s) and are not necessarily representative of or endorsed by IFPRI.

<sup>2</sup> The boundaries and names shown and the designations used on the map(s) herein do not imply official endorsement or acceptance by the International Food Policy Research Institute (IFPRI) or its partners and contributors.

<sup>3</sup> Copyright remains with the authors. The authors are free to proceed, without further IFPRI permission, to publish this paper, or any revised version of it, in outlets such as journals, books, and other publications.

## **Acknowledgement**

We thank the academia, scholars, researchers, and functionaries of the Government for their very useful comments and feedback during the Consultative Workshops jointly organized by the Pakhtunkhwa Economic Policy Research Institute and International Food Policy Research Institute-Pakistan. We acknowledge the work of Stephen Davies, Senior Research Fellow in International Food Policy Research Institute in reviewing descriptive Statistics sections to make the analysis clearer. We also thank the US Agency for International Development [Grant Agreement # AID-BFS-10-17-00005] for their support.

## TABLE OF CONTENTS

Contents	Page No.
<b>Executive Summary</b>	<b>viii</b>
<b>Key Results</b>	<b>ix</b>
<b>Recommendations</b>	<b>xi</b>
1. Introduction .....	2
2. Literature Review .....	3
<b>3. Sampling Strategy and Survey Results for the Model Farm Services Centers Assessment</b>	<b>6</b>
3.1. Study Area .....	6
3.2. Methodology .....	6
3.3. Sampling Frame and Sample Size .....	7
3.4. Sample Selection .....	8
3.5. General Characteristics of Respondents .....	10
3.6. Cropping Pattern Adopted by Members and Nonmembers Across various districts/regions in KP .....	14
<b>4. Evaluation of Farm Services Centers</b> .....	<b>18</b>
4.1. Evaluation of Farm Service Centres in Providing Mandated Services to Members .....	25
4.2. Evaluation of Farm Service Centres in Sample districts .....	26
4.3. Evaluation of Farm Service Centers (FSCs)-Price Difference between FSC and Open Market Rates...	29
4.4. Willingness to Pay for Crop Inputs .....	32
4.5. Provision of Advisory Services to Farmers .....	33
4.6. Membership Criteria for FSCs and Farmers' Satisfaction .....	34
4.7. Transparency in Operation of FSCs .....	36
<b>5. SWOT Analysis of Farm Services Centres</b> .....	<b>38</b>
5.1. Internal Factors .....	39
5.2. Region Wise Analyses of Focal Group Discussions .....	39
5.2.1 Central Plains .....	39
5.2.2 North Eastern Mountainous Zone .....	41
5.2.3 Southern Piedmont Plains .....	42
References .....	44
 <b>Annexures</b>	
Annex-1. Survey Questionnaire .....	49
Annex-2. Summary of Survey and Focal Groups Discussions Findings .....	53
Annex-3. Methodology Used for Data Analysis and Econometric Estimation to Assess Impact of FSCs .....	55
Annex-4. Draft Amendment Bill to Amend Farm Services Centres Act 2014 .....	62
<b>Appendix</b> .....	<b>67</b>
Box 1. Transforming Agriculture through KVK Program .....	4
 <b>List of Figures</b>	
Figure 1. Location of MFSCs in Khyber Pakhtunkhwa across Agroecological Zones .....	7
Figure 2. Comparison of Household Characteristics Across Members and Non-members .....	11
Figure 3 Level of Satisfaction With FSC Membership, MCs and other Eligibility Criteria .....	34
Figure 4 Transparency in Working of FSCs .....	36

## List of Tables

Table 1: Membership of Farm Service Centres (FSC) Across Districts and Regions in KP.....	7
Table 2: Conversion of Confidence Interval Normal Deviate .....	8
Table 3. Final Sample Size and Allocation to District and region.....	9
Table 4. District/Region-wise Membership Status and Whether Contacted for Becoming Members of A FSC...	9
Table 5. Membership of the Management Committee (MC) Across Various Districts/Regions in KP.....	9
Table 6. Farmer's and Farm Characteristics Across FSCs Members and Non-members.....	12
Table 7: Land ownership of the FSC member and nonmember farmers in various districts/regions.....	12
Table 8: Sources of Credit Members and Nonmembers Across Various Regions.....	13
Table 9: Sources of Irrigation of Members and Nonmembers Across Various Regions .....	13
Table 10: Tubewell Ownership Status of Members and Nonmembers of FSC Across Regions.....	14
Table 11: Wheat Cropping Pattern Comparison Across Various Regions/Districts.....	14
Table 12: Maize Cropping Pattern Comparison Across Various Regions/Districts .....	16
Table 13: Sugarcane Cropping Pattern Comparison Across Various Regions of KP.....	17
Table 14: Rice cropping Pattern Comparison Across Various Regions.....	17
Table 15: Inputs Usage Trend Across Districts and Regions and between Members and Nonmembers.....	19
Table 16: Evaluation of FSCs: Inputs Provision Region wise from Various Sources –Wheat .....	19
Table 17: Evaluation of FSCs: Inputs Provision Region Wise from Various Sources –Maize Seed .....	20
Table 18: Evaluation of FSCs: Inputs Provision Region Wise from Various Sources–Orchard Plants.....	21
Table 19: Evaluation of FSCs: Inputs Provision Region wise from Various Sources-DAP (bags) Used.....	22
Table 20: Evaluation of FSCs: Inputs Provision Region Wise from Various Sources-Urea (bags) Used.....	23
Table 21: Evaluation of FSCs: Inputs Provision Region Wise from Various Sources–Tractor's hours.....	23
Table 22: Evaluation of FSCs: Inputs Provision Region Wise from Various Sources–Sprayer's hours.....	24
Table 23: Wheat Seed (%) Used by FSCs members and Nonmembers from Various Sources.....	26
Table 24: Maize Seed (%) Used by FSCs Members and Nonmembers from Various Sources.....	26
Table 25: Orchard Plants (%) Used by FSCs Members and Nonmembers from Various Sources.....	26
Table 26: DAP Fertilizer (%) Used by FSCs Members and Nonmembers from Various Sources.....	26
Table 27: Urea fertilizer (%) Used by FSCs Members and Nonmembers from Various Sources.....	26
Table 28: Tractor hours (%) Used by FSCs Members and Nonmembers from Various Sources.....	26
Table 29: Sprayer hours (%) Used by FSCs Members and Nonmembers from Various Sources .....	26
Table 30: Percentage of wheat Seed Aailed from Various Sources.....	27
Table 31: Percentage of Maize Seed Aailed from Various Sources.....	27
Table 32: Percentage of Orchard Nursery Plants Aailed from Various Sources.....	27
Table 33: Percentage of DAP bags Aailed from Various Sources.....	28
Table 34: Percentage of Urea bags Aailed from Various Sources.....	28
Table 35: Percentage of Tractors hours Aailed from Various Sources.....	28
Table 36: Percentage of Sprayers hours Aailed from Various Sources.....	28
Table 37: Mean Difference between FSCs and Open Market-Wheat Seed Prices.....	29
Table 38: Mean Differences between FSCs and Open Market-Maize Seed .Prices.....	30
Table 39: Mean differences between FSCs and Open Market-DAP 50Kg Prices.....	30
Table 40: Mean differences between FSC and Open Market:Urea Prices.....	30
Table 41: Mean differences between FSC and Open Market-Tractor hour Prices.....	31
Table 42. Willingness to Pay for Inputs Across Members and Non-Members of .....	32
Table 43. Willingness to Pay for Accessibility of FSCs Across Various Districts and Regions and Between Members and Non-Members of FSCs.....	32
Table 44: Provision of Advisory Services to Farmers Across Districts.....	33
Table 45: Provision of Advisory Services to Farmers Across Regions.....	33
Table 46: Provision of Advisory Services to Farmers Across FSCs Membership.....	33
Table 47: Frequency of Farmers' Satisfaction with the working of FSCs.....	35
Table 48: Overall Satisfaction being A Member of FSC.....	35
Table 49: Region wise Satisfaction with the Management Committees.....	35
Table 50: Transparency in the working of FSCs Regarding Meetings, Decisions, and Elections.....	37

## Appendix Tables

Table A-1: Probit Model Results.....	67
Table A-2: OLS Results for Wheat Yield of Non-Members.....	67
Table A-3: OLS Results for Maize Yield of Non-Members.....	68
Table A-4: OLS Results for Tobacco Yield of Non-Members.....	68
Table A-5: OLS Results for Sugarcane Yield of Non-Members.....	68
Table A-6: OLS Results for Rice Yield of Non-Members.....	69
Table A-7: Region wise Satisfaction with Membership Criteria for FSCs.....	70
Table A-8: District wise Satisfaction with the Membership of FSCs and Management Committee.....	71
Table A-9: District wise satisfaction with the Membership criteria for the FSC.....	71
Table A-10: Difference in Characteristics of FSCs Members and Non-members .....	72
Table A-11: Determinants of FSCs Membership and its Impact on Wheat Yield.....	72
Table A-12: Determinants of FSCs Membership and its Impact on Maize Yield.....	73
Table A-13: Determinants of FSCs Membership and its Impact on Tobacco Yield .....	73
Table A-14: Determinants of FSCs Membership and its Impact on Sugarcane Yield .....	73
Table A-15: Determinants of FSCs Membership and its Impact on Rice Yield .....	74
Table A-16: Average Treatment Effects on the Treated (ATT) by Different Crop Yields.....	74
Table A-17: Factors Affecting FSCs Membership Decision and Marginal Effects.....	74
Table A-18: Average Treatment Effects on the Treated (ATT) by Different Crop Yields (in maund).....	75
Table A-19: District wise Average Treatment Effects on the Treated (ATT).....	75
Table A-20: Region wise Average Treatment Effects on the Treated (ATT) .....	75

## Executive Summary

**The sub-national Government of Khyber Pakhtunkhwa in Pakistan enacted Farm Services Centers Act, 2014, to establish Model Farm Services Centers (MFSCs) and Farm Services Centers as “one-stop-shop” based on public-private partnership principle to strengthen extension system.** The aim of these Centers is to empower small farmers at a platform to enhance their knowledge and skills and availability of quality agricultural inputs as stipulated in Section 4(g) of the Act, 2014, that each FSC shall “purchase certified seed, fertilizers, animal husbandry services, quality veterinary health care services and medicines, farm machinery, expertise and technology for provision to the members who are registered with the Centre on affordable rates in comparison to open market rates”. The objective is to improve rural livelihoods, and development of the rural economy.

**Currently, these MFSCs and FSCs have 199,428 beneficiaries (members) in 23 districts (excluding Newly Merged Districts) and 47 sub-centers.** District-wise number of beneficiaries are at Table 1. 41 percent (82,144) of the total members are in Northern Districts followed by Central valley with 36 percent (72,625) and Southern districts with 22 percent (44,659) members. However, most of the Model Farm Service Centres (MFSC) are in the north, followed by the South and the central valley. The criteria for membership of a FSC is that (a) an individual must be a farmer in the concerned agriculture office circle, (b) should not be less than 18 years of age, (c) should have not been convicted for more than 6 months in criminal or civil case, (d) should have not defaulted on any loan to a financial institution, and (e) willing to pay Rs. 100 as a registration fee and Rs. 500 as share money.

**The findings of this study are summarized below:**

**The main aim of the FSC is to enhance farmers’ knowledge and skills, increase yields, and improve overall development of the rural economy** through the availability of inputs such as certified seeds, fertilizers, pesticides, and machinery, along with expertise and advice and other services. The discussions in the sections below elaborate on the *sources and extent of use of various types of agricultural inputs* by district, region, and membership status. It then considers perceived differences in prices of inputs from FSCs versus the open market. The final discussion on this topic looks at the farmers’ willingness to pay for more inputs from the FSCs and their use of advisory services.

**The area considered in this study** is all districts of the province, pre-merger, which have FSCs. Total members are 199,428 in 23 districts and 47 sub-centers. The exact districts sampled were based on a combination of random and purposive approaches. The sample size by district along with results of a question asking whether non-members had been contacted for membership is presented in the first section below. Few non-members had been solicited for membership in any district.

The data for this study was collected from the selected sample size comprising members and non-members of MFSCs/FSCs through structured Questionnaire (Annexure-1) and focal groups discussions with the stakeholders. The methodology used to select the sample representative districts from each region<sup>1</sup>, sample

---

<sup>1</sup> Northern Region (Swat fairly represents Malakand, Shangla, Buner, Dir Lower, and Dir Upper while Abbottabad represents Mansehra, Batagram, and Torgar; historically the State of Swat until 1969 consisted of the present districts of Malakand, Shangla, Buner, Dir Lower, and Dir Upper); Peshawar, Charsadda and Nowshera districts represent the Central region very well given their climatic conditions and cropping pattern; and Karak and D.I. Khan represent the Southern region. Karak is situated centrally to Kohat, Hangu and Bannu while D.I. Khan is close to Tank and Lakki Marwat. Secondly, Canal irrigation is dominant in Peshawar, Swat, Charsadda, D. I. Khan and Nowshera while Abbottabad and Karak are predominantly rainfed.



size of members and non-members for each selected district, primary data analysis and econometric analysis to assess the impact and effectiveness of FSCs is elaborated at length in Section 3 and Section 4 of this study as well as Annexure-3. Farmer's and farm characteristics are at Table 7 and Figure 3.

**The major evidence produced to create an assessment of the MFSC** was a farm survey administered to 827 farmers with 403 being non-members and 422 members. The sample size was determined using standard statistical approaches based on the prevalence of FSCs in various parts of KP. This structure permits a comparison of characteristics and performance differences of the groups to show benefits and challenges for the FSCs. Section 3 describes the sampling and data collection approach and provide major results from the survey to provide a first stage in the assessment of the FSCs. The Section 4 will provide regression and other further analysis of the data through a variety of techniques.

## Key Results

**Farm and Farmers Characteristics:** After the methodology, the major results are first given *for farm and farmer characteristics*. Members had one and a half more years of education, but both groups have just about or slightly over an elementary education. Additionally, FSC members had close to six more years of farming experience than non-members (27 versus 21 years) and had significantly larger farms (22 jeribs versus 14 for non-members). A significant part of the farm size difference came from farms in D.I Khan, where members average 122 jeribs versus 20 for non-members. The survey also looked at *sources of credit and water*, as they are important determinants of productivity. Most farms received credit from local arthis or friends and family. There was very little dependence on either the formal banking system or FSCs.

**Source of Irrigation:** Farmers in the central region's districts have *a reliable source of canal irrigation* and rarely use tubewells or are dependent on rain, with over half of the farms using mainly canal water (Table 9). The Southern district of Karak and the Northern district of Abbottabad largely rely on rain for irrigation, accounting for 31 percent of the observations, and have the lowest yields of wheat and maize (Tables 11 and 12). Just 13 percent of the sample uses tubewells significantly.

**Further results** (in Tables 11 to 14) contain the district, region and FSC membership-wise comparison of mean values of *area planted by an average farmer, yields, and seed quantities and costs* for four major crops. Wheat is the most common crop grown by the sampled farmers, with nearly 85 percent of farmers producing it. That is followed by maize grown by 60 percent of farmers. Only 20 percent grow sugarcane, in just four districts, and just six percent of the sampled farmers grew rice.

**Yield of Different Crops:** The *yields of major crops across districts* are important metrics for this evaluation. Wheat yields were lowest in Abbottabad, at 5 maunds per acre, but were 11 maunds in Peshawar and Nowshera. Much of this variation can be explained by irrigation differences, as the cost and quantities of wheat seed used was generally consistent across districts. For maize, the yields were quite variable as were prices and the use of seed. They ranged from a low in Nowshera of 3.5 maunds to a high in D.I. Khan of 8.7 maunds. In sugarcane, yields in DI Khan were double those in any other region that produced sugarcane, while all others were similar (*See Tables A-11 to A-14*).

**Major Inputs:** For the major inputs, *fertilizer and seed*, farmers buy mostly from the market or from FSCs. On the high side, FSC members buy 44% of their seed from the centers themselves, 41 percent comes from

the market and 15 percent is from their own sources. For wheat and maize, holding back production for seed during the following year is a common practice but may lead to lower productivity. Maize farmers in general buy less seed from the FSC's, but there are significant differences by district. In Karak, urea use per jerib is three times less than in most other districts. In Swat, for example, farmers averaged 1.5 bags per jerib, five times as much as in Karak. Karak also has a low relative use of DAP fertilizer, but tractor hours per jerib tend to be consistent across districts.

**Average Price:** The *average prices for these inputs* were cheaper from the FSCs than from the open market, as reported in Tables 37-41. However, there were significant differences by type of input and location. For wheat seed, open market prices as reported by farmers seem to be consistent in all regions, and with FSC prices lower by about PKR 500 in the Northern region, PKR 200 in the Central region, and PKR 300 in the Southern region. In contrast, maize seed prices were very heterogeneous across regions but not significantly different by location. Non-members felt that FSC prices were higher than the open market, perhaps reflecting a perception that better quality could be found in the FSCs. For both fertilizer types, perhaps reflecting relatively well-developed markets, the reported prices were uniform with some variations by region, as would be expected. In the Northern and Southern areas, a PKR 120 benefit from buying from the FSC's was seen. As most non-members did not buy from the FSC it's certainly questionable as to what their reported prices of FSC inputs might mean.

**Purchasing Pattern of Inputs from FSCs:** The study also examines the purchasing patterns of FSC inputs, namely maize seed, wheat seed, DAP, and Urea, with respect to the membership status of the purchasers in the FSC. The analysis of the data revealed that a significant proportion of purchasers (17% for maize, 19% for wheat, 15% for DAP, and 24% for Urea) were non-members of the FSC. Additionally, it was found that a considerable number of FSC members who were purchasing inputs were also members of the management committee (25%, 27%, 20%, and 22% for wheat seed, maize seed, DAP, and Urea, respectively). The proportion of farmers who made use of the FSC was highest for wheat seed, with 196 total buyers including 158 FSC members. For maize seed, 75 farmers including 62 members purchased from the sample of 825. For DAP and urea, around 100 buyers with 80 percent being members. It is thus notable that less than fifteen percent of our sample purchased inputs from the FSC aside from wheat seed.

**Satisfaction of Farmers with FSCs:** With this limited use of FSC inputs, it is important to understand satisfaction that farmers have with the *provision of those inputs and also uses of advisory services* that are usually an important part of extension activities. The survey administered several brief willingness to pay questions about the inputs provided, and about the sources of advisory services. It turned out that, for whatever reasons, relatively few members were willing to pay anything for specific services, but many in fact were willing to pay about PKR 900 for more but unspecified services. Perhaps many farmers feel there is potential for the FSCs but they do not know what that might be. The advisory services used most extensively had to do with seed varieties and rates, fertilizer, pesticides and machinery.

**Farmers' Perspective on the Criteria of Membership:** The *farmers' were asked their perspectives on the criteria for membership of the FSC and the farmers' satisfaction with the institution*. The survey asked respondents about five different requirements for membership, including location of the farm, age, absence of a criminal conviction or financial default, and willingness to pay Rs. 100 as a registration fee and Rs. 500 as share money. Additionally, questions were asked about the management committee and overall satisfaction with the FSCs. Table 46 shows the frequency of farmers' satisfaction with the FSC, MC and membership criteria, and infers that significantly more than fifty percent of members were satisfied or very satisfied with most requirements.

**Overall Satisfaction of the Members with the Centers:** More than fifty percent were satisfied (35.7 percent) or very satisfied (22.3 percent), and 53 percent are satisfied with the working of the Management Committee (MC). The main concern was the requirement of secondary school certificate (SCC- at least 10 years of education) for a member of Management Committee, where a low score indicated partial dissatisfaction as more experienced farmers with lesser education could not become MC members. Finally, members' opinion regarding transparency and smooth functioning of the FSCs were asked about. 62 percent of the members respondents had attended meetings of FSCs. There were concerns about frequency of general body meetings, budget estimates that were not shared nor approved by the general body, and 74 percent of the respondents were not aware that they can vote for members of the management committee.

**Modest Impact:** While establishment of Model Farm Services Centres in the province is an initiative in the right direction, well aligned with emerging trends in developing and developed countries, their impact has been modest because of financial constraints, limited services and non-availability of required machinery when needed, far off locations from farm areas, stagnated membership, weak extension work, technology awareness, weak expertise in digital agriculture, etc.

**Drivers of Membership:** Location of FSCs from farms, model farms, timely availability of quality agricultural inputs at a lower rate compared to market, availability of farm machinery, frequent extension contacts and information obtained from friends, peers, and neighbors highly influence the farmers' decision to join MFSC or FSC.

**Elections of Management Committees:** Elections of the Management Committees (MCs) of FSCs are not held regularly and in some FSCs, members are not aware of their right to vote in decision-making and election of MCs.

**Financial Status of FSCs/MFSCs:** FSCs across the province are facing financial constraints as most do not get matching grants from the government as envisaged in the law.

**Access to Quality Agricultural Inputs:** Generally, the response of the members is positive. However, this mandatory services suffers from different constraints: (i) finances to ensure purchase of quality inputs and their timely availability; (ii) distance of FSCs from the farm area which deters the farmers in accessing FSCs because of higher transportation cost; (iii) lack of availability of agricultural inputs on credit from FSCs, particularly in case of fertilizers while dealers provide this facility; and (iv) non-availability of orchard saplings.

**Availability of Farm Machinery:** Farm machinery is either limited or non-available or non-operative or not aligned to local cropping needs. Resultantly, the members hire farm machinery from the market.

**Willingness to Pay for the Services of a FSC:** The farmers in Southern districts (D I Khan) have higher willingness to pay for each farm inputs as compared to farmers in Central region (Peshawar). Significant differences are observed in willingness to pay for farm inputs across FSCs members and non-members. In general, FSCs members have low willingness to pay for the services provided by a FSC as compared to non-members.

SWOT analysis of the study is discussed at Chapter 5 while a summary of the Survey and Focal Group Discussions is at Annexure 2.

## **Recommendations**

**The true Potential of MFSCs can be harnessed by transforming them into a single window for providing quality agriculture inputs including machinery, extension advisory role for**

**adoption of new technologies and modern farm practices to enhance productivity, precision agriculture, digital agriculture, climate smart and regenerative agriculture, knowledge sharing, advice on reducing post-harvest losses, storage, processing, packaging, branding, and to become hubs for providing timely markets information in terms of demand for various agricultural products, and disposal of marketable surpluses as has been observed in the survey.** To expand the network of MFSCs and FSCs and strengthen their functions, it is recommended:

***Restructuring and Revamping FSCs:*** It is important to restructure and revamp the FSCs to make them a real “One-Window” in terms of quality agriculture inputs, farm services and machinery, extension advisories and technical support in modern farm as well as adoption of new technology, reducing post-harvest losses, access to credit, developing ICT based system to access market information regarding demand, prices, disposal of farm outputs, a catalyst to develop and integrate with value chains, promoting agribusiness, and other allied services as iterated above.

***Mandate of the MFSCs/FSCs:*** The mandate of the FSCs may be expanded from merely an agricultural inputs center to a provide all support activities to the farmers including, (i) On-farm testing (OFT) to identify the location specificity of agricultural technologies under various farming systems; (ii) Front Line Demonstrations (FLD) to establish its production potentials on the farmers’ fields; (iii) training of farmers and extension personnel to update their knowledge and skills in modern agricultural technologies; (iv) work as resource and knowledge centre of agricultural technologies for supporting initiatives of public, private and voluntary sector for improving the agricultural economy of the district; (v) produce and make available technological products like seed, planting material, bio agents, young ones of livestock etc. to the farmers; (vi) organize extension activities to create awareness about improved agricultural technologies to facilitate fast diffusion and adoption of technologies in agriculture and allied sectors; and (vii) climate smart, regenerative and digital agriculture.

***Availability of Managerial and Technical Staff:*** The assigned mandate of the FSCs under the law requires availability of managerial and technical staff including Agricultural Officer, Plant Protection officer, Veterinary Officer, Soil Conservator, Water Management, Marketing Officer and Horticulture officer in the long run to accomplish trust and utility of the FSCs. Currently, some of the mentioned technical/managerial staff is not available in FSCs. Manitoba Agriculture, Food and Rural Initiatives published a paper on Human Resource Management for Farm Business in Manitoba in 2012 arguing that skilled and effective employees play key role in success and profitability of an organization. The Government may take necessary measures to ensure this on need basis of FSCs and farm area.

***Extension Advisories and Technical Support to Farmers:*** In view of the above, each MFSC/FSC may be linked with a team of Program Coordinator, subject specialists in the core disciplines, such as, agronomy, plant breeding, horticulture including kitchen gardening, livestock production, home science, extension education, agricultural engineering, livestock, soil science, agro-forestry, plant protection, climate smart and regenerative agriculture, and digital and precision agriculture depending on the need of the area and services hubs.

**Technology Transfer:** For the purpose of technology transfer in each district or Tehsil, Agricultural Technology Wing or Extension and Adaptive Research Department may be linked with these FSCs to support the farmers through these FSCs with: (i) an integrated extension programs across the line departments (i.e. more of a farming systems approach); (ii) link research and extension activities within each district, and (iii) decentralized decision making through “bottom-up” planning procedures that would directly involve farmers and the private sector in planning and implementing extension programs at the block and district level. This should be demand-driven extension and encourage crop diversification across the entire food and agriculture value chain. At the same time, private sector initiatives, like digital agricultural cells, and other small-scale models may provide information on diverse areas from production to accessing markets through ICTs which is a useful tool to increase connectivity between the various extension approaches and extension agencies.

**Training Centers:** These MFSCs/FSCs may also employed to play the role of influences for technological changes in addition to development of knowledge and management capacity as well as women empowerment in terms of improving knowledge and skills of the women trainees in farming and livestock rearing.

**Expanding the FSCs Network:** Farmers highlighted the distance to the FSCs as the main hurdle in approaching the centers. It is proposed that FSCs network may be expanded gradually, first to Tehsil level including Newly Merged Districts (NMDs) and then to Union Council level depending upon the demand, farmers’ needs, and availability of resources. It has been clearly established that distance of FSCs from farms is a constraint in availing their services because of high transportation cost.

**Establishing Retail Outlets Near Farms:** Pending expansion of FSCs network to Tehsil and Union Council level, the FSCs may be allowed to establish retail outlets near farms or start mobile service to expand their outreach to its members to provide agriculture inputs and combined it with extension services. This may also encourage non-members to become members of FSCs.

**Increasing Membership of FSCs:** Financial viability of a FSC depends on its membership, revenue it generates, its ability to purchase agricultural inputs and providing them to its members cheaper than the market-rates, imparting knowledge and promoting adoption of modern technology to its members. Therefore, FSCs need to carry out regular membership campaigns periodically to incentivize and motivate farmers to become its members.

**Productive Employment of Experienced Farmers:** FSCs can benefit from more experienced older aged farmers to gain from their experience and knowledge as well as to build capacity of extension agents and farmers. They can be engaged either on honorary basis or providing them honorarium. It is already happening in some areas of Punjab (Ashraf et al. 2019). The major areas in which advisory services can be provided by these old but experienced farmers may include seed selection, rate of applying seed and treatment, sowing time, methods and techniques, land preparation, crop rotation, technology use, selection and usage of pesticides and insecticides, irrigation, fertilizers, harvesting, storage and marketing.

**Women Membership of FSCs:** The women in rural areas may also be allowed to become members of FSCs as well as building their capacity as women are significantly engaged in agricultural



activities in rural areas of KP (FAO, 2015). They are already engaged in many agricultural activities such as seed cleaning, sowing, weeding, hoeing, harvesting, threshing, drying, seed storage, selling commodities, packing, sorting, and even selling.

***Training of Women in Farming:*** It is equally important to train women in modern practices and newer technology for animal health care. Livestock farming is a major source of livelihoods in the arid plains and mountains region of southern KP, with majority of farm households involved in goat and cattle rearing. In KP, almost every rural household maintains 2-10 units of livestock of various sizes including poultry, sheep and goat, buffalo and cow, horses, and bulls etc. and these are reared and taken care of by women. Major activities include cleaning and milking of cattle, feeding and watering livestock, stall feeding, grazing of animals, shed cleaning, watering of animals, bathing of animals, making and storage of dung cake, fodder cutting and feeding, preparing ghee, marketing of animals, selling products to villagers, marketing of animals produce, brooding and breeding, raising of goat and sheep, collection of farmyard manure, animal health caring. In Pashtun society where there are many taboos attached with woman engagement outside homes, thus their role can be instrumental for more engagement in livestock and gardening and growing fruits and vegetables on small scales.

***Employing Rural Youth:*** Yasin (2016) found that rural youth faced many constraints in engaging in agricultural activities, such as, lack of formal trainings or motivation (Butt et al., 2009). Establishing more sub-centres at more localized levels can help the youth to be engaged in various activities of FSCs and also in various agri-business activities throughout the value chain that it can bring with it.

***Revenue Generation for FSCs:*** Revenue generation, budgeting, and auditing are also an important challenge facing the FSCs. The FSC Act envisions that “each Centre shall have a Fund which shall consist of donation from Provincial allocations, grants, membership fee, contribution, income from own resources, donations, trusts, bequests endowments and any other sources of income and the account of a Centre shall be maintained and audited in such form and in such manner as may be prescribed under The Khyber Pakhtunkhwa Farm Services Act 2014. By expanding the existing network of FSCs and reaching to maximum farmers is the key to revenue and employment generation.

***Matching Grants:*** The Government must ensure that matching grants provided to the FSCs as envisaged in the law to incentivize and encourage the FSCs to enhance their revenues and improve their services.

***Budgeting and Audit of FSCs:*** The FSCs must generate revenues to meet not only their expenditures but also generate enough resources to lend credit at a cheaper rate than the market or middleman to their members. For this, each FSC need to develop an enterprise budget in the month of July each year for its members, farming community and agricultural producers, extension specialists, financial institutions, governmental agencies, and other advisers making decisions in the food and fiber industry. The FSCs’ budget may include estimated income to be generated from an enterprise, estimates for inputs and production practices required, efficiency evaluation, estimate benefits and costs for major changes in production practices, provide the basis for a total farm plan and support applications for credit. Secondly, since these FSCs function on public-

private partnership (PPP) basis, their audit may be conducted either through Local Fund Audit or through Commercial Audit firms rather than through Auditor General of Pakistan. The government may notify rules for maintaining record of revenue receipts, budgeting and auditing of FSCs.

***Procurements by FSCs:*** It was observed that financial transactions of FSCs are cumbersome and facilitators from the agriculture departments are hesitant to serve as a signatory as it could have implications for departmental inquiries in case of any mistake. Therefore, FSCs' transactions for procurement of farm machinery or agricultural inputs need to be exempted from Khyber Pakhtunkhwa Procurement Regulatory Authority and government audit procedures.

***Engaging the Private Sector:*** Solis and Bravo-Ureta (2005) based on the financial analysis of Farm Management Centre (FMC) that the private sector could be attracted to provide services for marketing, management, and technology transfer. In addition, the potential profitability stemming from these centers could generate motivation for private sector engagement in agricultural extension, storage, processing, and strengthening value chains. The literature suggests that in many developing countries, the entity such as FSCs are privatized. The privatization of agricultural services began as a response to a decline in public expenditures worldwide. Dinar (1996) shows that, in real terms, public expenditures on extension have been declining since the mid-1980s. Beynon (1995) provides two explanations for these reductions: first, fiscal budget restrictions that have been imposed to reduce state activity in those areas where the private sector may be willing to invest; and second, the need to increase the cost-effectiveness of a deteriorating system of public research and extension in many developing countries. The current experience with private agricultural extension ranges from complete privatization to cost-recovery approaches. Complete privatization has been shown to be effective among larger-scale commercial farmers and for high-value cash crops and livestock (Kidd et al., 2000). Bindlish and Evenson (1997) argue that in order to establish sustainable agricultural development strategies, the focus must be on helping farmers to become better managers.

***FSCs as Catalyst to Strengthen Value Chains of Agriculture Products:*** FSCs can also be catalyst in promoting horticulture, enhancing its productivity, and strengthening the value chain. Value chains are organized linkages between groups of producers, traders, processors, and service providers that join together to improve productivity and the value added from their activities. In a well-managed value chain, the value of end-product is often greater than the sum of individual value additions. By joining together, the participants in a value chain increase competitiveness and are better able to maintain competitiveness through innovation. The limitations of each single participant in the chain are overcome by establishing synergies and governance rules aimed at producing higher value. The main advantages to commercial stakeholders from being part of an effective value chain include being able to: (a) reduce the cost of doing business; (b) increase revenues; (c) increase bargaining power; (d) improve access to technology, information, and capital; and, by doing so, innovate production and marketing processes to gain higher value and provide higher quality to customers. Smallholder farmers need to better engage with value chains to gain added value for improving their livelihoods, whilst reducing their risks and increasing their resilience<sup>2</sup>.

---

<sup>2</sup><https://ag4impact.org/sid/socio-economic-intensification/building-social-capital/agricultural-value-chains/>

***Acquiring Dealership by FSCs:*** FSCs may be allowed to acquire dealership of fertilizers, pesticides, and seeds to provide these at cheaper rates to their members which may incentivize the farmers to become members.

***Access to credit:*** Access to credit through formal channels is a key requirement for all participants in a value chain. Most credit is directed towards farmers for production related initiatives and hardly address the needs of other stakeholders in the value chain, such as, processors, traders, output markets, value addition, etc. Currently, farmers access credit from *arthis* (market traders) for agricultural purposes during the cultivation season at a high mark-up and return to the *arthis* at the time of crop sale to the trader. Inability of farmers to provide collateral to credit providers constraints their access to formal channels. FSCs, due to their local knowledge of the farmers may act as a third-party guarantor and advise the banks to extend short term small credits to member farmers on competitive interest rates. FSCs may also use the methodology of micro-finance devised initially by the Grameen Bank of Bangladesh.

***Availability of Farm Machinery and Equipment:*** There is a mismatch in demand and supply of farm machinery in most FSCs, such as, potato diggers were supplied to Karak FSC where the crop is not even grown; and secondly, FSCs either have redundant or inoperative farm machinery and equipment. It is a demotivating factor to become a member of FSCs. It is recommended that proper need-assessment should be done for farm machinery procurement and its procurement. The Government may develop system to allow digital tagging of farm machinery, monitor its movement as well as revenues earned and a proper mechanism for maintenance to ensure their timely availability of farm machinery.

***Rural infrastructure development:*** Farm-to-Market roads and markets infrastructure are important, as they provide critical linkages for connections and transactions between value chain participants. Aside from the other rural functions, they indirectly support value chain development. While roads are useful for value chains, they must connect agricultural areas that have a competitive advantage with strategic markets. This has not always been the case. Likewise, the locations of markets and storage facilities are critical for value chain development.

***Acquisition and Adoption of Technology:*** Value chain of agricultural products require continuous innovation and adoption of new technology to remain competitive. FSCs can become main hubs for providing innovation and promote adoption of new technology for its members to enhance their productivity and connect them to other participants of the value chain.

***Standards and Grading:*** The provincial government may develop standards and grading system for agricultural products and a system of variable prices for quality products. FSCs can be an easy outlet to impart this knowledge to its members to enhance their income.

***Markets Development, Markets Access, and Contract Farming:*** An understanding of markets demands and requirements is necessary to take advantage of markets opportunities. Most development projects support market access through capacity development and training to build basic business skills. While important, these skills often do not go far enough in providing the specific market information required for selected agricultural value chains. From the study of different countries, several examples of improving market access through contract farming have emerged primarily by linking producers with agricultural processors. Secondly, the FSCs can

encourage establishing Farmers Markets allowing the producers to market their products directly. *A separate paper on Contract Farming has been published by the IFPRI-Pakistan.*

***Access to timely market information:*** Access to timely market information, such as prices, is essential for a functioning value chain. This helps participants in the chain, such as producers, to respond to changes in market demand as well as prices and improves their negotiating power with traders and processors. Generally, the market information is not provided in a timely manner resulting in huge post-harvest losses. FSCs, connected with ICT based system, can provide this timely information to their members, which may motivate other farmers to become members.

***Monitoring and Evaluation System for FSCs:*** *At present there is no mechanism in place for monitoring and evaluation of the FSCs.* A well-established and proper M&E system is essential to monitor performance and effectiveness of the FSCs and also provide timely feedback on the issues and problems that are faced by them as well as the members. Valmohammadi and Servati (2011) argue that performance measurement can be defined as the process of quantifying the efficiency and effectiveness of action. Wu, Tzeng, and Chen (2009) suggest that performance is referred to as one kind of measurement of the goals of an enterprise, while evaluation is referred to as the goal that an enterprise can effectively obtain during a specific period.

***Developing Key Performance Indicators for FSCs:*** For the purpose of evaluation, Key Performance Indicators (KPIs)<sup>3</sup> need to be designed and measured to assess success the success of a particular activity or service in which FSCs are engaged and to measure progress toward those goals and targets of FSCs. FSCs can use these designed KPIs to identify weaknesses in their performance as well as set specific targets<sup>4</sup>. The important key performance indicators for FSCs can be their services and level of satisfaction of the farmers. Important KPIs for an FSC may include: (i) number of registered and active members; (ii) increase in members from the base year; (iii) increase in revenues over previous year; (iv) timely availability and sale of agriculture inputs; (v) timely availability of farm machinery and equipment and their accessibility to the farmers; (vi) satisfaction of farmers and landowners with the services provided by the FSCs; (vii) farmers satisfaction with the training of farmers, knowledge shared, and awareness created about the new technology and modern farm practices as large percentage of farmers in Pakistan are unskilled and inadequately educated about the progress in field of farming (Zakar, 2007; Khan, 2010) because of which they are not able bring efficiency in their production and need specialized skill in order to prepare for quality expansion and showcasing; (viii) number of field assistants per center and area covered by one assistant; (ix) availability of technical and managerial staff in the FSC and satisfaction with their technical skills; (x) arrangements for providing market information and farmers satisfaction level for FSCs' support to market their produce; (xi) promotion and adoption of new technology; (xii) efforts to integrate with the value chains; and (xi) outreach of a FSC to the target population.

***Role in Global Traceability Standards:*** As the capacity of FSCs is strengthened and these are organized on modern lines linked with ICT based system, these can also play a role in

---

<sup>3</sup><https://blog.agrivi.com/post/measuring-kpis-for-increasing-productivity>

<sup>4</sup><https://www.thedairysite.com/articles/4312/key-performance-indicators-best-management-practices-on-tropical-dairy-farms/>

implementing the Global Traceability Standards (GTS) to preserve consumer confidence, reduction in the cost of information sharing and the cost of product identification, reduction in time required for information sharing, inventory management and registration of products (Brunsson and Jacobsson, 2002 and Rinsberg et al., 2011). The implementation of GTSs plays a significant role in ensuring the quality and safety of food. Knowledge concerning incentives, opportunities and challenges can also support managers at FSC enterprises and governmental authorities in their decisions about implementing GTSs to meet legal and end consumer food traceability requirements.

## **Proposed Amendments in FSCs Act 2014**

***The Draft Bill to amend the Farm Services Centres Act 2014 is at Annexure 4. The objective of the proposed changes is multi-pronged as follows:***

***First***, while ensuring the FSCs to be a body corporate with public-private partnership, their mandate may be expanded as underlined above (second recommendation) transforming them into knowledge hubs to support and help farmers to move towards digital and climate smart agriculture in addition to managing required agricultural inputs.

***Second***, Provincial Board is proposed to be reconstituted to *include Director General Agricultural Research, Director General Extension, Director Agriculture Engineering, Director Soil Conservations, Director Model Farm Services Centers, representatives of Livestock Department, Food Department and Food Safety Authority, academia and research institutes to make it a robust body for policy formulation and implementation.* The SWOT analysis in this report presents internal problems in FSCs that affects their working. The proposed amendment will give wider and coordinated support to the FSCs to improve their operation.

***Third***, it is proposed to empower Director General Agriculture Extension to recommend, after due process and diligence, to the Board to dissolve the Executive Committee of a non-performing FSC and arrange to hold fresh election.

***Fourth***, the changes will allow the FSCs to access development funds through participation in Annual Development Plan (ADP) of the Government of KP for improving FSCs services, developing value chains and agribusiness. This is facilitated by amending section 3 stipulating the “*Government may invite development proposal and programs for from Model Farm Services Centres to support the agriculture sector*”. Every FSC has been assigned an Agriculture Officer (BPS-17).

***Fifth***, FSCs are proposed to have powers to become *authorized agricultural input dealers, procure agricultural machinery for renting it out to members, and have powers to establish farmers’ markets, ICT based system to provide markets information, developing value chains and promoting agri-business.* Agricultural inputs are central to agricultural innovation and productivity improvement. Having status of authorized agriculture inputs dealers, FSCs will have the opportunity to procure quality inputs and innovative technologies suitable for registered members at competitive rates directly from the companies. In the past, the government procured technologies without knowing the real needs of farmers. These needs change from one area to another given the changes in the agro-climatic conditions.



*Sixth*, it is proposed to ensure that these FSCs operations are well aligned with the Government policy objectives and goals.

*Seventh*, FSCs are proposed to generate revenues to provide access to credit to its members at competitive rates to minimize their reliance on informal sources of credit.

*Eighth*, it is proposed to provide the services of an Agriculture Officer (BPS-17) to provide necessary guidance and support as well as training to the FSCs members based on research and knowledge

*Ninth*, it is proposed to title the Management Committee as “*Executive Committee*” and change the composition of the Executive Committee.

*Tenth*, each center is proposed to maintain Fund, its accounts and arrange its audit.

*Eleventh*, the Department of Agriculture will develop performance indicators and establish an ICT based Monitoring and Evaluation System to monitor the performance of the Centres and implementation of this Act.”

**To conclude, members are positive’ about FSCs.** They feel empowered to be part of general bodies, electing Management Committees and decision making, getting extension advisories on modern farm practices as well as technical support. They think they are important to the Government as FSCs have legal cover and have been established for the benefit of farmers. At the consultative workshop, most of the participants agreed that the MFSC is an excellent idea and has a promising future. The KP’s MFSC Act enacted in 2014, however, needs to be amended as proposed and implemented in letter and spirit implying, effective functioning provincial Board, addressing financial position of FSCs including matching grants, increasing their membership, improving services, and other related matters. Also an ICT based M&E system is essential to monitor performance, periodic evaluation to assess effectiveness of the FSCs and to get timely feedback on the issues and problems that are faced by them. It is equally important to ensure that the decision making of FSCs is insulated from political interventions and local influential to allow these FSCs to function as a public-private-partnership entity in true sense. Going forward, these FSCs may be strengthened as suggested above to make them truly “one-window”.

## 1. Introduction

**Agriculture play vital role in Pakistan's economy.** It contributes 22.7 percent to the Gross Domestic Product (GDP), employs 38 percent of the total employed labour force, and is a major source of foreign exchange earnings (Economic Survey of Pakistan 2021-22). According to Census of 2017, around 64 percent of country's population and over 80 percent of country's poor reside in rural areas. Recognizing the significance of the agriculture sector, the federal as well as provincial governments have invested huge public resources in irrigation, infrastructure including farm-to-market roads, agricultural technology, and market development. They have also established many academic institutions, research and extension system, incentivized agriculture inputs industry and mechanization of agriculture, encouraged financial inclusion to promote innovative approaches to boost farm and non-farm productivity as well as exports to accelerate rural transformation in collaboration with the development partners.

**Realizing the need for a vibrant extension services system to modernize the agriculture sector, the government began Training and Visit ("T" and "V") system in 1970** (Davidson et al., 2001). However, the agriculture extension around the globe has experienced structural reforms as countries transitioned from centralized to decentralized and privatized extension system (Rivera, 1998). Over the years, the system has evolved to include farmers' training, promoting adoption of new technologies, stimulating innovative agriculture practices, and encouraging mechanization. Many studies have indicated that the country's agricultural extension education/services address crop production, crop management, knowledge and technology transfer with an aim to improve the overall agriculture in Pakistan (Davidson et al., 2001, Luqman et al., 2007, Shah et al., 2010). It also strives to disseminate useful information through various modes and provide various skills relevant to farming through various extension agents. However, Shah et al. (2010) and Luqman et al. (2007) argued that the education curricula in colleges and universities as well as the extension services in Pakistan have not addressed the 'environmental' and 'social' problems in Pakistan, which could be mainly due to the country's weak institutional framework that involved enormous loopholes between the policies and practices.

**The Government of Khyber Pakhtunkhwa following public-private partnership approach established Model Farm Services Centres (MFSC) in 1999 to strengthen the extension services system and to lead farmers communities towards sustainable agriculture by delivering demand-based services.** FSCs were established as "one-stop-shops" with the aim of building farmers' capacity and enhancing access to technical advice as well as farm inputs, such as, certified seeds, fertilizers, farm machinery, crop protection products including pesticides, veterinary supplies, crop price information, soil testing, financing and trade credit, and equipment leasing to farmers, enhancing farmers knowledge and skills in the farm management, planning and need assessment, increasing the crop yield and improving farmers' livelihood and connecting them to Government Line Agencies (GLAs). Every person above 18 years of age involved in agricultural businesses and have his own agricultural land, dairy farm, poultry farm, fish farm or in any other agricultural related activities is eligible for membership for the MFSCs after paying an enrolment fee and membership fee.

The purpose of this study, desired by the Agriculture Department, Government of KP is to evaluate performance of Farm Service Centers and recommend measures to upgrade and strengthen them as well as expanding its network to anchor the MFSCs/FSCs for inclusive growth, modernizing agriculture sector, development of horticulture subsector, transferring technology and suggest institutional and legal changes if so required.

## 2. Literature Review

**Growing population, declining cultivable land due to global industrialization and rapid urbanization combined with climate change is threatening yield and production of key major crops, thus raising concerns for national food security.** It necessitates a vibrant agriculture innovation system supported by a strong research and extension system for producing new seed varieties, creating awareness about hybrid seed, building farmers' capacity, minimizing gap between potential and average yield of crops by diffusing agricultural technologies among farmers communities and enhancing farm and water productivity for a sustainable and inclusive agriculture growth (Khatam et al., 2013). Exposure of farmers to new information is an important factor that influences their adoption behavior (Muhammad et al., 1995). Towards this end, awareness is the first step in the adoption process (Mahmood and Sheikh, 2005). Agricultural advisory services are perceived as a key driver behind innovation processes in agriculture. However, changes in national and global contexts cause dramatic variations in the orientation of advisory services, their organization and their methods of intervention (Faure et al., 2012). Landholding is a significant factor which also changes the behavior of an individual particularly in farming for modern technology. As the size of landholding increases, the individual will be more inclined towards the adoption of technologies and vice versa (Belay et al., 2012).

**The agriculture extension around the globe has been experiencing structural reforms as countries transitioned from centralized to decentralized and privatized extension system (Rivera, 1998).** Solis and Bravo-Ureta (2005) argue that two main reasons have motivated the privatization of agricultural extension in the Central American country of El Salvador: (i) reduction in public expenditures on agricultural research and extension because of budget constraints and administrative reforms (World Bank, 1998) and (ii) the condition for self-financing mechanism to finance agricultural projects imposed by international development agencies (Beynon, 1998). Saadi et al. (2008) and Singh et al. (2011) contend that in the worldwide market today, farmers must have information with respect to new systems of cultivating, new strategies for development, seeds, pesticides, better government arrangements in regards to agribusiness, reduce losses of their potential harvests and convenient procurement of inputs. Therefore, there is an increasing interest in the countries on private strategies that compensate the reduction of the state investment in agricultural extension and that fulfill the conditions imposed by the development agencies.

**Recent literature suggests that extension work is more productive if it is strongly supported by the local governments (Feder et al, 2001).** The Farm Service Agency of the United States provides guaranteed credit directly to farmers to build their credit history and to fill the gaps in the commercial credit market (USDA FSA, May 2004). Western Africa has introduced four types of institutional systems namely, those managed by (i) farmers organizations; (ii) inter-professional body; (iii) service delivery centers; and (iv) private providers of services advising individual farmers (Faure and Paul, 2004) under Management Advice for Family Farms and Farmers Governance (MAFF). The Australian agricultural research development and extension system (RD&E) is pluralistic and reflects many attributes of privatizing extension systems internationally (Klerkx and Nettle, 2013). The RD&E is largely commodity/industry driven with multiple public, private, industry-good (shared government-farmer levy-arrangements by agricultural commodity) and farmer-owned R&D groups as well as vocational training providers involved in agricultural extension.

**Publicly funded agricultural research and extension have played a major role in rapid expansion of the real output and agricultural products in China. At the same time, technology contributed more than 40 percent of agriculture growth.** China established a decentralized public agricultural extension system (PAES) since the end of 1970s to provide technology and applications related to all processes during agriculture production through experimentation, demonstration, training, and consulting (Hu et al., 2009). It implemented a series of self-sufficiency reforms for its PAES since the late 1980s encouraging the PAES

stations, organized by agricultural sub-sectors including crop, livestock, agricultural machinery, aquaculture, and economic management centers to earn their income through commercial activities. At the end of the 1990s, the Chinese government carried out an administrative decentralization reform shifting the administrative rights (personnel, finance, and materials) from county agricultural bureaus to township governments (Hu et al., 2012).

**India also initiated Krishi Vigyan Kendra (KVK) Program, also known as Farm Science Centers (FSC), as a multidisciplinary agricultural extension education and knowledge center located in each district in 1974 mandated to provide several farm support activities** (*for details see Box 1*). At the same time, private sector initiatives, like e-Choupal, and other small-scale models are providing information on diverse areas from production to accessing markets through ICTs which is a useful tool to increase connectivity between the various extension approaches and extension agencies (Kumar, et al., 2019).

#### **Box 1. Transforming Agriculture through KVK Program**

KVKs are mandated provide several farm support activities, such as, (1) On-farm testing (OFT) to identify the location specificity of agricultural technologies under various farming systems; (2) Front Line Demonstrations (FLD) to establish its production potentials on the farmers' fields; (3) training of farmers and extension personnel to update their knowledge and skills in modern agricultural technologies; (4) work as resource and knowledge centre of agricultural technologies for supporting initiatives of public, private and voluntary sector for improving the agricultural economy of the district; (5) produce and make available technological products like seed, planting material, bio agents, young ones of livestock etc. to the farmers; and (6) organize extension activities to create awareness about improved agricultural technologies to facilitate fast diffusion and adoption of technologies in agriculture and allied sectors. For the purpose of technology transfer in each district, Agricultural Technology Management Agency (ATMA) has been introduced to: (i) Integrate extension programs across the line departments and the KVKs (i.e. more of a farming systems approach); (ii) Link research and extension activities within each district, and (iii) Decentralized decision making through "bottom-up" planning procedures that would directly involve farmers and the private sector in planning and implementing extension programs at the block and district level. The ATMA model is also increasing demand-driven extension and encourages crop diversification across the entire food and agriculture value chain. At the same time, private sector initiatives, like e-Choupal, and other small-scale models are providing information on diverse areas from production to accessing markets through ICTs which is a useful tool to increase connectivity between the various extension approaches and extension agencies.

Empirical evidence suggests that access to a KVK is strongly associated with the socioeconomic and demographic characteristics of farm households. Farmers with better education, large landholdings, and access to credit are more likely to seek information from a KVK.<sup>5</sup> Impact analysis suggests that KVK's trainings have played a key role in influencing technological changes in addition to development of knowledge and management capacity.<sup>6</sup> KVKs are also playing important role in women empowerment in

<sup>5</sup> Anjani Kumar A K Singh Sunil Saroj Misha Madhavan M P K Joshi, 2019. The Impact of India's Farm Science Centers (Krishi Vigyan Kendras) on Farm Households' Economic Welfare: Evidence from a National Farmers Survey, IFPRI Discussion Paper 01832 April 2019.

<sup>6</sup> S.B. Katole<sup>1</sup>, J. H. Bhatt<sup>2</sup> and G. G. Patel<sup>3</sup>, 2017. Impact Analysis of Activities Oo Krishi Vigyan Kendra, Guj. J. Ext. Edu. Vol. 28 : Issue 2 : December 2017.

terms of improving knowledge and skills of the women trainees, *albeit* some hurdles due to which rural women are unable to initiate professional activity.<sup>7</sup>

**Khyber Pakhtunkhwa also established MFSCs and FSCs to strengthen the extension system in the province.** It enacted the Farm Services Centers Act in 2014 to provide for the establishment and regularization of Farm Services Centres with public private partnership, in the province to create linkages among farming community, GLAs, and enhance agricultural yield. While FSCs successfully imparted skills to farmers in fertilizer application, improved agricultural technology and sowing methods and developed the linkages with agriculture research and water management department (Ahmad et al., 2017), these Centers failed to establish linkages with the agriculture engineering, seed companies, pesticides companies, farm machinery and credit providing agencies Haq et al. (2009). Muhammad et al. (2017) argue that there is a significant correlation between age, education, landholding and tenancy status and their participation in various activities of MFSCs. They suggested that relatively young, educated, big and owner farmers may be given priority for registration in MFSCs so that they could avail full benefits of MFSCs through active participation for planning, purchasing of inputs, fixing prices for inputs, distribution of inputs, making arrangement of trainings, and conducting tours and trips to research stations and progressive farmers of the area. Shah et al. (2017) indicates that most of the member farmers of FSC are relatively more aware of various aspects of agricultural system prevailing in the DI Khan and rest of the country such as best crop varieties suiting their environment, extension activities and their yield is higher than that of non-member respondents. Some of the respondents were of the view that lack of agricultural inputs, shortage of farm machinery, unavailability of credit facilities and long distance of the MFSC are the main problems they are confronted with. Aldosari et al. (2019) found that the respondents' community in Peshawar Valley was well aware of information technologies especially internet and mobile phone. They also consider television and radio are useful source of important information dissemination means in emergency reports and warnings.

**The purpose of this study is to evaluate performance of Farm Service Centers and recommend measures to upgrade and strengthen them and expanding its network to anchor the MFSCs/FSCs for inclusive growth, modernizing agriculture sector, development of horticulture subsector, transferring technology and skills and suggest institutional and legal changes if so required.**

---

<sup>7</sup>Sewa Singh Dahiya, Samunder Singh, and Sunil Deswal, 2020. Role of Krishi Vigyan Kendras in Women Empowerment: A Study of Haryana State, Maharshi Dayanand University Research Journal ARTS 2020, Vol. 19 (1) pp.15-26



## Chapter 3.0: Sampling Strategy and Survey Results for the Model Farm Services Centers Assessment

### Key Messages:

- *This chapter aims to better understand the methodology employed for sampling strategy and results of survey as well as focal groups discussions with the stakeholders for Model Farm Services Centers Assessment.*
- *Significance of MFSCs/FSCs in transforming agriculture sector in Khyber Pakhtunkhwa and its role in driving rural transformation, and the profile of rural areas - including demography, economy, social outcomes, and vulnerability.*
- *While a shrinking fraction of the overall economy, agriculture remains critical for rural livelihood, food security, poverty reduction, and broader economic development.*
- *Fiscal space for rural investments needs to be expanded through revenue generation particularly through agriculture income tax and property tax and service tariffs from densely populated areas outside of urban cities.*

**Khyber Pakhtunkhwa is located in the north-western region of the country along the international border with Afghanistan.** It comprises of 35 districts after the merger of erstwhile Federally Administered Tribal Areas (FATA). KP is the third most populous province after Sindh and Punjab and has 28 districts (excluding newly merged areas). According to 2017 census, total population of the province is 35,525,047 which is almost 17.9 percent of the Pakistan's total population. Its geographical area is 101,741 km<sup>2</sup>. Khyber Pakhtunkhwa has the third largest provincial economy in Pakistan with share of 10 percent of national GDP. Agriculture remains important sector in the province and the main cash crops include wheat, maize, tobacco, rice, sugarcane, as well as fruits and vegetables are grown in the province<sup>8</sup>.

### 3.1. Study Area

**The area of this study is all districts of the province, pre-merger, which have MFSCs.** Total members are 199,428 in 23 districts and 47 sub-centers.<sup>9</sup> The district-wise number of beneficiaries are shown in Table 1. Northern districts have 41 percent (82,144) of the total members, followed by the Central valley having 36 percent (72,625) and Southern districts with 22 percent (44,659) of all members. However, most of the Model Farm Service Centres (MFSCs) are in the north, followed by the south and then central valley. The locations of MFSC are given on the map of KP in Figure 1.

### 3.2. Methodology

For evaluation of MFSCs/FSCs, the study employed various tools, such as: (i) collecting data from a randomly chosen representative sample of 806 farmers, 403 members and 403 non-members, through structured Questionnaire (Annexure-1); (ii) Focal Group Discussions and stakeholders' consultations with members and non-members of FSCs; (iii) descriptive analysis examining various aspects of the KP's model farm services centers (MFSC) by districts, regions, and membership wise and do a comparison of means between various factors; and (iv) econometric analysis using endogenous switching regression (ESR) and propensity score matching (PSM). Endogenous Switching Regression (ESR) and Propensity Score Matching (PSM) are used to estimate the impact of FSC membership on farm yield, selection bias and

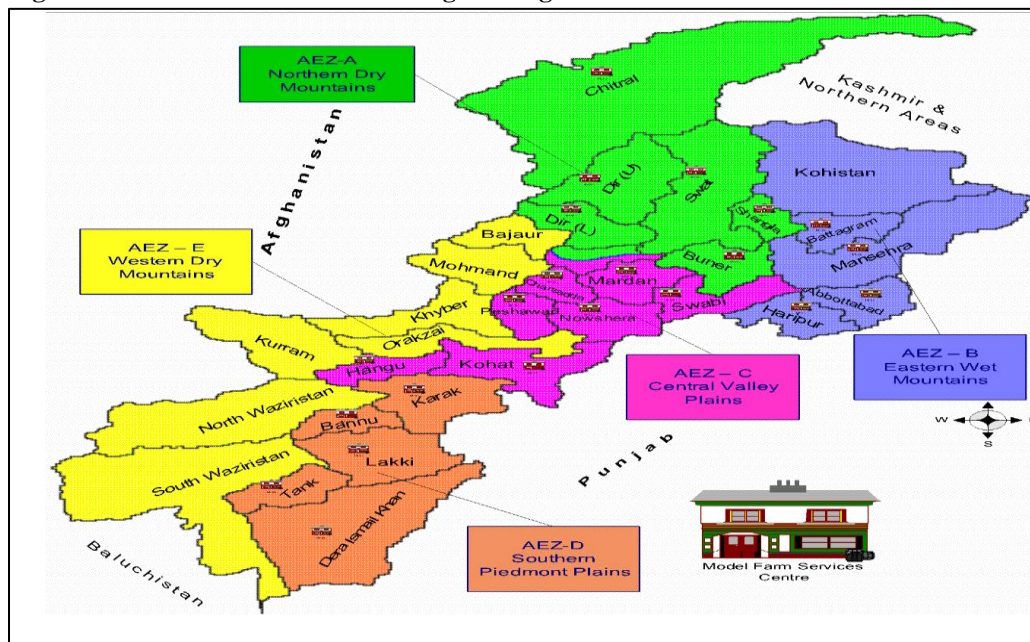
---

<sup>8</sup> [https://en.wikipedia.org/wiki/Khyber\\_Pakhtunkhwa](https://en.wikipedia.org/wiki/Khyber_Pakhtunkhwa)

<sup>9</sup> Beneficiaries are defined as members of the MFSCs while non-members are non-beneficiaries.

unobserved heterogeneity. To check the sensitivity of results obtained from ESR model, propensity score matching (PSM) analysis has been done.

**Figure 1. Location of MFSCs across Agroecological Zones in the Province**



**Table 1. Membership of Farm Service Centres across districts and regions in KP**

S. No.	District	Model FSC	Sub-Centres	Membership
<b>NORTHERN DISTRICTS</b>				
1	Abbottabad	1	1	3623
2	Batagram	1	1	10203
3	Chitral	1	2	5109
4	Dir Lower	1	2	8984
5	Dir Upper	1	0	8960
6	Malakand	1	1	2603
7	Mansehra	1	6	19969
8	Shangla	1	0	4201
9	Swat	1	4	4760
10	Torghar	1	0	2238
11	Bunir	1	3	11494
<b>NORTH-Sub-Total</b>		<b>11</b>	<b>20</b>	<b>82144</b>
<b>SOUTHERN DISTRICTS</b>				
12	Bannu	1	0	12409
13	DI Khan	1	1	1856
14	Hangu	1	2	3601
15	Karak	1	2	7544
16	Kohat	1	0	9313
17	LakkiMarwat	1	4	6452
18	Tank	1	0	3484
<b>SOUTH-Sub-Total</b>		<b>7</b>	<b>9</b>	<b>44659</b>
<b>CENTRAL VALLEY</b>				
19	Charsadda	1	3	14263
20	Mardan	1	4	6010
21	Nowshera	1	3	4544
22	Peshawar	1	3	21812
23	Swabi	1	5	25996
<b>CENTRAL-Sub-Total</b>		<b>5</b>	<b>18</b>	<b>72625</b>
<b>ALL-Grand Total</b>		<b>23</b>	<b>47</b>	<b>199428</b>

### 3.3. Sampling Frame and Sample Size

**A grand list of membership<sup>10</sup>, district-wise, was compiled, which provided the sampling frame for selection of the sample.** Before selection of the individual respondent, sample size was determined based

<sup>10</sup> Lists of members of MFSCs/FSCs were obtained from the office of Director Farm Service Centres, Peshawar. Which were arranged, district wise, in one Excel file.

on two relationships. First, single-stage random sample of Casley and Kumar (1988) was used that allows minimizing sampling error and the uncertainty attributed to estimates from the sample. Casley and Kumar (1988) proposes single stage simple random sample ( $n$ ) calculation based on the following relationship.

$$n = \frac{K^2 V^2}{D^2} \quad (3.1)$$

where  $K$  is the standard normal deviate for the required confidence interval,  $V$  is the coefficient of variation of the variable under study (i.e., its standard deviation as a proportion of its mean), and  $D$  is the margin of error, expressed in percentage points and representing the largest acceptable error in the estimates. The values of  $K$  for two- and one-sided intervals are given in Table 2. A figure of 90 percent confidence for a two-sided margin implies a 10 percent probability that the error will exceed one of the other margins.

**Table 2: Conversion of Confidence Interval to Normal Deviate**

Two-sided interval	One-sided interval	Normal Deviate ( $K$ )
75	87.5	1.15
80	90.0	1.28
85	92.5	1.44
90	95.0	1.64
95	97.5	1.96

*Source: Casley and Kumar (1988)*

The values of  $K$  and  $D$  can be assumed, and the mean (8421.7) and standard deviation (6500.5) of membership of all the MFSCs are used to derive  $V$ . The mean of membership is used in the absence of any other relevant data of FSCs. The assumed value of  $K$  and  $D$  and the calculated value of  $V$  gets us a sample of 226, which can be proportionately allocated to all the MFSCs according to their membership.

**The second relationship provides the sample size required to estimate the true population mean with the required margin of error and confidence level** (Equation 3.2). The margin of error ( $\epsilon$ ) shows the precision of the estimate required and is assumed to be 10 percent in this case. The confidence level of 10 percent is the probability that the margin of error (5 percent or 0.05) contains the true proportion. If the study is repeated and the range calculated each time, the expect true value occurs on 95% of occasions. The  $z$  is the  $z$ -statistics attached with the confidence interval and its value is 1.96 (Table 1). The study assumed the probability value of 0.5 to get the highest possible sample size.

$$n = \frac{z^2 \times \hat{p}(1-\hat{p})}{\epsilon^2} \quad (3.2)$$

**The calculated sample size is 384.** The sample size can be further adjusted for population size. However, the sample size does not change much for populations larger than 100,000. Assuming a very large population yields a sample size of 403 which does not change further with increase in the population size. This is the largest possible sample to represent the beneficiaries/members of FSC and an equal number of non-beneficiaries is also considered. Hence data is collected from 806 respondents. The number of non-beneficiaries (members) to be selected is kept the same to save on travel time and cost, but providing a comparison group of similar farmers who are not members, and while maintaining the overall number of respondents in Northern and Southern districts and central Valley the same.

### 3.4. Sample Selection

The selection of individual respondents was made in five steps as follows.

In step 1, the sample of 403 is proportionately allocated among the three regions based on the number of members of each region, i.e. 165, (41 percent), 145 (36 percent), and 93 (22 percent) from Northern districts, Central valley and Southern districts, respectively (Table 3).

**Table 3. Final Sample Size and Allocation to District and regions**

S. No.	District	MFSC	Sub-Centres	Members	Sample	
					Members	Non-Members
<b>A</b>	<b>Northern Region</b>	<b>11</b>	<b>20</b>	<b>82144</b>	<b>165</b>	<b>165</b>
1	Abbottabad	1	1	3623	71	71
2	Swat	1	4	4760	94	94
<b>B</b>	<b>Southern Region</b>	<b>7</b>	<b>9</b>	<b>44659</b>	<b>93</b>	<b>93</b>
3	DI Khan	1	0	1856	21	21
4	Karak	1	2	7544	72	72
<b>C</b>	<b>Central Region</b>	<b>5</b>	<b>18</b>	<b>72625</b>	<b>145</b>	<b>145</b>
5	Charsadda	1	4	14263	51	51
6	Nowshera	1	3	4544	16	16
7	Peshawar	1	3	21812	78	78
	Grand Total	7	17	58402	403	403
<b>D</b>	<b>All Regions - KP</b>	<b>23</b>	<b>47</b>	<b>199428</b>	<b>403</b>	<b>403</b>

In step-2, districts from each region were purposively selected based on the diversity and similarities in the region and the size of membership. For example, Swat fairly represents Malakand, Shangla, Buner, Dir Lower, and Dir Upper while Abbottabad represents Mansehra, Batagram, and Torghar. Historically the State of Swat until 1969 consisted of the present districts of Malakand, Shangla, Buner, Dir Lower, and Dir Upper. Similarly, central districts of Peshawar, Charsadda and Nowshera represent the region very well given their climatic conditions and cropping pattern. Karak and D.I. Khan can represent the remaining regions in the South. Karak is situated centrally to Kohat, Hangu and Bannu while D.I. Khan is close to Tank and Lakki Marwat.

The number of respondents in each region is then proportionately allocated to each district within a region based on the number of members in the districts. .

The respondents in the selected districts (i.e., Abbottabad, Swat, DI Khan, Karak, Charsadda, Nowshera and Peshawar) was then randomly selected using STATA software. The members having missing information in the database, such as address or phone number, were dropped from the list. Many members reported that they are no longer members and do not know about the services provided by the FSC. Such members and those not available were replaced by a member from the same locality.

Similar farmers who are located adjacently to the members interviewed but were not members of the FSC were selected as non-members.

Individual respondents were directly interviewed using a structured questionnaire (found in Appendix I). The questionnaire was administered to both beneficiaries and non-beneficiaries of the MFSCs to collect data on various aspects of farm management and performance. The questionnaire was pilot tested in Peshawar.

Various factors determine whether farmers become members of an FSC. These might include availability of inputs and their distribution, income potential, and efforts of FSC to contact and convince the farmers to become members to increase its membership (Chamala & Shingi, 1997). Table 4 shows the district and region wise FSC membership status and whether non-members have been contacted to become members. A majority of those who were not members had not been contacted. Secondly, the benefits of membership may not have been evident to the nonmembers and thus, no incentives were seen to become members of the FSC. *With only membership and endowment payments of a one time PKR 600, there is not much incentive to aggressively market for new members.*

**Table 4. District/Region-wise Membership Status and Whether Contacted for Becoming Members of A FSC in Khyber Pakhtunkhwa**

District Name	Member	Non Member	Chi-Square Test	Contacted	Non Contacted	Chi-Square Test
Abbottabad	71	75		0	75	
Charsadda	53	53		2	51	
D I Khan	18	22		0	22	
Karak	73	71	2.330 (0.887)	0	70	12.858 (0.045)
Nowshera	16	16		0	15	
Peshawar	84	77		0	68	
Swat	109	89		0	89	
Total	424	403		2	390	
Northern Region	180	164	0.397 (0.820)	0	164	3.784 (0.151)
Central Region	153	146		2	134	
Southern Region	91	93		0	92	
Total	424	403		2	390	

A further category reflecting interest and participation in an FSC was whether a farmer was a member of the management committee, as farmers' active participation and interest in the FSC plays a major role in its success (Table 5). The FSC Management Committee (MC) is required for each FSC under Section 6 of The Khyber Pakhtunkhwa Farm Services Centers Act, 2014, through elections by the general body. District Distribution and determinants of membership in the FSCs.

**Table 5. Membership of the Management Committee (MC) Across Various Districts/Regions in KP**

District Name	Member	Non Member	Chi-Square Test	Un-aware	Don't have Membership fee	Not Satisfied with the working of FSC far from my village	Others	Chi-Square Test
Abbottabad	11	135		144	0	0	0	
Charsadda	10	96		101	0	0	0	
D I Khan	6	34		31	0	2	1	
Karak	27	117	12.400 (0.054)	116	1	0	0	42.283 (0.001)
Nowshera	3	29		29	0	0	0	
Peshawar	14	147		140	1	1	2	
Swat	21	177		177	0	0	0	
Total	92	735		738	2	3	3	
Northern Region	32	312		321	0	0	0	
Central Region	27	272	11.113 (0.004)	270	1	1	2	8.683 (0.192)
Southern Region	33	151		147	1	2	1	
Total	92	735		738	2	3	3	

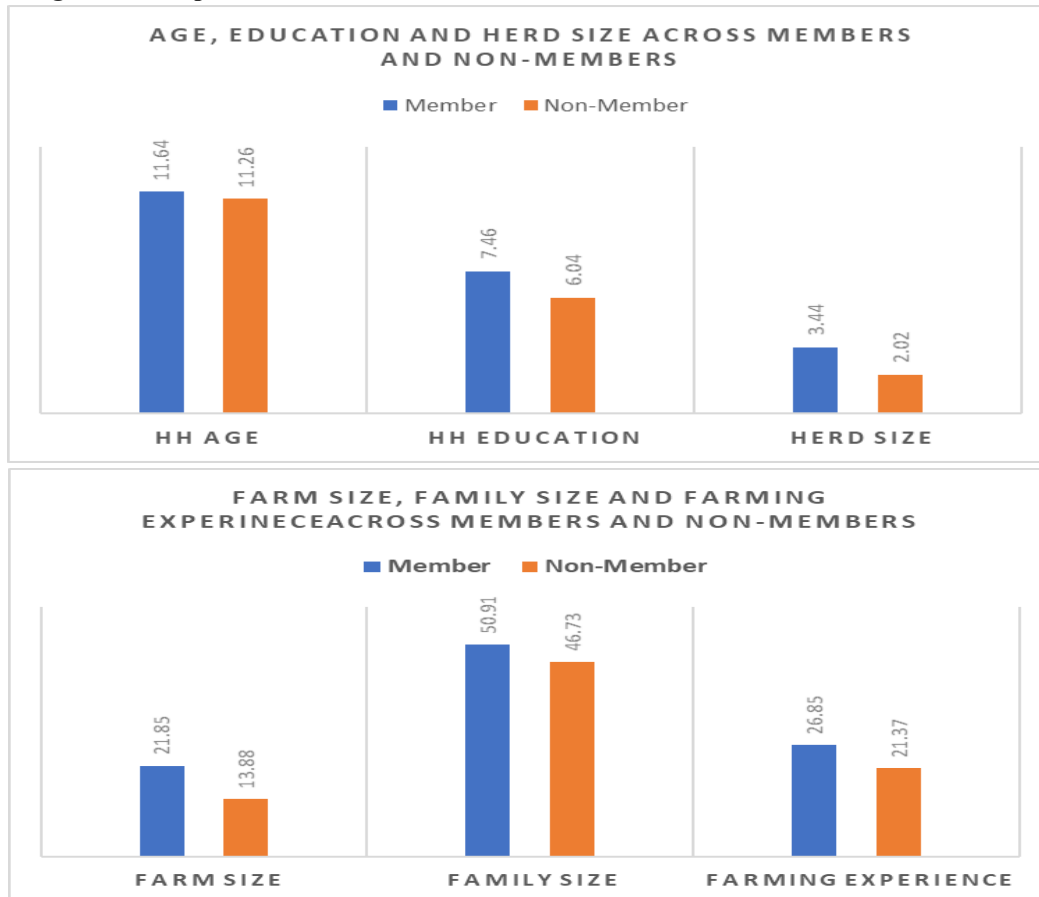
### 3.5. General Characteristics of the Respondents

This section looks at the general characteristics of the surveyed farmers and makes comparisons between members and nonmembers of FSCs. The first set of characteristics looks at the family and education differences between the two groups of farmers, while the second one makes comparisons with respect to levels of major assets, including land ownership,

A general comparison of the household characteristics is provided in Figure 2. It is observed that the member farmers in the sample have, on average, higher age, education, herd size, farm size, family size and farming experience. The detailed district-wise descriptive analysis of the important household characteristics are presented in Table 6, while extended descriptive analysis of these characteristics can be found in Annex 2.



**Figure 2: Comparison of Household Characteristics Across Members and Non-members**



**Key findings of the survey are enumerated below:**

**Education:** Table 6 shows that members of FSCs have higher education compared to nonmembers in each district. However, when comparing mean years of education between the members and nonmembers of FSCs, a statistical difference was observed only in the districts of Abbottabad, D.I. Khan, and Swat. Finally, mean years of education between members and nonmembers of FSCs is statistically different in the northern and southern regions. It can be inferred that more educated farmers chose to adopt membership of FSCs. Table 6 shows that the highest average level of farmers' education (8.7 years) is observed in the district Abbottabad, followed by Karak (7.9 years), Charsadda (7.7 years), Swat (6.3 years). The average education level in the remaining districts is close to 5 years. However, the average difference across the whole sample is just one and half years, so both groups have just about or slightly over an elementary education.

**Age and Farming Experience:** Farmer members of FSC are older in age compared to nonmembers except in Nowshera. However, statistical difference was observed in the districts of Peshawar and Swat when comparing mean age between the members and nonmembers of FSCs. Finally, across the three regions, members of the FSCs are older compared to nonmembers and a statistically significant difference in age is observed only in the northern and central regions. Further, Table 6 contains descriptive statistics for farming experience for FSCs members and nonmembers. Farmers who are members of FSCs have more farming experience across all districts and regions, and the difference in farming experience was only statistically significant for the districts of Charsadda, Karak, Peshawar and Swat.

**Table 6. Farmer's and Farm Characteristics Across FSCs Members and Non-members**

District	FSC membership	Farmer education			Age of farmer			Farming experience			Land ownership (jeribs)		
		Mean	Std. Deviation	t-stat	Mean	Std. Deviation	t-stat	Mean	Std. Deviation	t-stat	Mean	Std. Deviation	t-stat
Abbottabad	Member	9.9	3.8	3.273	51.3	12.3	1.38	25	11.1	1.282	11.2	11.5	0.384
	Non-Member	7.5	5	(0.001)*	48.4	13.3	(0.17)	22.6	10.9	(0.202)	10.2	17.5	(0.702)
Charsadda	Member	7.8	5.5	0.256	45.7	15	1.77	25.8	15.7	1.857*	19.3	21	0.286
	Non-Member	7.5	5.9	(0.798)	40.8	13.5	(0.08)	20.7	12.9	(0.066)	17.2	36.9	(0.776)
D I Khan	Member	8.4	6.4	2.979	48.6	12.6	0.28	20.9	10.6	0.373	122.4	215.7	2.203*
	Non-Member	3	5.2	(0.005)*	47.4	14.2	(0.78)	19.6	10.5	(0.717)	20.4	26.1	(0.034)
Karak	Member	8.5	5.5	1.179	56	11.6	0.82	24	10	2.275*	25	52.7	1.675*
	Non-Member	7.4	5.5	(0.240)	54.4	11.9	(0.41)	20.3	9.5	(0.024)	14	16.4	(0.096)
Nowshera	Member	5.3	5.3	0.737	48.4	12.2	0.06	28.1	10.8	1.222	13.8	16.3	1.592
	Non-Member	3.9	4.8	(0.467)	48.7	12.3	(0.95)	22.2	15.9	(0.231)	5.4	3.5	(0.126)
Peshawar	Member	5.2	5.2	1.025	51.7	14.5	2.06*	31	14	3.747*	8.7	14.5	1.085
	Non-Member	4.3	5	(0.307)	46.7	16.1	(0.04)	22.7	14.2	(0.000)	6.1	4.3	(0.281)
Swat	Member	6.9	5.9	1.697*	50	13.6	3.55*	28.1	13	3.865*	12.3	18.2	0.204
	Non-Member	5.5	5.6	(0.091)	42.8	14.7	(0.00)	20.8	13.5	(0.000)	11.5	24.6	(0.839)
Northern	Member	8.1	5.4	2.875	50.5	13.1	3.47	26.9	12.4	3.919*	11.8	15.6	0.455
	Non-Member	6.4	5.4	(0.004)*	45.4	14.3	(0.00)	21.6	12.4	(0.000)	10.8	20.9	(0.649)
Central	Member	6.1	5.4	1.009	49.3	14.6	2.62	28.9	14.5	4.283*	12.8	17.5	0.865
	Non-Member	5.5	5.5	(0.314)	44.8	15	(0.01)	21.9	13.9	(0.000)	10.1	23.1	(0.388)
Southern	Member	8.5	5.7	2.519	54.5	12.1	0.98	23.4	10.1	2.215*	44.3	111.9	2.437*
	Non-Member	6.3	5.7	(0.013)*	52.7	12.8	(0.33)	20.1	9.7	(0.028)	15.6	19.2	(0.016)

Note: \* represents statistical significance (p-value < 0.10)

**Land Ownership:** Table 6 also contains the analysis of landownership between the members and nonmembers of the FSC in each district, while more detail is provided in Table 7. While examining specific districts, it is found that the difference in landholdings in jeribs<sup>11</sup> is statistically significant in only in the southern districts of D I Khan and Karak, but where members in DI Khan have 122 jeribs of land and non-members have just 20 jeribs. In Karak, the averages are lower, but members own nearly twice land as much as non-members (25 jeribs versus 14). Land ownership on average is not very different in the Northern and Central regions, and per the defined small holdings of 12.5 acres (25 jeribs) for KP, a majority of districts have mainly small farms, and there is little difference in size by membership status.

**Table 7: Land ownership in jeribs of the FSC member and nonmember farmers in various districts/regions of Khyber Pakhtunkhwa**

District	Member of FSC	Mean	Std. Deviation	N	10% CI		t-statistic
					Lower	Upper	
Abbottabad	Member	11.2	11.5	71	0.6	1.3	0.384 (0.702)
	Non-Member	10.2	17.5	75	0.6	1.3	
Charsadda	Member	19.3	21.0	53	1.2	3.1	0.286 (0.776)
	Non-Member	17.2	36.9	53	1.2	3.1	
D I Khan	Member	122.4	215.7	18	96.1	107.8	2.203**
	Non-Member	20.4	26.1	22	95.4	108.4	(0.034)
Karak	Member	25.0	52.7	73	10.1	11.8	1.675*
	Non-Member	14.0	16.4	71	10.1	11.8	(0.096)
Nowshera	Member	13.8	16.3	13	7.7	9.1	1.592 (0.126)
	Non-Member	5.4	3.5	10	7.8	9.0	
Peshawar	Member	8.7	14.5	57	2.3	2.9	1.085 (0.281)
	Non-Member	6.1	4.3	39	2.3	2.9	
Swat	Member	12.3	18.2	91	0.3	1.1	0.204 (0.839)
	Non-Member	11.5	24.6	60	0.2	1.2	
Northern	Member	11.8	15.6	162	0.7	1.2	0.455 (0.649)
	Non-Member	10.8	20.9	134	0.7	1.2	
Central	Member	12.8	17.5	103	2.2	3.0	0.865 (0.388)
	Non-Member	10.1	23.1	78	2.2	3.0	
Southern	Member	44.3	111.9	91	27.2	30.2	2.437***
	Non-Member	15.6	19.2	93	27.2	30.2	(0.016)

**Sources of credit:** A key function envisioned by many for the FSCs is the provision of credit to its members along with acquiring agricultural inputs. However, due to the paucity of funds in the FSCs, farmers are not provided credit by any FSC centers. Table 8 outlines the sources of credit by farmers in the study area. It is evident that a majority obtained credit from non-formal sources such as arthis, friends and families and

<sup>11</sup>Jerib is equivalent to 0.5 acre

other sources. In fact, only in the Northern region in Swat and Abbottabad, was there some reliance on commercial banks. It is however questionable, given this starting point, what role FSCs should play in providing credit to its members.

**Table 8: Sources Of Credit Availed by the Members and Nonmembers of FSCs Across Various Districts/Regions in KP**

District Name	Member of FSC	Local Arthi	ZTBL	Commercial Bank	Friends & Family	Others
Abbottabad	Member	4	9	2	48	5
	Non-Member	7	1	3	64	3
Charsadda	Member	6	0	0	44	1
	Non-Member	11	1	0	43	0
D I Khan	Member	8	0	0	10	0
	Non-Member	5	0	0	17	0
Karak	Member	15	0	0	58	0
	Non-Member	8	0	0	61	0
Nowshera	Member	5	0	0	11	0
	Non-Member	4	0	0	12	0
Peshawar	Member	15	1	1	59	8
	Non-Member	25	0	0	50	2
Swat	Member	35	2	1	69	2
	Non-Member	16	1	0	60	8
Total		164	15	7	606	29
Northern	Member	39	11	3	117	7
	Non-Member	23	2	3	124	11
Central Region	Member	26	1	1	114	9
	Non-Member	40	1	0	105	2
Southern	Member	23	0	0	68	0
	Non-member	13	0	0	78	0
Total		164	15	7	606	29

**Sources of Irrigation:** Northern areas are hilly, while farmers in the central region's districts, such as Peshawar, Charsadda and Nowshera, and D.I. Khan in the South, have a more reliable source of canal irrigation and rarely use tubewells or say they are dependent on rain (Table 9). The Southern district Karak and the Northern district Abbottabad largely rely on the rain for irrigation, and as such have the lowest yields of wheat and maize (Tables 11 and 12). The Swat district had the most diversified sources of water. These differences are found to have important effects in later econometric work.

**Table 9: Sources of Irrigation for Members and Non-Members of FSCs Across Various Districts/Regions**

District Name		Canal	Tubewell	Canal and Tubewell	Rain	Others
Abbotabad	Member	5	5	1	60	0
	Non-Member	3	1	0	71	0
Charsadda	Member	45	4	4	0	0
	Non-Member	48	3	2	0	0
D I Khan	Member	14	2	0	1	1
	Non-Member	17	2	1	2	0
Karak	Member	4	13	1	32	23
	Non-Member	4	4	1	59	3
Nowshera	Member	8	2	6	0	0
	Non-Member	12	2	2	0	0
Peshawar	Member	77	4	2	0	1
	Non-Member	76	0	0	0	0
Swat	Member	67	19	5	16	1
	Non-Member	51	13	5	13	8
Total		431	74	30	254	37
Northern Region	Member	72	24	6	76	1
	Non-Member	54	14	5	84	8
Central Region	Member	130	10	12	0	1
	Non-Member	136	5	4	0	0
Southern Region	Member	18	15	1	33	24
	Non-Member	21	6	2	61	3
Total		431	74	30	254	37

Farmers were also asked if they owned a tubewell or rented one. Table 10 indicates there is only significant ownership of tubewells in Swat and Karak, and the rental market seems to have developed only in Swat. Of course, most districts do not rely on tubewell irrigation, especially in the central region, as they already have access to canal irrigation. Karak has high ownership of tubewells as it is in a rainfed region, and thus more farmers need to own tubewells to access reliable irrigation.

**Table 10: Tubewell Ownership & Rental by Members and Nonmembers of FSCs**

District Name	Member of FSC	Total	Owned	Rented
Abbottabad	Member	71	0	0
	Non-Member	75	0	0
Charsadda	Member	53	0	0
	Non-Member	53	0	0
D I Khan	Member	18	2	0
	Non-Member	22	2	0
Karak	Member	73	18	1
	Non-Member	71	6	2
Nowshera	Member	13	6	0
	Non-Member	10	1	0
Peshawar	Member	57	3	0
	Non-Member	39	0	0
Swat	Member	91	9	14
	Non-Member	60	8	11
Total		706	55	28
Northern Region	Member	162	9	14
	Non-Member	134	8	11
Central Region	Member	123	9	0
	Non-Member	102	1	0
Southern Region	Member	91	28	1
	Non-Member	93		2
Total		706	55	28

### 3.6. Cropping Pattern Adopted by Members and Nonmembers of FSCs Across Various Districts/Regions in the province of KP

This section compares cropping patterns of various crops grown during *Rabi* and *Kharif* seasons by districts, regions, and membership in a FSC. It reports total production, consumption of the product at the household level and amounts marketed for revenue generation.

**Wheat Cropping Pattern:** The results in Table 11 contain the district, region and FSC membership-wise comparison of mean values of area planted by an average farmer, yield, and seed cost for the wheat crop. Wheat is the most common crop grown by the sampled farmers, with nearly 85 percent of farmers producing it. Most land was allocated to wheat during the *Rabi* season in D I Khan, with about 47 jeribs (23.5 acres) planted. Also in the Southern region, an average farmer in Karak planted 11.4 jeribs to wheat, so together farmers in the southern districts of KP allocated about 18.1 jeribs to wheat, much higher than the average allocation of 6.1 and 6.8 jeribs in the northern and central regions, respectively. *Table 11 also suggests that FSC members allocate more land to wheat (11.1 jeribs on average) compared to non-members (7.5 jeribs). This was mostly due to members having very large land holdings in D. I. Khan, as was shown in Table 7.*

**Table 11: Comparison of Wheat Cropping Pattern Across Various Districts and Regions and Between Members And Non-Members of FSCs**

Variable	Area planted in jerib	Yield in maunds (37.32 kg) per jerib	Seed used per jerib in kg	Seed cost per jerib	Available for home consumption	Available for marketable surplus	N
<b><u>District-wise</u></b>							
Abbottabad	7.2	5	28.2 <sup>k</sup>	1328	25	85	111
Charsadda	6.5	9	26.9 <sup>k</sup>	1358	46	80	95
D I Khan	47	9	26.7 <sup>k</sup>	1510	64	772	33
Karak	11.4	7	34.2 <sup>a,c,d,n,p,s</sup>	1461	51	82	141
Nowshera	4.4	11	27.5 <sup>k</sup>	1340	44	17	29
Peshawar	7.4	11	26.8 <sup>k</sup>	1273	49	47	147
Swat	5.2	7	29.8 <sup>k</sup>	1402	29	2	132
Average	9.4	8	29.2 <sup>k</sup>	1371	42	61	688
F-statistic	14.6	21.53	4.091	1.0	8.9	17.78	
F-statistic p-value	0.000	0.000	0.000	0.41	0.000	0.000	
<b><u>Region-wise</u></b>							
Northern Region	6.1	6	29.1 <sup>c,s</sup>	1369	27	7	243
Central Region	6.8	10	26.9 <sup>n,s</sup>	1310	47	48	271
Southern Region	18.1	8	32.8 <sup>n,c</sup>	1470	53	270	174
Average	9.4	8	29.2	1371	42	61	688
F-statistic	13.8	46.94	8.365	2.37	24.82	15.88	
F-statistic p-value	0.000	0.000	0.000	0.09	0.000	0.000	

<i>Membership-wise</i>							
Members	11.1	9	29.2	1309	46	84	360
Non-members	7.5	8	29.2	1440	37	34	328
Average	9.4	8	29.2	1371	42	61	688
F-statistic	3.3	5.43	0	5.00	7.68	2.00	
F-statistic p-value	0.070	0.02	0.997	0.02	0.000	0.120	

The wheat yields reported across the province shows that highest yields are obtained by farmers of Nowshera and Peshawar, whereas the sampled farmers in Abbottabad had the lowest yields i.e., 5 maunds<sup>12</sup> or 187 kgs per jerib (0.5 acre), which may be because of the hilly terrain in Abbottabad and the lack of canal water. Among the regions, yields in the central region are the highest (10 maunds or 373 kgs per jerib) followed by southern region (8 maunds or 299 kgs per jerib) and then by the northern region (6 maunds or 224 kgs per jerib). *A comparison of wheat yield per jerib between FSC members and nonmembers reveals that FSC members obtain higher wheat yield (9 maunds per jerib) compared to non-members (8 maunds or 299 kgs per jerib). These results suggest that membership leads to a one maund gain, or 37.32 Kgs. Valued at wheat support prices of PKR 1600 per 40 kg leads to a gain of about PKR 1500 from FSC membership from advice, better seed, and other inputs .*

A region-wise comparison of wheat seed used per jerib indicates that farmers in the southern region use on average about 32.8 kg of seed, due mostly to high use by farmers in Karak, which is significantly higher than the seed used in the northern and central regions. Surprisingly, the FSCs members and non-members use the same amount of wheat seed per jerib. However, the *cost of seed per jerib of wheat is significantly lower among the FSC member farmers, by 10%, compared to non-members. This indicates the advantage of input pricing that FSCs members enjoy.*

The last two columns of Table 11 contain results for wheat kept for home consumption and the related marketable surplus. It is observed that the highest amount of wheat kept for home consumption is in D I Khan (64 maunds or 2.39 tons) whereas the lowest amount of wheat kept for home consumption is in Abbottabad and Swat districts.

A comparison between FSC members and non-members reveals that the FSC members keep significantly higher amounts of wheat for home consumption as compared to non-members. As far as the availability of marketable surplus is concerned, farmers in D.I. Khan have the highest amount of marketable surplus from their wheat crop i.e., 772 maunds (28.814 tons). On the other hand, the least amount of marketable surplus is observed in the districts of Nowshera and Swat. *A comparison of FSC members and non-members also reveals that the FSC members have significantly higher amount of marketable surplus in their wheat crop as compared to non-members. They are, however, also larger farms with more production on average.*

**Maize Cropping Pattern:** Table 12 presents cropping pattern of maize across different regions of the province, with a comparison between FSC members and non-members. An average farmer in the province allocated about 5.6 jerib or 2.8 acres to maize in *kharif* season, which is smaller than the average land allocation to wheat but is the second most prevalent crop, as close to 60 percent of farmers produce maize. Area wise, farmers in D I Khan allocate the most to maize i.e., 8.7 jeribs or 4.3 acres, whereas farmers in Nowshera and Swat allocate the least i.e., 3.5 (1.7 acres) and 4.2 jeribs or 2.1 acres. The differences across districts are not statistically significant as the p-value of the F-statistic is large. *The difference in land allocated to maize is also insignificant between the members and non-members of FSC.*

<sup>12</sup> Maund is equal to 37.32 kgs

As far as the yield of the maize crop is concerned, farmers in Charsadda and Peshawar obtain the greatest yield of 11.2 maunds or 418 kgs per jerib (0.5 acre) and 9.6 maunds or 358 kgs per jerib, respectively. Farmers of Karak, Abbottabad and D I Khan see the lowest yields across the sample districts. *Regarding FSC members and non-members, FSC members on average obtained slightly higher yield from maize as compared to non-members, which was a significant difference.*

Regarding the seed used for the maize crop, the highest amount is reportedly used in the districts of Karak and Swat. A region-wise comparison also indicates that the farmers in the Southern and Northern regions apply more seed for cultivation of maize crop compared to the central region. As far as the difference between FSC members and non-members is concerned, there is not much difference in the amount of seed used or its cost. A question for later examination is the question of seed quality.

**Table 12: Maize Cropping Pattern-Comparison Across Various Districts and Regions and Between Members and Non-Members of FSCs**

Variable	Area planted in jerib	Yield in Maunds (50 kg) per jerib	Seed used per jerib in kg	Seed cost per jerib	Available for home consumption	Available for marketable surplus	N
<b><u>District-wise</u></b>							
Abbottabad	6.1	5.6	10.6	575.7	19.4	41.9	122
Charsadda	6.8	11.2	8.1	1232	45.7	181.4	77
D I Khan	8.7	6	18	612.1	27.9	49.2	28
Karak	4.9	5.3	16.5	408.8	14	16.3	28
Nowshera	3.5	7.8	11.1	722.1	28.4	15.6	20
Peshawar	5.2	9.6	8	650.5	24.1	42	123
Swat	4.2	8	12.6	943.6	23.7	2.5	96
Average	5.6	8	10.7	766.6	26.1	32.5	494
F-statistic	1.58	8.755	13.806	8	8.357	5.563	
F-statistic p-value	0.151	0.000	0.000	0.000	0.000	0.000	
<b><u>Region-wise</u></b>							
Northern Region	5.2	6.7	11.5	737.7	21.1	8.7	218
Central Region	5.6	10	8.3	860.5	32.2	63.2	220
Southern Region	6.8	5.7	17.3	510.4	21.2	36	56
Average	5.6	8	10.7	766.6	26.1	32.5	494
F-statistic	0.722	19.200	36.988	4.488	8.539	5.538	
F-statistic p-value	0.486	0.000	0.000	0.012	0.000	0.005	
<b><u>Membership-wise</u></b>							
Members	5.7	8.5	10.8	775.3	27.8	28.9	218
Non-members	5.4	7.6	10.6	757.2	24.3	37.1	220
Average	5.6	8.0	10.7	766.6	26.1	32.5	56
F-statistic	0.130	2.345	0.095	0.062	1.650	0.249	494
F-statistic p-value	0.719	0.126	0.759	0.804	0.2	0.618	

Like wheat, maize is also a staple crop in the province, and part of the maize harvested is kept for home consumption, with the remaining amount sold in the market. Among the sampled districts, an average farmer in Charsadda keeps the most maize for home consumption, whereas an average farmer in Karak and Abbottabad keeps the least for consumption. The differences across districts are also statistically significant, as the F-statistic value shows. *However, the difference in the amount of maize kept for home consumption and the amount available for sale in the market between FSC members and non-members is not statistically significant.*

**Sugarcane Cropping Pattern:** The cropping pattern of sugarcane crop is presented in Table 13. Sugarcane is one of the most popular cash crops in the Central region (Charsadda, Nowshera and Peshawar) and, also in D.I Khan. However, in total only 20 percent of farms in four districts grow sugarcane. Among these districts, farmers in Charsadda allocate the largest area to sugarcane on average (13.6 jeribs or 6.7 acres). It is pertinent to mention that sugarcane is not a popular crop in the northern region. Secondly, *FSC members allocate slightly more land to the sugarcane crop as compared to non-members.* However, the difference is not statistically significant. As far as sugarcane yield is concerned, the highest yield is observed in D I

Khan, and the differences among districts are also statistically significant. *A comparison of sugarcane yields between FSCs members and non-members reveals that non-members obtain higher yield than FSCs members on average, but the difference is not statistically significant.*

**Rice Cropping Pattern:** Rice is grown mainly in Swat and D I Khan, with most grown in Swat. Only six percent of the sampled farmers grew rice. The average area allocated to rice by farmers in D I Khan is highest at 27 jeribs or 13.3 acres. Farmers of Peshawar and Swat obtain higher yields than farmers in D I Khan. Most rice harvested by the farmer is sold in the market. A comparison of FSC members and non-members reveals that non-members receive significantly higher yields from their rice crop as compared to the yield of FSC members (Table 14).

**Table 13: Sugarcane Cropping Pattern Comparison across Various Districts and Regions and between Members and Non-members of FSCs**

Variable	Area planted in jerib	Yield in maunds (50 kg) per jerib	Available for home consumption	Available for marketable surplus	N
<u>District-wise</u>					
Charsadda	13.6	195.3	N/A	2339.4	66
D I Khan	8	399.9	N/A	2882.6	19
Nowshera	4.7	223.9	N/A	780	13
Peshawar	7.4	229.5	N/A	1194.7	61
Average	9.9	235.2	N/A	2078.9	159
F-statistic	3.092	12.516		1.224	
F-statistic p-value	0.029	0.000		0.307	
<u>Region-wise</u>					
Central Region	10.1	212.8	N/A	1815.7	140
Southern Region	8	399.9	N/A	2882.6	19
Average	9.9	235.2	N/A	2078.9	159
F-statistic	0.393	35.141		1.505	
F-statistic p-value	0.532	0.000		0.224	
<u>Membership-wise</u>					
Members	10.4	224.4	N/A	2303	82
Non-members	9.3	246.7	N/A	1686.8	77
Average	9.9	235.2	N/A	2078.9	159
F-statistic	0.266	0.98		0.618	
F-statistic p-value	0.607	0.324		0.434	

**Table 14: Rice Cropping Pattern Comparison across Various Districts and Regions of KP and between Members and Non-members of FSC**

Variable	Area planted in jerib	Yield in maunds (50 kg) per jerib	Available for home consumption	Available for marketable surplus	N
<u>District-wise</u>					
Charsadda	2	5	10	0	1
D I Khan	27	7	30.5	204.7	8
Peshawar	2	16.3	22.5	10	2
Swat	4.5	18.3	30.7	40.3	36
Average	8.1	16	29.9	60	47
F-statistic	5.428	3.741	0.231	2.967	
F-statistic p-value	0.003	0.018	0.875	0.043	
<u>Region-wise</u>					
Northern Region	4.5	18.3	30.7	40.3	36
Central Region	2	12.5	18.3	6.7	3
Southern Region	27	7	30.5	204.7	8
Average	8.1	16	29.9	60	47
F-statistic	8.331	5.124	0.284	4.557	
F-statistic p-value	0.001	0.01	0.754	0.016	
<u>Membership-wise</u>					
Members	9.9	13.6	28	58.4	24
Non-members	6.3	18.6	31.9	61.6	23
Average	8.1	16	29.9	60	47
F-statistic	0.577	2.97	0.246	0.006	
F-statistic p-value	0.452	0.092	0.623	0.939	

## 4.0 Evaluation of Farm Service Centers (FSCs)

### **Key Messages:**

- *This section addresses two different issues – one, making inputs available to farmers and the other is making them available at a rate lower than the market.*
- *Members in all regions purchased a high percentage of needed certified seed from the market or from their sources. Same is true of maize seed and orchard nursery plants. This suggests a potential to strengthen the FSCs and encourage farmers to purchase certified wheat seed from these outlets. Control of the quality and assurance of the seed being certified is a critical capacity for the FSCs*
- *Members of FSCs purchased a high percentage of fertilizer from the market. The FSCs should revisit whether providing DAP makes sense, given the high use of the market fertilizer seen in the survey.*
- *FSCs need to ensure the availability of agricultural machinery and equipment as well as arrangements for its timely repair.*
- *Prices of agricultural inputs are generally 5-15 percent lower than open market prices. However, the supply is constrained due to non-availability of required finances.*

Section 4 (g) of the Khyber Pakhtunkhwa Farm Services Centers Act, 2014, specifies that a centre shall “purchase certified seed, fertilizers, animal husbandry services, quality veterinary health care services and medicines, farm machinery, expertise and technology for provision to the members who are registered with the Centre on affordable rates in comparison to open market rates”. This section addresses two different issues – *one, making inputs available to farmers and the other is making them available at a rate lower than the market*. The main aim of the FSC is to enhance farmers’ knowledge and skills, modernize agriculture, increase yields, and improve rural livelihood, and overall development of the rural economy through the availability of certified quality inputs such as certified seeds, fertilizers, pesticides, and various types of machinery, expertise and advice and other services, (Khan, Ahmad and Nawaz, 2017). The discussion below elaborates the sources of various types of agricultural inputs used by farmers based on district, region, and membership status.

**Crop Inputs Usage Comparison:** Table 15 highlights the trend of input usage across various regions of the province as well as between FSC members and non-members. Urea is seen to be used more per jerib of crops compared to DAP. The highest amount of urea is used in Swat and Charsadda regions. In the southern districts, urea is not used as much as the northern and central regions. Again, use of DAP is highest amongst the farmers of Swat and Charsadda. *However, significant difference in the application of urea and DAP was not observed between the FSC members and non-members.*

1. **Provision of Wheat seed:** Table 16 presents the region-wise use of wheat seed availed from various sources by farmers, such as, own seed, from FSCs, agricultural research, fellow farmers, market and other miscellaneous sources. It is found that about 28 percent of seed is availed from FSCs in the Northern Region while about half is purchased from the market and about 22 percent is from their own sources. Similarly, about 66 percent seed is purchased from the market, 18 percent from FSCs and 16 percent from own sources in the Central region. Finally, in the Southern region, about 46 percent of the seed used is availed from the market, followed by FSC (35 percent) and owned (19 percent). It is evident that more farmers utilized seed purchased from FSC than the other sources in the Southern region compared to farmers in the Central and Northern region. This comes from the much larger acreage found in that region. Khan et al. (2017) in their study asked a similar question about the vegetable seed



utilization from various sources and found that in a majority cases less than 10 percent is availed from the FSCs. Similarly, Ullah et al. (2016) found that about 60 percent of farmers obtained vegetable seeds from the market and only about 40 percent from FSCs. *This suggests a potential to strengthen the FSCs and encourage farmers to purchase certified wheat seed from these outlets. Control of the quality and assurance of the seed being certified is a critical capacity for the FSCs.*

**Table 15. Inputs Usage across Districts and Regions, and Between Members and non-Members of FSCs**

Inputs	Urea quantity used per Jerib in 50 kg bags	DAP quantity used per Jerib in 50 kg bags	Tractor used in hours per Jerib	Chemicals spray in hours per Jerib
<i>District-wise</i>				
Abbottabad	0.6	0.3	1.6	0.0
Charsadda	1.4	0.6	2.2	0.0
D I Khan	1.1	0.5	1.8	0.0
Karak	0.3	0.2	1.4	0.0
Nowshera	0.7	0.4	2	0.1
Peshawar	0.8	0.4	2.4	0.2
Swat	1.5	0.7	1.9	0.0
Average	0.9	0.4	1.9	0.1
F-statistic	19.2	33.3	1.0	1.0
F-statistic p-value	0.00	0.00	0.40	0.40
<i>Region-wise</i>				
Northern Region	1.1	0.5	1.8	0
Central Region	1	0.5	2.3	0.1
Southern Region	0.5	0.3	1.5	0
Average	0.9	0.4	1.9	0.1
F-statistic	16.1	24.3	2.5	1.4
F-statistic p-value	0.00	0.00	0.10	0.20
<i>Membership-wise</i>				
Members	0.9	0.4	1.8	0
Non-members	0.9	0.5	2	0.1
Average	0.9	0.4	1.9	0.1
F-statistic	0.1	3.1	0.3	1.1
F-statistic p-value	0.80	0.10	0.60	0.30

**Table 16. Evaluation of FSC: Input provision region wise from various resources – Wheat**

Total wheat seeds used in Kgs									
Region	Mean	S.D	N°	95% Confidence Interval for Mean		Min	Max	F-Stat	Sig.
				Lower Bound	Upper Bound				
Northern Region	131.9	128.0	253	116.0	147.7	0.0	1,000.0	56.762	.000
Central Region	153.4	154.0	273	135.1	171.8	0.0	1,250.0		
Southern Region	372.6	430.3	173	308.0	437.1	50.0	4,000.0		
Average	199.9	265.9	699	180.1	219.6	0.0	4,000.0		
Wheat Seeds FSC provided in Kgs									
Northern Region	36.8	84.3	245	26.2	47.5	0.0	800.0	15.230	.000
Central Region	27.6	70.3	270	19.2	36.0	0.0	560.0		
Southern Region	129.8	381.4	173	72.5	187.0	0.0	4,000.0		
Average	56.6	206.6	688	41.1	72.1	0.0	4,000.0		
Wheat Seeds Agri Research centre provided in Kgs									
Northern Region	0.0	0.0	245	0.0	0.0	0.0	0.0	1.975	.140
Central Region	0.4	6.1	270	-0.4	1.1	0.0	100.0		
Southern Region	4.9	53.6	173	-3.1	13.0	0.0	700.0		
Average	1.4	27.1	688	-0.7	3.4	0.0	700.0		
Wheat Seeds from own sources in Kgs									
Northern Region	31.0	73.9	245	21.7	40.3	0.0	500.0	7.526	.001
Central Region	24.4	74.3	270	15.5	33.3	0.0	500.0		
Southern Region	67.4	198.8	173	37.6	97.2	0.0	1,400.0		
Average	37.6	119.6	688	28.6	46.5	0.0	1,400.0		
Wheat Seeds fellow farmers provided in Kgs									
Northern Region	1.4	14.6	245	-0.4	3.3	0.0	200.0	.897	.408
Central Region	0.2	2.4	270	-0.1	0.5	0.0	40.0		
Southern Region	2.9	38.0	173	-2.8	8.6	0.0	500.0		
Average	1.3	21.0	688	-0.3	2.9	0.0	500.0		
Wheat Seeds purchased from market in Kgs									

Northern Region	66.4	120.6	245	51.2	81.6	0.0	1,000.0	16.496	.000
Central Region	101.6	136.4	271	85.3	117.9	0.0	1,000.0		
Southern Region	168.8	282.4	174	126.5	211.0	0.0	2,000.0		
Average	106.0	184.5	690	92.2	119.8	0.0	2,000.0		
<b>Wheat Seeds gained from other sources in Kgs</b>									
Northern Region	0.0	0.0	245	0.0	0.0	0.0	0.0		
Central Region	0.0	0.0	270	0.0	0.0	0.0	0.0		
Southern Region	0.0	0.0	173	0.0	0.0	0.0	0.0		
Average	0.0	0.0	688	0.0	0.0	0.0	0.0		

\*The number (N) shows the respondents using the input. The actual purchasers from the FSC is 196, with 158 being members

2. **Provision of Maize Seed:** As far the maize seed used by the farmers region wise, it is evident that almost 50 percent was purchased from the market by farmers residing in the Northern region, followed by about 15 percent from FSCs, 33 percent from own sources and another 3 percent from fellow farmers. In the central region, a majority of the farmers (80 percent) purchased maize seed from the market while the remaining 10 percent came from the FSCs and own sources. In the Southern region, the input utilization from the FSC stood at almost 40 percent, 46 percent from the market and remaining from own sources (Table 17).

**Table 17. Evaluation of FSC: Input provision region wise from various sources – Maize Seed**

Total Maize seeds used in KGs									
Region	Mean*	S.D	N*	95% Confidence Interval for Mean		Min	Max	F-Stat	Sig.
				Lower Bound	Upper Bound				
Northern Region	52.1	69.3	225	43.0	61.2	1.2	600.0	27.787	.000
Central Region	23.8	43.3	249	18.4	29.2	0.0	500.0		
Southern Region	115.9	177.0	31	51.0	180.8	2.0	800.0		
Average	42.1	74.0	505	35.6	48.5	0.0	800.0		
Maize seeds FSC provided in Kgs									
Northern Region	7.3	22.1	226	4.4	10.2	0.0	192.0	.578	.561
Central Region	2.7	11.1	221	1.2	4.1	0.0	100.0		
Southern Region	46.0	166.8	31	-15.2	107.2	0.0	800.0		
Average	7.7	46.3	478	3.5	11.8	0.0	800.0		
Maize seeds Agri Research centre provided in Kgs									
Northern Region	0.0	0.0	225	0.0	0.0	0.0	0.0	9.968	.000
Central Region	0.1	0.9	221	-0.1	0.2	0.0	14.0		
Southern Region	0.0	0.0	31	0.0	0.0	0.0	0.0		
Average	0.0	0.6	477	0.0	0.1	0.0	14.0		
Maize seeds from own sources in Kgs									
Northern Region	16.8	49.7	225	10.2	23.3	0.0	600.0	4.423	.012
Central Region	2.6	10.1	221	1.3	3.9	0.0	70.0		
Southern Region	35.3	116.6	33	-6.1	76.6	0.0	600.0		
Average	11.5	47.0	479	7.3	15.7	0.0	600.0		
Maize seeds fellow farmers provided in Kgs									
Northern Region	1.2	13.9	226	-0.6	3.0	0.0	200.0		
Central Region	0.1	0.8	221	-0.1	0.2	0.0	12.0		
Southern Region	9.4	53.0	32	-9.7	28.5	0.0	300.0		
Average	1.2	16.7	479	-0.3	2.7	0.0	300.0		
Maize seeds purchased from market in Kgs									
Northern Region	25.2	50.0	225	18.6	31.8	0.0	500.0	2.097	.162
Central Region	19.2	42.0	251	14.0	24.4	0.0	500.0		
Southern Region	53.6	82.2	34	25.0	82.3	0.0	350.0		
Average	24.1	49.7	510	19.8	28.5	0.0	500.0		
Maize seeds gained from other sources in Kgs									
Northern Region	0.0	0.0	225	0.0	0.0	0.0	0.0	.176	.679
Central Region	0.0	0.0	221	0.0	0.0	0.0	0.0		
Southern Region	0.0	0.0	31	0.0	0.0	0.0	0.0		
Average	0.0	0.0	477	0.0	0.0	0.0	0.0		
*The number (N) shows the respondents using the input. The actual purchasers from the FSC is 196, with 158 being members.									

3. **Provision of Orchard Nursery plants:** Many of the orchards are grown either in the Northern parts of KP or the Central regions. It is found that many of the saplings and plants were purchased from the market (57 percent) and own sources (37 percent) while 3 percent each came from the FSC and fellow farmers. In the Southern region, all the farmers bought the sapling from the market or private nurseries (Table 18).

**Table 18. Evaluation of FSC: Input provision region wise from various sources – Orchard Nursery Plants**

Number of Orchard Nursery plants used									
Region	Mean*	S. D	N*	95% Confidence Interval for Mean		Min	Max	F-Stat	Sig.
				Lower Bound	Upper Bound				
Northern Region	714.8	612.3	22	443.3	986.2	30.0	3,000.0	.269	.609
Central Region	75.0	35.4	2	-242.7	392.7	50.0	100.0		
Southern Region	0.0	0.0	0	0.0	0.0	0.0	0.0		
Average	661.5	612.3	24	402.9	920.0	30.0	3,000.0		
Number of Orchard Nursery plants FSC provided									
Northern Region	22.7	75.2	22	-10.6	56.1	0.0	300.0	.087	.770
Central Region	0.0	0.0	2	0.0	0.0	0.0	0.0		
Southern Region	0.0	0.0	0	0.0	0.0	0.0	0.0		
Average	20.8	72.1	24	-9.6	51.3	0.0	300.0		
Number of Orchard Nursery plants from own sources									
Northern Region	260.0	694.4	22	-47.9	567.9	0.0	3,000.0	1.945	.144
Central Region	0.0	0.0	2	0.0	0.0	0.0	0.0		
Southern Region	0.0	0.0	0	0.0	0.0	0.0	0.0		
Average	238.3	667.6	24	-43.6	520.2	0.0	3,000.0		
Number of Orchard Nursery plants fellow farmers provided									
Northern Region	21.8	102.3	22	-23.6	67.2	0.0	480.0	4.175	.016
Central Region	0.0	0.0	2	0.0	0.0	0.0	0.0		
Southern Region	0.0	0.0	0	0.0	0.0	0.0	0.0		
Average	20.0	98.0	24	-21.4	61.4	0.0	480.0		
Number of Orchard Nursery plants purchased from market									
Northern Region	410.2	393.7	22	235.7	584.8	0.0	1,000.0	.843	.431
Central Region	75.0	35.4	2	-242.7	392.7	50.0	100.0		
Southern Region	0.0	0.0	0	0.0	0.0	0.0	0.0		
Average	382.3	388.0	24	218.5	546.1	0.0	1,000.0		
Number of Orchard Nursery plants taken from other sources									
Northern Region	0.0	0.0	22	0.0	0.0	0.0	0.0	1.813	.164
Central Region	0.0	0.0	2	0.0	0.0	0.0	0.0		
Southern Region	0.0	0.0	0	0.0	0.0	0.0	0.0		
Average	0.0	0.0	24	0.0	0.0	0.0	0.0		
*The number (N) shows the respondents using the input. The actual purchasers from the FSC is 75, with 62 being members									

\*The number (N) shows the respondents using the input. The actual purchasers from the FSC is 75, with 62 being members

4. **Provision of DAP Fertilizer:** Fertilizer plays a big role in achieving better yield by providing important nutrients to crops. Proper and timely application of fertilizers is of paramount importance for achieving higher productivity. Major sources of fertilizers have been either FSCs or input dealers/open market. Farmers purchased about 18 percent of DAP fertilizer from the FSCs and the remaining 82 percent was obtained from the market in the Northern region while more than 90 percent was purchased from the market and less than 10 percent accounted for through the FSCs in the Central region. Similarly, in the Southern region, almost 82 percent was secured from the market and the remaining from FSCs. The results suggest that a much smaller proportion of the DAP is secured from the FSCs (10-15 percent) compared to 60 percent reported in Khan et al., (2017). This variation can be attributed to the fact that the present study covers much larger geographically diverse regions compared to their which was conducted in Dhakki Union Council in Charsadda only largely growing fruits and vegetables. Also, the time variation can play a role too as their study was done in 2017 while this study has been

conducted in 2020. Secondly, their study sample covered FSC's member farmers only while the present study covers both members and non-members which may have compressed the percentage fertilizer purchased from the FSCs. It is also evident that differences in use of DAP bags across the regions from various sources have been insignificant (Table 19). *The FSCs should revisit whether providing DAP makes sense, given the high use of the market seen in our survey.*

**Table 19. Evaluation of FSC: Input provision region wise from various resources - DAP (bags) used**

Number of DAP bags used									
Region	Mean*	S.D	N*	95% Confidence Interval for Mean		Min	Max	F-Stat	Sig.
				Lower Bound	Upper Bound				
Northern Region	11.4	31.8	284	7.7	15.1	0.1	350.0	1.544	.214
Central Region	9.3	38.4	256	4.6	14.1	0.5	600.0		
Southern Region	5.2	6.8	149	4.1	6.3	0.5	40.0		
Average	9.3	31.2	689	7.0	11.6	0.1	600.0		
Number of DAP bags FSC provided									
Northern Region	2.1	12.2	283	0.7	3.5	0.0	150.0	1.739	.176
Central Region	0.2	0.8	256	0.1	0.3	0.0	6.0		
Southern Region	0.7	2.4	149	0.3	1.1	0.0	24.0		
Average	1.1	8.0	688	0.5	1.7	0.0	150.0		
Number of DAP bags Agri Research centre provided									
Northern Region	0.0	0.0	283	0.0	0.0	0.0	0.0	5.529	.004
Central Region	0.0	0.1	256	0.0	0.0	0.0	1.0		
Southern Region	0.0	0.0	149	0.0	0.0	0.0	0.0		
Average	0.0	0.0	688	0.0	0.0	0.0	1.0		
Number of DAP bags from own sources									
Northern Region	0.0	0.3	283	0.0	0.1	0.0	5.0	1.679	.187
Central Region	0.0	0.5	256	0.0	0.1	0.0	8.0		
Southern Region	0.3	1.7	149	0.0	0.6	0.0	12.0		
Average	0.1	0.9	688	0.0	0.2	0.0	12.0		
Number of DAP bags fellow farmers provided									
Northern Region	0.0	0.0	283	0.0	0.0	0.0	0.0	1.018	.362
Central Region	0.0	0.0	256	0.0	0.0	0.0	0.0		
Southern Region	0.0	0.3	149	0.0	0.1	0.0	4.0		
Average	0.0	0.2	688	0.0	0.0	0.0	4.0		
Number of DAP bags purchased from market									
Northern Region	9.3	29.9	285	5.8	12.8	0.0	350.0	2.107	.122
Central Region	8.8	38.3	258	4.1	13.5	0.0	600.0		
Southern Region	4.2	6.8	149	3.1	5.2	0.0	40.0		
Average	8.0	30.4	692	5.7	10.3	0.0	600.0		
Number of DAP bags from other sources									
Northern Region	0.0	0.0	283	0.0	0.0	0.0	0.0		
Central Region	0.0	0.0	256	0.0	0.0	0.0	0.0		
Southern Region	0.0	0.0	149	0.0	0.0	0.0	0.0		
Average	0.0	0.0	688	0.0	0.0	0.0	0.0		

\*The number (N) shows the respondents using the input. The actual purchasers from the FSC is 99, with 84 being members

\*The number (N) shows the respondents using the input. The actual purchasers from the FSC is 99, with 84 being members

- Provision of Urea Fertilizer:** Urea fertilizer is one of the most common and extensively used fertilizer. Farmers' response regarding purchase of urea fertilizers in bags from various resources is provided in Table 20. It is evident that in all regions, majority of the farmers obtained urea fertilizers from the open market. However, in the Northern regions, farmers got 23 percent from FSCs, followed by 11 percent and 1 percent in the Southern and central regions respectively. Since this study is not classifying the farmers based on FSCs membership but overall farmers, region wise, thus the results may not be comparable with other studies. Finally, there has not been any significant differences across various regions from different sources in the use of urea fertilizer.
- Provision of Tractors' Hours Used:** One of the major responsibilities of FSCs is the provision of modern machinery when needed at a lower than market rate. Table 21 indicates the region wise utilization of tractors hours by farmers from various resources. On overall basis, it is evident that almost more than 85 percent of the hours of tractors used are rented from the open market. Also, about 10 percent came from the farmer's own sources. A very minimal number of hours of tractors used were from the FSCs. It is found that FSCs do not own an appropriate number of tractors to cater to the needs

of all the farmers. In a majority of cases, the tractors of FSCs were out of order rendering them non-usable by the farmers.

**Table 20. Evaluation of FSC: Input provision region wise from various resources - Urea (bags) used**

Number of bags of Urea used									
Region	Mean*	S.D	N*	95% Confidence Interval for Mean		Min	Max	F-Stat	Sig.
				Lower Bound	Upper Bound				
Northern Region	13.1	28.9	316	9.9	16.3	0.1	250.0	2.675	.070
Central Region	16.7	62.7	276	9.2	24.1	0.5	1,000.0		
Southern Region	8.5	12.8	148	6.5	10.6	1.0	80.0		
Average	13.5	43.1	740	10.4	16.6	0.1	1,000.0		
Number of Urea bags FSC provided									
Northern Region	3.0	16.2	314	1.2	4.8	0.0	250.0	.845	.430
Central Region	0.2	1.1	276	0.0	0.3	0.0	10.0		
Southern Region	0.9	2.9	148	0.4	1.4	0.0	25.0		
Average	1.5	10.7	738	0.8	2.3	0.0	250.0		
Number of Urea bags Agri Research centre provided									
Northern Region	0.0	0.0	314	0.0	0.0	0.0	0.0	.754	.471
Central Region	0.1	1.7	276	-0.1	0.3	0.0	20.0		
Southern Region	0.0	0.0	148	0.0	0.0	0.0	0.0		
Average	0.1	1.0	738	0.0	0.1	0.0	20.0		
Number of Urea bags from own sources									
Northern Region	0.0	0.0	314	0.0	0.0	0.0	0.0	.743	.476
Central Region	0.1	1.2	276	-0.1	0.2	0.0	20.0		
Southern Region	0.0	0.2	148	0.0	0.1	0.0	2.0		
Average	0.0	0.8	738	0.0	0.1	0.0	20.0		
Number of Urea bags fellow farmers provided									
Northern Region	0.0	0.0	314	0.0	0.0	0.0	0.0	3.238	.040
Central Region	0.0	0.0	276	0.0	0.0	0.0	0.0		
Southern Region	0.0	0.4	148	0.0	0.1	0.0	5.0		
Average	0.0	0.2	738	0.0	0.0	0.0	5.0		
Number of Urea bags purchased from market									
Northern Region	10.0	25.1	316	7.3	12.8	0.0	248.0	1.478	.249
Central Region	15.5	62.6	276	8.1	22.9	0.0	1,000.0		
Southern Region	7.6	13.0	148	5.5	9.7	0.0	80.0		
Average	11.6	42.0	740	8.6	14.6	0.0	1,000.0		
Number of Urea bags taken from other sources									
Northern Region	0.0	0.0	314	0.0	0.0	0.0	0.0	.352	.707
Central Region	0.0	0.0	276	0.0	0.0	0.0	0.0		
Southern Region	0.0	0.0	148	0.0	0.0	0.0	0.0		
Average	0.0	0.0	738	0.0	0.0	0.0	0.0		
*The number (N) shows the respondents using the input. The actual purchasers from the FSC is 101, with 83 being members									

\*The number (N) shows the respondents using the input. The actual purchasers from the FSC is 101, with 83 being members

**Table 21. Evaluation of FSC: Input provision region wise from various resources – Tractor's hours used**

Total tractor Hours used									
Region	Mean*	S.D	N*	95% Confidence Interval for Mean		Min	Max	F-Stat	Sig.
				Lower Bound	Upper Bound				
Northern Region	19.7	37.2	302	15.5	23.9	1.0	300.0	.313	.735
Central Region	31.2	82.5	280	21.5	40.9	1.0	1,200.0		
Southern Region	26.0	46.5	169	18.9	33.1	2.0	350.0		
Average	25.4	60.0	751	21.1	29.7	1.0	1,200.0		
Tractor Hours FSC provided									
Northern Region	0.1	1.2	302	0.0	0.3	0.0	15.0	1.157	.332
Central Region	0.1	1.5	280	-0.1	0.3	0.0	25.0		
Southern Region	0.4	3.9	169	-0.2	1.0	0.0	50.0		
Average	0.2	2.2	751	0.0	0.3	0.0	50.0		
Tractor Hours Agri Research centre provided									
Northern Region	0.0	0.0	302	0.0	0.0	0.0	0.0		
Central Region	0.0	0.0	280	0.0	0.0	0.0	0.0		
Southern Region	0.0	0.0	169	0.0	0.0	0.0	0.0		
Average	0.0	0.0	751	0.0	0.0	0.0	0.0		
Tractor Hours from own sources									
Northern Region	2.7	20.8	302	0.3	5.0	0.0	300.0	3.901	.028
Central Region	0.9	9.7	280	-0.2	2.1	0.0	150.0		
Southern Region	2.5	23.7	169	-1.1	6.1	0.0	300.0		
Average	2.0	18.3	751	0.7	3.3	0.0	300.0		
Tractor Hours fellow farmers provided									
Northern Region	0.0	0.2	302	0.0	0.0	0.0	4.0		

Central Region	0.0	0.0	280	0.0	0.0	0.0	0.0		
Southern Region	0.0	0.0	169	0.0	0.0	0.0	0.0		
Average	0.0	0.1	751	0.0	0.0	0.0	4.0		
<b>Tractor Hours purchased from market</b>									
Northern Region	16.9	32.3	302	13.3	20.6	0.0	300.0		
Central Region	29.1	82.2	280	19.4	38.8	0.0	1,200.0		
Southern Region	22.7	41.2	169	16.4	28.9	0.0	350.0		
Average	22.8	57.8	751	18.6	26.9	0.0	1,200.0		
<b>Tractor Hours taken from other sources</b>									
Northern Region	0.0	0.0	302	0.0	0.0	0.0	0.0		
Central Region	0.0	0.0	280	0.0	0.0	0.0	0.0		
Southern Region	0.0	0.0	169	0.0	0.0	0.0	0.0		
Average	0.0	0.0	751	0.0	0.0	0.0	0.0		

\*The number (N) shows the respondents using the input. The actual purchasers from the FSC are 196, with 158 being members.

7. **Provision of Sprayers' Hours Used:** Sprayers are generally used to apply various types of insecticides and pesticides. These can be small hand operated sprayers which are generally owned by the farmers or big like small jet engines that could cover larger areas. The responses about utilization of sprayers from various sources outlined in Table 2. It is evident that the farmers in Northern region rented almost 55 percent from market while about 45 percent is from own sources. Similarly, about 50 percent obtained from market while almost a quarter each from the FSC and own sources in the Central region. Finally, almost entire utilization of the sprayers is from own sources in Southern region.

**Table 22. Evaluation of FSC: Input provision region wise from various resources – Sprayer's hours used**

Sprayers Hours used									
Region	Mean*	S.D	N*	95% Confidence Interval for Mean		Min	Max	F-Stat	Sig.
				Lower Bound	Upper Bound				
Northern Region	7.9	5.7	7	2.6	13.2	4.0	20.0		
Central Region	29.2	30.9	16	12.7	45.7	1.0	100.0		
Southern Region	26.0	38.1	3	-68.7	120.7	3.0	70.0		
Average	23.1	28.1	26	11.7	34.4	1.0	100.0		
<b>Sprayers Hours FSC provided</b>									
Northern Region	0.0	0.0	7	0.0	0.0	0.0	0.0		
Central Region	6.8	24.9	16	-6.5	20.1	0.0	100.0		
Southern Region	0.0	0.0	3	0.0	0.0	0.0	0.0		
Average	4.2	19.6	26	-3.7	12.1	0.0	100.0		
<b>Sprayers Hours Agri Research centre provided</b>									
Northern Region	0.0	0.0	7	0.0	0.0	0.0	0.0		
Central Region	0.0	0.0	16	0.0	0.0	0.0	0.0		
Southern Region	0.0	0.0	3	0.0	0.0	0.0	0.0		
Average	0.0	0.0	26	0.0	0.0	0.0	0.0		
<b>Sprayers Hours from own sources</b>									
Northern Region	3.4	7.5	7	-3.5	10.3	0.0	20.0		
Central Region	7.6	21.2	16	-3.7	18.9	0.0	72.0		
Southern Region	0.0	0.0	3	0.0	0.0	0.0	0.0		
Average	5.6	17.1	26	-1.3	12.5	0.0	72.0		
<b>Sprayers Hours fellow farmers provided</b>									
Northern Region	0.0	0.0	7	0.0	0.0	0.0	0.0		
Central Region	0.0	0.0	16	0.0	0.0	0.0	0.0		
Southern Region	0.0	0.0	3	0.0	0.0	0.0	0.0		
Average	0.0	0.0	26	0.0	0.0	0.0	0.0		
<b>Sprayers Hours purchased from market</b>									
Northern Region	4.4	3.6	7	1.1	7.7	0.0	10.0		
Central Region	14.8	21.2	16	3.4	26.1	0.0	50.0		
Southern Region	25.0	39.1	3	-72.0	122.0	0.0	70.0		
Average	13.2	20.9	26	4.7	21.6	0.0	70.0		
<b>Sprayers Hours you have taken from other sources</b>									
Northern Region	17.2	26.9	19	4.2	30.1	0.0	100.0		
Central Region	1.7	4.5	21	-0.4	3.7	0.0	20.0		
Southern Region	0.0	0.0	3	0.0	0.0	0.0	0.0		
Average	8.4	19.6	43	2.4	14.4	0.0	100.0		

\*The number (N) shows the respondents using the input. The actual purchasers from the FSC are 10.

#### 4.1 Evaluation of Farm Service Centers (FSCs) in Providing Mandated Services to Members

This Section provides a membership-wise comparison of the usage of a FSC for obtaining crop inputs. It is observed that the FSCs members secure significantly higher percentage of inputs from the FSCs as compared to non-members, whereas non-members obtain significantly higher amount of crop inputs from the market.

1. **Wheat Seed:** Table 23 represents the use of wheat seed based on the FSC membership. It reveals that FSCs members purchased 44 percent of wheat seed from FSCs while 41 percent of seed was secured from the market and 15 percent was farmers-owned. However, the non-members purchased 69 percent of wheat seed from the market followed by 23 percent from own sources and about 8 percent from the FSC.
2. **Maize Seed:** Table 24 shows that more than one quarter of maize seed (28 percent) was obtained from FSCs by the FSCs members, followed by 47 percent from the market and 23 percent from own sources. In contrast, non-FSC members obtained 72 percent of maize seed from the market, 33 percent from own sources and only about 5 percent from the FSCs.
3. **Orchard Saplings:** Table 25 indicates that FSCs members obtained almost half of the orchard saplings from their owned sources and about half from the market and only about 5 percent from the FSC. While non-farm members got majority of their saplings (88 percent) from the market and about 10 percent from fellow farmers. It can be inferred that FSCs has not been very active on distributing saplings to both the members and nonmembers farmers. One reason this may be the unavailability of the saplings at the FSCs. Also, acquiring the saplings at the right time could have been an issue as these cannot be stored for a long time.
4. **DAP and Urea Bags:** Percentage wise DAP used by FSCs members and non-members is given in the Table 26 below. It indicates that FSC members got about 25 percent of DAP from the FSCs compared to 2 percent non-members. Further, FSC members acquired 75 percent of DAP from the market compared to 97 percent by non-FSC members. Similarly, FSC members purchased about 19 percent urea from the FSCs and about 75 percent from the market. In contrast, non FSC members obtained about 97 percent from the market and only 3 percent from the FSC (Table 27).
5. **Tractor Service:** It is further observed that not many people are availing the tractors service from the FSC (Table 28). A large proportion of tractors hours used both by FSC members (86 percent) and non-FSC members (95 percent) have been rented from the market. It could be due to less than appropriate number of tractors available with FSCs to meet the demand or these may have been parked without renting or due to some technical problems. Field survey has identified both the problems.
6. Table 29 shows the percentage use of the sprayers rented from various sources. FSC members rented about 54 percent of sprayers hours used from the market, 31 percent from FSCs and 14 percent from own sources. In comparison, non-FSC members rented about 61 percent from the market and used 37 percent from owning them.

**Table 23. Wheat Seed (%) used by the FSC and non FSC members from various sources**

Source	FSC members	Non FSC members
FSC	44.15	7.79
Agricultural research	1.01	0.28
Owned	15.35	23.31
Fellow farmers	0.18	1.27
Market	41.06	68.73

**Table 24. Maize Seed (%) used by the FSC and non FSC members from various sources**

Source	FSC members	Non FSC members
FSC	27.77	4.76
Agricultural research	0	0.28
Owned	23.17	33.61
Fellow farmers	2.3	3.92
Market	47.18	72.27

**Table 25. Orchard Nursery Plants (%) Used by FSCs Members and nonmembers from Various Sources**

Source	FSC members	Non FSC members
FSC	4.57	0
Owned	51.16	2.43
Fellow farmers	0	9.74
Market	44.27	87.83

**Table 26. DAP fertilizer (%) Used by FSCs Members and nonmembers from Various Sources**

Source	FSC members	Non FSC members
FSC	22.09	1.98
Market	74.42	97.03

**Table 27. Urea fertilizer (%) Used by FSCs Members and nonmembers from Various Sources**

Source	FSC members	Non FSC members
FSC	18.98	3.01
Market	75.18	97.74

**Table 28. Tractor hours (%) Used by FSCs Members and nonmembers from Various Sources**

Source	FSC members	Non FSC members
FSC	1.03	0
Owned	9.97	4.61
Market	85.91	94.93

**Table 29. Sprayer hours (%) Used by FSCs Members and nonmembers from Various Sources**

Source	FSC members	Non FSC members
FSC	31.06	0
Owned	14.33	38.76
Market	53.92	61.24

## 4.2. Evaluation of Farm Service Centers (FSCs) in Sample Districts

This section discusses the performance of FSCs in the selected sample districts in providing the mandated agricultural inputs and services.

1. **Wheat Seed:** On average, the largest quantity of seed (492 Kgs) is used in DI Khan district followed by Karak (344 Kgs). In the remaining districts, the seed used ranged from 111 kgs to 175 kgs. The difference in average use of seed amongst the districts is statistically significant with the F value of 21.05. Table 30 shows district wise use of wheat seed by farmers from various sources. The higher percentage availed from FSCs may indicate a more proactive role of FSCs in providing wheat seed which is one of its key roles. It is observed that in Nowshera district, about 58 percent of the seed was purchased by farmers from the FSC, followed by the DI Khan (50 percent), Karak (30 percent),



Abbottabad (24 percent), Peshawar (16 percent) and Charsadda (13 percent). However, majority of the seed used in Charsadda and Peshawar Districts was purchased from open market.

**Table 30. Percentage of Wheat Seed Availed from Various Sources**

Districts	FSC	Agri. Res centre	Own	Fellow Farmers	Market	Other	Total
Abbottabad	24.27	0.00	38.74	0.65	42.73	0.00	106.40
Charsadda	12.54	0.00	18.18	0.00	70.94	0.00	101.65
D I Khan	49.87	0.00	2.46	0.00	47.67	0.00	100.00
Karak	29.76	1.77	23.34	1.05	44.51	0.00	100.44
Nowshera	58.11	0.00	11.26	0.00	30.63	0.00	100.00
Peshawar	15.95	0.47	15.07	0.20	68.31	0.00	100.00
Swat	31.31	0.00	9.86	1.50	57.33	0.00	100.00

2. **Maize Seed:** As far as district wise use of maize seed is concerned, it is found that almost 57 percent seed used in the DI Khan came from FSCs, followed by Abbottabad (18 percent), and other districts where about 10 percent maize was availed from FSCs. In Nowshera district, about 58 percent of the seed was availed by farmers from the (Table 31).

**Table 31. Percentage of Maize Seed Availed from Various Sources**

Districts	FSC	Agri. Res centre	Own	Fellow Farmers	Market	Other	Total
Abbottabad	17.67	0.00	47.41	0.22	28.23	0.00	93.53
Charsadda	8.33	0.00	11.81	1.39	88.19	0.00	109.72
D I Khan	56.91	0.00	6.55	0.00	37.51	0.00	100.96
Karak	9.63	0.00	70.49	21.87	61.77	0.00	163.76
Nowshera	10.61	0.00	13.33	0.00	76.36	0.00	100.30
Peshawar	11.30	0.33	9.30	0.00	78.74	0.00	99.67
Swat	10.90	0.00	18.40	4.26	66.44	0.00	100.00

3. **Orchard Seedlings/Saplings:** It is observed that entire saplings planted in Peshawar district were mainly purchased from the open market while in Swat, about 57 percent came from the open market, followed by 36 percent from own sources and 3 percent from FSC. It seems that there is a huge potential to cater for sapling needs of the farmers. From the conversation with the FSC managers in Peshawar and farmers, there is a demand to purchase these saplings from FSCs provided they have these available in time and right quality (Table 32).

**Table 32. Percentage of Orchard Nursery Plants Availed from Various Sources**

Districts	FSC	Agri. Res centre	Own	Fellow Farmers	Market	Other	Total
Abbottabad	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Charsadda	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D I Khan	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Karak	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nowshera	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Peshawar	0.00	0.00	0.00	0.00	100.00	0.00	100.00
Swat	3.18	0.00	36.37	3.05	57.39	0.00	99.99

4. **Provision of Fertilizers:** Many of the farmers need timely and affordable fertilizers during the sowing seasons. Therefore, FSCs can play an important role in making it available at right time and affordable rates. Generally, farmers are cash starved during the sowing seasons and tend to purchase fertilizer on deferred payment basis. Despite this, it transpired about 64 percent of DAP used in Abbottabad was bought from the FSC, 20 percent in Karak and 12 percent in Swat. In the remaining districts, less than 6 percent was obtained from FSCs. It is evident that most of the DAP fertilizer in all the districts except in Abbottabad was purchased from the market (Table 33). The reasons for such a high percentage of DAP purchased from open market could be more convenient locations of the private dealerships of DAP fertilizers and obtaining it on loan to pay after harvesting season.

Similar pattern has been observed in case of urea (Table 34). It indicates that there is a huge potential for the FSCs to perform better in availability of fertilizers and identify the reasons for low intake from FSCs by farmers. In focus group discussions with the famers, it was indicated that main reasons for not purchasing from the FSCs are: (a) location of FSCs generally far from the agricultural area; (b) transportation cost which outweighs the discount in prices especially for small farmers; (c) unawareness of farmers about getting fertilizers at discounted prices; and (d) unaffordability of farmers to pay at the time of purchase because of financial constraints while private fertilizer dealers provide deferred payment facility. Therefore, the main recommendation is that the inputs may be made available to them at the local/village or tehsil level rather than at district levels.

**Table 33. Percentage of DAP Fertilizer Bags Availed from Various Sources**

Districts	FSC	Agri. Res centre	Own	Fellow Farmers	Market	Other	Total
Abbottabad	64.29	0.00	2.38	0.00	35.71	0.00	102.38
Charsadda	0.58	0.00	0.58	0.00	92.44	0.00	93.60
D I Khan	6.73	0.00	0.00	0.00	93.27	0.00	100.00
Karak	20.00	0.00	11.43	0.00	68.57	0.00	100.00
Nowshera	5.77	0.00	0.00	0.00	96.15	0.00	101.92
Peshawar	4.26	0.00	0.00	0.00	95.74	0.00	100.00
Swat	11.76	0.00	0.00	0.00	88.24	0.00	100.00

**Table 34. Percentage of Urea Bags Availed from Various Sources**

Districts	FSC	Agri. Res centre	Own	Fellow Farmers	Market	Other	Total
Abbottabad	59.32	0.00	0.00	0.00	38.98	0.00	98.31
Charsadda	0.32	1.30	0.65	0.00	91.23	0.00	93.51
D I Khan	3.70	0.00	0.00	0.00	96.83	0.00	100.53
Karak	20.00	0.00	0.00	0.00	78.00	0.00	98.00
Nowshera	4.48	0.00	0.00	0.00	95.52	0.00	100.00
Peshawar	2.22	0.00	0.00	0.00	97.78	0.00	100.00
Swat	15.08	0.00	0.00	0.00	84.92	0.00	100.00

- Tractor/Sprayers Service:** Most of tractor's usage in the selected sample districts came from either open market sources or the farmers owned equipment (Table 35). FSCs have not played a major role in providing this service to its members mainly because of fewer tractors/sprayer available to meet peak demand of the farmers. Similarly, many of them were out of order waiting for maintenance work. At many places if they had the equipment, then they did not have the drivers/operators available. Finally, many famers could rent it on loan and closer to their farms rather than approaching the FSC for rent as many farmers complained that they were located far from their farm. Similar pattern was observed in case of sprayer hours (Table 36).

**Table 35. Percentage of Tractors' Hours Availed from Various Sources**

Districts	FSC	Agri. Res centre	Own	Fellow Farmers	Market	Other	Total
Abbottabad	1.76	0.00	19.41	0.00	78.82	0.00	100.00
Charsadda	0.00	0.00	0.00	0.00	93.61	0.00	93.61
D I Khan	0.00	0.00	22.96	0.00	77.04	0.00	100.00
Karak	2.45	0.00	0.98	0.00	93.63	0.00	97.06
Nowshera	0.00	0.00	16.48	0.00	82.97	0.00	99.45
Peshawar	0.83	0.00	4.56	0.00	94.61	0.00	100.00
Swat	0.00	0.00	10.14	0.00	90.32	0.00	100.46

**Table 36. Percentage of Sprayers' Hours Availed from Various Sources**

Districts	FSC	Agri. Res centre	Own	Fellow Farmers	Market	Other	Total
Abbottabad	0.00	0.00	63.16	0.00	36.84	214.74	314.74
Charsadda	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D I Khan	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Karak	0.00	0.00	0.00	0.00	96.15	0.00	96.15
Nowshera	0.00	0.00	100.00	0.00	0.00	0.00	100.00
Peshawar	27.76	0.00	12.55	0.00	59.70	6.84	106.84
Swat	0.00	0.00	0.00	0.00	100.00	0.00	100.00

### 4.3. Evaluation of Farm Service Centers (FSCs)-Price Difference between FSC and Open Market Rates

One of the main objectives of FSC policy is for centers to offer inputs at affordable rates to farmers. From discussions with the management committee (MCs) members of the FSCs, it was revealed that the prices at the FSC are generally 5-15 percent lower than open market prices. Sometimes discounts are not offered but better quality, advisory services, and other services are offered at the FSC. Prices are set by the respective MCs in various districts depending upon the demand/supply situations, finances available and other factors. Therefore, prices of agricultural inputs at FSCs vary across districts. The discussion below offers a comparison of prices of major inputs in the open market and from the FSC for the various districts, regions, and membership categories.

**Wheat Seed Price Difference:** Table 37 presents a comparison of wheat seed prices across various districts, regions, and FSC membership status. Overall, the reported prices of wheat seed were lower by 11 percent at the FSC compared to open market prices. Across districts, the average wheat seed prices per bag were about Rs. 344 lower than the open market. There were 196 farmers, slightly less than 20 percent of the sample, who purchased wheat seed from the FSC. These represented 37% of FSC members and 11% of non-members. Only eight farmers from D.I Khan made use of the service, while on the high side, 46 farmers used the service in Karak and 44 in Swat.

The highest average differences in prices between the FSC and open markets for wheat seed (Rs. 759) was observed in Swat, followed by Rs. 515 in DI Khan, Rs. 382 in Charsadda, Rs. 245 in Nowshera, Rs. 240 in Karak, and Rs. 218 in Abbottabad. The lowest difference was Rs. 19 in Peshawar. These prices are statistically different across districts except for D. I. Khan and Peshawar. Similarly, looking at the region wise variations, it was found that wheat seed prices offered by FSCs were lower than the open market prices in the Northern region by 18 percent, central by 7 percent and Southern by 10 percent. Also, these differences are statistically significant. Finally, FSCs members who purchased wheat seed from the FSCs got almost a 14 percent discount compared to nonmembers with a 5 percent discount.

**Table 37. Mean Differences between FSCs and Open Market-Wheat Seed Prices**

Districts	No of FSC Purchasers	FSC price	Open market price	Difference	St. Err.	% Change
Abbottabad	34	2502.90	2721	-218.10**	101.20	-8.02
Charsadda	18	2347.10	2728.6	-381.50***	48.73	-13.98
D I Khan	8	3168.80	3683.3	-514.50	456.15	-13.97
Karak	46	2482.10	2722.2	-240.10***	58.02	-8.82
Nowshera	16	2325.00	2569.6	-244.60***	71.18	-9.52
Peshawar	30	2656.30	2675.1	-18.80	57.19	-0.70
Swat	44	2041.50	2800.5	-759.00***	101.58	-27.10
<b>Region wise</b>						
Northern	78	2260.36	2772.73	-512.37***	74.66	-18.48
Central	54	2493.85	2683.57	-189.72***	36.86	-7.07
Southern	64	2634.72	2928.13	-293.41**	128.77	-10.02
<b>Membership wise</b>						
Member	150	2371.73	2766.38	-394.65***	57.02	-14.27
Non-member	46	2613.89	2761.89	-148.00**	70.72	-5.36
<b>Average/Total</b>	<b>196</b>	<b>2,420.40</b>	<b>2764</b>	<b>-343.60***</b>	<b>42.07</b>	<b>-12.43</b>

Note: Percentages are calculated using open market price as a base category.

\*\*\* Significant at 1% level, \*\* significant at 5% level and \* significant at 10% level.

**Maize Seed Price Difference:** Table 38 indicates that the average price of maize seed per bag at FSCs was Rs. 1837 compared to the open market price of Rs.1500, a difference that was significant at 10% level. The maize seed on average was about Rs. 337 higher at FSC compared to open market price. There were 75 farmers, slightly less than 10 percent of the sample, who purchased wheat seed from the FSC. On the high

side, 41 farmers in the Northern region used the service, or about 55 percent of all farmers buying maize seed.

In Southern districts of Karak and DI Khan, farmers paid about Rs. 1,096 and Rs. 648 per bag less at FSCs. Similarly, in Nowshera and Swat, farmers paid Rs. 410 and Rs. 189 less at FSCs compared to the open market. However, farmers paid higher prices for maize seed at FSCs in the districts Abbottabad, Charsadda, and Peshawar. These differences were not statistically significant. The significant difference between FSCs and market prices for maize seed is observed for non-members of FSC.

**Table 38. Mean Differences between FSCs and Open Market-Maize Seed Prices**

Districts	No of FSC Purchasers	FSC price	Open market price	Difference	St. Err.	% Change
Abbottabad	29	2,708.10	2645.5	62.60	195.60	2.37
Charsadda	5	1,233.30	1,217.20	16.15	112.60	1.33
D I Khan	2	2,425.00	3,073.30	-648.30	1130.38	-21.09
Karak	5	2,900.00	3,996.40	-1096.40	3725.66	-27.43
Nowshera	6	933.30	1,342.80	-409.50*	277.96	-30.50
Peshawar	12	1,261.60	823.6	438.00	252.73	53.18
Swat	16	1,152.50	1,341.70	-189.20	652.97	-14.10
<b>Region wise</b>						
Northern	45	2273.95	1895.83	378.12	305.00	19.94
Central	19	1166.91	1005.48	161.43	153.46	16.06
Southern	7	2662.5	3570.39	-907.89	1957.89	-25.43
<b>Membership wise</b>						
Member	62	1805.68	1711.12	94.56	297.12	5.53
Non-member	13	1951.77	1301.45	650.32**	291.00	49.97
<b>Average/Total</b>	<b>75</b>	<b>1836.73</b>	<b>1499.87</b>	<b>336.86*</b>	<b>208.09</b>	<b>22.46</b>

Note: Percentages are calculated using open market price as a base category.

\*\*\* Significant at 1% level, \*\* significant at 5% level and \* significant at 10% level

**DAP and Urea Price Differences:** Table 39 suggests that a DAP bag was about Rs. 132 (4 percent) cheaper compared to open market. In most of the districts, FSC members on average got DAP bags cheaper, except in DI Khan, Charsadda and Karak, where the price differences have been statistically significant. Finally, variations across regions and membership have been statistically significant too. Likewise, average difference between urea fertilizer that farmers obtained from a FSC, and the open market was Rs. 123 (6 percent). The prices differences have been significantly different in districts of Abbottabad, Karak, and Swat as well as in the Northern and Southern regions. Difference in urea prices between FSCs and the open market is also observed among the non-members of FSCs in Table 40.

**Table 39. Mean Differences between FSCs and Open Market-DAP 50 Kg Prices**

Districts	No of FSC Purchasers	FSC price	Open market price	Difference	St. Err.	% Change
Abbottabad	50	3601.70	3741.53	-139.83***	44.38	-3.74
Charsadda	1	3650.00	3645.67	4.33	243.58	0.12
D I Khan	1	3000.00	3736.84	-736.84	---	-19.72
Karak	22	3683.33	3743.75	-60.42	68.93	-1.61
Nowshera	4	2850.00	3645.65	-795.65***	258.35	-21.82
Peshawar	8	3643.48	3761.87	-118.39**	69.38	-3.15
Swat	13	3362.50	3663.93	-301.43***	69.00	-8.23
<b>Region wise</b>						
Northern	63	3557.54	3682.85	-125.31***	33.19	-3.40
Central	10	3585.19	3708.03	-122.84**	67.18	-3.31
Southern	23	3630.77	3741.79	-111.02**	64.43	-2.97
<b>Membership wise</b>						
Member	15	3555.37	3699.31	-143.95***	36.30	-3.89
Non-member	84	3639.13	3711.91	-72.77*	54.66	-1.96
<b>Average/Total</b>	<b>99</b>	<b>3573.71</b>	<b>3705.56</b>	<b>-131.84***</b>	<b>29.04</b>	<b>-3.56</b>

Note: Percentages are calculated using open market price as a base category.

† Only one farmer purchased DAP from FSC in the comparison group, therefore, standard errors are not available.

\*\*\* Significant at 1% level, \*\* significant at 5% level and \* significant at 10% level.

**Table 40. Mean Differences between FSCs and Open Market-Urea 50 Kg Bag Prices**

Districts	No of FSC Purchasers	FSC price	Open market price	Difference	St. Err.	% Change
Abbottabad	54	1752.10	1867.07	-114.97***	41.63	-6.16
Charsadda	1	1700.00	1806.57	-106.57	---	-5.90
D I Khan	1	1700.00	1848.16	-148.16	146.60	-8.02

Karak	23	1833.33	1967.19	-133.85***	42.74	-6.80
Nowshera	3	1775.00	1869.36	-94.35	84.37	-5.05
Peshawar	6	1855.71	2001.79	-146.08	349.17	-7.30
Swat	13	1753.85	1873.76	-119.92***	35.16	-6.40
<b>Region wise</b>						
Northern	67	1752.40	1871.84	-119.44***	23.67	-6.38
Central	8	1842.50	1915.40	-72.90	236.97	-3.81
Southern	24	1814.29	1933.43	-119.15***	46.67	-6.16
<b>Membership wise</b>						
Member	18	1771.28	1913.81	-142.53	115.06	-7.45
Non-member	83	1804.44	1890.76	-86.72***	36.90	-4.59
<b>Average/Total</b>	<b>101</b>	<b>1779.20</b>	<b>1902.10</b>	<b>-122.89**</b>	<b>71.49</b>	<b>-6.46</b>

Note: Percentages are calculated using open market price as a base category.

† Only one farmer purchased Urea from FSC in the comparison group, therefore, standard errors are not available.

\*\*\* Significant at 1% level, \*\* significant at 5% level and \* significant at 10% level.

**Rate Difference for Tractor and Sprayer Services:** The average rate per hour of tractor in KP was about Rs.989 offered at FSCs compared to Rs. 1169 in open market with the average difference of Rs. 179 (15 percent). The tractor hour rate difference between a FSC and open market is statistically different in Abbottabad, D I Khan and Peshawar districts, in the Central and Southern regions and membership wise Table 41. However, in fact, only ten farmers used tractor services from the FSC. Sprayers are rarely availed from FSCs, and there were only a few reported users of FSC sprayers. The reasons have already been outlined above, attributing it to nonavailability of sprayers and nonavailability of operators. These are generally handheld sprayers that can be easily obtained from neighbors or dealers. Thus, it can be seen that there have not been significant differences in the rates of sprayers between the open market and a FSC.

**Table 41. Mean Differences between FSCs and Open Market-Tractor Hour Prices**

Districts	FSC price	Open market price	Difference	St. Err.	% Change
Abbottabad	1200.00	1451.33	-251.33**	108.83	-17.32
Charsadda	1000.00	1079.41	-79.41	--†	-7.36
D I Khan	500.00	1101.39	-601.39***	125.39	-54.60
Nowshera	900.00	1086.67	-186.67	--†	-17.18
Peshawar	1005.26	1039.26	-34.00*	21.74	-3.27
Swat	900.00	1135.63	-235.63	--†	-20.75
<b>Region wise</b>					
Northern	1140.00	1259.93	-119.93	103.88	-9.52
Central	1000.00	1058.90	-58.90***	22.61	-5.56
Southern	500.00	1197.21	-697.21***	132.83	-58.24
<b>Membership wise</b>					
Member	938.89	1145.15	-206.26***	44.18	-18.01
Non-member	1080.00	1191.58	-111.58**	68.86	-9.36
<b>Average/Total</b>	<b>989.29</b>	<b>1168.59</b>	<b>-179.30***</b>	<b>38.70</b>	<b>-15.34</b>

Note: Percentages are calculated using open market price as a base category.

† Only one farmer hired tractor from FSC in the comparison group, therefore, standard errors are not available.

\*\*\* Significant at 1% level, \*\* significant at 5% level and \* significant at 10% level.

The study also examines the purchasing patterns of FSC inputs, namely maize seed, wheat seed, DAP, and Urea, with respect to the membership status of the purchasers in the FSC. The analysis of the data revealed that a significant proportion of purchasers (17% for maize, 19% for wheat, 15% for DAP, and 24% for Urea) were non-members of the FSC. Additionally, it was found that a considerable number of FSC members who were purchasing inputs were also members of the management committee (25%, 27%, 20%, and 22% for wheat seed, maize seed, DAP, and Urea, respectively). These findings suggest the importance of understanding the membership status of seed purchasers and FSC members while developing membership and marketing strategies. Additionally, it highlights the need for the FSC to investigate the reasons why some seed purchasers are not members and to consider incentives to attract more members.

#### 4.4. Willingness to Pay for Crop Inputs

Table 42 contains the results for farmers' willingness to pay for inputs such as seed, fertilizer, pesticides, services of tractors, sprayers, thresher, etc. Perhaps most remarkable is how few respondents seemed willing to pay added fees for resources. In general, there were too few observations to have meaningful comparisons. However, in the last column, when asked whether some of the whole list of possible resources could be made available by FSC's, about 40% of both members and non-members responded with a positive number, averaging over PKR 900 for each of the two groups. These values are not statistically different.

Table 43 summarizes the willingness to pay to access FSC. It indicates that the approximate distance to the Model Farm Services Center (MFSC) is significantly higher in the southern districts (D I Khan and Karak) as compared to the Northern region. That deters most farmers in Southern region to access FSCs as compared to Northern region (Swat and Abbottabad) where FSCs are easily accessible. However, the farms in the Southern district are much larger than elsewhere and so distance may not be as much of a constraint. It further suggests that the appropriate desired distance of a FSC should be in the proximity of 1.5 kilometers from the farm area in all three regions. It implies that the desired distance to a FSC is significantly less than the existing distances to a FSC. Majority of the respondent farmers are willing to pay higher fees to have FSC established in their vicinity (average is < 1.5 in all regions). Similarly, farmers in all the three regions are willing to pay about 1000 rupees in membership fee to have a FSC in their vicinity.

**Table 42. Willingness to Pay for Inputs Across Members and Non-Members of FSCs (Number of farmers with positive WTP and Rs. amounts)**

Input	Tractor	Sprayer	Thresher	Rotavator	Seeds	Fertilizers	Pesticides	All resources
<i>Membership-wise</i>								
Members WTP	694	700	1275	1050	1975	1200	633	961
(No reporting)	(9)	(4)	(4)	(4)	(4)	(4)	(4)	(187)
Non-members WTP	900	1100	1100	0	1550	1000	500	913
(No reporting)	(3)	(2)	(3)	(0)	(2)	(1)	(1)	(178)
t-statistic	-.094	**	**	**	**	**	**	0.64
t-statistic p-value	0.38	**	**	**	**	**	**	0.52

**Table 43. Willingness to Pay for Accessibility of FSCs Across Various Districts and Regions of KP And Between Members and Non-Members of FSCs**

	Approximate distance to MFSC (kms)	Is MFSC far or accessible? (1=far, 2= accessible)	How far should MFSC be to be accessible? (kms)	Are you willing to pay higher membership fee if it is established nearby? (1=yes,2=no)	How much membership fee are you willing to pay for nearby FSC? (Rs.)
	(1)	(2)	(3)	(4)	(5)
<i>District-wise</i>					
Abbottabad	11	1.6	1.7	1.3	600
Charsadda	8.7	1.4	1	1.5	996
D I Khan	18.7	1.3	2	1.4	1280
Karak	17.9	1.3	1.4	1.3	960
Nowshera	8.5	1.7	1.6	1.4	1800
Peshawar	11.9	1.3	1.8	1.1	910
Swat	5.9	1.7	1.4	1	1114
Average	11.2	1.5	1.5	1.3	962
F-statistic	23.597	16.741	11.445	13.143	8.305
F-statistic p-value	0.000	0.000	0.000	0.000	0.000
<i>Region-wise</i>					
Northern Region	8.1	1.6	1.6	1.2	846
Central Region	10.5	1.4	1.5	1.3	1001
Southern Region	18.1	1.3	1.5	1.4	1026
Average	11.2	1.5	1.5	1.3	962
F-statistic	55.712	39.509	0.538	4.814	2.472
F-statistic p-value	0.000	0.000	0.584	0.001	0.086
<i>Membership-wise</i>					
Members	10.6	1.5	1.6	1.3	1021
Non-members	11.8	1.4	1.5	1.3	899
Average	11.2	1.5	1.5	1.3	962
F-statistic	2.385	8.911	0.878	1.461	3.177
F-statistic p-value	0.123	0.000	0.349	0.227	0.075
N	801	801	517	582	451

## 4.5. Provision of Advisory Services to Farmers

Many farmers (95 percent) reported that they attended meeting for advice on farming practices, new technologies and improving yield (see the later Table 49). However, also in Table 49, 60 percent of respondent farmers found out that the FSCs sold inputs only from outside the FSCs and extension agents, indicating perhaps a marketing deficiency by the FSCs.

Tables 44 to 46 indicate that all farmers use advisory services for topics such as seed rate, seed sources, fertilizer information, and pesticides information. The value of 1.1 for seed variety advice by FSC members implies about 90% of FSC members said yes to having received advice on seed varieties. However, that advice could come from one of six sources, not just the FSC. The numbers who actually received the advisory services are found in the last column of Table 46. However, services such as machinery, soil management, credit, packaging etc. are not being provided in most of the districts except in Swat and Peshawar. District wise and region wise analysis of all three regions reflect similar situation (Tables 44 and 45). The study found identical results across FSCs members and non- as reflected in Table 46.

**Table 44. Provision of Advisory Services to Farmers Across districts**

District	Abbottabad	Swat	Charsadda	Nowshera	Peshawar	D I Khan	Karak
Seed (Variety)	81.50%	93.50%	98.10%	93.80%	85.00%	97.50%	97.20%
Seed rate	98.60%	91.10%	98.10%	84.40%	85.40%	97.50%	97.20%
Seed sources	98.60%	73.30%	95.20%	71.90%	74.50%	97.50%	97.20%
Fertilizer type	98.60%	83.60%	97.20%	90.60%	80.90%	97.50%	97.20%
Fertilizer rate	98.60%	92.60%	97.20%	96.90%	81.90%	97.50%	97.20%
Pesticides	98.60%	57.60%	99.00%	68.80%	69.90%	95.00%	97.20%
Machinery	0.00%	90.20%	0.00%	28.10%	47.70%	0.00%	1.40%
Orchard management	0.00%	73.10%	0.00%	9.40%	22.70%	0.00%	0.00%
Soil management	0.00%	53.10%	0.00%	0.00%	11.90%	0.00%	0.00%
Credit	0.00%	43.50%	0.00%	0.00%	14.30%	0.00%	0.00%
Sorting/grading	0.00%	42.90%	0.00%	0.00%	22.70%	0.00%	0.00%
Packaging	0.00%	35.00%	0.00%	3.10%	14.30%	0.00%	0.00%
Transportation	0.00%	18.80%	0.00%	6.30%	16.70%	0.00%	0.00%
Market destination	15.30%	83.90%	5.80%	53.10%	68.40%	5.10%	0.00%
Livestock diseases	0.00%	0.00%	0.00%	0.00%	12.20%	0.00%	0.00%
Poultry diseases	0.00%	0.00%	0.00%	0.00%	11.60%	0.00%	0.00%
Seed tech train	0.00%	0.00%	0.00%	0.00%	2.50%	0.00%	0.00%
Exchange visits	0.00%	0.00%	0.00%	0	0.00%	0.00%	0.00%

Note: 81.5 percent implies that 81.5 percent of the farmers have received that service from FSC

**Table 45. Provision of Advisory Services to Farmers across regions**

Region	Northern Region	Central Region	Southern Region	Total	No from FSC**
Seed (Variety)	88.20%*	90.80%	97.30%	91.20%	224
Seed rate	94.60%	90.10%	97.30%	93.70%	209
Seed sources	84.70%	83.30%	97.30%	87.30%	192
Fertilizer type	88.20%	83.90%	97.30%	89.00%	104
Fertilizer rate	90.10%	88.50%	97.30%	91.20%	194
Pesticides	95.20%	89.80%	97.30%	93.90%	186
Machinery	76.80%	83.60%	96.70%	84.10%	166
Orchard management	40.00%	19.80%	1.10%	20.40%	146
Soil management	24.70%	7.20%	0.00%	9.90%	115
Credit	12.70%	2.80%	0.00%	4.50%	16
Sorting/grading	8.00%	3.40%	0.00%	3.30%	8
Packaging	7.30%	5.60%	0.00%	3.90%	18
Transportation	5.70%	3.90%	0.00%	2.90%	7
Market destination	2.50%	5.10%	0.00%	2.50%	7
Livestock diseases	34.50%	38.10%	1.10%	26.00%	9
Poultry diseases	0.00%	2.80%	0.00%	1.10%	5
Seed tech train	0.00%	2.80%	0.00%	1.00%	5
Exchange visits	0.00%	0.60%	0.00%	0.20%	1

Note: 88.2 percent implies that 88.2 percent of the farmers have received that service from one of six sources. \*\*The number using the FSC is reported in this column.

**Table 46. Provision of Advisory Services to Farmers Across FSCs Membership (Yes =1, No = 2)**

	FSC Members	FSC Non-Members	Total
Seed (Variety)	1.1	1.07	1.09
Seed rate	1.08	1.04	1.06
Seed sources	1.14	1.11	1.13
Fertilizer type	1.12	1.1	1.11
Fertilizer rate	1.1	1.08	1.09
Pesticides	1.07	1.05	1.06

Machinery	1.18	1.14	1.16
Orchard management	1.76	1.83	1.8
Soil management	1.9	1.9	1.9
Credit	1.97	1.94	1.96
Sorting/grading	1.96	1.98	1.97
Packaging	1.93	1.99	1.96
Transportation	1.95	1.99	1.97
Market destination	1.96	1.99	1.97
Livestock diseases	1.72	1.77	1.74
Poultry diseases	1.98	2	1.99
Seed tech train	1.98	2	1.99
Exchange visits	2	2	2

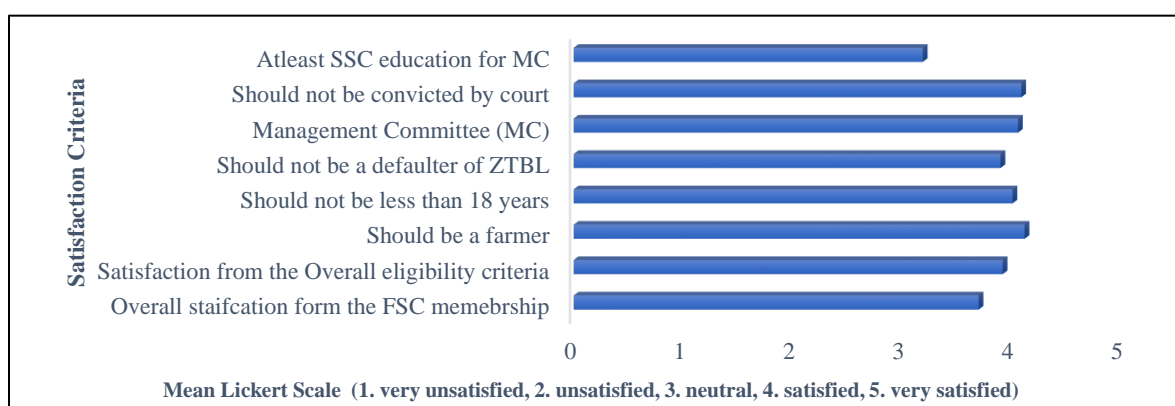
Note: The value 1.1 for seed variety advice by FSC members implies about 90% of FSC members said yes to having received advice on seed varieties. However, that advice could come from one of six sources, not just the FSC.

#### 4.6. Membership Criteria for FSC and Farmers' Satisfaction

The main driver behind establishment of FSCs was to strengthen extension services and availability of quality agriculture inputs at a cheaper rate than found in the market. For this, the provincial government is expected to provide a one-time matching grant equivalent to registration and security fees as well as endowment funds. Farmers through their membership fees are required to establish a revolving fund to enable them to manage FSC as a business enterprise independently. The management committee elected by FSC members are mandated to make decisions on their behalf.

The criteria for membership of the FSC is that (a) an individual must be a farmer in the concerned agriculture office circle, (b) should not be less than 18 years of age, (c) should have not been convicted for more than 6 months in a criminal or civil case, (d) should have not defaulted on any loan to a financial institution, and (e) are willing to pay Rs. 100 as a registration fee and Rs. 500 as share money. The following discussions elaborate the farmers stratification based on above criteria and their level of satisfaction as a member on a Likert scale (1. very unsatisfied, 2. unsatisfied, 3. neutral, 4. satisfied, 5. very satisfied) is in Figure 3.

**Figure 3. Level of satisfaction With FSC membership, MC, and other Eligibility Criteria**



The satisfaction of most members with FSCs and eligibility criteria for membership moves between neutral to satisfied. Low score on the requirement of secondary school certificate (SCC- at least 10 years of education) for a member of Management Committee indicates partial dissatisfaction as more experienced farmers with lesser education may not be able to become MC members which may affect performance of FSCs. Table xxx reflects the frequency of farmers' opinions about their satisfaction from the FSC, MC and membership criteria. It is evident that a majority of members remained either neutral (35.4 percent) or satisfied (35.7 percent), while nearly a quarter were very satisfied (22.3 percent) with the overall FSC membership. A majority of farmers (53 percent) indicate that they are satisfied from the working of Management Committee (MC). Also, overall eligibility criterion was rated from satisfied (46 percent) to



very satisfied (27 percent). On individual criteria such as being a farmer, less than 18 years of age, not defaulter, and not convicted by a court also ranged between satisfied to very satisfied.

Table 47 presents the region wise satisfaction of farmers with the working of FSCs. A majority of respondents rated their satisfaction level between neutral to very satisfied (>90 percent) in all regions with less than 10 percent being very unsatisfied to satisfied. A majority of farmers (35 percent) in the Central region indicated that they were very satisfied, compared to only 4 percent in the Southern region. The satisfied category was almost uniform across the regions (32 percent in Northern region, 40 percent in Central region and 36 percent in the Southern region). Majority in the Southern region (55 percent) opined that they were neither satisfied nor dissatisfied.

**Table 47. Frequency of the Farmer's Satisfaction with the Working of FSCs**

Criteria	very unsatisfied	unsatisfied	Neutral	satisfied	very satisfied	Total
Overall FSC membership	16(4.1)	10(2.5)	140(35.4)	141(35.7)	88(22.3)	395(100.0)
Overall eligibility criteria	15(3.8)	5(1.3)	84(21.3)	182(46.1)	109(27.6)	395(100.0)
Should be a farmer	19(4.8)	5(1.3)	39(9.9)	179(45.3)	153(38.7)	395(100)
Should not be < 18 years	32(8.1)	5(1.3)	27(6.8)	195(49.4)	136(34.4)	395(100.0)
Not be a defaulter	43(10.9)	8(2.0)	24(6.1)	188(47.7)	131(33.2)	394(100.0)
Management Committee	45(11.4)	12(3.0)	24(6.1)	105(26.6)	208(52.8)	394(100.0)
Not convicted by court	48(12.2)	4(1.0)	23(5.9)	107(27.2)	211(53.7)	393(100.0)
SSC education for MC	87(23.2)	72(19.2)	22(5.9)	71(18.9)	123(32.8)	375(100.0)

**Table 48. Overall Satisfaction being a Member of FSCs**

			Region of FSC			Total	Asymp. Sig. (2-sided) $\chi^2$ value
			Northern Region	Central Region	Southern Region		
How much are you satisfied with the FSC Membership?	very unsatisfied	Count	10	5	1	16	0.000
		% within Region of FSC	5.7%	3.6%	1.3%	4.1%	
	unsatisfied	Count	3	4	3	10	
		% within Region of FSC	1.7%	2.9%	3.8%	2.5%	
	neutral	Count	69	27	44	140	
		% within Region of FSC	39.2%	19.4%	55.0%	35.4%	
	satisfied	Count	57	55	29	141	
		% within Region of FSC	32.4%	39.6%	36.3%	35.7%	
	very satisfied	Count	37	48	3	88	
		% within Region of FSC	21.0%	34.5%	3.8%	22.3%	
Total		Count	176	139	80	395	
		% within Region of FSC	100.0%	100.0%	100.0%	100.0%	

**Satisfaction with the Management Committee of a FSC:** The management committee is responsible for the working of the FSC. While farmers in the Southern region were not very satisfied with the FSC, they seem to be satisfied (91 percent) with the MCs. In the Central region, 65 percent of respondents were either satisfied or very satisfied with MCs. Similarly, a majority of the Northern region's farmers (85 percent) expressed satisfaction with the MCs. The significant Chi square value indicates that there have been significance variations in the satisfaction level from MCs across the regions (Table 49).

**Table 49. Region wise Satisfaction with the Management Committee**

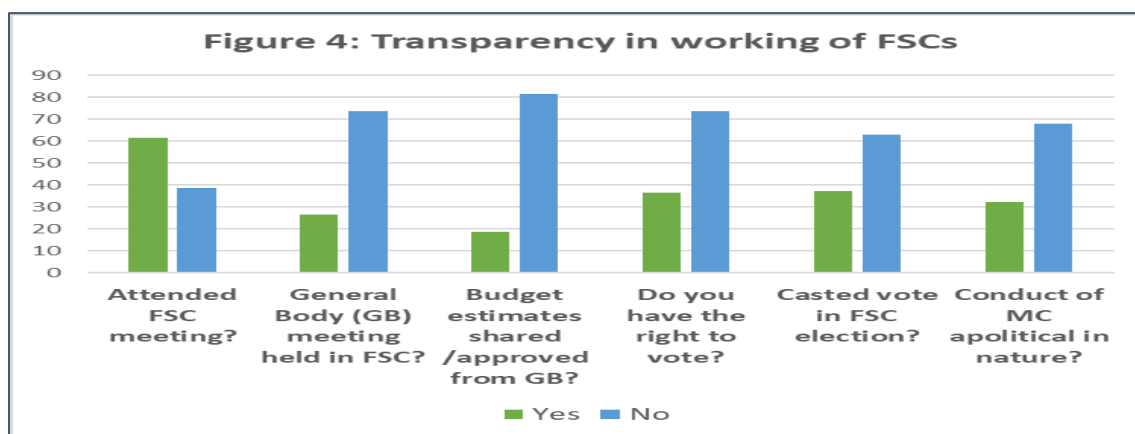
			Region of FSC			Total	Asymp. Sig. (2-sided) χ <sup>2</sup> value
			Northern Region	Central Region	Southern Region		
Management Committee	very unsatisfied	Count	19	26	0	45	0.000  85 65 91
		% within Region of FSC	10.8%	18.7%	0.0%	11.4%	
	unsatisfied	Count	2	8	2	12	
		% within Region of FSC	1.1%	5.8%	2.5%	3.0%	
	neutral	Count	5	14	5	24	
		% within Region of FSC	2.8%	10.1%	6.3%	6.1%	
	satisfied	Count	45	24	36	105	
		% within Region of FSC	25.6%	17.3%	45.6%	26.6%	
	very satisfied	Count	105	67	36	208	
		% within Region of FSC	59.7%	48.2%	45.6%	52.8%	
Total		Count	176	139	79	394	
		% within Region of FSC	100.0%	100.0%	100.0%	100.0%	

**Region-wise satisfaction with criteria for FSC membership:** Tables A-7 to A-9 suggests that approximately 75 percent of respondents are satisfied with the eligibility criteria set out in the FSC Act, 2014. Similar satisfaction (of 78 and 79 percent) is observed in the Northern and Central regions respectively. Only 54 percent are satisfied with the eligibility criteria in the Southern region. Overwhelming majority of the respondents (about 88 percent) in the Northern and Central regions were satisfied with the condition that a member needs to be a resident of the concerned agriculture circle office, and practice farming, while the percentage was 54 percent in the Southern region. Farmers in the Northern (89 percent), Central (78 percent) and Southern region (81 percent) also expressed satisfaction with the criterion that the age for membership need to be no less than 18 years. Majority of the farmers in different regions (86 percent in Northern, 71 percent in Central, and 81 percent in Southern) expressed satisfaction with the criterion that defaulter in any financial institution renders a farmer ineligible for FSC membership. About 86 percent of farmers in Northern region, 69 percent in the Central region and 85 percent in Southern region endorsed the criterion that a conviction in any civil or criminal case should not be a member of FSC.

Finally, less than 50 percent of farmers in Central and Northern regions but 87 percent in Southern region showed satisfaction with the requirement of at least an SSC (10 years of education) be needed to be a member of a MC. However, 53 percent in the Northern region, 57 percent in the Central region and only 12 percent in the Southern region showed dissatisfaction with this requirement. Average years of education has been 7.3 years in the Northern region, 5.8 years in the Central region and 7.4 years in the Southern region. For FSC members, 8.1, 6.1 and 8.5 years of education is observed in the Northern, Central, and Southern respectively. Members of an FSC have on average 7.5 years of education compared to 6.1 years amongst non-members. It can be safely concluded that the education level of farmers community does not meet the criteria as many informally educated but experienced famers do not get a chance to become a member of the management committee.

#### 4.7. Transparency in the Operation of FSCs

**Members' opinion regarding transparency and smooth functioning of the FSCs are summarized in Figure 4.** 62 percent of the respondent members had attended meetings of FSCs. Around 25 percent indicated that general body meetings are not held regularly as required by law. 82 percent of respondent members underlined that the budget estimates are neither shared nor approved by the general body. 74 percent of the respondents were not aware that they can vote for election of members of the management committee or on every decision taken at the general body meetings. About 63 percent of respondents never voted in the election of members of MCs. It was further observed that MCs are more political in nature and support politically influential or connected farmers. *Thus transparency seems limited across several dimensions.*



**Majority of the farmers (95 percent) informed that FSC meetings are called to provide advice on farming practices, new technologies and improving yield (Table 50).** However, 60 percent of the respondent farmers found from others than the FSCs and extension agents that a variety and quantity of agriculture inputs could be procured from FSCs. Farmers also opined that the decision making gave them the feeling of ownership of the FSC. 42 percent of the members of Management Committees were elected through elections and 54 percent had no idea as to how they were chosen.

**Table 50. Transparency in Working of FSCs Regarding Meetings, Decisions, and Elections**

What was the purpose of the meeting?		
	Frequency	Valid Percent
Suggestion and Advice related to farming	244	94.6
Input provision	11	4.3
Training	3	1.2
<b>Total</b>	<b>258</b>	<b>100.0</b>
How decision about inputs procurement made?		
General Body	14	4.3
Management Committee	38	11.8
Agriculture Officers	19	5.9
Others	194	60.2
Don't know	57	17.7
<b>Total</b>	<b>322</b>	<b>100.0</b>
How you elect members of Management Committee (MC)?		
Election	175	41.6
Nomination	21	5.0
Don't know	225	53.4
<b>Total</b>	<b>421</b>	<b>100.0</b>
How you elect members of Executive Body (EB)?		
Election	171	41.9
Nomination	16	3.9
Don't know	221	54.2
<b>Total</b>	<b>408</b>	<b>100.0</b>

## 5.0 SWOT<sup>13</sup> Analysis of Farm Services Centres

**It is imperative to supplement the quantitative data collected through a structured questionnaire with qualitative information as well.** The qualitative data for SWOT analysis was collected through **Focus Group Discussions** (FGDs) with members of FSCs. These were conducted to collect information from groups of people having similar background and facing challenges common among them. The group members (not more than 12 at a time) were moderated by a team of researchers to generate discussion and to encourage members to take active part in such discussions by agreeing or disagreeing to any specific issues or outcome. The FGDs<sup>14</sup> were arranged and conducted with members of FSCs in different Agro-Ecological Zones (AEZs) of the province. The districts of Peshawar, Charsadda and Nowshera were covered in Central plain region, Abbottabad and Swat districts were selected from North-Eastern mountainous zone and districts of Karak and D. I. Khan were selected from Southern Piedmont Plains.

**The literature on SWOT revealed that some aspects are more crucial than others to evaluate the status of FSCs.** The literature also suggests that **Internal Factors** will be of little help unless “Weight” and “Rating” is assigned to each factor to quantify its impact. Therefore, Weight and Rate assessments were obtained from participants and recorded against each factor. Weights were taken in percentage points and were running from 0 to 100 percent, which indicated how important a factor was for the FSC concerned. That was obligatory to show because all (Strength and/or Weakness) factors may not necessarily be equally important. Rather some factors may be more important (e.g., 50 percent, 70 percent) than others (e.g., 5 percent, 10 percent). Likewise, Ratings were fixed between 1 to 3, which indicated the effect of a factor whether Minor or Major. That was also obligatory to show because all (Strength and/or Weakness) factors may not necessarily be having equal effect. Rather some factors may have Major effect (e.g., 3) than others (e.g., 1).

**The literature on SWOT indicates that External Factors also need to be accompanied by “Weight” and “Chance” scores and therefore, Weight and Chance scores are to be mentioned against each factor for measuring impact.** Weight means the magnitude of impact how important a factor is for the concerned FSC. That was required to display because all (Opportunity and/or Threat) factors may not essentially be equally central. Rather some factors may be more vital (e.g., 60 percent, 80 percent) than others (e.g., 5 percent, 15 percent). Likewise, Chance indicates the likelihood of occurrence of an event.

---

<sup>13</sup> **SWOT** is an acronym that stands for: S=Strengths; W=Weaknesses; O=Opportunities; and T=Threats of an organization. **Strengths** are Internal factors (which are in control of the FSC) that make FSCs better: For example, availability of trained officers; availability of Agricultural Machinery, good reputation of FSCs’ Management Team members, etc. Likewise, **Weaknesses** are also Internal factors (and which are in control of FSCs management) that can affect FSC’s progress or effectiveness: For instance, least cooperative members, non-functional Committee, shortage of trained members, misuse of funds, etc. **Opportunities** represent External factors (which are NOT in direct control of the FSC’s management) that, if availed of properly, may put the FSC in an advantageous position in future, such as increase in matching funds, construction of roads reducing transportation costs, etc. **Threats** refer to External factors as well (again NOT in direct control of FSCs’ management) that, if NOT responded to in a timely manner, may put the FSC in somewhat dis-advantageous position in future, such as abolishing the policy of extending matching funds, increase in women harassment cases causing reduction in female participation in FSC activities, government policy to repeal FSC Act-2014, etc

<sup>14</sup> FGDs are source of providing in-depth understanding that may supplement pure statistical results obtained from survey data analysis.

That is also obligatory to show because all (Opportunity and/or Threat) factors may not necessarily be equally likely. Rather some factors may have a higher chance of happening (e.g., 3) than others (e.g., 1).

## **5.1. Internal Factors**

**The internal and external factors listed for FGDs were as follows:**

- (i) The internal factors discussed with FMCs' members included were: (a) timely availability of skilled agricultural officers; (b) extension workers, modern machinery; (c) improved seed, pesticides, financial support, technical support; (d) easy access to extension messages; (e) new knowledge, market information; (f) opportunity to avail of demonstration plots, field visits; (g) political involvement; and (h) women involvement.
- (ii) The external factors discussed with FSCs' members during FGDs were: (a) possible change in government policy and FSCs' Act-2014; (b) political and financial health of the province; (c) acquisition of machinery; (d) storage facility; (e) CPEC, COVID-19, inflation; terrorism; (f) fluctuation prices of agricultural inputs and produce; (g) capacity to adapt to rapidly changing environment, etc.
- (iii) Factors marked less important for the members with minor effect were excluded from analyses and discussion. The prominent themes, such as, women participation, women harassment, terrorism and COVID-19 reported to have no existence or no importance by the members for their respective FSCs.

## **5.2. Region-wise analyses of FGDs:**

### **5.2.1 The Central Plains**

#### **District Peshawar**

**The Model Farm Services Centre (MFSC) Naguman, Peshawar, has more than 6,400 registered members and a fund of PKR 3.8 million.** However, the center did not receive matching grant from the government as yet. Due to excessive workload, insufficient quantity of inputs (seed, fertilizers and machinery etc.) and fewer field staff available, the registrations for induction of new members has been stopped. The FGD participants sounded positive about the FSC and its management committee with well qualified staff, holding regular meetings, maintaining proper check and balance on the budget and services that are provided by the FSC. There was no report on misuse of fund and facilities as well. The Management system was termed fair and trustworthy. The FSC members felt empowered, and more informed about quality and prices of inputs. Specifically, the members considered the FSC management qualified to provide advisory services to the farmers and provide guidance about agriculture services and use of inputs. The reported benefits of the FSC were availability of seed, pesticides, learning the seed certification process, establishment of linkages with other line departments, exposure to farming practices in other areas by way of field visits.

**The main concerns of the members were defective farm machinery, non-availability of operators, limited and delayed availability of inputs** (seed, pesticides, and fertilizers etc.), the non-provision of matching grants since establishment of the sub-Centre in 2018, non-enrolment of new members, fewer field staff, failure to guide and support farmer members in sale of surplus production, increase in labour costs, financial uncertainty, higher inputs costs (seed, pesticide, fertilizers etc.), decrease in government funding, involvement of public office holders in the FSC affairs and persistent purchase of outdated and useless

machinery. Farmers suggested to increase funding for the FSC, improve departmental coordination with management committees and purchase of machinery needed by farmers.

### **District Charsadda**

**Members in Charsadda expressed that creation of FSC has enabled easy access to extension workers.**

They can get guidance on modern agricultural techniques and are satisfied with the delivery of services. Respondents revealed that FSC has played role in effective delivery of extension messages and educating farmers on inputs quality and its use. A mix response was noted on the possible role of FSC in marketing and sharing market information. FSC provides wheat seed to its members while timely availability of farm machinery is not possible, as limited number of farm implements are available at the FSC. Respondents revealed that farmers who directly need the services of FSC are ignored. Members during FGD highlighted active role of FSC in developing linkages with government and non-government organizations as these organizations make intervention in close consultations with the agriculture extension department of the district. Majority of the respondents were aware of the limited number of demonstration plots and reported that only selected progressive and well-off farmers get these plots. The participants were of the view that the system is influenced by political interference. While a mix response was noted when asked about equal rights to members of the FSC.

**The respondents proposed for an active role of FSC to benefit the resource poor farmers through increase in government funding, effective and farmers friendly government policy, and political and economic stability of the country.** The group unanimously raised concerns over high fertilizer and other input cost and low prices for agricultural commodities. The group demanded for timely dissemination of output prices in various markets. They also opined that infrastructure including better roads and transportation are crucial for agriculture growth and development in the area, as most of the farmers from far flung areas have low access to markets and face difficulties in transportation of inputs and outputs. Group members also stressed on the development of storage and processing facilities especially for fruits and vegetables within the region. These facilities may not only reduce postharvest losses but also help in managing marketing surpluses that may fetch better prices for the produce of resource poor farmers of the region. Participants stressed that seed production opportunities be allotted on merit, as none of the respondents were aware of this facility of the FSC. In addition, none of the member were aware of the Management Committee (MC), board and consequently their working.

### **District Nowshera**

**FSC at district Nowshera has about 4000 registered members and funding of PKR 3.8 million including matching funds.** The funds are used for purchase of inputs. The Management committee meets on monthly basis to discuss the allocation of available funds for purchases. The Management committee is fair and trustworthy. Nowshera district has three tehsils namely: Nowshera, Jahangira and Pabbi with only 6 Tractors in which three are with Nowshera tehsil, one with Jahangira and two with Pabbi, which is an inexcusably low number.

**The prominent strengths reported were multi-faceted.** First, members get seed cheaper by PKR 100-150 than market rates making market prices more competitive. However, only those avail this facility who are near to FSC while farmers far from the extension Centres buy from market because of high transportation cost. The major weaknesses included: non-availability or inefficient farm machinery. Farmers were confident that in future, the government officials related to FSCs would improve coordination with management committees and would buy machinery only when it will be needed by farmers. They were

also looking forward to improvements in roads and especially the CPEC to get transportation cost down and boost exports. However, they were wary of continual increase in input prices and increasing cost of labour. They were also hopeful that cold storages will develop in the area.

### **5.2.2. The North-Eastern Mountainous Zone**

From the North-Eastern mountainous zone, the districts of Abbottabad and Swat were selected.

#### **District Abbottabad**

**FSC members in Abbottabad expressed that the creation of FSCs in the province has made access to agricultural extension staff and workers easy.** FSCs members can easily get guidance on the best suited technology. Members of the FGD view that FSC has achieved the purpose of effective delivery of extension messages and to educate farmers on inputs quality and use. While a mix response was noted regarding role of FSC in marketing, seed and farm machinery, other inputs, develop linkages with other line departments if needed, and design and implement crop demonstration plots and other activities. Mostly members of the FSC received seed of wheat crop whereas they expressed their concerns about timely availability of farm machinery because such machinery at the disposal of FSC is limited and falls short of demand. Members also expressed concerns over the role of FSC in providing any marketing information. However, some of the members articulated the role of FSC in developing linkages with government and other non-government organizations. They view that organizations working for farmers mainly contact FSC for any intervention in the field of agriculture. Majority of the respondents know and understand limited number of crop demonstration plots. They voiced that only selected progressive and well-off farmers are preferred and get these plots and majority of the members are deprived of this facility. None of the selected FGD members had crop demonstration plot. The group members argued that farmers who frequently visit FSC offices are getting more benefits.

**Members appreciated the efforts of extension staff regarding field visits and conduction of field days for providing guidance on issues if any.** Even though members of the FSC in Abbottabad consider the process and working of the FSC is transparent, non-political system, and to some extent every member has equal right, but they complained about the weak decision-making system. Members of the FGD view that role of FSC can be strengthened for the betterment of the farming community through increase in government funding, effective and farmers friendly government policy, and political and economic stability of the country. The group unanimously raised concerns over high fertilizer and other input cost and low prices for agricultural produce. The group demanded for timely dissemination of output prices prevailing in various markets. They also view that infrastructure including better roads and transportation crucial for agriculture growth and development in the area, as most of the farmers from far flung areas have difficult access to market and face difficulties in transportation of input and output. Group members also stressed on the development of storage and processing facilities especially for fruits and vegetables within the region. These facilities may not only reduce postharvest losses but also help in managing marketing surpluses that may fetch better prices for the produce of resource poor farmers of the region. Participants of the FGD demanded transparency in procedure of seed production as none of the respondents was aware of this facility of the FSC. In addition, none of the member were aware of the Management Committee (MC), board and consequently their working.

#### **District Swat**

**At Swat, member of the FSC viewed that Farmers' access to and timely availability of extension staff has increased with the formation of FSCs in the area.** Most of the respondents disclosed that extension staff/workers are available whenever they visit FSC. They further delineated that extension staff and workers educate farmers on inputs quality and use and also guide farmers on the best suited available

technology. They consider effective delivery of extension messages from the FSC/extension are very helpful to the farmers. They added that FSC field staff is actively working in their areas and properly provide guidance about the issues, if any.

**However, FSC role in marketing of input and output produce is minimal and do not provide marketing information including availability of inputs and disposal of output and their prices.** Majority of the respondents view that FSCs have no such system to provide information about input and output markets. Farmers in the FGD were satisfied with the availability of seed and pesticides at FSC and showed dissatisfaction with the non-availability of farm machinery when needed. They believe that influential farmers of the area are served. While some of the respondents were also not happy with the available machinery at FSC and consider that the available machinery is not usable in their areas.

**During the FGD farmers were inquired about crop demonstration plots and other activities of the FSC. The participants knew that crop demonstration plots were limited in numbers and only selected farmers get these plots.** Majority of the respondents never got any plot except a few. The respondents think that farmers who have easy access to FSC and visit frequently have more chances to get benefits from the system. Participants of the FGD were unaware of the development of linkages with other government and nongovernment departments. However, participants considered the system a transparent one though influenced by political interference. With respect to functioning of FSC, it was observed that none of the members were aware about the Management Committee (MC), board of FSC and its working. Further, few of the participants were having interest in the election/decision making while majority of the respondents were unaware about the voting or election in the FSC.

**Participants of the FGD pointed out that no storage facility is available in Swat district.** Further, FSC does not help in marketing of surpluses. Participants of the FGD stressed that increase in government funding can provide them more facilities including seeds, pesticides, fertilizers and machinery etc. Lack of funds for the FSC operation and its working may affect stability and growth of the FSC system. They also demanded for a positive change in government policy towards FSC. They consider that FSC can achieve its goal with the economic and political stability of the country.

### **5.2.3. Southern Piedmont Plains**

From the Southern piedmont plains, the districts of Karak and D. I. Khan were selected.

#### **District Karak**

**FSC at district Karak has about 4000 registered members and 5.7 million rupees of funds including matching funds.** The funds are used for purchase of inputs. Most of the area in district Karak is barren because of water scarcity. The Management committee meets on monthly basis to discuss the allocation of available funds for purchases. The Centre has 4 tractors, 2 small tractor with 65 horsepower and 2 medium 75 horsepower. One of the major demands of the people of that area was installation of solar tube wells.

**The FGD participants spoke high about the FSC in general.** To begin with, the Management Committee was reported to have been holding regular meetings, election and voting for selection of members for management committee and campaigning for recruiting more members. To date the Centre has more than PKR 5.7 million of funds with proper check and balance on the budget and services that are provided by the FSC. The Management system was termed fair and trustworthy where member farmers have equal rights and free involvement of public office holders. The FSC members felt empowered, and more informed about quality and prices of inputs. Specifically, the members considered the FSC management cooperative and well qualified who provide advisory services to the farmers and provide guidance about agriculture services and use of inputs. The reported benefits of the FSC were availability of seed, pesticides on lower



prices than those in the market, learning the seed certification process, establishment of linkages with other line departments, exposure to farming practices in other areas by way of field visits and the like.

**Nevertheless, the members complained about the non-availability of appropriate farm machinery.**

For instance purchase of Potato-digger because potatoes are never grown for market in Karak district. The machinery that is available in the FSC is not usable because it was having lesser capacity than required for agriculture in Karak. Further, FSC was reported to have played no specific role in sale of the surplus production. Likewise, late availability of seed and other inputs, allotment of fewer demonstration plots, insufficient number of field staff and absence check and balance at the higher level was also reported. The participants were hopeful that political and economic stability in the country will prove as impetus to further expansion of the FSC membership and increase funds and thereby acquisition of machinery suitable for the farming sector in Karak district. However, the members were mindful of the financial uncertainty in the country, rising of inputs' cost, possible involvement of public office holders in the FSC affairs, water crises and possible inconsistency in government policies regarding the fate of FSC.

### **District Dera Ismail Khan**

**FSC at district Dera Ismail Khan has about 4550 registered members.** Most of the area is barren because of water scarcity. The Management committee was reported as passive and dysfunctional. However, the membership strength hints otherwise.

**The FGD participants felt proud of the FSC as it had as many as 4,550 registered members with a possibility to rise further and trustworthy and cooperative Management Committee at their disposal.**

The reported benefits of the FSC were availability of skilled officers, learning the seed certification process, establishment of linkages with other line departments, exposure to farming practices in other areas by way of field visits and the like. Due to limited available resources, further registration has been halted by the FSC. Neither proper guidance on use of inputs and machinery was available nor field visits and field days were arranged to train farmers. As was the case in Karak district, the available machinery in D.I. Khan was very limited in number and was neither suitable nor operational. Further, FSC was reported to have played no specific role in sale of the surplus production. Likewise, late availability of seed and other inputs, allotment of fewer demonstration plots, insufficient number of field staff were also reported. The participants were optimistic that the government would bring a positive change in its policy towards FSC and may increase its funding for the FSC which would improve the working of FSC in future. The leading concerns were, financial uncertainty, higher inputs costs (seed, pesticide, fertilizers etc), probable involvement of political and public office holders in the FSC, inflation, inability to adapt to latest machinery, water crises for agriculture lands and non-seriousness of the FSC staff towards their jobs.

## References

- Abdulai, A., & Huffman, W., 2014. The adoption and impact of soil and water conservation technology: An endogenous switching regression application. *Land Economics*, 90(1), 26-43.
- Abid, M., Schilling, J., Scheffran, J., & Zulfikar, F. (2016). Climate change vulnerability, adaptation and risk perceptions at farm level in Punjab, Pakistan. *Science of the Total Environment*, 547, 447-460.
- Adelson, J. L., McCoach, D. B., Rogers, H. J., Adelson, J. A., & Sauer, T. M. (2017). Developing and applying the propensity score to make causal inferences: variable selection and stratification. *Frontiers in psychology*, 8, 1413.
- Ahmad, M., Qureshi, S. K., & Hussain, Z. (1999). Recent Evidence on Farm Size and Land Productivity: Implications for Public Policy [with Comments]. *The Pakistan Development Review*, 1135-1153.
- Ahmad, S.S. and M.Z. Khan. 2017. Role of farm services center regarding empowerment of vegetables growers in District Charsadda. *Sarhad Journal of Agriculture*, 33(3): 377-384.
- Aldosari, F., Al Shunaifi, M.S., Ullah, M.A., Muddassir, and Noor, M.A., 2017. Farmers' perceptions regarding the use of Information and Communication Technology (ICT) in Khyber Pakhtunkhwa, Northern Pakistan, *Journal of the Saudi Society of Agricultural Sciences*, 18 (2019) 211-217
- Ali, S., Ahmad, M., Ali, T., Hassan, S. W., & Luqman, M. (2011). Role of private extension system in agricultural development through advisory services in the Punjab, Pakistan. *Pakistan Journal of Science*, 63(2), 70-73.
- Ali, A., & Abdulai, A. (2010). The adoption of genetically modified cotton and poverty reduction in Pakistan. *Journal of Agricultural Economics*, 61(1), 175-192.
- Ali, A., & Erenstein, O., 2017. Assessing farmer use of climate change adaptation practices and impacts on food security and poverty in Pakistan. *Climate Risk Management*, 16, 183-194.
- Ali, O. H., Al-sayed, H., Yasin, N., & Afifi, E. (2016). Effect of different extraction methods on stability of anthocyanins extracted from red onion peels (*Allium cepa*) and its uses as food colorants. *Bulletin of the National Nutrition Institute of the Arab Republic of Egypt*, 47(2), 1-24.
- Akça, K., Chang, T. L., Tekdemir, İ., & Fanuscu, M. I. (2006). Biomechanical aspects of initial intraosseous stability and implant design: a quantitative micro-morphometric analysis. *Clinical Oral Implants Research*, 17(4), 465-472.
- Appleton S, Balihuta A (1996) Education and agricultural productivity: evidence from Uganda. *J Int Dev* 8(3):415–444.
- Ashraf, S., Ali, Q., Zahir, Z. A., Ashraf, S., & Asghar, H. N. (2019). Phytoremediation: Environmentally sustainable way for reclamation of heavy metal polluted soils. *Ecotoxicology and environmental safety*, 174, 714-727.
- Austin, P. C. (2011). An introduction to propensity score methods for reducing the effects of confounding in observational studies. *Multivariate behavioral research*, 46(3), 399-424.
- Ayinde OE, Adewumi MO, Olatunji GB, Babalola OA (2010). Determinants of Adoption of Downy Mildew Resistant Maize by small-scale Farmers in Kwara State, Nigeria. *Global J Sci Frontier Res*, 10(1): 32-35.
- Baumüller, H. (2012). Facilitating agricultural technology adoption among the poor: The role of service delivery through mobile phones.
- Bernard T, Taffesse AS, Gabre-Madhin E (2008) Impact of cooperatives on smallholders' commercialization behavior: evidence from Ethiopia. *Agric Econ* 39(2):147–161.  
doi:[10.1111/j.1574-0862.2008.00324.x](https://doi.org/10.1111/j.1574-0862.2008.00324.x)

- Belay, D., K. Yisehak and G.P.J. Janssens. 2012. Socio-Economic Factors influencing urban smallscale dairy management practices in Jimma Town, Ethiopia. *Libyan Agric. Res. Cen. J. Int.* 3(1): 7-12
- Beynon-Davies, P. (1995). Information systems 'failure': the case of the London Ambulance Service's Computer Aided Despatch project. *European Journal of Information Systems*, 4(3), 171-184.
- Bindlish, V., & Evenson, R. E. (1997). The impact of T&V extension in Africa: The experience of Kenya and Burkina Faso. *The World Bank Research Observer*, 183-201.
- Caliendo, M. and Kopeinig, S. 2008. Some Practical Guidance for the Implementation of Propensity Score Matching. *Journal of Economic Surveys*, 22 (1): 31-72.
- Casley, D. J., & Kumar, K. (1988). *The collection, analysis and use of monitoring and evaluation data*. The World Bank.
- Chamala, S., & Shingi, P. M. (1997). Establishing and strengthening farmer organizations. Chapter 21, in the Swanson, B. E., Bentz, R., & S ofranko, A. (1997). Improving agricultural extension. a reference manual was prepared under a contract between FAO and the International Program for Agricultural Knowledge System (INTERPAKS). *College of Agricultural, Consumer, and Environmental Sciences, University of Illinois at Urbana-Champaign, United States*.
- Cham, H., Reshetnyak, E., Rosenfeld, B., & Breitbart, W., 2017. Full Information Maximum Likelihood Estimation for Latent Variable Interactions With Incomplete Indicators. *Multivariate behavioral research*, 52(1), 12-30.
- Chen, Z., Huffman, W. E., & Rozelle, S., 2011. Inverse relationship between productivity and farm size: the case of China. *Contemporary Economic Policy*, 29(4), 580-592.
- Christopher-Stine, L., Casciola-Rosen, L. A., Hong, G., Chung, T., Corse, A. M., & Mammen, A. L. (2010). A novel autoantibody recognizing 200-kd and 100-kd proteins is associated with an immune-mediated necrotizing myopathy. *Arthritis & Rheumatism*, 62(9), 2757-2766.
- Das, G. (2018). Role of Farm Science Centre on Agricultural information Networks A study among the farm women of North Bengal.
- Davidson, J. W. (2001). The role of the body in the production and perception of solo vocal performance: A case study of Annie Lennox. *Musicae Scientiae*, 5(2), 235-256.
- Dehejia, R. H. and Wahba, S. (2002). Propensity score-matching methods for nonexperimental causal studies, *The Review of Economics and Statistics*, 84: 151-161.
- Dinar, A. (1996). Extension commercialization: how much to charge for extension services. *American Journal of agricultural economics*, 78(1), 1-12.
- Dahiya, S.S., Singh, S., Deswal, S., 2020. Role of Krishi Vigyan Kendras in Women Empowerment: A Study of Haryana State, Maharshi Dayanand University Research Journal ARTS 2020, Vol. 19 (1) pp.15-26
- Feder, G., Willett, A., & Zijp, W. (2001). Agricultural extension: Generic challenges and the ingredients for solutions. In *Knowledge generation and technical change* (pp. 313-353). Springer, Boston, MA.
- Guy Faure & Paul Kleene (2004) Lessons from new experiences in extension in West Africa: Management advice for family farms and farmers' governance, *The Journal of Agricultural Education and Extension*, 10:1, 37-49, DOI: [10.1080/13892240485300061](https://doi.org/10.1080/13892240485300061)
- Guy Faure , Yann Desjeux & Pierre Gasselin (2012) New Challenges in Agricultural Advisory Services from a Research Perspective: A Literature Review, Synthesis and Research Agenda, *The Journal of Agricultural Education and Extension*, 18:5, 461-492, DOI: [10.1080/1389224X.2012.707063](https://doi.org/10.1080/1389224X.2012.707063)
- Heckman, J. J. (1979). Sample selection bias as a specification error. *Econometrica: Journal of the econometric society*, 153-161.

- Hodgson, A., & Haq, S. (2009). Water adsorption and the wetting of metal surfaces. *Surface science reports*, 64(9), 381-451.
- Hu, R., Yang, Z., Kelly, P., and Huang, J., 2009. Agricultural Extension System Reform and Agent Time Allocation in China. *China Economic Review* 20 (2009) 303–315.
- Hu, R., Huang, J., and Chen, K.Z., The Public Agricultural Extension System in China: Development and Reform, A background paper prepared for Consultation, 2012)
- Huffman, W. E. (2020). Human Capital and Adoption of Innovations: Policy Implications. *Applied Economic Perspectives and Policy*, 42(1), 92-99.
- Hujer, R., Caliendo, M. and Thomsen, S. L. (2004). New evidence on the effects of job creation schemes in Germany – A matching approach with threefold heterogeneity, *Research in Economics*, 58: 257–302.
- Iqbal, M., Ahmad, M., & Mustafa, G., 2015. Impact of Farm Households' Adaptation on Agricultural Productivity: Evidence from Different Agro-ecologies of Pakistan.
- Jalan, J. and Ravallion, M. (2003). Does piped water reduce diarrhea for children in rural India? *Journal of Econometrics*, 112: 153–173.
- Israr, M., & Khan, N. (2019). The role of farm service centre (FSC) in adoption of improved wheat seed technology in Khyber Pakhtunkhwa: A logistic regression analysis. *Sarhad Journal of Agriculture*, 35(4), 1351-1356.
- Katol, S.B., Bhatt, J. H., and Patel, G. G., 2017. Impact Analysis of Activities Oo Krishi Vigyan Kendra, Guj. J. Ext. Edu. Vol. 28 : Issue 2 : December 2017
- Khan, I. U., Sajid, S., Javed, A., Sajid, S., & Shah, S. U. (2017). Comparative diagnosis of typhoid fever by polymerase chain reaction and widal test in Southern Districts (Bannu, LakkiMarwat and DI Khan) of Khyber Pakhtunkhwa, Pakistan. *Acta Sci. Malaysia*, 1(2), 12-15.
- Khan, N., Idrees, M., Shah, M., Ali, A., & Muhammad, N. (2009). The tractor impact in the rural area of District Peshawar. *Sarhad Journal of Agriculture*, 25(3), 509-515.
- Khatam, A., S. Muhammad, and I. Ashraf. 2013. Role of individual contact methods in dissemination of agricultural technologies. *Pakistan J. Agric. Res.* 26 (1): 40- 45.
- Kidd, P. S., & Parshall, M. B. (2000). Getting the focus and the group: enhancing analytical rigor in focus group research. *Qualitative health research*, 10(3), 293-308.
- Klerkx, L. and Nettle, R. 2013, Achievements and challenges of innovation co-production support initiatives in the Australian and Dutch dairy sectors: a comparative study. *Food Policy*, 40: 74– 89
- Kumar, A., Singh, A.K., Saroj, S., Madhavan, M., and Joshi, M.P.K, 2019. The Impact of India's Farm Science Centers (Krishi Vigyan Kendras) on Farm Households' Economic Welfare: Evidence from a National Farmers Survey, IFPRI Discussion Paper 01832 April 2019
- Lokshin, M., & Sajaia, Z., 2004. Maximum likelihood estimation of endogenous switching regression models. *The Stata Journal*, 4(3), 282-289.
- Luqman, S., Dwivedi, G. R., Darokar, M. P., Kalra, A., & Khanuja, S. P. (2007). Potential of rosemary oil to be used in drug-resistant infections. *Alternative Therapies in Health & Medicine*, 13(5).
- Khan, S., Rehman, S., Khan, A. Z., Khan, M. A., & Shah, M. T. (2010). Soil and vegetables enrichment with heavy metals from geological sources in Gilgit, northern Pakistan. *Ecotoxicology and environmental safety*, 73(7), 1820-1827.
- Joint, F. A. O., & WHO Expert Committee on Food Additives. (2002). *Safety evaluation of certain food additives and contaminants*. World Health Organization.

- Ma, W., & Abdulai, A., 2016. Does cooperative membership improve household welfare? Evidence from apple farmers in China. *Food Policy*, 58, 94-102.
- Mahmood, M.A., and A. D. Sheikh. 2005. Crop yields from new technologies. P: III. Daily Dawn March 28: April 3, 2005. <https://www.dawn.com/news/386758/crop-yields-from-new-technologies>
- McNiel, D. E., Eisner, J. P., & Binder, R. L. (2000). The relationship between command hallucinations and violence. *Psychiatric services*, 51(10), 1288-1292.
- Muhammad, H., Fuchs, T. J., De Cuir, N., De Moraes, C. G., Blumberg, D. M., Liebmann, J. M., ... & Hood, D. C. (2017). Hybrid deep learning on single wide-field optical coherence tomography scans accurately classifies glaucoma suspects. *Journal of glaucoma*, 26(12), 1086.
- Muhammad, S., Ashraf, I., Khatam, A., & Nawaz, N. (2017). Socio-economic characteristics of farmers and their participation in activities of Model Farm Services Centers in Khyber Pakhtunkhwa, Pakistan. *Pakistan Journal of Agricultural Research*, 30(1).
- Muhammad, S., and C. Garforth. 1995. Farmers' information exposure and its impact on their adoption behaviour. *Pakistan J. Agri. Sci.* 32: 262–265.
- Okafor, O. E., & Okafor, P. I. (2017). Membership of cooperative society and adoption of agricultural technology in Awka North LGA of Anambra State, Nigeria. *J Agric Biol Res*, 6, 1-11.
- Paltasingh, K.R., Goyari, P. Impact of farmer education on farm productivity under varying technologies: case of paddy growers in India. *Agric Econ* 6, 7 (2018). <https://doi.org/10.1186/s40100-018-0101-9>
- Paul, B., Chatterjee, S., Gop, S., Roy, A., Grover, V., Shukla, R., & Tyagi, A. K. (2016). Evolution of lattice dynamics in ferroelectric hexagonal REInO<sub>3</sub> (RE= Ho, Dy, Tb, Gd, Eu, Sm) perovskites. *Materials Research Express*, 3(7), 075703.
- Rehman, S., Ullah, R., Butt, A., & Gohar, N. D. (2009). Strategies of making TiO<sub>2</sub> and ZnO visible light active. *Journal of hazardous materials*, 170(2-3), 560-569.
- Rivera, W.M. 1998. An institutional variant in extension: the Rural Business Advisory Services in Uzbekistan. *Senegal J. Int. Agri. Ext. Edu.* 5 (3): 37-43.
- Rosenbaum, P. and D. Rubin (1983) The Central Role of the Propensity Score in Observational Studies for Causal Effects. *Biometrika* 70, 41–55.
- Rosenbaum, P. R., & Rubin, D. B. (1984). Reducing bias in observational studies using subclassification on the propensity score. *Journal of the American statistical Association*, 79(387), 516-524.
- Schultz, T. W. (1964). Transforming traditional agriculture Yale University press. *New Haven*, 212.
- Shah, T., & Tao, J. (2016). Analyzing the Performance of Member and Non-member Farming Community of Model Farm Services Center in District Dera Ismail Khan, Pakistan. *J. Appl. Environ. Biol. Sci*, 6(4), 191-201.
- Shah, T., Hayat, U., & Bacha, M. S. Muhammad. 2019. An empirical analysis of livestock activities of the model farm service center in Khyber Pakhtunkhwa. *Sarhad Journal of Agriculture*, 35(2), 557-564.
- Shahzad, M. F., & Abdulai, A. (2020). Adaptation to extreme weather conditions and farm performance in rural Pakistan. *Agricultural Systems*, 180, 102772.
- Smith, J. A. and Todd, P. E. (2005). Does matching overcome Lalonde's critique of non-experimental estimators? *Journal of Econometrics*, 125: 305–353.
- Solís, D., & Bravo-Ureta, B. E. (2005). Economic and financial sustainability of private agricultural extension in El Salvador. *Journal of Sustainable Agriculture*, 26(2), 81-102.
- Solís, E. T. (2002). La educación ambiental comunitaria y la retrospectiva: una alianza de futuro. *Tópico de educación ambiental*, 4(10), 7-21.

- Ullah, R., Khan, M. Z., Ullah, K., & Butt, T. M. (2015). Model Farm Services Center Approach: An Implication to Boost Farmer's Yield. *Agricultural Sciences*, 6(9), 953.
- Weir S (1999) The effects of education on farmer productivity in rural Ethiopia. Centre for the Study of African Economies Working Paper no. WPS/99-7, Oxford University, Oxford
- Valmohammadi, C., & Servati, A. (2011). Performance measurement system implementation using Balanced Scorecard and statistical methods. *International Journal of Productivity and Performance Management*.
- Wu, H. Y., Tzeng, G. H., & Chen, Y. H. (2009). A fuzzy MCDM approach for evaluating banking performance based on Balanced Scorecard. *Expert systems with applications*, 36(6), 10135-10147.
- Wossen, T., Abdoulaye, T., Alene, A., Haile, M. G., Feleke, S., Olanrewaju, A., & Manyong, V. (2017). Impacts of extension access and cooperative membership on technology adoption and household welfare. *Journal of rural studies*, 54, 223-233.
- Bernard T, Spielman DJ (2009) Reaching the rural poor through rural producer organizations? A study of agricultural marketing cooperatives in Ethiopia. *Food Policy* 34(1):60–69, <http://dx.doi.org/10.1016/j.foodpol.2008.08.001>

## Annexure 1 – Survey Questionnaire

Serial No. \_\_\_\_\_  
Signature: \_\_\_\_\_

### 1. Interviewers and FSC information

Name:	FSC:	Date
Supervisor:	Supervisor cross checked	
Latitude	Longitude	

### 2. Respondent

Respondent's name	District					
Tehsil	Village Name					
Cell Number/Other Contact Method	Family Size (Number)					
Family Composition starting from Household Head						
Name and Relationship to HH	Gender (M/F)	Age (years)	Marital Status (Married/Single)	Education (years)	Profession	Income Rs.
Your farming experience (years)						
Are you FSC member?	___ Yes ___ NO		If Yes, Since when? (Year)			
If you are member, how much did you pay for your membership Rs.?			Is the membership fee per year or is it lifetime membership?			
If you are not a member of FSC, have you ever been contacted to get membership?	___ Yes ___ NO		Major reason for being not member			

Have you ever been member of Management Committee (MC)?	___ Yes ___ NO
If not a member of MC then specify the reason?	___ Un-aware ___ Don't have membership fee ___ not satisfied with the working of FSC far from my village ___ Other(specify)
In case you need any credit facilities, where do you get credit from? (%)	___ Local Arthi ___ ZTBL ___ Commercial Bank ___ Friends and Family ___ Other (sp)
Main source of irrigation (%)	___ Canal ___ TW ___ Canal + TW, ___ Rain ___ Other (sp)
If Tube Well, then specify the ownership status	___ Owned ___ Rented ___ Other (sp)
If owned/Rented, Payment made/received in Rs.	

### 3. Land Holdings (Acres/Jereb/Kanals)

Owned land		Rented-in	
Land rented out		Land share in	
Land share out		Barren/mountainous	
Land Sharing	50:50	One third	Other Specify

### 4. Cropping Pattern (Crops 2019-2020)

S.#	Type of Crop	Area Planted	Total Production	Household Consumption	Marketable surplus
Rabbi Crops					
1	Wheat				
2	Gram				
3	Barley				
4	Mustard				
5	Shaftal				
6					
7					
Kharif Crops					

1	Sugarcane				
2	Maize				
3					
4					
5					
6					
7					

#### 5. Cropping Pattern (Vegetables 2019-2020)

S.No	Vegetable	Area planted	# pickings	Production/ picking	Avg. price/kg
<b>Rabi Vegetables</b>					
1	Onion				
2	Tomato				
3	Potato				
<b>Kharif Vegetable</b>					
1					
2					
3					

What is the mode of selling vegetables? 1. \_\_\_\_\_ Sold vegetables 2. \_\_\_\_\_ Sold-out field to contractor  
3. \_\_\_\_\_ Other and value of field sold (Rs): \_\_\_\_\_

#### 6. Cropping Pattern (Fruits)

S.No	Type of Crop	Area Planted	# plants	# crates (bags)	Weight/crate	Total Production (Current Year)	Avg. Price/crate	Total Production (Previous Year)	Avg. Price/crate
1	Peach								
2	Pear								
3	Plum								
4	Persimmon								
5	Malta								
6	Apple								
7									
8									

What is the mode of selling fruits? 1. \_\_\_\_\_ Sold fruits 2. \_\_\_\_\_ Sold-out orchard to contractor 3. \_\_\_\_\_ Other and value of orchard sold (Rs): \_\_\_\_\_

#### 7. Livestock

S.No	Type	Number	Milk/eggs Produced	Home consumed	Sold value
1	Cows				
2	Buffaloes				
3	Goats and goats				
4	Poultry				

#### 8. Evaluation of FSC: Input provision

Input	Total used	FSC	Agri. Research	Owned	Fellow farmer	Market	Other
Wheat seed (Kgs)							
Maize seed (Kgs)							
Orchard nursery plants (Number)							
DAP (Bags)							
Urea (Bags)							
Tractor (Hours)							
Sprayers (Hours)							

#### 9. For inputs purchased from FSC:

Input	Rate charged by FSC	Market Rate
Wheat seed (Ks)		
Maize seed (Kgs)		
Orchard nursery plants (Number)		
DAP (Bags)		



Urea (Bags)		
Tractor (Hours)		
Sprayers (Hours)		

## 10. Advisory services

Advice	Availed?	Source						Extent of provision				
		1	2	3	4	5	6	1	2	3	4	5
Seed (Variety)	Yes/No											
Seed rate	Yes/No											
Seed sources	Yes/No											
Fertilizer type	Yes/No											
Fertilizer rate	Yes/No											
Pesticides	Yes/No											
Machinery	Yes/No											
Orchards management	Yes/No											
Soil management	Yes/No											
Credit	Yes/No											
Sorting/grading	Yes/No											
Packaging	Yes/No											
Transportation	Yes/No											
Market destination	Yes/No											
Livestock diseases	Yes/No											
Poultry diseases	Yes/No											
Seed technology training												
Exchange visits												

EXTENT: 5. Great Extent, 4. Moderate extent, 3. Some extent, 2. Small extent. 1. Not at All.

SOURCE: 1. FSC, 2. Agri. Research, 3. Input dealer, 4. Fellow farmer, 5. Radio/TV, 6. Specify

### 11. Are the following technical staff available in the FSC?

Agricultural Officer	Yes/No	Plant Protection officer	Yes/No
Veterinary Officer	Yes/No	Soil Conservator	Yes/No
Water Management	Yes/No	Marketing	Yes/No
Horticulture officer	Yes/No		

If any of the above technical staff is not available, then would you like to have them? Yes/No

### 12. Membership criteria

	Satisfaction				
	1	2	3	4	5
Membership					
Are you satisfied from the eligibility criteria?					
Should be a farmer.					
Should not be less than 18 years.					
Should not be a defaulter of ZTBL.					
Management Committee					
Should not be convicted by court.					
For management committee, should have at least SSC education					
Can you propose an alternative model if you are not specified from the above? Please provide detail.					

### 13. Transparent system

Have you ever attended a FSC meeting in FSC?	Yes/No
What was the purpose of the meeting?	
Are General Body (GB) meeting held in FSC?	
Are budget estimates shared in/approved from GB?	
How decision about inputs procurement made?	GB, MC, AO, Ag. Ext. (HQ) other
How you elect members of Management Committee (MC)?	1. Election, 2. Nomination, 3. Consensus, 4. Don't Know
How you elect members of Executive Body (EB)?	1.Election, 2. Nomination, 3. Consensus, 4. Don't Know
Do you have the right to vote?	
Have you casted vote in election in FSC?	
Is the conduct of MC non-political in nature?	

### 14. In your view how much is it important in availing the services from FSC:

	1	2	3	4	5
Your farm distance from FSC					
Number of Tractors					
Number of Sprayers					
Number of Threshers					
Number of Rotavator					
Seed					

Fertilizer					
Specialists (Crop protectionist, entomologist, horticulturist, soil scientist, extension agents)					
Fruit plants/Nurseries					

EXTENT: 5. Not important, 4. Not very important, 3. Neutral 2. Somewhat Important, 1. Very Important.

#### 15. Willingness to pay (WTP) for accessibility of FSC

How much is approximate distance to MFSC?	_____ KMs
What do you think is it far or accessible?	Far/ Accessible
If it is not accessible or it is far, how far in KMs it should be for you to be accessible?	_____ KMs
Are you willing to pay higher membership fees if it is established near to your farm to be accessible?	Yes/No
If yes, how much are you willing to pay more in membership fee to establish the FSC at the distance accessible for you?	_____ Rs.

#### 16. Willingness to pay (WTP) for resources

Questions	Yes/No	If No, how much are you willing to pay more in membership fee to acquire the resource?
Tractor	Yes/No	_____ Rs.
Sprayer	Yes/No	_____ Rs.
Thresher	Yes/No	_____ Rs.
Rotavator	Yes/No	_____ Rs.
Seeds	Yes/No	_____ Rs.
Fertilizers	Yes/No	_____ Rs.
Pesticides	Yes/No	_____ Rs.
Nurseries	Yes/No	_____ Rs.
How much are you willing to pay more in membership fee for the mix of resources that answered "No" above?		_____ Rs.

#### 17. Transport and Customer Service

Services		Your willingness to pay if "Yes" is chosen
Do you think that a service from FSC such as a call at the beginning of the growing season shall be useful to provide guidance and assess your need for the various inputs?	Yes/No	_____ Rs.
Do you think that storage/cold storage facilities are impediments to the revenue you earn?	Yes/No	_____ Rs.
Do you think that the processing, grading, labeling and other value-added services are scarce and pose impediments?	Yes/No	_____ Rs.
Do you think that availing credit from commercial banks is hard to get and on stricter terms?	Yes/No	_____ Rs.

#### 18. Income generating

Do you market the surpluses yourself?	Yes/No
Do you think that FSC can have a role for marketing your surplus products in order to fetch you better price?	
Have you received basic seed for seed production?	
If yes, how much: _____ (Kgs) , How much seed is produced? _____ Kgs	
Have you been considered for seed certification process through FSC registration process?	
Was the basic seed provided of good quality?	

Can you outline any limitations of the working of FSC that have not been covered above?

Can you provide any suggestions in improving the working of the FSC?

## Annexure-2: Summary of Survey and Focal Group Discussions Findings

Input	Northern Region	Central Region	Southern Region	Members	Non-Members	Swat	Abbottabad	Peshawar	Nowshera	Charsaddah	D.I.Khan	Karak
Wheat Seed purchased from FSCs	30% or less	65% or less	35% or less	45% or less	8% or less							
Maize Seed purchased from FSCs	50% or less	80% or less	40% or less	30% or less	5% or less							
Orchard sapling purchased from FSCs	3% or less	3% or less	market	5% or less	1% or less							
DAP purchased from FSCs	20% or less	10% or less	18% or less	25% or less	2% or less							
Urea purchased from FSCs	25% or less	1% or less	15% or less	20% or less	3% or less							
Tractor Hours rented from FSCs	5% or less	5% or less	5% or less	15% or less	5% or less							
Sprayers Hours rented from FSCs	0	25% or less	0	30% or less	2% or less							
Price Difference of Wheat Seed at FSCs compared to Open Market	<18%	<7%	<11%									
Price Difference of Maize Seed at FSCs compared to Open Market)	> market price	> market price	> market price									
Price Difference of DAP at FSCs compared to Open Market	<5%	<5%	<5%									
Price Difference of DAP at FSCs compared to Open Market	<6%	>6%	<6%									
Rent Difference for Tractors at FSCs compared to Open Market	<15%	<15%	<15%									
Members Satisfaction with Membership Criteria	86%	69%	85%									
Members Satisfaction with the Management Committee	85%	65%	91%									
Members satisfaction with the Performance of FSCs						62%	41%	82%	63%	65%	67%	32%
Farmers Getting advice on modern practices, technologies & impact on yield				95%								
<b>Impact of FSCs on Yield increase (Mean)</b>												
1. Wheat (maunds per jerib)				6.759								
2. Maize (naunds per jerib)				4.796								
3. Tobacco (naunds per jerib)				0.326								
4. Rice (naunds per jerib)				0.911								
5. Sugarcane (naunds per jerib)				45.22								
<b>Transparency in FSCs: Members-</b>												
1. Attended meetings of FSCs				62%								
2. General Body Meetings not held regularly				25%								
3. Budget neither shared nor approved by GB				82%								
4. Not aware of voting rights in FSCs/MCs elections				74%								
5. Never voted in MCs elections				63%								

Input	Northern Region	Central Region	Southern Region	Members	Non-Members	Swat	Abbottabad	Peshawar	Nowshera	Charsaddah	D.I.Khan	Karak
<b>Mean:</b>												
1. Age of Farm Household Head (years)				48.875								
2. Education of household head (years)				6.767								
3. Farming experience of household head (years)				24.177								
4. Present land holding (Jerib)				17.97								
5. Livestock herd size per household				2.75								
6. No of contacts with extension agent				6.356								
7. Credit access				0.993		0.239	0.177	0.195	0.039	0.128	0.048	0.174
<b>Evaluation of FSCs</b>				30								
1. Matching Grant received from Government						No	Not much	No	Yes	Not much	Not much	Not much
2. Satisfaction with services provided by FSC						+Ve	+Ve	+Ve	+Ve	+Ve	+Ve	+Ve
3. Sufficient quantity of agricultural inputs Available						Yes	Yes	No	Yes	Yes	No	No
4. Cheaper quality seed compared to market						Yes	Yes	Yes	Yes	Yes	No	Yes
5. Availability of required field staff						Yes	Yes	No	Yes	Yes	Late	Yes
6. Registration of new members of FSCs						No	No	Stopped	No	No	Stopped	Yes
7. Misuse of FSC's Funds						No	No	No	No	No	No	No
8. FSC Holding regular meetings						Yes	Yes	Yes	Yes	Yes	Yes	Yes
9. FSC members felt empowered						Yes	Yes	Yes	Yes	Yes	Yes	Yes
0. Exposure of members to farm practices						+Ve	+Ve	+Ve	+Ve	+Ve	+Ve	+Ve
1. Availability of farm machinery						Not available	Not available	Defective	Defective	Defective	Less	Least
2. Involvement of public office holders in FSCs						Yes	No	Yes	N/A	Yes	Yes	Some
3. FSC affairs influenced by political interference						Yes	No	Yes	N/A	Yes	Yes	No
4. Support for access to markets						No	No	No	No	No	No	No
5. Support for agricultural outputs pricing						No	No	No	No	No	No	No
6. Availability of Demonstration plots						Fewer	Fewer	Fewer	Fewer	Fewer	Fewer	Fewer
7. Farm to market roads and transportation						Demand	Demand	Available	Available	Demand	Demand	Demand
8. Demand for postharvest losses reduction						Demand	Demand	Demand	Demand	Demand	Demand	Demand
9. Demand for storage and processing facilities						Demand	Demand	Available	Available	Yes	Yes	Yes
0. Demand for supportive agriculture policy						Yes	Yes	Yes	Yes	Yes	Yes	Yes
1. Demand for political stability and pricing						Yes	Yes	Yes	Yes	Yes	Yes	Yes

### **Annexure-3: Methodology Used for Data Analysis and Econometric Estimation to Assess The Impact of FSCs**

#### **1. Data Analysis**

**A template in SPSS was developed to computerize the collected data from members of FSCs and non-members.** The data collected through structured questionnaire consists of the following type of responses.

- i. Continuous or ordinal scale responses such as farm area, cropped area, total output of crops etc. and their proportion.
- ii. Dichotomous responses such as yes/no
- iii. Ranked data, responses collected on Likert or other appropriate scale
- iv. Willingness to pay data for services to be potentially offered by FSC

**An appropriate test(s) commensurating each type of data is used. F-statistics is used for comparing of means of continuous data across the three regions.** Post-hoc analysis using Least Significant Difference (LSD) has been carried in case F-Statistics associated with analysis of variable is statistically significant. Parametric techniques and tests on the other hand assume that data arise from a distribution described by a few parameters such as mean and variance and hence avoids the assumption of normal distribution. Parametric methods such as t-test is more efficient and powerful than non-parametric methods if the normality assumption holds. However, if the normality assumption is violated then nonparametric becomes more relevant and powerful. Non-parametric tests convert raw values to ranks for analysis.

**Fisher's LSD (Least Significant Difference) test is used after F test once F rejects the null hypothesis.** LSD uses the ordinary t-tests among all pairs of means for comparison. It tests the null hypothesis that  $H_0 = \mu_i - \mu_j$  where  $\mu_i$  and  $\mu_j$  are the two means. It is a simple technique to implement as follows.

$$t = \frac{\bar{y}_i - \bar{y}_j}{\sqrt{MSE(1/n_i + 1/n_j)}} \quad (3.3)$$

where MSE is mean square error measured as the standard deviation of means.

**If F-Statistics is significant then the Type I errors are not possible (or less likely), because they only occur when the null is true.** The LSD test has been criticized for not sufficiently controlling for this Type I error. Tukey's test on the other hand considers the differences among all pairs of means divided by the estimated standard deviation of the mean (MSE) and compares them with the critical values given in the table as follows:

$$t = \frac{\bar{y}_i - \bar{y}_j}{\sqrt{MSE(1/n)}} \quad (3.4)$$

Tukey uses one critical value and compares it with all with all possible pairs of means. If the difference is larger than the Tukey value, the comparison is significant. So, there could be several treatment groups, but these are compared to one control group which makes Tukey superior to LSD.

As the formula of each test shows, LSD will produce a narrow confidence interval for the differences between means as compared to the Tukey's test. Tukey is preferred test because it is very conservative with respect to Type I error when the Null hypothesis is true. It is preferred one the number of means increases six. We have seven FSCs in this study and Tukey test is recommended and used in the study.

**Cross-tabulations and Chi-square are used for analysis of the categorical data.** It helps to establish and test hypothesis among the association between exogeneous and endogenous variables using the following relationship.

$$X^2 = \sum_{i=1}^j \sum_{j=1}^k (O_{ij} - E_{ij})^2 / E_{ij} \quad (3.5)$$

where,  $X^2$  represents Chi-square for two categorical variables,  $O_{ij}$  represents the observed frequencies in the cross-classified category at  $i$ th row and  $j$ th Column. And  $E_{ij}$  represent he expected frequency for the same category, assuming no association between variables under investigation. The resulting frequency is distributed as Chi-squared with relevant degree of freedom. The degree of freedom is calculated as  $df = (r-1)(c-1)$  where  $df$  is equal to degree of freedom,  $r$  represents the number of rows and  $c$  represents number of columns.

## 2. Willing to Pay (WTP)

**Contingent Valuation estimates the value of a good or service that a user place on it.** The technique asks users to report their Willingness-to-Pay (WTP) for using a good or service thus providing a hypothetical marketplace for making transactions. The technique has been criticized for considering the value of the passive use of a good, even then the technique has been popular in evaluation of policies and use of natural resources. Willingness-to-pay can be used to measure the compensating or equivalent variations for parks. Compensating variation is appropriate when the good is purchased. Equivalent variation measures the potential loss of a good a person faces. Willingness-to-pay is more formally defined as the amount that must be taken away from the consumer's income while keeping his utility constant. A number of questions on the WTP on use of services that can be potentially provided by the FSC were asked in the survey. Some of the examples of these questions are as follows:

Are you willing to pay higher membership fees if it is established near to your farm to be accessible? If yes, how much?	Yes/No	Rs. _____
How much are you willing to pay more in membership fee to use the following resource?	Yes/No	Rs. _____
1) Tractor	Yes/No	Rs. _____
2) Sprayer	Yes/No	Rs. _____
3) Thresher	Yes/No	Rs. _____
4) Rotavator	Yes/No	Rs. _____
5) Seeds	Yes/No	Rs. _____
6) Fertilizers	Yes/No	Rs. _____
7) Pesticides	Yes/No	Rs. _____
8) Nurseries	Yes/No	Rs. _____

To describe the value of WTP, let's assume household with a utility function,  $u(X, Q)$  where  $X$  is a consumer good while  $Q$  is a good provided by the FSC. Utility depends on the quantity

of both  $X$  and  $Q$  consumed. It is assumed that utility increases with the increase in the consumption of  $X$  and  $Q$  subject to the income constraint;  $I = PX$ , where  $P$  represents market price. The household minimize its expenditures,  $PX$ , subject to attain a given level of utility,  $U = u(X, Q)$ , leads to the expenditure function,  $e(P, Q, U)$ . The increase availability of a service by the FSC, the WTP for this change, changes the expenditure function of the household. The new willingness to pay (WTP') is the difference between two expenditure functions, and if the change in FSC provided service or good is incremental such that  $Q' > Q$ , then the WTP will rise.

$$WTP' = e(P, Q, U) - e(P, Q', U) \quad (3.6)$$

Equation (3.2) in-terms of indirect utility function is given as under.

$$WTP' = I - e(P, Q', V(P, Q, I)) \quad (3.7)$$

where  $V$  represents the indirect utility function,  $I$  is monthly income,  $P$  is a vector of prices,  $Q$  and  $Q'$  are the alternative levels of the good or service provided by the FSC. Since the expenditures needed for desired utility level are less than the income, WTP' is positive. If the change in public good is a decrement,  $Q > Q''$ , the respondent will be willing to pay to escape the decrement. In this case expenditures required for desired utility level with decrement are higher than income of the respondent, WTP is still positive. Empirically, the following general model postulates the effect of different factors on WTP.

$$WTP = f(S, O) \quad (3.8)$$

where  $S$  is a matrix consisting of socio-economic characteristics of the individual and  $O$  is a matrix consisting of other variables including perception of the individual related to FSC and its governance structure. The actual specification of the model will be given when it is estimated.

**Treatment effect model can be used to estimate the effect of a binary variable on an outcome variable of interest.** The effect of membership of FSCs on variables of outcome such as farm productivity, adoption of technology etc can be estimated using treatment effect model. Treatment effect models estimate an average effect of the variables.

### 3. Econometric Estimation of the Impact of Farm services centres

**Consider a multi-product risk neutral farm household producing  $n$  crops to maximize farm production.** The conceptual framework is based on farmer's choice of FSC membership assumption to opt for FSC services. It means farmers are self-selecting to FSC membership based on certain factors. We assume that farmers are risk neutral, and they take into account potential farm yields of crops ( $R_M^*$ ) derive from FSC members and expected farm yields ( $R_N^*$ ) derived from non-members. Let the difference between yields of members and non-members is  $R_i^*$  i.e.,  $R_i^* = R_M^* - R_N^*$ . The farmer will choose the FSC membership if  $R_i^* > 0$ , we can't observe  $R_i^*$  directly but can be used to express as a function of observable elements in the following latent variable model:

$$R_i^* = Z_i\beta_i + \mu_i R_i = 1 \text{ if } R_i^* > 0 \quad (\text{selection equation}) \quad (3.9)$$

Where  $R_i$  is a binary indicator variable representing household  $i$  and equal to 1 if a farmer is a member of FSC and zero otherwise.  $Z_i$  is vector of explanatory variables including household and farm level characteristics such as household size, household head age, education, farm size, credit

access, location of farm, etc.  $\beta_i$  is the vector of parameters to be estimated and  $\mu_i$  is the error term assumed to be normally distributed with zero mean and constant variance. To make a relationship of FSC membership to potential farm outcome, it is assumed that rational farmers maximize expected utility from agricultural production.

#### 4. Endogenous Switching Regression (ESR) Model specification

For the impact analysis, Endogenous Switching Regression (ESR) model is employed. This model is based on two stages. At first stage decision of adaptation based on dichotomous criteria as a selection equation considered as described in Eq. (3.9). In second stage two equations for FSC members and non-members can be specified as outcome equations. The model specification is as under:

$$\text{Adopters: } Y_{iM} = X_i\beta_{iM} + \varepsilon_{iM} \quad (3.10a)$$

$$\text{Non-adopters: } Y_{iN} = X_i\beta_{iN} + \varepsilon_{iN} \quad (3.10b)$$

$Y_{iM}$  and  $Y_{iN}$  are the outcomes (such as yields of different crops) for FSC members and non-members respectively.  $X_i$  represents independent variables assumed to be exogenous and may influence the outcomes.  $\varepsilon_i$  is the random error term associated with outcome variables.

**As the variable  $Z_i$  from adaptation equation and  $X_i$  in equation (3.10a and 3.10b) overlap**, so proper model identification is required i.e. at least one variable in  $Z_i$  should not appear in  $X_i$ . That variable is considered as an instrument for model identification. This instrumental variable directly affects the FSC membership decision and outcomes of members but has no effect on the outcome equations of non-members. In the present study, the information about FSC services is employed from social networking as an instrumental variable. For the validity of the instrumental variable, probit model for is run for the selection equation and simple OLS regression for outcome equations of non-members. In selection equation this variable is significant but insignificant in outcome equations of non-members.<sup>15</sup>

**As the farmers are self-selecting for the FSC membership, so the issue of selection bias may arise.** It means that the unobservable factors can be correlated between the error term of selection equation and outcome equations i.e.  $\text{corr}(\mu_i, \varepsilon_i) \neq 0$ . To overcome the issue of selection bias we use ESR model that accounts for selection bias arising from unobservable factors as omitted variable problem. For the adjustment of selection bias inverse Mill's ratio and covariance term  $\sigma_{iM} = \text{cov}(\mu_i, \varepsilon_{iM})$  and  $\sigma_{iN} = \text{cov}(\mu_i, \varepsilon_{iN})$  incorporated in the above given equations 3.11a and 3.11b.

$$Y_{iM} = X_i\beta_{iM} + \sigma_{iM}\lambda_{iM} + \xi_{iM} \text{ if } R_i = 1 \quad (3.11a)$$

$$Y_{iN} = X_i\beta_{iN} + \sigma_{iN}\lambda_{iN} + \xi_{iN} \text{ if } R_i = 0 \quad (3.11b)$$

---

<sup>15</sup> For the interest of brevity instrumental validation results are given in the appendix 4 (please see Table A1-Table A6).



$\lambda_{iM}$  and  $\lambda_{iN}$  are the control for the selection bias arising from unobservable factors.  $\xi_{iM}$  and  $\xi_{iN}$  are the error terms with conditional zero mean.

**Full information maximum likelihood (FIML) method introduced by Lokshin and Sajaia (2004) has been used to estimate the selection and outcome equations simultaneously.** The FIML estimation can handle the incomplete indicators of FSC membership and non-membership. After running the ESR model, correlation coefficients  $\rho_{\mu M}(\sigma_{\mu M}/\sigma_{\mu}\sigma_{iM})$  and  $\rho_{\mu N}(\sigma_{\mu N}/\sigma_{\mu}\sigma_{iN})$  of the covariance between selection and outcome equations are obtained. If the value of  $\rho_{\mu M}$  or  $\rho_{\mu N}$  is significant it means selection bias is present in data due to unobservable factors. Selection bias is positive if  $\rho_{\mu M} < 0$  and negative if  $\rho_{\mu M} > 0$ . If the value of  $\rho_{\mu M}$  and  $\rho_{\mu N}$  have alternate signs it means farmer's choice of FSC membership is based on comparative advantage but if signs are same, it shows FSC members get more than average outcomes irrespective of the membership decision.

## 5. Average Treatment Effects (ATT)

**ATT can be calculated by using ESR model.** Observed and unobserved counterfactual outcomes can be written as follows:

Farmer with FSC membership (observed)

$$E[Y_{iM}|R = 1] = X_i\beta_{iM} + \sigma_{iA}\lambda_{iM} \quad (3.12a)$$

Farmer without FSC membership (counterfactual)

$$E[Y_{iN}|R = 1] = X_i\beta_{iN} + \sigma_{iN}\lambda_{iN} \quad (3.12b)$$

These two equations can be used to derive average treatment effects.

$$\begin{aligned} ATT &= E[Y_{iM}|R = 1] - E[Y_{iN}|R = 1] \\ &= [X_i\beta_{iM} + \sigma_{iM}\lambda_{iM}] - [X_i\beta_{iN} + \sigma_{iN}\lambda_{iN}] \\ &= X_i(\beta_{iM} - \beta_{iN}) + \lambda_{iM}(\sigma_{iM} - \sigma_{iN}) \end{aligned} \quad (3.13)$$

As farmers self-select in joining FSC, so the decision for becoming an FSC member is non-random, this decision may be endogenous and may arise the problem of selection bias (Heckman, 1979). The studies have applied a propensity score matching technique (Ali and Erenstein, 2017) and Heckman's treatment effects model (Iqbal et al., 2015) to address the problem of selection bias. However, a well-known limitation of the propensity score matching approach is that it only addresses observable factors without accounting for unobservable factors such as cognitive abilities, farming skills, and inborn abilities (Ma and Abdulai, 2016). Heckman's treatment effects model is estimated in two steps, whereby a notable shortcoming of two-step estimation is that it generates heteroskedastic residuals that cannot be used to obtain consistent standard errors without adjustments (Lokshin and Sajaia, 2004). By contrast, the ESR model estimates selection and outcome equations simultaneously, employing full information likelihood method for the

estimation that can handle the incomplete indicators of FSC membership and non-membership (Cham et al., 2017), therefore, has an advantage over the two approaches.

**In contrast, propensity score matching requires no assumption for the functional form in specifying the relationship between the outcome and predictors of outcome, unlike the parametric methods mentioned above** (Ali and Abdulai, 2010). The drawback of the approach is the strong assumption of unconfoundedness. As argued by Smith and Todd (2005), there may be systematic differences between FSC members and non-members even after conditioning because the selection is based on unobserved characteristics that are unknown to the researcher and can't be measured. However, Jalan and Ravallion (2003) point out that the assumption is no more restrictive than those of the IV approach employed in the analysis of cross-sectional data. Therefore, to address the sensitivity of our results obtained using ESR approach, this study employs statistical matching by pairing FSC members and non-members based on observable characteristics (Dehejia and Wahba, 2002).

## 6. Sensitivity analysis by using PSM approach

**The PSM is defined as the conditional probability that a farmer joins FSC, given pre-selection characteristics** (Rosenbaum and Rubin, 1983). This method compares the members with non-non-members considering the similar characteristics for both groups and balances the observed covariates between the two groups based on the similarity of their predicted probabilities of joining FSC, called their 'propensity scores. As selection to join FSC is non-random, therefore, we need to create the condition of a randomized experiment, the PSM employs the unconfoundedness assumption, also known as the conditional independence assumption (CIA), which implies that once  $Z_i$  is controlled for, FSC membership becomes random and uncorrelated with the outcome variables. The propensity score  $p(Z_i)$  can be expressed as:

$$p(Z_i) = Pr(R_i|Z_i) = E(D_i|Z_i) \quad (3.12)$$

The conditional distribution of  $Z_i$ , given  $p(Z_i)$  is similar in both participant and non-participant groups. After calculating the propensity scores the average treatment effect on the treated (ATT) denoted by  $\tau$  can be calculated as follows:

$$\begin{aligned} \tau &= E(U_{i1} - U_{i0}|R_{i1} = 1) \\ &= E\{E\{U_{i1} - U_{i0}|R_{i1} = 1, p(Z_i)\}\} \\ &= E\{E\{U_{i1}|R_{i1} = 1, p(Z_i)\}\} - E\{E\{U_{i0}|R_{i0} = 0, p(Z_i)\}|R_{i0} = 0\} \end{aligned} \quad (3.13)$$

**Several techniques have been developed to match members and non-members of similar propensity scores.** The most commonly used techniques include Nearest Neighbour Matching (NNM), Kernel-Based Matching (KBM), and Stratified Matching methods. The NNM involves choosing individuals from members and non-members that are closest in terms of propensity scores as matching partners. In the literature, several variants of the NNM have been proposed, including NNM matching with replacement and without replacement. In the former case, an

untreated individual can be used more than once as a match, whereas in the latter case it is considered only once (Smith and Todd, 2005). The KBM method is also a non-parametric matching method that uses the weighted average of the outcome variable for all individuals in the group of non-participants to construct the counterfactual outcome, giving more importance to those observations that provide a better match. This weighted average is then compared with the outcome for the group of participants. The difference between the two terms provides an estimate of the treatment effect for the treated. Hujer et al. (2004) point out that a proper imposition of the common support condition is quite crucial in employing the KBM, as this helps in avoiding bad matches. While in stratification matching, mutually exclusive subsets of households based on estimated propensity scores are stratified. Then respondents are ranked according to their estimated propensity scores. This approach divides households into five equal-size groups using the quintiles of the estimated propensity score (Austin, 2011). Once a researcher stratifies the households based on their propensity scores, they can compare the effects of participation between the two groups within the same strata, or subclass, thus controlling for overt bias (Rosenbaum and Rubin, 1984; Adelson et al., 2017). Here, it is also important to note that a major objective of propensity score estimation is to balance the observed distribution of covariates across the groups of members and non-members. The balancing test is normally required for the matched sample to make sure whether the differences in the covariates in the two groups have been eliminated, in that case, the matched comparison group can be considered as plausible counterfactual (Caliendo and Kopeinig, 2008).

## **Annexure 4: Draft Amendment Bill to Amend FSCs Act 2014**

**A**

### **BILL**

to amend the Khyber Pakhtunkhwa Farm Services Center Act, 2014

WHEREAS, it is expedient to amend the Khyber Pakhtunkhwa Farm Services Center Act, 2014 for the purpose hereinafter appearing;

It is hereby enacted as follows:

**1. Short title and commencement.**--- (1) This Act may be called the Khyber Pakhtunkhwa Farm Services Centres (Amendment) Act, 2023.

(2) It shall come into force at once.

**2. Amendment in Section 2.** In the said Act, in sub-section (1) of Section 2, the following amendments shall be made, namely:-

- (i) In clause (b) before the words “Farm Services Centre”, the word “Model” and after the word “Centre”, the words “including the Farm Services Centres” shall be inserted.
- (ii) Clause (c) shall be substituted as follows:

“Department” means Agriculture and Cooperation Department of the Khyber Pakhtunkhwa;
- (iii) After clause (c), the following new clauses shall be inserted, namely:
  - “(c-i) “Director General” means the Director General, Agriculture Extension;
  - “(c-ii) “Director” means Director, Model Farm Services Centres;
  - “(c-iii) “District Director” means District Director, Agriculture Extension;
  - “(c-iv) “Executive Committee” means a Committee elected from amongst the General Body of a Center on a ratio of one to one hundred; and
  - “(c-v) “Extension” means Department of Agriculture Extension;
- (iv) After clause (e), the following new clause shall be inserted, namely:
- (v) In clause (m), for the words “Management Committee”, the words “Executive Committee”, shall be substituted and shall be so substituted wherever it occurs in the Act;
- (vi) After clause (o), the following new clause shall be inserted, namely:
  - “(o-i) “Prescribed” means prescribed by the rules;
- (vii) After clause (p), the following new clauses shall be inserted, namely:
  - (q) “Secretary” means the Secretary of the Department of Agriculture;
  - (r) “Spokesperson” means the Information Secretary of a Centre;
- (viii) Clause (q) shall be renumbered as “clause (s)”.

**3. Amendment in Section 3.** In the said Act, in section 3, the following amendments shall be made, namely:-

- (a) in sub-section (1), after the word “establish”, the words “and register Model” shall be inserted;
- (b) in sub-section (5), after the word “community”, the words “aligned with the government policy” shall be added;
- (c) in sub-section (6), after the first proviso, following second proviso shall be inserted, namely:-  
“Provided further that a declared defaulter after clearing all outstanding dues and obtaining such certificate from the said financial institution declaring him a defaulter shall be eligible to be a member of a Centre.”
- (d) in sub-section (7), after the words “establishment of Centre”, the word “only” shall be inserted; and
- (e) after sub-section (7), the sub-section (8) shall be inserted, namely:-  
“(8) Government may invite development proposals and programmes from Model Farm Services Centres to support the agriculture sector.”

**4. Amendment in Section 4.** In the said Act, in Section 4, the following shall be substituted:-  
**Functions of Centre.**—Subject to general control and supervision of the Board, the Centre shall—

- (a) safeguard farmers rights and interests;
- (b) provide necessary support to the farmers with the assistance of Directorate of Extension and Research including (i) on-farm testing to identify the location specificity of agricultural technologies under various farming systems; and (ii) Front Line Demonstration to establish production potential on the farmers’ fields to enhance productivity;
- (c) organize training of farmers for creating awareness and update their knowledge and skills in modern agricultural practices and adoption of technologies with the support of Directorate of Extension;
- (d) work as resource and knowledge centers for climate smart, regenerative and digital agriculture with the support of the Department and supporting public and private and initiatives through services providers identified by the Department to modernize agriculture and improving rural economy of the district;
- (e) increase in crop yields by ensuring availability of quality agricultural inputs and adoption of modern technology with the support of the Department;
- (f) improve farmers livelihood;
- (g) purchase certified seed, fertilizers, animal husbandry services, quality veterinary health care services and medicines, farm machinery, expertise and technology for the provision to the members who are registered with the Centre on affordable rates as approved by the Executive Committee through a resolution in comparison to open market rates;

- (h) provide or extend the facility of loan to the members, subject to the availability of fund, from its own resources on such terms and conditions as may be prescribed by Board;
- (i) facilitate its members to avail the facilities of laboratories established and maintained by Government on such charges as may be prescribed from time to time by Government;
- (j) make marketing arrangements for all types of surplus produce at Centres and establishing farmers' markets, either at existing agricultural produce markets or separately, to allow registered members to dispose of their agricultural produce;
- (k) acquire dealership of agriculture inputs with the approval of Government to provide these to register members at competitive rates compared to market;
- (l) establish an ICT based system with the support of the Department to provide market information to its registered members;
- (m) preparing plans for developing agribusiness and strengthening agricultural produce value chains to seek support of the private investor or the Government.

**5. Amendment in Section 6.** In the said Act, in section 6:-

- (a) Sub-Section (1) shall be substituted with “**Executive Committee.**--- (1) The General Body of a Centre, shall elect, President, Vice President, Executive Secretary, Finance Manager, Spokesperson, and such other persons as the Board on the recommendation of General Body may specify, for a period of two years through such procedures as may be prescribed by the Board.”

- (b) Sub-section (6) shall be substituted as follows, namely:-

“Except the facilitator, all members of the Management Committee shall be the residents of the Union Council or Teshil concerned, as the case may be.”

- (c) After sub-section (6), the following new sub-sections shall be added, namely:-

“(7) Government shall create a post of Agriculture Officer in BPS-17, having MSc Agriculture Degree for each Centre along with necessary support staff as may be proposed by the Executive Committee and duly recommended by the Director of the district concerned to act as facilitator of a Center.

(8) The Director, Agriculture Extension may act as a supervisor to assist and monitor the activities of a Center.

(9) The Director, Agriculture Extension if feels that the Executive Committee is not working in accordance with this Act and the rules framed thereunder and is liable to be dissolved, he may send his recommendation along with detailed reasons and justification to the Director General Agriculture Extension through Director MFSCs who shall dissolve the Management Committee after issuing show cause to the concerned Executive Committee and hearing both sides through a speaking order.

(10) The Director MFSCs, after dissolution of the Executive Committee of a MFSC/FSC, shall arrange for the fresh election of the Executive Committee of that MFSC or FSC within forty five days of the day of dissolution.”

**6. Amendment of section 7.** In the said Act, in section 7:-

- (a) In clause (c), before the full stop, the words “ based on needs and in accordance with the standards prescribed by the Department and subject to availability of sufficient funds” shall be added.
- (b) In clause (i), after the words “General Body”, the words “and Executive Committee” shall be added;
- (c) After clause (m), the following new clauses shall be added namely:-
  - “(n) The Centres shall act as authorized dealers for the purpose of entering into contract with seed, fertilizers, and pesticides companies on such terms and conditions as the Government may approve for sale of agricultural inputs to its members at competitive rates;
  - (o) Provide procured or purchased agricultural machinery to the registered members on rental at formula based rates fixed by the Executive Committee:

**Explanation:** The formula shall be based on: Annual Depreciation Cost of machinery + Cost of fuel + Cost of Operator + Any other cost + 15 percent profit;

- (p) Establish Farmers’ Markets either within the Centre or at appropriate location for disposal of agricultural produce of registered members.”

**7. Amendment of Section 9.** In the said Act, in section 9,

- (a) Sub-section (1) shall be substituted with “(1) Each Centre shall maintain a Fund which shall consist of matching and other grants from the provincial government, donations, share money, registration fee and annual fee of members, income from its operations, and contributions, bequests endowments and any other legal sources of income.

**8. Amendment of Section 10.** Section 10 of the Act shall be substituted as follows:-

- (1) “The quorum for a meeting of the Executive Committee shall be three-fourth of its members.
- (2) The Executive Committee shall take decisions with the approval of simple majority of the total membership of Executive Committee.
- (3) Any decision of the Executive Committee shall not be invalid because of any vacancy in the composition of Management Committee.

**9. Amendment of Section 11.** The Section 11 of the Act shall be substituted as “All the subordinate offices under the Administrative Control of Department of Agriculture or any other related Departments shall be bound to provide assistance to a Centre if and when so required by it on a request moved through facilitator.”

**10. Amendment of Section 12.** In the said Act, for Section 12, sub-section (2) shall be substituted as follows:

- “(2) The composition of the Board shall be as follows:
  - (a) Secretary to Government of the Khyber Pakhtunkhwa Agriculture and Cooperation Department; Chairman

(b)	Additional Secretary	Vice Chairman
(c)	Director General Agriculture (Extension)	Member
(d)	Director General Agriculture (Research)	Member
(e)	Director General Livestock and Dairy Development Department	Member
(f)	Director, Agriculture Engineering	Member
(g)	Director, Soil Conservation	Member
(h)	Director (Operations), Food Safety and Halal Food Authority	Member
(i)	one nominee each of the Finance, Food Department and Planning and Development Departments, not below the rank of Deputy Secretary	Member
(j)	Seven Divisional Presidents of the Centers	Member
(k)	Three representatives from the Agriculture Universities and Nayab Research Institutes	Member
(l)	Two representatives of the private sector relating to agribusiness	Member
(m)	Director, Model Farm Services Centers	Secretary

(a) in sub-section (7), for the word “Six”, the word “Thirteen” shall be substituted.

**11. Amendment of section 13.** In the said Act, in sub-section (1) of section 13, clause (f) shall be substituted with the words “develop performance indicators and establish an ICT based Monitoring and Evaluation System to monitor the performance of the Centres and implementation of this Act.”

**12. Amendment of section 15 of the Khyber Pakhtunkhwa Act No. VIII of 2014:---** in the said Act, in section 15, in clause (a), for the word “Management”, the word “Executive” shall be substituted.

### **STATEMENT OF OBJECTS AND REASONS**

The Farm Services Centre Act was enacted. Since then environment have changed various assessments have been made by researchers and scholars, last one in 2021, have underlined the need to make critical amendments in the Act to strengthen the Model Farm Services Centres to serve as “one-stop-shop” including empowering them, extension advisories, providing quality agricultural inputs to enhance productivity as well as access to credit and market information to their registered members, improving their financial health, and development of value chains and agribusiness. The proposed amendments will help in achieving the objectives and will ensure provision better and coordinated support of the Government to Farm Services Centres.

**MINISTER-IN-CHARGE**



## Appendix-I

### Instrumental variable validation test

**Table A-1. Probit Model Results**

FSC_member	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
HH Age	.006	.014	0.45	.656	-.021	.033	
Family size	-.005	.024	-0.19	.85	-.052	.043	
Iv	.026	.025	1.04	.297	-.023	.074	
HH Edu							
Farming Experience	.002	.015	0.15	.878	-.027	.032	
Farm size	0	.002	0.14	.887	-.004	.005	
Herd size	.004	.016	0.22	.825	-.028	.035	
Extension contacts	.135	.058	2.34	.019	.022	.248	**
Credit access	-.729	2.721	-0.27	.789	-6.062	4.603	
Abbottabad	.981	.584	1.68	.093	-.163	2.125	*
Charsadda	.529	.486	1.09	.276	-.423	1.481	
Swat	1.18	.531	2.22	.026	.139	2.221	**
D I Khan	-.011	.578	-0.02	.984	-1.144	1.121	
Peshawar	.568	.428	1.33	.185	-.272	1.408	
Nowshera	1.133	.934	1.21	.225	-.697	2.963	
Info_FSC	5.25	.479	10.97	0	4.312	6.189	***
Constant	-4.369	2.9	-1.51	.132	-10.052	1.315	
Mean dependent var		0.513	SD dependent var			0.500	
Pseudo r-squared		0.912	Number of obs			827	
Chi-square		1045.128	Prob > chi2			0.000	
Akaike crit. (AIC)		132.804	Bayesian crit. (BIC)			208.289	

\*\*\*  $p < .01$ , \*\*  $p < .05$ , \*  $p < .1$

**Table A2: OLS Results for Wheat Yield of Non-Members**

Wheat_Yield_mand_j~b	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
HH Age	-.026	.024	-1.09	.276	-.072	.021	
Family size	-.022	.047	-0.47	.64	-.115	.071	
HH Edu	-.06	.047	-1.28	.2	-.152	.032	
Farming Experience	.005	.027	0.19	.85	-.047	.057	
Farm size	-.001	.008	-0.11	.916	-.016	.015	
Herd size	.06	.078	0.78	.438	-.092	.213	
Extension contacts	.031	.11	0.28	.779	-.185	.246	
Credit access	2.979	3.397	0.88	.381	-3.701	9.659	
Abbottabad	-2.269	.815	-2.79	.006	-3.87	-.667	***
Charsadda	1.895	.923	2.05	.041	.081	3.71	**
Swat	-1.437	.826	-1.74	.083	-3.061	.188	*
D I Khan	.748	1.192	0.63	.531	-1.595	3.09	
Peshawar	3.341	.885	3.77	0	1.6	5.081	***
Nowshera	4.386	1.454	3.02	.003	1.527	7.246	***
Info_FSC	1.691	1.484	1.14	.255	-1.227	4.608	
Constant	4.308	3.737	1.15	.25	-3.04	11.656	
Mean dependent var		6.243	SD dependent var			5.185	
R-squared		0.197	Number of obs			400	
F-test		6.297	Prob > F			0.000	
Akaike crit. (AIC)		2394.780	Bayesian crit. (BIC)			2458.643	

\*\*\*  $p < .01$ , \*\*  $p < .05$ , \*  $p < .1$

**Table A3: OLS Results for Maize Yield ff Non-Members**

maize_yield_jerib	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
HH Age	-.012	.029	-0.41	.682	-.068	.045	
Family size	.056	.057	0.97	.335	-.057	.168	
HH Edu	-.042	.057	-0.73	.464	-.153	.07	
Farming Experience	.002	.032	0.07	.943	-.061	.065	
Farm size	.003	.01	0.32	.752	-.016	.022	
Herd size	-.006	.087	-0.07	.943	-.177	.164	
Extension contacts	.249	.133	1.87	.062	-.013	.511	*
Credit access	.939	4.143	0.23	.821	-7.207	9.085	
Abbottabad	3.417	.993	3.44	.001	1.464	5.37	***
Charsadda	7.191	1.125	6.39	0	4.979	9.402	***
Swat	1.329	1.007	1.32	.188	-.651	3.31	
D I Khan	3.058	1.452	2.11	.036	.203	5.913	**
Peshawar	6.028	1.078	5.59	0	3.909	8.147	***
Nowshera	3.901	1.639	2.38	.018	.678	7.124	**
Info_FSC	-.589	1.809	-0.33	.745	-4.144	2.967	
Constant	-1.244	4.557	-0.27	.785	-10.202	7.715	
Mean dependent var		4.461	SD dependent var			6.226	
R-squared		0.172	Number of obs			403	
F-test		5.346	Prob > F			0.000	
Akaike crit. (AIC)		2572.670	Bayesian crit. (BIC)			2636.653	

\*\*\*  $p < .01$ , \*\*  $p < .05$ , \*  $p < .1$

**Table A4: OLS Results for Tobacco Yield ff Non-Members**

Tobacco_yield_jerib	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
HH Age	.002	.008	0.22	.826	-.013	.017	
Family size	.035	.015	2.28	.023	.005	.065	**
HH Edu	.004	.015	0.27	.784	-.025	.034	
Farming Experience	-.011	.009	-1.30	.194	-.028	.006	
Farm size	-.003	.003	-1.10	.274	-.008	.002	
Herd size	.028	.023	1.24	.216	-.017	.074	
Extension contacts	-.014	.035	-0.38	.701	-.083	.056	
Credit access	.036	1.097	0.03	.974	-2.121	2.194	
Abbottabad	.074	.263	0.28	.779	-.443	.591	
Charsadda	1.476	.298	4.95	0	.89	2.062	***
Swat	.083	.267	0.31	.757	-.442	.607	
D I Khan	-.006	.385	-0.02	.988	-.762	.75	
Peshawar	-.077	.285	-0.27	.789	-.638	.485	
Nowshera	-.015	.434	-0.03	.973	-.868	.839	
Info_FSC	-.153	.479	-0.32	.749	-1.095	.788	
Constant	-.248	1.207	-0.21	.837	-2.621	2.124	
Mean dependent var		0.187	SD dependent var			1.594	
R-squared		0.114	Number of obs			403	
F-test		3.307	Prob > F			0.000	
Akaike crit. (AIC)		1501.836	Bayesian crit. (BIC)			1565.819	

\*\*\*  $p < .01$ , \*\*  $p < .05$ , \*  $p < .1$

**Table A5: OLS Results for Sugarcane Yield ff Non-Members**

Sugarcane_prod_pj	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
HH Age	-1.46	.505	-2.89	.004	-2.453	-.467	***
Family size	.811	1.013	0.80	.424	-1.181	2.803	
HH Edu	-1.339	1.001	-1.34	.182	-3.307	.628	
Farming Experience	1.224	.566	2.16	.031	.111	2.338	**
Farm size	.228	.17	1.34	.181	-.107	.562	
Herd size	.308	1.528	0.20	.84	-2.696	3.312	
Extension contacts	-.266	2.349	-0.11	.91	-4.885	4.353	
Credit access	-22.816	73.07	-0.31	.755	-166.48	120.848	
Abbottabad	-8.421	17.516	-0.48	.631	-42.86	26.018	
Charsadda	100.721	19.838	5.08	0	61.717	139.724	***
Swat	-19.001	17.765	-1.07	.285	-53.928	15.927	

D I Khan	197.38	25.608	7.71	0	147.032	247.729	***
Peshawar	70.878	19.006	3.73	0	33.511	108.245	***
Nowshera	40.837	28.908	1.41	.159	-16	97.674	
Info_FSC	3.909	31.895	0.12	.903	-58.8	66.617	
Constant	75.182	80.361	0.94	.35	-82.817	233.181	
Mean dependent var	47.143	SD dependent var		119.249			
R-squared	0.298	Number of obs		403			
F-test	10.942	Prob > F		0.000			
Akaike crit. (AIC)	4885.842	Bayesian crit. (BIC)		4949.825			

\*\*\*  $p < .01$ , \*\*  $p < .05$ , \*  $p < .1$

**Table A6: OLS Results for Rice Yield of Non-Members**

Rice_yield_jerib	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
HH Age	-.008	.023	-0.37	.71	-.053	.036	
Family size	.058	.046	1.28	.2	-.031	.148	
HH Edu	-.059	.045	-1.31	.19	-.148	.029	
Farming Experience	.03	.025	1.19	.236	-.02	.08	
Farm size	.008	.008	1.11	.27	-.007	.024	
Herd size	.037	.069	0.54	.587	-.098	.173	
Extension contacts	-.344	.106	-3.25	.001	-.552	-.136	***
Credit access	-1.037	3.289	-0.32	.753	-7.504	5.429	
Abbottabad	.025	.788	0.03	.975	-1.525	1.575	
Charsadda	-.145	.893	-0.16	.871	-1.901	1.61	
Swat	4.231	.8	5.29	0	2.659	5.804	***
D I Khan	.219	1.153	0.19	.85	-2.048	2.485	
Peshawar	-1.307	.855	-1.53	.127	-2.989	.375	
Nowshera	-.237	1.301	-0.18	.855	-2.796	2.321	
Info_FSC	-.529	1.436	-0.37	.713	-3.351	2.294	
Constant	2.805	3.617	0.78	.439	-4.307	9.917	
Mean dependent var	1.060	SD dependent var		4.996			
R-squared	0.189	Number of obs		403			
F-test	6.032	Prob > F		0.000			
Akaike crit. (AIC)	2386.572	Bayesian crit. (BIC)		2450.555			

\*\*\*  $p < .01$ , \*\*  $p < .05$ , \*  $p < .1$

**Table A-7. Region wise Satisfaction With the Membership Criteria for FSCs**

			Region of FSC			Total	Asymp. Sig. (2-sided) χ² value
			Northern Region	Central Region	Southern Region		
Are you satisfied from the eligibility criteria?	Very unsatisfied	Count	10	5	0	15	0.00
		% within Region of FSC	5.7%	3.6%	0.0%	3.8%	
	Unsatisfied	Count	1	3	1	5	
		% within Region of FSC	.6%	2.2%	1.3%	1.3%	
	Neutral	Count	27	21	36	84	
		% within Region of FSC	15.3%	15.1%	45.0%	21.3%	
	Satisfied	Count	99	42	41	182	
		% within Region of FSC	56.3%	30.2%	51.3%	46.1%	
	very satisfied	Count	39	68	2	109	
		% within Region of FSC	22.2%	48.9%	2.5%	27.6%	
Total		Count	176	139	80	395	
		% within Region of FSC	100.0%	100.0%	100.0%	100.0%	
Should be a farmer.	Very unsatisfied	Count	11	8	0	19	
		% within Region of FSC	6.3%	5.8%	0.0%	4.8%	
	Unsatisfied	Count	0	3	2	5	
		% within Region of FSC	0.0%	2.2%	2.5%	1.3%	
	Neutral	Count	11	6	22	39	
		% within Region of FSC	6.3%	4.3%	27.5%	9.9%	
	Satisfied	Count	73	59	47	179	
		% within Region of FSC	41.5%	42.4%	58.8%	45.3%	
	very satisfied	Count	81	63	9	153	
		% within Region of FSC	46.0%	45.3%	11.3%	38.7%	
Total		Count	176	139	80	395	
		% within Region of FSC	100.0%	100.0%	100.0%	100.0%	
Should not be less than 18 years.	Very unsatisfied	Count	11	21	0	32	
		% within Region of FSC	6.3%	15.1%	0.0%	8.1%	
	Unsatisfied	Count	1	2	2	5	
		% within Region of FSC	.6%	1.4%	2.5%	1.3%	
	Neutral	Count	7	7	13	27	
		% within Region of FSC	4.0%	5.0%	16.3%	6.8%	
	Satisfied	Count	103	46	46	195	
		% within Region of FSC	58.5%	33.1%	57.5%	49.4%	
	very satisfied	Count	54	63	19	136	
		% within Region of FSC	30.7%	45.3%	23.8%	34.4%	
Total		Count	176	139	80	395	
		% within Region of FSC	100.0%	100.0%	100.0%	100.0%	
Should not be a defaulter of ZTBL.	Very unsatisfied	Count	18	25	0	43	
		% within Region of FSC	10.3%	18.0%	0.0%	10.9%	
	Unsatisfied	Count	2	4	2	8	
		% within Region of FSC	1.1%	2.9%	2.5%	2.0%	
	Neutral	Count	4	11	9	24	
		% within Region of FSC	2.3%	7.9%	11.3%	6.1%	
	Satisfied	Count	93	51	44	188	
		% within Region of FSC	53.1%	36.7%	55.0%	47.7%	
	very satisfied	Count	58	48	25	131	
		% within Region of FSC	33.1%	34.5%	31.3%	33.2%	
Total		Count	175	139	80	394	
		% within Region of FSC	100.0%	100.0%	100.0%	100.0%	
Should not be convicted by court.	Very unsatisfied	Count	19	29	0	48	
		% within Region of FSC	10.8%	20.9%	0.0%	12.2%	
	Unsatisfied	Count	1	1	2	4	
		% within Region of FSC	.6%	.7%	2.6%	1.0%	
	Neutral	Count	5	16	2	23	
		% within Region of FSC	2.8%	11.5%	2.6%	5.9%	
	Satisfied	Count	39	39	29	107	
		% within Region of FSC	22.2%	28.1%	37.2%	27.2%	
	very satisfied	Count	112	54	45	211	
		% within Region of FSC	63.6%	38.8%	57.7%	53.7%	
Total		Count	176	139	78	393	
		% within Region of FSC	100.0%	100.0%	100.0%	100.0%	
For management committee, should have at least SSC education	very unsatisfied	Count	53	34	0	87	
		% within Region of FSC	30.3%	23.8%	0.0%	23.2%	
	Unsatisfied	Count	35	37	0	72	
		% within Region of FSC	20.0%	25.9%	0.0%	19.2%	
	Neutral	Count	5	10	7	22	
		% within Region of FSC	2.9%	7.0%	12.3%	5.9%	
	Satisfied	Count	24	24	23	71	
		% within Region of FSC	13.7%	16.8%	40.4%	18.9%	
	very satisfied	Count	58	38	27	123	
		% within Region of FSC	33.1%	26.6%	47.4%	32.8%	
Total		Count	175	143	57	375	
		% within Region of FSC	100.0%	100.0%	100.0%	100.0%	

**Table A-8: District wise satisfaction with the Membership of FSCs and Management Committee**

	How much you are satisfied with Membership?								Chi-Square Test
	Abbottabad	Charsadda	D I Khan	Karak	Nowshera	Peshawar	Swat	Total	
Very unsatisfied	0	2	0	1	0	3	10	16	107.654 (0.000)
Unsatisfied	0.0%	4.3%	0.0%	1.6%	0.0%	3.9%	9.5%	4.1%	
Neutral	0	3	1	2	0	1	3	10	
	0.0%	6.5%	5.6%	3.2%	0.0%	1.3%	2.9%	2.5%	
Satisfied	42	11	5	39	6	10	27	140	
	59.2%	23.9%	27.8%	62.9%	37.5%	13.0%	25.7%	35.4%	
Very satisfied	25	19	11	18	2	34	32	141	
	35.2%	41.3%	61.1%	29.0%	12.5%	44.2%	30.5%	35.7%	
Total	4	11	1	2	8	29	33	88	
	5.6%	23.9%	5.6%	3.2%	50.0%	37.7%	31.4%	22.3%	
<b>Management Committee</b>									Chi-Square Test
	Abbottabad	Charsadda	D I Khan	Karak	Nowshera	Peshawar	Swat	Total	
Very unsatisfied	2	11	0	0	2	13	17	45	95.216 (0.000)
Unsatisfied	2.8%	23.9%	0.0%	0.0%	12.5%	16.9%	16.2%	11.4%	
Neutral	0	7	0	2	1	0	2	12	
	0.0%	15.2%	0.0%	3.3%	6.3%	0.0%	1.9%	3.0%	
Satisfied	1	3	0	5	3	8	4	24	
	1.4%	6.5%	0.0%	8.2%	18.8%	10.4%	3.8%	6.1%	
Very satisfied	17	0	8	28	5	19	28	105	
	23.9%	0.0%	44.4%	45.9%	31.3%	24.7%	26.7%	26.6%	
Total	51	25	10	26	5	37	54	208	
	71.8%	54.3%	55.6%	42.6%	31.3%	48.1%	51.4%	52.8%	
									Chi-Square Test
	Abbottabad	Charsadda	D I Khan	Karak	Nowshera	Peshawar	Swat	Total	
Very unsatisfied	2	11	0	0	2	13	17	45	95.216 (0.000)
Unsatisfied	2.8%	23.9%	0.0%	0.0%	12.5%	16.9%	16.2%	11.4%	
Neutral	0	7	0	2	1	0	2	12	
	0.0%	15.2%	0.0%	3.3%	6.3%	0.0%	1.9%	3.0%	
Satisfied	1	3	0	5	3	8	4	24	
	1.4%	6.5%	0.0%	8.2%	18.8%	10.4%	3.8%	6.1%	
Very satisfied	17	0	8	28	5	19	28	105	
	23.9%	0.0%	44.4%	45.9%	31.3%	24.7%	26.7%	26.6%	
Total	51	25	10	26	5	37	54	208	
	71.8%	54.3%	55.6%	42.6%	31.3%	48.1%	51.4%	52.8%	
									Chi-Square Test
	Abbottabad	Charsadda	D I Khan	Karak	Nowshera	Peshawar	Swat	Total	
Very unsatisfied	2	11	0	0	2	13	17	45	95.216 (0.000)
Unsatisfied	2.8%	23.9%	0.0%	0.0%	12.5%	16.9%	16.2%	11.4%	
Neutral	0	7	0	2	1	0	2	12	
	0.0%	15.2%	0.0%	3.3%	6.3%	0.0%	1.9%	3.0%	
Satisfied	1	3	0	5	3	8	4	24	
	1.4%	6.5%	0.0%	8.2%	18.8%	10.4%	3.8%	6.1%	
Very satisfied	17	0	8	28	5	19	28	105	
	23.9%	0.0%	44.4%	45.9%	31.3%	24.7%	26.7%	26.6%	
Total	51	25	10	26	5	37	54	208	
	71.8%	54.3%	55.6%	42.6%	31.3%	48.1%	51.4%	52.8%	
									Chi-Square Test
	Abbottabad	Charsadda	D I Khan	Karak	Nowshera	Peshawar	Swat	Total	
Very unsatisfied	2	11	0	0	2	13	17	45	95.216 (0.000)
Unsatisfied	2.8%	23.9%	0.0%	0.0%	12.5%	16.9%	16.2%	11.4%	
Neutral	0	7	0	2	1	0	2	12	
	0.0%	15.2%	0.0%	3.3%	6.3%	0.0%	1.9%	3.0%	
Satisfied	1	3	0	5	3	8	4	24	
	1.4%	6.5%	0.0%	8.2%	18.8%	10.4%	3.8%	6.1%	
Very satisfied	17	0	8	28	5	19	28	105	
	23.9%	0.0%	44.4%	45.9%	31.3%	24.7%	26.7%	26.6%	
Total	51	25	10	26	5	37	54	208	
	71.8%	54.3%	55.6%	42.6%	31.3%	48.1%	51.4%	52.8%	

**Table A-9. District wise Satisfaction with Membership Criteria for FSCs**

	Are you satisfied from the eligibility criteria?								Chi-Square Test
	Abbottabad	Charsadda	D I Khan	Karak	Nowshera	Peshawar	Swat	Total	
Very unsatisfied	0	2	0	0	0	3	10	15	178.738 (0.000)
Unsatisfied	0.0%	4.3%	0.0%	0.0%	0.0%	3.9%	9.5%	3.8%	
Neutral	0	3	0	1	0	0	1	5	
	0.0%	6.5%	0.0%	1.6%	0.0%	0.0%	1.0%	1.3%	
Satisfied	0	8	2	34	3	10	27	84	
	0.0%	17.4%	11.1%	54.8%	18.8%	13.0%	25.7%	21.3%	
Very satisfied	63	10	16	25	3	29	36	182	
	88.7%	21.7%	88.9%	40.3%	18.8%	37.7%	34.3%	46.1%	
Total	8	23	0	2	10	35	31	109	
	11.3%	50.0%	0.0%	3.2%	62.5%	45.5%	29.5%	27.6%	
									Chi-Square Test
	Abbottabad	Charsadda	D I Khan	Karak	Nowshera	Peshawar	Swat	Total	
Very unsatisfied	0	5	0	0	0	3	11	19	115.567 (0.000)
Unsatisfied	0.0%	10.9%	0.0%	0.0%	0.0%	3.9%	10.5%	4.8%	
Neutral	0	1	0	2	0	2	0	5	
	0.0%	2.2%	0.0%	3.2%	0.0%	2.6%	0.0%	1.3%	
Satisfied	1	1	1	21	2	3	10	39	
	1.4%	2.2%	5.6%	33.9%	12.5%	3.9%	9.5%	9.9%	
Very satisfied	24	24	15	32	5	30	49	179	
	33.8%	52.2%	83.3%	51.6%	31.3%	39.0%	46.7%	45.3%	
Total	46	15	2	7	9	39	35	153	
	64.8%	32.6%	11.1%	11.3%	56.3%	50.6%	33.3%	38.7%	
									Chi-Square Test
	Abbottabad	Charsadda	D I Khan	Karak	Nowshera	Peshawar	Swat	Total	
Very unsatisfied	0	7	0	0	4	10	11	32	106.072 (0.000)
Unsatisfied	0.0%	15.2%	0.0%	0.0%	25.0%	13.0%	10.5%	8.1%	
Neutral	0	1	0	2	0	1	1	5	
	0.0%	2.2%	0.0%	3.2%	0.0%	1.3%	1.0%	1.3%	
Satisfied	0	0	0	13	2	5	7	27	
	0.0%	0.0%	0.0%	21.0%	12.5%	6.5%	6.7%	6.8%	
Very satisfied	61	16	12	34	6	24	42	195	
	85.9%	34.8%	66.7%	54.8%	37.5%	31.2%	40.0%	49.4%	
Total	10	22	6	13	4	37	44	136	
	14.1%	47.8%	33.3%	21.0%	25.0%	48.1%	41.9%	34.4%	
									Chi-Square Test
	Abbottabad	Charsadda	D I Khan	Karak	Nowshera	Peshawar	Swat	Total	
Very unsatisfied	2	11	0	0	2	12	16	43	109.668 (0.000)
Unsatisfied	2.8%	23.9%	0.0%	0.0%	12.5%	15.6%	15.4%	10.9%	
Neutral	0	0	0	2	1	3	2	8	
	0.0%	0.0%	0.0%	3.2%	6.3%	3.9%	1.9%	2.0%	
Satisfied	0	0	0	9	1	10	4	24	
	0.0%	0.0%	0.0%	14.5%	6.3%	13.0%	3.8%	6.1%	
Very satisfied	62	19	9	35	5	27	31	188	
	87.3%	41.3%	50.0%	56.5%	31.3%	35.1%	29.8%	47.7%	
Total	7	16	9	16	7	25	51	131	
	9.9%	34.8%	50.0%	25.8%	43.8%	32.5%	49.0%	33.2%	

Total	71	46	18	62	16	77	104	394	
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	
Should not be convicted by court.									
	Abbottabad	Charsadda	D I Khan	Karak	Nowshera	Peshawar	Swat	Total	Chi-Square Test
Very unsatisfied	2	11	0	0	3	15	17	48	81.228 (0.000)
	2.8%	23.9%	0.0%	0.0%	18.8%	19.5%	16.2%	12.2%	
Unsatisfied	0	0	0	2	1	0	1	4	
	0.0%	0.0%	0.0%	3.3%	6.3%	0.0%	1.0%	1.0%	
Neutral	0	8	0	2	1	7	5	23	
	0.0%	17.4%	0.0%	3.3%	6.3%	9.1%	4.8%	5.9%	
Satisfied	25	17	6	23	2	20	14	107	
	35.2%	37.0%	33.3%	38.3%	12.5%	26.0%	13.3%	27.2%	
Very satisfied	44	10	12	33	9	35	68	211	
	62.0%	21.7%	66.7%	55.0%	56.3%	45.5%	64.8%	53.7%	
Total	71	46	18	60	16	77	105	393	
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	
For management committee, should have at least SSC education									
	Abbottabad	Charsadda	D I Khan	Karak	Nowshera	Peshawar	Swat	Total	Chi-Square Test
Very unsatisfied	36	13	0	0	4	17	17	87	324.412 (0.000)
	51.4%	26.0%	0.0%	0.0%	25.0%	22.1%	16.2%	23.2%	
Unsatisfied	34	37	0	0	0	0	1	72	
	48.6%	74.0%	0.0%	0.0%	0.0%	0.0%	1.0%	19.2%	
Neutral	0	0	0	7	3	7	5	22	
	0.0%	0.0%	0.0%	17.9%	18.8%	9.1%	4.8%	5.9%	
Satisfied	0	0	7	16	2	22	24	71	
	0.0%	0.0%	38.9%	41.0%	12.5%	28.6%	22.9%	18.9%	
Very satisfied	0	0	11	16	7	31	58	123	
	0.0%	0.0%	61.1%	41.0%	43.8%	40.3%	55.2%	32.8%	
Total	70	50	18	39	16	77	105	375	
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	

**Table A-10. Difference in Characteristics of FSCs Members and Non-members**

Variables	Member	Non-Member	difference	Std. Err.
Wheat yield	7.246	6.242	1.004**	0.391
Maize yield	5.114	4.462	0.652	0.450
Tobacco yield	0.458	0.187	0.271	0.214
Rice yield	0.769	1.060	-0.291	0.307
Sugarcane yield	43.392	47.143	-3.751	7.774
HH Age	11.644	11.263	0.381	0.389
Family size	50.913	46.732	4.181***	0.985
HH Edu	7.455	6.042	1.413***	0.385
Farming Experience	26.846	21.367	5.479***	0.880
Farm size	21.853	13.884	7.969**	3.424
Herd size	3.444	2.020	1.424***	0.501
Extension contacts	6.550	6.152	0.398**	0.166
Credit access	0.991	0.995	-0.004	0.006
Abbottabad	0.168	0.186	-0.018	0.026
Charsadda	0.125	0.132	-0.007	0.024
Swat	0.257	0.221	0.036	0.030
D I Khan	0.043	0.055	-0.012	0.015
Peshawar	0.198	0.191	0.007	0.028
Nowshera	0.037	0.040	-0.003	0.014

\*\*\*  $p < .01$ , \*\*  $p < .05$ , \*  $p < .1$ .

**Table A-11. Determinants of FSCs Membership and its Impact on Wheat Yield**

Variables	Selection	Wheat Yield			
		Member		Non-Member	
Constant	-4.363	3.036	6.303*	3.267	4.323
HH Age	0.004	0.014	-0.037	0.028	-0.026
Family size	-0.002	0.025	0.014	0.046	-0.022
HH Edu	0.026	0.025	-0.003	0.050	-0.060
Farming Experience	0.004	0.015	0.013	0.029	0.005
Farm size	0.000	0.003	-0.003	0.005	-0.001
Herd size	0.003	0.016	0.016	0.032	0.060
Extension contacts	0.131**	0.058	0.089	0.115	0.026
Credit access	1.048*	0.607	3.317	2.721	2.991
Abbottabad	0.504	0.487	-4.932***	0.925	-2.273**
Charsadda	1.247**	0.540	-1.029	1.031	1.890**
Swat	0.140	0.605	-3.688***	0.877	-1.450*
D I Khan	0.577	0.429	-0.817	1.493	0.759
Peshawar	1.218	1.020	2.065**	0.930	3.346***
Nowshera	-0.761	2.867	2.236	1.534	4.377***
Info_FSC	5.302***	0.496			
$b\sigma_\mu$			1.681***	0.035	1.535***
$r_\mu$			-0.291	0.191	-0.173
$\sigma_\mu$			5.368***	0.187	4.642***
$\rho_\mu$			-0.283*	0.176	-0.171
LR test of indep. Eqs.	3.24*				
Wald $\chi^2$	103.44***				
Log likelihood	-2541.71				
Number of obs.	827		424		403

\*\*\* Significant at 1% level, \*\* significant at 5% level and \* significant at 10% level.

**Table A-12. Determinants of FSCs Membership and its impact on Maize Yield**

Variables	Selection	Maize Yield				
		Member		Non-Member		
Constant	-4.562	3.263	2.055	3.804	-1.233	4.466
HH Age	0.006	0.014	-0.019	0.032	-0.012	0.028
Family size	-0.004	0.025	-0.014	0.054	0.055	0.056
HH Edu	0.024	0.025	-0.033	0.059	-0.043	0.056
Farming Experience	0.003	0.015	0.003	0.034	0.002	0.031
Farm size	0.000	0.002	-0.007	0.006	0.003	0.009
Herd size	0.004	0.018	0.049	0.037	-0.009	0.085
Extension contacts	0.145**	0.059	0.134	0.134	0.253*	0.130
Credit access	1.042*	0.605	-0.406	3.169	0.905	4.061
Abbottabad	0.634	0.522	3.600***	1.077	3.455***	0.973
Charsadda	1.272**	0.547	6.476***	1.199	7.215***	1.102
Swat	-0.013	0.576	3.843***	1.020	1.364	0.986
D I Khan	0.638	0.444	3.189*	1.738	3.064**	1.423
Peshawar	1.171	0.972	6.762***	1.083	6.027***	1.056
Nowshera	-0.687	3.087	3.228*	1.785	3.939**	1.606
Info_FSC	5.302***	0.484				
$\ln\sigma_\mu$			1.833***	0.035	1.733***	0.035
$\tau_\mu$			-0.328	0.217	-0.011	0.156
$\sigma_\mu$			6.252***	0.218	5.660***	0.199
$\rho_\mu$			-0.317*	0.195	-0.011	0.156
LR test of indep. Eqs.	1.66					
Wald $\chi^2$	62.30***					
Log likelihood	-2697.14					
Number of obs.	827		424		403	

\*\*\* Significant at 1% level, \*\* significant at 5% level and \* significant at 10% level.

**Table A-13. Determinants of FSCs Membership and its Impact on Tobacco Yield**

Variables	Selection	Member	Tobacco Yield			
			Non-Member			
Constant	-4.511***	1.617	-0.831	2.287	-0.254	1.183
HH Age	0.020	0.013	-0.017	0.019	0.002	0.007
Family size	-0.007	0.018	-0.009	0.032	0.035**	0.015
HH Edu	0.040**	0.020	0.028	0.035	0.004	0.015
Farming Experience	-0.010	0.014	0.043**	0.021	-0.011	0.008
Farm size	-0.000	0.001	-0.001	0.004	-0.003	0.002
Herd size	0.000	0.011	0.010	0.022	0.028	0.022
Extension contacts	0.115***	0.043	0.043	0.079	-0.013	0.035
Credit access	0.276	0.414	-0.060	1.911	0.033	1.075
Abbottabad	0.995***	0.330	0.100	0.643	0.078	0.257
Charsadda	0.696***	0.378	3.435***	0.714	1.482***	0.292
Swat	0.055	0.471	0.045	0.608	0.088	0.260
D I Khan	0.947**	0.391	0.120	1.037	-0.005	0.377
Peshawar	0.609	0.598	-0.353	0.651	-0.073	0.280
Nowshera	-0.177	1.401	0.027	1.065	-0.010	0.425
Info_FSC	3.771***	0.370				
$\ln\sigma_\mu$			1.338***	0.034	0.405***	0.035
$\tau_\mu$			1.672***	0.324	0.042	0.121
$\sigma_\mu$			3.812***	0.131	1.499***	0.053
$\rho_\mu$			0.932***	0.043	0.042	0.121
LR test of indep. Eqs.	23.27***					
Wald $\chi^2$	49.40***					
Log likelihood	-1940.82					
Number of obs.	827		424		403	

\*\*\* Significant at 1% level, \*\* significant at 5% level and \* significant at 10% level.

**Table A-14. Determinants of FSCs Membership and its Impact on Sugarcane Yield**

Variables	Selection	Member	Sugarcane Yield			
			Non-Member			
Constant	-4.313	2.913	42.422	53.051	75.271	78.752
HH Age	0.005	0.014	-0.560	0.450	-1.460***	0.495
Family size	-0.004	0.024	-0.461	0.755	0.811	0.993
HH Edu	0.025	0.025	-0.232	0.820	-1.344	0.982
Farming Experience	0.003	0.015	0.409	0.476	1.223**	0.555
Farm size	0.000	0.002	-0.229***	0.082	0.227	0.167
Herd size	0.004	0.016	0.515	0.516	0.301	1.498
Extension contacts	0.134**	0.058	-1.429	1.872	-0.271	2.299
Credit access	0.978*	0.585	0.586	44.166	-22.855	71.602
Abbottabad	0.520	0.486	-5.960	15.024	-8.362	17.159
Charsadda	1.170**	0.532	112.322***	16.734	100.744***	19.433

Swat	0.014	0.593	-8.294	14.237	-18.978	17.387
D I Khan	0.562	0.429	176.511***	24.254	197.406***	25.096
Peshawar	1.117	0.944	75.935***	15.116	70.858***	18.625
Nowshera	-0.740	2.730	118.540***	24.899	40.881	28.319
Info_FSC	5.249***	0.479				
$\ln\sigma_\mu$			4.467***	0.034	4.603***	0.035
$r_\mu$			-0.054	0.189	-0.027	0.160
$\sigma_\mu$			87.119***	2.993	99.803***	3.515
$\rho_\mu$			-0.054	0.188	-0.027	0.160
LR test of indep. Eqs.	0.11					
Wald $\chi^2$	180.12***					
Log likelihood	-4972.98					
Number of obs.	827		424		403	

\*\*\* Significant at 1% level, \*\* significant at 5% level and \* significant at 10% level.

**Table A-15. Determinants of FSCs Membership and its Impact on Rice Yield**

Variables	Selection	Rice Yield				
		Member		Non-Member		
Constant	-4.423	2.897	-1.184	2.174	2.798	3.545
HH Age	0.007	0.014	-0.034*	0.018	-0.008	0.022
Family size	-0.005	0.025	0.045	0.031	0.058	0.045
HH Edu	0.026	0.025	0.032	0.034	-0.059	0.044
Farming Experience	0.002	0.015	0.014	0.020	0.030	0.025
Farm size	0.000	0.002	0.006*	0.003	0.008	0.007
Herd size	0.004	0.016	0.014	0.021	0.037	0.067
Extension contacts	0.136**	0.058	0.041	0.077	0.343***	0.103
Credit access	0.990*	0.591	1.529	1.809	-1.042	3.223
Abbottabad	0.536	0.486	-0.088	0.617	0.029	0.772
Charsadda	1.233**	0.569	-0.174	0.686	-0.142	0.875
Swat	-0.001***	0.584	2.236***	0.584	4.238***	0.782
D I Khan	0.588	0.433	1.523	0.993	0.218	1.130
Peshawar	1.143	0.938	0.210	0.619	-1.305	0.838
Nowshera	-0.731	2.705	-0.059	1.020	-0.232	1.274
Info_FSC	5.261***	0.483				
$\ln\sigma_\mu$			1.272***	0.034	1.502***	0.035
$r_\mu$			-0.139	0.224	0.054	0.147
$\sigma_\mu$			3.569***	0.123	4.493***	0.158
$\rho_\mu$			-0.138	0.219	0.054	0.147
LR test of indep. Eqs.	0.26					
Wald $\chi^2$	47.60***					
Log likelihood	-2368.43					
Number of obs.	827		424		403	

\*\*\* Significant at 1% level, \*\* significant at 5% level and \* significant at 10% level.

**Table A-16. Average Treatment Effects on the Treated (ATT) by Different Crop Yields**

	Obs.	Member	Non-Member	ATT	St Err	%age change
Wheat	424	7.246	6.064	1.183***	0.053	19.51
Maize	424	5.113	4.418	0.696***	0.071	15.75
Tobacco	424	0.957	0.174	0.783***	0.045	81.82
Sugarcane	424	43.393	44.891	-1.498	1.719	03.34
Rice	424	0.769	1.291	-0.521***	0.084	40.36

Note: Mean values are given in mounds of 50 kg. Gain/loss by FSC membership for the whole KP province is given in metric tons. \*\*\* Significant at 1% level, \*\* significant at 5% level and \* significant at 10% level.

**Table A-17. Factors Affecting FSC Membership Decision and Marginal Effects**

Variables	Coef.	St. Err.	dy/dx	Std. Err.
HH Age	0.006	0.005	0.002	0.002
Family size	0.001	0.009	0.001	0.003
HH Edu	0.043***	0.009	0.017***	0.003
Farming Experience	0.022***	0.005	0.009***	0.002



Farm size	0.002	0.001	0.001	0.001
Herd size	0.033***	0.012	0.013***	0.005
Extension contacts	0.063***	0.020	0.025***	0.008
Credit access	-0.283	0.552	-0.113	0.220
Abbottabad	-0.057	0.156	-0.023	0.062
Charsadda	0.052	0.175	0.021	0.070
Swat	0.265*	0.153	0.106*	0.061
D I Khan	-0.084	0.245	-0.033	0.098
Peshawar	0.210	0.164	0.084	0.065
Nowshera	0.114	0.256	0.045	0.102
Constant	-1.394**	0.632		

\*\*\*  $p < .01$ , \*\*  $p < .05$ , \*  $p < .1$ .

**Table A-18. Average Treatment Effects on The Treated (ATT) by Different Crop Yields (In Maunds)**

Crop Yield	Nearest Neighborhood Matching		Kernel Matching		Stratified Matching	
	Treated 424	Control 205	Treated 424	Control 391	Treated 424	Control 391
	ATT	Std. Err.	ATT	Std. Err.	ATT	Std. Err.
Wheat	1.229***	0.403	1.173***	0.464	1.180***	0.220
Maize	0.916*	0.542	0.681	16.579	0.590***	0.253
Tobacco	0.309**	0.178	0.297	0.293	0.304	0.319
Sugarcane	14.996*	9.185	2.186	9.680	3.914	2.571
Rice	-0.689	0.498	-0.363	0.310	-0.427	0.420

**Table A-19. District Wise Average Treatment Effects on the Treated (ATT)**

Crops	Districts	Members	Non-members	ATT	St Err
Wheat	Abbottabad	3.842	3.341	0.501***	0.042
	Charsadda	7.878	7.724	0.153***	0.055
	D I Khan	7.692	6.780	0.912***	0.214
	Karak	8.406	5.511	2.895***	0.079
	Nowshera	11.114	10.303	0.811***	0.082
	Peshawar	10.751	9.220	1.530***	0.109
	Swat	5.037	4.225	0.812***	0.043
Maize	Abbottabad	4.806	4.461	0.345***	0.048
	Charsadda	7.720	8.380	0.660***	0.072
	D I Khan	3.856	4.434	-0.578	0.420
	Karak	0.919	1.117	-0.197*	0.112
	Nowshera	4.540	5.095	-0.555***	0.168
	Peshawar	7.817	7.211	0.606***	0.107
	Swat	5.062	2.418	2.644***	0.050
Tobacco	Charsadda	3.695	1.412	2.283***	0.095
Sugarcane	Charsadda	120.782	119.419	1.363	2.533
	D I Khan	160.381	229.684	-69.302***	23.535
	Nowshera	128.408	60.012	68.396***	4.700
	Peshawar	84.001	94.540	-10.539***	3.175
Rice	D I Khan	2.294	1.278	1.016***	0.232
	Swat	2.272	4.641	-2.369***	0.143

\*\*\* Significant at 1% level, \*\* significant at 5% level and \* significant at 10% level

**Table A-20. Region wise Average Treatment Effects on the Treated (ATT)**

Crops	Regions	Members	Non-members	ATT	St Err
Wheat	Northern	4.566	3.876	0.689***	0.033
	Central	9.793	8.816	0.978***	0.082
	Southern	8.265	5.762	2.503***	0.113
Maize	Northern	4.961	3.224	1.737***	0.091
	Central	7.441	7.394	0.046	0.083
	Southern	1.500	1.773	-0.273**	0.122
Tobacco	Central	1.469	0.472	0.997***	0.101
Sugarcane	Central	101.386	99.547	1.839	2.759
	Southern	31.722	48.675	-16.952***	5.926
Rice	Northern	1.375	2.788	-1.412***	0.129
	Southern	0.453	0.513	-0.061	0.114

\*\*\* Significant at 1% level, \*\* significant at 5% level and \* significant at 10% level

