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Sociological Analysis Of Model Farm Services Centers (Mfscs) As An Influencing Factor In Agriculture Productivity In Pakistan

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Abstract

The current study was conducted to know about the role of Model Farm Services Centers (MFSCs) in agricultural production, the formal institutions devised by the government for the uplifting of agriculture in Pakistan. The study was conducted in two districts (Charsadda and Mardan) of Khyber Pakhtunkhwa, Pakistan. A sample of 384 respondents was selected through a multistage random sampling technique which was proportionally allocated to the 12 Union Councils of the selected districts. Data was collected through interview schedule and analyzed into bivariate and multivariate results with the help of SPSS (20 version).The findings of the study indicated that agricultural productivity increase for those farmers to whom MFSCs provided training to the farmers. Similarly, the production was increased in case of agricultural inputs (seeds, fertilizers, etc. were provided to the farmers, problems related to agriculture solved by the MFSC employees, or frequent meetings were arranged for facilitation with the farmers. However, it was also found

during the study that such opportunities were provided to the rich farmers while poor and small farmers were ignored due to which their agricultural productivity was decreased. It is recommended that if MFSCs are strengthened technically and financially, they can provide training and agricultural inputs to the farmers which can further increase their production.

Keywords: Model Farm Services Center, Farmers, Agriculture, Production, Inputs

Introduction

Farmers do not get the required output from their farms due to the lack of adaptation of modern agricultural technologies (Khatam and Khan, 2013). For this purpose, many extension strategies have been adopted to improve the capacity of the farmers in crop management practices. The Model Farm Services Centers are part of the extension strategies that are introduced to enable poor farmers to access the appropriate technologies, knowledge, and practices to improve their productivity. Such types of approaches like MFSCs are very effective in improving farmers' engagement in policy matters to solve their farming-related problems (Muhammad et al., 2017).

As agriculture is the combination of art and science to grow crops, feed humans and meet their associated needs, therefore, this profession requires a great deal of understanding the cultural practices and the scientific knowledge to grow crops. To update the farming communities with scientific and innovative knowledge and skills and provide them verified and quality inputs under one roof, the government has instituted the Model Farm Services Centers (MFSCs) in all districts of Khyber Pakhtunkhwa. These centers bridge between the farming community and scientists in the provision of knowledge, skills, and technologies to the farmers in order to overcome their technical issues in agricultural production and provide them input on controlled rates under its supervision.

Model Farm Services Centers work under the model of diffusion of agricultural innovation through enhancement of the knowledge and skills of the farmers and persuading them for organization and adoption of favorable technologies and implementation of these innovative technologies in best possible way. The extension agents and the farmers are the major actors in this whole process that is facilitated by governmental and non-governmental organizations. A knowledgeable and motivated extension agent organizes the community for various training programs and distribution of other agricultural inputs and machinery-related benefits. On the other side, a positive gesture from responsive farmers streamlines the flow of knowledge, skills, and practices to them in a befitting manner. Thus, a regular system of interaction is established between the employees of Model Farm Services Centers and farmers that regulate the flow of knowledge and benefits in a multidimensional manner and result in an increase in agricultural production. However, an inappropriate social organization in favor of the powerful elite, low motivated farmers, and low enthusiasm of the extension agents hinder the achievement of goals of high agricultural production.

Literature review

The literature on farmers' access to MFSCs found that the average yield of crops increases after registration and getting training from MFSCs by farmers (Ullah et al., 2015). Nowadays numerous Model Farm Institutions are involved in different crops value chains like agriculture, malt barely, etc. (BIF, 2018; Kifle, 2016; Tefera et al., 2016). Some of these approaches follow microcredits plus approaches, as suggested by Bastiaensen and Marchetti (2011), their role goes beyond financial support. They deliver inputs in kind, facilitate market linkages and provide agricultural training which influences agricultural productivity positively (Tefera et al., 2016). Similarly, Muhammad et al. (2017) stated that agriculture extension workers are responsible to increase farmers' productivity through their capacity building in agricultural inputs. Various agricultural extension approaches have been adopted in Pakistan for the purpose to improve farmers' agricultural productivity as well as their profitability. However, Haq et al. (2013) observed during their study that Model Farm Services Centers play their role in improving the yield of different crops and vegetables. Such improvement in productivity was recorded due to the supply of quality inputs, machinery, and guidance, and appropriate training regarding vegetable/crop management by MFSCs. Similarly, Agriculture extension has been using a variety of extension education methods for training of farmers and dissemination of agricultural innovations (Bajwa et al., 2010).

Farmers registered with extension organizations have more chances to access inputs like improved seeds, credits, herbicides, fertilizers, pesticides, and extension services which havea significant influence on crop productivity (Msuta and Urassa., 2015). Islam et al. (2018) found the effect of food security status of the farmers status through government or non-governmental organizations in Bangladesh. The findings of the study showed that for those farmers who were supported by any government or non-governmental organization by providing quality inputs and training, their agricultural productivity and food security were higher compared to their counterparts. Despite a huge organizational setup by the government of Pakistan, the extension services do not reach most farmers because of the geographical scatter and low motivation of the extension staff serving them. Resultantly, this influences the growth of the agriculture sector. Various organizations are working for the empowerment of farmers by providing information related to agriculture and inputs. However, the most striking cause which the farmer experiences are the shortage of relevant information needed for taking befitting timely action. For this purpose, various organizations planning to develop cell phone information and trading system (Siraj, 2011). Shah et al. (2017) stated that although the land of Pakistan is fertile for agriculture, still the productivity of most of the crops is far behind those from developed countries. Some of the reasons for low productivity are lack of technical knowledge among farmers and lack of availability of quality inputs and machinery. For this purpose, since the independence of this country, the government has launched numerous agricultural programs for agricultural development, but they did not give the possible results as the extension agencies failed to provide their services to the farmers.

Fahim et al. (2017) found that the agriculture growers who knew about the agricultural extension department and had established linkages, these growers got average cane yield up to

74.21 tons/hectare. While the farmers who have no such connection had an average yield upto 55.75 tone/hectares. It seems that the farmers who frequently visited and benefited from the extension services had higher agriculture productivity and vice versa.

Rehaman et al. (2012) found that the productivity of member farmers of form services centers was higher than the non-members. It is because when agricultural field assistant provides new or recommended information to agriculture growers in the office through office call methods or office meeting etc or agricultural field assistant visit the field of agriculture growers and provide new information through field demonstration, farm home visit, research study,etc then production of agriculture increases because the agriculture growers adopt new or recommended information. Therefore, due to the above reasons, agriculture production increases because of providing new or recommended information by agricultural field assistants (Khan, 2015). Msuta and Urassa (2015) estimated the income of farmers after joining farmer organizations had increased 67.5% as compared to before joining. This result suggests that goods and services received by farmers from FOs contributed positively to farmers' incomes.

Pillegowda et al. (2010) stated that education of farmers, their economic motivation, the role of media, farm scientist contact, participation in training programs, extension agents contacts, and extension participation had a significant relationship with the farmer's knowledge level that can increase crop productivity. Similarly, Ullah et al. (2015) conducted a study to estimate the contribution of MFSC in the productivity of major crops in D.I. Khan Pakistan during the year 2014-15 and found that maximum improvement in yield was recorded in agriculture, wheat, rice, and maize in comparison to other crops. An increase in these crops might be attributed to the seed farms of the Agricultural Extension Department which is mainly focused on seed production of crops. While some of the farmers still had poor productivity even after the registration with MFSC. Thus, they might not obtain the inputs or farm implements which reduces their yield. The repercussions of increased yield might be attributed to the gigantic task being accomplished by MFSC i.e. due to farming skills provided by MFSC, timely suggestions and empowerment in skills of proper crop management, access to quality inputs including best varieties which improved their yield. The aim of extension revolves around the identification of farmers' problems and providing solutions in their best interest (Havrland and Kapila, 2000). Muhammad et al. (2017) stated that the agriculture extension workers must improve the farmer's agricultural productivity through their capacity building in agricultural inputs. For this purpose, various agricultural research extension approaches have been adopted and used in Pakistan to improve agriculture productivity as well as farmers' profitability but most of them are failed as extension workers often do not pay field visits and solve the issues faced by the farmers.

The MFSCs was established with the mandate to provide quality inputs, farm machinery to the farmers to increase their productivity and provide good market opportunities for their products. Further, the government provided matching grants and endowment funds to help them to manage the service needs of member farmers (Muhammad et al., 2018), to increase the access to farmers to quality inputs, experience sharing, and technical advices. These centers were formed to organize small farmers in a platform where full technical support is provided to them.

Furthermore, the representatives of allied sectors of the Agriculture Department were kept under one roof and to provide one window services to the farmers in the real sense where all major inputs like seed, pesticides, machinery, and fertilizers are provided to farmers to increase their productivity (Haq et al., 2013). However, Shah et al. (2017) stated while most of the land is suitable for agriculture, Pakistan still lags in agricultural productivity. He criticized the role of MFSCs in providing technical knowledge to farmers, inputs, and new agricultural machinery due to which their productivity remains low. Studies have found that there are numerous reasons for the decrease in agriculture productivity in Pakistan, like illiteracy, financial constraints, lack of agro-technical practices, fertilizers, reluctance to adopt new methods, lack of information sources, and poor extension services, and lack of advanced machinery (Iqbal, 2006). However, the study of Ullah (2016) analyzed constraints and gaps of the MFSCs in D. I. Khan Pakistan and found that agricultural machinery required for agriculture and other growers were provided by MFSCs. However, the less duration of the machinery utilization, costly rental prices, complicated booking procedure, outdated machinery, and lack of availability of crop-specific machinery on proper time were the main constraints of getting machinery from MFSC which effect negatively crop.

Research Methodology

Study design

The current study was carried out under cross-sectional design which is the most suitable design to measure a problem or issue by taking a cross-section of the population (Babie, 1989).

Universe of the study

Agriculture is the major livelihood source of rural Khyber Pakhtunkhwa province with agriculture as its important cash crop. The central valley of the Khyber Pakhtunkhwa comprises five districts and is the main agriculture growing area. District Charsadda and District Mardan are the top agriculture-producing areas of the province. Therefore, these districts were selected as study universe, where the current study was conducted.

Sampling procedure

For the selection of the respondents, a multistage random sampling procedure was adopted by taking a series of steps as depicted in table1.

Sample size

The total population of the study universe (12 selected UCs), as counted through a pilot survey conducted by the researcher, comes out to be 3720 agriculture growers. Keeping in view the number of variables (table 2) and study population, the formula proposed by Chaudhry (2009) was used for sample size calculation as below.

$$n = \frac{N\hat{p}\hat{q}Z^2}{\hat{p}\hat{q}Z^2+Ne^2-e^2} \quad \text{..... Equation-1}$$

N= total number of farmers in selected UCs = 3720, p = population proportion = 0.5, q = opposite proportion = (1-p) = 0.5, z = confidence level = 1.96, e = margin of error = 0.05, n= 384
The required sample size worked out based on above formula is 384 farmers. The calculated sample size was proportional allocated to each Union Council by using formula proposed by (Bowly, 1926).

$ni = n.Ni/N$ …….. Equaltion-2

while ni= Proportional allocated sample size to each UC, n= Total population size, Ni= Total number of households in each UC, N= Total number of households.

Table 1: Total farmers & sample size distribution in selected UCs of District Charsadda and District Mardan

Name of District	Tehsils	Selected Union Councils (UCs)	Number of agriculture farmers in each Union Council	Sample Size
Charsadda	Charsadda	Ghunda Karkana	250	25
		Prang	320	33
	Tangi	Mandani	385	40
		Ziam	235	24
	Shabqadar	Tarkha	295	30
		Malikabad	150	16
Mardan	Mardan	Mohib Banda	430	45
		Hoti	323	33
	Katlang	Alo	259	27
		Jamal Garhi	472	49
	Takht bhai	Hathian	371	38
		Kati Garhi	230	24
Total	06	12	3720	384

Source: Pakistan Bureau of Statistics census report (2017) and pilot survey conducted in selected UCs.

Criteria for the inclusion of the respondents

1. Farmers growing agriculture in selected UCs
2. Age from 18 years and above

Tools of data collection

During the quantitative research phase, a well-thought-out Interview Schedule/Questionnaire encompassing all the study variables, as given in the conceptual framework, was devised for collecting quantitative data from randomly selected respondents. The items used for study measurement were pre-tested to 25 respondents (Kothari, 2004) to assure the understanding of the

instrument items by the respondents and researcher, consistency and relevance of questions, and to determine the time required to administer the instrument. The data was collected through a trained team of researchers under the supervision of the core investigator (researcher himself).

Table 2.Conceptual framework of the study

Background Variable	Independent Variable	Dependent Variable
Socio-economic status	Access to Model Form Services Centers	Agriculture productivity

Indexation and Reliability analysis

Cronbach's alpha was executed for measuring the reliability of the study scale. The test results show that the value of both variables, e.g., Model Form Services Centers (independent) and agricultural productivity (dependent), was above 0.69. See Table.2, and hence, fulfilled the criteria of indexation. In social sciences, indexation is used for the assessment of the respondent's attitude about the study variables (Nachmias, 1992).

Table 3 Results of Reliability Analysis

Variables	Cronbach's alpha
Access to Model Form Services Centers	.69
Agriculture productivity	.87

Data analysis

The collected data was analyzed into bi-variate and multi-variate analysis through SPSS software (version 20); as given below.

Bi-variate analysis

For testing the association between independent and dependent variables, Bi-variate analyses were carried out. Agricultural productivity, as the dependent variable, was categorized into three levels (above average, average, and below-average) and cross-tabulated with the independent variable (Access to Model Form Services Centers). The Chi-square test was used to determine the association among independent and dependent variables according to the statistical method proposed by Tai (1978).

$$\chi^2 = \sum_{i=1}^{r} \cdot \sum_{j=1}^{c} \cdot \frac{(Oij - eij)^2}{eij}$$

---------- (Equation-3

Multivariate analysis by contingency tables

The multivariate analysis was undertaken to examine whether the variation in agricultural productivity caused by the independent variable is explained by the control variables or not. As the independent variable (access to Model Form Services Centers) was found fit for indexation on Cronbach's Alpha coefficient criteria (above 0.6) and was indexed and cross-tabulated with the dependent variable (agriculture productivity) at the multivariate level while controlling respondents' family socioeconomic status. For measurement of association between variables, Chi-Square/Fisher's exact test was applied, and Kendall tau-c (T^c) test was used to assess whether variation in study variables is affected by the control variables or not.

Kendall $T^c = \frac{2\,(n_c - n_d)}{n^2 \frac{(m-1)}{m}}$……..Equation-4

Results and discussions

Association between access to Model Farm Service Centers and agriculture productivity

Results in table 4 show that for all those respondents who were trained by Model Farm Services Centers in the agricultural field, 53.8% earned above-average net income from the sale of agriculture production compared to 24.1% of those who were not trained by Model Farm Services Centers and 41.4% of those who were uncertain about it. Provision of training to farmers in the agricultural field by Model Farm Services Centers enhanced the agricultural production of the farmers as shown in the significant and positive association (p=0.001; T^c= 0.043). In the same line, for all those respondents who were provided with different inputs (seeds, fertilizers, machinery, etc.) by Model Farm Services Centers, 60% earned above-average net income from agriculture production compared to 24.5% of those who were not facilitated by Model Farm Services Centers through the provision of agricultural inputs and 38.7% of those who were not certain to it. Facilitation by Model Farm Services Centers in terms of provision of agricultural inputs also exhibited a positive increase in agriculture net income as shown in the significant and positive association (p=0.001; T^c= 0.049). The Model Farm Services Centers are meant to disseminate scientific knowledge and innovative technologies and practices to enhance the agricultural production of the farmers. These centers follow a standard procedure for the diffusion of these technologies and practices. The initial thrust of the Model Farm Services Centers is on building rapport with the farming communities and providing them with the information and knowledge related to agricultural innovations. For this purpose, the farmers are registered with the Model Farm Services Centers under its farmers' registration program. These registered farmers are focal points for all interventions proposed by Model Farm Services Centers including training programs and provision of agricultural inputs. This is a stepwise procedure, where the registered farmers are engaged in the classroom and on-farm training along with excursion visits to progressive farmers to update their knowledge to innovative technologies in agriculture. In this way, the enthusiasm level of the farmers is also raised to the level that they are motivated to invest in productive technologies and practices despite its high costs. Moreover, the subsidies approved

by the government to the agricultural department are also streamlined by Model Farm Services Centers, through the provision of agricultural inputs and machinery on subsidized/controlled rates. However, being recently established, the benefits of Model Farm Services Centers are not well known to the farming communities. In addition, due to limited resources, it is difficult for Model Farm Services Centers to train and facilitate the farming community at large. Therefore, those limited number of farmers who are the direct beneficiaries of educational and input-related interventions of Model Farm Services Centers are resilient to overcome their agricultural problems and enhance their agricultural production. For Ullah et al. (2015) the agricultural interventions executed by Model Farm Services Centers are like a planned social change to educate and equip the farming communities and bring a shift from traditional subsistence farming to a commercial high yielding agriculture. However, it is hard to break the status quo, especially when the farmers have strong cultural bonds and low literacy levels(BIF, 2018; Kifle, 2016). Those farmers who accepted the change, learned the knowledge and skills to enhance their production, reduce crop loss, and enhance its value chain. Conversely, the laggards stick to the conventional practices and technologies and produced merely sufficient for their subsistence (Tefera et al, 2016; Bastiaensen and Marchetti, 2011; Muhammad et al., 2017; Haq et al., 2013; Bajwa et al., 2010). Msuta and Urassa (2015) further added that the likelihood of the farmers to access quality inputs like improved seeds, credits, herbicides, fertilizers, pesticides, and extension services has increased for the farmers who are active members of Model Farm Services Centers that result into a substantial increase in their agricultural production (Alemayehu, 2008; Demaine, 2008; Islam et al., 2018). Shah et al., (2017), however, pointed some gaps and connected links between the provision of knowledge and inputs that are necessary to achieve required agricultural outcomes, failing to which the training provided to farmers is insufficient to enhance agricultural production (Khan et al., 2010).

Furthermore, for all those farmers who have developed linkages with Model Farm Services Centers, 53.8% earned above-average net income from agriculture production compared to 24.4% of those who did not develop such linkages and 25% of those who were uncertain in their linkages with Model Farm Services Centers. Linkages development with Model Farm Services Centers exhibited a highly significant and positive association with agriculture production ($p=0.000$; $T^c= 0.130$). In addition, for all those respondents to whom employees of Model Farm Services Centers conducted regular meetings, 45.7% earned above-average net income from agriculture production compared to 22.6% of the who were not contacted by employees of Model Farm Services Centers for any meeting and 40% of those who were uncertain to it. Regular meetings with the Model Farm Service Centers enhanced the net income from agriculture production as can be seen from the significant and positive association ($p=0.001$; $T^c= 0.107$). The Model Farm Services Centers act as a hub for disseminating such knowledge and diffusing those technologies that are efficient in overcoming agricultural problems and enhancing the production system. The interaction with the Model Farm Services Centers may range from very low and superficial awareness of the functioning of the Model Farm Services Centers to a very strong and regular interaction with the employees of the Model Farm Services Centers for regular updates and benefits from the services

provided by these centers. Thus, alongside the normal and formal procedure of Model Farm Services Centers, some of the farmers have managed to develop such strong linkages with those centers that they are readily updated of any innovative knowledge and technology and are the first to adopt such technologies. Thus, these farmers regularly attend the meeting and trainings arranged by Model Farm Services Centers and are proactive in consulting the center and its employees when they are exposed to some problems of technical nature. As a result, these innovative farmers are the first to adopt the new technologies and are benefit from high agricultural production. These farmers are characterized with up to-date knowledge and improved practices due to their regular contact with Model Farm Services Centers. A series of studies reported enhancement in agriculture production with improved linkages development between farmers and agricultural extension department (Khan et al., 2017; Abbas et al., 2003; Singh, 1999). These linkages played a vital role in sustainable resource use, enhanced agricultural knowledge, adoption of best practices, and an overall increase in agricultural production. However, inadequate linkages between farmers and the extension department led to failure in ensuring promising results (Singh, 1999; Ahmad et al., 2007). According to Iheke (2010), the development of the agricultural sector requires the efforts for the development of innovative technologies and their dissemination to the farmers in a befitting manner. Thus, the zeal of extension agents to disseminate scientific knowledge to the agricultural community is equally important to bring a positively directed planned change. A responsive farming community facilitates the transmission of knowledge and diffusion of innovation as well (Nwaru, 2004; Nwaru et al., 2011; Pillegowda et al., 2010; Ullah et al., 2015; Khan, 2008; Davidson et al., 2005; Betz, 2009). However, due to administrative inefficiencies, low budgetary allocations to Model Farm Services Centers, and low response rates from the community, the targeted agricultural output are far from achievement in Pakistan (Muhammad et al., 2017).

Conversely, the association of establishment of farmer associations at the village level had a non-significant association with agriculture productivity ($p=0.129$; $T^c= 0.070$). Similarly, a non-significant association was found between the solution of farmers' problems by employees of Model Farm Services Centers and agriculture productivity ($p=0.068$;$T^c= 0.070$). In addition, a non-significant association was found between ease in renting-in the agricultural machinery from Model Farm Services Centers and agriculture productivity ($p=0.747$; $T^c= 0.029$). The community-based participatory approaches emphasize the involvement of rural communities, through elected organizations for any welfare and extension program. In such community-based participatory developmental programs various village-level organizations, including farmers organizations (FOs), are established to identify agricultural problems and implement relevant interventions to solve these problems in coordination with technical experts. In this way, the genuine problems faced by farming communities are identified and solved through the coordination of farmers and extension agents. In addition, these parties develop consensus and devise mechanisms to manage the machinery and other agricultural inputs deployed by the government for agricultural development. However, the non-significant associations of the above variables pertain to the weakness of Model Farm Services Centers to establish farmer organizations, solve their priority problems and ensure the provision of machinery to them on rent. Thus, despite the importance of

social organizations, problems census and subsidized inputs, these important factors were not upto the mark in enhancing the agricultural production due to administrative causes, faulty planning, or lack of interest from extension agents and the farming community (Demaine, 2008). Rehman et al. (2012), therefore, emphasized on establishment of farmer organizations at the village level to facilitate regular meetings of farmers with field assistants and regulate the field visit programs of field assistance (Khan et al., 2015), to disseminate innovative knowledge (Msuta and Urassa, 2015), deploy machinery when needed (Bachke, 2009) and solve the problems of the farming community (Jason, 2008; Mushi, 2000). Furthermore, the mere establishment of farmer organizations is insufficient for agricultural development until the farming communities are persuaded by the extension agents to make favorable decisions in favor of the implementation of innovative practices and technologies (Iheke, 2006). Muhammad et al. (2018) also approved the one window operation of Model Farm Services Centers in the provision of agricultural-related devices and inputs. However, it was suggested that improvement in the social organization of communities through integrated and participatory approaches is required to overcome the negative influences of elite capture in the process (Haq et al., 2013). Shah et al (2017) also mentioned the element of elite capture in the irregular distribution of facilities to farmers. Thus, an even distribution of expensive inputs and machinery to all farmers, including the poorest ones, is a must for enhancing agricultural productivity (Ullah, 2016).

Table 4 Association between access to Model Farm Services Centers and agriculture productivity of the respondents

Attributes	**Attitude**	**Agriculture productivity (in terms of net income)**				**Statistics** x^2 **(P-Value)** T^c
		Above-average net income	**Average net income**	**Below average net income**	**Total**	
You are provided any training by MFSC in agriculture field	Yes	21 (53.8)	11 (28.2)	7 (17.9)	39 (100)	x^2 =19.308 (0.001) T^c=0.043
	No	76 (24.1)	121 (38.3)	119 (37.7)	316 (100)	
	Uncertain	12 (41.4)	11 (37.9)	6 (20.7)	29 (100)	
You are provided with different inputs (seeds, fertilizers, machines, etc.) by MFSC	Yes	18 (60)	5 (16.7)	7 (23.3)	30 (100)	x^2 =19.920 (0.001) T^c= 0.049
	No	79 (24.5)	130 (40.2)	114 (35.3)	323 (100)	
	Uncertain	12(38.7)	8 (25.5)	11 (35.5)	31 (100)	
Have you developed any linkages with MFSC	Yes	28 (53.8)	17 (32.7)	7 (13.5)	52 (100)	x^2 = 21.809 (0.000) T^c=0.131
	No	76 (24.4)	119 (38.1)	117 (37.5)	(100)	
	Uncertain	5 (25)	7 (35)	8 (40)	20 (100)	

Farmer organizations are established at your village	Yes	26 (33.8)	32 (41.6)	19 (24.7)	77 (100)	x^2 =7.124 (0.129) T^c=0.087
	No	77 (27.5)	104 (37.1)	99 (35.4)	280 (100)	
	Uncertain	6 (22.2)	7 (25.9)	14 (51.9)	27 (100)	
Employees of agricultural department/ FSC conduct regular meetings with you	Yes	37 (45.7)	26 (32.1)	18 (22.2)	81 (100)	x^2 =18.732 (0.001) T^c=0.107
	No	64 (22.6)	111 (39.2)	108 (38.2)	283 (100)	
	Uncertain	8 (40)	6 (30)	6 (30)	20 (100)	
Employees of agricultural department/ FSC identify/solve your agricultural problems	Yes	21 (44.7)	16 (34)	10 (21.3)	47 (100)	x^2 =8.720 (0.068) T^c=0.070
	No	82 (25.7)	122 (38.2)	115 (36.1)	319 (100)	
	Uncertain	6 (33.3)	5 (27.8)	7 (38.9)	18 (100)	
You can easily rent the machinery required from MFSC	Yes	15 (32.6)	18 (39.1)	13 (28.3)	46 (100)	x^2 =1.941 (0.747) T^c=0.029
	No	88 (27.6)	120 (37.6)	111 (34.8)	319 (100)	
	Uncertain	6 (31.6)	5 (26.3)	8 (42.1)	19 (100)	

Percentages are given in parenthesis

Association between access to Model Form Service Centers and agriculture productivity (controlling the socioeconomic status of the respondents)

Results in table 5 show that for all those respondents from high socio-economic status who had high access to Model Farm Services Centers, 70.3% earned above-average net income from agriculture sales as compared to 35% of those who had moderate access to and 16.7% that had low access to MFSCs. In addition, for all those respondents from middle socioeconomic status who had high access to Model Farm Services Centers, 29.2% earned above-average net income from agriculture sales as compared to 19.6% of those who had moderate access and 20% of those who had low access to Model Farm Services Centers. Furthermore, for all those respondents from low socio-economic status who had high access to Model Farm Services Centers, 31.6% earned above-average net income as compared to 26.1% of those who had moderate access and 18.5% with low access to Model Farm Services Centers. The association between Model Farm Services Centers and net income from agriculture production was found highly significant (p=0.000) and positive (T^c= 0.364) for high socio-economic group. In addition, the association of these variables was highly significant and positive (P=0.000; T^c= 0.0.261) for middle socio-economic group. However, the association of the above-said variables was non-significant and positive (P=0.069; T^c= 0.164) for low socioeconomic groups. Value of level of significance and T^c for entire table shows highly significant and positive (P=0.000 & T^c= 0.251) association between access to Model Farm Services Centers and agriculture productivity for all the three socio-economic groups. Variation in Kendal T^c and chi-square significance values for all the three socio-economic groups indicated that the association of access to Model Farm Services Centers and agriculture

productivity is spurious based on the socioeconomic statuses of the respondents. Where middle and high socioeconomic status groups have a slighter edge over low socio-economic status group respondents in better agriculture production and earning from it due to their better access to MFSCs.

Interaction between MFSCs and farmers has two important scenarios. In the first scenario, the MFSCs are supposed to initiate and accomplish the process of dissemination of innovative knowledge, technologies, and subsidies to the farmers. In the second scenario, the farmers approach the MFSCs to get benefits from innovative information, technologies, and subsidies. In both these scenarios, the farmers from the high socioeconomic group are better placed in the socioeconomic hierarchies to attract the functionaries of MFSCs or to access their services through their initiatives because of their high level of knowledge, better income level, and superior status based on authority. The low socioeconomic status farmers, on the other side, are at a low level of awareness of MFSCs due to their low literacy level, insufficient interpersonal connections, and low economic standings. These farmers are also neglected by the authorities of MFSCs as convincing them to adopt modern technologies needs extra efforts and financial inputs. Moreover, a low economic and literacy standing of poor socioeconomic farmers obstruct the diffusion of innovative technologies with an overall low positive influence on their agricultural production. The element of elite capture and high preference to high and middle socioeconomic farmers in terms of benefiting from government subsidies and input facilitation are not rare (Ahmad et al., 2007). The agricultural extension is supposed to focus on farmers from all socioeconomic categories without discrimination. However, in most cases, the agricultural extension intervention has failed to focus the poor farming communities in its true spirit (Pasa, 2017). Therefore, the agriculture extension activities that were supposed to break the spiral of poverty and bring the poor farmers out of the vicious circle of poverty through enhanced agricultural production are seldom achieved. As a result, the production gap between high and low socioeconomic status farmers has been increased due to differential treatment of agriculture extension services to different socioeconomic groups (BIF, 2018; Kifle, 2016). In some cases, the dedicated agricultural extension workers failed to break the status quo of low socioeconomic farmers and could not motivate them to adopt innovative technologies that are an important reason for their low agricultural production (Shah et al., 2017; Islam et al., 2018).

Table 5Association between Access to Model Farm Services Centers and agriculture productivity (controlling the socio-economic status of the respondents)

Socio-economic status	Relationship with Model Form Services Centers	Net Income				Statistics x^2 (P-Value) T^c=	Level of significance for the entire table
		Above-average net income	Average net income	Below average net income	Total		
High socioeconomic status	High	26 (70.3)	6 (16.2)	5 (13.5)	37 (100)	x^2 =20.991 (0.000) T^c=0.364	x^2 =34.066 (0.000) T^c=0.251
	Moderate	7 (35)	6 (30)	7 (35)	20 (100)		
	Low	5 (16.7)	15 (50)	10 (33.3)	30 (100)		
	Total	38 (43.7)	27 (31)	22 (25.3)	87 (100)		
Middle socioeconomic status	High	28 (29.2)	53 (55.2)	15 (15.6)	96 (100)	x^2 =32.756 (0.000) T^c=0.261	
	Moderate	20 (19.6)	35 (34.3)	47 (46.1)	102 (100)		
	Low	6 (20)	5 (16.7)	19 (63.3)	30 (100)		
	Total	54 (23.7	93 (40.8)	81 (35.5)	228 (100)		
Low socioeconomic status	High	6 (31.6)	5 (26.3)	8 (42.1)	19 (100)	x^2 =8.692 (0.069) T^c=0.164	
	Moderate	6 (26.1)	12 (52.2)	5 (21.7)	23 (100)		
	Low	5 (18.5)	6 (22.2)	16 (59.3)	27 (100)		
	Total	17 (24.6)	23 (33.3)	29 (42)	69 (100)		

Percentages are given in parenthesis

Conclusions and recommendations

The role of MFSCs is pivotal to the development of agriculture. The agricultural extension agent/workers work as a bridge between the agriculture department and farmers. Farmers' contact with MFSCs for diagnosis and solution of their agriculture-related problems had a positive effect on agricultural productivity. However, the beneficiaries of MFSCs in terms of access to expert advice subsidized agricultural inputs and machinery provided by the agricultural department were countable. Strengthening MFSCs in technical and financial terms by providing the extension agents the appropriate trainings and skills related to use and communication of innovative technologies, subsidizing quality inputs to the farmers, the establishment of farmer's organizations/cooperatives, and facilitating mobility and access of extension workers for timely and speed diffusion of technologies to farmers for their efficient inputs can solve the problem of agricultural productivity in Pakistan.

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