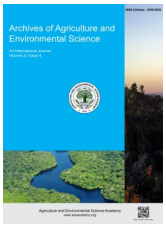
Archives of Agriculture and Environmental Science 4(4): 388-395 (2019)
https://doi.org/10.26832/24566632.2019.040404

e-ISSN: 2456-6632

This content is available online at AESA

Archives of Agriculture and Environmental Science

Journal homepage: www.aesacademy.org



CASE STUDY

CrossMark

Sustainability of smallholder seed enterprises (SSE): A case study of Nagarpur and Shahjadpur Upazila, Bangladesh

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ARTICLE HISTORY

Received: 11 September 2019
Revised received: 05 November 2019
Accepted: 16 November 2019

Keywords

Bangladesh
Composite indicator (CI)
Smallholder seed enterprises
Sustainability

ABSTRACT

Smallholders' seed production, processing, and marketing of major crops such as rice, wheat, and maize have been important issues for seed security worldwide. According to the Food and Agriculture Organization reports, the smallholder's seed enterprise (SSE) is the best way of ensuring the availability of quality non-hybrid seeds. The concept of SSE is built to fulfill the farmer's seed demand by the development of their own seed production system. It is so important for sustainable agriculture. Although, this system does not perform properly due to some limitations. So, the present study aimed to assess the important indicators that directly related to the sustenance of smallholder's seed enterprises. It will be helpful to enhance SSEs effectiveness. Data were collected from 120 smallholders of six villages of Nagarpur and Shahjadpur Upazila under Tangail and Sirajganj districts in Bangladesh, respectively. Results revealed that 92.5% of the smallholder had moderate to highly sustainable seed enterprises. Based on standardized coefficients, institutional functions, price of seed, human capital and marketing facilities considered as highly influential indicators. Finally, the existing institutions play a key role in achieving the sustainability of SSEs by providing necessary supports.

Citation of this article: Hossen, M.S., Roy, R., Islam, M.K., Akhter, A., Mondal, S. and Islam, M.M. (2019. Sustainability of smallholder seed enterprises (SSE): A case study of Bangladesh. *Archives of Agriculture and Environmental Science*, 4(4): 388-395, https://dx.doi.org/10.26832/24566632.2019.040404

INTRODUCTION

Seed products are basic agricultural input. Quality seeds of any recommended variety are the basis of improved agricultural productivity since these seeds respond to farmers' needs for both their increasing productivity and crop quality (Pelmer, 2005). Over 90% of the crops with the crops in establishing countries are still rooted in farmers' varieties and farm-saved seeds (Almekinders *et al*., 1994; Almekinders and Louwaars, 1999; Maredia *et al*., 1999; World Bank, 1998). As a result, large international seed companies concentrate on those countries with large commercial seedling sectors, often concentrating on higher-value crops grown by simply larger farmers in even more favorable areas, i.e. targeting those who are best able to pay for their seeds. They are likely to prevent self-pollinating crops (Rice, wheat, etc.) which include most of the crops smallholder farmers grow and on which they depend for their food security because these usually are the crops for which farmers save their own seeds, reducing opportunities regarding commercial seed production associated with these crops.

In the past, public sector universities, governmental organizations, and global organizations were a major source of new varieties and quality seeds of food crops for the smallholder farming sector, especially along with regards to self-pollinating crops.

Nevertheless, in recent yrs., many countries have motivated privatization or commercialization associated with public sector seed activities, while international organizations have faced budget constraints, major to reduced investment in public-sector plant breeding in addition to seed production enterprises. Therefore, public-sector seed activities possess tended to target the narrow range of crops grown by larger maqui berry farmers. This way, reducing supplies associated with the seed of new kinds of subsistence crops to smallholder farmers even further (Bengtsson, 2007). Nevertheless, there are a number regarding examples throughout the globe where seeds of cultivars are supplied by prosperous small to medium-scale seed enterprises or farmer businesses. The Food and Agriculture Organization (FAO) regards typically the Smallholder Seed Enterprises (SSEs) as the best method of ensuring the in addition to quality of non-hybrid seed for food and nourish crops in developing nations around the world as they recognize the particular contribution of smallholder seedling enterprises in addressing international challenges, such as attaining the Millennium Development Targets (MDGs), adaptation to weather change and the attainment associated with food and nutrition safety (FAO, 2010). Sustaining typically the growth of smallholder seed enterprises through the advertising of public and exclusive partnerships and capacity building is a focus area regarding FAO.

The term 'smallholder farmer' varies among nations around the world and ecological zones due to different factors such since crop types, the area developed and produced. People who else participate in the daytime to day activities by providing labor and management of the farm/livestock can be considered as smallholder maqui berry farmers (Babu and Sanyal, 2010). The World Development Report 2008 states that the most significant proportion of farmers in developing countries is smallholders and about 85% of them are farming in less than two hectares of land (World Bank, 2007). According to this statement, in countries such as China, Egypt, Bangladesh and Malawi, smallholder farms with less than two hectares of farmland accounts for 95% of the total. The simplest and conventional meaning of a smallholder is the circumstance when the land available for a farmer is very limited (Hazell *et al*., 2007). However, the meaning goes significantly beyond this conventional description and includes some common characteristics that the so-called small farms or smallholders generally exhibit. Chamberlin has determined four styles based on which smallholders can be differentiated from others. These kinds of themes include landholding size, wealth, market orientation, and amount of vulnerability to risk. Accordingly, the smallholder is one with limited land availability, poor resource endowments, subsistence-oriented and highly prone to risk. Nevertheless, the smallholder may or might not exhibit all these sizes of smallness simultaneously.

Tiny enterprises may be appropriate to smallholder communities because seed selection and seedling use are location-specific, with varieties. Neck (1977) expressed that small corporations are those in which the management lies in the hands of 1 or two and is also in charge of the major decisions. Smallholder seed enterprises (SSEs) is ad advertisement perspective in the informal seed system through which it provides entrepreneurial skills, management expertise, and financial resources to local neighborhoods, farmer cooperatives, NGOs or other groups enthusiastic about producing seed for the local market. Their advantage is based on their ability to serve distant areas, work in near partnership with local maqui berry farmers, produce seeds of diverse varieties including landraces, local varieties, farmer bred varieties and populations, thereby increasing the supply of seeds of a sizable number of locally adapted varieties. Smallholder seed enterprises give attention to countrywide food security, contribution to monetary growth and making sure social and environmental durability of the agricultural sector. Quality seed is one of the main agricultural inputs to ensure food security. Quality seed production and preservation at farmers' degrees following the modern techniques can minimize the seedling shortage as well as storage losses (Islam *et al*., 2010). The use of quality seed only can enhance productivity by 5-20 pct (IRRI, 2013).

Within recent times, the supply of quality seed both from the public and private fields has increased. The volume of seed supply had been 240475 mt. in 2009-10. Seed supply quantity has grown to 267777 mt. in 2012-13, which is twenty-one % of the complete demand. But in the real situation, it is far better, due to the fact rice is our primary crop and in the circumstance of rice, the volume of quality seed provide is almost 60%, in-case of wheat is 56%, maize 75%, Jute 83%, etc. The total average goes down due in order to lessen the flow of spices and oilseed. The top quality is also less in case there is the potato. BADC supplies only 2-3% of quality potato seed, and the rest of the seed comes coming from the farmer's own creation. If the availability of seeds could be increased as much as thirty percent (which is projected in 2015) that will be a fantastic success for the agriculture sector of typically the country.

Although most seeds are still farm-saved, more and more farmers buy commercial seeds of their food crops (Joshi, 2011). Mele *et al.* (2005) reported that poor farmers need better and even more affordable use of quality seeds in order to improve their livelihood. Probert *et al.* (2007) reported that the quality of seed preservation, collection, and hence their value for species reintroduction or restoration, is critically dependent on factors working in the period between the point of series and arrival at environmentally managed processing and safe-keeping facilities. The main issues connected to processing plants in addition to storage capacity in general public sector, low capacity accessible at the private sector for processing/conditioning, a low investment inside seed infrastructure and weak seed processing procedures plus quality measurement. There are also barriers to marketing and advertising of seeds. This consists of a lack of proactive marketing components and poor availability of quality products. The main issues on marketing are usually inadequate seed dealers, programs and networks, insufficient campaign and advertisement campaigns, extreme flow of exotic hybrids and other crop seed (maize, vegetables and affectation crops), absence of improper labeling and inappropriate sizing of seed containers, un-affordable pricing of seed packets, high competition

with imported seeds, and limited seeds quality services. Bangladeshi culture is yet to see modernization and competitiveness regarding attaining national goals regarding food and nutritional protection.

Therefore, it is crucial that identify and analyze the factors that affect the degree of sustainability of smallholder farms as well as seed enterprises. It will be helpful for the policymakers to design appropriate policy instruments, institutions and other interventions for sustainable financial development smallholder farmers.

MATERIALS AND METHODS

Study location and time

The research was conducted in six villages of Nagarpur and Shahjadpur Upazila under Tangail and Shirajganj district respectively. Three villages from each Upazila such as Ghiorkol, Danga Dhalapara, Danga Shalinapara under Nagarpur Upazila and Bathiya Purba study are popular for agricultural seed production. The locales were also selected purposively for the suitability of the researcher to collect data. The data were collected in March and April 2014. The map of Tangail and Shirajganj district have been presented in Figure 1 and the specific study location has also been shown in Figure 2, respectively.

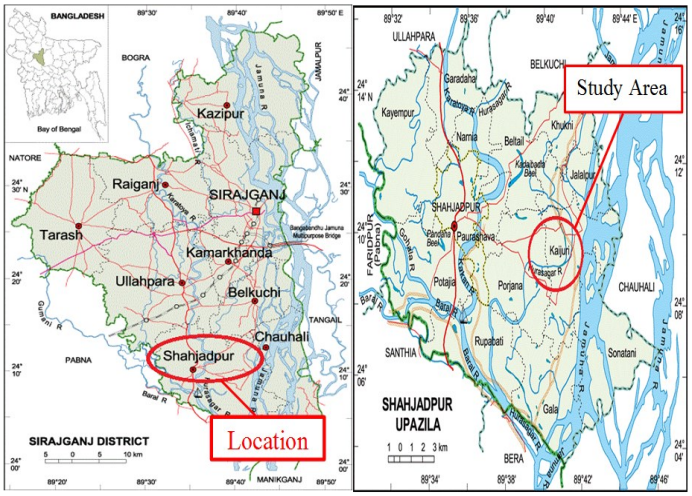

Figure 1. *Map of Tangail District shows study area (Nagarpur upazila).*

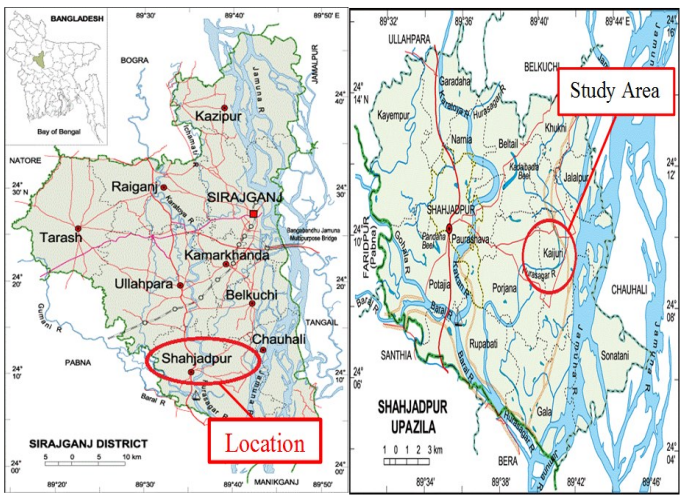

Figure 2. *Map of Shirajganj district shows study area (Shahjadpur upazila).*

Determination of population size

Household heads in the selected villages of Nagarpur and Shahjadpur Upazilas under Tangail and Shirajganj districts constituted the population of this study. Considering the time, financial resources and other constraints, data were collected from a sample rather than the entire population A total of 600 households were listed from 6 villages (Ghiorkol, Danga Dhalapara, Danga Shalinapara, Bathiya Purbapara, Kaijuri, Narina) for household's survey purposively. However, a representative sample from the population was taken for collection of data following the random sampling technique. A random sampling procedure was followed to select one district from the whole of Bangladesh, and the same method was used to select the area of the district as well as the villages as the study group. Six hundred farmers constituted the population of this study which is shown in the following Table 1.

Determination of sample size

There are several methods for determining the sample size; here, the study used Yamane's (1967) formula for the study group:

$$n = \frac{z^2 P(1-P)N}{z^2 P(1-P) + N\,(e)^2}$$

Where, n = Sample size; N, population size = 600; e, The level of precision = 8%; z = the value of the standard normal variable given the chosen confidence level (e.g., z = 1.96 with a confidence level of 95 %) and P, The proportion or degree of variability = 50%; Here, the sample size (n) =120.

Distribution of the population, sample size, and reserve list

According to Yamane's formula, the sample size comprised of 120 farmers. Reserve lists of 12 farmers (10% percent of the sample size) were also prepared so that the farmers of this list could be used for interviews if the farmers included in the original sample were not available at the time of conduction of the interview. The farmers of the villages were measured according to the proportionate of the total sample size (120) which was calculated using Yamane's (1967) formula. The distribution of the population, the number of sample sizes and the number of respondents along with the reserve list are given in the following Table 1.

Sustainability assessment using CI

Sustainability is often described as a vague and heterogeneous concept, but its evaluation by using indicators is well established (Bell and Morse, 2004). CI is the mathematical combination of individual indicators based on an underlying model, taking methodological assumptions and subjective as well as objective judgments. CI is increasingly recognized as a useful tool for assessing the environmental sustainability, policy analysis (Brand *et al.*, 2007), good governance (Rotberg and Gisselquist, 2008), environmental performance, and competitiveness (WEF, 2012). Surveyed a comprehensive review of CI and reported a dramatic growth of CI in diverse fields. In the agricultural sector, CI has been used by many researchers employing different approaches (Rigby *et al.*, 2001).

Table 1. Distribution of the rural farmers involved with different financial services according to population and reserve list.

Name of the selected Upazila	Name of the selected villages	Number of the household	Sample size	Reserve list
Nagarpur	Ghiorkol	97	19	2
	Danga Dhalapara	77	15	2
	Danga Shalinapara	126	25	2
Shahjadpur	Bathiya purbapara	113	23	2
	Kaijuri	89	18	2
	Narina	98	20	2
Total		600	120	12

Table 2. Construction methodology of a composite indicator (CI).

Step	Stage	Tools and methods applied	Output
Step 5	Index construction	Correlation and path analysis	Generating a meaningful and communicative CI
Step 4	Normalization, weighting, and aggregation	Max-min normalization factor analysis for weighting and linear aggregation	Making data comparable, assessing the weight of indicators and combining them
Step 3	Data screening, bivariate and multivariate analysis	Estimating skewness, kurtosis, outlier checking, correlation	Ensuring the quality and structure of the data set for subsequent methodological choices
Step 2	Conducting survey and data collection	Farm household's survey, checking and cross-checking data	Preparing a complete data set
Step 1	Theoretical foundation and indicator development	Literature review, expert opinion, and focus group discussion	Developing a set of indicators

The methodology employed for indicators development and construction of CI

Freebairn and King (2003) have proposed an approach for the generation of indicators, illustrating the significance of key-players in the indicator development process. Many studies (Monroy-Ortiz *et al*., 2009) reported developing an indication by adopting a participatory approach that was fit-for-purpose, integrative, and comprehensive in conditions of the efficiency and effectiveness in creating sustainability-compatible development strategies. Moreover, expert-led indicator development with the active participation of local stakeholders is recognized for consolidative assessment (Roy and Chan, 2012). Table 2 provides an illustration of the methodology utilized for the construction of a composite indicator in the study.

Statistical analysis

The analysis was performed using SPSS (Statistical Package for Social Sciences) computer package. Descriptive analyses such as range, number, percentage, mean, standard deviation were used whenever possible. Throughout the study, at least a five percent ($P<0.05$) level of probability was used as the basis of rejecting a null hypothesis.

RESULTS AND DISCUSSION

Human capital

A human capital score of the respondents ranged from 45 to 60 against possible score 12-60 with a mean and standard deviation of 53.31 and 3.35, respectively. Based on the human capital score, the respondents were classified into three categories (Mean ± Standard Deviation) namely 'low', 'medium' and 'high' human capital. The distribution of the respondents according to their human capital is presented in Table 3.

Table 4 indicates that the highest proportion (74.1 percent) of the respondents had medium human capital compared to 14.2 percent in low human capital and the lowest 11.7 percent in the high human capital category, respectively.

Non-farm income-generating activities

The observed score of non-farm income of the respondents ranged from 2 to 6 score against possible score 0-11 with a mean and standard deviation of 3.03 and 0.87, respectively. Based on non-farm income, the respondents were classified into three categories (Mean ± Standard Deviation) namely 'low', 'medium' and 'high' non-farm income. The distribution of the respondents according to their non-farm income is presented in Table 5. Data revealed that the respondents having medium non -farm income constitute the highest proportion (66.6 percent), while the lowest proportion in high non-farm income (4.2 percent) and low-income category constituted 29.20 percent of respondents. The overwhelming majority of respondents involves in low to medium level non-farm income-generating activities (Table 5).

Access to financial services

The observed score of access to financial services of the respondents ranged from 4 to 10 against a possible range of 0 to 21. The average score of the respondent's needs for financial services was 7.45 with a standard deviation of 1.35 (Table 6). The respondents were classified into three categories based on their access to financial services, they were classified into three categories (Mean ± Standard Deviation) namely 'no access', 'intermittent access' and 'sustained accesses of financial services of the respondents. Data showed that the highest proportion (85.8 %) of the respondents had intermittent access to financial services and no access to financial services was 7.53 percent of them and 6.67 percent fell in sustained access to financial services. From this, it might be concluded that the majority of the respondents had intermittent access to financial services (Table 6).

Utilization of seed of improved cultivars

The utilization of seed of improved cultivars scores of the farmers ranged from 4 to 10 with an average of 5.73 and a standard deviation of 1.29. The possible score of the utilization of the seed of improved cultivars is 0-10. Based on the utilization of seed of improved cultivars score, the respondents were classified into three categories (Mean ± Standard Deviation) namely 'low', 'medium' and 'high' utilization of seed of improved cultivars. Data in (Table 7) reveal that the highest proportion 77.5 percent of the respondents fell into a category and 15 percent had medium utilization category regarding utilization of seed of improved cultivars. 7.5 percent fell into the high utilization category. The mean value (5.73) clearly indicates that respondents tend to low to medium utilization of seed of the improved cultivars.

Market prices of the seeds

Market prices of the seeds of the respondents ranged from 3 to 14 against a possible score of 0 to 24. The average score and standard deviation were 8.23 and 2.84, respectively. Based on the market price scores, the respondents were classified into three categories (Mean ± Standard Deviation) namely low, fluctuating and high market price.

Table 8 reveals that 73.3 percent of the respondents had faced fluctuating market prices of seeds, 14.2 percent had a low market price and 12.5 percent had a high market price. Thus, an overwhelming majority (87.5 percent) of the respondents had faced low to fluctuating market prices of seeds.

Table 3. Salient features of the selected indicators.

Characteristics	Value		Possible score	Skewness	kurtosis
	Min.	Max.			
Human capital	45	60	12-60	-0.122	-0.624
Non-farm income generating activities	2	6	0-11	0.796	0.926
Access to financial services	4	10	0-21	-0.328	0.217
Utilization of seed of improved cultivars	4	10	0-10	1.093	1.632
Market prices of the seeds	3	14	0-24	-0.147	-0.791
Marketing facility	11	24	0-28	0.164	-0.663
Adequacy of extension services	1	9	0-12	0.445	-0.264
Information accessibility	18	24	0-24	0.003	-0.457
Institutional function	12	29	0-36	0.197	-0.565

Table 4. Distribution of the respondents according to their human capital.

Category	Score		Respondent		Mean	SD
	Basis	Observed	Number	Percent		
Low human capital	≤ 49	45-60	17	14.2	53.31	3.35
Medium human capital	50-57		89	74.1		
High human capital	≥ 58		14	11.7		
Total			120	100		

Table 5. Distribution of the respondents according to their non-farm income-generating activities.

Category	Score		Respondent		Mean	SD
	Basis	Observed	Number	Percent		
Low	≤ 2	2-6	35	29.2	3.03	0.87
Medium	3-4		80	66.6		
High	≥ 5		5	4.2		
Total			120	100		

Table 6. Distribution of the respondents according to their access to financial services.

Category	Score		Respondent		Mean	SD
	Basis	Observed	Number	Percent		
No access	≤ 5	4-10	9	7.53	7.45	1.35
Intermittent access	6-9		103	85.8		
Sustained access	≥ 7		8	6.67		
Total			120	100		

Table 7. Distribution of the respondents according to their utilization of seed of improved cultivars.

Category	Score		Respondent		Mean	SD
	Basis	Observed	Number	Percent		
Low	≤ 4	4-10	18	15	5.73	1.29
Medium	5-7		93	77.5		
High	≥ 8		9	7.5		
Total			120	100		

Marketing facility

Marketing facility scores of the respondents ranged from 11 to 24 against a possible score of 0 to 28. The average score and standard deviation were 17.06 and 3.25, respectively. Based on the marketing facility scores, the respondents were classified into three categories (Mean ± Standard Deviation) namely poor, moderate and developed marketing facilities. Table 9 reveals that 68.3 percent of the respondents had a moderate marketing facility, 15 percent had poor marketing facility and 16.7 percent had developed a marketing facility. Thus, an overwhelming majority (85 percent) of the respondents had moderate to developed marketing facilities.

Adequacy of extension services

The observed score of contact with extension agents of the respondents ranged from 1 to 9 against a possible range of 0 to 12. The average score of the respondents' contact with extension agents was 3.69 with a standard deviation of 1.75 (Table 9). The respondents were classified into three categories based on their contact with extension agents scores and distribution of the three categories (Mean ± Standard Deviation) namely 'no visit', 'intermittent visit' and 'frequent visit' of the respondents. Data showed that the highest proportion (85.8 percent) of the respondents had intermittent contact and no contact with the extension agents was 9.2 percent and 5 percent fell in frequent contact with extension agents. From the data of Table 10, it might be said that the majority of the respondents had no contact with intermittent contact with extension agents. It could be stated that the extension agent or media of the study area were available to the respondents. Finding reveals that 9.2 percent of the respondents had no extension organization contact which is indicating the improvement of the communication strategy. No extension contact might be the reason that some respondents may think that they have enough knowledge. This results in a cognitive change of the users with an eventual change in behavior and in skill. They receive information from their neighbors, relatives, and workmates, etc. in the study area.

Information accessibility

Information access scores of the respondents ranged from 18 to 24 against a possible score of 0 to 24. The average score and standard deviation were 21.32 and 1.46, respectively. Based on the Information access scores, the respondents were classified into three categories (Mean ± Standard Deviation) namely low, medium and high Information access. Table 11 reveals that 80.8 percent of the respondents had medium Information accessibility, 10 percent had low Information accessibility and the lowest 9.2 percent had high Information accessibility.

Table 8. Distribution of the respondents according to their market prices of the seeds.

Category	Score		Respondent		Mean	SD
	Basis	Observed	Number	Percent		
Low	≤ 4	3-14	17	14.2	8.23	2.84
Fluctuating	5-11		88	73.3		
High	≥ 12		15	12.5		
Total			120	100		

Table 9. Distribution of the respondents according to their marketing facility.

Category	Score		Respondent		Mean	SD
	Basis	Observed	Number	Percent		
Poor	≤ 13	11-24	18	15	17.06	3.25
Moderate	14-20		82	68.3		
Developed	≥ 21		20	16.7		
Total			120	100		

Table 10. Distribution of the respondents according to their adequacy of extension services.

Category	Score		Respondent		Mean	SD
	Basis	Observed	Number	Percent		
No visit	≤ 1	1-9	11	9.2	3.69	1.75
Intermittent visit	2-6		103	85.8		
Frequent visit	≥ 7		6	5		
Total			120	100		

Table 11. Distribution of the respondents according to their information accessibility.

Category	Score		Respondent		Mean	SD
	Basis	Observed	Number	Percent		
Low access	≤ 19	18-24	12	10	21.32	1.46
Medium access	20-22		97	80.8		
High access	≥ 23		11	9.2		
Total			120	100		

Table 12. Distribution of the respondents according to their institutional function.

Category	Score		Respondent		Mean	SD
	Basis	Observed	Number	Percent		
Less effective	≤ 15		20	16.7		
Medium effective	16-24	12-29	83	69.1		
Highly effective	≥ 25		17	14.2	19.78	4.1
Total			120	100		

Table 13. Distribution of the respondents according to their sustainable smallholder seed enterprises.

Category	Score		Respondent		Mean	SD
	Basis	Observed	Number	Percent		
Not sustainable	≤ 36.27		9	7.5		
Moderately sustainable	36.28-45.54	27.01-64.08	28	23.3		
Reasonably sustainable	45.55-54.81		53	44.2	48.98	8.05
Highly sustainable	≥ 54.82		30	25		
Total			120	100		

Institutional function

The institutional function score of the respondents ranged from 12 to 29 with a mean and standard deviation of 19.78 and 4.1, respectively. The possible against an observed score of institutional function is ranged from 0-36. Based on the institutional function score, the respondents were classified into three categories (Mean ± Standard Deviation) namely a less effective, medium effective and highly effective institutional function score. The distribution of the respondents as per their institutional function score is presented in Table 12. Data reveals that the highest proportion (69.1 percent) of the respondents had medium effective in institutional function, while 16.7 percent had less effective in institutional function and the lowest 14.2 percent had highly effective in institutional function. It might be logical because the respondents of the study area were suppressed by some political barriers.

Sustainability of smallholder seed enterprise

The sustainability of smallholder seed enterprise scores of the respondents ranged from 27.01 to 64.08. The average score and standard deviation were 48.98 and 8.05 respectively. Based on the sustainability of smallholder seed enterprises scores, the respondents were classified into four categories namely not sustainable, moderately sustainable, reasonably sustainable and highly sustainable to rural financial services. This following categorization is based on the Royal London (2017).

Table 13 reveals that 44.2 percent of the respondents had reasonably sustainable to smallholder seed enterprise, 23.3 percent had moderately sustainable to smallholder seed enterprise, 25 percent had highly sustainable to smallholder seed enterprise and the lowest 7.5 percent had not sustainable to smallholder seed enterprise. Thus, an overwhelming majority (92.5 percent) of the respondents had moderately to highly sustainable to smallholder seed enterprises.

Conclusion

From this study, it has been concluded that 92.5% of the smallholder farmers had moderate to highly sustainable seed enterprises in the study area. Although many factors involved in this system but institutional functions, price of seeds, human capital, and marketing facilities considered as highly influential factors among them. Respective institutions may play a key role in achieving the sustainability of SSEs by providing necessary supports to the farmers and the improvement of influential indicators.

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