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Livelihood Assets and Outcomes of Rural Farm Households in Central Khyber Pakhtunkhwa of Pakistan

Abdul Hassan^{*1}, Shahnaz Akhtar² and Muhammad Ishaq³

¹ PhD Scholar, The University of Agriculture, Peshawar, Pakistan.

² Professor, The University of Agriculture, Peshawar, Pakistan.

³ Director, SSD, Pakistan Agricultural Research Council, Islamabad.

ABSTRACT

This study explores the factors of livelihood assets possessed by small farm households in Central Khyber Pakhtunkhwa of Pakistan that determines the livelihood outcomes using sustainable livelihood framework. Primary data were collected from 349 small farm households using well-structured pre-tested questionnaire having both closed and open-ended questions. The study first measured the livelihood assets worth through composite indices followed by the factors that influencing the livelihood outcomes using multiple regression model. The overall value of livelihood assets of small farm households in the study area was 0.297. The area small farmers were lacked in livelihood assets along with low level of living standards as well as economic development in the area. The empirical findings of regression model revealed that all the five capitals of livelihood asset had significant positive effect on livelihood outcomes. Additionally, household active labour and education of labor earners of human capital, family land of natural capital; livestock and access to formal financial credit of financial capital, distance to public services of physical capital and membership in MFSCs, access to service providers of social capital had significant positive effect on the livelihood outcomes. The study suggests that the livelihood asset should be upgraded in all capitals followed by changing the approach of agriculture departments and other allied stakeholders for developing agriculture sector and rural economy.

Keywords

Livelihood, Assets, Outcomes, Rural, Farm, Pakistan

JEL Classification

N5, Q0, Q13

*ahassan7796@gmail.com

1. Introduction

Assets are the households' endowment of resources that makes living. Its acquisition or creation needs time and money investments (Galab et al., 2006). Five capitals of asset (Human, Natural, Financial, Physical and Social) are identified by The Department for International Development (DFID) that represents the building blocks of livelihood. These capitals could be partially substituted for each other. Being people first and foremost, the livelihood approach is deemed for necessitating on choices of capitals for positive livelihood outcomes. A single category of capital is not enough for yielding the entire and different livelihood outcomes that people seek (DFID, 1999 a, b, c).

Human capital means knowledge, skills, labor ability and good health that depend on quantity and quality of available labor (DFID, 1999c). Access to and investment in education and health sectors is important in stimulating the agricultural and non-agricultural activities in rural areas that influence livelihood opportunities of household and returns on other capitals in rural areas (Siegel, 2005). Natural capital is the resource flows and services originated from natural resource stocks. It is vital for those where the livelihood depends mainly or partly on natural resource-based activities. Infrastructure and producer goods are the physical capital necessary for supporting livelihoods (DFID, 1999c) and is considered as a critical asset by influencing the availability and accessibility of goods and services (Dominique van de Walle, 2000a; 2000b; Siegel, 2009). Financial capitals are the available stocks like savings and financial resources and regular inflows of money. It is multipurpose of the five capitals (DFID, 1999c). Access to financial capital empowers people to generate stable and productive lives (Meinzen-Dick et al., 2011). Social capital impacted the other capitals of asset. It is the networks, formalized groups membership and trust relationships, reciprocity and exchanges. This capital facilitated the co-operation and reduction of transaction costs that might be the provision as a base for informal safety nets among poor. Livelihood Outcomes are the output of livelihood strategies. It could be categorized as improved food security, higher income, reduction in vulnerability, increased well-being and usage of natural resources in more sustainable way subject to circumstances (DFID, 1999c).

In Pakistan, as well as in Khyber Pakhtunkhwa province, the rural economy has been highly dependent on agriculture as perceived by many researchers and policymakers. Recently in the literature this view was revised and an emerging non-farm segment has been reported with a vibrant role at an increasing trend (Adams, 1993; Urrehman *et al.*, 2008; Ali *et al.*, 2014; Farooq, 2014 and Kanwal *et al.*, 2016). The rural farm households were resorting to farm and non-farm sources for their livelihood

(Israr and Khan, 2010). The available asset with farmers has a significant base for their survival to attain decent livelihood.

In Khyber Pakhtunkhwa, majority (81 percent excluding newly merged districts) of the population is living in rural areas (GoP, 2017). More than half (57.8 percent) of the rural population are identified as multidimensionally poor (MPI). Of the rural population 42.8 percent is engaged in agriculture activities to earn their livelihood mostly at subsistence level (GoKP, 2010). Agriculture sector on one side has not performed in line with its potential (GoKP, 2015) while on the other side it is most susceptible to the negative climate change impacts (GoKP, 2016). Studies from Khyber Pakhtunkhwa showed that the rural inhabitants were not solely relying on farming but supplemented their farm income with off-farm income to secure their livelihood (Israr and Khan, 2010). Therefore, the strategies to cope with the available asset of rural dwellers for securing their livelihood indicated scope for further research.

The available evidence on the importance of asset and understanding the strategies of rural livelihood are scarce in Pakistan in general and Khyber Pakhtunkhwa in particular. Mostly available studies were concerned to livelihood sources (Israr and Khan, 2010), livelihood strategies (Urrehman et al., 2008), livelihood diversification (Israr et al., 2014). Few studies to the theme have focused on income diversification (Ikram, 2016), non-farm income diversification (Kanwal et al., 2016; Ping et al., 2016) and also crop diversification (Shahbaz et al., 2017). The issues discussed in those studies were crucial; however, the evidence of the household asset that have effect on total household income of farm households was not documented. This study tried to assess the existing livelihood asset, livelihood outcome and their relationship in the framework of sustainable livelihood to help policy makers in initiating future rural development programs. The study identified main factors of farm household capitals that determines the current household incomes generated by smallholder farmers by utilizing their capitals/asset. This provides study rationale where the outcome would help in making recommendations to policy makers in terms of household capitals/asset for future designs.

2. Materials and Methods

2.1. Description of the study area

This study has been conducted in Central Valley Plains of Khyber Pakhtunkhwa province of Pakistan. This zone comprises 42 percent of the total household of Khyber Pakhtunkhwa wherein 71 percent of the households are rural dwellers while the rest 29 percent are urban households. According to latest available Agriculture Census (2010),

the valley has 22 percent and 25 percent of the farm and cultivated area respectively (GoP, 2012). In the climate regime, the valley will receive less precipitation than before that will probably become water stressed region in the coming years and contribute to droughts. The vulnerable sectors in the central valley plains are the agriculture, water and biodiversity (GoKP, 2016).

2.2. Sampling Frame

Multistage sampling techniques was applied during this study in order to cover the full spectrum of small farm households and to meet the study objectives. In stage I, two districts, Peshawar and Nowshera were selected from the central valley plains followed by selection of one tehsil from each district in stage II, two union councils from each tehsil were selected in stage III and in stage IV two villages were randomly selected from each union council of the selected tehsils (Table 1).

A list of small farm households of each village was prepared in the study area. The total numbers of farm households in the selected eight villages was selected by utilizing the Solwin Sampling Procedure used and referred by Khan (2014) following Mwakaje (2013):

$$n_r = \frac{N}{1+Ne^2} \dots\dots\dots (1)$$

Where, n_r is the Representative sample size, N is the Population of total farm households in the study area and e is the desired margin of error.

Applying Solwin sampling procedure with N population of 627 and desired margin error e of 5 percent, the representative sample size n_r obtained was 244 households (Table 1).

After selecting the representative sample size for this study, there is a need to have a high response rate from the respondents during the survey. However, there may be non-responses. These non-responses may be due to (1) respondent refusal, (2) respondent ineligibility, (3) lack of ability for locating respondent and (4) respondent positioned but not able to contact. As a result, data collected will not represent the total population and will be biased. Therefore, it is necessary that sample size had enough in the data (Saunders et al., 2003). Hence, actual sample size was estimated using equation 2 from Saunders et al., 2003:

$$n_a = \frac{n_r}{r_e\%} \times 100 \dots\dots\dots (2)$$

Where, n_a is the actual sample size, n_r is the representative sample size of total farm households in the study area (obtained by using equation 1) and $r_e\%$ is estimated

response rate expressed as a percentage. Babbie (1990) suggested a 60 percent of response rate as ‘good’ and 70 percent response as ‘very good’.

Applying equation 2 with representative sample size n_r 244 and response rate of 70 percent, the actual sample size n_a obtained was 349 farm households (Table 1). Additionally, proportional allocation technique was also applied for achieving the requisite sample size by village.

2.3. Data

For this study, data has been collected from primary source. Primary data were directly obtained from farm households. The sampled respondents were interviewed personally by framing a well-structured pre-tested questionnaire developed in the light of study objectives. Primary data were collected from the respondents on the convenient places. The data has been collected in the month of April 2019 to June 2019. The sampled farmers are promised that the data collected will be strictly confidential and will only be used for this research work. After developing rapport with the farmers, they agreed to unveil their real income.

Table 1. Distribution of farm households by village

Villages	Small Farm Households in each village	Sample Households
Shiggi Bala	85	47
Bhatian	80	45
Jogani	78	43
Angoor Kala	73	41
Jabba Daudzai	70	39
Garhi Momin	71	40
Mufti	105	58
Tarkha	65	36
Total	627	349

Source: Author calculation

2.4. Measuring the Assets

The asset indicators were measured in different scale. Index for each indicator was calculated in order to normalize them. The equation adopted following Hahn et al., (2009); Samsudin & Kamaruddin (2013); Gautam & Andersen (2016); Xu et al., (2018); Yang et al., (2018); Zhifei et al., (2018) and used by UNDP in Human Development Indices:

$$\text{Index } I_i = \frac{I_i - I_{\min}}{I_{\max} - I_{\min}} \dots \dots \dots (3)$$

Where: I_i is the actual indicator value and I_{\min} and I_{\max} are the respective minimum and maximum indicator values. These minimum and maximum values are used to transform these indicators into a normalized index. After normalizing the indices, it ranges in between 0 to 1 that indicates low to high score respectively and are unit free. Next to normalization of each variable, the variables of each asset were averaged for calculating the value of each asset as:

$$A_i = \frac{\sum_{i=1}^n \text{Index } I_i}{n} \dots\dots\dots (4)$$

Where, A_i is one of the five capital, Index I_i represent the indicator by I that make the livelihood capital and n is the number of variables in each capital.

2.5. Multiple Regression Model

In this research work, the functional form of the relationship of the household capitals with household output (income) could be expressed as in equation 5, assuming ceteris paribus on all other factors. The null hypothesis will be that the capitals of the household had no effect on household income. e_i is a random disturbance term on observations made on household i .

The relationship can be described as:

$$y_i = \alpha_0 + \beta_1 hc_i + \beta_2 nc_i + \beta_3 pc_i + \beta_4 fc_i + \beta_5 sc_i + e_i \dots\dots\dots (5)$$

Where; α_0 is the intercept and β_i are the respective parameters of the explanatory variables, i.e., livelihood capitals and

y is Livelihood Output, hc : Household Capital, nc : Natural Capital, pc : Physical Capital, fc : Financial Capital, sc : Social Capital are the explanatory variables of household i .

2.5.1. Selection of Functional Form of Multiple Regression Model

In linear regression model, there is a linear relationship between dependent variable and independent variables. None of the variables are transformed in linear regression model. However, in log-linear model, the dependent variable is transformed by natural logarithm while the independent variables are not transformed. In log-linear models, the dependent variable need to be greater than zero. Similarly, in log-log model, both the dependent and independent variables are transformed by natural logarithm. In log-log model, both dependent and independent variables must be greater than zero, as the logarithm of positive numbers is only defined. Likewise, in the linear-log model the dependent variable is not transformed while the independent variables are transformed

by natural logarithm. In this form of models, the independent variables need to be greater than zero (Hill et al., 2011).

Keeping in view the requirements of the data for different functional forms of the multiple regression model, only two types of functional forms i.e., linear regression and log-linear functional forms are applicable in this study. The functional forms of log-log model and linear-log model are not applicable to the data of this study, because both this type of functional forms have a precondition to have values of independent variables greater than zero, however, the independent variables in this study has zero values. Hence two models i.e., linear regression model and log-linear regression model are used and the best fit model is then selected for further interpretations. Moreover, after selecting the best fit model, the model was run for both Livelihood Capitals and for Capital variables.

Similarly, equation 6 gives the relationship of household capitals with household output (income). In order to identify the influence of each variables of livelihood capitals on livelihood output, by utilizing the variable of each capital, the model could be econometrically specified as:

$$y_i = \alpha_0 + \beta_1 hlc + \beta_2 hhs + \beta_3 hel + \varphi_1 nfl + \varphi_2 nsq + \gamma_1 phc + \gamma_2 pps + \theta_1 flk + \theta_2 ffc + \delta_1 sim + \delta_2 ssp + \varepsilon_i \dots \dots \dots (6)$$

Where; α_0 is the intercept, $\beta_i, \varphi_i, \gamma_i, \theta_i, \delta_i$; are the respective parameters of the explanatory variables and ε_i is a random disturbance term on observations made on household i and

- y_i : Dependent variable i.e., the total household income of household i
- hlc : Labour capacity
- hhs : Health status
- hel : Education of labor force (mean years of schooling calculated by adopting the formula from UNESCO Institute for Statistics (UIS, 2013).
- nfl : Family own land
- nsq : Soil quality
- phc : Housing condition
- pps : Public services
- flk : Livestock (unit coefficients from FAO (2011) was used for calculating equivalent units except for donkeys that is presumed though discussion with livestock experts
- ffc : Access to formal financial credit
- sim : Institutional membership
- ssp : Access to Service Providers

are the explanatory variables of household i.

Diagnostic tests are also employed to make bold statements on the validity of models' empirical findings.

2.6. Multiple case deletion

Data has been checked for abnormal observations. Same like Xu et al., (2015) the invalid questionnaires based on nonsensical responses were excluded from analysis. Additionally, in a set of data, an outlier is the observations (or subset of observations) that appear inconsistent with rest of that set of data (Barnett & Lewis, 1994). The presence of outliers in the data set misleads the results (Zakaria et al., 2014). Cook's distance is the most important measure that detect the influence of individual or subsets of observations in linear regression for cross-sectional data (Zhu et al., 2012). A rough rule of thumb is if the value of Cook's Distances for the outliers are > 1 , then these outliers are the influential points (Dhakal, 2017) and have abnormal effects (Abdallah, 2013). The Cook's distance was used in this study to remove the outlier observations from the data. After cleaning the data by removing the nonsensical responses and influential outliers, the total number of observations used for data analysis were 307.

3. RESULTS AND DISCUSSION

3.1. Characteristics of rural farm livelihood assets

3.1.1. Human Capital

The study results revealed that 48 percent of the sampled household's members were in the household labour category, the rest 52 percent of the sampled household members were not fall in the labour category. Moreover, more than four-fifth (82 percent) of the sampled households had no member with health issues. Additionally, the overall literacy rate in the study area was very low. The average schooling of the household labour force was 2.85 years (Table 2). The educational level of farmers is a good measure of the flexibility of farmers in adopting better cropping practices.

3.1.2. Natural Capital

Land is a finite resource in the world (Kenea, 2008; Nuru & Seebens, 2008) and is an important resource due to its provision of food and other necessities that requires proper care (Qasim et al., 2014). Size of land holdings greatly determines the economic practice and capacity of the farm households. According to Jafri (undated) consideration, farm size of 5 hectares to be the minimum farm size for sustaining a farm family. Soil quality is the overall condition of soil with respect to its intended use. A good quality soil is productive and sustainable over generations for farmers. An unhealthy soil can be cherished back to health with improved management (Wolkowski, 2005). The family own land was 1.59 acres. The sampled farmers have had shared-in,

shared-out and rented-in land. About three quarter of the sampled households were satisfied with quality of soil in the study area (Table 2).

3.1.3. Physical Capital

The results regarding house space per capita of the sampled households in the study area revealed that on average sampled households had an area of 2.26 marlas (1 marla= 0.00625 acre) of their houses. Moreover, the average distance in kilometers to public services was 10.75 km (Table 2). Easy access to public services like headquarters, education, health, agricultural services, banks and markets might enhance the quality of rural livelihood.

3.1.4. Financial Capital

Livestock is vital for the livelihood to secure food and cash income to the rural poor in Pakistan. It is a subsistence sector mainly possessed by small holders. The overall production of livestock is low in Khyber Pakhtunkhwa (Hassan et al., 2014). Low productivity is due to poor nutrition, weak infrastructure and lack of financial facilities along with other constraints that hinders the livestock productivity of the farmers (Ishaq et al., 2016). The sampled farmers had on average 0.18 livestock equivalent units that includes cattle, buffalo, goat, sheep, poultry, donkey and horses (Table 2).

There are two sources of rural credit in Pakistan i.e., (1) Informal and (2) Formal. Sources of informal credit are friends/relatives and landlords while Zarai Taraqiati Bank Limited (ZTBL) is the main formal source of credit for farmers (Amjad & Hasnu, 2007). The study results revealed that majority (66 percent) of the sampled households viewed that they cannot availed the opportunity to obtain loan from formal sources (Table 2). Non-availability, high interest rate and the financial situation of the farmers that they were not be able to return on time were the reasons for non-accessibility to formal institutions for obtaining loan.

3.1.5. Social Capital

Model Farm Services Centers (MFSCs) after being named the Farm Services Centers (FSCs) in 2005 was established in Khyber Pakhtunkhwa of Pakistan for increasing the farmer's access to the quality inputs, technical advice and experience sharing. MFSCs offer one window services to the farmers by keeping all the allied representative of agriculture sectorial departments (Ullah et al., 2015). The study results revealed that more than half (58 percent) of the sampled households had no membership in MFSCs while remaining 42 percent had membership in MFSCs (Table 2). Positive role of MFSCs in agriculture sector can increase the agricultural yield of the farmers.

Agricultural Service Providers (ASPs) being a private sector already exists in the area where they provide services to the farmers. According to Salunkhe & Movaliya, ASPs can be considered an agency that provides their services with various agricultural related inputs in sufficient quantity to the farmers at their places and at right time with affordable prices and quality. The farmers discuss field level problems that they faced with them and get appropriate suggestions that influence the farmers' decision making process (2016). Hassan et al., (2017) in District Faisalabad of Pakistan showed a significant positive influence of ASPs on crop productivity, their livelihood and income. The study results revealed that 66 percent of the sampled households had not accessed agricultural service providers while remaining 34 percent had access to agricultural service providers (Table 2). It is noted that due to economic conditions of the sampled farmers, there is a lack of trust between them. The ASPs might not help those farmers in cash or in kind who had already taken loan in cash/kind or not trust worthy.

Table 2. Characteristics of rural farm livelihood assets in the study area

Assets	Variables	Unit	Average / No	Std. Deviation / Percent
Human	Household labour	Percent	47.63	20.43
	Household with health issues	No	253	82
		Yes	54	18
	Education of labour force	Years	2.85	2.70
Natural	Family Land	Acres	1.59	2.42
	Soil quality	No	76	25
		Yes	231	75
Physical	House space per capita	Marla per capita	2.26	3.11
	Distance to the public services	Kilometer	10.75	3.37
Financial	Equivalent units of livestock	Number	0.18	0.29
	Household with access to formal institutes to obtain loan	No	203	66
		Yes	104	34
Social	Membership in Model Farm Services Centers (MFSCs)	No	177	58
		Yes	130	42
	Access to service providers	No	202	66
		Yes	105	34

Note: Dummy variables are in number and percentage

Source: Survey data 2019

3.2. Rural farm Livelihood Assets of sampled households in the Study Area

The overall livelihood asset composite index score in the study area was 0.297. Same like Liu et al., (2018) the area farmers are lack of livelihood resources along with low level of living standards as well as economic development in the area. The composite index scores of the livelihood capitals revealed that natural capital dominated

the other four capitals by achieving highest value (0.429) and social capital that possessed a relatively high value (0.383) followed by human capital (0.271) and financial capital (0.202). However, physical capital possessed lowest value (0.201) among the five livelihood capitals (Table 3). The overall result showed that rural farmers are lacked in livelihood asset but still natural and social capital affected livelihood of the farmers. The index of capacity structure of sustainable livelihood capitals revealed that there is a huge deficiency in all other four capitals while natural capital is also deficient among farming households in the study area.

The magnitude of the natural capital index indicates that the sampled farm households can survive with the key environmental resources and services along with food production from the natural capital (Nagesha et al., 2006; Udoh et al., 2017). Large farm households would have good economic condition and probably have more sustainable livelihoods through encompassing suitable combinations of farm enterprises (Nagesha et al., 2006; Udoh et al., 2017) however, small farm holders and tenants have to be less sustainable livelihood. Social capital makes an important contribution to sense of dwellers of well-being by identity, honour and belonging. This capital has a direct impact on other types of household capital on the way through efficiency of economic relations (financial capital), facilitation of sharing views and experiences with other members of the organization and development along with sharing of knowledge (human capital) (Udoh et al., 2017). Trust is one the main factor that restrained the farm households to be benefited from the institutions. The financial status of the farm households also matters as poor farmers were generally not given with loaned inputs due to their capability of not returning the loan on time. Human capital is essential for use of other forms of asset capitals (Udoh et al., 2017). The results revealed that the human capital is not sufficient among sampled farm households for utilization of other capitals more efficiently. Household with high dependency ratio and quality of household members' mainly female members affected the human capital in the study area. The absence of human capital would force the sampled household members to work on low wages and would be pushed towards traditional agriculture production. Financial capital is needed for adopting the innovations, new technologies and participation in non-farm sector. The magnitude of financial capital in the study area is low. The access to formal institutions by farm households are difficult due to fulfilling the formalities required for borrowing loan from these institutions. Due to overall low financial conditions of the area farm households, it is difficult for one friend and / or relatives to give loan to another. In the absence of financial capital, the sampled farm households were facing the poverty and to have abundant labour force in agriculture sector. The ownership or control over physical capital in the study area was also low. In

the absence of physical capital, the sampled respondents had low produce that needs to be developed according to socioeconomic and geographical characteristics of the sampled respondents in the context of global and cultural conditions of the area.

It is observed during discussion with farmers throughout the survey that the rural farmers are experiencing persistent poverty. The people lost faith on the system of both formal and informal institutions. They sensed that they have no means and due to their powerlessness, there is no way-out for changing their life. The area farmers lack hope and think that working hard have no assurance that their livelihood will become better. The hopelessness expresses that small farmers have no idea and longer plans for improving their livelihood. They perceived that the life they have is well. There is need for provision of hope to the area farmers for changing their conditions.

Table 3. Livelihood Assets of the sampled households in the study area

Asset	Mean	Minimum	Maximum
Natural	0.429	0.000	1.000
Human	0.271	0.030	0.800
Financial	0.202	0.000	0.640
Physical	0.201	0.010	0.800
Social	0.383	0.000	1.000
Livelihood	0.297	0.030	0.620

Source: Survey data 20190

3.3. Multiple Regression Model

3.3.1. Diagnostic Tests

Randomness: Both total household income and Log-total household income follows randomness (Annexure).

Normality: Kolmogorov-Smirnov test revealed that total household income as dependent variable was not normally distributed while log-total household income as dependent variable showed normal distribution at 3 percent significance level (Annexure).

Multicollinearity: The minimum Tolerance value for testing the multicollinearity was 0.536 and the maximum VIF value was 1.866 for linear variables i.e., linear model and log-linear model. The result showed the rejection of multicollinearity in the explanatory variables used for linear model and log-linear model (Annexure).

Heteroscedasticity: The current study used Breusch-Pagan /Cook-Weisberg test for heteroscedasticity. The test results cannot reject the null hypothesis for log-linear model i.e., Homoscedasticity and found constant variances across all levels of independent variables. However, the results for linear model reject the null hypothesis i.e., Heteroscedasticity and cannot found constant variances across all levels of independent variables (Annexure).

Summary of selection of model functional form

The study results revealed that the log-linear model fulfilled the normality assumption at 3 percent significant level, as according to Hill et al., (2011) that income as an economic variable has skewed distributions and its logarithmic form in model is common. Moreover, both the model fulfills the assumption of multicollinearity and only log-linear model fulfill the assumption of homoscedasticity. Based on these findings, the log-linear model was selected for further analysis and interpretations.

3.3.2. Empirical results of the study

The value of coefficient of determination (R^2) of the asset model showed that 18 percent of the variations in the dependent variable were explained by the explanatory variables (Table 4). Similarly, the value of coefficient of determination (R^2) of the capital model showed that about 36 percent of the variations in the dependent variable were explained by the explanatory variables (Table 5). The value of F-statistics for both the models revealed that the overall models were highly significant.

The study results regarding human capital of livelihood asset in the regression model revealed that human capital had significant positive effect on the livelihood output (Table 4). The variables of human capital like household active labor and education of active labor had positive significant effect on the livelihood output, while family with health issues had non-significant effect on livelihood output (Table 5). Education in non-rural households designates high quality labor force which enabled them to be engaged in non-agricultural occupations and increased non-agricultural revenue (Zhifei et al., 2018). The statistically non-significant effect of health issues is contrary and not in accordance with the expected outcome. The disease affects livelihood asset and the resource base of affected households via asset disposal along with education, health, income, family relations and social roles (Maaka, 2012). This might be due to that the Government had provided free of cost health care facilities to few chronic diseases. Household with health issues is a perceived aggregate of chronic diseases whether any household member had chronic disease. Further categorization of households with different disease and availing free health opportunities should be made that might have been different statistical result.

The empirical result showed that livelihood with a predicted household output of Rs. 100, the estimated increase in household output for an additional unit of human capital was 91.7 (Table 4). Moreover, livelihood with a predicted household output of Rs. 100, the estimated increase in household output for an additional household active labor was 0.4. Similarly, the livelihood with a predicted household output of Rs. 100,

the estimated increase in household output for an additional household education of labour of one year was 9.8 (Table 5).

The study findings of the regression model revealed that natural capital of livelihood asset had significant positive effect on the livelihood output (Table 4). The variables of natural capital like family own land had significant positive effect on the livelihood output while soil quality had non-significant effect on the livelihood output (Table 5).

Bazezew et al., (2013) found a non-significant correlation of farm size with annual income of households. Family own land is one of the important asset as the orchard, economic trees and its produce are the possession of the land owner and there is no allocation made to the tenant in the study area. Falco & Zoupanidou, (2017) found that soil fertility (index) has significant positive influence on the revenues of farmers while in this study soil quality had non-significant effect on the livelihood output.

The empirical result showed that livelihood with a predicted household output of Rs. 100, the estimated increase in household output for an additional unit of natural capital was 40.3 (Table 4). Moreover, livelihood with a predicted household output of Rs. 100, the estimated increase in household output for an additional acre of family own land was 4.5 (Table 5).

The study findings revealed that physical capital of livelihood asset had significant positive effect on the livelihood output (Table 4). The variables of physical capital like access to public services had significant positive effect on livelihood output while house space per capita had non-significant effect on livelihood output (Table 5).

The empirical result showed that livelihood with a predicted household output of Rs. 100, the estimated increase in household output for an additional unit of physical capital was 78.1 (Table 4). Moreover, livelihood with a predicted household output of Rs. 100, the estimated increase in household output for an additional access to public services was 2.2 (Table 5).

The study results indicated that financial capital of livelihood asset had significant positive effect on livelihood output (Table 4). Additionally, both the factors, livestock and formal financial support of financial capital had significant positive effect on livelihood output (Table 5).

The study findings are consistent with the results found in literature, that the possession of livestock had significant and positive influence on household income (Deressa, 2010; Sharp et al., 2003; Million, 2010; Tefera, 2009; Bazezew et al., 2013). Similarly, access to credit has significant and positive correlation with annual income

of households (Beyene, 2008; Bazezew et al., 2013). However, farmers tend for interest free loans to sustain their livelihood (Su & Shang, 2012).

The empirical result showed that livelihood with a predicted household output of Rs. 100, the estimated increase in household output for an additional unit of financial capital was 52.5 (Table 4). Moreover, livelihood with a predicted household output of Rs. 100, the estimated increase in household output for an additional livestock unit was 63.8. Additionally, the empirical result showed that livelihood with a predicted access to formal financial support of Rs. 100, the estimated increase in household output having access to formal financial support was 17.1 (Table 5).

The empirical finding of the study revealed that social capital of livelihood asset had significant positive effect on the livelihood output (Table 4). Both the variables of social capital like institutional membership and access to service providers used in the model had significant positive effect on livelihood output (Table 5). Hassan et al. (2017) reported a significant positive influence of agriculture service providers on crop productivity, their livelihood and income.

The empirical result showed that livelihood with a predicted household output of Rs. 100, the estimated increase in household output for an additional unit of social capital was 33.3 (Table 4). Moreover, livelihood with a predicted household output of Rs. 100, the estimated increase in household output having institutional membership was 17.7. Additionally, livelihood with a predicted household output of Rs. 100, the estimated increase in household output having access to service providers was 23.1 (Table 5).

Table 4. Coefficients of log-linear regression model using livelihood capitals

Model	Unstandardized Coefficients		T	Sig.
	B	Std. Error		
(Constant)	11.989	0.115	104.18	0.000
Human Capital	0.917	0.266	3.452	0.001
Natural Capital	0.403	0.169	2.378	0.018
Physical Capital	0.781	0.341	2.29	0.023
Financial Capital	0.525	0.175	3.006	0.003
Social Capital	0.333	0.124	2.694	0.007
Dependent variable: Log of Household income (PKR/year)				
Number of observations: 307				
R Square: 0.180				
F-Statistics: 13.180***				
Highly Significant***(000)				

Source: Survey data 2019

Table 5. Coefficients of log-linear regression model using capital variables

	Unstandardized Coefficients		T	Sig.
	B	Std. Error		
(Constant)	11.643	0.170	68.570	0.000
HH Active Labor (percent)	0.004	0.002	1.956	0.051
Education of Labor (years)	0.098	0.015	6.784	0.000
Family with health issues	-0.110	0.109	-1.009	0.314
Family Own Land (acre)	0.045	0.017	2.629	0.009
Soil Quality	0.079	0.089	0.888	0.376
Livestock (Equivalent units)	0.638	0.131	4.859	0.000
Access to Formal Financial Credit	0.171	0.081	2.102	0.036
House Space per Capita	0.007	0.013	0.541	0.589
Distance to Public Services (km)	0.022	0.012	1.796	0.073
MFSC Membership	0.177	0.081	2.184	0.030
Access to Service Providers	0.231	0.079	2.907	0.004
Dependent variable: Log of Household income (PKR/year)				
Number of observations: 307				
R Square: 0.358				
F-Statistics: 14.925***				
Highly Significant***(000)				

Source: Survey data 2019

4. Conclusions

On the basis of firsthand data collected for this study, the rural small farmers were lacked in livelihood asset. This specific asset status of the small farmers' uncovered the living standard of small farmers having limited livelihood resources. The effective use of family land could increase the livelihood output. Household labour force and education of household labor earners were main factors that could increase livelihood output. Family size with more number of dependent household members may limit farm households in increasing their livelihood output. Moreover, physical and financial capital have the capability to increase livelihood output by its effective usage. Additionally, access to service providers of social asset, due to their timely provision of advice and inputs either on loan or in cash to farmers increases the livelihood of rural farmers. Limited membership with institutions is due to its poor distrustment that ultimately could not affected the livelihood of rural farmers. Based on the study results, following policy suggestion are made:

- Sustainable use of natural capital in terms of efficient utilization of land through the application of agricultural smart techniques and technologies. The Agricultural Departments and other allied stakeholders are required to change their approach and vision for agricultural development in view of educating the rural farmers especially youth about Agricultural smart technologies and latest innovations applicable

according to socioeconomic conditions. Further synchronizing it with the climate change and emerging market trends.

- The conventional household structure in terms of female empowerment and dependency needs to be studied in the context of sustainable livelihood paradigm.
- Still there is a huge potential for livestock rearing in the study area and the farmers should be motivated to run the livestock business commercially.
- Organizations need to be developed in the area to develop social capitals.
- Local government system needs to be studied in light of sustainable livelihood paradigm and to develop favorable policies in terms of formal financial support and others to boost livelihood of the rural people.

Limitations of the study

Although the study provides empirical evidence to the direction of future policy, still numerous limitations apprehend the pragmatic results of this study. Constraints of resource and time are not allowing to cover the whole Khyber Pakhtunkhwa inclusively. The study focused on small farm rural households. There is not enough clarity on the sufficiency of the selected indicators of livelihood asset to conclude that these represent each livelihood capital that effect livelihood output. The income data is based on cash incomes for study year that may be low and high in comparison to last or next year. The data collected is based that is reported by respondents.

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ANNEXURE

Randomness

Runs Test	Total HH income (Rs./year)	Ln Total HH income (Rs./year)
Test Value	367200.00	12.81
Cases < Test Value	153	153
Cases >= Test Value	154	154
Total Cases	307	307
Number of Runs	158	158
Z	0.400	0.400
Asymp. Sig. (2-tailed)	0.689	0.689
a. Median		

Tests of Normality— Kolmogorov-Smirnov

Dependent variable	Statistic	Df	Sig.
Total HH income (Rs./year)	0.133	307	0.000
Ln Total HH income (Rs./year)	0.054	307	0.034

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity

	Chi ² (1)	With p-value = Prob > Chi ²
Linear Model	42.50	0.0000
Log-Linear	1.35	0.2457
H₀ : Error term is homoscedastic i.e. Having Constant variance		
H₁ : Error term is not homoscedastic i.e. Heteroscedastic		

Multicollinearity Tests

Variables	Linear Model		Log-Linear	
	Tolerance	VIF	Tolerance	VIF
(Constant)				
Family Land (Ac)	0.744	1.344	0.744	1.344
Farm land cultivated (Ac)	0.672	1.488	0.672	1.488
Soil Quality (Dummy)	0.792	1.263	0.792	1.263
Family Size (#)	0.635	1.575	0.635	1.575
HH Off-Farm Earners (#)	0.536	1.866	0.536	1.866
Education of labor earners (years)	0.581	1.722	0.581	1.722
Livestock (Equivalent Units)	0.809	1.236	0.809	1.236
Formal Financial Support (Dummy)	0.908	1.101	0.908	1.101
HH Asset-Farm Asset (#)	0.738	1.354	0.738	1.354
Access to Public Services (Km)	0.854	1.171	0.854	1.171
Institutional Membership	0.764	1.309	0.764	1.309
Service Provider	0.795	1.257	0.795	1.257