RESEARCH ARTICLE

Human capital development and food security nexus: An empirical appraisal from districts of Punjab province

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ABSTRACT

It is proven fact that human capital development plays a pivotal role in enhancing industrial and agricultural productivity and economic growth. Comprehensive research has been rendered by scientists to observe the relationships of human capital development (HCD) with multiple dimensions but none of the scientists explored, yet, connections between HCD and food security. This study is an endeavor to explore ranking of districts of Punjab province of Pakistan with respect to different indicators of HCD including overall literacy rate, farmers' literacy rates and population per school. Moreover, relationships between food security and target variables are also quantified. Data are collected from Punjab Development Statistics (Government of Punjab 2009) and Food Insecurity report 2009 (SDPI, SDC and WFP 2009). Moreover, values of the target variables are arranged in descending order to explore the ranks of the districts in the province while bidirectional Pearson correlation analysis is rendered to know the direction of relationships between food insecure population (%) and overall and farmers' literacy rates and population per school. Negative relationships are found between food insecure populations and rest of other indicators. Therefore, it is strongly recommended that policy maker must make necessary arrangements to augment literacy rates to secure food for the masses in the province.

Key Words: *Human capital development; Literacy rate; Farmers literacy rate; Population per school; Food security; School infrastructure*

INTRODUCTION

Human Capital is described as the stock of skills, experience and productivity exhibited by a worker. The human capital is developed for better future earnings and productivity by investing on education/literacy, migration and health (1). Although investment on migration and health are extremely important but education is the foremost and significant factor to be invested upon to raise economic growth, productivity, earnings of the individuals, make better and efficient use of technologies, get rid of poverty etc. Having the pyramid significance, elimination of hunger and education provision has been ear marked as one of the top priority agenda by Millennium Development Goals (2).

According to Food and Agriculture Organization and World Food Program (2010) high Malnutrition is caused by lower level of literacy rates. Human Development Report South Asia (1998) exclaimed that the farmers with four years of education are expected to be 9% more productive than the farmers with no education. Burchi (3) used cross country analysis to study linkages between education, human development and food security. He concluded that food security reduces by 22% with the 100% increase in primary education in young children. Moreover, World Food Program and Food and Agriculture Organization (2010) also observed negative relationship between Global hunger index (as proxy of food insecurity) and education.

The theorized the merits of education and concluded that higher stock of human capital leads to better wage outcomes in labor markets and higher productivity (4,5). However, in an empirical gender study regarding human capital in Bangladesh, World Bank (6) delineated that educated women earn 7 times higher than the non-educated women. Moreover, Rosegrant et al., (7), observed 2.7% rise in farm productivity with 10% increase in male literacy while they noticed only half percent increase in farm productivity with the same percentage increase in any other input, in Pakistan.

Although education, not only, helps to increase wages, profits and productivities but it also increases the rates of returns to this investment which is different to different people. A World Bank (8) report showed that number of years in school leads to lower rates of returns e.g., in Nepal primary education yield highest returns (100%) as compared to lower secondary (29.1%), secondary (15%) and graduation (2.17%).

Education has been considered as a key determinant of economic growth since the introduction of Solow's (1956) growth model, which was later on asserted in different manners by Nelson and Phelps (9), Lucas (10), Romer (11) and Mankiw et al., (12). Barro (13) observed positive link between school enrollment as a proxy of human capital and economic growth. Similarly, it estimated the cause and effect relationship between GDP per capita and enrollment rate (12). They concluded that one percent increase in enrolment rate contributes 0.66 and 0.76 percent to GDP for non-oil exporting and OECD member countries, respectively.

However, marginal impact of years of schooling assessed by Barro and Lee (14) exclaimed 1.7 to 12.1 percent increase in per capita GDP while this impact was estimated at 12.3 to 22.1 percent, respectively, by Cohen and Soto (15). According to Human Development Report (16), Asian economies which greatly focused on the human capital development experienced uninterrupted economic growth by setting good precedence for other economies. Several studies have concluded that education has positive impact on the labor productivity (17,18). They iterated that educated workers are more likely to find better opportunities for employment with better earnings and are contributing in higher levels of production.

As per goals set by MDGs nations are trying their best to enhance their literacy rates by focusing on education in their countries. According to Global Monitoring Report (2), school enrollment has been significantly increased in more than 60 United Nations' countries by registering 115 million out of school children in 2002 as compared to 72 million in 2007. Therefore, primary school completion rate has reached up to 86% for developing countries, 93% for middle income countries and 65% for the low income countries. The report (Ibid) also expressed that there are still

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31.5 and 41 million children in South Asia and Sub-Sahara Africa, who are not yet enrolled in primary schools (Figure 1).

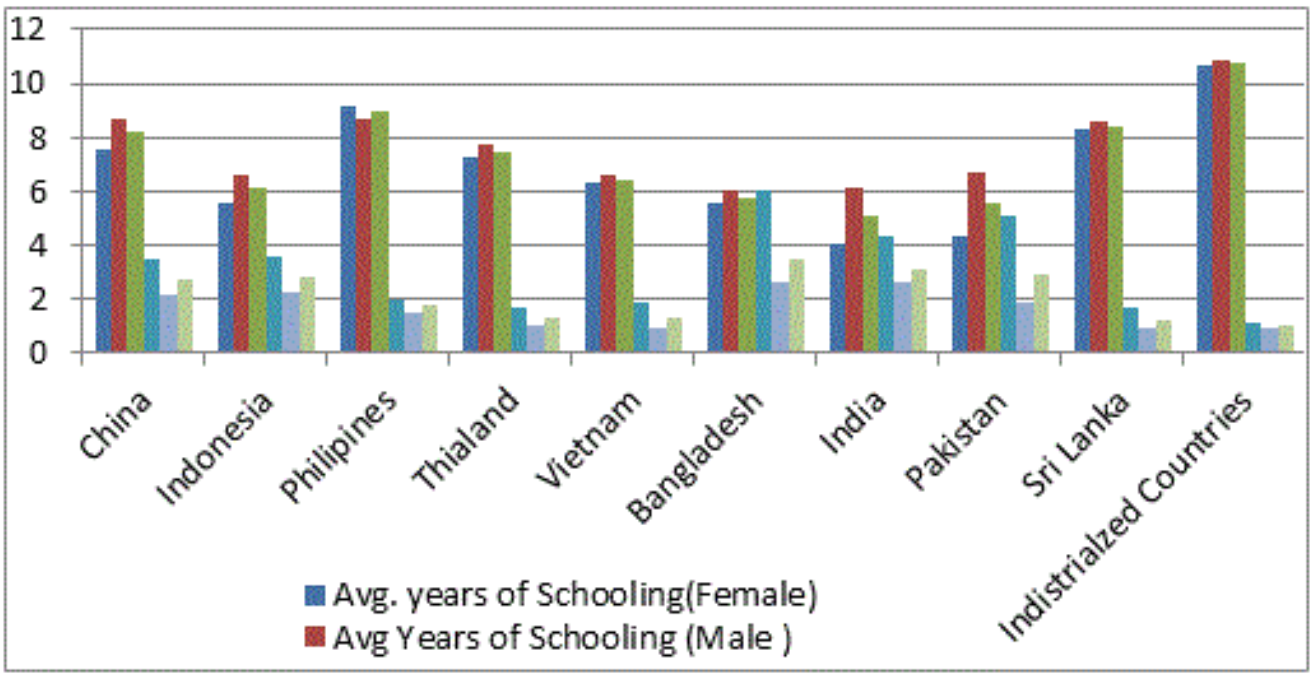

Figure 1) *Average years of schooling (2010) and schooling growth rates (1950-2010) in selected asia economies*

Economics backwardness like illiteracy leads to immobility in technological development and hence causes food insecurity (19). Unfortunately, Pakistan only spends 2.1% of GDP on education and as a consequence, it ranks 141 out of 158 in Human Development Index (20,21). According to Global Monitoring Report (22), Pakistan's educational expenditures are lowest as compared to its neighbors. Perhaps due to this reason, 10 million population have been added to category of engulfing inadequate food from 2006-08 (20). According to Government of Pakistan (21), the literacy rate in the population of 10 years and above have been progressed from 45 to 57% where as for the Punjab province it has improved from 55 to 59%. In Pakistan, poverty according to 2350 per capita calorie intake have been improved from 22.3% to 26.1% (Ibid). However, over three years (i.e., from 2005-2008) severely food insecure population has increased from 23 to 28 percent while during the same period moderately food insecure population with consumption of a little greater than 1700 K calories/day as compared to international standards of 2100 K calories/day was slightly changed in Pakistan (UNIAAM, 2008). According to Kugelman and Hathaway (20) there are about 52% food insecure populations in Pakistan. Different indicators have been employed as proxy measure of human capital by different researchers like literacy rates were used by Azariadis and Drazen (23), school enrollment rates were used by Barro (13) and Mankiw et al., (12) years of schooling was used by Barro and Lee (14) and Cohen and Soto (15) and test scores were rendered by Hanushek and Kimko (24) and Hanushek and Woessmann (25). However, as per our Literature survey none of the study tried to correlate education infrastructure available to population. Therefore this study has been devised to rank districts of Punjab province of Pakistan on the basis education infrastructure for their population, farmers' literacy and overall literacy rates. Moreover, relationships of the population per school have been determined with percentage food insecure population in all of the districts of the Punjab province of Pakistan.

METHODOLOGY

The brief description of the target research site of this study would be worth mentioning here. The study has been commissioned in the province of the Punjab, Pakistan. It is the largest populated province of the country having 35 administrative units called districts. The topography, culture, tradition, norms and taboos of some of the districts are identical, but of some other ones are absolutely distinctive from others. Being the largest province of the country it adds lion's share to the country's population (i.e., 55%), constitutes 29% of reported area and contributes 76, 70, 68 and 69 percent of the total production of wheat, rice, sugarcane and cotton, respectively (26). Therefore, country's population mainly depends upon Punjab for its food requirements.

Data description

As far as data are concerned, it was cross-sectional one and collected from different secondary data sources like Punjab Agricultural Census Report 2010 at Government of Pakistan (27), Punjab Multiple Indicators Cluster Survey at Government of Punjab (28) and Food Insecurity Report Pakistan (29). Four major indicators were used in the study that is (i) percentage of food insecure population in the districts of the province of the Punjab, Pakistan (ii) population per school at district level (iii) district level literacy rates and (iv) district level farmers' literacy rates. As far as percentage food insecure population, overall and farmers' literacy rates are concerned, these are standard variables to understand but population per school was estimated by dividing population of the districts after adding different kinds of education infrastructures available in the districts of the said province. Those included number of Government Primary Schools for Boys and Girls, No. of Govt. Middle Schools for Boys and Girls, No. of Govt. High Schools for boys and girls, number of Government Mosque Schools, number of Middle Schools for boys and girls, number of Secondary and Higher Secondary Schools for boys and girls and number of Arts and Science Intermediate and Degree Colleges (Punjab and Federal Govt. and Private Organizations). Our target variables have been used as proxy of human capital except % food insecure population.

Data analysis

Different data analysis techniques were employed to achieve the objective i.e., ranking and relationships of population/school, overall literacy rates and farmers literacy with % food insecure the population in the districts of

the Punjab province. In this regard, first of all ranking of the districts were undertaken by placing the values of the target indicators in descending order tagging highest as number 1 and district with smallest values with their corresponding related numbers. In the end of the analysis, the relationships between all target variables were determined by employing Pearson correlation. Prior to run the correlation analysis, K-S test as well Leven's tests were rendered to know the attributes of the data that whether data were parametric or non-parametric. Amongst the 4, only one variable exhibited the properties of non-parametric while the rest were proved as parametric. Therefore, parametric analysis .i.e., Pearson correlation was employed.

RESULTS AND DISCUSSION

It is noteworthy here that the results and discussion part does not include ranking of % food insecure population in the districts of the Punjab die to the fact that it has already been food Insecurity report 2009 (WFP, SDC and SDP 2009 (30,31). Table 1 delineates the ranking of the districts of the province on the basis of population per school. It is evident from the Table that Lahore, Faisalabad, Gujranwala districts have largest population per school while Nankana Sahib, Mianwali, Bhakkar, Narowal have least population per school. These very surprising results that the most populous districts of the province have the highest ranking in this context, perhaps, due to the fact that data used in paper only belong to public sector schools if the private sector schools area an also included the scenario might have been different because private sector, education is a booming business in larger cities of the country.

TABLE 1 Districts ranking of population per school

Rank	District	PPS	Rank	District	PPS	Rank	District	PPS
1	Lahore	5698	13	Multan	1337	25	Kasur	1052
2	Faisalabad	2234	14	Sialkot	1322	26	D. G. Khan	1016
3	Gujranwala	2060	15	MandiBahauddin	1309	27	Jehlum	986
4	Sahiwal	1673	16	Gujrat	1283	28	Chakwal	956
5	Rawalpindi	1640	17	T. T. Singh	1280	29	Bahawalnagar	934
6	Pakpattan	1615	18	Sargodha	1183	30	Layyah	893
7	Okara	1584	19	Rajanpur	1157	31	Khushab	879
8	Muzaffargarh	1568	20	Attock	1142	32	Narowal	841
9	Khanewal	1554	21	R. Y. Khan	1136	33	Bhakhar	798
10	Lodhran	1544	22	Sheikhpura	1096	34	Mianwali	758
11	Vehari	1544	23	Hafizabad	1074	35	Nankana Sahib	684
12	Balawalpur	1443	24	Jhang	1057			

However, population per school in Sargodha, Rajanpur and Attock has been ranked in the middle. This is very interesting to observe that the dominant trends of population per school with reference to their ranking mover from the districts with largest cities population as well as more populous to less ones. As far as the district ranking is concerned on the basis of overall literacy rates are concerned, it is evident from the Table 2 that Rawalpindi is once again on the top having its largest population literate which is followed by Jehlum, Lahore, Gujrat, Chalwal and so forth. It can easily be understood from the ranking trends of the Table that most of the districts of the central as well as northern Punjab have highest literacy rates while territories belonging to southern side of the districts have least educated people. This is very unhealthy divide which may reduce distribution and their efficiency in the districts with less literacy rates. However, Khushab, Mianwali and Khanewal lie in the middle of this ranking.

TABLE 2 District ranking of overall literacy rates

Rank	District	OLR	Rank	District	OLR	Rank	District	OLR
1	Rawalpindi	78	10	Sargodha	56	18	Bahawalnagar	46
2	Jehlum	74	10	Sheikhpura	56	18	Bhakhar	46
3	Lahore	72	11	Hafizabad	53	18	Vehari	46
4	Gujrat	71	11	Khushab	53	19	Kasur	44
5	Chakwal	69	11	Mianwali	53	20	Pakpattan	43
5	Sialkot	69	12	Sahiwal	52	21	Balawalpur	42
6	Gujranwala	68	13	Khanewal	51	22	Lodhran	41
7	Narowal	63	14	Nankana Sahib	50	22	Muzaffargarh	41
8	Faisalabad	62	15	Multan	49	22	Rahim Yar Khan	41
9	Attock	59	16	Layyah	48	23	Dera Ghazi Khan	40

9	MandiBahauddin	59	17	Jhang	47	24	Rajanpur	30
9	Toba Tek Singh	59	17	Okara	47			

As far as district ranking of farmers' literacy rates are concern, it is delineated by the Table 3 that top ranked districts are Lahore, Jehlum, Rawalpindi, and Gujranwala and so on. However, tail enders in this regard there are RajanPur, Lodhran, Rahim Yar Khan, Layyah and so forth. The trends of the ranking of farmer's literacy rates are not very much different from the overall literacy rates given in Table 2. Once again it has been witnessed that most of the southern Punjab districts are deprived in the context of farmer's literacy rates while central and northern districts are well-endowed and bestowed with famer's literacy rates. This might be due to the fat that southern Punjab districts have to just rely on public sector schools and those areas do not have available this facility by private sector. Moreover, the population of these areas mostly belongs to rural regions which are characterized as backwards and laggards. Moreover, governments need to focus on southern Punjab districts to cater up to the mark educational facilities if they intend to bring them at par to the central and northern Punjab population.

TABLE 3 Districts ranking of farmer's literacy rate

Rank	District	FLR	Rank	District	FLR	Rank	District	FLR
1	Lahore	86	9	Toba Tek Singh	70	17	Bahawalnagar	58
2	Jehlum	84	10	Okara	67	17	Dera Ghazi Khan	58
2	Rawalpindi	84	10	Sahiwal	67	17	Jhang	58
3	Gujranwala	82	11	Khanewal	66	18	Balawalpur	57
4	Chakwal	81	11	Sheikhpura	66	19	Muzaffargarh	55
4	Gujrat	81	12	Sargodha	65	20	Pakpattan	53
5	Attock	79	13	Kasur	64	21	Bhakhar	51
6	Narowal	75	13	MandiBahauddin	64	22	Layyah	49
7	Faisalabad	74	14	Multan	63	23	Rahim Yar Khan	46
7	Sialkot	74	15	Hafizabad	62	24	Lodhran	41
8	Mianwali	72	15	Vehari	62	25	Rajanpur	31
9	Nankana Sahib	70	16	Khushab	60			

CORRELATION AND CASUATION ANALYSIS

The relationship between food insecure population and Human Capital is evident from Table 4. It is needed to be clarified here that with the rise in food insecure population (%) press the food secure population automatically in opposite direction. Table 4 exclaims that the relationship between all of the human capital indicators and food insecure population are negative expressing rise in food insecure population with the increase in all the target variables (i.e., overall literacy rate, farmer's literacy rate and population per school). As far as the relationships of food security with literacy rates are concerned, those are absolutely as per expectations which mean rise in literacy rates, whether it is overall or farmers' literacy, helps to increase food security in the study area. Moreover, these relationships are strongly significant at less than 1 percent. The strength of the correlation between farmers' literacy as compared to overall literacy and population per school with % food security has been found much higher. The reason might be direct involvement of farmers' in food production. Moreover, it is proven fact from a number of studies that more literate farmers' are greater productive than less literates and illiterates. Therefore, it is strongly recommended to cater better education to the rural communities by building up educational infrastructure along with agricultural extension services. However, overall literacy plays also significant role in combating population against food insecurity by enhancing earning capacities of the people and their labor productivities as well.

TABLE 4 Pearson correlation between % food insecure population and human capital

Indicators	Food Insecure Population (%)	Population/School	Overall Literacy (%)	Farmers' Literacy Rates (%)
Food Insecure Population (%)	1	-0.158	-0.345*	-0.356*
Population/School	-0.158	1	0.304	0.311
Overall Literacy	-0.345*	0.304	1	0.900**
Farmers' Literacy Rates	-0.356*	0.311	0.900**	1

*Correlation is significant at the 0.05 level (2-tailed).

**Correlation is significant at the 0.01 level (2-tailed).

Moreover, the negative association between food insecure population and population per school is surprising and absolutely against the expected results which should have been positive. The negative association shows that rise in population per school enhances food security and vice versa. There might be multiple reasons for such association including (a) priority of the parents is, perhaps, to send their children to work for earning when

they don't find cheaper school facility in their neighborhood (b) due to unavailability of schools they don't afford to send their children away from home due to un-affordability of boarding expenditures and prefer to send them to work and earn money (c) availability of ghost schools and (d) extreme conditions of poverty, food insecurity and food prices compelled parent to send their children to work which help to reduce food insecurity and vice versa. Albeit the probability of this relationship to be occurred is insignificant but policy makers and relevant stakeholders must focus on the school infrastructure development and make necessary arrangements to augment literacy rates to combat food insecurity in the province of the Punjab Pakistan. Similarly from the linear curve causation analysis between the human capital and food insecure population gives us greater insight how marginal change in the human capital can influence change in the food insecurity (Figure 2).

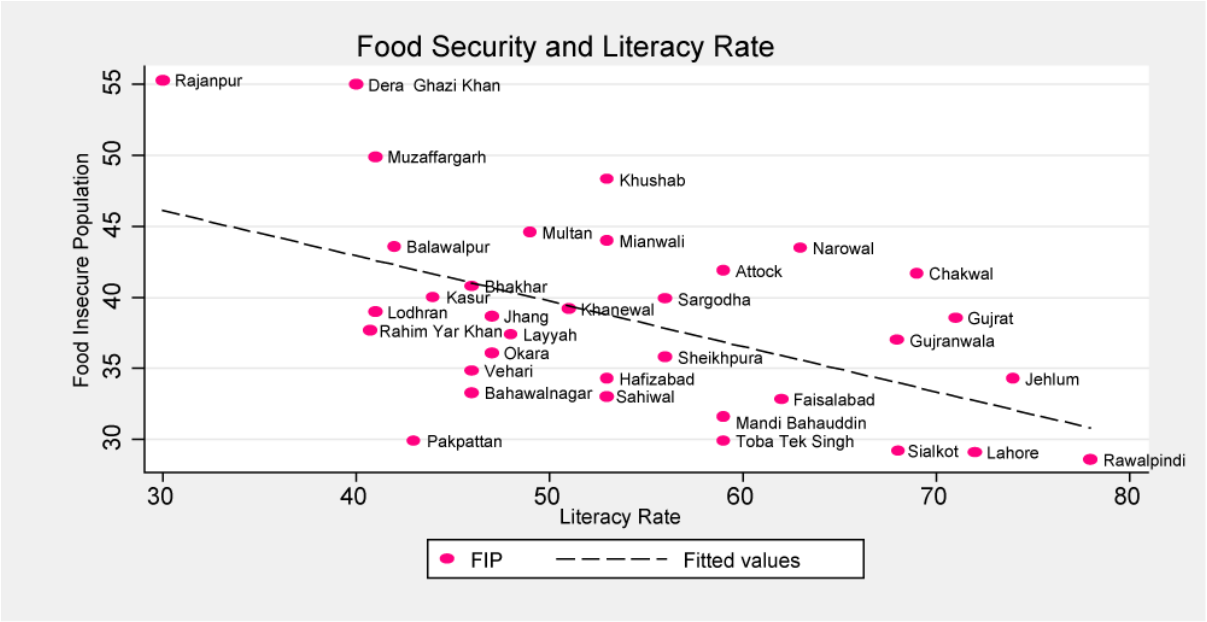

Figure 2) *Linear curve estimation between food insecure population and overall literacy rate*

While comparing the literacy rate and food security we can see that majority of the districts are located centrally with medium food security and literacy rate and while considering District Rajanpur having highest degree of food insecurity with lowest level of literacy rate in contrast to District Rawalpindi with lowest level of food insecurity and highest level of literacy rate for the linear curve fitting, we can come to conclusion that increase in the literacy rate negatively cause the food insecurity while positively cause the food security for the districts of Punjab, this results similar with the correlation analysis.

If we compare Farmer literacy rate with food insecurity there is no district of interest on the higher human capital side but similar to previous Rajanpur faces high food insecurity with low stock of human capital. This graph shows that increase in farmer literacy rate is negatively causing food insecurity and leads to increase the food security for the districts of Punjab.

While the farmer's literacy rate has positive relationship with food security (33). In case of educational infrastructure, it also has negative relationship with food insecure population which means that with the increase in population par school food insecurity decreases and food security increases (Figure 3).

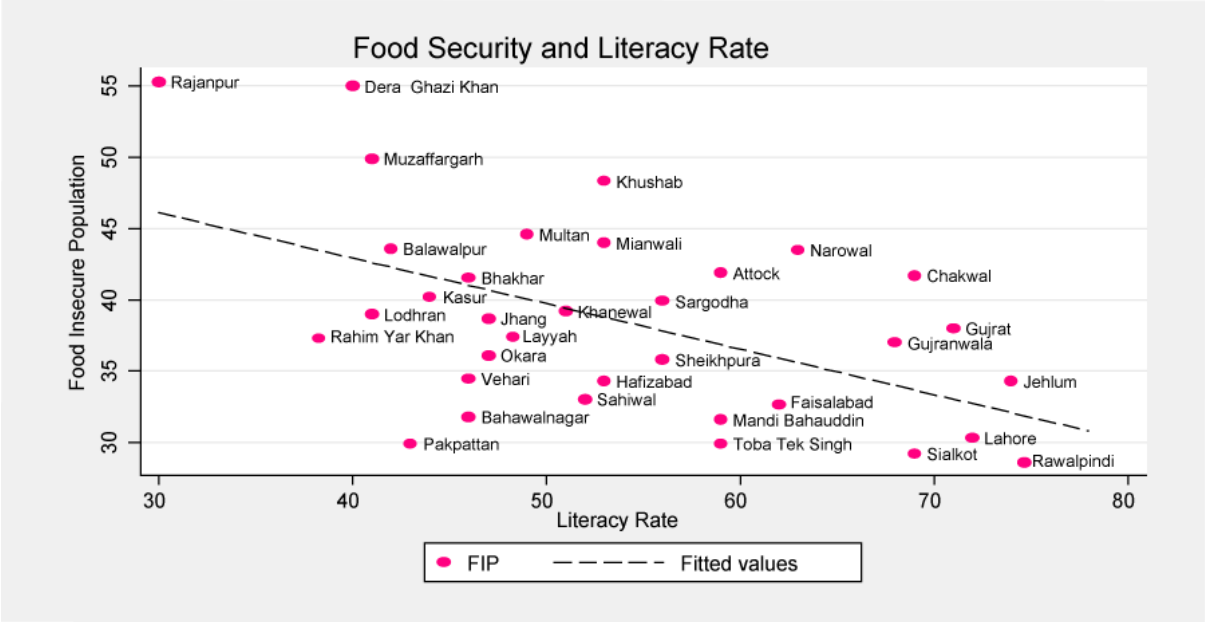

Figure 3) *Linear curve estimation between food insecure population and farmer's literacy rate*

REGRESSION ANALYSIS

In the below given model Educational Infrastructure is the proxy of school per population and Canal & Tube well Irrigation per Total Cultivated Area is the proxy of Irrigation.

Table-5: Regression Analysis.

Dependent Variable=Food Insecure Population (%)	
Variables	**Beta**
(Constant)	54.39
	(0.000)
Educational Infrastructure	-.0012
	(0.293)
Literacy Rate	-.4949
	(0.000)***
Institutional Agricultural Credit	-.2336
	(0.095)**
Canal & Tubewell Irrigation/Total Cultivated Area	-.1234
	(0.002)***
Family Size	2.858
	(0.032)*
R-Square	0.659
P-value	0.000

*Significant at 10% level of significance.

**Significant at 5% level of significance.

***Significant at 1% level of significance.

The econometric model is highly significant and having 65% R-square value in the Table 5. Literacy Rate has negative relationship with food insecure population which means that with the increase in 1 unit in literacy rate leads to reduce food insecurity by 0.494 units while food security increased by 0.494 units. Our finding is similar to the (33) which concluded negative relationship between output adult literate and food security (32).

CONCLUSION

The study concludes that the districts belonging to central and northern Punjab territories have higher levels human capital developed in the form of overall literacy and farmers' literacy. However, results are a bit different in case of ranking of district on the basis of population per school due to the fact that districts with larger populations does not have ample public sector educational infrastructure and, therefore, those have to depend upon private ones but the data taken from Punjab development statistics (2009) only cater information regarding public sector institutions. As far as relationships between % food insecure population and target variables i.e., population per school, overall literacy rates and farmers literacy rate are concerned, negative relationships were found with highly significant probability values with literacy rates while relationship with population per schools was found insignificant. Nevertheless, different trends in relationship with population per school and food security were observed which are absolutely against the expected results.

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