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Role of Livelihood Diversification in Control of Tobacco Leaf Supply in Khyber Pakhtunkhwa

Dr. Muhammad Shahzad[1], Dr Anwar Shah[2], Naveed Jehan[3] and Majid Khan[3]

Abstract

Tobacco has been associated with various health detriments. Different measures have been taken to control the tobacco epidemic at national and international level. These measures consist of both on the demand and supply sides. The current study has investigated the role of livelihood diversification across tobacco farmers in controlling of tobacco leaf supply and tobacco epidemic. We aim to identify the link of livelihood diversification with willingness to decrease tobacco leaf supply of tobacco farmers. We collected cross sectional data of farmers from three major tobacco producing districts (Swabi, Mardan and Charsadda) of Khyber Pakhtunkhwa in Pakistan in 2019. We used Simpson diversification index to determine the extent of livelihood diversification of farmers whereas, probit estimates were applied to determine its role with farmers' willingness to decrease in tobacco leaf supply, used in health damaging tobacco products. Findings of the study reveal high livelihood diversification score is associated with more willingness to decrease in tobacco leaf supply. However, decrease in volatility for prices of tobacco competing crops and creating livelihood earning opportunities for tobacco farmers is required.

Keywords: Tobacco control, Livelihood, Diversification, Competing crops

[1] Lecturer in Economics, University of Buner, Msdresearcher2011@gmail.com, shahzad@ubuner.edu.pk
2 Professor of Economics, School of Economics, Quaid-i-Azam University Islamabad.
3 Ph.D Scholar, University of Peshawar.
Corresponding Author: Msdresearcher2011@gmail.com, shahzad@ubuner.edu.pk

1. Introduction

Tobacco products consumption has been one of the largest preventable risk factors for most of the major non-communicable diseases (Reitsma, et al., 2017).The peculiar consumption related health risks include diseases of the cardiovascular system, diseases of the respiratory tract such as Chronic Obstructive Pulmonary Disease (COPD), asthma, emphysema, and cancer, particularly lung cancer and cancers of the larynx and tongue. Documenting the ill effects of tobacco consumption, International Agency for Research on Cancer (IARC) estimated that out of 1.1 million lung cancer deaths, 0.94 million were attributable to smoking. Apart from diseases, tobacco addiction increases the probability of premature death as half of the long-term smokers, loss 20 to 25 years of their productive lives (The World Bank, 1999). Moreover, tobacco attributable monetary costs are estimated to be $700 billion in USA, $1.685 billion in New Zealand, $9.3 billion in Canada, 26 billion Euro in France whereas, India, Pakistan and Bangladesh face $22.4 billion, Rs.192 billion and 305 billion BDT annually, whereas it reaches to US$ 1.436 trillion on the global level (Eyre et al., 2004; John et al., 2009; Eriksen et al., 2015; Anh, et al., 2016; & Ahmed, et al., 2019).

Tobacco leaf has been major input for tobacco products. Despite posing important implications for public health, tobacco leaf supply has received little scholarly attention. Though important scholarship on the economic complications of farming tobacco has been evolved over time, particularly about the experiences of many hundreds of thousands of small farmers, who supply most of tobacco leaf on global level, still remains much scope for work to be done (Otanez, et al., 2008; Prowese, 2011; & Moyer-Lee, 2015). The public health treaty World Health Organization Frame Work Convention on Tobacco Control (WHO-FCTC) framing global tobacco control, recognizes the importance of supply side of tobacco through articles, 15, 16 and 17. Article 15 covers the illicit trade issue in tobacco, and article 16 deals with controlling access to minors, while article 17 stresses on developing alternative livelihood sources for tobacco farmers and tobacco related labors (World Health Organization, 2003). To properly implement article 17 of the WHO-FCTC, there is much to gain from farmers' perspectives, particularly to identify the venues out of tobacco farming (Appau, et al., 2019).

The tobacco industry has long been trying to undermine public health under the guise of the concern for the livelihood of tobacco farmers and workers (Warner, 2000; Otanez, et al., 2009; Van Minh, et al., 2009; & Gilmore, et al., 2015). It insists that tobacco is essential to

tobacco farmers, workers, and governments' treasuries. And governments and policymakers often succumb to the fear induced by tobacco industry's projections for low and middle income countries (LMICs) delaying the formulation and implementation of effective tobacco control policies (Drope & Lencucha, 2013; Chavez, et al., 2016; Eckhardt, et al., 2016; Lencucha, et al., 2016; & Magati, et al., 2019). Tobacco industry, in order to prove their claims are busy in conducting ghost research with tobacco favoring outcomes. These ghost studies reflect that tobacco income contributes for more than half of the income in tobacco farmers' livelihood in countries like in Brazil and Germany while in countries like Tanzania and Taiwan farming families earned their whole income from tobacco crop (Giest, et al., 2009).

There is emerging small-scale literature that exposes tobacco industry's ruse with some recent farm level research. These studies unveil the alarming situation of small scale farmers' debt traps, losses and poverty (Chavez, et al., 2016; Goma, et al., 2016; Drope, et al., 2017; Makoka, et al., 2017 & Magati, et al., 2019). However, countering the narrative of the tobacco industry requires substantial empirical evidence on the role of tobacco across multiple countries. Country specific evidence can help enhance policymakers' ability to devise informed policies for effective tobacco control.

The current study is rigorous household level assessment of the role of tobacco in the livelihood of farming community in major tobacco producing districts of Pakistan. This is the first study utilizing extensive data collected from tobacco and non-tobacco farmers since the adoption of the FCTC. Specific objectives of the study are to determine the extent of diversification of livelihood outcomes of farmers and explore the role of diversification on willingness of tobacco farmers for decreasing tobacco cultivation. The study hypothesized that tobacco farmers have more diversified livelihood activities as compared to non-tobacco farmers. Furthermore, high diversification score for livelihood activities is positively associated with farmers' willingness to decrease tobacco cultivation. The study found that tobacco farmers earn more than 75 percent of the share of their livelihood from non-tobacco sources and farmers with higher diversification scores are more likely to decrease tobacco cultivation. Rest of the work is followed by literature review in section 2 and methodology is given in section 3. Results and discussion are presented in section 4, while conclusion and recommendations conclude the work in section 5.

2. Literature Review

Tobacco is produced in more than 120 countries, but the intensity of debate, especially increases with its role in terms of its contribution in the economy. For example in China and Malawi tobacco has significantly high role which makes them oppose to tobacco control legislation (Wang, 2006). Moreover, many developing countries have achieved higher efficiency more than at par with developed countries and provide a commanding position to tobacco industry in their policy making. The tobacco per acre yield in Pakistan is at par with the advanced countries in tobacco only, while it lags behind in other sectors. Similarly the record of Zimbabwean tobacco industry efficiency resembles the tobacco industry of developed world (Woelk, et al., 2001).

Over time more researchers started devoting their efforts to health consequences of tobacco, made it realized that tobacco has been associated with fatal diseases and the two edge role of tobacco has been changed to double menace both for health as well as economy (Makay & Crofton, 1996). Efforts for the control of tobacco gained momentum with the reports of US surgeon general which established the association of various detrimental health conditions with tobacco use. The enormous level of tangible and intangible cost made it recognized at the highest level that tobacco is the single greatest preventable cause of death & poverty and led the global community to respond to the catastrophe by adopting the world's first modern day public health treaty the WHO Framework Convention on Tobacco Control in 2003 (Huber, 2014).

WHO-FCTC aims to tackle some of the causes of the tobacco catastrophe including complex factors with cross border effects, such as trade liberalization and direct foreign investment, tobacco advertising, promotion and sponsorship beyond national borders and illicit trade in tobacco products. The WHO-FCTC articles on the demand side control measures like articles 6 to 14 call for various policy initiatives. Supply control related articles 15 is about eliminating illicit trade in tobacco products whereas, 16 and 17 call for the underage sale prohibition and provision of support for economically viable alternatives to farmers (WHO-FCTC, 2015). However, tobacco industry has been vigilant to protect their profitable business by invoking the interest of policy makers and farmers associations like International Tobacco Growers Association (ITGA). It has long claimed about the pivotal role of tobacco in the livelihood of farmers and policies leading to decline in domestic tobacco consumption will create livelihood crises for farmers (Lencucha et al., 2016).

To overcome the threat to sustainable development a global convention went in to effect in 2005 with the objective to reduce the health burden of tobacco induced diseases and also address the social, economic and environmental implications of tobacco crop (Giest, et al., 2009). To assess the claims of tobacco industry many studies have been conducted in different countries like Kenya, Malawi, Vietnam, Indonesia and Philippines, finding the opposite scenario to the tobacco industry long perpetuated high returning claims (Otanez, et al., 2009 ;Van-Minh, et al., 2009; Chavez, et al., 2016 & Makoka, et al., 2017).

Similarly, tobacco has been cultivating in Pakistan for the same reasons, its contribution in farmers livelihood and employment. Researchers have written on different aspects of tobacco like cost estimation, revenue generation, acreage response to price fluctuation (Qamar, et al., 2006 ; Ali, et al., 2014; Ali, et al., 2015; Ullah, et al., 2015 & Nasrullah, 2019). However, none of these studies has considered the health cost of tobacco farming and the context of the FCTC. The current study has tried to test the claim of tobacco industry that tobacco is the significant source of livelihood for farmers and also analyze whether implementation of article 17 of FCTC will help in controlling of tobacco leaf supply.

Theoretical framework

Rural households choose a number of income-generating activities based on their assets, status, knowledge, training, location and availability of various opportunities. The main motive behind choosing different activities is maximization of household income and raising the standard of living given a budget constraint. The constraint compels household to have tradeoffs and allocation of time and assets based on the best returns. A rural household may earn income from self-employment in agriculture, wage employment in agriculture, self-employment in non-agriculture and wage employment in non-agriculture. We can show that household income is sum of the income from all these mentioned employments activities.

$$Y = Y_1 + Y_2 + Y_3 + Y_4 \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where Y is total income from all activities, while Y_1 is income from self-employment in agriculture, Y_2 wage income from agriculture, Y_3 income from self-employment in non-agriculture and Y_4 is wage employment in non-agriculture sectors. Time allocated to different activities have an opportunity cost and here we take the wage rate, therefore we can write equation 1 as

$$Y = W_1L_1 + W_2L_2 + W_3L_3 + W_4L_4 \quad \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Subject to

$$L = L_1 + L_2 + L_3 + L_4 + \text{liesure} \quad \ldots\ldots\ldots\ldots\ldots\ldots (3)$$

Where

Y is value of total livelihood in terms of money and L is total time

W_1 and L_1 are wage rate and time allocated to self employment agriculture respectively,

W_2 and L_2 are wage rate and time allocated in wage employment in agriculture respectively

W_3 and L_3 are wage and time allocated to employment in own non-agri. sector respectively

W_4 and L_4 are wage and time allocated to wage employment in non agri. sector respectively and leisure is time spent on non-earning activities

Taking derivative on both sides of equation 2 with respect to X representing the endowments of households like land, education, location, family size, technology etc

$$\frac{dY}{dX} = \left[\frac{dW_1}{dX}L_1 + \frac{dW_2}{dX}L_2 + \frac{dW_3}{dX}L_3 + \frac{dW_4}{dX}L_4\right] + \left[\frac{dL_1}{dX}W_1 + \frac{dL_2}{dX}W_2 + \frac{dL_3}{dX}W_3 + \frac{dL_4}{dX}W_4\right] \ldots(4)$$

The term enclosed in the first bracket of equation 4 is called Welch's or Schultz's worker effect, which can be interpreted as the effect of asset endowments on marginal productivity of labor. The term in second bracket can be interpreted as Welch's or Schultz's worker effect that is the effect of assets endowments on the allocation of labor on both activities. The first part of equation 4 on right side can be called the marginal productivity of labor in different activities chosen while the second part represents the marginal productivity of choice of activities (Rahut et al., 2014).

Taking Y_1 as livelihood from self employment in agriculture, a multitude of diverse factors are involved in allocation of time and resources to different crops and other agricultural related activities for example prices of different commodities, fertility of land, land holding size, availability of labor, experience of productivities of different crops, market demand etc. We can show the income from self employed agriculture as

$$Yi = \sum PiQi \quad \ldots\ldots\ldots\ldots\ldots\ldots (5)$$

where

Y_i is income from agriculture sector of respective household

P_i represents prices of different crops and products produced and

Q_i shows quantity of different crops and products

However, only competitive prices which maximize the overall livelihood outcomes of farming community. If prices deviate from competitive pricing, farmers' livelihood is

jeopardized. Marketing system of developing countries reflect huge concentration of market power in the hands of a small bunch of buyers acting like monopsony and farmers are given less than competitive prices depending on the nature of commodity (Gibbon, 2004). Similarly, tobacco market is concentrated to few large tobacco companies who have established brands and business. Tobacco control laws discourage new entrant in tobacco leaf buying and farmers are at the mercy of big tobacco companies. The low prices due to monopsonistic behavior of big tobacco and tobacco control efforts discourage tobacco farming. Furthermore, households also view agriculture-based livelihood risky, and adopt a diversified strategy to raise their livelihood from various sources like crops diversification, livestock and non-farm activities. Already, agriculture sector in developing countries has high exposure to natural calamities and crop insurance is non-prevalent, therefore, farmers get involved in growing more crops as a strategy to diversify and sustain their minimum livelihood. In this way they learn to grow different crops and get expertise in cultivating them with the passage of time. Over time they acquire required skills and marketing know-how for different crops. They avoid adverse effects of one crop failure on their livelihood and overall wellbeing. When there is fall in the demand of one commodity, resources are distributed in next best alternatives to sustain livelihood and standard of living.

A high diversification score for livelihoods of farmers is likely to overcome the adverse effects of tobacco crop acreage reduction. Proper support for alternative livelihood sources in the form of market access and credit facilities is likely to help in switching from tobacco cultivation.

3. Data and Methodology

This study is based on cross-sectional data collected from three major tobacco producing districts: Swabi, Mardan and Charsadda of the Khyber Pakhtunkhwa province of Pakistan.

Taking into account the financial and time constraints, a sample of 330 farming households was selected and 322 farmers' data were used for analysis, since eight farmers reported incomplete data. Among the 322 farmers, 205 were tobacco growers, whereas, the remaining 117 did not grow tobacco crop and were therefore, labeled as the non-tobacco group. A stratified multistage random sampling technique was used to select the sample from the respective districts. In the first stage the three districts Swabi, Mardan, and Charsadda were selected based on their share of total production. In the second stage one tehsil (sub-district) was selected in each Charsadda and Mardan (i.e, Tangi and Takhtbhai, respectively) while two

tehsils, Chota Lahore, and Razzar were selected in the Swabi district on the basis of their share in total production. Among the districts, the sample was distributed proportionately based on the share of total tobacco production in each district. Charsadda and Mardan account for 15 and 25 percent, respectively, of Pakistan's total tobacco production (Nasrullah, et al., 2019).The sub samples collected from the Swabi, Mardan and Charsadda districts had 186, 86 and 50 farmers, respectively. Further, 5 villages were selected from each of these tehsils (sub-districts). We prepared separate lists of tobacco and non-tobacco farmers. From both categories i.e tobacco and non-tobacco farmers were selected randomly.

Data were collected through face to face interviews using a well-structured and pre-tested questionnaire to solicit the relevant information for addressing the study's objectives. The information was gathered by conducting one to one personal interview with the farmers at their farms/ residences. After collection of data from field, the data was entered in Microsoft Excel Spreadsheet whereas Stata-12 was used for statistical analysis. According to the objectives of our study we carried out descriptive as well as econometric analysis.

Tobacco Share in Farmers' Livelihood

To determine the role of tobacco in farmers' livelihood we estimated the share of tobacco income in total income of the households. We estimated profit and wage income while working on own tobacco farms. We added the profit and wage income of households to get total income of tobacco crop. We employed descriptive statistics like percentages to find the share of tobacco crop as below

$$shoTob_{inc} = Tob_{inc}/Total_{inc} * 100 \quad \ldots\ldots\ldots\ldots\ldots\ldots (6)$$

Where

$shoTob_{inc}$ is share of income earned from tobacco

Tob_{inc} Stands for total income earned from tobacco i.e net profit and share of labor income

$Total_{inc}$ Stands for total income of household from all sources

Similarly by the same equation we found the share of other crops income in the farmers' total income.

Livelihood diversification

Livelihood diversification is a strategy of households to construct a portfolio of different activities and social capabilities for their survival and improving their standard of wellbeing (Ellis, 1988). It can take place both by involving in multiple crops cultivation in agricultural

based livelihood or moving to non-farm-based earning opportunities. Though there are different measures and indicators used for measuring livelihood diversification like Simpson index, Herfindhal index, Ogive index, Entropy index, Modified entropy index, Composite entropy index (Shiayani & Pandya, 1998) but we employed Simpson index in our study. Reasons for using Simpson index was its computational simplicity, robustness and wider applicability (Khatun & Roy, 2012). Its value falls in the range of 0 and 1, where 0 means complete specialization and 1 reflects on highest diversification score. To estimate diversification index we identified sources of income of the households. These sources of income for farmers included livestock income, crops income, rent income, business income, salaries, remittances, wage income, poultry income and income from any other categories.

Livestock income was calculated by the quantity of dairy products produced, multiplied by their prices in the respective area and the value of animals sold in the whole year. Both products income and animals value were added to get livestock total income.

Crops income was calculated by multiplying the quantity of output of different crops and their market prices. We calculated total income of the households by aggregating their income from different sources on annual basis in Pakistani currency (rupee), mentioned below

$$T_Y = L.S_Y + \mathrm{Tob_Y} + \mathrm{Wh_Y} + \mathrm{Maiz_Y} + \mathrm{Sug_Y} + \mathrm{B.G_Y} + \mathrm{Pot_Y} + \mathrm{C.F_Y} + \mathrm{Tom_Y} + \mathrm{M.G_Y} + \mathrm{W.M_Y} + \mathrm{Okra_Y} + \mathrm{MM_Y} + \mathrm{Pea_Y} + \mathrm{CuC_Y} + \mathrm{Strb_Y} + \mathrm{GrF_Y} + \mathrm{Sal_Y} + \mathrm{Pen_Y} + \mathrm{Bus_Y} + \mathrm{Rmt_Y} + \mathrm{Wage_Y} + \mathrm{Othr_Y} \quad \ldots\ldots\ldots\ldots\ldots\ldots (7)$$

Where variable on the left hand side of equation shows total income of the household on annual basis and right hand side are incomes from livestock, tobacco, wheat, maize, sugarcane, bitter-gourd, potato, cauli-flower, melon-gourd, tomato, water-melon, okra, musk-melon, pea, cucumber, strawberry, grass & fodder, salary, pension, business profit, re,ittances, wage and others income on annual basis.

We divided the income from a source on the total income to determine the share of that source. Sources of income are mentioned in the equation 7.

$$\mathrm{sh_{Source_i}} = {}^{\mathrm{Source_i Tot_Y}}/_{\mathrm{T_Y}} \quad \ldots\ldots\ldots\ldots\ldots\ldots (8)$$

Where, $\mathrm{sh_{Source_i}}$ is share of income from i^{th} source, $\mathrm{Source_i Tot_Y}$ is total income from i^{th} source T_Y is total income of the respective household from all income sources

After determining share of individual sources, we took square of the individual share and added the squared terms.

$$PY_i^2 = shL.SY_i^2 + shTobY_i^2 + shWhY_i^2 + shMaizY_i^2 + shSugY_i^2 + shB.GY_i^2 + shPotY_i^2 + shC.FY_i^2 + shTomY_i^2 + shM.GY_i^2 + shW.MY_i^2 + shOkraY_i^2 + shMMY_i^2 + shPeaY_i^2 + shCucY_i^2 + shStrbY_i^2 + shGr.FY_i^2 + shSalY_i^2 + shPenY_i^2 + shBusY_i^2 + shRemY_i^2 + shWageY_i^2 + shOthrY_i^2 \ldots\ldots\ldots\ldots\ldots\ldots (9)$$

Simpson index can be calculated by the following equation

$$S.I_i = 1 - \sum_{i=1}^{N} P_i^2 \qquad \ldots\ldots\ldots\ldots\ldots\ldots (10)$$

Where , $S.I_i$ is Simpson diversification index of household, N is total number of livelihood sources and P_{+i}^2 is share of *i*-th source of income

We used t-test analysis to check the significance of difference in the diversification of livelihood sources of tobacco and non-tobacco farmers. We classified the farmers in both groups on the basis of livelihood scores into four categories. There were four categories i.e low category has less than 0.250 score, medium had score from 0.251 to 0.500, highly diversified category had score from 0.501 to 0.750, while farmers achieving scores higher than 0.750 were kept in very highly diversified farmers. The same categorization was used in estimating livelihood diversification in Bangladesh (Ahmed, et al., 2018).

Willingness to decrease in tobacco cultivation

Third objective of the study is to check willingness of the tobacco farmers to decrease tobacco cultivation. We hypothesized that diversification leads to convincing the farmers to decrease tobacco cultivation. We used probit regression model by taking willingness to decrease the tobacco cultivation as dependent variable and diversification index score(S.I) as independent variable, the other variables like age, average education level of household, tobacco farm size, family size, license status (dummy), infrastructure investment, rent rate of the land, tobacco price of the last year, awareness score about tobacco health hazards, tobacco health hazards treatment cost and tenancy of the farmers as controlled variables.

Model is given as below

$$Y_i = \alpha + \beta SI + \emptyset_1 age + \emptyset_2 edu + \emptyset_3 TFS + \emptyset_4 FS + \emptyset_5 LiS + \emptyset_6 II + \emptyset_7 RR + \emptyset_8 TP + \emptyset_{9AS} + \emptyset_{10} THC + \emptyset_{11} T + \varepsilon \qquad N\sim(0,1) \qquad \ldots\ldots\ldots\ldots\ldots\ldots (11)$$

Where

Y_i is dummy for willingness to decrease area under tobacco cultivation, 1 for willingness, 0 otherwise

SI is Sampson index and its value lies between 0 and 1. Construction of Sampson index is given in equations 3, 4, 5, and 6.

age is the age of farmers in years

edu is education level years.

TFS is the area under tobacco cultivation last year measured in jeribs which is equal to half of the acre

FS is the number of household members

LiS is dummy variable for License status, 1 if farmers has availed license (agreement), 0, otherwise

II is the investment on tobacco infrastructure like tobacco barn, goddown, veranda and any other shady place. It is measured in thousands rupees

RR is the rate of rent for land on per jerib basis, is measured in thousand rupees

TP is the price of last year tobacco, and measured in rupees per kilogram

AS is awareness score about disease like cancer, heart problem, respiratory problem, chest problem and any other diseases associated with tobacco. Maximum score can reach to 5 while the lowest is 0

THC is total hazards cost incurred on the treatment for health hazards faced while working in tobacco farms, it is measured in hundred rupees

T is dummy for the ownership of the farm, 1 for owner farmer, o otherwise

ε is error term and α is intercept term

4. Results and Discussion

This section describes the findings of the study and discusses them in light of theory and evidence from literature.

Sources of farmers' income

Farmers earn their income from different sources mainly farm, off-farm and non-farm. Farm income shares about 60 percent while off-farm contributes only 5.5 percent in total livelihoods of farmers. Disaggregating farm income, tobacco shares 15 percent, non-tobacco crops share 24.14 percent whereas, livestock shared 12.45 percent on average. Non-farm which is comprised of salaries, pension, remittances and business' profits collectively contributed 34.34 percent in total

income of the farming households. This analysis reflects the dominance of agriculture sector in livelihood of farming community. The behavior of farmers to rely on non-farm livelihood sources is in line with the behavior of farmers in rural Asia and other parts of the world. For example non-farm contributes 42 percent in Africa, 40 percent in Latin America, 50 percent in rural Mexican, Tijedo sector, 60 percent in Eastern Himalayan region of India and Cambodia whereas, the contribution of non-farm sector to rural employment in developing countries ranges from 20 to 50 percent (Lanjouw & Shariff, 2004; Micevska & Rahut, 2008, Rahut & Scharf, 2012b; & Islam, 1997). Income shares of different sources are presented in Table 1.

Table 1 Income share from different sources

Sources of income	Mean share	Standard Error	[95% C.I]	
Own agricultural share	0.6013	0.017	.5685118	.6341524
Non-tobacco crops	0.2414	0.015	.2114634	.271367
Tobacco crop	0.1505	0.012	.125527	.1754905
Livestock	0.1245	0.009	.1065562	.1424105
Off-farm wage	0.0553	.0079828	.039596	.0710066
Non-farm	0.3434	.0176149	.3087115	.3780218

Source: *Field survey, 2018-19*

Tobacco and non-tobacco farmers' income from different sources

Farming is a very vulnerable venture due to its exposure to natural and man-made calamities (Hay, 2007). Over time farmers have known about volatility of livelihood associated with farming, and many are no longer relying solely on it. Not only they have diversified their farming tasks through growing multiple crops, raising livestock, and cultivating orchards but they have also utilized non-farm activities for more stable livelihoods. The degree of involvement varies from farmer to farmer, depending on the labor requirement of different crops. Tobacco farmers mostly depend on farming work, and earn 64 percent of their livelihood from farming, whereas, non-tobacco farmers depend on farming for 54 percent of their livelihood. Non-tobacco crops contributed 18 and 35 percent shares to the income of tobacco and non-tobacco farmers respectively, while tobacco contributed 24 percent of tobacco farmers' livelihood earnings. Non-tobacco farmers earned a higher share, 39 percent from non-farm sources including jobs in public and private sectors, remittances, pension and business income, compared to the 32 percent share for tobacco farmers.

Tobacco farmers were mostly employed at and needed more for their own farms. They had less time to search for jobs in non-farm sectors or to work at the farms of others to earn wages. The prestige of being your own boss makes tobacco attractive for them, and they were used to staying at their own farms instead of searching for jobs and wages through employment in non-farm sectors in cities. However, over time the insufficiency of tobacco income to meet household needs compelled them to augment their families' income from non-farm sources. This analysis reflects that tobacco is not the sole source farmers rely on for their livelihood. The claim that tobacco control policy would adversely impact farmers' livelihoods, may not find strong support even in the present scenario. Farmers can easily compensate the lost income from tobacco by diverting resources like land and labor to other livelihood ventures. The role of different sources in farmers' livelihoods is presented in Table 2.

Table 2 Tobacco and non-tobacco farmers' income shares from different sources

Sources of income	Unit	Tobacco farmer	Non-tobacco farmer	Diff.	t-value
Own agricultural share	%age	.64 (0.02)	0.54 (0.03)	0.10* (0.03)	2.89 > 0.004
Non-tobacco crops	%age	0.18 (0.02)	0.35 (0.03)	-0.17* (0.03)	-5.71 > 0.00
Tobacco crop	%age	0.24 (0.02)	0 (0.00)	0.24* (0.02)	10.32 > .000
Livestock	%age	0.13 (0.01)	0.12 (0.02)	0.01* (0.02)	0.67 > 0.501
Off-farm wage	%age	0.05 (0.01)	0.07 (0.02)	-0.02* (0.02)	1.44 > 0.150
Non-farm	%age	0.32 (0.02)	0.39 (0.03)	-0.07* (0.04)	2.07 > 0.039
Figure in parenthesis are standard errors					

Source: Field survey, 2018-19

Tobacco and other crops' contribution in livelihood of farmers

Every household wants to ensure a secure livelihood and have diversified their livelihood generation activities. Acting on the adage of "*not keeping all eggs in same basket*" farmers have

adopted both farm and non-farm portfolios to earn their livelihoods. This study's survey revealed that tobacco contribution is 24 percent in the over-all livelihood of tobacco farmers whereas, on the basis of crops income only, tobacco shares 55 percent in farmers' livelihoods. Wheat, maize and sugarcane contributed 10, 6, 11 and 32, 15, 30 percent in the over-all and crop based livelihoods respectively. Tobacco competing crops like bitter-gourd, tomatoes, musk-melon, water-melon, okra and cucumber contributed 19, 52, 42, 12, 19, 26 percent, in total livelihoods whereas, in crop based livelihoods these crops shared 38, 24, 68, 14, 37 and 40 percent, respectively. Results are presented in the Table 3.

Table 3 Share of different crops in livelihood of farming community

Crop Name	Obs	Total income		Crops income	
		Mean	S.D	Mean	S.D
Tobacco	205	0.24	0.22	0.55	0.34
Wheat ©	288	0.10	0.12	0.32	0.28
Maize	264	0.06	0.09	0.15	0.19
Sugarcane ©	106	0.11	0.16	0.30	0.32
Bitter-gourd ©	15	0.19	0.16	0.38	0.23
Tomato ©	14	0.52	0.08	0.24	0.34
Melon-gourd	13	0.11	0.20	0.18	0.30
Cauli-flower	28	0.11	0.13	0.17	0.22
Muskmelon ©	14	0.42	0.28	0.68	0.15
Pea	29	0.02	0.07	0.03	0.15
Watermelon ©	21	0.12	0.18	0.14	0.26
Okra ©	12	0.19	0.14	0.37	0.15
Cucumber ©	11	0.26	0.15	0.40	0.22
Strawberry	9	0.04	0.08	0.15	0.28
Grass	21	0.10	0.14	0.21	0.27
© indicates a tobacco competing crop					

Source: *Field Survey, 2018-19*

Comparative analysis of the role of tobacco and other crops in farmers' livelihood

Farmers have different preferences and accordingly, decide which crops to be grown. This study data revealed that farmers diversify their livelihood by growing different crops as well as opt for

other non-farm activities to maximize and ensure their livelihood outcomes. Following section shows the results about the mean shares of different crops in the farmers' livelihood, differences of other crops with tobacco and significance of the difference in mean shares of tobacco and non-tobacco crops. It can be observed that tobacco share is significantly higher than wheat, maize, sugarcane, potato, cauli-flower, pea, water melon, grass & fodder and melon-gourd. Tobacco competing crops like muskmelon and tomatoes showed higher and significant shares in growers' livelihood than tobacco growers' livelihood and the differences were found to be significant at less than 1 % level of significance. These findings shed light on the scope for implementation of WHO-FCTC article 17 to protect the livelihood of farming community and labor in tobacco industry due to fall in tobacco leaf demand as a result of tobacco control measures. Results are presented in Table 4.

Table 4 Comparative analysis of tobacco and others crops share in farmers' livelihood

Non-Tobacco Crop	Tobacco share	Non-Tobacco Crop share	Difference	Standard Error	t-value
Wheat ©	0.24	0.10	0.14***	0.02	9.30
Maize	0.24	0.06	0.18***	0.01	12.75
Sugarcane ©	0.24	0.11	0.13***	0.02	5.51
Bitter-gourd©	0.24	0.19	0.05	0.06	0.94
Potato	0.24	-0.06	0.30***	0.05	5.97
Cauli-flower	0.24	0.11	0.13***	0.04	3.19
Musk-melon ©	0.24	0.42	-0.18***	0.06	-2.94
Pea	0.24	0.02	0.22***	0.04	5.25
Watermelon ©	0.24	0.12	0.12***	0.05	2.33
Okra ©	0.24	0.19	0.05	0.06	0.88
Cucumber ©	0.24	0.26	-0.02	0.07	-0.25
Strawberry	0.24	0.04	0.20***	0.07	2.76
Grass and fodder	0.24	0.10	0.14***	0.05	2.84
Melon-gourd	0.24	0.11	0.13***	0.06	2.14
Tomatoes ©	0.24	0.52	-0.28***	0.06	-3.26

* Indicates significance of difference between means
© Indicates the crop is a tobacco competing crop

Source: Field survey, 2018-19

Diversification of livelihood and tobacco farming

As mentioned above, many farmers no longer rely on a single source for their livelihood. They mitigate the effects of shocks like crop failure, poor market conditions, and natural disasters including hailstorms, floods, droughts and heat wave, by diversifying their livelihoods. Using the Simpson index of diversification scores for livelihoods of farmers, this study's survey data indicate that farmers on average fall in the highly diversified category of livelihood diversification. Furthermore, tobacco farmers' diversification scores exceed those of non-tobacco farmers. The average scores were found to be 0.734 and 0.669 for tobacco and non-tobacco farmers, respectively. The difference 0.064 was statistically significant. This analysis illustrates that tobacco control efforts will not hurt farming community as much as the tobacco industry claims. Diversification scores of tobacco and non-tobacco farmers are given in Table 5.

Table 5 Diversification scores analysis of tobacco and non-tobacco farmers

Group	Obs	Mean	Standard error	Standard deviation	[95% CI]
Tobacco farming	205	0.734	0.011	0.153	.7132747 .7554341
Non-tobacco farming	117	0.669	0.014	0.150	.6420057 .697038
Combined	322	0.711	0.008	0.155	.6938025 .7277919
Difference		0.064	0.018		.0301681 .0994969
Difference = mean(tobacco) – mean (non-tobacco) H_0 = difference =0 Pr(|T| > |t|) = 0.0003, t = 3.679					

Source: *Field survey, 2018-19*

Farmer type wise diversification categories

Average diversification scores provide an overall macro picture of the farming community, but further classification of farmers into different diversification categories will help to provide more details that can inform targeted action. Classification of farmers into different diversification categories further revealed that most tobacco farmers fall in the highly diversified category compared to non-tobacco farmers. Moreover, in the lowest diversification category the proportion of non-tobacco farmers (3.42 percent) was high compared to tobacco farmers (2.40 percent) of tobacco farmers. Similarly, in the medium and high diversification categories non-

tobacco farmers had higher proportions. However, in the very high diversification category the proportion of tobacco farmers was high at 20.50 percent against 9.40 percent of non-tobacco farmers. It can be inferred that tobacco farmers are prepared to switch to non-tobacco livelihood sources, and tobacco control efforts may expedite the process. A summary of the diversification categories are presented in Table 6.

Table 6 Diversification categories of farming groups

Category	Tobacco farming group		Non-tobacco group	
	Frequency	**Percentage**	**Frequency**	**Percentage**
Low (SID<=0.25)	5	2.40	4	3.42
Medium (0.25<SID<=0.50)	29	14.15	25	21.37
High (0.50< SID<=0.75)	129	62.63	77	65.81
Very High (SID > 0.75)	42	20.50	11	9.40

Source: *Field Survey, 2018-19*

Consent for decreasing tobacco cultivation

Tobacco control laws and changing cigarette manufacturing technology are likely to decrease tobacco leaf demand. This decrease in tobacco leaf demand will affect tobacco farmers in different ways. Realizing the livelihood aspect of tobacco farmers, the WHO-FCTC incorporated the development of alternative livelihood sources for farmers in article 17. Our model predicts that highly diversified farmers are more willing for decreasing tobacco leaf supply. The probability of consent is 0.301 at 10 percent level of significance. These findings support the theoretical foundation as farmers are used to other ventures of livelihood earning, and decreasing tobacco cultivation is not going to affect their livelihoods adversely.

Getting used to other high profitable crops cultivation is more likely to quit tobacco cultivation which the farmers themselves perceive to be highly hazardous for health (Beaglehole, et al., 2015). Among the other controlled factors, farmers' age is negatively associated with consent for decrease in tobacco cultivation. Increase in age of farmers by one year from mean age of 43.12 years is likely to increase the chances of non-consent by 10 percent at less than 1 % significance level. The reason may be the experience they have attained over the years in tobacco farming. Moreover, aged farmers find it difficult to experience new ventures like tomatoes, cucumber, muskmelon, bitter-gourd, and okra have shown significantly higher returns but due to their age

they are not taking the risk of new ventures as risk aversion increases with ageing (Deakin et al., 2004; & Altman, et al., 1998).

Education of the farmers also decreases the probability of decreasing tobacco cultivation. Raising the average education level from 10.74 years of schooling, by one year is likely to raise the chances of non-consent by about 7 percent at less than 10 % significant value. These findings are in similarity with findings for relationship of tobacco and education in Mansehra district (Ahmed, 2005). These findings are in contrast to the hypothesized relation. Reasons for the contrary role of education may be the self-maximization tendency, and ignoring public health issues associated with tobacco consumption. Findings about the role of age and education find support in literature (Altman, et al., 1998).

A rational farmer is likely to have contrary opinion in the presence of highly uncertain prices for the tobacco competing crops. Similarly, large family size and high prices for tobacco are associated with non-willingness for decreasing tobacco cultivation. These factors are significant at 1 and 5 percent. However, farmers having large tobacco farms are more likely to show consent for decreasing tobacco cultivation. These farmers mostly used hired labor and increase in the labor costs caused their profit from tobacco to shrink on one hand and the non-willingness of labor to work at the prevailing wage rate in tobacco farms due to associated health risks on the other. Moreover, these farmers were more aware of the tobacco control policies and more ability to exercise on other livelihood ventures. Also trying alternative crops were not likely to affect cost-effective size of tobacco farms.

Discussion with farmers revealed that 5 jeribs (2.5 acres) of tobacco can utilize the infrastructure constructed for tobacco curing effectively. Along with tobacco infrastructure, it enhances the effectiveness of labor use and fuel wood consumption to decrease the cost of production of tobacco. Both too small and too large farm sizes cause cost of production to rise as compared to economic size. Other covariates associated with convincing the farmers for tobacco decrease are awareness score about tobacco health hazards and cost of treatment for health issues faced during work in tobacco farms.

Similarly, family size and tobacco prices play the role for non-willingness to decrease tobacco cultivation. Tobacco is labor intensive crop and employs more household members of earning age. Large households are protected from the shambles of unemployment by cultivating tobacco. They earn wages from their own farm. The creation of 65 labor man-days employment is

significantly higher than any other traditional crops farmers are experienced in. Over time tobacco farmers have maintained large household size for tobacco cultivation (Kibwage, et al., 2009). Previous year prices for tobacco have negative association with decreasing supply of tobacco. Higher prices mean higher level of income for tobacco farmers and it will be irrational to decrease the high income generating ventures. Results about lag period prices are in compliance with the positive agricultural supply response function (Bond, 1983; & Leaver, 2004). effect of decrease in tobacco leaf supply may result in high prices of tobacco products. also applying taxes will further increase retail prices which will decrease tobacco consumption as tobacco products demand elasticity lie in the range of -0.2 to -0.5 depending on the age and exposure level of smokers (Chaloupka, et al., 2012). Details about marginal effects are presented in Table 7.

Table 7 Marginal effects of consent for decreases in tobacco supply

Variable	dy/dx	R.SE	Z	P >|z|	[95% Conf. Interval]	X
Simpson index	0.301*	0.174	1.73	0.084	-.040412 .641855	0.61
Age	-0.010***	0.003	-3.02	0.003	-.016474 -.003495	43.12
Education	-0.026*	0.015	-1.80	0.072	05554 .002354	10.74
Tobacco area	0.039***	0.011	3.47	0.001	.016892 .060855	7.42
Family size	-0.016***	0.006	-2.48	0.013	-.029264 -.00343	13.49
License status(Dummy)	-0.047	0.100	-0.47	0.641	-.24349 .15001	0.68
Infrastructure investment	-0.006*	0.003	-1.92	0.054	-.001222 .000011	206.40
Rent rate	-0.003	0.005	-0.59	0.555	-.014985 .008054	21.70
Tob. Price	-0.005**	0.002	-2.02	0.043	-.009741 -.000146	174.38
Awareness score	0.001	0.028	0.04	0.966	-.05428 .056727	1.68
Tob. hazard cost	0.017	0.011	1.54	0.125	-.004659 .038396	2.58
Tenancy (Dummy)	-0.013	0.078	-0.17	0.867	-.165226 .139145	0.32

y=Pr (consent)(predict) = 0.52

dy/dx is for discrete change of dummy variable from 0 to 1

* significance level at 10 percent, ** significance level at 5 percent,*** significance level at 1 percent

source: Field survey, 2018-19

5. Conclusion and Recommendations

This study concludes that farmers have highly diversified sources of livelihoods including farm, off-farm, and non-farm with average diversification score of 0.71.More interestingly, group-wise analysis shows that diversification scores of 0.73 for tobacco farmers are higher than 0.67 of non-tobacco farmers. Overall, farmers earn 65 percent of their livelihoods from farming while 35 percent is earned from non-farm sources. However, reliance of tobacco farmers on farm based livelihood is as high as 69 percent against 61 percent of non-tobacco farmers. Furthermore, in farm based livelihood, farmers rely on crops, livestock and wages earned by working in farms. Tobacco crop share 15 percent, non-tobacco crops share 24.14 percent whereas, livestock contributed 12.45 percent in total livelihood.

This study recommends for creating opportunities for diversification in the form of skill development by imparting technical skills, non-farm job opportunities, seeking access to labor demanding countries, public works programs employing labor from local community in general and farming community in particular, and providing incentives to alternative crops. The incentives for alternative crops could be in the form of research on development of less perishable commercial crops, cold storage facilities for horticultural produce to not let the prices down in case of more supply, training facilities to enable farmers grow high quality exporting crops, improving packaging technology to increase the shelf life of horticultural produce, quota based production in tobacco producing districts.

Moreover, farmers have infrastructure in the form of tobacco curing building structures which can be used for livestock farming, hence providing tobacco farmers with subsidized high quality and productive livestock conditional to quitting tobacco crop cultivation, can help in decreasing tobacco leaf supply, and sustaining farming livelihood capacity. Furthermore, establishing edible oil industry in tobacco producing districts can discourage tobacco cultivation as well as provide employment opportunity to local labors. The development of edible oil industry will also conserve foreign exchange reserves on the import of edible oil.

Similarly, promoting value addition for many agricultural commodities may help in addressing the livelihood issues, which may arise with discouraging tobacco cultivation. Finally convincing the farmers to decrease in quota by offering them higher prices to sustain their livelihood is likely to solve the issue of tobacco epidemic early.

Also intervention in the form of reducing pricing volatility for tobacco competing crops can provide incentives to shift to other crops and decrease tobacco leaf supply, used in tobacco products associated with health detriments.

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