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COMPETITIVENESS OF TOMATO PRODUCTION IN PUNJAB, PAKISTAN

Waqar Akhtar*, Muhammad Sharif**, Abdul Hayee Qureshi*, Khalid Mahmood Aujla*** and Muhammad Azeem Khan*

ABSTRACT:- The study measures competitiveness at farm level and economic efficiency at country level of tomato production in relation to tomato trade by using Policy Analysis Matrix (PAM) framework in Punjab, Pakistan. The province was divided into two tomato production regions i.e., Central and Southern Punjab for analysis purpose under importable scenario by using import parity price. Results of PAM model revealed that tomato production in both regions of Punjab has competitiveness under prevailing market situation as indicated by positive private profitability and private cost ratio (PCR) which is less than 1. Competitiveness difference in two regions indicated that Central Punjab has more competitiveness at farm level in tomato production. Economic efficiency results i.e. Domestic Resource Cost (DRC) ratio remained 0.39 and 0.51 in Central and Southern Punjab, respectively with positive social profitability indicating strong comparative advantage under importable scenario. The above results implied that Central Punjab has greater economic efficiency than Southern Punjab in domestic resources use for production of tomato as import substitute commodity. Results of Nominal Protection Coefficient (NPC) and Effective Protection Coefficient (EPC) indicated that combine effects of policies on output and tradable input market did not pass any protection to tomato farmers in the study area. Net effect of policy or market failure is reducing the profitability of tomato producers at farm level which indicates lack of motivation from policies for farmers to expand tomato production as import substitute crop. Present study recommended competitiveness and economic efficiency analysis in other tomato producing regions of the country for year round tomato supply on the basis of resource efficiency and to curtail tomato imports to save the precious foreign exchange. To enhance the competitiveness there is need to increase farmer's incentives through increase of farm level price up to import parity prices of tomato through efficient marketing. Technological improvement in production, marketing and value addition of tomato is also needed to address farm and market level issues of competitiveness.

Key Words: Tomato; Competitiveness; Economic Efficiency; Trade; Policy Analysis Matrix; Pakistan.

INTRODUCTION

In the global context horticultural sector has a major economic opportunity with an estimated global export market of US$ 150 billion (FAO, 2011). Due to growing population, rising consumer income and changing lifestyle throughout the world, Pakistan has a great potential for export of fruits, vegetables and condiments (GoP, 2011). Horticultural sector contributes about 12% in agricultural GDP of Pakistan and is

*Social Sciences Resach Institute, National Agricultural Research Centre, Park Road, Islamabad, Pakistan.
** Social Sciences Division, Pakistan Agricultural Research Council, Islamabad, Pakistan.
Corresponding author:viqars71@gmail.com

emerging as an important component of the sector (PHDEB, 2007). Pakistan's Punjab is the major producer of horticultural produce and has ability to harness the opportunity available to it.

Tomato (Solanum lycopersicum) in the world ranking remained second most important vegetable crop after potato. World tomato production was about 153 mt (FAO, 2011) while its production in Pakistan has shown an increase from 0.2 mt in 1990-91 to 0.6 mt 2008-09. Tomato also emerged as an important tradable commodity of Pakistan during the same period. Pakistan has been a regular importer of tomato since 1993 and also exporting small quantities of tomato every year. In 2008-09 tomato import share in fresh vegetable was 18% while in 2009-10 it was 26% (GoP, 2011).

Competitiveness analysis measures the ability of a farming system to earn profits at the market prices. It may be defined in term of private profitability under actual market conditions on one hand and economic efficiency refers the ability of a farming system to earn profit at efficient (social/economic) prices on the other. This reflects the absence of distorting policies and market failures and thus leads to the highest income for the country. Measuring competitiveness at farm level is one of the objectives of present study while measuring economic efficiency or comparative advantage at national level is another. In literature there are various concepts of competitiveness and also different indicators being used for measuring it (Frohberg and Hartmann, 1997).

Tomato production in Punjab is a commercial activity and a source of cash income for farmers in the study area. Tomato is grown in Punjab in rabi season; competes with wheat for area allocation. Increasing input costs and low and fluctuating output prices at harvest season leads to low profitability of horticultural produce. Need to understand, economic viability of the agricultural production of Pakistan especially horticulture is the potential candidate of this analysis. Such potential products in the short run are horticultural crops (Aujla et al., 2007).

In this context farmers need to find means of reducing costs, increasing returns and policy makers needs to find ways of increasing domestic resource use efficiency to save or earn foreign exchange through trade in this globalized world. Masters (2003) argued in this context and witnessed intense upgrading analysis and economic modeling in the recent decades.

Considering the importance of tomato commodity in Pakistan there is dire need to measure competitiveness at farm level by observing private profitability and economic efficiency at national level by observing social profitability or comparative advantage. Competitiveness and economic efficiency analysis in tomato production in Punjab, Pakistan may aid in deriving meaningful policy and research recommendations for tomato production system in Pakistan with special reference to strengthen the optimal allocation of scarce resources in tomato production.

Khan (1980) and Mohy-ud-Din (1991) argued that perishability nature of horticulture produce, fickle price behavior leads to great differences between farm level and consumer prices. This study was planned by considering Punjab's notable potential and ability in production of tomato as high value agricultural crop.

MATERIALS AND METHODS

The ambit of the present research is Pakistan's Punjab. Tomato is grown in almost all 36 districts of Punjab. However, Muzaffargarh in Southern Punjab and Gujranwala and Nankana Sahib in Central Punjab were the three major tomato growing districts in Punjab (GoP, 2011). These three districts were selected and divided into two region namely Southern and Central Punjab to capture regional dimensions for analysis purpose. Gujranwala and Nankana Sahib districts were selected from the Central Punjab and Muzaffar-garh district was selected from Southern Punjab. Pakistan is net importer of tomato during the analysis period hence import scenario was used for analysis at country level.Import scenario means the analysis of economic efficiency and protection coefficients were based on import parity price of tomato.

Policy Analysis Matrix (PAM) developed by Monke and Pearson (1989) was used as model of analysis (Table 1)PAM framework/model has been extensively used in policy analysis in the world including Pakistan (Turner and Golub, 1997; Appleyard, 1987; Krugman and Hatsopoulos, 1987; NAPC, Syria, 2011). Many studies have been utilized PAM to evaluate the comparative advantage and policy effects on different crops in Pakistan (Longmire and Debord, 1993; Anwar, 2004; Akhtar et al., 2007; Khan and Akhtar, 2006)

The PAM has been widely used to compute market driven profitability and social profitability i.e., competitiveness and comparative advantage of different crops for farming systems under different scenarios. On the basis of private and economic prices, different indicators in the PAM structural model were evaluated to see if tomato production systems in Punjab are competitive .PAM also used to know the efficiency of tomato production systems in Punjab Indicators like Private Cost Ratio (PCR) and Domestic Resource Cost (DRC) were constructed from average cost budget based on observed input-output and imputed shadow prices. DRC ratios are extensively used by number of researchers like Greenaway et al. (1994); Kannapiran and Fleming (1999); Warr (1994); Gittinger (1982) and Ward et al., (1991). To measure comparative advantage, Bruno (1972) brought DRC into common use. According to Bruno (1972) and Krueger (1966) minimizing the DRC leads to maximizing social profits in other words domestic costs are in excess of foreign exchange costs or savings, indicating that goods should be imported insteadof producing domestically. DRC presents the advantage of evaluating competitiveness without using data

Table 1. Policy Analysis Matrix (PAM) Framework

	Revenue			Profit
		Tradable	Domestic	
Private Prices	$A=pd_i$	$B=\sum_{j=1}^{n} a_{ij} pb_j$	$C=\sum_{j=n+1}^{n} a_{ij} pd_j$	D=A-(B+C)
Economic Prices	$E=pb_i$	$F=\sum_{j=1}^{n} a_{ij} pb_j$	$G=\sum_{j=n+1}^{n} a_{ij} ps_j$	H=E-(F+G)
Divergence	I=A-E	J=B-F	K=B-F	L= D-H

Source: Monke and Pearson (1989)

The D provides a measure of competitiveness through private profitability its defined as

Private profit (Competi-tiveness) D =A- (B+C)

The H measure of economic efficiency or comparative advantage through social profitability and defined as:

Social profit (Economic Efficiency) H =E- (F+G)

According to the Table 1 Divergence means transfers that can be measure as under:

Output transfer I =A-E
Input transfer J =B- F
Factor transfer K=C- G
Net policy transfer L= D- H

from other countries than the one considered (Siggel, 2006). Such budget based indicators remain widely used in policy debates and the choice of indicator is of considerable practical importance (Masters and Winter-Nelson, 1995).

PAM framework also provides some quantitative indicators for policy analysis. These measures analyze incentive and disincentive, protection, disprotection to agricultural production in any country resulting from state policies that affect agricultural input and output markets, trade and exchange rate policies, policies supporting or penalizing non-agricultural sectors compared to the agriculture sector. Nominal Protection Coefficient (NPC), Effective Protection Coefficient (EPC), Domestic Resource Cost (DRC) and Private Cost Ratio (PCR) are the indicators for policy analysis.

NPCO below 1 implies that domestic producers are not protected or producers have been implicitly taxed and vice versa. EPC is ratio between value added in producing a commodity at private prices and at social or economic prices. Its values greater than 1 suggests that government policies provide positive incentives to producers, while values less than 1 indicates that producers are dis-protected through policy interventions on value added. The economic efficiency in domestic resource use of a commodity system can be assessed by using DRC ratio, which indicates the opportunity cost of domestic resources employed per unit of value added in the production of commodity. A DRC ratio less than 1, then the system uses domestic resources efficiently and the economy saves foreign exchange by producing the good domestically either for export or for import substitution. If the DRC ratio is greater than 1, then the system shows inefficiency in domestic resource use and possesses a comparative disadvantage. PCR ratio used to evaluate competitiveness at farm level. PCR is the ratio of factor costs (C) to value added in private prices (A-B). The system is competitive if the PCR is less than 1. Under PAM framework the above mentioned ratios can be expressed as:

$$NPCO = \frac{pd_i}{pb_i} \quad (1)$$

$$NPCI = \frac{pd_j}{pb_j} \quad (2)$$

$$EPC = \frac{pd_i - \sum_{j-1}^{k} a_{ij}\, pd_j}{pb_i - \sum_{j-1}^{k} a_{ij}\, pb_j} \quad (3)$$

$$DRC = \frac{\sum_{j-k+1}^{n} a_{in} ps_n}{pbi - \sum_{j-1}^{k} a_{ij} pb_j} \quad (4)$$

$$PCR = \frac{\sum_{j-k+1}^{n} a_{in} pd_n}{pd_j - \sum_{j-1}^{k} a_{ij} pd_j} \quad (5)$$

where,

pd_i= Domestic prices of tomato realized by sampled farmers

pb_i= Economic prices (Import unit value) of tomato (adjusted for transportation, handling and marketing expenses etc. at farmer market level)for import parity price of tomato.

pd_j= Domestic price of the j^{th} tradable input (fuel, fertilizers, pesticides)

pb_j= Adjusted world reference price of jth tradable input (fuel, fertilizers, pesticides)

pd_n= Market prices of non-tradable inputs n,

ps_n= Shadow price of non-tradable input n

a_{ij} = Quantity of jth inputs required

to produce a unit of tomato

J= 1…k= Directly traded inputs plus the traded elements of non-traded inputs used in tomato production

N= k+1…n= Primary inputs plus non-traded elements of non-traded inputs obtained after decomposing the non-traded items into non-tradable.

RESULTS AND DISCUSSION

Based on primary and secondary data, two policy analysis matrixes were constructed on regional basis within Punjab province of Pakistan under importable scenario which presents summary budgeting information of outside and inside farm activities(Mohanty et al., 2002). Result showed that both regions of Punjab have competitiveness in tomato production. The competitiveness level was demonstrated by positive private profitability at farm level in the two regions of Punjab given current level of technologies, prices of inputs, output and current policy and market failure effects. Central Punjab has shown higher competitiveness as compared to Southern Punjab. These results are consistent with the findings of FAO (2004)which reported that tomato production systems have competitiveness at farm level in Syria. In Pakistan, Khan and Akhtar (2006) reported competitiveness of potato production at farm level in Northern Areas of Pakistan.

The present study also evaluated the economic efficiency of the tomato production systems in Punjab at regional basis. Economic efficiency is generally measured by social profits – the net change in national income that results from the introduction of the commodity system into the economy (Monke and Pearson, 1989). Economic efficiency results revealed that tomato production in Punjab was socially profitable and have resource use efficiency in the importable scenario. Central Punjab has higher efficiency than Southern Punjab by having higher social profit. The finding argued that expansion of tomato production at current level of technology, prices of inputs and outputs in the Punjab province has economic proposition and would be beneficial to the country as import substitute crop. In other words, the cost of domestic production is less than the cost of importing tomato meaning thereby that the Pakistan would be better off in producing tomato within the country rather than importing it.

A negative divergence between private and social profit implies that the net effect of policy intervention or market failure is to reduce profitability of tomato production at farm level. Quddus and Mustafa (2011) confirmed this situation and reported that distortions are present in factor and output markets hence economic profitability deviates from private profitability that in most developing countries. Removal of policy distortions would increase profitability at farm level which has incentives to expand tomato production as import substitute crop. On the other hand, the prevailing price structure discriminates against growing this crop as shown by negative transfers. A negative transfer in the total revenue column indicates that the producers are receiving less than the import parity price for the tomato. The value of output (revenues) transfer was negative for both regions. Considering the two cost columns i.e., tradable factor and domestic factor, a negative

transfer in the domestic factors represents a positive transfer to the producers of the commodity as this contributes to an increase in profit while a negative transfer in profit indicates output dis-protection that producers earning less than they would earn if distortion were not present in output market (Table 2).

Ratio Indicators under Importing

Table 2. Policy Analysis Matrix of tomato production in Punjab - Importable scenario

	Revenue	(Rs./acre) Cost		Profit
Indicators		Tradable factor	Domestic factor	
Southern Punjab				
Private prices	121560	36287	62381	22892
Economic	167361	38571	65985	62805
Divergence	-45801	-2283	-3604	-39913
Central Punjab				
Private prices	125973	29595	54267	42111
Economic	178110	32571	56688	88851
Divergence	-52138	-2977	-2421	-46740

Source: Authors analysis based on survey and secondary data

Scenario

Nominal Protection Coefficient (NPCO) was 0.73 in Southern Punjab and 0.71 in Central Punjab which revealed the existence of output transfer from farmers to the economy. Apparently, it stemmed from failures in domestic market of output and overvalued in official exchange rates; and farmers were dis-protected by the output market. Farmers received 72% and 71% of the import parity prices in Southern and Central Punjab, respectively. NPCI remained close to 1 but less than 1 indicating that farmers are receiving a little subsidy on tradable inputs. The Effective Protection Coefficient (EPC) ratios were 0.66 in Southern and Central Punjab which implies that transfers of output and tradable inputs were significant. Output transfer from farmers to the economy was higher than the input transfer from the economy to farmers (Table 3).

Table 3. Competitiveness and economic efficiency indicators of tomato in Punjab importable scenario

Parameter	Southern Punjab	Central Punjab
NPCO	0.73	0.71
EPC	0.66	0.66
DRC	0.51	0.39
NPCI	0.94	0.91
PCR	0.73	0.56

DRC ratios are less than 1 in Southern Punjab (0.51) and Central Punjab (0.39), that domestic production of tomato is efficient and internationally competitive under import substitution crop. DRC is thus an ex-ante measure of comparative advantage, used to evaluate projects and policies (Bruno, 1972).The result argued that producing tomato domestically was more efficient in the use of scarce resource in comparison with importing it. Low DRC ratio of Central Punjab indicated high level of resource use efficiency as compared to Southern Punjab in tomato production domestically against import (Table 3). The result demonstrated that the opportunity cost of using domestic resources is smaller than the net foreign exchange saved by substituting for imports of tomato. These measures also indicated that tomato commodity systems are likely to expand in the future as import substitute crop in the country. Competitiveness at farm level was

further validated by PCR indicator that remains below unity, depicting the ability of tomato production to create value for the growers. Central Punjab has maintained more competitiveness as compared to Southern Punjab by having low PCR value (Table 3).

CONCLUSION

Tomato is the Pakistan's traded commodity as it has been the net importer since 1993 along with regular exports of small quantities. Analysis revealed that tomato production has competitiveness at farm level with regional differences. Central Punjab has relatively higher resource use efficiency in tomato production as import substitution. Under importing scenario overall selected areas of Punjab province has economic efficiency in its production under prevailing technology and market situation. Positive social profit implies that domestic resources used in production were cost effective and expansion of production at current level of technology, prices of inputs and outputs has economic proposition. Itwould be beneficial to the Pakistan to promote tomato as import substitute crop in other parts of the country to ensure year round supply, curtail imports and save the precious foreign exchange. There is need to increase farmer's incentives through increase in farm level price up to import parity prices of tomato.To reap the benefit of domestic resources competitiveness and economic efficiency analysis is needed in other regions of the country as well for promotion of tomato production in the country. Tomato varietal development i.e. hybrid, capacity building of farmers and labour is necessary to increase the competitiveness of production system in the country. Improvements in the production technologies, marketing, processing and value addition are also required for fair returns to tomato growers.

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AUTHORSHIP AND CONTRIBUTION DECLARATION

S. No	Author Name	Contribution to the paper
1.	Mr.Waqar Akhtar	Conceived the idea, write abstract, introduction, methodology, analysis, result and discussion
2.	Dr. Muhammad Sharif	Conceived idea, overall interpretations
3.	Dr. A.H Qureshi	Finalize abstract and write-up
4.	Dr. Khalid Mehmood Aujla	Write up
5.	Dr. Muhammad Azeem Khan	Conceived creative idea on regional competitiveness analysis

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