

Production Efficiency Of The Selected Agro Industries In Punjab

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SECTION I

INTRODUCTION

Agro-industry is that subset of the manufacturing sector, which is engaged in processing raw materials and intermediate products derived from agriculture, fisheries and forestry (Hansen and Cranfield, 2009). Traditionally, the agriculture sector used to draw most of its inputs from the villages and the farms and apparently, agro industries were perceived to be the first level post-harvest processing of farm produce (Goyal, 1993). However, the agro industry forms a part of the broader concept of agribusiness today. It includes the suppliers of inputs to the agricultural, fisheries and forestry sectors, and distributors of food and non-food outputs from the agro-industry. FAO (1997) described the agro-industrial sector as that sector which includes manufacturers of food, beverages and tobacco, textiles and clothing, wood products and furniture, paper, paper products and printing, and rubber and rubber products. The Agro-industrial sector, with its strong forward and backward linkages, and its potential to generate employment opportunities, holds the key to the economic development of a country.

In India, the agro based industry is regarded as a sunrise sector, owing to its large potential for growth and likely socio-economic impact, specifically on employment and income generation. Estimates show that in developed countries, up to 14 percent of the total work force is engaged in the agro-processing sector directly or indirectly. However, in India, only about 3 percent of the workforce finds employment in this sector, revealing its underdeveloped state and vast untapped potential for employment (Kachru, www.agricoop.nic.in/Farm%20Mech.%20PDF/05024-06.pdf, 2006).

In 1960s, aiming to strive for food security, our policy makers' struggle culminated into a revolution called the “*Green Revolution*”. Green Revolution occurred due to the excessive outlay of subsidized input use and high procurement prices (Sarkar, 2011). As a result of the Green Revolution, Punjab turned out to be the food basket of the country. Punjab has made a significant contribution in agricultural production in the country since the Green Revolution. To make further headway in the economic front, it needs to concentrate on agro-based industries, as it enjoys the natural advantage of locally available inputs. Furthermore, the state has identified the agro-based industry as a thrust area in view of the fact that it has a potential for diversification and commercialization of agriculture. Moreover, it can also lead to value addition and export possibilities. Furthermore, many economists have advocated for the development of agro- based industries on a war footing¹. However, very little attention has been paid to the variations in efficiency within the agro- processing sector, although this question is significant in the formulation of development policies of the agro- based industry. The present study aims to evaluate the performance of various agro-industries in the state of Punjab in terms of their efficiency.

SECTION II

DATABASE AND METHODOLOGY

For this study, primary data for the year 2006 was collected with the help of a specially prepared questionnaire through the interview method. First of all, the researcher identified a group of industries that were dominating in Punjab for the year i.e. 1997-98 (based on NIC- 87)². Out of 20 dominating industries identified, 10 units were selected randomly out of the total units operating in each industrial group. Thus, the researcher had a sample of 200 units. However, despite the best efforts, the researcher could get data from 179 units spread all over the state. The primary data so collected was analyzed by applying various statistical tools like Multiple Correlation Coefficient, Cobb Douglas Model and Farrell's Efficiency Index.

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The study has been divided into four sections. The first section is introductory in nature. Database and methodology of the study is discussed in the second section. In section three, analyses of the collected data is carried out. Conclusion and policy recommendations follow in section four.

SECTION III

ANALYSIS AND INTERPRETATION

Size of an industry can be measured in terms of employment, invested capital, output or value added. The present study uses the value of output as the measure of size. In order to investigate the inter-industry differences in efficiency of the selected agro industries, the study focuses on the Farrell's index. The study uses gross value added per employee as the measure of labor productivity and the ratio of gross value added to investment in fixed assets as the measure of capital productivity. For each industry, relative productivity of labor and capital (say, in the i^{th} industry) were obtained by dividing productivity of labor and of capital in the i^{th} industry by those in 'all other industries' in the following manner.

$$RE^i = \left(\frac{LP^i}{LP^{A-i}} \right)^w \left(\frac{KP^i}{KP^{A-i}} \right)^r$$

where,

$$w = \frac{(w^i + w^{A-i})}{2}$$

$$r = \frac{(r^i + r^{A-i})}{2}$$

$$w + r = 1$$

..... (Farrell, 1957)

The relative efficiency index was computed as the weighted average of relative productivity of labor and of capital. Thus, where LP and KP denote productivity of labor and of capital respectively, subscript i refers to the i^{th} industry and superscript $A-i$ refers to all but the i^{th} industry. w and r are the income shares of labor and capital respectively. This measure of relative efficiency assumes that there are constant returns to scale ($w + r = 1$) and competitive equilibrium prevails in the market. The efficiency measure described above is based on the Cobb-Douglas production function. Using the logarithmic transformation, it can be written as :

$$\ln RE^i = w \ln \left(\frac{LP^i}{LP^{A-i}} \right) + r \ln \left(\frac{KP^i}{KP^{A-i}} \right)$$

The vintages of capital might vary widely across the industries, but while computing relative productivity of capital, taking average over all the industries except the one for which relative productivity is being calculated has taken care of the effect of extreme cases. Similarly, there could be wide variations of hours worked among the states, but even in this case, taking an average has reduced the effect of extreme cases sufficiently. The estimates of partial productivity, relative efficiency, and capital interests in the selected agro based industries of Punjab are shown in the Table 1.

RELATIVE LABOUR PRODUCTIVITY

It can be seen from the Table 1 that relative labour productivity in case of the manufacture of soft drinks industry was maximum (1.15) followed by knitting in mills (1.08), spinning, weaving and finishing of other textiles (1.03) and wool spinning and weaving other than in mills (1.02) industries. Other industries which were showing a high relative labour productivity included manufacture of leather footwear (1.00), pulp paper and paper board (1.00) and distilling, rectifying and blending of spirits (0.96). The industries which were relatively inefficient in terms of labour productivity were tanning, finishing and japanning of leather (0.61), sugar manufacturing and refining (0.75), other edible oils (0.80) and printing, dyeing and bleaching of synthetic textiles (0.80).

Table 1 : Estimates Of Partial Productivities, Relative Efficiency And Capital Intensity In The Selected Agro-Based Industries In Punjab					
Industry/Variable	Labour Productivity	Capital Productivity	Relative Labour Productivity	Relative Capital Productivity	Index of Relative Efficiency
Manufacture of Soft Drinks	7602.75	2.10	1.15	0.97	1.12
Cotton Ginning, Cleaning and Baling etc	347.88	0.79	0.89	0.39	0.35
Canning and Preservation of Fruits and Vegetables	396.68	0.23	0.91	0.12	0.11
Knitting in Mills.	4059.71	4.94	1.08	2.32	2.51
Malt Liquor and Malt.	918.26	0.56	0.96	0.29	0.28
Manufacture of Food Products n.e.c.	718.56	0.59	0.94	0.30	0.28
Hydrogenated Vanaspati Ghee etc.	760.58	0.85	0.93	0.43	0.40
Manufacture of Dairy Products	944.31	3.48	0.96	1.56	1.49
Pulp, Paper & Paper Board	1269.38	0.43	1.00	0.22	0.22
Manufacture of Leather Footwear	1233.46	20.60	1.00	13.89	13.84
Other Edible Oils	282.13	0.06	0.80	0.04	0.03
Printing, Dyeing and Bleaching of Synthetic Textiles	192.45	0.57	0.80	0.30	0.24
Grain Mill Products	254.93	1.44	0.82	0.69	0.57
Sugar Manufacturing and Refining	339.21	1.55	0.75	0.76	0.57
Tanning, Curing, Finishing, Japanning of Leather	156.50	0.20	0.61	0.15	0.09
Weaving of Cotton	626.57	0.84	0.93	0.42	0.38
Wool Spinning and Weaving (other than in Mills)	1536.67	0.17	1.02	0.09	0.10
Spinning, Weaving and Finishing of other Textiles	2005.46	1.14	1.03	0.54	0.56
Manufacture of Bakery Products	875.21	1.20	0.96	0.58	0.56
Distilling, Rectifying and Blending of Spirits	1131.72	1.43	0.99	0.68	0.67
Source: Primary Survey					

RELATIVE CAPITAL PRODUCTIVITY

As far as the capital productivity was concerned, the industry manufacturing leather footwear (13.89) showed the maximum capital productivity amongst all the agro-industries. It was followed with a rather large gap - by three industries namely - knitting in mills (2.32), manufacture of dairy products (1.56), and manufacture of soft drinks (0.97) industries. The Table 1 reveals that capital productivity in the leather industry was nearly six times more than the capital productivity in the knitting in mills industry. The industries where capital productivity was low were other edible oils (0.04), wool spinning and weaving other than in mills (0.09), canning and preservation of fruits and vegetables (0.12). Tanning, curing, finishing and japanning of leather (0.15), and pulp, paper and paperboard (0.22). The probable cause of low capital productivity in these industries was the use of old plant and machinery, which were not efficient.

RELATIVE EFFICIENCY

The industries which showed a high relative efficiency were manufacture of leather footwear (13.84), knitting in mills (2.51), manufacture of dairy products (1.49), and manufacture of soft drinks industry (1.12). Other industries, which showed a high relative efficiency were distilling, rectifying and blending of spirits (0.67), grain mill products, sugar manufacturing and refining (0.57 each), spinning, weaving and finishing of other textiles, and manufacture of bakery products (0.56 each). Further, the relative efficiency index of other edible oils (0.03), tanning, finishing and japanning of leather (0.09), wool spinning and weaving other than in mills (0.10) and canning and preservation of fruits and vegetables (0.11) industries was low. It reflects the fact that these industries were less efficient than other agro-based industries in the state.

ESTIMATES OF FRONTIER PRODUCTION FUNCTION

In order to estimate the economies of scale for the factors, Cobb Douglas production function was used.

$$Y = A K^{\alpha} L^{\beta} e^{\mu}$$

Where, Y is the output, L is the labour, K is the capital, μ is stochastic term. For the present analysis, the study made use of the Ordinary Least Squares (OLS) method because of its simplicity and big size of the sample.

Table 2 : Estimates Of The Cobb Douglas Production Function For The Selected Agro- Based Industries Of Punjab	
No. of observations = 179	Dependent variable: Log Output
Explanatory variable	Regression Coefficient
Constant	4.901 (0.706)
t-value	6.9419
Log (L)	0.517 (0.231)
t-value	2.2380
Log (K)	0.140 (0.139)
t-value	1.0071
Returns to scale	0.657
R ²	0.586
F	12.036
Standard errors of the estimates are shown in the parentheses. Y= Output; L = No. of workers; K = Invested capital.	

The estimates of α and β were obtained by regressing Log Y on log L and log K using a principle of OLS. Coefficient of determination between log Y and joint effects of log L and log K was also carried out to check the overall significance and hence, F - test was used. To test the significance of output elasticity of labour (α) and capital (β), t - test was used. The estimates of α and β obtained are presented in the Table 2.

The equation clearly indicates towards decreasing returns to scale in production, since the sum of α and β (0.657) turns out to be less than 1. Further, the elasticity of labour is observed to be higher than elasticity of capital input (0.517 Vs. 0.14). Furthermore, the elasticity of labour is highly significant, whereas elasticity of capital is found to be statistically insignificant. This clearly suggests that agro- based units in Punjab are adopting labour intensive techniques of production. Coefficient of determination was found to be significant at 5 percent level of significance, indicating that about 59 percent variation in output was explained by labour and capital taken together.

Thus, it indicates that a high degree of correlation exists between output and joint effect of labour, and capital invested. However, production is subjected to decreasing returns to scale in case of agro- based industries in Punjab. From the above discussion, it becomes clear that the agro- based industries that could become the nucleus of Punjab's agro industrialization policy include manufacture of dairy products, manufacture of soft drinks industry, knitting in mills, manufacture of leather footwear, distilling, rectifying and blending of spirits, spinning, weaving and finishing of other textiles, manufacture of bakery products, sugar manufacturing and refining and grain mill products.

SECTION IV

CONCLUSION AND POLICY RECOMMENDATIONS

Punjab has identified agro-based industry as a thrust area in view of the fact that it has a potential for diversification and commercialization of agriculture, besides employment generation. The results also indicate that a high degree of correlation exists between output and joint effect of labour, and capital invested, making it feasible to develop more agro based industries in the state. However, production is subjected to decreasing returns to scale in case of agro-based industries in Punjab. Core agro-based industries that could become the nucleus of Punjab's agro industrialization policy includes manufacture of dairy products, manufacture of soft drinks industry, knitting in mills, manufacture of

leather footwear, distilling, rectifying and blending of spirits, spinning, weaving and finishing of other textiles, manufacture of bakery products, sugar manufacturing and refining and grain mill products. Thus, the present study goes a long way in identifying a list of agro-based industries that could usher in an agro industrial revolution in Punjab.

The researcher figured out a set of policies and measures that will not only speed up the development of these industries, but also help them in acquiring the competitive edge in the national and international market. Such policy measures for agro-industries' development should form an integral part of the new industrial policy of the state, apart from creation of adequate and efficient infrastructural facilities, cheap quality power, maintenance of harmonious industrial relations and environment of peace and order in the state. Incentives and policy measures should be concentrated on the promotion of the priority list agro-processing industries, rather than being thinly spread over-all agro-based industries.

A vigorous programme of rural industrialization should be undertaken in order to create substantial job opportunities in agro-industries. Further, appropriate steps for developing relevant skills through vocational training should also be taken up. Functional industrial clusters in selected rural areas need to be established where all modern facilities such as banking, transport, quality power at affordable prices, telecommunication, health, education, etc. are made available. Government should establish quality improvement centres for different agro-based products. Small agro-processing firm operators should be given help and training in these centres to improve and standardize the quality of the product. This will also make these industries more competitive in the international market. So far, as the food-processing industries are concerned, there is no exclusive zone for food-processing in the state. Even the adequate cold storage facility is not available for these units. The researcher, therefore, recommends that necessary steps should be taken to set up food-processing zones in the state to assist the units engaged in food-processing, and also to enhance cold storage facilities.

Processed food products have shown a tremendous scope in India and abroad in the recent past. The target group of processed foods industry is the families having working couples and all those families which require convenience food at one point of time or the other. With this target group, we can say that the foreign countries possess a huge market for the processed foods and India is at an advantage as India is an agriculturally dominant country. Punjab Agro Export Corporation (PAEC) and Punjab State Industrial Exports Corporation (PSIEC) must be the nodal agencies so that the various export units export their produce through them. This way, these units will be saved of various problems hindering the exports. For further boosting the exports of processed items, there is a need to have international airports at Chandigarh and Ludhiana and freight subsidies for exports, etc.

Thus, a major effort is required from the government as well as the private sector to provide critical infrastructure in order to bring a new revolution in the state, which is agro-industrial centric in nature.

NOTES

¹ See Chadha (1999), Singh (1999), Shergill and Singh (2001), Kansra (2002), Sidhu (1999, 2002) and Singh (2004).

² The new National Industrial Classification 1998, which is pretty wide-ranging, at the 5 digit level, has not been found to be comparable with the NIC 1987. Moreover, the NIC 1998 has only 16 industries falling under the gamut of agro industries, whereas there were 45 industries in NIC 1987.

REFERENCES

1. Chadha, S. K. (1999), "Prospects of Agro Food Processed Industries", *Political Economy Journal of India*, Vol. 8, Nos. 3 and 4, pp. 124-131.
2. Chatterjee, A (1992), "Entrepreneurship development programme and self-employment", *Yojana*, Vol. 36, No. 16, pp. 12-15.
3. FAO (1997), *The State of Food and Agriculture 1997*, *FAO Agriculture Series*, No. 30, Rome.
4. Farrell, M. J. (1957), "The Measurement of Productive Efficiency", *Journal of the Royal Statistical Society, Series A*, Vol. 120, Part 3, pp. 253-290.
5. Fei, J. C. H. and G. Ranis (1961), "A Theory of Economic Development", *American Economic Review*, Vol. L1, No. 4, pp. 533-565.
6. Goldar, B.N. (1985), "Unit Size and Economic Efficiency in Small Scale Washing Soap Industry in India", *Artha Vijnana*, Vol. 27, No. 1, pp. 21-40.
7. Goyal, S. K. (1993), "Policies towards development of agro-industries in India" working paper no. WP1993/01, Institute for Studies in Industrial Development, September.
8. Hansen, S and Cranfield, J. (2009), "Building the political case for agro-industries and agribusiness in developing countries" in Da Silva

- Carlos A, Doyle Baker, Andrew Shepherd, Chakib Jenane and Sergio Miranda-da-Cruz (ed.) *Agro Industries for Development*, The Food and Agriculture Organization of the United Nations and The United Nations Industrial Development Organization Publications, Rome, p.10.
9. Kansra, S. L. (2002), "Looking Closely at the Various Segments of Modern Food Processing Industry in India", *Political Economy Journal of India*, Vol. 11, Nos. 1 and 2, pp. 15-21.
10. Sarkar, Anandita (2011), "Socio-economic implications of depleting groundwater resource in Punjab: a comparative analysis of different irrigation systems" *Economic and Political Weekly*, Vol. XLVI, No 7, February, pp. 59-66.
11. Shergill, H.S. and Gurmail Singh (2001), *Scope of Agro-Processing Industries in Punjab*, Institute for Development and Communication, Chandigarh, Ajanta Publishers.
12. Sidhu, H. S. (1996), "Development of Agro-Industries in an Agrarian Economy (A Case Study of Punjab)", *International Journal of Punjab Studies*, Vol. 3, No. 2, pp. 109-150.
13. Singh Navchetan (1999), *Agro - Based Industries in Punjab - A Comparative Study*, Unpublished M.Sc (Hons.) Dissertation, Punjab School of Economics, Guru Nanak Dev University, Amritsar.
14. Singh, Sant Surinder Pal (2004), *Linkages between Agriculture And Industry - A Case Study of Punjab*, Unpublished Ph.D. Thesis, Department of Economics, Punjabi University, Patiala.