An Economic Analysis of Production Industrial Co-operatives in Tamil Nadu: The Stochastic Production Function Model

** B. Gandhimathy*

Abstract

There are twenty types of Industrial Cooperatives (ICs) functioning all over Tamil Nadu under the category of Production ICs and Service ICs. They have been classified under different types of trades Tea ICs, Sago and Starch ICs, Match ICs, Leather ICs, Coal Coke ICs, Brick ICs, Metal ICs, Engineering ICs, Polythene ICs, Coir ICs, Auto ICs, Tailoring ICs, Estate ICs, Print ICs, Bank ICs, Labour ICs, Special ICs, and Handicrafts ICs. These societies use local resources as the raw material, employ local labourers including skilled, unskilled, and women labourers. The study examines the trend of industrial cooperative societies, the operational efficiency of the societies, and trade wise performance of the societies. The Input - Output relations were also analyzed. It was found from the analysis that societies will have a positive growth trend in the forthcoming years, but the reduction of workers in this sector indicates the reduction of employment opportunities in the sector. It was also found that the distribution of societies is more in the profit-making units than in the loss incurring and dormant units.

Keywords : **industrial cooperatives, trend and forecasting method, operational efficiency, per unit analysis, input-output relationship**
JEL Classification : C4, D7, L3

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Industrial cooperatives (ICs) are organized by the small-scale producers to compete successfully with the large-scale producers. These cooperatives are significant in the villages where they are run by the members of a family or by a group of individuals. The small scale manufacturers face difficulties such as lack of adequate finances and equipment, difficulty in procuring raw materials, and also in marketing of the produce. If the producers group together and form co-operative societies, such hurdles are by and large overcome. These societies purchase raw materials in bulk prices at reasonable rates and the products are disposed-off at reasonable prices.

Broadly, the activities of ICs are classified under production and service co-operatives, and covers a wide spectrum of economic activities (Ravichandran & Nakkiran, 2009). As of now, there are twenty types of ICs functioning all over Tamil Nadu under the category of Production ICs and Service ICs. They have been classified under different types of trades – Tea ICs, Sago and Starch ICs, Match ICs, Leather ICs, Coal Coke ICs, Brick ICs, Metal ICs, Engineering ICs, Polythene ICs, Coir ICs, Auto ICs, Tailoring ICs, Estate ICs, Print ICs, Bank ICs, Labour ICs, Special ICs, and Handicrafts ICs (Gandhimathy, 2013). These societies use the local resources as the raw material, employ local labourers, both skilled and unskilled, including women.

Review of Literature

Broadly, the structure of cooperatives in Tamil Nadu is classified into four categories such as agricultural credit, agricultural non-credit, non-agricultural credit, non-agricultural non-credit. To have an overall development in the co-operative sector, research is needed to explore all possible areas of co-operatives. Earlier studies concentrated only on the major sector of co-operatives such as agricultural credit and neglected the functional department of co-operatives leading to a partial development in cooperative research. For instance, studies by authors like Madan (2007), Singh (2009), Ravichandran and Nakkiran (2009), Sharma (2010), Arora (2010), and Rajendran (2011) are available to emphasize the significance of co-operatives.

Agarwal (2010) discussed that agricultural collectivities were of two types – production collectivities involving some form of joint cultivation and service collectivities for credit, inputs, and marketing. Production co-operatives

* *Guest Lecturer,* Department of Economics, Sri Sarada College for Women, Salem – 636 016, Tamil Nadu.
E-mail : drgandhibaliah02@gmail.com

largely failed, especially in the early period, while service co-operatives were relatively successful. A lot of literature is available to explore the significance and performance of co-operatives with particular reference to agriculture. However, only a few studies have thrown light on ICs. Anbarasan (2008) in his research problem stated that the present position of ICs indicates that because of lack of inherent strength and absence of self-help attitude, ICs have not been able to find their feet. Large numbers of ICs are dormant. Even out of active societies, most of them are in a loss. There is also no evidence of the societies giving any substantial advantage to their members.

The success story of the ICs was revealed by Ramana (2009) in his study on Gandhigram Agro-Industrial Co-operative Society Limited (GAICS). Due to the rubber dealer intermediaries, the rubber growers found it difficult to get a good remunerative price. Seeing the difficulties of the local people, Fr. Pazhempally (one of the Fathers of Churches in the Gandhigram area) brought the people together under the umbrella of co-operatives, which could give collective strength to challenge the rubber dealers and their exploitative dealings. Fr. Pazhempally drew a four stage strategy to lay the foundation of the Gandhigram Agro-Industrial Cooperative Society. In the first stage, the farmers were organized with primary level co-operatives on the basis of wards of the area, called rubber processing societies. In the second stage, the primary societies joined together to form a secondary co-operative which processes and markets the products. In the third stage, the rubber produce from the farmers is used to produce consumer products by the secondary co-operatives. The last stage was the establishment of its own distribution channels to market their products in different areas. The flow chart of operation of GAICS is Rubber Growers → Rubber Processing Services→ GAICO → Dealers → Industrial Customers. The GAICS has attributed its success mainly to the support of its members. The challenge for this journey is to face foreign entry and private sectors. The political intervention is another area.

Bhaskaran (2010) made a detailed study on the performance of ICs in Tamil Nadu by using the Data Envelopment Analysis of Charnels Cooper Rhodes (CCR) Model with the important variables like production, sales, wages, and employment. The findings suggested that the number of societies significantly increased, while on the other hand, employment of persons significantly came down. The financial parameters - production and sales turnover were improving, whereas the wages remained more or less the same. The study also revealed an important policy suggestion that micro, small, and medium industrial policies should be separated as the national level policy, and the policy interventions should be based on infrastructure support, direct capability, subsidy support, technical support, and information and marketing support. However, the study did not classify the trade wise performance of ICs. According to a policy note - 2010-11 on Micro, Small, and Medium Enterprises Department, the ICs have been organized with the twin objectives of social and economic upliftment of the people living below the poverty line in the State of Tamil Nadu. The most important social objective is to safeguard the interest of the poorest section against exploitative trends and to pave the way for dispersal of wealth and to provide gainful employment to the economically weaker sections, that is, rural artisans, workers, and labourers. These societies ensure remunerative prices for the production of small tea growers and tapioca cultivators (Palanisamy, 2011).

In addition, studies carried out by Bhaskaran (2010), Commissionerate of Industries and Commerce (2006), Anbarasan (2008), and Rajendran and Gandhimathy (2010) are available for ICs. However, an intensive study is needed to explore the performance of ICs. Hence, the present study was undertaken to fill this research gap.

Objectives of the Study

The objective of the study is to find the trend of industrial co-operative societies, examine the operational efficiency and trade wise performance of the societies. In addition, the input - output relations were also analyzed.

Methodology

The time series data was gathered from the Ministry of Industries and Commerce, Tamil Nadu for a period of one decade (2000-10) and appropriate statistical tools were used. In addition to this, the data were collected from the Statistical Abstract of Tamil Nadu and Tamil Nadu Statistical Hand Book. The variables selected for this study are societies, workers, sales, profit, government loan, bank loan, sundry debtors, and paid-up capital. Averages, compound annual growth rate (CAGR), trend and forecasting analysis, and stochastic production function were used for the analysis. Per unit analysis was found using the mean value.

Per Society Workers = Total Workers / No. of Societies;

Per Society Sales = Total Sales Value / No. of Societies;

CAGR is computed by the formula of CAGR = (Ending value/Starting value)$^{1/n-1}$ -1x100.

Trend analysis was used for finding the movement of societies and membership over time. Operational efficiency was analyzed with the help of Microsoft Excel 2007. The production function with stochastic model was constructed with selected independent variables by using SPSS Package (Version 15). The model was constructed as production is the function of a number of societies, number of workers, paid-up capital, bank loan, government loan, and sundry debtors. The present study focuses on production industrial cooperatives only and service ICs were not considered. As ICs is a State subject, it has State federations only, and data also pertains to the State level.

Analysis and Discussion

During the year 1959-60, there were 593 ICs and after fifty years of their growth (2009-10), the number of societies decreased to 363. In the earlier periods (during 1950s-60s), the ICs had obtained various aids from the Government - price and purchase preference, share capital loan, tax exemption, and government guarantees. By availing these aids, the ICs were flourishing during the 1950s, but later, the ICs slowly decreased in number due to withdrawal of these aids. The Commissionerate of Industries and Commerce (2006) quoted that the problems associated with the functioning of the ICs are transferring of societies to social welfare department, withdrawal of purchase/price preference by the government, refusal of government guarantees to financial institutions, discontinuance of government posts in the ICs, withdrawal of common label concession and excise duty to cottage and hand make match industries, and non-availability of financial assistance from the government to the industrial cooperative societies.

a) Trend and Forecasting Analysis of Industrial Cooperatives : The Table 1 shows the trend and forecasting analysis of the ICs.

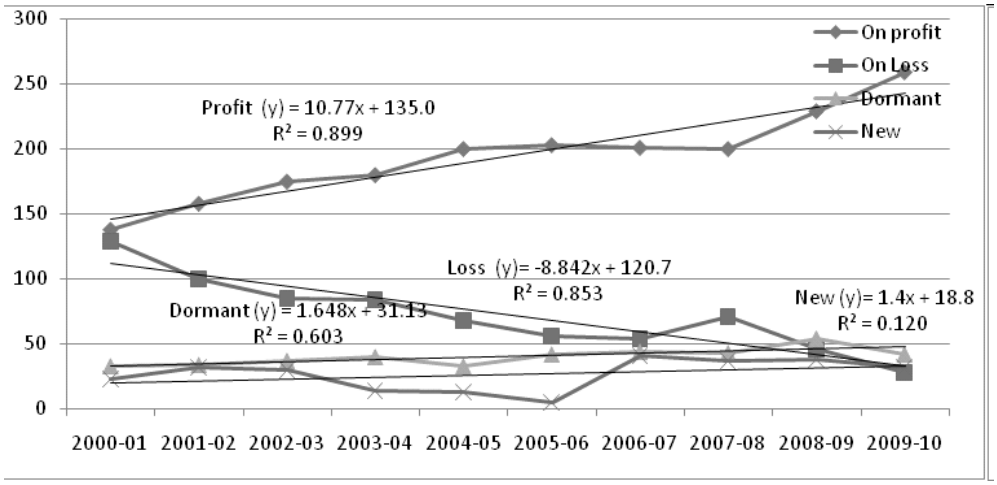
Table 1. Trend and Forecasting Analysis for Industrial Cooperatives in Tamil Nadu

Year	Societies	Trend	Oscillation	Trend in (%)
2000-01	323	310	-11	104
2001-02	324	316	-10	103
2002-03	327	321	-7102	
2003-04	318	326	-16	97
2004-05	314	331	-20	95
2005-06	306	337	-28	91
2006-07	340	342	699	
2007-08	361	347	27	104
2008-09	367	353	33	104
2009-10	361	358	27	101
Forecasting				
2014-15		**384**		
2019-20		**411**		
Mean		**334**		
SD		**21.84**		
CAGR		**1.24%**		

Source : Compiled by the Author

The Table 1 reveals the trend in industrial co-operatives in terms of societies and memberships. The societies increased from 310 to 358 during the study period of one decade (2000-10), which had a CAGR of 1.24%. The

Figure 1. Operational Efficiency of ICs in Tamil Nadu (from 2000-01 to 2009-10)
(Number of Societies in *Y* axis and Years in *X* axis)



Source : Compiled by the Author

average number of societies were 334. The forecast for the number of societies would be 384 and 411 for a period of 2014-15 and 2019-20 respectively.

b) Operational Efficiency : Operational efficiency of the industrial cooperatives can be found by the efficiency indicators - profit making units, loss incurring units, dormant units, and newly established units. The R^2 value

Table 2. Per Unit Analysis for Production Industrial Cooperatives in Tamil Nadu
(Workers in Number and Sales Value in Thousands)

Trade	Attributes	2000-01	2002-03	2004-05	2006-07	2008-09	2009-10	Average (2000-10)	CAGR (%)
Tea factories	Per society workers	6755	6403	6344	6399	5709	5658	6306	-0.75
	Per society sales	32024	27654	39115	44586	60309	716731	104496	13.89
Leather workers	Per society workers	11	7	49	7	6	6	12	0.59
	Per society sales	1419	3	969	314	299	185	479	-11.27
Brick	Per society workers	21	16	27	38	43	37	30	4.46
	Per society sales	655	589	790	1030	1726	1908	998	4.74
Metal	Per society workers	15	9	15	8	8	8	11	-3.26
	Per society sales	2188	1550	1476	1613	2084	1920	1610	-3.32
Engineering	Per society workers	32	30	28	7	10	12	18	-6.13
	Per society sales	1599	896	711	1061	1189	3526	1154	-3.53
Polythene	Per society workers	22	21	17	17	16	15	19	-1.37
	Per society sales	2552	21	2335	2687	1397	1826	1940	-2.97
Coir	Per society workers	28	24	21	21	18	19	21	-2.91
	Per society sales	1247	1368	1625	1340	1432	1624	1430	1.51
Tailoring	Per society workers	31	31	33	24	22	22	27	-1.55
	Per society sales	1013	580	886	820	1106	1323	905	-1.23
Handicrafts	Per society workers	21	21	18	17	19	16	19	-1.15
	Per society sales	1636	724	993	715	926	996	905	-6.31

Note: Per society average workers and sales value are calculated for a decade (from 2000-01 to 2009-10) and not for even years.

Source : Compiled by the Author

indicates statistical significance of the selection of the two variables. For all the categories, time is the independent variable. The results are exhibited in the Figure 1.

The total numbers of societies are distributed as profit making, loss incurring, dormant, and newly established. If the profit making societies and newly established societies are in the upward path and loss incurring, and dormant units are in the downward path, it is a healthy sign for the ICs. The results of the study show that profit making units increased by 10%. In case of loss incurring societies, there was a decrease in trend by 9%. The dormant cases increased by 1%, and the newly established units also increased by 1%. The regressed lines are fit at 89% in the case of profit making units. In the loss making units, it is fit at 85%, in case of dormant units, the regressed lines are fit at 60%, and for the newly established units, the regressed lines are fit at 12%.

c) Trade-wise Performance of Production ICs : Based upon the business activities, ICs are grouped under two categories as Production ICs and Service ICs. Tea Factories, Leather Workers, Brick Workers, Metal, Engineering, Polythene, Coir, Tailoring, and Handicrafts are the Production ICs. Tea Service, Sago, Leather Finishing, Match, Coal and Coke, Auto, Print, and Special are the Service ICs. Excluding Service ICs, the Production ICs were considered for the per unit analysis. The Table 2 shows per society workers and per society sales.

Trade wise results revealed that both - the workers and sales value was high in tea factories. Bricks and tailoring occupied the next two places. The CAGR of sales value (13.89%) was high in case of tea factories despite the reduction of employment opportunities (-0.75). Bricks societies alone had a positive growth rate in terms of both workers and sales (4.46% and 4.74% respectively). All other units had a negative growth rate for the study period from 2000- 2010.

d) Stochastic Production Function : The production function shows the relationship between input and output variable. The Model is constructed as the production (dependent and output variable) is the function of number of societies (X_1), workers (X_2), government loan (X_3), bank loan (X_4), sundry debtors (X_5), and paid up capital (X_6). Multiple regression analysis was used to infer the results. The Table 3 indicates the stochastic production function for ICs in Tamil Nadu.

↳ **Assumptions:** It is assumed that the higher the number of societies, the higher is the level of output; hence, more number of workers will increase the production; government and bank loans will be given for the purpose of production enhancements; sundry debtors are capitalized, and paid-up capital will improve the production. The results were drawn using SPSS. The Model is given by the use of two or more independent variables and the changes in one variable can be explained by changes in several other variables.

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 \ldots\ldots\ldots\ldots + \beta_n X_n + €$$

Where,
Y is the dependent variable,
β_0 = constant,
$\beta_1, \beta_2, \beta_3 \ldots\ldots\ldots\ldots + \beta_n$ are the regression co-efficients,
$X_1, X_2, X_3 \ldots\ldots\ldots\ldots X_n$ are the independent variables.
€ = error term.

Production = f (No of societies (X_1), Workers (X_2), Government Loan (X_3), Bank Loan (X_4), Sundry debtors (X_5), and Paid up capital (X_6)).
Production = -36621.24 +189.84 (Societies) - 0.15 (Workers) + 7.03 (government loan) +5.72 (Bank Loan) + 7.89 (paid up capital).

At the aggregate level (sum of all the Production ICs), production function with stochastic production model was used to draw the inferences. The R^2 value indicates the judicial selection of the independent variables, and it is 98%. Hence, the variable selection is highly fit to explain the dependent variable. The F value is significant at the 1% level of significance For every unit raise of the societies, the production increases at 189.89 units. As there is a direct relationship between the number of societies and production, increase in the number of societies raised the production considerably.

Table 3. Stochastic Production Function for ICs in Tamil Nadu

Multiple - Regression Analysis

Model Summary

Model	*R*	*R* Square	Adjusted *R* Square	Std. Error of the Estimate
1	.992(a)	.984	.952	480.94728

ANOVA(b)

Model		Sum of Squares	df	Mean Square	*F*	Sig.
1	Regression	42967160.811	6	7161193.469	30.959	.009(a)
	Residual	693930.867	3	231310.289		
	Total	**43661091.678**	**9**			

Coefficients(a)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-36621.248	9449.184		-3.876	.030
	societies	189.847	77.971	.462	2.435	.093
	workers	-.145	.081	-.387	-1.788	.172
	Govt_loan	7.031	2.974	.554	2.364	.099
	bank_loan	5.724	1.549	.481	3.695	.034
	sud_debt	5.786	1.168	.664	4.955	.016
	paidup	7.891	2.200	.590	3.586	.037

a Dependent Variable: Prod_n

Source : Compiled by the Author

The production and workers have an inverse relationship in ICs. The workers may be disguised laborers or they enroll their name into the society, but their marginal contribution is zero. Hence, it gives a negative association between workers and production to an extent of every unit raise of workers, the production decreases by 0.15 units. As the government loans are invested for further capital formation, for every unit increase of bank loan, the production increases by 7 units. Bank loan and sundry debtors also influence the production of industrial cooperatives. For every unit increase of bank loan and sundry debtors, the production increases by 5.72 and 5.78 units respectively. The members and government contribution are the two components of paid-up capital. It is very much needed for capital formation of the societies. For every unit increase of paid-up capital, the production increases by 7.9 units. Except workers, all other independent variables have a significant level ranging from 1-10%. The model also satisfies the *F* test as shown in ANOVA(b) of the Table 3.

Conclusion and Suggestions

ICs are of paramount importance in the rural areas as they employ rural unskilled labourers including women. This study explored the growth of industrial cooperatives in Tamil Nadu. It was found that the growth of the societies will witness a positive trend in the forthcoming years, but the reduction of workers indicates the reduction of employment opportunities in the sector. It was also observed that the distribution of societies is more in the profit making areas than in the loss incurring and dormant units. The Tea sector is one of the major sectors in the Production ICs. The pattern of paid-up capital and government loan are the important inputs which highly influence the production units.

In order to strengthen the ICs in the State, a number of societies - both Production and Service ICs need to increase in number. The notified sectors identified in this regard are Herbal Oil Extraction, Civil Engineers Contract Service, Goods Transporters Service, Industrial Laundry, Leaf-cup Making, Paper Bags and Napkins, Automobile Services,

Including Selling of Spares and Running Petrol Pumps, Auto-rickshaws, Cell Phone Servicing, Security Services, Electronics and Electronic Goods, Computer Hardware Servicing, Turmeric Manufacturers Services, Repairs and Servicing of Boats, Leather Goods Manufacturing Services, and Drumstick Powder Manufacturing Services. Diversified economic activities are essential for sustainable growth of the ICs.

Computerization in the co-operative sector is one of the important factors to develop the industrial sector. The government should support industrial cooperatives though their purchasing programmes. Regenerating and revitalizing the loss making and dormant societies is essential. Adequate financial assistance, marketing assistance, upgrading the technology, familiarizing them with modern equipments, and training will bring them back to life. The dormant and loss-making units should try and collaborate with large scale public sector organizations. The ICs should take lessons from the private sector, where it is possible to get back from dormancy and liquidity. Consolidation and viability of the societies are the need of the hour. For secular growth of the ICs, it is necessary to canvass about the intrinsic value of the co-operatives among the small scale producers.

For a long time, the operational efficiency of the ICs was neglected by the researchers and this study is a gateway to further explore the realm of ICs. In future, the researchers can conduct regression analysis to find the relation between production and another set of independent variables.

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