Vol XXI
No. 4

ISSN 0019-5014

CONFERENCE
NUMBER

OCTOBER-
DECEMBER
1966

INDIAN JOURNAL OF AGRICULTURAL ECONOMICS

INDIAN SOCIETY OF
AGRICULTURAL ECONOMICS,
BOMBAY

GROWTH AND LOCATION OF THE GROUNDNUT SOLVENT EXTRACTION INDUSTRY

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INTRODUCTION

Groundnut cultivation has become a major agricultural operation in India since the first half of this century and the crop occupied 5 per cent of the total area sown in 1963-64. Nearly 75 per cent of the total oilseeds production is accounted for by groundnut. The crop was to have primarily developed as an export commodity. The organization of the trade consequently took a pattern to meet exporters' requirements whose buying agencies at different centres played a vital role in its growth. But in recent years, groundnut as such is not exported. What is mostly exported is the products or by-products of processed or solvent extracted products of groundnuts. For example, in 1962-63, India exported groundnut products worth Rs. 40.8 crores. The value of groundnut kernels (HPS) sold during the same year was Rs. 2.2 crores, *i.e.*, 5.4 per cent. In 1965-66, the total value of groundnut products exported was Rs. 29.9 crores and the value of kernels exported was only Rs. 55 thousand (0.02 per cent). These figures not only indicate the increasing share of processed goods of groundnut exported but also indicate an increase in internal demand of groundnut and groundnut by-products and a consequent decrease in the total exported value of groundnut and groundnut by-products. However, the increased share in the export of processed groundnut products was possible mainly due to the tremendous increase in the growth of solvent extraction units during recent years.

The chief by-products of groundnut processing are (*i*) groundnut oil cake (expeller product), (*ii*) de-oiled cake (groundnut cake obtained after treating the groundnut oil cake in the process of solvent extraction) and (iii) groundnut oil (both edible and non-edible). The increasing internal demand for the first two by-products in a country like India, which possesses one-fifth of world's cattle population is most obvious. The present controversy over export of groundnut cake is centred round the issue whether meeting the needs of livestock industry which has such a lot of potential is more important, or earning equally important and very valuable foreign exchange by exports. It is in this context of scarcity[1] both in the world market and in the domestic market that the growth of solvent extraction industry is to be viewed. The objectives of this paper[2] are (*i*) to examine the pattern of growth of the solvent extraction units and its impact on groundnut

*I am grateful to Dr. D. K. Desai, Professor, Indian Institute of Management for suggesting this problem and for his valuable guidance and encouragement.

1. (*a*) In the world market, prices for expeller cake and de-fatted cake rose sharply by more than 75 per cent and 38 per cent respectively within a span of five years (1958-1963). (*b*) The increasing demand and the expected (projected) demand in 1975-76 for groundnut oil (National Council of Applied Economic Research study : Long-term Projections of Demand for and Supply of Agricultural Commodities) is roughly of the order of 100 per cent over 1960-61 figures.

2. This study forms a part of a research project on the "Export Promotion of De-oiled Groundnut Cake" being conducted by the Indian Institute of Management, Ahmedabad.

cultivation, (*ii*) to make an attempt to investigate the locational aspects of the industry (which to a large extent account for transport costs, resource mobilization and influence marketing strategies), and (*iii*) to examine the current position of capacity utilization in order to meaningfully project the future growth of the industry.

II

SOLVENT EXTRACTION TECHNIQUE

Oil cakes are obtained as by-products from the processing of groundnuts, cotton or other oilseeds. When oil is removed by using *ghanis*, rotary mills or expellers, oil cakes obtained still contain 5 to 12 per cent of oil. By solvent extraction process the oil in the cakes is extracted chemically with a solvent and the meals contain only 1.5 per cent or less of oil. Thus the solvent extraction process is adopted to reduce the oil content and other oil-bearing materials in the cake. Usually, the oil cake is treated with 'hexane' (the solvent), which dissolves the oil present in the cake. The solution containing oil and solvent is passed through condensers where the oil is distilled. At present oil is non-edible and is used mainly in the soap industry.

While solvent extracted meals or de-fatted meals have very little fat, their protein content is higher than the *ghani* or expeller-processed oil cakes and they are considered to be satisfactory as a feeding stuff for dairy cattle. Groundnut meal contains a minimum of 41 per cent of protein and ranks high in digestibility and feeding value. There are two types of processes which are in vogue in this industry, *viz.*, batch process and continuous process. In batch type process, the extraction is done in batches in extractors. In continuous process, the materials are continuously fed and the meal and oil are obtained continuously.

III

GROWTH OF SOLVENT EXTRACTION UNITS

The solvent extraction industry of India is of recent origin—only 20 years young. The first solvent extraction unit was started in 1946 in the Bhavnagar district of Gujarat State with an installed capacity of 80 tonnes per day (24 hours). According to a survey[3] conducted by the Oil Technological Research Institute, Anantapur, 70 per cent of the units in 1964 extracted oil from groundnut cake only and the rest extracted oil also from other materials such as rice bran, cotton seed cake, linseed cake, mohua cake, copra cake, etc.

Though the origin of the industry was in 1946, very little expansion is noticed till 1956. The growth of solvent extraction units is shown in Table I.

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3. There seems to be only two studies on solvent extraction industry in India, so far. One is conducted by the Oil Technological Research Institute in 1964, giving the cost estimates for two types of processing units besides the enumeration of units. The second study was conducted by the Indian Institute of Foreign Trade (1966) on 'Animal Feeds' wherein the organization, production and marketing of de-fatted groundnut meal has been studied.

TABLE I—GROWTH OF SOLVENT EXTRACTION UNITS

Year	No. of Units	Capacity in tonnes per day	Area under oilseeds (in thousand acres)
1946	1	80	N.A.
1947	1	80	N.A.
1948	2	230	N.A.
1949	2	230	9,832
1950	2	230	11,106
1951	3	230	12,106
1952	4	260	11,848
1953	5	320	10,495
1954	5	320	13,693
1955	6	345	12,685
1956	12	898	13,671
1957	12	898	15,865
1958	19	1,343	15,477
1959	24	1,713	15,919
1960	43	3,223	15,461
1961	53	3,852	15,869
1962	70	4,962	16,962
1963	80	5,602	16,814
1964	82	5,652	N.A.
Year of establishment not known	23	700	—
Total	105	6,359	

N. A.=Not available.

It is clear from the table that the rate of growth of the industry is very slow from 1946 to 1955. During this period only 6 units were established—two each in Maharashtra and Gujarat, and one each in Andhra Pradesh and Madras. The total installed capacity during this period was only 365 tonnes per day. In 1956 the number of units doubled. Following 1956, the installed capacity expanded very rapidly. The all-India linear rates of growth of installed capacity in the two periods of slow increase and rapid increase, *i.e.*, between 1946 to 1957 and 1958 to 1964 were respectively 62.6 tonnes and 801.6 tonnes per year. (The linear trend lines which are statistically good fits were $Y = -1.05 + 62.63\ X$ during the first period (1946-57) and $Y = 1358.15 + 801.57\ X$ during the second period (1958-64). Such a fast rate of growth in the second period could be attributed to (*a*) a tremendous increase in demand for de-fatted oil cake from foreign countries, particularly from Britain;[4] (*b*) a favourable licence policy for the export-oriented industries; and (*c*) a considerable rise in the area under oilseeds, particularly groundnut. Further, de-fatted oil cakes and non-edible oils being demanded increasingly, lead to an attractive margin for the industry. According to the annual survey of industries (1963)[5], the net value added per 100 tonnes

4. As evidenced by the statistics published in Ports of Gujarat, Annual Traffic Review, Government of Gujarat.
5. Unpublished statistics, Bureau of Economics and Statistics, Government of Gujarat.

capacity (per day) is estimated at Rs. 5.3 lakhs. The gross margin in 1963 per tonne of expeller cake (raw material) was Rs. 88.80 (as estimated from a sample of 7 units in Gujarat). This indicates a gross return of 26.2 per cent in 1963. Figures for earlier years are not available. The impact of this growth in the solvent extraction industry on the cultivation of groundnut has been salutary. As indicated in Table I, the expansion in the cultivation of groundnut kept pace with the increase in installed capacity.[6] While all the credit can be attributed solely to the extraction industry, it would be logical to assume that this export-oriented industry did have sufficient impact on the cultivation of groundnut. Groundnut prices also were covariant with the oil and cake prices, indicating the percolation of benefits even up to the farm level.

Statewise growth rates of the number and capacity of units have not been uniform. This leads to the question of locational differences in the industry.

IV

LOCATION OF THE UNITS AND THEIR INSTALLED CAPACITY

An agro-based industry is generally presumed to be supply-based. However, distribution or export-basis or other special features (co-operative movement, credit or power facilities, etc.) might shift the location away from the region of production to some extent.

The solvent extraction units are located in nine States of India which together grow about 98 per cent of the groundnut in the country. These States also cover about 94 per cent of the total oilseeds production.

TABLE II—STATEWISE DISTRIBUTION (1964) OF SOLVENT EXTRACTION UNITS

States	No. of units	Installed capacity per day	Total production of oilseeds (in thousand tonnes) (1961)	Ground-nut production (in thousand tonnes) (1961)	Annual installed capacity per thousand tonnes of oilseed production
Andhra Pradesh	13	190	561	484	45.0
Gujarat	23	1,830	1,160	1,095	57.6
Madras	8	280	1,032	988	9.9
Madhya Pradesh	8	290	536	297	19.7
Maharashtra	22	1,760	857	764	75.0
Mysore	9	467	456	423	37.4
Punjab	9	355	205	64	63.2
Uttar Pradesh	9	440	1,294	159	36.5
West Bengal	4	260	47	—	20.2
Total	105	6,372	6,148	4,274	37.8

Source : Central Organisation for Oil Industry and Trade, Bombay.
Note : Except in Maharashtra and West Bengal the installed capacity excludes one or two units.

6. The rank correlation coefficient between installed capacity and next year's area under groundnut was 0.88 (significant at 95 per cent confidence level).

Gujarat and Maharashtra alone cover more than 50 per cent of the total installed capacity. They are also the pioneer States in giving a start to solvent extraction industry in the second half of 1940's. Equally these two States cover about 42 per cent of the total groundnut production in India and about 32 per cent of total oilseed production. From Table II it is clear that the solvent extraction units in the country are located at, and according to, the oilseeds production at different States of India.

Basis of Location

While considering the State level aggregates, the industry was seen to be production-based. In order to examine this evidence at the micro level, the location of the solvent extraction units within a State should be studied. Gujarat has the highest concentration of units and also has the highest groundnut production. A brief analysis of the districtwise location of units in Gujarat is made here to examine the possibility of the units being more export-based than supply-based.

Out of the 23 units existing in the State, 20 are in the Saurashtra region. And out of the total installed capacity of 2,285[7] metric tonnes per day of 24 hours, as much as 2,175 tonnes is installed in the Saurashtra region. Again, it is only the four districts of Saurashtra that have all these 20 units. Their location is shown in Table III.

TABLE III

Districts	No. of units	Installed capacity in tonnes per day of 24 hours	Production of groundnut in 100 tonnes (1964)	Annual installed capacity per 100 tonnes of production
Bhavnagar	3	130*	1,247	38.1
Jamnagar	6	865	1,771	178.3
Junagadh	6	570	2,867	72.6
Rajkot	5	610	3,327	95.4
Amreli	—	—	2,333	—
Surendranagar	—	—	513	—
Kutch	—	—	277	—
Total	20	2,175†	12,335	—

*Capacity of 1 unit not available.

†This total differs from the figure of Table I, since it is the latest figure collected from the Directorate of Industries, Gujarat State, Ahmedabad.

7. Capacity of 1 unit not available.

By making a critical examination of the figures above, it is found that the location of the solvent extraction units in this region is generally more export-based than supply-based. It is possible to further substantiate this observation that though the distribution of solvent extraction units among the four districts looks fairly equal, the actual location of the units and the capacity located within the districts seem to be indicative of this particular pattern. That is, out of the 20 units and 2,175 tonnes of installed capacity, 11 units with 1,155 tonnes total installed capacity are very near to the sea (ports) around the region in the districts of Bhavnagar, Junagadh (at Veraval and Porbundar) and Jamnagar. Five units, though not 'very near' to the ports are located nearer to the sea. These five units occupy an installed capacity of 570 tonnes. Only four units in Rajkot seem to be a bit interior to the ports as compared to the other units. The annual installed capacity per 100 tonnes of production in Jamnagar is as high as 178.3, which is about four and a half times greater than Bhavnagar, two and a half times of Junagadh and nearly twice as high as Rajkot; and it is for export facility from the port Bedi. Apart from these, in the interior of Saurashtra there are no solvent extraction units established. The different location of solvent extraction units in Saurashtra may be classified as shown in Table IV.

TABLE IV—ACTUAL LOCATION OF SOLVENT EXTRACTION IN SAURASHTRA REGION

	Distance from the sea/ports	Location	No. of units	Installed capacity tonnes/day
I	Very near to the ports (0—6 miles)	Bhavnagar town	3	130 (only of two units)
		Veraval	1	100
		Porbundar	1	60
		Jamnagar town	6	—865
			11	1,155
II	Nearer to the ports (38—50 miles)	Junagadh town	2	225
		Manavadar	2	185
		Upleta	1	160
			5	570
III	Interior (55 miles and above)	Dhoraji	2	250
		Rajkot town	2	200
			4	450
	Total :		20	2,175

Secondly, a look into the production figures of groundnut for these four districts shows that Junagadh ranks first. But in respect of installed capacity, Jamnagar ranks first. The ranks of area and production of groundnut, number of expeller units and the installed capacity of the extraction units of the four districts are as shown in Table V.

TABLE V—RANKING OF DISTRICTS IN SAURASHTRA WITH RESPECT TO AREA AND PRODUCTION OF GROUNDNUT, EXPELLER UNITS AND INSTALLED CAPACITY

Districts	Extraction units installed capacity	No. of expeller units	Groundnut	
			Area	Production
Jamnagar	1	3	4	4
Rajkot	2	1	1	1
Junagadh	3	2	2	2
Bhavnagar	4	5	5	5
Amreli	6	4	3	3
Surendranagar	6	7	6	6
Kutch	6	6	7	7

The fact that the highest installed capacity is in Jamnagar, though the district ranks fourth both in respect of area under groundnut and its production, leads to the hypothesis that the location of solvent extraction units is not necessarily supply-based. Indication of supply is also measured by the number of expeller units in the district. Perhaps because of the same reason, as high as 67 per cent of Rajkot's installed capacity is located at its extreme south—touching to Junagadh and thus nearing towards the ports—instead of towards the eastern or the northern part of the district. The location of expellers, *i.e.*, groundnut crushing industry is obviously more supply-based than the export-oriented extraction industry.

The by-products of the industry, mainly de-fatted oil cake and groundnut oil, being mainly exported, it is natural that the units should be located near the exporting ports. Here the transport cost of the product to port-based units may come into picture. However, in this particular industry transportation difference in the bulk of either raw material handled or the by-products handled, is not much. A slight increase in the cost of transportation of raw material from the concentrated supply centres to the port-based units may be considerably negligible if one considers the advantages of their (the units) being nearer the ports. For example, the market situation, particularly the world market prices, which keep changing from country to country are so fluctuating that it needs a quick and bulk handling of goods with a very short notice. Such a handling seems to be more possible from the port-based units. The marketing manager in a port-based unit may be in a better position than his compeer in the interior, in knowing the position of day-to-day fluctuations of export market and thus to effect quickly and efficiently, the handling of the exporting goods.

However, we do not find solvent extraction units being established near all the ports of Saurashtra region. The important ports around which the solvent extraction units are concentrated are Bedi, Veraval, Bhavnagar and Porbundar. The reasons why the units are flocked around only a few ports—four (though Saurashtra region has as many as 26 ports out of 49 of the State's) are : other

ports are not (*a*) 'all-weather working ports,' (*b*) not considered 'foreign ports,' and (*c*) the coastal exports are all by sailing vessels and the foreign exports are all by steamers and particularly the oil cakes are exported only by steamers; and the steamers cannot be handled from the other ports. Out of the four ports—Bedi, Veraval, Bhavnagar and Porbundar—Bedi and Bhavnagar are 'all-weather working ports' and all the four ports are considered 'intermediate foreign ports.'

The foreign exchange earned by the four ports alone by exporting oil cakes in 1963-64 was Rs. 17.56 crores and in 1964-65 it was Rs. 20.05 crores. We also see that the port Bedi in the Jamnagar district alone handled about 60 per cent of the oil cake exported. It only speaks that the port Bedi is not only a 'foreign port' and a 'all-weather port' but also more capacious and convenient than the other three ports. Considering the districtwise and locationwise distribution, the highest installed capacity is located in the Jamnagar district—that too at a single location.

V

RECENT TRENDS IN CAPACITY UTILIZED AND ESTIMATED ECONOMIC CAPACITY

In the absence of a detailed utilization of the units established, it is difficult to assess the extent of utilization of the installed capacity. The total installed capacity in tonnes per day of 24 hours (or three shifts) in India is 6,372. That is, an annual capacity of 23,25,780 tonnes. All-India estimation of installed capacity used being difficult to assess, an attempt is made to know the capacity utilized in the Saurashtra region where data are available for a sample of seven units for the period 1962-65. These seven units in four districts are classified in three groups according to the size of the unit : units having a capacity of less than 100 tonnes per day, 100 tonnes per day and 200 tonnes per day. Thus, it was possible to find out the utilized capacity for (*a*) different size-group of units, (*b*) for different districts, (*c*) for different years and (*c*) a four-year average utilization of the installed capacity for all the size-groups of the units and for all the districts. The relevant data are given in Tables VI and VII.

TABLE VI—PERCENTAGE OF CAPACITY UTILIZED ACCORDING TO THE SIZE OF THE UNITS DURING 1962 TO 1965

Capacity	Percentage utilization of the total capacity				Weighted average
	1962	1963	1964	1965	
Less than 100 tonnes per day	—	—	—	68.32	68.32
100 tonnes per day	97.20	67.98	66.60	52.19	67.25
200 tonnes per day	88.55	76.07	70.86	55.45	69.27

(Sample data for seven units in Saurashtra.)

TABLE VII—PERCENTAGE OF CAPACITY UTILIZED : DISTRICTWISE, YEARWISE AND OVERALL SAMPLE

Districts	Percentage of installed capacity utilized				Weighted average
	1962	1963	1964	1965	
Bhavnagar	—	—	—	88.32	68.32
Jamnagar	94.49	79.38	70.59	50.22	70.32
Junagadh	—	42.84	49.13	50.40	77.51
Rajkot	87.99	71.55	70.60	64.52	72.48
Weighted average	84.49	70.09	67.89	54.54	68.10

Source : Directorate of Industries, Government of Gujarat.

It is clear from Tables VI and VII that in almost every case the percentage of capacity utilized has been continuously decreasing from 1962 to 1965. And, while there seems to be no difference between the size of the units and the percentage of capacity utilized, we do see a considerable difference in the percentage utilized between the districts. The percentage utilized in Junagadh was as high as 77.5, the next highest was Rajkot with 72.5 per cent utilization. And Jamnagar, which has the highest installed capacity, was third in the order here. The overall percentage utilization of the extraction units of all sizes, during the period 1962 to 1964 was 68.

In consequence of a continuous reduction in the percentage of installed capacity used there is also a continuous reduction in the margin of gross value earned per tonne by the extractors. In 1963, for every one tonne of oil cake treated the extractor earned a gross revenue of Rs. 88.80. It declined to Rs. 85.60 in 1964, and further to Rs. 55.90 in 1965. The margin worked out to 26.2 per cent in 1963, 18.7 per cent in 1964 and 11.5 per cent in 1965. The expansion of further capacity appeared to be coming to a standstill in 1963-64. The gross revenue per unit has been falling, under-utilization has been on the increase resulting in a drastic reduction in the rate of return for the industry. This could be true of the units in different States of the country, as well.

Estimated Economic Capacity

On the basis of the percentage utilization of the capacity in the Saurashtra region, an attempt is made to know the economic capacity needed for each State. For this purpose the Statewise production of oilseeds and groundnut (in the year 1961) is taken into consideration. The 'capacity' is estimated with two assumptions : (*a*) The maximum capacity needed if 80 per cent of groundnut production is available for crushing and all the expeller cake is available to the solvent extraction industry; and (*b*) Economic capacity if only 65 per cent utilization is there. In both cases it is assumed that a unit works for 300 days in a year and 10 per cent 'breakage time' for machinery is allowed. The installed capacity along with the production of total oilseeds and groundnut for different States is given in Table VIII.

TABLE VIII

States	Actual installed capacity (I) per day	Production of oilseeds (in thousand tons)	Maximum capacity (M) = Production × 80% × 60%* (tonnes per day)	Economic capacity (E) $\frac{(I \times 65\% \times 365)}{(300 \times 90\%)}$
Gujarat	1830	1160	1972	1608
Maharashtra	1760	851	1447	1547
Andhra Pradesh	690	561	954	606
Mysore	467	456	775	410
Uttar Pradesh	440	1294	2200	387
Punjab	355	205	349	312
Madhya Pradesh	290	536	911	255
Madras	280	1032	1754	246
West Bengal	260	47	80	228
Total	6372	6142	10442	5599

*The ratio of oilseed: expeller cake is taken to be 1: 0.6.

At present though there is under-utilization, obviously, in almost all the States except Maharashtra, Punjab and West Bengal there is scope for further utilization of the capacity installed. Future expansion of units could benefit by locations at Uttar Pradesh, Madras, Andhra Pradesh and Gujarat. However, in the current situation, expansion is hardly desirable.

Shortage of raw materials (expeller cake) seems to be the chief concern of the industry. Unless measures are taken (*i*) to prevent the wasteful use of expeller cakes as cattle feed and manure and (*ii*) to increase the productivity per acre of groundnut, long run stability and economic viability of the industry seem to be endangered. The domestic demand as well as the export possibilities are very high. This is an industry which can significantly aid the country's economy both through exports and through increased benefits to the agricultural sector.

SUMMARY AND CONCLUSIONS

During the past two decades, the export of groundnut and groundnut products increased significantly resulting in an expansion of groundnut cultivation and in the establishment of solvent extraction industry. The rate of growth was nominal from 1946 (when the first unit was established) to 1957. The next period (1958-64) saw a phenomenal increase both in the number of units and the capacity established. The direction of expansion was towards the establishment of new units rather than an increase in the capacity of the existing units.

Though generally speaking, the distribution of the installed capacity among different States is production-based, a detailed study of the Saurashtra region provides evidence for the export-oriented nature of the industry's location.

There is heavy under-utilization of capacity in the existing units. Even in the Saurashtra region, the heavily concentrated groundnut region, the extent of capacity used is only 65 per cent. Data for the past three years show a regressive trend in the capacity used, gross margin obtained, and the rate of return.

Shortage of raw materials is the chief hindrance to growth and even the economic viability of this industry. The solvent extraction industry as a foreign exchange earner can vitally help the economy of the country and thus play a significant role in the development of the agricultural sector.

LOCATION OF COTTON GINNING AND PRESSING INDUSTRY IN LUDHIANA DISTRICT

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The success or otherwise of an agro-industry depends, amongst other things, upon the strategy of its location. The location of such an industry, in turn, depends upon such factors as the easy availability of raw material in the feeding area, availability of quick transport, location of capital market, volume of business handled by the processing unit, cost structure of the firm and its net earnings.

The ginning and pressing industry in respect of cotton was located in the Ludhiana district without giving considerable thought to the factors that should govern such decisions. Consequently, this industry has already started showing signs of disintegration and some of the ginning factories, particularly those located in the Ludhiana market, have closed their gates. In other markets such as Raikot and Mullanpur, the locational disadvantage of this industry has resulted in a decline in its business. The present study was undertaken to examine the locational and other factors affecting the economy of cotton ginning and pressing industry in the Jagraon and Mullanpur markets.