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Labour Productivity Trends in Indian Manufacturing Sector

NPC RESEARCH SECTION*

The role of productivity data in the context of evolving techno-managerial and policy measures at enterprise, sectoral and national levels need hardly any emphasis. In the case of developed nations of Europe, USA and Japan such data are released at frequent intervals (quarterly for instance) by the macro level data channelising agencies. The productivity data released by organisations like Bureau of Labour Statistics (BLS) of the United States, Japan Productivity Centre (JPC), National Productivity Board (NPB) of Singapore etc., are some examples in this context. In India also sporadic studies were undertaken by organisations like Central Statistical Organisation (CSO), Labour Bureau, National Productivity Council etc. to arrive at a continuous time series on labour productivity in India. Of late such studies are characterised by long delays and inadequate coverage of input/output categories. The inadequacies could be attributed mainly to the difficulties in securing relevant detailed and timely data from the case source of information namely the Annual Survey of Industries (ASI).

The objective of the present paper is to revise and update the indices of labour productivity arrived at by an earlier study by the National Productivity Council.** It is attempted here to arrive at labour productivity indices upto 1984-85, the latest year for which disaggregated Detailed National Accounts Statistics from the Central Statistical Organisational and employment data from Labour Bureau sources are available.

Ideally, these labour productivity indices should have been supplemented with data on the productivity of associated inputs like capital, material, energy etc. However, this could not be achieved because of the lack of required data on these aspects from the sources mentioned.

Nature and Sources of Data

Output

The principal source of data for output (Net value added) in Indian manufacturing industries is the Annual Survey of Industries (ASI) which replaced the erstwhile Census of Manufacturing Industries (CMI) in 1959. The ASI was designed to obtain comprehensive data, on the functioning of the registered factory sector in India. The sector consists of all factories which employ 10 or more workers with power and 20 or more workers without the aid of power. The Survey is carried out under the statutory provisions of the Collection of Statistics Act (1953) in all the states and Union Territories of Indian Union except the state of Jammu and Kashmir. In the case of Jammu and Kashmir it is carried out under the provisions of

* Prepared by the Research Cell of NPC.

** Labour Productivity and Output Growth in Indian Mining and Manufacturing sector during 1951-76, (Productivity Supplement), 20(2), July-Sept. 1976, pp S1—S41.

the Jammu and Kashmir Collaboration of Statistics Act (1960).

For the purposes of the Survey, factories are divided into two categories, Census Sector and the Sample Sector. The Census Sector covers all factories which employ 50 or more workers with power and 100 or more workers without the aid of power. The Sample Sector covers all factories employing 10 to 49 workers with the aid of power and 20 to 99 workers without the aid of power. Factories in the Census Sector are enumerated completely while the factories under the Sample Sector are enumerated on the basis of a 50 per cent probability Sample. Electricity undertakings are included in the Census Sector irrespective of the number of workers they employ.

The data used in the present study related to the whole of the factory sector had been obtained by adding the aggregates of Census Sector to estimated totals of the Sample Sector. As for as temporal comparability of the data is concerned, it may be stated that there were differences in the quality of data overtime due to differences mainly on the coverage. This was more so upto the year 1958, the data for which were based on the Census of Manufacturing Industries (CMI). However, the estimates upto year 1958 underwent some revisions by the CSO to make the output series from 1951-52 to 1958-59 comparable with the post 1959-60 ASI series. The data used, here are taken from the *National Accounts Statistics (Disaggregated) Table of* the Central Statistical Organisation for various years.

From 1973-74, a new sector viz. Repair Services was introduced within the manufacturing industries. Repairs of household goods were included under respective manufacturing divisions prior to 1973-74. This is not expected to affect the temporal comparability of the series mainly due to the negligible share of repair services in the total manufacturing sector and its broad divisions.

The output, in this study, is measured in forms of net value added. Net value added is arrived at after deducting consumption of capital from the Gross Value Added. The Gross Value Added is arrived at after deducting all the intermediate inputs from the total gross value of output. The Net Value Added at constant price by the C.S.O. is arrived at by the method of single diflation, i.e. after deducting all the intermediary inputs at current price from the gross value of output at current prices, the value added net of consumption of capital is deflated by the respective industries' price indices. The indices of Net Value Added for different manufacturing industries are given in Appendix 1.1.

Labour Input

The labour data used here are from Labour Bureau sources. The Labour Bureau collects data on labour input on the basis of returns filed by the factories under the Factories Act 1948. The definition of a factory according to the Factories Act 1948 is the same as that had already been referred to in the case of output measurement.

However, output data available from the CSO sources and labour data available from Labour Bureau sources may not be strictly comparable due to variations in response ratios, particularly for those units in the category of 10-49 workers with power and 20-99 workers without power. The Labour Bureau data are not estimated based on a 50 per cent probability sample for this group. The data are based on the actual returns filed by the individual factories. For factories not submitting returns during any year the estimated figures of employment are, however, furnished by the concerned agencies from the following sources in order of their preference :

(i) recent factory inspection report.

(ii) previous years employment data.

(iii) employment figures indicated in the registration and grant for renewal of Licence.

The labour data from the source relate to "person employed directly or through agencies, whether for wages or not, in any manufacturing process or in cleaning any part of the machinery or premises used for a manufacturing process or any other kind of work incidental to or connected with the manufacturing process or the subject of manufacturing process". The

employment figures represent the average daily employment. The figures of average daily employment are furnished by each factory and then arrived at by averaging the total number of attendance (mandays worked) during a year by the total number of working days during a year. The measure of employment was based on the attendance and not on the physical number of persons on roll.

For purpose of productivity computations, some alternative concepts of labour input like manhours worked could have been a better measure. The ASI series provide data on manhours worked for different industries of the manufacturing sector. However, the manhours data for arriving at labour productivity could not be used because of the following reasons :

(i) The data on manhours worked available from ASI sources relate only to the workers and not to total employees. The data, thus, ignore the manhours worked by the non-worker categories of the employees.

(ii) The manhours worked data were not available from the CMI reports which formed the basic source of data during the period 1951-52 to 1958-59.

(ii) There are considerable delays between the collection of data by ASI and its release of detailed data for use by others. This also explains the reasons for relying on output data from the National Accounts sources and labour input data from Labour Bureau Sources.

Results

It is seen from Table 1 that the net value added over the year 1951-52 to 1984-85, showed an increase of 5.8 per cent compound whereas the employment increased at an annual compound rate of 3.1 per cent, thereby, showing an improvement in labour productivity at an annual compound growth rate of 2.7 per cent. The highest growth rate in labour productivity (6.0 per cent compound) for the total manufacturing sector is obtained during the period 1981-82 to 1984-85, whereas the net value added showed the highest improvement (8.3 per cent compound) during the period 1957-58 to 1962-63. This is because the employment shows a much lower increase (1.1 per cent compound) during 1981-82 to 1984-85 than in 1957-58 to 1962-63 (3.6 per cent compound).

It is observed from Table 2 that among the various industy groups, Machinery except electrical machinery showed the highest growth in labour productivity during the period 1951-52 – 1984-85 at an annual compound growth rate of (6.8 per cent) followed by Electrical Machinery (4.7 per cent compound). The only industry which showed a negative growth rate of labour productivity over the same period is Leather and Leather Products including footwear (2 per cent compound). Labour productivity was affected the worst during the period 1969-70 to 1974-75, when the output growth rate was only about 3.3 per cent against a labour input growth rate of 3.7 per cent.

TABLE 1

Compound Growth Rate of Total Manufacturing Industries

	1951-52 to '56-57	'57-58 to '62-63	'63-64 to '68-69	'69-70 to '74-75	'75-76 to '80-81	'81-82 to '84-85	'51-52 to '84-85
Net Value Added	7.5	8.3	4.5	3.3	4.9	7.2	5.8
Labour Inputs	3.7	3.6	1.6	3.7	4.3	1.1	3.1
Net Value Added per employee	4.2	4.5	2.7	−0.3	0.6	6.0	2.7

APPENDIX

Indices of Output in the Indian Manufacturing

(Values At

(Indices Base

Year	Food	Beverages & Tobacco	Textiles	Leather & Leather Products including Footwear	Wood & Wood Products including Furniture & Fixtures	Paper & Paper Products including Printing & Publishing	Rubber & Rubber Products including Products from Petroleum & Coal	Chemical & Chemical Products	Non-Metallic Mineral Products
	1	2	3	4	5	6	7	8	9
1951-52	40.61	34.20	71.50	104.25	17.75	26.97	12.60	19.65	20.73
1952-53	41.12	29.74	75.70	83.55	19.21	27.55	10.48	21.32	21.43
1953-54	39.23	29.90	79.74	90.52	16.95	28.60	12.57	22.52	23.24
1954-55	42.55	33.05	83.09	86.26	21.31	32.29	16.72	23.29	25.65
1955-56	47.20	37.16	85.23	93.81	28.68	35.31	24.99	26.00	28.30
1956-57	50.10	42.05	92.10	104.64	32.40	30.16	27.79	26.82	32.67
1957-58	55.30	45.37	91.25	106.77	33.24	40.49	30.46	27.10	38.54
1958-59	56.12	48.41	89.04	110.10	38.70	43.22	31.15	32.91	41.60
1959-60	59.15	51.05	89.61	129.01	48.65	48.28	35.57	35.07	47.41
1960-61	63.40	59.25	93.47	148.16	54.03	53.52	40.50	43.22	51.60
1961-62	67.87	63.90	96.05	158.60	58.32	57.55	43.83	48.67	54.70
1962-63	67.14	64.63	98.82	162.20	68.30	62.21	48.23	52.06	60.88
1963-64	71.01	64.73	104.08	169.24	78.17	70.09	54.15	58.65	67.11
1964-65	74.36	76.21	108.11	147.30	93.14	74.64	57.89	63.13	72.02
1965-66	79.55	87.69	103.32	157.06	111.33	79.19	63.10	65.52	74.93
1966-67	76.74	91.95	101.09	164.60	99.64	80.71	71.66	71.09	75.99
1967-68	73.20	85.93	102.36	153.77	103.96	84.09	78.11	77.77	79.28
1968-69	79.76	97.35	102.71	139.26	105.23	90.14	92.27	84.98	79.71
1969-70	92.45	98.05	101.02	108.51	106.69	97.43	96.07	91.79	92.79
1970-71	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
1971-72	81.58	107.70	98.29	85.97	105.49	89.19	106.31	117.86	99.80
1972-73	85.01	110.72	101.24	81.19	108.56	88.74	103.13	128.00	103.45
1973-74	76.37	80.57	130.52	66.90	87.52	101.93	89.78	131.23	302.34
1974-75	92.02	67.62	130.49	85.58	81.93	109.60	100.17	129.56	96.16
1975-76	99.24	90.83	128.18	52.08	76 66	106.75	103.54	125.85	103.99
1976-77	107.83	143.55	128.96	87.79	86.04	107.51	134.84	142.00	112.84
1977-78	135.37	106.32	136.57	92.04	91.44	111.78	152.84	162.40	133.13
1978-79	140.04	140.41	161.94	92.80	91.50	118.57	126.18	200.43	122.93
1979-80	124.80	123.37	171.25	92.21	96.38	117.39	135.45	190.14	121.72
1980-81	92.08	110.88	175.85	79.82	79.28	114.75	125.19	164.80	127.18
1981-82	123.93	117.24	161.69	97.17	78.83	128.81	118.02	200.02	137.85
1982-83	169.50	121.26	155.00	108.45	79.77	114.67	184.66	211.37	175.47
1983-84	163.40	114.59	158.26	124.73	84.32	113.07	203.68	227.23	164.94
1984-85	157.84	116.88	172.50	127.48	89.04	129.80	209.38	243.36	191.67

1.1

Sector (Net Value Added)

1970-71 Prices)

1970-71 = 100)

Basic Metal Industries	Metal Products Except Mechinery & Transport Equipment	Mechinery Except Electrical Machinery	Electrical Mechinery	Transport Equipment	Miscella-neous Industries	Electricity Gas & Water Supply	Total	Gross Value Added (at 1970-71 Prices) Total
10	11	12	13	14	15	16	17	18
23.10	31.81	5.94	6.66	38 93	19.45	14.31	30.56	28.93
23.18	30.40	4.24	7.51	28.25	16.65	15.33	30.49	29.07
22.81	37.86	5.62	7.94	32.07	17.42	16.74	31.95	30.44
26.03	50.05	8.68	9.21	45.09	22.46	18.01	35.53	33.90
26.33	56.36	10.93	11.63	65.56	27.17	19.93	39.74	37.95
27.44	56.66	14.60	15.87	83.93	26.56	21.14	43.88	42.13
28.89	50.62	15.23	17.81	85.64	25.60	24.71	45.48	43.94
31.84	48.42	17.41	19.59	73.03	27.21	26.77	46.18	44.95
41.16	63.96	19.28	21.67	79.67	29.87	31.56	50.48	49.10
51.22	80.10	27.49	27.71	82.36	37.86	34.96	55.98	54.87
59.27	93.54	33.58	31.31	101.09	42.53	40.59	61.76	60.95
73.61	95.78	43.27	36.75	113.91	64.79	45.24	67.77	68.92
84.25	101.68	57.19	42.33	123.66	72.49	54.91	75.09	75.24
85.96	106.99	75.72	50.39	146.30	74.53	60.47	81.77	82.28
88.56	98.85	80.49	56.74	151.07	65.47	66.98	84.25	84.87
93.12	93.05	87.99	64.82	129.52	75.12	71.60	85.53	86.68
88.18	94.36	89.81	67,73	117.22	80.64	77.79	86.54	88.26
99.17	89.30	103.75	78.79	121.28	98.35	86.07	93.75	95.98
103.57	99.67	116.84	91.16	124.23	109.12	92.71	100.19	100.79
100 00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
97.52	102.53	110.75	115.39	113.58	86.32	105.95	101.68	101.75
101.83	108.69	118.36	127.16	113.12	94.48	111.48	106.08	105.92
108.23	115.00	125.55	148.64	105.64	83.75	114.52	114.02	111.73
133.25	108.00	143.37	136.08	107.73	78.43	123.54	118.04	112 63
138.82	105.85	139.61	147.87	98.13	74 62	141.37	118.18	113.71
147.21	118.55	169.03	161.23	116.41	82.56	161.52	132.06	127.00
134.10	134 72	191.12	161.64	117.46	66.80	165.83	139.64	134.83
160.58	122.60	182.02	185.69	131.84	87.84	191 49	155.66	150.70
141.91	144.88	179.04	193.14	131.44	86.34	194.05	152.87	148.02
159.51	136.26	187.68	222.27	134.19	94.86	203.61	150.28	146.64
170.72	137.33	200.25	228.17	154.50	108.93	219.75	161.47	156.31
171.77	138.13	212.56	293.56	176.36	141.75	234.89	176.78	170.71
177.39	138.54	245.51	309.11	226.44	152.57	250.27	187.03	180.55
187.33	138.27	255.57	321.79	241.84	185.45	280.52	198.69	191.84

APPENDIX

Indices of Labour in the (Employment Base

Year	Food	Beverages & Tobacoo	Textile	Leather & Leather Products including Footwear	Wood & Wood Products including Furniture and Fixuture	Paper & Paper Products including Printing and Publishing	Rubber & Rubber Products including Products from Petroleum & Coal	Chemical & Chemical Products
	1	2	3	4	5	6	7	8
1951-52	64.74	108.63	89.59	48.38	35.23	51.70	38 29	36.58
1952-53	60.29	96.40	94.63	53.22	39.04	52.19	37.23	36,17
1953-54	58.37	102.15	93.35	56.45	35.23	48.78	36.17	36.38
1954-55	61 77	112.95	93.83	56.45	37.14	53.17	40.42	30.21
1955-56	63.05	114.38	94.23	54.83	40.00	54.63	42.55	41.46
1956-57	70.51	135.25	99.19	61.29	48.57	58.53	50.00	43.27
1957-58	72.14	134.53	98.55	62.90	51.42	60.97	50.00	43.03
1958-59	72.44	142.44	91.35	62.90	54.28	62.92	51.06	48.37
1959-60	76.29	133.81	94.95	62.90	62.85	67.80	54.25	53.25
1960-61	79-70	133.09	93.99	64.51	64.76	70.73	58.51	56.50
1961-62	82.51	130.93	96.55	70.96	65.71	73.65	60.63	50.35
1962-63	84.80	130.21	98.95	79.03	71.42	77.07	64.89	63.02
1963-64	86.07	133.09	101.84	98.38	82.85	80.00	70.21	71.54
1964-65	89.40	137.41	108.48	109.67	86.66	85.36	81.91	78.84
1965-66	91.25	128.05	104.80	111.29	92.38	87.80	85.10	80.08
1966-67	89.03	123.74	100.96	106.45	91.42	89.26	82.97	83.74
1967-68	88.88	130.93	101.28	100.00	93.33	91.21	84.04	86.17
1968-69	91.25	124.46	98.47	96.77	94.28	93.65	90.42	91.05
1969-70	94.66	111.51	96.95	98.38	90.47	95.61	95.74	96.74
1970-71	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
1971-72	100.14	105.03	112.97	93.54	93.33	101.46	114.89	100.35
1972-73	104.59	134.53	119.93	93.54	93.33	105.85	120.21	115.04
1973-74	109.77	141.00	120.09	91.93	98.09	107.31	126.59	117.48
1974-75	116.14	110.79	122.57	93.54	101.90	110.24	135.10	125.20
1975-76	120.44	110.79	122.17	114.51	100.00	111.70	134.04	134.14
1976-77	131.11	109.55	129.46	77.42	122.86	121.46	145.74	146.34
1977-78	136.15	120.14	130.18	77.42	120.95	122.44	151.06	168.70
1978-79	140.59	142.45	134.68	80.64	126.67	123.90	163.83	174.39
1979-80	144.74	156.83	138.59	85.48	133.33	133.17	175.53	179.67
1980-81	149.78	152.52	140.91	83.87	141.90	137.56	182.98	184.55
1981-82	155.11	120.86	142.35	37.10	148.57	166.54	189.37	195.12
1982-83	157.19	121.58	139.39	90.32	164.76	144.88	208.51	202.03
1983-84	157.19	135.25	141.63	111.29	166.67	143.41	207.45	196.75
1984-85	159.85	137.41	142.43	116.13	168.57	153.66	214.89	203.25

1.2

Indian Manufauturing Sector
1970-71 = 100)

Non-Metallic Mineral Products	Basic Metal Industries	Metal Products Except Machinery & Transport Equipment	Machinery Except Electrical Machinery	Electrical Machinery	Transport Equipment	Miscellaneous Industries	Electricity Gas & Water Supply	Total excluding 16
9	10	11	12	13	14	15	16	17
57.91	35.41	29.38	29.72	15.68	41.90	40.57	50.68	57.43
56.75	35.06	31.28	26.66	15.19	46.15	77.14	47.94	59.42
54.82	31.94	27.48	25.55	14.21	46.76	76.00	43.83	58.22
46.33	32.63	27.96	26.38	15.19	48.98	74.85	46.57	59.44
48.64	35.76	31.28	29.72	16.66	49.59	75.42	50.68	61.06
53.28	39.23	36.96	37.22	20.58	57.89	80.00	54.79	67.02
58.68	41.66	40.75	39.44	23.03	60.32	78.85	54.79	68.38
61.00	46.18	49.28	40.55	22.54	60.93	57.14	56.16	67.31
68.72	53.12	53.55	45.00	29.90	65.99	63.42	63.01	71.70
72.58	54.86	58.29	53.88	37.74	70.04	66.85	65.75	74.42
74.51	61.80	63.98	59.72	42.64	72.47	74.28	71.23	77.80
79.15	67.36	71.66	65.27	52.45	76.31	75.42	76.71	81.64
84.94	79.86	83.41	71.66	59.80	81.78	78.28	78.08	86.84
87.64	86.80	90.52	78.61	65.68	85.22	89.14	79.45	92.11
91.50	89 58	96.20	90.27	75.00	88.46	95.42	82.19	94.54
90.73	91.66	95.26	95.83	77.94	91.49	94.85	89.04	94.10
93.82	90.97	96.68	95.83	84.80	92.71	96.00	94.52	94.22
92.66	91.66	96.68	91.94	84.31	94.33	92.00	97.26	94.78
95.75	93.75	97.63	95.55	90.19	96.96	96.00	97.26	96.18
100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
105.01	112.84	87.67	102.77	102.94	61.13	32.00	98.63	98.49
107.72	121.87	91.46	105.27	110.29	61.94	32.57	86.30	103.86
113.51	125.69	92.41	110.00	115.68	65.78	34.85	89.04	111.98
115.83	131.94	95.26	116.38	118.13	57.81	35.42	91.78	115.11
115.05	138.88	92.41	114.16	122.54	71.86	34.28	119.17	117.10
123.94	148.96	99.52	118.89	127.94	78.34	81.71	124.65	126.52
123.94	147.57	101.42	131.39	127.94	79.35	90.29	131.51	130.28
128.18	155.21	107.58	131.39	135.29	80.57	93.71	128.78	135.14
132.82	165.97	114.69	136.11	145.10	81.78	97.70	135.62	140.52
140.54	170.14	118.48	138.61	151.96	87.65	100.57	145.21	144.88
145.94	180.21	123.70	143.61	155.88	90.69	102.86	150.68	151.91
162,55	192.36	130.81	148.33	160.78	93.93	104.00	160.27	152.45
174.90	197.92	129.86	143.61	160.78	91.30	105.71	164.38	154.24
182,24	195.49	132.70	145.28	165.69	91.30	106.86	168.49	156.84

APPENDIX

Indices of Net Value Added Per Employee in the Indian Manufacturing

Year	Food	Beverages & Tobacco	Textile	Leather & Leather Products Including Footwear	Wood & Wood Products including Furniture & Fixtures	Paper & Paper Product s includ ing Printing & Publishing	Rubber & Rubber Products including Products from Petroleum & Coal	Chemical & Chemical Products	Non-Meta-llic Mineral Products
	1	2	3	4	5	6	7	8	9
1951-52	62.73	31.49	79.81	215.46	50.37	52.16	32.90	53.71	35.80
1952-53	68.20	30.85	79.99	156.99	49.21	52.80	28.15	58.94	37.77
1953-54	67.21	29 27	85.41	160.35	48.12	58.63	34.76	61.55	42.29
1954-55	68.88	29.26	88.54	152.81	57.38	60.72	41.36	60.97	54.94
1955-56	73.93	32.49	90.45	177.06	71.71	64.64	58.72	62.70	58.36
1956-57	71.16	31.68	92.92	170.73	66.88	65.20	55.59	63.44	61.33
1957-58	76.76	30.73	95.59	169.73	64.63	66.40	60.92	62.90	65.68
1958-59	77.47	33.99	97.47	187.87	71.45	68.69	61.01	68.03	68.20
1959-60	77.53	38.74	94.37	205.09	77.40	71.20	65.56	73.56	68.99
1960-61	79.65	44.52	99.44	229.65	84.66	75.67	69.23	76.50	71.08
1961-62	82.25	48.81	100.31	223.49	88.74	78.13	72.28	82.02	73.41
1962-63	79.10	49.63	99.86	205.33	95.62	80.72	74.32	81.58	76.92
1963-64	82.50	48.64	102.20	172.02	94.34	87.62	77.13	81.99	79.01
1964-65	83.10	55.46	101.52	134.38	107.47	87.43	70.67	80.89	82.17
1965-66	87.16	68.48	98.59	141.12	120.51	90.19	74.25	81.81	81.88
1966-67	86.19	74.81	100.13	154.62	108.98	90.41	86.36	84.90	83.75
1967-68	82.44	65.63	101.07	158.77	111.38	92.18	92.95	90.24	84.50
1968-69	87.40	78.22	104.30	143.90	111.60	96.24	102.04	93.32	86.02
1969-70	97.66	87.93	104.19	110.28	117.92	101.91	100.34	94.87	96.90
1970-71	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
1971-72	81.46	102.54	87.00	91.47	113.03	87.90	92.53	107.78	94.26
1072-73	81.28	82.30	84.41	86.79	116.32	83.83	85.79	111.26	96.04
1973-74	69.57	57.10	107.27	72.57	90.44	93.86	70.92	111.70	90.16
1974-75	79.23	61.02	105.08	91.47	81.09	98.77	74.15	103.48	83.71
1975-76	82.40	81.85	102.39	44.86	77.69	91.61	77.25	93.82	90.39
1976-77	82.24	131.27	99.61	113.39	70.03	88.51	95.52	97.03	91.04
1977-78	99.43	88.50	104.91	118.89	75.60	91.29	101.18	96.26	107.41
1978-79	99.61	98.57	120.25	115.08	72.23	95.70	77.02	114.93	95.90
1979-80	85.22	78.66	123.57	107.87	72.29	88.15	77.19	105.83	91.64
1980-81	61.48	72.70	124.80	95.17	55.87	83.42	68.42	89.30	91.06
1981-82	79.90	97.00	113.59	111.56	53.06	77.44	62.32	102.51	94.46
1982-83	107.83	99.74	111.20	120.07	48.42	79.15	88.56	104.62	107.95
1983-84	103.95	84.72	111.74	112.08	50.59	78.84	98.18	115.49	94.31
1984-85	98.74	85.06	121.11	109.78	52.82	84.47	97.44	119.73	105.17

1.3

(At 1970-71 Prices)
Sector, Base 1970-71 = 100

Basic Metal Industries	Metal Products Except Mechinery & Transport	Mechinery Except Electrical Mechinery	Electrical Mechinery	Transport Equipment	Miscella neous Industries	Electricity Gas & Water Supply	Total (Net Value) Added Per Employee at 1970-71 prices)	Indices of Gross Value added (at 1970-71 Prices) per Employee
10	11	12	13	14	15	16	17	18
65.24	108.28	20.01	42.46	92.92	47.96	28.24	53.21	50.47
66.12	97.19	15.93	49.46	61.22	21.59	31.97	51.31	48.92
71.43	137.73	22.00	55.86	68.58	22.92	38.18	54.88	52.28
79.75	179.00	32.89	60.64	92.04	30.01	38.36	59.77	57.03
73.62	180.21	36.79	69.83	132.20	36.02	39.33	65.08	62.15
69.94	153.29	39.23	77.11	114.98	33.19	38.58	65.47	62.86
69.35	124.21	38.61	77.31	141.96	32.46	45.11	66.51	64.26
68.96	98.23	42.94	86.90	119.86	47.36	47.67	60.61	66.77
77.49	119.43	42.84	72.50	120.73	47.10	50.08	70.40	60.48
93.87	137.41	51.03	73.42	117.59	57.26	56.99	75.22	73.73
95.90	146.21	56.22	73.41	139.50	85.90	58.98	79.38	70.34
109.28	133.84	66.29	70.07	149.26	92.59	70.33	83.01	84.42
105.50	121.90	79.80	70.78	151.21	83.61	76.18	86.47	86.64
99.03	118.19	96.32	76.72	171.67	68.61	76.11	88.77	89.33
98.86	102.75	89.16	75.66	170.77	60.61	81.49	89.12	89.77
101.59	97.68	91.02	83.16	141.56	79.19	80.41	90.86	92.11
96.93	97.60	93.71	79.87	125.13	81.00	82.30	90.88	92.69
108.18	92.36	112.84	93.45	128.56	106.90	88.50	98.91	101.27
110.48	102.09	122.27	101.07	128.12	113.67	95.33	104.17	104.79
100.09	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
86.42	116.94	107.76	112.89	105.79	269.77	107.42	103.24	103.31
82.89	118.83	112.14	115.29	182.63	290.08	129.18	102.14	101.98
86.11	124.44	114.14	128.49	160.60	240.31	128.62	101.82	99.78
100.99	113.27	123.19	115.10	158.87	221.43	134.60	102.54	97.85
99.96	114.55	122.29	120.67	136.56	218.19	118.63	100.92	97.11
98.83	119.12	142.17	126.02	148.60	101.04	129.58	104.38	100.38
90.87	132.83	145.46	126.34	148.03	73.98	126.10	107.18	103.49
103.46	113.96	138.53	137.25	163.63	93.74	148.70	115.18	111.51
85.50	126.32	131.54	133.11	160.72	88.37	143.08	108.79	105.34
93.75	115.01	135.40	146.27	153.10	94.32	140.22	107.73	101.21
105.83	111.02	139.44	146.37	170.37	105.90	145.82	106.29	102.90
90.86	105.60	143.30	182.58	187.76	136.30	146.56	115.96	111.98
89.63	106.68	175.95	192.26	248.02	144.33	152.26	121.26	117.06
95.83	104.20	175.91	194.09	264.88	173.54	166.49	128.68	122.32

TABLE 2

Compound Growth Rate For Various Manufacturing Industries (Labour Productivity)

	1951-52 to '56-57	'57-58 to '62-63	'63-64 to '68-69	'69-70 to '74-75	'75-76 to '80-81	'81-82 to '84-85	'51-52 to '84-85
Food	2.6	0.6	1.2	—4.1	—5.7	4.3	1.4
Beverages & Tobacco	0.1	5.1	10.0	—7.0	—2.3	—2.6	3.1
Textiles	3.1	1.5	0.4	0.2	4.0	2.2	1.3
Leather & Leather products including Footwear	—4.5	3.9	—3.5	—3.7	16.2	—0.3	—2.0
Wood & Wood products including Furniture & Fixtures	5.8	8.1	3.4	—7.2	—6.4	—0.2	0.1
Paper & Paper Products including Printing and Publishing	4.6	4.0	1.9	—0.6	—2.0	2.9	1.5
Rubber & Rubber Products including products from Petrolum & Coal	11.1	4.1	5.7	—5.9	—2.4	16.1	3.3
Chemical & Chemical Products	3 4	5.3	2.6	1.0	—1.0	5.3	2.5
Non Metallic Mineral Products	11.4	3.2	1.7	—2.9	0.1	3.6	3.3
Basic Metal Industries	1.4	9.5	0.5	—3.5	—1.3	—3.2	1.2
Metal Products Except Machinery & Transport Equipment	7.2	1.3	—5.4	2.1	0.1	—2.1	0.0
Machinery Except Electrical Machinery	14.4	11.4	7.2	0.2	2.1	8.1	6.8
Electrical Machinery	12.7	—1.9	5.7	2.6	3.9	9.9	4.7
Transport Equipment	9.3	1.8	—3.2	4.4	2.3	15.8	3.2
Miscellaneous Industries	—7.1	21.5	2.9	14.3	—15.4	17.9	4.0
Electricity, Gas & Water Supply	6.4	5.5	4.7	7.1	3.4	4.5	5.5

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Role of Productivity in Reviving A Sick Unit*

DR. G. K. SURI

This case study focusses on the role of Productivity and the managerial policies and practices for prevention of sickness and rehabilitation of sick industry.

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Introduction

Sickness in industry is not a new Phenomenon. Enterprises from both private and public sectors have failed to flourish in the past too, but the incidence of sickness is found significantly high during the past one decade or so. Upto March 1981, as many as 23,742 industrial units of all size categories were reported to have been sick, blocking as much as Rs. 1,912 crores, approximately 7.6% of the total funds advanced by banks. According to the Economic Survey (1986-87) the number of sick units had gone up to a staggering 1,19,606 involving an outstanding bank credit of Rs. 4,270.91 crores. The process of rehabilitation of sick units has been rather slow. Only 2429 Units are reported to have become viable during the period 1979-81.

Although several studies had been carried out by both government and non-government agencies

*The study was undertaken by a team from the National Productivity Council consisting of the author; M/s. N.K. Nair, Director (Research); A.K. Barman, Asstt. Director (Research); and K.D. Kohli, Project Consultant. The findings were presented at an International Seminar on "Industrial Sickness : Causes and Cures" convened in New Delhi during April 28-30, 1987 by the Parliamentary Forum for Public Enterprises and Centre for Public Sector Studies in collaboration with the National Productivity Council (NPC), International Labour Organisation (ILO) and the United Nations Industrial Deveiopment Organ isation (UNIDO).

regarding industrial sickness*, the role, of productivity had not received much attention in these studies. The present study is, therefore, focussed on the role of productivity in the revival and rehabilitation of sick industrial units through a case study of the erstwhile Ganesh Flour Mills (GFM), a private sector company which started operation almost a century ago in Lyallpur, now in Pakistan. Today this Mill forms a part of the Hindustan Vegetable Oil Corporation Ltd., a public sector company entrusted with the management, amongst others, of the rehabilitated Delhi Vanaspati Unit, the Bombay solvent extraction plant and the Hindustan Breakfast Foods Factory at Delhi. The present case study covers only the Delhi Vanaspati Unit (DVU).

Objective of the Case Study

The study focusses on:

(a) the role of productivity in the revival of sick industrial undertakings; and
(b) managerial policies and practices for the revival and rehabilitation of sick industrial undertakings.

The Organisation

The Ganesh Flour Mill was founded in 1891. The GFM put up its first vanaspati plant in Delhi in 1928 and another one in Kanpur in 1932. After 20 years, GFM set up the Hindustan Breakfast Foods at Delhi for the manufacture of corn and oat flakes. The company diversified into the other areas and set up a Solvent Extraction Unit in Bombay in 1964 and an electric fan unit in Delhi in 1965 followed by a Food Canning Unit in 1966-67 also in Delhi. By 1967, GFM had six manufacturing units including the one in Pakistan which was later taken over by Pakistan after the 1965 Indo-Pak War, as 'Enemy Property' and was, thus, lost by the company.

Being a family concern, the company was managed by the founder till his death in 1956. Eventually, GFM management became top heavy due to the induction of younger members of the family. Modern professional managerial techniques were not employed by the management, they relied mainly on the goodwill and market reputation of the family for success in the diversification projects. Dissensions among family members became common and affected company's performance particularly during the later half of the Sixties.

The employees most of whom were obliged to the owner founder's family were generally loyal and peaceful. Most of them had worked for the company for many years. Some of them had more than one generation in the company's rolls. Several of them were related or obligated to the family in one way or the other.

The installed capacity of the Delhi Vanaspati Unit during the sixties was about 50 tonnes per day or 15 thousand tonnes per year. Production fell considerably short of capacity particularly during the late Sixties. The financial performance of the unit also became dismal during this period. By the end of 1971-72, the capital fund (Fixed Assets/Current Liabilities) was reduced to a negative figure of Rs. 0.35 crores. By this time the Unit had virtually closed down its operations.

Following concerted agitation by a section of employees the Government of India set up an Inquiry Committee in March 1972 to ascertain the economic viability of the company. The committee, after a detailed study submitted its report in August 1972 which inter-alia contained the following important recommendations:

(i) The overall economic viability of GFM would largely depend on the successful operation of the two Vanaspati Units.

(ii) The two vanaspati units will have to operate under normal commercial principles and without the application of the usual Government constraints and restrictions generally applied to public sector undertakings.

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* See, for instance;

1. S.K. Chakravarthy and S.K. Sen (ed), Industrial Sickness and Revival in India : Essay, Cases and Debates. Indian Institute of Management, Calcutta (1980).
2. S.N. Bidani and P.K. Mitra, Industrial Sickness: Identification and Rehabilitation, Vision Books, New Delhi (1982).
3. P.K. Sahu, "Some Conceptual Issues on Industrial Sickness" Indian Journal of Commerce; XXXVIII, Part 1, No. 142, January-March 1985.

(iii) The purchases of Raw Oil (the main input) which is subject to heavy price fluctuations will have to be made on the spot.

(iv) The administrative structure of the company will have to be reorganised and revitalized.

The Government of India under the power conferred by Section 18-A of the Industrial (Development & Regulation) Act, 1951, authorised the Industrial Reconstruction Corporation of India to take over the management of the GFM, initially for a period of 5 years with effect from November, 1972. The orders issued by the Government also laid down the necessary conditions for its operation and placed a moratorium on the credit and other liabilities of GFM for a period of one year.

Approach & Methodology

The productivity performance of any organisation is multi-dimensional phenomenon involving numerous factor inputs and all major functional areas. The productivity concept for the purpose of the present case study has been evolved taking into account the specific characteristics of the organisation. While it has been attempted to measure productivity levels and changes therein of all major factor inputs like men, machine and materials individually and collectively, the study has transgressed into the wider managerial framework within which these input resources were expected to perform. It is contended here that the managerial outlook as reflected in its policies and the consequently adopted systems and procedures promote or impede the contributions to productivity from identifiable and measurable input factors.

Within the above framework, data regarding the inputs employed and outputs produced by the DVU were collected relating to the pre (1967-71) and post (1974-77) take-over phases. The selection of productivity measures for interpretation and analysis has been governed purely by the considerations relating to data availability from the company's records particularly for the immediate years prior to the take-over.

All aspects of the company's performance could not be substantiated with the required data from the available records. Therefore, attempts have also been made to supplement the quantitative aspects of productivity with a set of qualitative data generated by unstructured interviews with the old and contemporary functionaries of the company selected from all levels of management*.

Due to the non-availability of appropriate data, particularly for the period when the unit was a 'Family Managed' company and due to the limitation of available information after the take-over, the present study had to be restricted to those years of GFM's operation for which data could be culled out from the past records of the company, Vanaspati Manufacturers Association, Vanaspati Directorate or other related sources.

The study has attempted to highlight comparative productivity performance, to the extent possible by the use of following productivity indicators :

Total Earning Productivity	Sales net of excise and raw materials (including packagings) divided by the conversion cost (net of raw materials cost). This represents total earnings per unit of conversion cost.
Surplus Generating capacity	Profits over conversion cost. This represents surplus generated by each rupee invested in operational cost.
Plant Utilisation	Achieved production over installed capacity. This ratio reflects the utilization efficiency of fixed assets.
Employee Productivity	Value of Production (at constant base prices) over total employees. This represents the efficiency with which labour resources are utilised.
Raw materials productivity	Value of raw meterials as percentage of value of Production. This represents the efficiency in raw material utilization.

Productivity Performance : The Results

Table—1 indicates that :

(1) There was no direct correspondence among production, earnings and productivity.

* Fourteen such functionaries were interviewed. The functionaries include levels like Managing Director, General Manager, Senior Manager, Superintendent etc.

TABLE 1

Total Earnings/Conversion Cost for Delhi Vanaspati Unit (DVU)

Year	1967	1968	1969	1970	1971	1974	1975	1976	1977
Total Earnings (Rs. lakhs at current prices)	38.69	27.99	46.50	53.65	30.17	47.20	121.0	104.1	163.0
Conversion Cost (Rs. lakhs at current prices)	41.35	46.77	47.95	57.45	43.19	44.46	64.71	79.59	86.84
Total Earnings/ Conversion Cost	0.935	0.599	0.97	0.933	0.698	1.06	1.87	1.308	1.877
Total Vanaspati Output (in tonnes)	*	13179	14795	8618	1447	8560	13780	17571	13742

* Figures not available

(2) During years prior to the take-over, the DVU had been incurring expenditure substantially above its income particularly in 1968 and 1971.

(3) Immediately after the take-over, the DVU succeeded in reversing the pre-take over trend and in all the years considered here, the total earnings/conversion cost ratio reached values well above unity, the figure for 1977 being as high as 1.9. This achievement is a notable feature of the post take-over period because there was no visible increase in the corresponding physical quantity of Vanaspati production.

Data presented in Table—2 show that while in the Five-year period 1967-71, the unit was incurring losses varying between 3 and 40 per cent of its operating costs, the trend was reversed during the immediate post-take-over years. Profits as a percentage of conversion costs varied between 6 and 87 during the later period.

Data presented in Table—3 show that there was a distinct improvement in the plant utilisation after the take-over as compared to the pre-take-over years. During the pre-1970 years the maximum achieved utilisation was about 98.6 per cent in 1969 followed by a steep fall in the next two years, that is, about 57.5 per cent in 1970 and a negligible 9.6 per cent in 1971. As against this, the IRCI take-over management team was able to achieve about 91.9 per cent utilisation in 1975 and 117.1 per cent in 1976.

It may be observed from Table—4 that all the alternative indices of employees productivity increased significantly during the post take-over years. While

TABLE 2

Surplus Generating Capacity of Delhi Vanaspati Unit

Year	1967	1968	1969	1970	1971	1974	1975	1976	1977
Profit/Loss (Rs. lakhs at current prices)	—2.67	—18.78	—1.45	—8.28	—15.44	31.95	32.00	36.98	76.87
Surplus Generating Capacity	—0.065	—0.401	—0.030	—0.067	—0.302	0.06	0.87	0.308	0.877

TABLE 3

Plant Utilisation Ratios in Delhi Vanaspati Unit

Year	1967	1968	1969	1970	1971	1974	1975	1976	1977
Plant Capacity ('000 tonnes)	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0
Output achieved ('000 tonnes)	*	13.18	14 80	8.62	1.45	8.56	13.78	17.57	13.74
Utilisation (Percentage)	*	87.86	98.63	57.45	9.64	57.06	91.86	117.14	91.61

* Data not available

TABLE 4

Employee Productivity in Delhi Vanaspati Unit

(Figures as on March 31)

	1967	1968	1969	1970	1971	1974	1975	1976	1977
Sales (Rs. lakhs at current prices)	587.1	552.5	498.8	653.0	357.2	850.0	994.2	1181.0	1222.00
Value of Production (Rs. lakhs at current prices)	588.8	554.5	503.3	647.4	357.0	854.1	1007.2	1189.5	1211.5
Value of Production (Rs. lakhs at constant 1970-71 prices)	929.6	680.3	677.4	717.7	357.0	648.0	587.3	743.5	818.5
Wages & Sales (Rs. lakhs at current prices)	10.9	13.3	13.0	14.2	14.5	15.8	22.3	22.7	20.6
No. of employees	300	374	366	409	390	304	293	302	294
Sales/Employee (Rs. lakhs at current prices)	1.54	1.43	1.36	1.60	0.92	2.79	3.39	3.91	4.15
Value of production per employee (Rs. lakhs at 1970-71 prices)	1.66	1.82	1.85	1.75	0.92	2.13	2.00	2.46	2.78
Share of wages and salaries in value of production at current prices (percentage)	1.85	2.40	2.58	2.19	4.06	1.85	2.21	1.91	1.70

sales per employee at current prices virtually doubled when compared to the pre-take-over years, the value of production per employee at 1970-71 prices remained significantly higher (about 40%) during the post-take-over years. Considering the fact that there were no significant additions of new machinery during the immediate post-take-over period, the increased employee productivity ratios may be interpreted to imply higher contributions from labour and management in terms of better efforts by labour, lower wastages of labour hours, better organisation of resources by the management, etc.

It is observed from Table—5 that during the pre-take-over period, the throughput had a share of about 91-101 per cent in the final value of output, (The average being about 94%). During the post-take-over period it came down by an impressive magnitude to about 86-94 per cent (average being about 90%). This decline in the share of throughput had a healthy impact on the performance of the unit during the immediate post take-over years.

Based on discussions with the persons at various levels of management, it was gathered that this reduction was achieved from the following major factors :

1. Gradual substitution of costly raw materials like cotton seed oil, groundnut oil, etc., with cheaper ones like soyabeans oil.
2. Improvement in the yield factor through conformity to technical standards developed by the company (Appendix-1) in the post-take-over period.
3. Plugging the loopholes in the material procurement procedures like elimination of hidden commissions, jacked up prices, reduction in handling and storage losses, elimination of pilferages, reduction in transportation costs through procurement from nearer markets controlling demurrages, etc.

Further, it was found that, in general the wholesale price indices of raw oils and of Vanaspati were increasing almost in the same proportion during the post-take-over phase (see Appendix-2), implying that the reduction in the share of raw materials in the final value of output should be a definite indicator of better raw material economy and efficiency.

Quality Standards

Detailed quality standards for input materials, packagings, and the finished products were specified with maximum and minimum permissible variations during the post-take-over period. An attempt was made to ascertain the actual quality standards achieved from the operating personnel, laboratory chemists and the Quality Control Staff. It was confirmed that the company has been generally adhering to quality standards evolved for the purpose. Rejections or reworks were extremely rare, according to them.

Inventory Management

Average inventory held could be a measure of working capital productivity. Unfortunately, this index could not be determined for the pre-take-over period, because of lack of reliable data. However, during the post-take-over period, it was found that the average inventory stock varied from 15 days to 23 days.

The variations in the productivity measures indicated that the productivity performance of the DVU during the post-take-over phase was distinctly

TABLE 5

Share of Raw Materials in the Value of Production in DVU

Year	1967	1968	1969	1970	1971	1974	1975	1976	1977
Value of Production (Rs. lakhs at current prices)	5888.8	554.5	503.3	647.4	357.0	854.1	1007.2	1189.5	1211.5
Value of throughput materials (Rs. lakhs at current prices)	550.2	562.5	456.8	593.7	326.8	802.8	873.0	1076.9	1059.3
Share of throughput materials in the value of production (percentage)	93:5	101.3	90.8	91.7	91.5	94.0	86.7	90.5	87.4

better as compared to the pre-take-over period. A summary statement of the pre-and-post-productivity scene is shown in Table—6.

TABLE 6

Summary of Factor Productivity Changes (Averages During the Years)

Productivity Ratio	Pre-take-over (1967-1971)	Post-take-over (1974-77)
Earning Conversion Ratio	0.83	1.25
Surplus Generating Capacity (—)	0.17	0.53
Plant Utilisation (%)	63.40	89.42
Employee Productivity (Rs. lakhs per employee)	1.60	2.34
Share of Raw materials in Value of Production (%)	93.76	89.65

The Qualitative Data

The qualitative statements obtained from those who were interviewed were classified and analysed in terms of the following major areas:

(i) Management's Role and Style;

(ii) Personnel Policies and Employee Relations;

(iii) Sales and Marketing Policies;

(iv) Purchase Procedures and Financial Control;

(v) Technology and Technology Changes; and

(vi) The Economic Environment.

The summary of the statements are presented in Charts 1 to 6.

Managerial Implications and Lessons for Future

A brief analysis of the data relating to selected productivity indicators reveals the following :

1. The failure of the unit could not be attributed to any one single factor or event. If any area could be singled out, it is the inexperienced handling of the company affairs by a top heavy and unskilled management that led to the company's down-fall.

2. Having a loyal, hard working and peaceful labour force alone is not enough for success in company business. The present case study lends support to this statement.

3. Similarly, having managerial commitment to the goals of the organisation alone would not ensure business success. Atleast on *prima facie* grounds, the commitment to company objectives by the family management of the DVU cannot be suspected.

4. What was critically missing in the case of DVU was a framework of systems and procedures, commensurate with the requirements of a competitive business environment which if present could have shielded against wilful foul plays and also possible 'business blunders'. Had there been such a framework, which could work successfully irrespective of the whims and fancies of individuals, the company could have been salvaged from the disaster which it eventually met with.

5. The erstwhile Management appeared to be ignorant of the business environment, the operating parameters and the financial health of the unit they were managing. This happe ed because there was no fool-proof management information system. No corrective measures could be initiated in time and hence they were not able to arrest, a progressively deteriorating performance of the unit. This had also led them to an untimely diversification into a totally unwarranted direction, financed by the diversion of liquid funds from an on-going business.

6. This experience provided the take-over management the necessary lessons towards the Company's healthy revival. The farmost consideration for them was to deal with the critical area viz., the raw oil purchase. The systems and procedures for raw oil purchase introduced during the take-over phase

happened to be the prime carrier of the sick undertaking into a stable organisation during later years. This was followed by concerted efforts towards eliminating corruption, evolving personnel policies and procedures and ensuring improved plant utilisation. This was later followed by the introduction of technical and processing improvements which seemed to have contributed significantly to achieve higher raw material productivity.

7. A major inference arising out of the analysis is in regard to the role of productivity measurement and monitoring. The method of monitoring the performance merely by measuring the output could not reveal the vulnerabilities to which an on-going business is exposed to. It needs constant and sustained surveillance over a series of ratios concerning the performance of all major factors and functions by varying frequencies depending upon the importance of the input, variability of operating and business conditions and finally the measurability itself. Had this been attempted by the erstwhile management, it could have detected the impending disaster and perhaps, could have prevented its occurrence through necessary managerial initiatives. The take-over management seemed to have succeeded in this direction.

CHART—I

Summary of the Statements Regarding the Management Styles in Delhi Vanaspati Unit (DVU)

Before take-over

1. The 'Family Management' had a paternalistic approach towards their employees and lacked both 'managerial and technical competence'. The failure of DVU (and GFM) was caused by :
   (a) dissensions within the 'family management'.
   (b) dilution of managerial control over the unit's functioning through continuous induction of younger family members.
   (c) unchecked corruption in different departments.
   (d) poor financial management and control; and
   (e) unplanned and unrelated diversification.
2. The family patriarch had placed inexperienced younger family members in important control points. They lacked professionalism and were over indulgent at times.
3. After the death of the founder, those who stepped into his shoes, did not possess the right type of business acumen and skills and regarded DVU as a 'milch cow' without knowing how to keep it from going dry.

After take-over

1. The management team which took over comprised experienced professional managers whose main object was to succeed.
2. The management was task, result and people oriented and was sufficiently autonomous in the early stages.
3. New procedures have been introduced for Oil purchase, a new plant was installed to balance capacity, beneficial commercial practices were adopted and activities were expanded only after careful planning and study of market forces. →

CHART—2

Summary of the Statements Regarding the Personnel Systems, Policies and State of Employee Relations in DVU

Before take-over

1. Formal Peronnel policies or procedures were practically non-existent. Recruitments, promotions, increments and other personnel functions were largely based on the 'Family's whims and fancies.'

2. Due to the benign nature of the 'Founder owner' his family had acquired a reputation of being the benefactor of the poor. The fact that two or three generations had served in the same company led to deep sense of loyalty and obligation amongst the employees who worked hard at whatever task they were entrusted with.

3. There were no labour disputes and hardly any organised labour union functioned in DVU. Employees were apparently happy despite low wages.

4. No participative forums existed, as all decisions taken by the 'owner-managers' were invariably accepted without question.

5. No formal incentive schemes were in operation. Employees were rewarded through gifts in kind on festival occasions or some family event, like marriages, birthdays, etc. No. bonus or other kinds of motivational means were in use.

After take-over

1. Recruitments, promotions, transfers, increments, etc. began to be regulated according to set procedures. Certain amount of flexibility however, was still enjoyed by the management.

2. Along with the impersonal nature of the personnel management came in the labour unions. The employee relations, though, satisfactory during the immediate post take-over have passed through difficult times. Inter-union rivalry which had been nonexistent earlier was now very much a reality to cope with.

3. Staff Councils, Works Committees, Production Committees, etc. did not exist. Recently a Safety Committee has been set up and a grievance procedure has been introduced.

4. There is no incentive scheme even now, but statutory bonus has been paid regularly. Winter and summer uniforms have also been provided to all workers. Wages were reasonably good. ESI benefits and other statutory allowances had been introduced.

CHART—3

Summary of the Statements Regarding Marketing Organisation in DVU

Before take-over

1. The products manufactured by the unit had a good market reputation as the 'Owner manager' generally was well-known for honest dealings and fair business practices. This

After take-over

1. The rehabilitated company and a well organised marketing set up of all its products. GFM was favoured for Government supplies both for civil and services consumption.

ensured a ready market for the vanaspati manufactured by DVU. No sales promotion or marke tstudies were either felt necessary or had ever been attempted. Despite excess capacity in the industry, DVU was able to retain its market share without any serious efforts on its part.

2. This happy situation continued until the sixties when the surplus funds available from Vanaspati business were diverted to the setting up of new projects for unrelated products. Starved of working funds, market commitments began to fail leading to an all-round setback in its operations.

Currently 90% of the Vanaspati output goes to the defence services. This ensured a regular and full capacity utilisation at all times. DVU alongwith its Kanpur and Amritsar units has 8 per cent of market share for Vanaspati in the Northern Zone.

2. An assured market is, thus, largely responsible for the DVU's satisfactory sales performance.

CHART—4

Summary of Statements Regarding Purchase Procedures in DVU

Before take-over

1. Purchases has been vested under the control of a family member with little experince in the area. He fell a victim to the mechanization of unscrupulous persons.

2. Malpractices such as wrong weighment, unrecorded commissions, high purchase price and adulteration, etc., gradually crept in and, in course of time, became more frequent leading to a chain reaction of falling production, dwindling sales, reduced cash flow and finally closure of the company.

After take-over

1. The first Company Management that took over in 1972 laid down a strict procedure for purchases, laboratory analysis and payment for all purchases and more particularly for raw oil.

2. The general public sector rules for purchases were set aside on grounds of unsuitability for Vanaspati industry; Oil purchases have been made on the spot with the help of a few brokers.

3. Sampling, coding and analysis are done by different persons. Weighment is supervised by a person selected from the Accounts Department.

4. Payments are authorised by the top management and the implementation of the procedure is regularly monitored at the head office.

CHART—5

Summary of Statements Regarding Technology

Before take-over	After take-over
1. DVU was set up in 1928 with German technology and till 1970-71, no improvement in the process had been brought about; nor any new refining process introduced. The 'family concern' remained orthodox in its approach to Vanaspati manufacture. As long as the plant gave adequate returns, the management did not feel compelled to look for technology improvements.	1. While initially the primary concern of the management was to recommission the plant and put it on a firm footing, subsequently a new plant for refining oils has been added alongwith some balancing plant to raise the capacity of the plant from 50 tons per day to 75 tons per day.

CHART—6

Summary of the Statements Regarding the Economic Environment External to DVU

Before take-over	After take-over
1. The number of working factories producing Vanaspati increased from 47 in 1967 to 64 in 1971.	1. Working factories producing Vanaspati remained stable around 70 during the rehabilitation period.
2. Production of Vanaspati in the meantime increased from 393 thousand tonnes to 590 thousand tonnes, exceeding the estimated demand for 565 thousand tonnes.	2. Production increased from about 473 thousand tonnes in 1973 to about 580 thousand tonnes in 1977. The estimated demand was about 585 thousand tonnes.
3. The industry was delicensed in 1968, following which 49 additional units came into existance, thus, raising the licensed capacity to 15.4 lakh tonnes in 1970. By 1972 the effective capacity of the industry amounting to 10.0 lakh tonnes was almost double the estimated demand.	3. The industry was brought back to statutory control in 1970. The price was decontrolled in 1975.
4. The wholesale prices of Vanaspati were characterised by uncertain movements during the period. The trend was, however, characterised by a stable downward movement.	4. The period was characterised by a steep increase in vanaspati prices to the extent 30-35 per cent during the period 1973-75. Prices fell moderately during 1975 and 1976 again recovering in 1977.
	5. Vegetable oils seeds, particularly of soyabeans, which is an important input for the industry, were characterised by steep rises in their prices, particularly in the recent years (Appendix 2).

APPENDIX—I

Technical Standards in Use at DVU

Basis 1%

F.F.A	Caustic Soda with 20% Excess	Fuller's Earth	Carbon (Brilex)	Hyflo-super cell	Nickle catalyst with 17% Nicle	Salt	Phosphoric Acid	Citric Acid	Electricity	Coal	Gross Loss per unit F.F.A	Dead loss on oils worked
	Kg/T	Kg/T	Kg/T	Kg/T	Kg/T	Kg/T	Kg/T	gms/T	Unit/T	Kg/T		
G.N. Oil	1.7	4.0	0.5	0.07	0 25	0.2	—	50	210	220	2.6%	0.4%
C.S. Oil (FFA 0.25%)	1.4	7.5	4.5	1	0.35	—	—	5—	280	250	2.0%	0.5%
S.B. Oil	1.7	4.0	—	1	0.45	—	0.50	50	410	300	3.0%	0.6%
Palm Oil	1.7	4.0	4.0	1	0.1	—	—	5—	8—	25—	3.0%	0.6%
Rapeseed Oil	1.7	5.0	4.5	1	0.45	0.5	0.50	75	280	300	3.0%	0.6%
Til Oil (as liquid oil)	1.7	1.0	—	0.5	0	0.5	0.25	—	40	100	3.0%	0.5%
Sunflower Oil	1.7	4.0	—	1	0.45	—	0.50	50	410	300	3.0%	0.6%
Ricebran Oil	1.7	7.5	4.5	1	0.5	2.0	2.0	50	210	300	3.0%	0.6%
Kardi Oil (as liquid oil)	1.7	4.0	—	0.5	—	—	—	—	40	100	3.0%	0.5%
Nigerseed Oil	1.7	4.0	—	0.5	0.45	—	0.50	50	410	300	3.0%	0.6%
Maize Oil (as liquid oil)	1.7	6.0	2.5	0.5	—	—	—	—	40	100	3.0%	0.5%
Watermelon	1.7	5.0	1.0	0.5	0.35	—	—	50	350	270	3.0%	0.5%

F.F.A. = Free Fatty Acids.
Source = Company Record.

APPENDIX—II

Wholesale Price Indices of Vanaspati and Edible Oils

Base 1970-71 = 100.0

Year	Vanaspati	Edible Oils	Groundnut Oil	Mustard Oil	Cotton Seed Oil	Soyabean
1966-67	93.5	84.4	89.4	79.9	—	—
1967-68	81.5	78.6	74.5	89.0	—	—
1968-69	74.3	70.0	67.7	74.0	—	—
1969-70	90.2	88.8	93.4	83.4	—	—
1970-71	100.0	100.0	100.0	100.0	100.0	100.0
1971-72	92.0	88.1	85.6	91.5	81.2	108.1
1972-73	100.1	99.4	99.5	104.4	95.3	120.3
1973-74	131.8	147.9	154.4	148.1	145.1	174.3
1974-75	171.5	172.4	173.5	176.4	164.3	220.9
1975-76	160.0	134.9	133.7	110.2	128.7	230.4
1976-77	148.0	142.8	134.2	144.9	131.7	306.7
1977-78	167.5	175.9	170.8	206.3	149.9	288.0

Source : Ministry of Industry, (Government of India), Index Number of Wholesale Prices in India, Various Issues.

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OB For Social Development

PRADIP N. KHANDWALLA

This paper throws light on how OB can contribute to the socio-economic development in the third world societies. It also expands the concept of strategic organisation as highly relevant to the poorer societies.

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OB and the Third World

Organizational Behaviour (OB) is a field of knowledge rather than a unified theory. It consists of a growing clutch of concepts, approaches, models, and tools pertinent to the structure and functioning of organization within their socio-economic contexts, and the study of individuals and groups within their organizational contexts.[1] Thus, OB spans macro-organizational concerns like inter-organizational system and organizational level goals, strategies, climate, cultures, structures, management styles and performances, and how these are influenced by one another and by task environment, societal values and institutions, technology, size, dependence. etc. OB also looks at organization—wide processes like decision making, socialization, and institution building. OB is equally concerned with the motivation, attitudes, skills, and interactional dynamics of individuals and groups operating within organizations, and the linkages between macro-organizational variables and these micro-organizational concerns. OB is a highly differentiated field, rife with contending theoretical perspectives, multiple levels of analysis, and diverse research philosophies and methods.[2] It has generated a rich variety of management tools and technologies. These range from OD types of interventions to various kinds of training, MBO, human resource management systems, modes of decision making, ways of making the job more interesting, organizational design gestalts, etc. Some of these tools and techniques are indicated in Table 1. The organizations of poor societies seeking

TABLE 1

Illustrative OB Tools For Use in Strategic Organizations

A. *Diagnostic tools* : action research, survey-feedback, search conference.

B. *Individual level tools* : Leadership and supervisory training, achievement motivation training, creativity training, stress management training, entrepreneurship training, change agentry training, job enrichment and task design.

C. *Group effectiveness tools* : Participative decision making, team building, process consultation, confrontation meetings, conscientisation.

D. *Structure-related tools* : Role clarification, decentralization, differentiation and integration, design of organizational chart.

E. *System tools* : Management by objectives system, human resource development system.

development tend to be replete with "people" problems. The combination of scarcity-ridden economies, high development aspirations of social elites, and the traditionalism and kinship orientation of the "masses" is a fascinating context. It often spawns bizarre organizational behaviour. Scarcity breeds, under a proactive social leadership, institutionalised means for alleviating it. Thus, a broad range of governmental, quasi-governmental, voluntary, and private commercial organizations come into existence with scarcity-alleviation goals. But these organizations are commonly staffed by members of the traditional, kinship-oriented, impoverished masses, and often the clients of these organizations are also segments of the masses. Add to that public funding of many of these organizations, and what emerges is a queer cocktail: of organizations with entrepreneurial, developmental aspirations at the top, bureaucratic structures, nepotistic staff cultures, fairly modern operations, technologies and installation of some professional management tools and systems. The organizations of developing societies, especially the larger strategic ones, tend to be melting pots struggling to understand the modalities of internal coherence. They are the microcosms of the growth adventure of some 3000 million human beings.

Most of the tools and techniques of OB have originated in the West; but they have become important elements of management software in many of the larger organizations of the Third World.[3] In India, for instance, such tools as survey feedback, action research, organization development (OD), management by objectives (MBO), human resource development systems (HRDS), stress management techniques, achievement motivation training, creative problem solving training, etc., have been used in a number of organizations.[4] While selective use of these tools and techniques in appropriate organizational situations is unquestioned, there are doubts about their wholesale applicability in Third World countries because of their apparent conflicts with the cultural, economic, and political realities in these countries.[5]

The main normative focus in OB is on effectiveness. At the organizational level, criteria used in Western research have, by and large emphasised organizational performance variables like profitability are growth rate, system effectiveness variables like adaptability and success in acquiring resources, staff well-being, and occasionally also corporate social responsibility-related criteria.[6] A criterion of special relevance to the developing world is the effective contribution of the organization to socio-economic development.[7] Developing countries commonly suffer from scarce managerial skills, low work ethic, a weak cooperation ethic, high dependency proneness. conservatism, and so forth.[8] Organized action—as distinct from sporadic individual or group level action—offers vast possibilities for expediting socio-economic development. This is because the formal organization brings under one roof all the human, material, financial, and technological resources needed to undertake relatively unfamiliar, long range, nation-building tasks. Also, formal organizations have the intrinsic ability to build up rapidly whatever additional resources they need. Indeed, most developing societies have set up a variety of special-purpose organizations whose main objective is contributing to various facets of socio-economic development. In India, for example, early after Independence, the government set up the Planning Commission at the national level, organisations to promote community development in the rural sector, organizations to provide project finance to new industries, and organisations to produce goods and

services basic to rapid industrialization (such as steel mills, equipment producing organizations, basic chemicals producing units, etc.). Besides, most governmental administrative organizations were sought to be reoriented from merely providing routine services like revenue collection and maintenance of law and order to also contributing to socio-economic development by drawing up developmental plans.[9]

Concept of the Strategic Organization, Group and Individual

A large amount of work has been done in OB on different kinds of organization, and on different facets of organizations and their functioning.[10] But work on the strategic organization, as a separate category, has been negligible. If, within each class of organizations, we were to array organizations on their potential contribution to positive change and development within their respective domains or sectors, then strategic organizations would be the top scorers in each array. Thus, organizations that are research and development oriented, organizations that pioneer into a sector needed products, services, and technologies, organizations attempting a change in the social status quo, organizations in the business of modernizing social values and attitudes—in short, organizations whose output and actions have a long term, developmental impact in their domain may be considered strategic organizations.[11]

The potential of organizations to contribute to socio-economic development of poor, under-developed societies may vary enormously. To survive, all organizations need to meet some social need or the other.[12] But there is a special need that only a few organizations are primarily concerned about : society's need to transform itself towards some ideal. While societies surely differ on cherished utopias, the consensus appears to be to equate socio-economic development with greater strength and autonomy for the society as a whole as well as for individuals and groups in that society, greater social justice and equity, and greater per capita availability of at least essential goods and services.[13] Inter-organizational comparisons on the "fuzzy" criteria of social development are difficult. However, it is possible to say that an administrative organization set up to promote literacy or family planning or adoption of better health practices is more strategic than one collecting revenues or keeping civil peace; or that an organization set up to identify, develop, and disseminate new products, processes, and practices in an industry is more strategic than most flrm in that industry; or that voluntary organizations seeking to conscientize the exploited and mobilize them for collective amelioration and development are more strategic than voluntary organizations merely promoting the interests of privileged castes or communities; or that organizations producing the means of further production, such as machinery, are more strategic than organizations producing cosmetics and so on.

This is not to say that non-strategic organizations are unimportant—on some criteria they may well be even more important. The army, the tax department, and the corporation marketing cigarettes and contributing billions in taxes to government coffers are obviously important. However, their importance vis-a-vis the developmental and transformational goals of a society may be less, or less direct, than the research laboratories, the institutes for training technologists, professional managers, and developmental administrators, social development programme organizations, and public enterprises producing equipment for the chemical, fertilizer, engineering, and metal industries. Table 2 lists, for illustrative purposes, some strategic Indian organizations.

Strategic organizations cannot be evaluated on just the more common criteria of organizational effectiveness, namely, financial performance, growth, staff well-being, system viability and adaptability, or good corporate citizenship.[14] They need to be evaluated also—perhaps primarily—on a new class of criteria pertaining to their socio-economic development impact. The latter may be measured in terms of how far they have pioneered or innovated new (but appropriate) products and technologies of production as well as management, strengthened (and not merely exploited profitably) underdeveloped client systems, created significant positive externalities, collaborated with other organizations in furthering national priorities, promoted social change and awareness about

TABLE 2

Some Examples of Indian Strategic Organizations

Government

Planning Commission; the cabinet; the various ministries, especially development—oriented parts of these ministries.

Financial Institutions

The apex financial institutions, especially IDBI, IFCI, ICICI, LIC, Unit Trust, the nationalized banks, particularly their merchant banking divisions.

Manufacturing

Public enterprises set up to produce means of further production or to pioneer new products and technologies; private enterprises operating in the "core" sector of the economy or in "sunrise" industries; research and training institutions set up for industries (e.g. ATIRA, CMERI).

Services

Key educational institutions like the IITs, IIMs, and research oriented post-graduate university departments; key health institutions, especially the research oriented ones; development-oriented voluntary organizations and cooperative societies

alternative, more science-based life styles, inculcated a culture of innovation, achievement, social concern, meritocracy, and participative decision making, etc.[15] Not that every strategic organization should be evaluated on all these criteria, but as a reinforcement mechanism, evaluation should be tilted in favour of the appropriate development-related criteria.

Just as there are strategic and non-strategic organizations, we can think of strategic and non-strategic organizational members and groups. Those individuals and groups within organizations that have the greatest potential for achieving the developmental, strategic objectives of those organizations may be deemed, respectively, strategic individuals and strategic groups. Thus, strategic individuals may consist of an assortment of managers, technocrats, stakeholders, and union leaders; and strategic groups may also consist of such diverse teams as the top management team, the corporate planning group, the research and development group, the human resource development group, the market research group, and so forth. Of obvious importance are strategic individuals and teams in strategic organizations, and from an OB point of view, their skills, values, attitudes, and motivation .

The thesis of this paper is that OB can most contribute to socio-economic development of the world's poorer societies by greater concentration on their strategic organizations, and within these strategic organizations, on strategic individuals and groups. Making this sort of an impact through OB implies a program of research on the structure, functioning, adaptation, boundary spanning, effectiveness, and revitalization of strategic organizations on the leadership, communication, innovation, and institution building processes within these organizations, on the values, motivations, attitudes, skills, and competency of strategic individuals and teams, and on the interrelations of these variables.[16] It implies greater emphasis on OB as a tool of social transformation. And it implies that OB scholars and practitioners must get busy developing, testing, and deploying the technology of transformation.

In the following sections an attempt is made to probe into the nature of the strategic organizations of developing societies, and to explore briefly key OB-related issues in their design and functioning in order to identify some high potential research areas.

The Nature of Strategic Organizations in Developing Societies

A better understanding of the nature of strategic organizations in developing societies may clarify how OB could be pressed into their service. Most strategic organizations in the developing world are likely to share three characteristics : (1) resource dependency on the government; (2) transformational or developmental role; and (3) unfamiliar tasks.

Resource Dependency on the Government

Throughout the developing world, many strategic organizations have been created by governments. As an example, the Government of India has set up, in

the last 30 years, over 200 public enterprises, most of which could be regarded as strategic organizations. These account for roughly half of the nation's total industrial production, and a higher percentage of goods and services considered basic to rapid industrialisation.[17] The provincial governments in India have set up perhaps three times this number.[18] But this is scarcely all. A number of project finance institutions have been set up and these in turn fund hundreds of strategic organizations in the private sector. Additional strategic organizations in the cooperative sector, the voluntary sector, the health and educational sector etc.' are all heavily dependent on government funding. In India and possibly throughout the developing world, the vast majority of strategic organizations are either government sponsored or heavily dependent upon the government or its agencies for funding.

The implication of resource dependency on the government is extensive government control, that is, political and bureaucratic control over strategic organizations. In turn, these have further implications: the appointments and tenures of the top executives of strategic organizations are often politically mandated; and there is a nearly irresistible pressure on strategic organizations to adopt the bureaucratic structures and procedures of the government.[19] The usually large size of strategic organizations provides further impetus to bureaucratisation.[20] Thus, strategic organizations often are prone to the well-known dysfunctions of the bureaucratic organization, namely, rigidity, suboptimization and interfunctional conflicts, close supervision and staff alienation, the emergence of a conformist, bureaucratic staff personality, etc.[21]

On the plus side, being strategic, and therefore enjoying high social priority and legitimacy, also implies a large capacity to raise resources and therefore, a large loss-bearing capacity.[22] This resource abundance in a scarcity-ridden poor society and this large loss bearing capacity makes it possible for the strategic organization to be venturesome.

Developmental Role and Unfamiliar, Non-routine Tasks

While strategic organizations tend to get bureaucratised, and suffer from the dysfunctions of bureaucracy, they must, paradoxically, operate in entrepreneurial and organic modes in order to fulfil their developmental missions and to cope with unfamiliar, non-routine tasks.[23] These strategic organizations, given their developmental missions, programs, products, technologies, and processes must innovate; they must make bold moves; they must take calculated risks; they must be impelled by a social vision rather than by just mundane considerations; they must operate flexibly in an unfamiliar terrain; they must operate as "open" and participative systems; they must win over their often conservative, traditional, poorly educated, and ignorant clients by persuasion and participative methods; they must adapt to local situations and resist excessive standardization; and they must instil in their rank-and-file the kind of work, cooperation, and innovation ethic so vital to mission accomplishment.

To summarise : Strategic organizations in developing societies usually have access to large governmental and government-controlled resources. Their missions and their loss-bearing capacity enable them to make entrepreneurial moves; but they are frequently hobbled by bureaucratic structures and dysfunctional practices generated by large size and resource dependency on the government and afflicted by weak organizational work cultures and resistance from conservative beneficiaries.

OB Issues in Strategic Organizations

Strategic organizations should become a major arena of OB research and effectiveness technology. Several fairly well-worked OB issues for their research implications for strategic organizations in developing societies are examined here. These issues are : motivation and control; coordination, collaboration, and conflict resolution; boundary management; management of growth; institution building; innovation and change; and revitalization of sick organizations.

Motivation and Control in Strategic Organizations

Motivation of organizational members is one of the more extensively researched areas in OB.[24] People join organizations to satisfy their needs. The organi-

zation employs people to achieve its goals. It does so through structures, procedures, and systems that often frustrate human needs by making work monotonous or meaningless. So long as the psychic and monetary inducements offered by the organization balance the psychic and monetary contributions made by the staff, so goes Western theory, there is motivation to remain with the organization; and so long as the employee expects that the organization will meet his or her needs if he or she meets the organization's demands, he or she would be motivated to contribute to the organization.[25] Western motivational models have incorporated the concept of a hierarchy of needs,[26] a dynamic aspiration level as an influence on the strength of motivation,[27] early socialization into certain enduring motives like the achievement, power, and affiliation motives,[28] etc. In conceptualising motivation in work situation, distinctions have been drawn between durable "intrinsic" motivators like challenges in job, and more ephemeral "extrinsic" motivators like pay and authority.[29]

Strategic organizations, thanks to their governmental links, tend to have restricted capacity to offer attractive hiring terms, to fire staff at will, or to remunerate staff handsomely for outstanding performance. In other words, their capacity to provide attractive extrinsic motivators is limited. But their mission and social relevance, and their pioneering, innovative, and developmental activities, can provide powerful spurs for the idealistic and the enterprising. Generally speaking, therefore, strategic organizations may have few charms for the money-minded but ample attractions for those with a high need for socially relevant achievement. Those strategic organizations that stress opportunities for challenging work, for learning on the job, for socially relevant work, etc., are likely to be able to attract, retain, and energise staff; those that fail to do so, may be blighted by an alienated or apathetic staff, high absenteeism, etc. Further research on work dedication, work commitment, achievement need, the pioneering-innovating motive, extension motivation, and social conscience may help the strategic organizations of developing societies to recruit and promote the right kinds of staff.[30]

Performance control in bureaucratic organizations tends to be effected mainly through hierarchical supesvision, budgets and quantitative targets, and emphasis on following laid down procedures.[31] Strategic organizations, too, therefore tend to rely heavily on these control mechanisms. But an overemphasis on these mechanisms may lead to staff alienation, and to such distortions as short term targetry, neglect of quality, neglect of hard-to quantify developmental objectives, etc. However, important additional means of control are available to strategic organizations. The first is control through pre-entry socialization,[32] commonplace among professionals, and possible in a strategic organization because of its need for professional expertise. The second is control through careful selection of staff with a strong identification with the missions of the organization,[33] also available to the strategic organization because of its missionary goals. The third is peer group control, also available to the strategic organization because developmental tasks are often best accomplished through work teams. Thus, the distortions wrought by hierarchical, budgetary, and procedural control can be limited by the strategic organization emphasising self, peer, and ideological control. Greater research on strategic organizations that have successfully harnessed these latter form of control should yield good dividends.

Coordination and Collaboration in Strategic Organizations

The very character of formal organizations—vertical differentiation due to a hierarchy of authority and horizontal differentiation through extensive functional specialization, role specialization, and division of labour—predisposes organizations to coordination difficulties. Western research has uncovered a variety of structural as well as behavioural mechanisms of coordination, conflict resolution, and collaboration.[34] Structural mechanisms include the hierarchy of authority, division or profit center concept, standardised operating procedures governing relations between potentially conflicting work groups, advance joint planning of operations to anticipate and rectify potential areas of conflict, profit sharing systems, etc. Behavioural mechanisms include participatory decision making in which people with

potentially conflicting interests come together to tackle problems jointly, training interpersonal competence and team building, accentuation of superordinate goals, confrontation meetings to articulate and iron out differences, organizational socialization and identification creation, etc.

Strategic organizations tend to be large and have diverse goals. Therefore they tend to have relatively high levels of functional and role specialisations.[35] This may impede inter-role and inter-functional coordination. On the other hand, strategic organizations tend to have missionary goals, and these superordinate goals can engender identification with the organization and promote cohesion within the staff. Continuing emphasis by management on the organization's strategic missions, and on communication to the staff of performance on mission-related objectives should offset conflicts engendered by specialization.[36] Besides, adroit institution building can create a distinctive organizational "clan" culture[37] that tends to contain inter-role and inter-personal conflicts.

Strategic organizations in developing societies often face a couple of distinctive coordination-related problems. As strategic, government-funded organizations, they find it difficult to practice nepotism. Norms of qualifications-based hiring tend to imply a culturally polyglot organizational membership. In these islands of cultural "cosmopolitanism" work relationships and kinship-based relationships often get out of step.[38]

A second problem area is the generation gap that some of these strategic organizations in developing countries suffer from. This generation gap arises because in many developing countries the strategic organizations set up during the initial period of planned development are staffed by the available senior bureaucrats or generalists with little technical training, but staffed at lower rungs by young technocrats, and later by professionally trained managers. The work identities of the senior managers may differ sharply from the work identities of the junior managers.[39] The former may be more traditional and obedience seeking possibly more intuitive as decision makers, while the latter may seek change, innovation, growth, participation, and professional ways of decision making.

Greater research on how some strategic organizations have moulded polyglot personnel, and how they have bridged the generation gap could lead to more effective strategies of organizational integration.

Boundary Management

Operating as "open systems", organizations must create structures and processes for obtaining the needed inputs and marketing their outputs.[40] Besides, they must establish their institutional legitimacy with the outside world.[41] For controlled organizations it may be especially important to manage their interface with their controllers.[42] Thus, the management of the various boundaries of the organization is an important element of organization design.[43]

As far as strategic organizations in developing societies are concerned, there are several interface with the environment that are particularly critical. The first is the interface with the control environment, usually the government and its agencies and institutions. The second is the interface with the intended beneficiaries of the strategic organization, its client system. The third is the interface with the suppliers of technology or know-how. The fourth is the interface with networks of organizations useful for accomplishing the missions of the strategic organization.

Concerning boundary management vis-a-vis the control environment, there are two facets : the management of the interface with the strategic organization, and the management by the strategic organization of its interface with the control environment. As progenitor and main purveyor of resources, the control environment has a legitimate interest in mission performance by the strategic organization. This generally translates into periodic performance reporting by the strategic organizations, appointment by the control environment of the top executives and board members of the strategic organization, etc. Additional useful mechanisms may be periodic review meetings with the top management of the strategic organization,

some sort of performance related contracting between the control environment and the strategic organization,[44] participative fixation of the goals of the strategic organization that takes realistic note of the latter's situation, considerable operating autonomy for the strategic organization, great care by the control environment in picking the right kind of dedicated professionals for top posts in the strategic organization, and a simultaneously nurturant (in crises) but demanding (in normal circumstances) treatment of the strategic organization.[45]

The strategic organization also needs to know how to deal effectively with the control environment.[46] It need not be obsequious; but it pays to cultivate powerful elements in the control environment and create a support network in it. It pays to take the control environment early into confidence about impending difficulties or crises. It also pays to educate the control environment about the traits of the strategic organization or of its operating environment that repuire special consideration.

Another boundary management that needs special study is the management of the interface with client systems. Many strategic organizations are set up to develop tradition-ridden, apathetic client systems—NDDB, IRDP, ATIRA, block development administration, etc., are ready Indian examples of such organizations. Too often, however, clients are seen as objects for head counts, so that physical or financial targets may be met but the essentially human, change and development targets are not.[47] It may be useful to coopt representatives of clients into the strategic organization's decision making processes. An even more radical possibility may be to set up special organizations whose business it is to organize fragmented and apathetic clients into making demands on the strategic organization. Thus, in developing societies, a prerequisite for developing the client system may be to conscientise it, and make it more cohesive and vociferous.[48] Such an investment may pressurise the strategic organization not only into providing better services, but also may make it more dynamic, progressive, participative, etc. This external pressure may be a good substitute for the commonplace lack of competitive pressure on the strategic organization. Besides, if there is competition, a strong client system would tend to induce greater competition, and thereby improve both the performance and management of the strategic organization.[49]

Know-how and technology are highly valued resources of many "high tech" strategic organizations of developing societies. These are usually availed of from developed countries. Technology acquisition is a complex process, with the strategic organization, the host government, the supplier's government, and the supplier being often involved in protracted and fluid interactions.[50] A significant boundary management problem for the strategic organization is to familiarize itself with the global technology market. A useful technology choosing heuristic in the early phase of the organization may be to "satisfice" : confine choice to "reputed" suppliers in "friendly" countries; formulate some broad cost and performance criteria; and choose the first supplier who meets these criteria. Further, as experience and skills accumulate, the technology acquisition decision can be delegated to specialists, comprehensive criteria can be formulated, and the attempt made to optimise on these criteria through global, systematic technology shopping.[51]

Finally, the strategic organization, though often a monopoly, is often just one element in a multitude of organizations that must collaborate for optimal mission accomplishment. Take the ambitious Integrated Rural Development Programme of India. Unless the programme organization elicits the cooperation of the nationalised banks, the local governmental administrative organizations, the local self-government organizations, and so forth, there would be minimal impact in the target area on the target population. Thus, the strategic organization must be competent at networking vis-a-vis the other organizations on which it is dependent for mission accomplishment but over which it has often no formal authority at all.[52] It must be able to play a change agent role in an inter-organizational network through appropriate environmental sensing, opportunity spotting, achievement drive, creativity, resourcefulness, collaboration, horse trading, planning, etc.

To summarise : some very significant areas of OB research on strategic organizations in developing

societies pertain to effective management of the interface with the control environment, with development-oriented interface with the client system, with foreign purveyors of technology, and with inter-organizational networks critical for mission accomplishment.

Management of Growth

The management of growth has become a significant topic of the fields of both business policy and organization theory. Western work has explored strategies of diversification and their structural consequences;[53] phases of growth and their organizational implications;[54] entrepreneurial strategies;[55] modes of strategy making,[56] etc.

As far as strategic organizations in developing societies are concerned, there are some distinctive features to their growth management. First of all, the goals of growth differ. Wealth, size, or profit maximization (subject to constraints) may be the principal goals of Western corporate growth management; maximization of positive externalities and development of targetted socio-economic sectors (subject to viability constraints) are the usual principal goals of strategic organizations in developing societies. Often, therefore, strategic organizations go in where corporate angels may fear to tread.

Second, the charters of strategic organizations tend to be more restricted; so opportunistic conglomerate diversification is less feasible for strategic organizations.[57] This may be fortunate because conglomerate diversification has generally been found to lead to poorer performance than related diversification.[58]

Third, subject as strategic organizations in developing societies are to governmental controls, effective boundary management for growth and diversification vis-a-vis the control environment is extremely important.[59] Establishment of goal congruence with the control environment before embarking on growth plans is an essential step.

Fourth, given government-mandated ceilings on remuneration, strategic organizations in developing societies tend to have poor availability of, and access to, top class growth managers.[60] This, combined with being very much in a learning situation vis-a-vis professional management systems and relative unfamiliarity with daunting developmental missions, implies great emphasis on a speedy and effective organizational learning strategy. Thus, learning through pilot projects, often in the most difficult operating terrain, starting in a modest way with a modest way with a single goal rather than starting in a big way with too many goals. "sticking to the knitting"[61] until management capabilities are built up, phasing expansions, investing in good performance feedback systems, etc., may be elements of an effective learning strategy.[62]

Fifth, their developmental thrust and client heterogeneity imply that the impulse to expand by replicating programs or products must be kept in check. Much growth needs to be decentralized to tap local opportunities creatively.

Finally, limited managerial and other resources imply a strategy as much of penetration as of withdrawal from areas in which the developmental missions have been achieved. The strategy is not just of withdrawing from "loser" activities, but also from "winner" activities that now some other organization(s) can handle reasonably well.

Effective corporate growth management of the Western variety may have only limited relevance for growth management by strategic organizations. Research on how effective strategic organizations manage growth, especially their learning strategies, and how they disengage from a sector once their missions are accomplished, should be rather useful.

Institution Building in Strategic Organizations

Institution building is the gradual transformation of the formal organization with its mundane concerns into a distinctive, well-accepted social institution that stands for some core values.[63] A corporation, for example, becomes an institution when beyond its customary profit or growth goals, it internalizes values like being a path breaker, or dedication to national priorities, or the growth of its human resources, or

trusteeship, etc. These values are held not just by the top management; they are shared by the rank-and-file, and concretely express themselves in the organization's policies and internal as well as external transactions. Criteria for assessing the effectiveness of institution building may be diverse; some that have been suggested are capability development, innovative thrust, and domain penetration.[64] A number of processes and choices that contribute to institution building have been identified. These include birth processes such as idea origination and nurturance, and choice of institutional form; developmental processes, such as culture creation through initial recruitment, decision-making, leadership, structuring, boundary management, etc.; renewal processes encompassing leadership changes, mission redefinition, etc.; and institutionalisation processes such as relevance building and environmental impact.[65]

Institution building is of obvious importance to the developing world, for formal, strategic organizations are the instruments of the developing world not only for achieving sepcific developmental missions but also for changing traditional and conservative societies with the new values of innovation and science-based modernization, democratic functioning, primacy of human growth, professionalism, and the growth and development of under-developed client systems.

Vis-a-vis institution building, strategic organizations in a developing society are at an advantage; for, compared to a run-of-the-mill corporation or a government bureau, they start with transformational missions. The initial choices; however, are important. If persons with bureaucratic or political orientation are put in charge of the fledgling strategic organization, the chances are that the organization will get 'set' as a bureaucracy or as a "spoils system". If, however, persons with a sense of mission, a team building, participative decision making orientation, and strong networking capabilities are put in change, it is likely that they will recruit like-minded persons, and institution building values will get set.[66] More often than not, the resource dependency of the strategic organization on the government takes its toll, and the strategic organization degenerates into a sick organization, heavily bureaucratised and politicalised. Thus, the strategic organization may have two sharply differing alternative life cycles :[67] an organic youth with a bureaucratic or political head, goal displacement,[68] the institutionalisation of bureaucratic values or the values of the "spoils systems" decay and degeneration into sickness; versus, an organic youth with a dedicated, participative professional as head, capability development, team building, goal elaboration, innovative thrust, and market or domain penetration and impact.

Research on alternation building life cycles should provide many insights into effective transformation of blueprints and bureaucracies into living bridges to human growth.

Innovation and Change in Strategic Organizations

Large and bureaucratic though the strategic organization may often be, its business is innovation and change culminating in socio-economic development. As perceptive observers of bureaucratic organizations have noted, their bureaucratisation impedes introduction of innovations; but once the initial resistance is overcome, the pressure for standardisation can expedite organization-wide adoption of the innovation or change.[69] The trick, therefore, is to create a precedent. Thus, attempts to create innovative precedents in marginal parts of the bureaucratised strategic organization or in its marginal activities should facilitate the diffusion of the innovation in the rest of the organization. Decentralization and local action research should, therefore, be useful.[70] The organizational leadership may play a critical role; whether it is entrepreneurial and development oriented or conservative and bureaucratic should make a very large difference to the strategic organization's innovativeness.[71] Preference for novel outputs, creativity, experimentation, dynamic young managers, and simultaneously for discipline and efficiency may be the strategic policy choices needed to generate a powerful innovation impulse in the organization.[72] A relatively flat structure, the creation of small work groups, and a reasonably effective formal as well as informal information, and planning system may be the structural devices necessary for innovations to take place.[73]

Certain mechanisms can speed up organizational learning in new ventures, such as pilot projects and phased expansions, parallel effort and "shoot outs".[74] Like other large, bureaucratic organizations, strategic organizations tend to accumulate once useful, currently obsolete practices, policies, and structures. A major opportunity for innovation may be for management to ask periodically the question : if the organization were to start all over again, which of its products, technologies, goals, strategies, policies, structures, and practices that it now has would it acquire ? "[75] Such a question opens up vast opportunities for spring cleaning, and for replacing the obsolete with the currently and futuristically useful. Periodic informal meetings between the top level managers and junior, younger managers may be productive. At these, the latter may be encouraged to share their aspirations and ideas for the organization, and the top level managers may provide briefing on the organization's missions, goal opportunities, threats, and constraints. Such meetings would help institutionalise a culture of innovation. The diffusion of innovations within a strategic organization (or a group of similar strategic organizations) can be expedited if details of innovations, both successes and failures, are quickly circulated throughout the organization (or group of organizations).[76]

There may be much potential for innovations at middle management levels in strategic organizations because these levels are commonly staffed by relatively young technocrats and professional managers raring for change But the adoptions of innovations at lower rungs may be a difficult process in strategic organizations because it requires considerable coalition building activity that cuts across functional and role specialization barriers. Innovation agentry may require a variety of skills relatively scarce even in professional managers : ability to diagnose innovation opportunities generate creative and relevant ideas; market the ideas to colleagues and superiors; understand and manage the politics of innovation; build a team for implementing the innovation, etc.[77]

Some important research areas vis-a-vis innovation and change in strategic organizations are how centralization and decentralization affect the adoption of what kinds of innovations, the role of top management ideology, spring cleaning as a spur to innovation, vertical two-way communications and innovation, strategic policy choices and innovation, and effective change agentry at middle management levels.

Revitalization of Sick Strategic Organizations

Organizational sickness may have become a global phenomenon. Organizations, even in the developed West despite easy access to high quality technocrats and managerial personnel, fall victims to too fast a change, too much complexity, too much competition, or too many restrictions.[78] Sickness seems to be rampant in the developing world. In India alone nearly 1,00,000 manufacturing units (mostly small scale units) are sick; a significant percentage of its public enterprises remain loss making; and sickness in its large, quasi-governmental institutions and governmental departments seems rampant.[79] Fortunately, turnaround research both in the West and in the Third World, especially in India, has led to the identification of useful models of effective turnaround management.[80]

Because of large size, complex, unfamiliar, long-term missions, and a strong interface with the government, strategic organizations are quite prone to organizational sickness, manifesting as low morale, in-fighting, a poor public image, sacrifice of quality for the sake of targetry, and mission failure. Given the often fuzzy goals of strategic organizations, the recognition of sickness itself may take a long time.[81] If a spoils system has got installed, the beneficiaries in the political system and in the organization may resist curative actions. Therefore, even if there is recognition of sickness, an effective consensus to do anything may take long to emerge. These delays may, of course, aggravate sickness. It may not be easy to find the right person to revive a sick strategic organization, partly because of the high risk of failure, but partly also because the kind of manager needed to revitalize a sick organization may be very different from the run-of-the-mill professional manager.[82] The turnaround manager needs to be something of an entrepreneur who can quickly see, and seize, opportunities in a murky situation, something of a missionary

who can mobilize a demoralised work force for the heroic efforts required for turnaround; something of a team builder who, through participative decision making can put together a team of dedicated managers for operating the turnaround; something of an expert negotiator who can negotiate concessions and support from the organization's various stakeholders for speeding turnaround something of a professional manager who can plug the biggest loopholes in the operating management systems; something of a creative learner who comes into an unfamiliar organizational system; learns the ropes fast and puts together a custom-tailored turnaround strategy; and something of an institution builder who gives a great deal of importance to the values he or she prizes, and disseminates them by setting a personal example. A right sort of top management team, instead of an individual, may find it easier to turnaround a sick strategic organization.[83] It may make sense for developing countries to raise a cadre of turnaround managers.

A number of research questions come to mind. Why is it that a disproportionately large number of strategic organizations do not seem to have an internal capability to prevent sickness or cure themselves and must pathetically wait for outsiders to set them right?[84] What could be the sizing up strategies of strangers who come in as rescuers ? What initial actions of rescuers could unfreeze a sick organization; what actions would ensure a direction change; and what actions could consolidate a turnaround ? How can a society provide its strategic organizations with the right kinds of turnaround managers ?

Concluding Comments

OB for social development is an exciting and over due paradigm shift from organizational narcissism. The primary instrumentality of this paradigm shift is research focus on the strategic organizations of the developing world, especially on motivation and control, coordination, boundary spanning, innovation and change, growth management, institution building, and sickness and revitalization. Such a paradigm shift would not only make OB immeasurably more relevant to over two-thirds of the globe's population, it should bring in its train exciting new concepts, approaches, data, and techniques that may revolutionise OB.

Fortunately, the opportunities for studying strategic organizations in Third World countries may be sizeable. The strategic organization tend to be rife with "people" problems thanks to its daunting missions, bureaucratic structure, kinship oriented staff and conservative clientele. Both the control environment and the strategic organization's management should generally be keen to get whatever help they can from the social scientist in order to tame the beast.

Besides this, the strategic organization in developing society is perpetually trying out something or the other. One year it is diversification; another year it is computerisation; a third year it is structural reorganization; a fourth year it is MBO, or quality circle, or T-group, or stress management, or creativity training, or OD, or whatever else. The point is that strategic organizations of developing societies offer exceptionally rich sites for natural experiment type research. All that the OB researcher has to do is to contact the strategic organization intending to do an experiment and negotiate "before" and "after" measurements of structure, strategy, style, culture, leadership, values or whatever else the OB researcher fancies. An extensive natural experiment based research strategy should provide invaluable causal grist for OB conceptualising and technologising. Table 3 summarises some significant OB research issues pertaining to the strategic organizations of the Third World. →

TABLE 3

Some OB Issues and Research Opportunities Vis-a-Vis Strategic Organizations

OB Issues in Strategic Organizations	*Significant Opportunities for Further OB Research*
1. Motivation and control in strategic organizations	1. Capacity to offer extrinsic and intrinsic motivators, particularly challenging. socially relevant jobs 2. Research on such other powerful and durable motivators as work dedication and conscientiousness, extension motivation, patriotism pioneering—innovative motivation 3. Research on inspiring, charismatic, missionary type of leadership found more commonly in military organizations in war time and among political leaders of revolutionary movements 4. Predisposition to use bureaucratic forms of performance control (hierarchy, budgets, rules). Potential for using self, peer group, and ideological forms of control.
2. Coordination, conflcit resolution, and inter-personal collaboration in strategic organizations	1. Effect on coordination and collaboration of functional and role specialization, "fair". qualifications based, non-nepotistic hiring practices, "generation gap", etc. 2. Potential for improving coordination and collaboration through greater emphasis on missionary motivation of selected personnel, indoctrination of staff into organizational mission, institution and team building processes 3. Need to research the right mix of bureaucratic, behavioural, and culture—specific coordination, conflict resolution, and collaboration inducting mechanisms
3. Boundary management in strategic organizations	1. Control environment's management of interface with strategic organization 2. Strategic organization's management of interface with control environment especially networking within the control environment for support to the organization 3. Client development by human services oriented strategic organizations 4. Technology acquisition management by "high tech" strategic organizations 5. Networking with other organizations for mission accomplishment.
4. Growth management in strategic organizations	1. Rapid organizational learning strategies for growth in unfamilar areas (pilot projects, single goals, phasing, starting small, starting small in the most difficult part of the domain)

(*Contd.*)

TABLE 3 (*Contd.*)

OB Issues in Strategic Organizations	*Significant Opportunities for Further OB Research*
	2. Organizational strategies for withdrawing from domains in which development missions are completed
	3. Establishment of criteria of success for mission accomplishment
	4. Negotiations of support from control environment for growth goals and initiatives
	5. Implications of growth for organizational structure, staff motivation, coordination, etc.
	6. Leadership needed at operating levels to manage growth.
5. Institution building in strategic origanizations	1. The long-term effects of initial policy, structure, and other choices for institution building
	2. Socialization processes for institution building
	3. Leadership style for institution building
	4. How strategic organizations can capitalize on their inherent external legitimacy
	5. How core values get introduced and institutionalised in the strategic organization
	6. How institutionalised core values affect the strategy, structure, performance pattern etc., of the strategic organizations
	7. Alternative institution building life cycles of strategic organizations
6. Innovation and change in strategic organizations	1. The role of precedents in the diffusion of innovations within strategic organizations. Facilitators of precedent creation
	2. Creation of a culture of innovation in the face of bureaucratic structure. The role of top management leadership strategic choices
	3. Organizational structure and control systems that are congruent with innovationist emphasis
	4. Innovation spurring practices-periodic junking of obsolete practices, periodic informal meetings between top level and junior managers, circulation of diagnoses of organization successes as well as failures within the organization, etc.
	5. Innovation change agentry within the strategic organization at operating levels.
7. Revitalization of sick strategic organizations	1. Proneness of the strategic organization to fall sick (because of large size, bureaucratisation due to external dependency etc.)

(*Contd.*)

TABLE 3 (*Contd.*)

OB Issues in Strategic Organizations	*Significant Opportunities for Further OB Research*
	2. Internal and external recognition of the sickness of the strategic organization and the development of indicators of organizational sickness 3. Traits and abilities of effective turnaround managers/ teams 4. Initial actions for "unfreezing" a paralysed strategic organization 5. Actions for initiating a change of direction 6. Actions for consolidating a revitalization 7. Mechanisms for preventing recurrence of sickness.

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Productivity
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Productivity in Process Industries

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Improving Productivity in Process Industries

Improving Productivity by efficient utilisation of resources is the basic function of the management. Present economic situation, shrinking resources, expanding population growth, and increasing demand for products and services have virtually driven us to a stage where we cannot afford to consume our resources extravagantly.

In the 1960s the cost of energy as fuel equivalent was 0.022 Rs/1000 Kcals, whereas today it is 0.15 Rs/1000 Kcal. The increased cost of energy has tremendously hit the economy of all the nations. Under these circumstances it is imperative that the Management must plan for efficient and effective utilisation of the available resources, so as to improve the productivity in the entire sphere of activities.

Resources Management for improving productivity is indispensable not only from the point of view of increasing organizational profits, but also from the resources conservation point, in the overall interest of the nation.

Process industries consume substantial quantities of Raw materials and utilities such as steam, air, cooling water, fuel etc. Effective management of these variables tend to increase the productivity of the overall industry.

There are innumerable areas that can be studied in depth from the optimisation point of view. From

Managerial angle productivity is defined as the ratio of output to input. This may be represented as

P = O/I where P = productivity., O = output, I = input.

Output normally represents the quantity of products produced or the products sold. Input represents the input of raw materials, manpower, energy, utilities and capital.

This article deals with some of the vulnerable areas of the process industry where productivity can be improved by optimisation by means of simple mathematical models and/or quantitative analysis. The increase in productivity ultimately tends to increase the profitability of the enterprise at the micro level, and the increase in the productivity in the subsystem will tend to increase the National Productivity.

A. *Choice of Plant Location in improving Productivity*

This example refers to the optimisation of plant location. Normal factors that influence the choice of the plant location are the availability of raw materials, nearness to major market, power availability and cheap labour.

The most of the major process industries have got their own captive power plant, and the cost of labour is almost standardised. Hence the factors that influence the choice of plant location are the cost of transportation of raw materials from the source of occurrence and the product transportation cost from the plant to the major market. This is because of the dynamic change in the cost of energy which is reflected in the high cost of transportation. Hence the optimum location of the plant is such that the sum of the transportation cost of raw material and product is minimum.

Quantitative Example

This example refers to the setting up of a steel plant to manufacture cast iron, wrought iron, and stainless steel from the iron ore. The raw materials required are the iron ore, coal, and time stone. Cost of transportation of lime stone may be neglected for simplicity. Iron ore required is about 100 tons per day and coal required is about 200 tons per day. Cost of transportation is Rs C/ton/km distance. C is assumed linear, Iron ore & Coal are available in stations A & B respectively which are at a distance of X_a & X_b kms from the proposed plant P. (as given in fig 1).

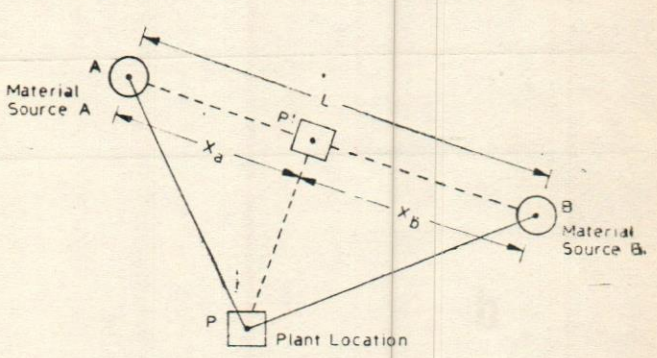


FIG 1 – OPTIMISATION OF PLANT LOCATION (Macro Level)

We know from mathematical relationship that the plant must be located somewhere in the line AB as the distance AB is minimum. (from P) i.e. AB is less than AP + BP. Let us assume the distance AB is equal to L kms.

The factors that determine the cost of transportation are 1. distance and 2. quantity of raw material that is transported. i.e. consumption rate. These two functions are linear. Hence

Cost of Transportation = cost in Rs/ton/km × quantity transported × distance transported. Based on this relationship,

Cost of transportation for

Raw material A = C_a = 800 X C X X_a.

Raw material B = C_b = 200 X = C X X_b.

Since the cost of transport is linear and proportional to the distance (Quantity predetermined) the rate of change of transportation cost is found by differentiating the above functions.

dC_a/dX_a = 800C (I)

dCb/dX_b = 200C. (II)

Value of Eqn II is less than eqn I C being a

constant. The mathematical model for the problem is

minimise $z = 800CX_a + 200CX_b$.

subject to $= X_a + X_b = L$.

X_a, X_b greater than or equal to 0.

Since II is less than I we should maximise X_b and minimise X_a so that the total cost of transportation (Energy) will be minimum.

Putting $X_a = O$ in equation we get $X_b = L$.

Total cost is equal to $200C X_b$.

$= 200CL$.

which means the plan must be situated in at A where raw material is produced. In all other cases the cost of transportation will be high. For example let us take $X_a = 0.01L$.

$X_6 = 0.99L$. Therefore $C_t = .01L. 800.C + .99 L. 200. C.$

$= 206$ CL. which is higher than 200 CL

This method (known as steepest descention) may be used to determine the optimum plant location.

At micro level, this model can be used for optimum plant location of a process unit between raw material section and product storage section so as to minimise the energy consumption of the total system which increases the productivity, by reducing handling costs.

B. Increasing Productivity by optimisation of the process & equipments

Selection of the process and equipments determines the fate of the industry. Decision on the choice of the process and equipments between alternates must be taken with extreme care, taking into consideration factors like raw material availability, power and utility costs, processing costs, performance and reliabiliry of the process and equipments.

A Quantitative Example

Two processes A & B are available for the oxidation of paraffin wax to manufacture fatty acids. Both the processes are technically sound. Cost details have been evaluated as shown below from the performance data.

Item	*Process A (Batch)*	*Process B. (Continuous)*
1. Installad plant cost.	1.2×10^6 Rs	4.8×10^6 Rs.
2. Salvage value.	$0.1 \times$,,	$0.8 \times$,,
3. *Operating costs*		
Labour.....	$0.35 \times$,,	$0.20 \times$,,
Utilities.....	$0.20 \times$,,	$0.10 \times$,,
Power.....	$0.20 \times$,,	$0.10 \times$,,
4. Cost of maintenance/year.	$0.60 \times$,,	$0.30 \times$,,
5. Cost of capital	2.0 years.	6.0 years.
6. Cost of capital... ..	12%	12%

The annual costs including operating cost and maintenance is Rs 1.35 million respectively for process A & B. Because of better material of construction, and instrumentation, process B has higher initial cost and less maintenance and operating cost compared to A.

The choice of the process in such cases is based on the evaluation of Present worth of the alternates. Based on 6 years operating cycle, the chronological operating pattern of the processes with discounted cash flows is given below.

At first sight it seems process A is cheaper than process B because of the low capital cost. But the high operating cost, maintenance cost, and low service life offset this advantage. On the basis of 6 years operation, process B is more economical than process A by 1.33×10^6 Rs. In terms of productivity, process B has higher productivity than A by 17.4%.

C. Fuel Mix & Productivity Improvement in Steam Generation Plant

Raw material scarcity is not common in developing countries. In such critical situations, process industries will have to use alternate feedstocks, which may adversely affect the economy of operation. Even in such adverse conditions it is possible to achieve high

Chronological Operating Pattern for Process A & B

Amount in million Rs.

Year.	*Item.*	*Process A.*		*Process B.*	
		Amount.	*Discounted value.*	*Amount.*	*Discounted value.*
I.	Investment.	1.2	1.2	4.8	4.8.
I.	Operation cost	1.35	1.35	0.70	0.70.
II.	Operating cost	1.35	1.20	0.70	0.60.
II.	Salvage value.	—0.10	—0.08	——	——
III.	Reinvestment.	1.20	0.96.	———	———
III.	Operating cost.	1.35.	1.08.	0.70	0.56.
IV.	Operating cost.	1.35.	0.96.	0.70	0.50.
IV.	Salvage value.	—0.10	—0.06.	——	———
V.	Reinvestment.	1.20.	0.76.	———	———
V.	Operating cost.	1.35.	0.86.	0.70	0.44.
VI.	Operating cost.	1.35.	0.77.	0.70	0.40.
VI.	Salvage value.	—0.10	—0.05	—0.80.	—0.40.
	Net Present Worth.	——	8.95	——	7.62.

productivity within the stipulated constraints by the application of linear and non linear programming techniques. The example refers to a steam generation plant in a fertilizer unit, based on F.O. Feedstock, and producing about 1350 tons/day of urea. Steam requirement for the above plant is 500 tons/hr which is generated by a high pressure boiler. The boiler has provision for coal firing, F.O. firing, & gas firing,either collectively or individually. Technical details, and stipulated constraints are given below.

Item.	*Coal Firing.*	*FO Firing*	*Fuel Gas firing*
1. Steam/Fuel ratio.	8.	51.	17.
2. Cost of fuel Rs/ton.	300.	1000.	500.
3. Operating cost Rs/ton fuel burnt.	100.	50.	40.
4. *Constraints.*			
minimum coal firing rate	30 tons/hr.	maximum coal available	45 tons/hr.
,, FO ,, ,,	5 ,, ,,	,, gas ,,	5 ,, ,,
,, gas ,, ,,	3 ,, ,,	FO availability ...	infinite.

The objective is to minimise the operation cost, without affecting the steam generation quantity within the constraints given above. Total cost for coal, F.O. & Gas firing are Rs. 400, 1050, & 540 per ton burnt. Steam generation cost for coal, F.O. & Gas, based on steam fuel ratio are Rs 400/8, 1050/15, 540/17. i.e. 50,70 & 32 Rs/ton of steam generated.

Let x_1, x_2, & x_3 be the quantities of coal, F.O. & Gas burnt/hr to generate 500 t/hr of steam. The mathematical based on our objective is

Minimise $Z = 400\ x_1 + 1050\ x_2 + 540\ x_3$

subject to $8\ x_1 + 15\ x_2 + 17\ x_3 = 500$ (steam quantity)

x_1 greater than or equal to 30 (coal firing constraint)

$x_1\ x_1 \leqslant 45.$ coal availability constraint.

$x_2 \geqslant 5$ oil firing constraint.

$x3 \geqslant 3$ gas ,,

$x_3 \leqslant 5$,, availability constraint.

The problem is now converted into a two variable problem for the sake of simplicity. Since the cost of steam generated by gas is minimum, and the available gas is 5 t/hr we must use the full gas to generate 85 t/hr of steam. Hence the balance quantity of steam to be generated is $500 - 85 = 415$ t/hr of steam. The problem now reduces to

Minimise $z = 400\ x_1 + 1050\ x_2$

subject to $8\ x_1 = 15\ x_2 = 415.$

$x_1 \geqslant 30$

$x_2 \geqslant 5$

$x^1 \leqslant 45.$ x_1, x_2 greater than or equal to 0.

This has been graphically solved and shown in fig. 2. The solution is

$x_1 = 42.5\ x_2 = 5\ x_3 = 5.$

Total operating cost/hr = 24, 950 Rs.

Effect of fuel mix on productivity

Due to non availability of coal, limitation in crusher, mill etc if the coal availability is reduced to 30 t/hr, there will be an increase in the operating cost. i.e. $x_1 = 30$ t/hr. Therefore $x_2 = 35/3$.

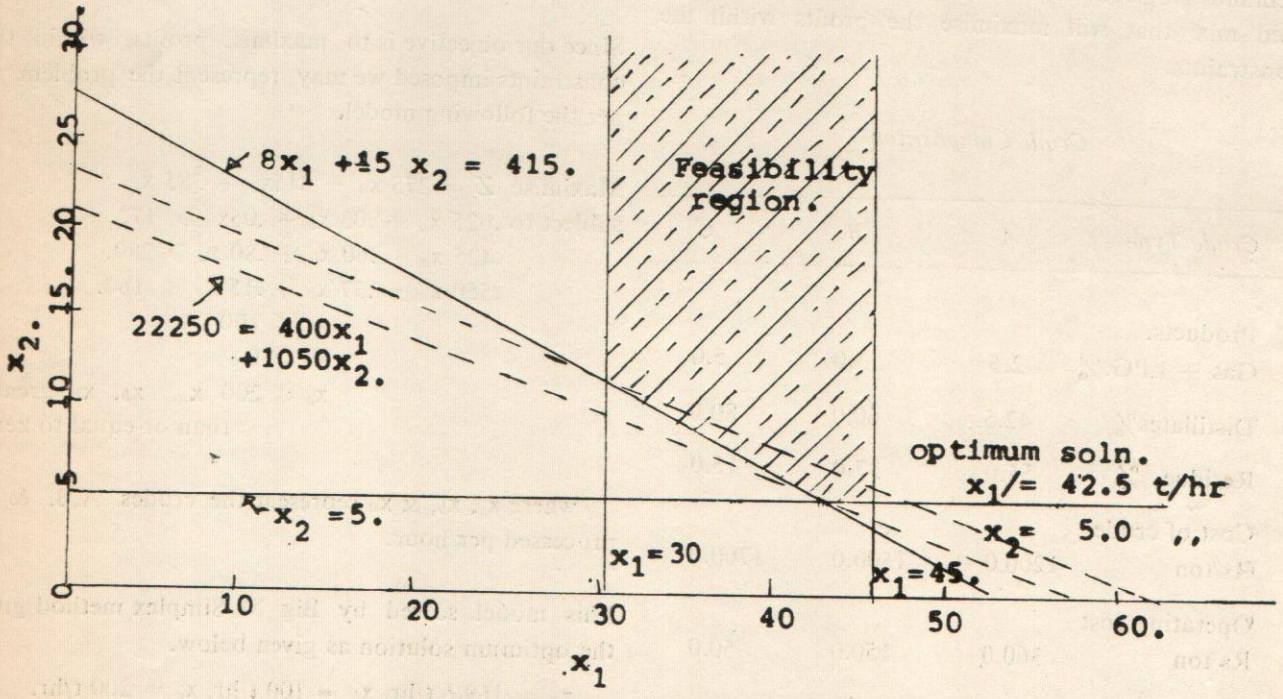


Fig. 2: Fuel mix Optimisation by linear Programming

Therefore revised operating cost is $30 \times 400 + 35/3 \times 1050 + 5 \times 540 = 26{,}953$ Rs.

Increase in operating cost is 2003 Rs/hr i.e. 48072 Rs/-day.

Increase in operating cost for three months will be 43.3 lakhs Rs. for the same steam generated. That is productivity reduction is 7.43% due to *fuel mix alone*.

D. Improving Productivity by Product Mix

Many process industries are so designed, that they can process a number of different raw materials of varying quality which increase or decrease the cost of operation depending on the feed mix. The model given below refers to petroleum refining, where different types of crudes are processed.

Example

Three different crude oils of different composition are to be processed in a refinery. The cost of the crude, composition, & operating costs are given below. Premium grade C is available only to the extent of 200 t/hr. Crude B availability is limited to 100 t/hr, while crude A is available to any extent. Product demand is given in the table below. Determine the feed mix that will maximise the profits within the constraints.

Crude Composition

Crude Type	*A*	*B*	*C*
Products.			
Gas + LPG.%	2.5	3.0	5.0
Distillates%	42.5	60.0	80.0
Residue %	55.0	37.0	15.0
Cost of crude Rs/ton	1200.0	1500.0	1700.0
Operating cost Rs/ton	360.0	150.0	50.0

	Product demand	*Price*
Gas + LPG	17 t/hr minimum.	3000.00 Rs/ton.
Distillates	280 ,, ,.	2200.00 ,,
Residue.	160 ,, maximum.	1500.00 ,,

Profitability of processing each type of crude can be calculated as follows.

Profit from processing = cost of products sold—crude cost—operating cost. = (300 × % LPG + 2200 % Distillates + 1500 % Residue) -(cost of crude + Operating cost)

Applying the above relationship, profits for processing crudes A, B, & C are calculated as Rs 275, 315, & 385 respectively.

Operating cost is the highest for crude A and less for crude B, and least for C. This is because A has to under go maximum secondary processing like cracking, visbreaking, etc B has to undergo moderate processing, while C directly gives the products. Hence crude C has premium price.

Since our ohjective is to maximise profits, within the constraints imposed we may represent the problem as per the following model.

$$\text{Maximise } Z = 275\,x_a + 315x_b + 385\,x_c$$

$$\text{subject to } .025\,x_a + .03\,x_b + .05x_c \geq 17.$$

$$.425\,x_a + .60\,x_b + .80\,x_c \geq 280.$$

$$.550\,x_a + .37\,x_b + .15\,x_c \leq 160.$$

$$x_b \leq 100$$

$$x_a \geqslant 0$$

$$x_c \leqslant 200$$

x_a, x_b, x_c greater than or equal to zero.

where x_a, x_b, & x_c represent the crudes A,B, & C processed per hour.

This model solved by Big M Simplex method gives the optimum solution as given below.

$x_a = 169.6$ t/hr. $x_b = 100$ t/hr, $x_c = 200$ t/hr.

Total operating profit for this feed mix is 1,55, 140 Rs. This solution meets all the constraints and also maximises the profits.

Any other mix will either fail to meet the constraints, or will result in surplus products or less operating profits. For example let us take another solution as given which meets the product pattern.

$x_a = 216.3$ t/hr. $x_b = 22.4$ t/hr $x_c = 218.4$ t/hr.

This crude mix meets the product pattern demanded, and the operating profit is Rs 1,50.412 which is less than the previous solution. However this solution violates the constraint that x_c should be less than or equal to 200 t/hr.

This linear pragramming model may be used to determine any number of feed stocks that will enhance the profits within the given constraints. If the number of elements are more, computer programming has to be resorted to, to get the optimum solution which increases productivity.

E. Impact of level of Activity/plant load on Productivity

Analysis of process performance in terms of % capacity utilisation is necessary for increasing productivity. At higher plant loads, and higher level of activity, specific consumption of raw materials, energy, and operating cost tend to be low. (Decreasing tendency) fig. 3.

This indirectly boosts the profits. A typical % Plant load vs specific consumption of Naphtha for an Ammonia plant is given here.

% Plant load.	Sp Consumption of Naphtha.
	tons naphtha/ton ammonia produced
60	1.20
68	1.17.
46	1.18
82	1.09
67	1.15.
76	1.06.
96	0.95.

Applying the principle of least squares, correlation between the plant load vs consumption is obtained as (Calculation not shown)

$$Y = -.005\,X + 1.46.$$

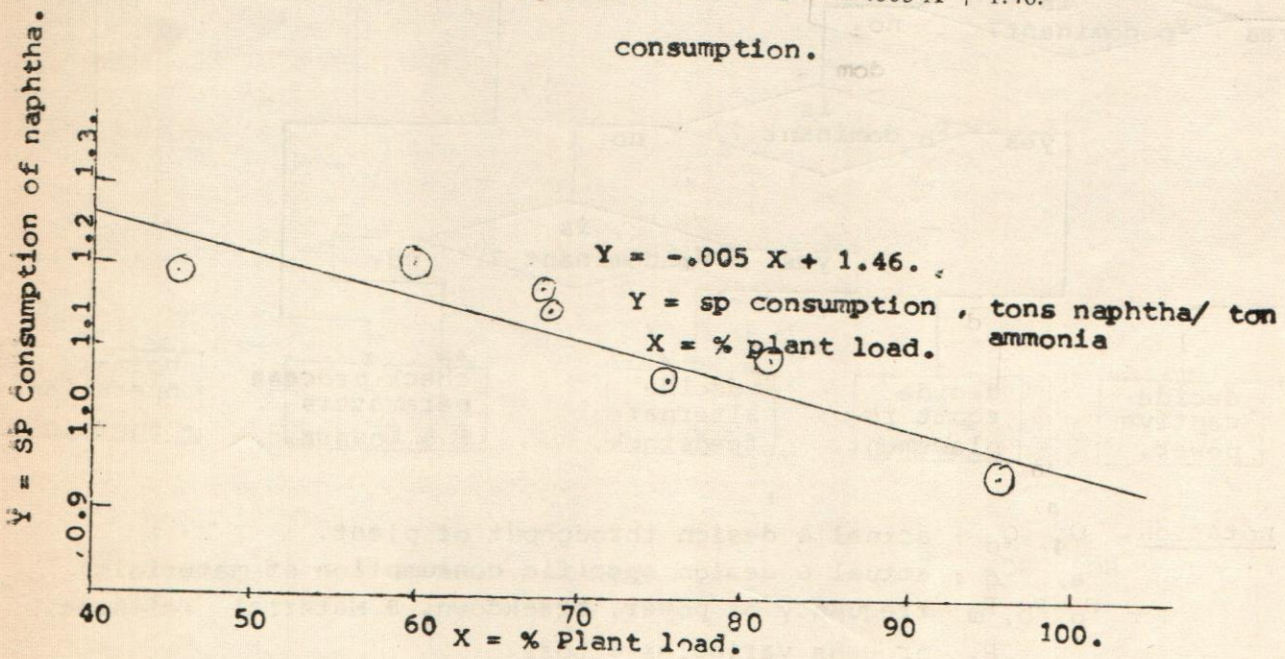


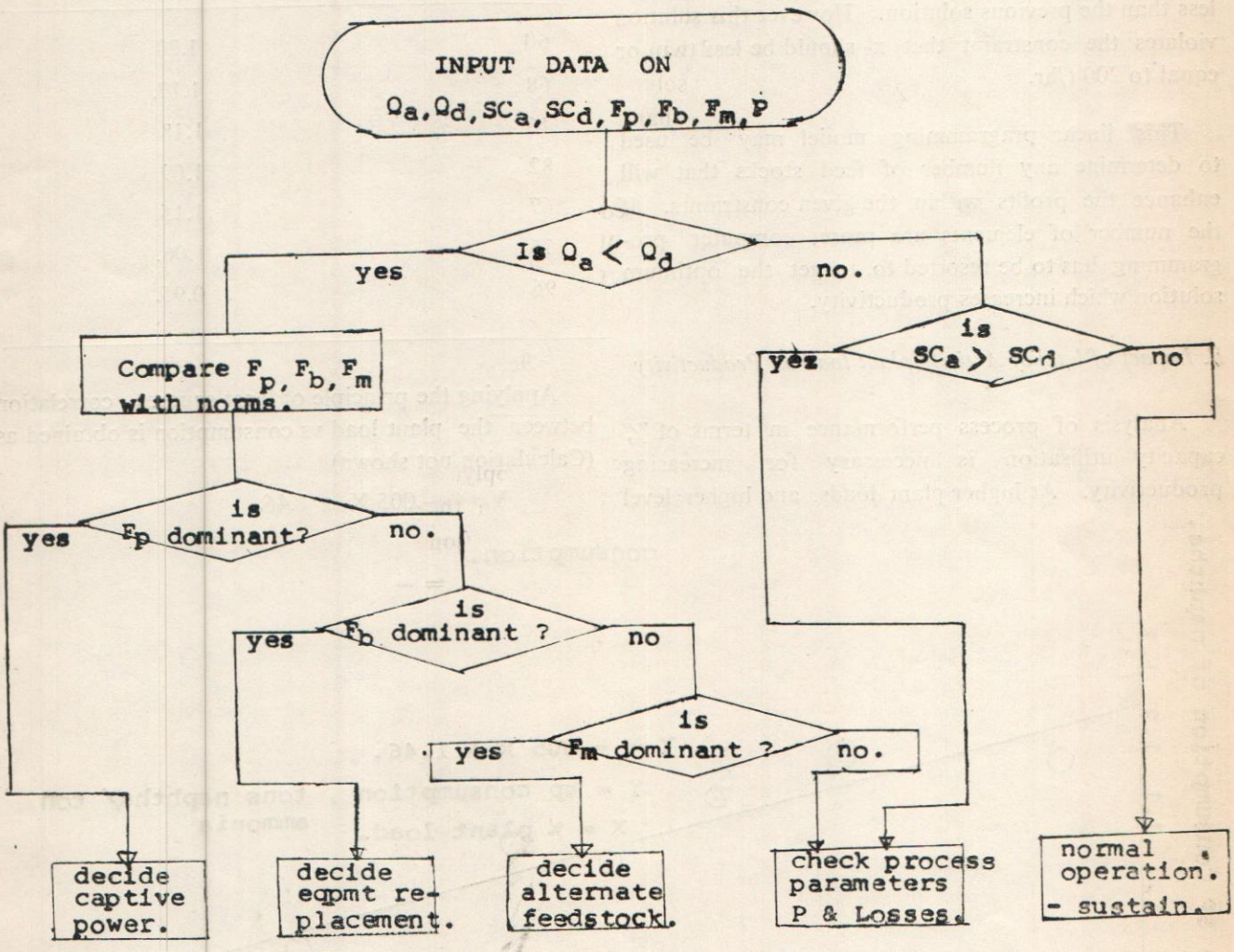
Fig. 3: Plant Load (Level of activity) Vs Specific Consumption

where Y = specific consumption of naphtha in tons/-ton ammonia produced.

X = % plant load equal to actual ammonia produced/design capacity. It is clear from the above relationship that at higher plant load specific consumption reduces. This means higher capacity utilisation tends to increase the productivity.

In most processes, actual throughput tends to be lower than the installed capacity due to equipment failures, power failures/interruptions, input limitations, labour unrest, and/or operational problems.

A decision flow diagram to identify the reason for lower capacity utilisation is given in fig.4. Major decisions such as equipment replacement, process modification, captive power plant, raw material subtitution, etc may be arrived at by cost benefit analysis, since these require extra resources and investment.



notation. Q_a, Q_d ; actual & design throughput of plant.
SC_a, SC_d ; actual & design specific consumption of materials.
F_p, F_b, F_m frequency of power, breakdown, & Material failures.
P. process variables & Loss.

Fig. 4: Decision Flow Diagram on Plant Performance Analysis

F. Optimisation of Energy Consumption to increase Productivity

Chemical process industries being energy intensive units, our attention must be focussed on all energy consuming centres. Major energy consuming sections are heaters, boilers, reactors, steam system, etc. Decision to install a waste heat boiler or air preheater to reduce energy consumption may be taken up after studying the cost-benefit analysis and energy balance. Flare loss contributes a great deal in energy loss. A simplified decision flow diagram on energy optimisation is given in fig 5 for reference.

G. Material Consumption Optimisation & Productivity

In section E, it was shown how specific consumption of raw materials and other resources may be optimised to improve the productivity. But in actual process, the quantity of raw materials required will be higher than the design values, because of process loss, handling loss, and storage loss. i.e. the actual quantity procured and stored will be higher than that actually used in the process itself.
This can be mathematically expressed as

$$q_a = q_d + p_l + p_h + p_s.$$

where q_a & q_d are actual specific consumption, & theoretical Specific consumption.

p_l, p_h, p_s are specific losses in process, handling and storage respectively. Reduction of these losses tend to equalise q_a to q_t. i.e.

Productivity in this case may be denoted by

$$P = q_d/q_a$$

$$= \frac{q_d}{q_d + \text{losses.}}$$

This concept is depicted in fig 6. As losses are reduced, productivity tends to unity. (this is practically impossible; but can be reduced) *Loss Reduction to increase Productivity.*

Process loss: This loss is attributed to leakages from process vessels, pumps, gland leaks, seal failures, compressor leaks, carry over from process vessels, over loading of system, poor condensation, poor cooling efficiency etc. A periodic survey on process loss will definitely reduce these losses. Proper maintenance and advanced process controls, and trained operating personnel are essential to reduce these losses and improve productivity.

Handling losses: Handling losses occur due to raw material & product handling. This loss is higher if the material handled is volatile and is proportional to the distance and frequency of handling. To minimise this loss optimum distance and frequency must be arrived at. In volatile liquid handling system, the pump must be of mechanical seal type and the temperature of handling must be below the boiling point of the liquid, to prevent vaporisation.

Storage loss: In process industries, raw materials are stored in tanks or hoppers or bins depending on the type of material. In case of volatile products the storage temperature must be below the vaporisation temperature, or should have high pressure tanks, or floating roof tanks. Sub cooling may be required in certain extremely volatile liquids like ammonia, LPG, methanol etc which is achieved by continuous refrigeration and returning the condensed liquid back. In case of tanks having similar products, there will be substantial loss due to vaporisation. Storage loss in such case is reduced by continuous withdrawal of vapors and condensing it and recycling it back to the process. This method reduces storage losses to a considerable extent, and increases productivity.

Conclusion

These quantitative models are only a few, where optimisation of resources to increase productivity may be carried out successfully. Productivity stems from efficient utilisation of resources which demands effective management. It is the result of multi pronged effort.

The illustrations show how productivity may be improved by proper design, and operation of the 4 'M's of management. men, machine, materials & money.

Productivity from men, & materials may be improved by reducing rejections, waste, idleness, etc. Inventory control, and resources pooling, based on

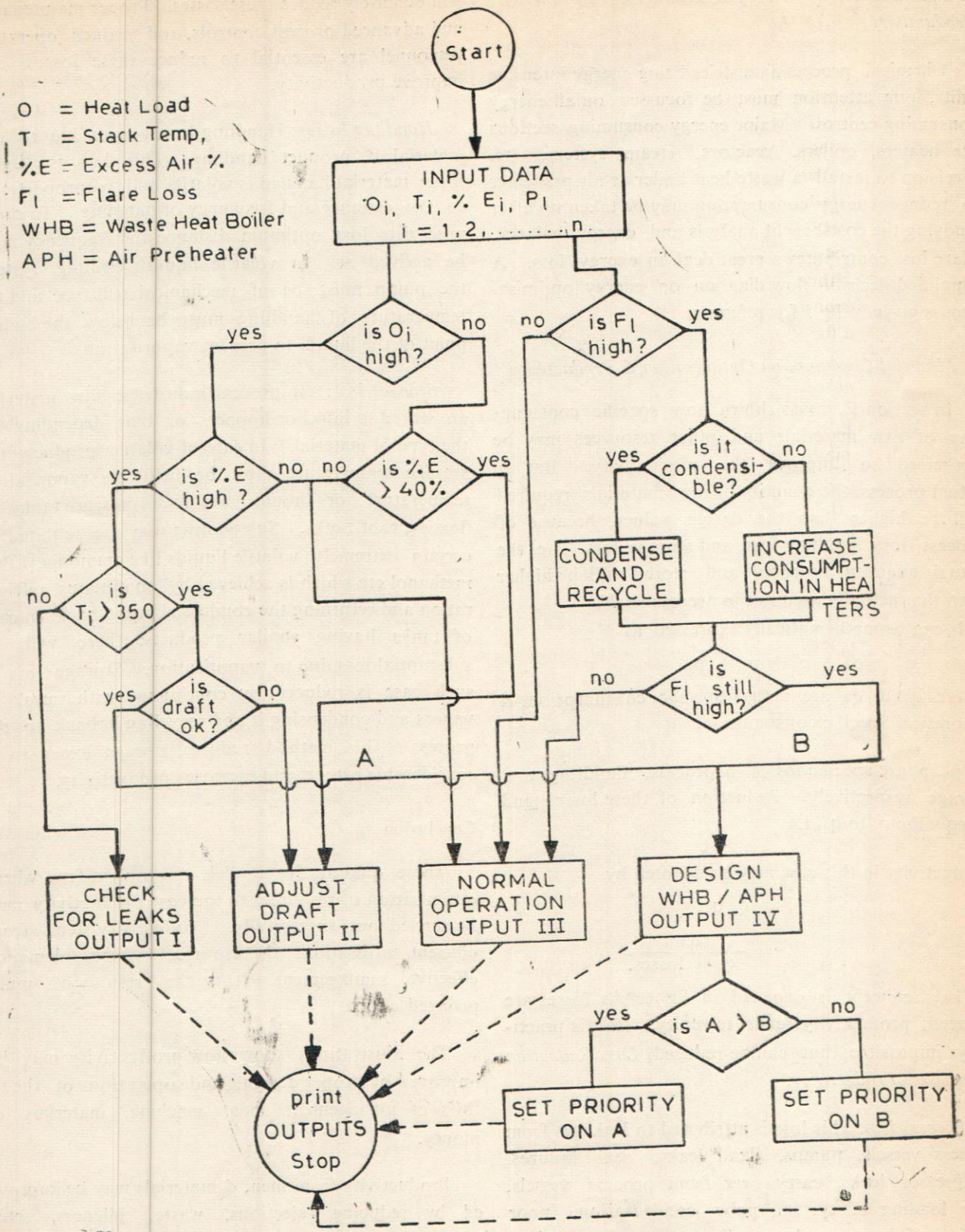


Fig. 5: Energy Consumption Optimisation. Decision Flow Diagram

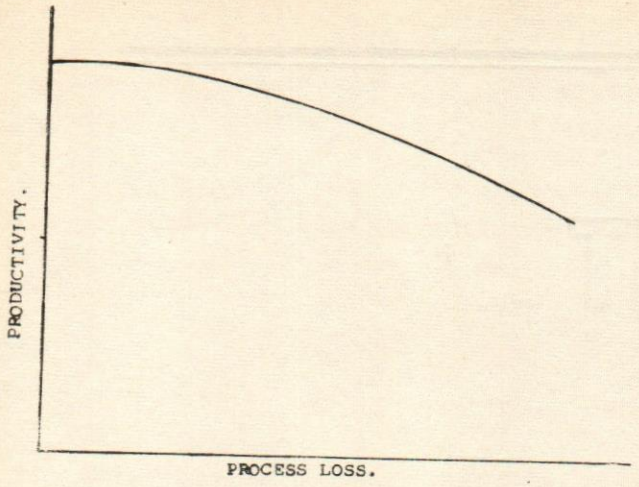


Fig. 6: Process Loss vs Productivity

standardisation and value analysis help in improving productivity.

These simple techniques result in enormous savings of the precious resources only if implemented and monitored effectively. Like the little drops of water making the mighty ocean, addition of productivity at each stage will ultimately lead to tremendous profitability for the organisation, which at macro level will boost the economy of the nation and lead to prosperity.

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Retrenchment : A Critical Review

E.M. RAO

The author in this paper has analysed the judicial trends regarding Retrenchment—a matter of great contemporary relevance. He points out the pit-falls in judicial interpretation and suggests suitable legislative amendments.

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The term "Retrenchment", as originally conceived and incorporated in the Industrial Disputes Act, underwent a revolutionary change to such an extent that it does not any longer retain its real connotation. A detailed analysis and discussion of the judicial disposition in dealing with the concept with special reference to the amount of case law generated and its hostile impact on the industrial relations scenario is therefore considered expedient in the current context. Having regard to the voluminuous nature of the subject, I limit the scope of discussion to the evolution of the concept and to a critical evaluation of the shift in Judicial opinion.

I. Conceptual Framework

The dictionary meaning of Retrenchment is "to cut off, out, or down; to cut down expenses; economy". When the term was drafted into the Industrial Relations legislation, it carried the essential ingredients of its dictionary meaing with it. In other words, Retrenchment unmistakably means "*reduction of surplus labour with a view to cut down expenses and to effect economy of operations*".

This phenomenon of reducing surplus labour, as a consequence of installation of labour-saving machinery, had its origin in the west. Different expressions were used to describe the phenomenon, such as, "*Technological unemployment*", "*transitional unemployment*", "*structural unemployment*", "*Rationalisation*", "*Redundancy*" and so on. But the one

unique feature common to all these expressions is the *involuntary unemployment of surplus labour.*

Having recognised the massive nature of the problem of unemployment caused by the technological change, the Parliament amended the ID Act in 1953 defining retrenchment and providing for compensation to the retrenched workmen. In this background, let us examine how the concept of retrenchment was understood and interpreted by our Courts.

II. Concept of Surplusage

The conceptual purity of the term was maintained by the Supreme Court till mid-70's.

1. *Retrenchment means only discharge of surplus labour or staff*

In three parallel judgements delivered on the subject in *Pipraich Sugar Mills Limited vs. Pipraich Sugar Mills Mazdoor Union,*[1] *Barsi Light Railway Company Limited vs K.N. Joglekar*[2] *and Hariprasad Shivshankar Shukla vs A.D. Divakar*[3] the Supreme Court laid down the law relating to the definition of retrenchment. The decision of a *five-judge Bench* constituted in *Barsi Light Railway Company* case is significant in this context. Speaking on behalf of the Bench S.K. Das, J. observed :—

> "What after all is the meaning of the expression 'for any reason whatsoever' ? When a portion of the staff or labour force is discharged as surplusage in a running or continuing business, the termination of service which follows may be due to a variety of reasons, e.g., for economy, rationalisation in industry, installation of new labour saving machinery etc. The legislature in using the expression 'any reason, whatsoever' says in effect : it does not matter why you are discharging the surplus, if the other requirements of the definition are fulfilled, then it is retrenchment".

2. *Position after introducing Sec. 25-FF and Sec. 25-FFF*

The ID Act was further amended in 1957 substituting the previous 25-FF by the present Sec. 25-FF and Sec. 25-FFF, providing for "notice or compensation to the workmen on transfer and closure of the undertaking, as if they had been retrenched".

Again, a five-judge Bench of the Supreme Court observed in *Anakapalle Co-operative Agriculture and Industrial Society vs Workmen*[4] *that retrenchment necessarily postulates the termination of the employees' services on the ground that the employees had become surplus*".

Thus, the ratio of *Barsi Light Railway Company* was affirmed even after the introduction of Sec. 25-FF and Sec. 25-FFF.

3. "*Termination simpliciter*" *is not retrenchment*

Following the decision of the Supreme Court in the above four cases, several High Courts held that "*Termination simpliciter*" under the provisions of the Standing Orders or otherwise *would not amount to retrenchment.* It was further held that *if the termination of service is found due to the reason that the workman discharged was surplus* i.e., *in excess of the requirements of business or industry concerned, it would amount to "retrenchment" and termination of service due to any other reason will not constitute "retrenchment".* The decisions of the Division Bench and full Bench of the Bombay High Court in *Municipal Corporation, Greater Bombay vs Labour Appellate Tribunal*[5] and *National Garage, Nagpur vs J. Gonsalves*[6] respectively, concurring with the earlier view of the Supreme Court deserve special mention here.

4. *Termination of Badli workman who became surplus—Retrenchment*

The Supreme Court in *Digwadih Colliery vs Workmen*[7] held that the termination of service of a 'Badli' workman, who worked for more than 420 days, *and who had become surplus*, amounts to retrenchment.

5. *Temporary employee terminated on ground of surplusage—Retrenchment*

The Supreme Court held in *Management of Willcox Buckwell India Ltd vs Jagannath*[8] that the termination

of services of even a temporary employee *on ground of surplus labour* amount to retrenchment.

In the above two cases, the Supreme Court extended the definition of Retrenchment to 'Badli' and temporary workmen. But the most important aspect is that, the *termination of service in these cases, was on the ground of surplusage* of the workmen concerned, and not otherwise.

III. Change in the Connotation

It was from mid-70's onwards that the definition of Retrenchment began *acquiring a strange connotation, taking into its fold almost every type of termination*, as is seen from the following decisions.

1. *Termination of temporary workman under the cantract of employment—Retrenchment*

The first pronouncement in this chain was that of the Supreme Court in *State Bank of India vs N. Sundara Money's*[9] holding that termination of services of a temporary workman employed *only for a certain days under the contract of employment* would constitute retrenchment.

2. *Striking-off the name—Retrenchment*

In *Delhi Cloth and General Mills Co. Ltd. vs Shambunath Mukherjee*[10] the Supreme Court went a step further in holding that *striking-off the name of a workman from the rolls* constitutes retrenchment.

3. *Termination due to efflux of time—Retrenchment*

The Supreme Court held in *Hindustan Steel Ltd. vs State of Orissa*[11] that such a *termination of service by efflux of time in terms of agreement between the parties, would also fall within the purview of the definition of retrenchment.* This decision overruled the earlier view of the labour appellate Tribunal in *Balakrishna Ganapat vs Ruston and Hornsby (India) Ltd.*[12]

4. *Every termination is retrenchment*

A too far-fetched view was expressed by the Supreme Court in *Santosh Gupta vs State Bank of Patiala.*[13] In this case, the services of an employee, who had completed 240 days of continuous service, were terminated for the reason that the employee had failed to pass the relevant test required for confirmation in the service. The Supreme Court observed that the expression "retrenchment" must include "every termination of the service of a workman by an act of employer". This view was reiterated by the Supreme Court in its subsequent decisions in *Surendra Kumar Verma vs Central Government Industrial Tribunal*[14] and *Mohanlal vs Bharat Electronics Ltd.*[15]

5. *Deemed termination—Retrenchment*

In *L. Robert D'Souza vs Executive Engineer, Southern Railway*[16] the Supreme Court held, that from the language of the order dated 8-10-74 reading;

> "you have absented yourself unauthorisedly from 18th September, 1974 and hence your services are deemed to have been terminated from the day you have absented yourself. Please note";
> it would appear that *the service was terminated by the employer and not by the employee himself. Hence, it constitutes retrenchment.*

6. *Termination on account of recession—Retrenchment*

In *Gammon (India) Ltd. vs Niranjan Das*[17] it was held that termination of service of the workman on account of recession and reduction in the volume of work of the employer amounts to retrenchment.

7. *Termination of a probationer—Retrenchment*

In *Karnataka State Road Transport Corporation vs Sk. Abdul Khader and others*[18] the Supreme Court observed that termination of the service of a probationer amounts to retrenchment.

8. *Termination of a casual workman—Retrenchment*

A division Bench of Calcutta High Court in *Tapan Kumar Jana vs General Manager, Calcutta Telephones*[19] held that termination of the service of a casual workman will fall within the meaning of the definition of retrenchment.

9. *Automatic termination under the Standing Orders—Retrenchment*

A Single Judge of Calcutta High Court in *Naresh Chandra Das vs Seventh Industrial Tribunal*[20] held that automatic termination of the service of a workman in accordance with the Standing Orders will amount to retrenchment.

10. *Retirement as defined in the Payment of Gratuity Act, 1972—Amounts to retrenchment*

A very strange and unusual decision of the Supreme Court was that of *State of Punjab vs Labour Court, Jullunder.*[21] In this case, on the construction of the expression "Retirement" which has been defined in Sec. 2(q) of the Gratuity Act, 1972, to mean "termination of service of an employee otherwise than on superannuation", the Supreme Court observed that such "retirement" would constitute "retrenchment" because retrenchment means 'termination of service for any reason, whatsoever' and that 'retirement' as defined under the Payment of Gratuity Act, 1972 is *termination otherwise than on superannuation.*

11. *Termination for loss of confidence—Retrenchment*

The Bombay High Court (Nagpur Bench) held, in *R.V. Kothare vs Industrial Court, Nagpur and others*[22] that termination of service for loss of confidence amounts to retrenchment.

12. *Acceptance of Resignation in disregard of the terms of resignation—Retrenchment*

The A.P. High Court held in *Coromandel Fertilisers Ltd. vs P. Venugopal and others*[23] that acceptance of resignation before the expiry of the date specified in the resignation letter *amounts to a counter offer which must again be accepted by the workman,* in the absence of which such action of the Management must be deemed to be an independent action which amounts to termination and therefore retrenchment as defined by the Act.

IV. Evaluation

A critical look at the pronouncements right from Sundara Money's case onwards unfolds a trend towards enlarging the scope of "Retrenchment" to almost every type of termination, notwithstanding the technical character of the concept or its instance professional import.

1. *The concept was handled in bits and pieces*

It is unfortunate that the courts should have, in the first place, *broken the whole concept of retrenchment into heterogeneous parts and pieces and then proceded to handle each part and piece separately,* regardless of the comprehensive nature of the term as defined in Sec. 2(oo) and, most importantly, the *inter-relationship between the definition on the one hand and the operative provisions enshrined in chapters V-A and V-B of the Act and the rules made thereunder,* on the other. To illustrate, the Courts laid greater emphasis on the expression '*for any reasons whatsoever*' appearing in Sec. 2(00) and then went on to interpret the concept in myriad ways.

Their lordships observed in L. Robert D'Souza's case (para 6) :

> "As *we are not prepared to examine* the contention over again, the submissions of Mr. Francis that "retrenchment" contemplates some overt act on the part of the employer, that it inherits the principle of *last come first go* which again requires an overt act on the part of the employer; that when retrenched workmen are required to be re-employed, first option for re-employment has to be given to the retrenched workmen, which necessitates some overt act on the part of the employer, *would be besides the point and of no relevance and significance.* The reference to Rules 76, 77 and 78 of the Industrial Disputes (Central) Rules, 1957 *does not advance his case a step further*".

Again, the expression "Amounts to Retrenchment" as used by the Supreme Court raises two basic questions namely :

(a) Is it sufficient if the employer complies with Sec. 25-F to the limited extent of notice and compensation ? or

(b) Is it necessary to obtain prior permission also under Sec. 25-N in a case where chapter V-B applies ?

The legal position in this regard continues to remain uncertain.

2. *Complex nature of observations*

Having delivered judgements in the cases of *Surendra Kumar Verma*, *Hindustan Steel Ltd.*, *State of Punjab*, *Santosh Gupta* and *L. Robert D'Souza* which were diametrically opposite to, and never contemplated by, the ratio of *Barsi Light Railway* and *Hariprasad Shivshankar Shukla*, the Supreme Court, nevertheless, *drew a favourable equation with the said ratio.*

Coming to Sundara Money's case the Supreme Court, having held that termination of service amounts to retrenchment which, in turn, is invalid due to non-compliance of Sec, 25-F, *did not award back wages to the workman.*

Recording a dissent note in *Surendra Kumar Verma's* case, Pathak, J observed; "*I should not be taken to have agreed to the interpretation of Sec. 2 (oo) rendered in Santosh Gupta vs State Bank of Patiala*".

(3) *Considerations of social justice*

The supreme Court seems to have been guided by considerations of socio-economic justice, and rightly so, while treating different types of termination as retrenchment. But then it poses a fundamental question as to the nature and extent of the role that such considerations can play, more specifically, while dilating upon the theoretical and conceptual aspects of a given term.

The terminology used in the following sections of the ID Act, is relevant in this context.

Sec. 2 (s) "workman" means.....who has been dimissed, discharged *or retrenched*".

Sec. 2-A ".....where any employer discharges, dismisses, *retrenches* or otherwise terminates the service of an individual workman .....such discharge, dismissal, *retrenchment* or termination.....".

Sec. 11-A ".....where an industrial dispute relating to the discharge or dismissal of a workman....."

While Sec, 2(s) clearly distinguishes *discharge from retrenchment*, Sec. 2-A draws a candid distinction between *discharge/termination on the one hand and retrenchment on the other*. Thus it can be seen that the requirements of social justice have been fully taken care of by Sec. 2-A and chapters V-A and V-B of the Act itself, *if it is a case of retrenchment*. Likewise, *specific relief has been provided* to the workmen under Sec. 2-A and Sec. 11-A of the Act, if it is a *case of wrongful discharge or dismissal.* In this connection, it is significant to note that the Parliament was guided by the ILO recommendation No. 119 while inserting Sec. 11-A, which conferred wider powers on Labour Courts and Tribunals, to award appropriate relief to the workmen including reduction in punishment, reinstatement and compensation.

By confounding different types of termination, including less of lien and voluntary abandonment with retrenchment, the Supreme Court had virtually rendered a number of provisions of the ID Act and Standing Orders infructuous. A collateral consequence of grave magnitude is that the day-to-day conduct of Industrial Relations has been thrown out of gear.

The following observations made by Mr. O.P. Malhotra[24] are significant in relation to the conventions of jurisprudence.

"If the court considers that *Barsi Light Railways Co.*, case does not lay down the correct law, *it is desirable to constitute a larger Bench and re-state the law.* The later decisions have accentuated the literal meaning of the expression "termination by the employer of the service of a workman for any reason whatsoever" without working of the implications and effect of the other relevant provisions of the Act. *The concept of surplusage is implicit in the scheme of provisions of the Act relating to retrenchment.....*"

It would have been a different matter, had the court distinguished a particular case from the principles laid down by the constituting Bench in *Hariprasad Shivshankar Shukla.* No such distinction was drawn by the court in most of the cases. On the contrary, the Supreme Court repeatedly held that its view was

in no way conflict with the law laid down by the larger Bench, *while at the same time, holding an opposite view.*

4. Position of law after 1984 amendment

Sub-clause 2(oo) (bb) inserted vide 1984 amendment excludes the termination of service of the workmen, as a result of the non-renewal of the contract of employment between the employer and workmen concerned on its expiry or of such contract being terminated under stipulation in that behalf contained therein, from the purview of the definition of retrenchment.

This amendment was brought as a consequence of the disturbing trends noticed in *Sundara Money and Santosh Gupta's cases.*

In a recent judgement in *S. Govinda Raju vs KSRTC and another*[25] the Supreme Court held that even in a case of termination falling within the ambit of Sec. 2(oo) (bb), the principles of natural justice would be attracted and the *employee would be entitled to an opportunity of explanation, though no elaborate enquiry would be necessary.* It was further held that giving an opportunity of explanation would meet the bare minimal requirement of natural justice. The expressions "even though no elaborate enquiry is necessary" and "employee would be entitled to an opportunity of explanation", are significant with special reference to the objectives sought to be achieved by the 1984 amendment.

V. Conclusions

1. It is unfortunate that the mandatory requirements, such as;

25-G—adhering to the principle of 'last come first go;

25-H—giving preferential treatment to the retrenched workmen in case of re-employment;

R. 77—publication of seniority list of workmen proposed to be retrenched.

R. 78—individual written communication to the retrenchment workmen offering re-employment on the basis of seniority,

Which have a direct bearing on, and a substantial relationship with, the definition of retrenchment did not receive adequate attention from the courts. The net result is that the concept of retrenchment has acquired a totally perverse connotation.

2. An objective discussion *on the functional integrality between the definition and other cognate provisions of the Act, with special reference to the principles laid down by the larger Bench of Supreme Court could have greatly helped in establishing the real character and import of the concept.* It is rather disappointing that this issue was not allowed to be debated even from an academic angle, if not for anything else.

3. If the intention of the legislature were to bring every type of termination within the ambit of retrenchment, then, admittedly, *there is no need for the legislature to accord a distinct legal status or to provide for separate relief in case of wrongful termination and wrongful retrenchment.* In fact, the differential treatment given to termination and retrenchment in the Industrial Disputes Act, richly endorses the view that *while every retrenchment involves termination, every termination is not retrenchment.* This essential difference between retrenchment and *termination simplicitor* has not been given due consideration by the courts.

4. It is equally difficult to appreciate the need for the law-makers to employ superfluous expressions such as "*for any reason, whatsoever*", "*otherwise than as punishment*", "*but does not include*", "*stipulation in that behalf*" in Sec. 2 (oo). This is more so, having regard to the accepted connotation of retrenchment and to the provisions contained in Sec. 25-G and 25-H of the Act. No wonder, the concept was defaced beyond recognition in the course of decade-long hair-splitting litigation. A simple and straight-forward definition could have avoided unproductive costs and consequences for the workmen, employers and for the government itself.

5. Even after the 1984 amendment which is aimed

at specifically excluding the cases of termination as a result of non-renewal of contract and termination by efflux of time from the purview of retrenchment, the legal position in this respect continues to be as grim as it was before.

6. The heavy financial burden imposed as a result of "reinstatement with back wages" has, in fact, *done greater disservice to the very cause of socio-economic justice.* Our anxiety to protect one or two individual workman has in fact rendered a vast majority of workmen unemployed due to closure or abdication of the units, particularly, in small and medium sectors. Misplaced emphasis on socio-economic justice has its own side effects in that the prospective entrepreneurs launched a counter-offensive by preferring capital intensive industries to labour intensive units, which in turn fuelled the fire of unemployment.

7. The emotional overtones and ultra-radicalism reflected in successive pronouncements of competitive nature have replaced logic with pedantism. The adverse impact of the confusing interpretations on the overall well being of organizations cannot be underestimated. To illustrate, *low productivity, high rate of absenteeism, large scale indiscipline, militancy' work stoppages are some of the dysfunctional consequences arising out of the excessive dose of protection granted to the workmen.* Huge chunks of backwages awarded in the guise of wrongful retrenchment, even in cases which are patently outside the purview of retrenchment, aggravated the situation further.

8. The expressions used by Supreme Court in S. Govinda Raju's case, namely, "*employee would be entitled to an opportunity of explanation* and "*even-though no elaborate enquiry is necessary*", have far-reaching implication in the context of the disciplinary provisions contained in the Standing Orders. This gives rise to another set of complications associated with *discharges simpliciter* vis-a-vis *dismissal for misconduct.*

9. It is therefore incumbent upon the government to take a fresh look at the concept of retrenchment, in the context of the confusion created in the recent past both in terms of interpretation of the definition and its extension to almost every conceivable type of termination. The right course would be *to repeal Sec. 2 (oo) altogether and re-define the concept in simple and clear terms to mean discharge of surplus labour or staff.* The definition should *manifestly exclude every other type of termination/separating from its purview.* Such an exclusive re-statement of the concept is all the more relevant, as every other type of termination is taken care of by different provisions of law. Appropriate legislative measures on these lines will go a long way in eliminating uncertainity and minimising litigation in this regard.

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Service Productivity Measurement

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The author in this paper presents in detail the productivity measurement at firm level in service organisations. He gives a bird's eye-view of the Indian practices obtaining in the same.

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Introduction

'Productivity' is being very rightly emphasized at present for our faster growth and betterment. Peter Drucker says "Without productivity objectives, a business does not have direction. Without productivity measurement, it does not have control" (1). But unfortunately science of productivity measurement has not come yet to that stage of all-acceptance in use. It is still debated for its mechanics of measurement. This is more so with micro level measurment especially at firm and shop/department levels. Since there is large diversity at these levels, productivity measurement may need to be unit specific. Davis in 1955 pointed out that each firm faces unique problems and therefore specific company's situation should be assessed to arrive at meaningful productivity measures (2). Further, it is a set of well meaning productivity measures that will be useful for planning, monitoring, interfirm comparison as well as for arriving at proper understanding with employees to share gains of higher productivity.

Again, study of recent literature shows that the problem of productivity measurement for a manufacturing organisation has been drawing maximum attention. But in today's environment, service organisations like ones providing services of banking, transportation, consultancy, welfare, public utilities, etc. are playing no less critical roles. Sizable amount of national resources are tied up with them. Therefore need for measuring their productivity is very important. But many of these service organisations do not have noticeable hardware products. Nature of services are

too heterogeneous and divergent. Therefore many of productivity measurement approaches that have been evolved for manufacturing organisations may not be applicable. A lot more attention is required to be given to grapple with above kind of problems. In India, certain amount of attention has been given to this area especially since 1979-80 when concept of productivity linked bonus schemes came into being. This paper attempts to :

(i) enumerate measurement principles, models and practices which are reported to have been applied or which could be done in service organisation.

(ii) discuss practices of whatever limited magnitude followed in India.

(iii) examine present Indian practices in the light of state-of-art and points out scope for further development.

Productivity Measures

Productivity denotes how much output of present design turned out and how will above design serve the purposes of the organisation in relation to resources deployed. In other words, productivity encompasses so called 'Efficiency', 'Quality' and 'Effectiveness' parameters (2). Further, resources referred above include all kinds of inputs—labour, capital, material, etc. However, there have been varying emphases on above performance parameters and inputs at various times. For example, labour efficiency has been till date most popular notion for productivity. But it is only a partial productivity measure. Similarly there is a total productivity measure too. In fact, of late, certain standardisation in terminology has been attempted.

Till now, literature has culled out following four basic types of productivity measures (2, 3)

(i) Partial Productivity—a ratio of output to one class of inputs like labour, materials, etc.

(ii) Total Productivity—a ratio of total output to sum of all inputs. This may be called 'Multi Factor Productivity' if a limited number of inputs are considered.

(iii) Total Factor Productivity—a ratio of net output (alternatively value added) to the sum of labour and capital inputs.

(iv) Surrogate Productivity—non-productivity ratio but reflecting some characteristics of performance.

It is to be noted that above measures may be expressed either in absolute values (which is of course rare) or in terms of Index number compared to base period.

Design Principles of Measures

In order to enable productivity measures serve desired purposes, certain considerations have been recommended in literature to be kept in view while developing specific measures. Sardana and Prem Vrat (1984) have listed some of them (4). Those are as follows :—

(i) A good measurement model should help management in analyzing areas of improvement and in monitoring the performance.

(ii) It should take into account all possible outputs and inputs as well as their interactions.

(iii) It should consider effects of external environment.

(iv) Data to be required should be easily available and comprehensible.

The Ohio State University Productivity Research Group (2) has also laid down a few more principles which are as follows:—

(v) It must be simple and cost effective.

(vi) It must fit into the ongoing management process/system.

(vii) It must be developed in participative. environment. Further, involvement must be perceived by the participants to be effective and efficient.

(viii) Successful productivity measurement systems should be as concerned with how they measure, whom they measure and who decides what to measure as with what is measured.

(ix) It must be perceived by the organisation as being systematic, explicit (while still respecting the necessity of intuition), consistent with management style and action oriented.

Review of Measurement Practices

International Labour Office (ILO) may be the first organistation who drew attention of all to systematic measurement of productivity, especially labour productivity at firm level first after 2nd world war. Some of the developed countries like USA, Japan, UK did have earlier some kind of labour productivity measures but lacked organised approach to measure and use them. This is more so in service sector. Mundel (1967) in USA first brought out conceptual difference between service organisation and others which have 'hardware products' to deal with (5). He advocated use of multi-level work units to identify service products. Finally he adapted various work measurement techniques of Industrial Engineering for application in service organisations and computed labour productivity by the formula (6).

$$\text{Labour Productivity} = \frac{\text{Standard Manpower Requirements}}{\text{Actual Manpower Deployed}}$$

Kendrick and Creamer (1965) introduced first time various kinds of productivity measures and their indices at firm level. According to them, both output and inputs are to be valued in terms of base period prices. Inspired by the above approach, Craig and Haris (1972), Hines (1976), and American Productivity Centre (1981) as reported by Sumanth (3), I.L. Riggs (7, 1981) built up more comprehensive and explicit expressions for various but unfortunately none of them did show applications of their measures in service units. Finally Sumanth (1984) developed Total Productivity Model (TPM) based on the same concept and categorically mentioned about its application in service organisations. He visualized outputs being benefits (which are often income) from different service units. For example, in a hospital in patients and out patients are two operational units. In a bank, income generated from various categories of transaction could be thought of outputs. The underlying concept in approaches adopted by all above can be expressed by the following formula :—

$$TP_{(b)} = \frac{\sum_{j=1}^{m} P_{j(b)} \cdot O_{j(b)}}{\sum_{i=1}^{m} P_{i(b)} \cdot I_{i(b)}}$$

$$TP_{(m)} = \frac{\sum_{j=1}^{m} P_{j(b)} \cdot O_{j(m)}}{\sum_{i=1}^{m} P_{i(b)} \cdot I_{i(m)}}$$

$$TPI = TP_{(m)}/TP_{(b)}$$

Similarly partial productivity measures or indices could be expressed by the same set of above formula except denominator of TP will be only one of the terms.

There is another approach based on above concept, which computes unit requirement of each of the inputs per unit of output (UR_i) and finally calculates partial productivity indices and aggregates them with the help of weightages of proportion of each input to total inputs. (8) In other words,

$$PP_i = \frac{\text{Output}}{\text{ith Input}} = \frac{=1}{UR_i}$$

$$PPI_1 = \frac{PP_{i(m)}}{PP_{i(b)}} = \frac{UR_{i(b)}}{UR_{i(m)}}$$

$$TPI = \sum_{i=1}^{n} PP_i \times W_i$$

$$\text{Where } W_i = \frac{I_i}{\sum_{i=1}^{n} I_i}$$

The above approach is believed to be in use with American Banking Organisations.

During the same period of end sixties and seventies, Harold Martin of U.K. (9) developed a set of primary

and secondary productivity, measures based on 'Total Earnings' and 'Conversion Costs'. According to him,

$$\text{Total Earnings Productivity (E)} = \frac{\text{Total Earnings}}{\text{Conversion Cost}} = \frac{I}{C}$$

Where T = Purchased services + Wage & Salaries + Depreciation + Profit
= Gross Sales Value − Materials (M)

C = Wages & Salaries + Depreciation + Capital Costs + Running Costs.

The above E is primary productivity measure. There are some secondary productivity measures which are given below :—

(a) Profit Productivity $= \frac{T - C}{C} = E—1$

(b) Working Capital Productivity $= \frac{T}{M+C}$

(c) Inventory Productity $= \frac{T}{M + Cinv}$

Cinv = Inventory carrying charges.

(d) Process Work Productivity $= \frac{Cd}{C}$

Where

Productive Work Costs (C_e)+Ancillary Work Costs (C_a)

= Processing Cost (C_d)

Processing cost (C_d) + Idle resource costs (C_i) = C

(e) Productive Work Productivity

$$= \frac{C_e}{C}$$

Martin is reported to have had used above frame to measure productivity in both manufacturing and service organisations all over Europe.

Faraday (10, 1971), Ramsay (11) & Taylor and Davis (3) used 'net output' or 'Value Added' measures of output which is very similar to above concept of 'Total Earnings' and TFP has been calculated by :—

$$\frac{\text{Total value—added output}}{\text{Wage \& Salary} + (\text{Fixed Capital} + \text{Working Capital}) \times \text{Investor Contribution}}$$

Both numerators & denominators are to be deflated.

But application of above approach in service organisation is not yet reported in commonly seen literature.

Asian Productivity Organisation (APO) which was carrying out certain amount of work related to sectoral level productivity measurement since early 1970s, launched a intensive research project on "operational level productivity measurement, analysis and improvement" under guidance of Dr. Mundel in 1982 and finally evolved a detailed algorithm for total productivity measure, application of which has been validated in Service organisations related to commercial and development banking, bus and air transportations (12). As per the above algorithm.

$$TPI = \frac{AOP/1_m + AOP/2_m + AOP/3_m}{R1P/1_m + R1P/2_m + R1P/3_m} \Big/ \frac{AOP/1_b + AOP/2_b + AOP/3_b}{R1P/1_b + R1P/2_b + R1P/3_b}$$

Where

/m indicates values related to a measured period.

/b indicates values related to a base period.

AOP/1 = Capital resource inputs recovered during the period in services rendered during the period at base year unit prices.

AOP/2 = Direct costs recovered during the period at base year unit prices.

AOP/3 = Overhead costs recovered at base year unit prices.

R1P/1, R1P/2 & RIP/3 are similarly costs actually increased at base year prices.

In order to compute AOP's, it is necessary to break down service outputs to various levels of work unit as per Mundel's approach as mentioned earlier. This approach seems to be highly promising for wide application.

Dewitt (1970, 1976) as reported by Sumanth (3) suggested a vector of partial productivity measures as basis for comparsion. Aggregation may not be neces-

sary. He applied his approach to 11 air-transport corporations to demonstrate its effectiveness.

A different line of approach was brought to productivity measurement by Mali in 1978 (13). He suggested use of both quntitative and qualitative measures for assessing efficiency and effectiveness both of which are required to be judged upon. He recommended checklist and Audit to be used for the purposes. He showed application of MBD concept in assessment of performance or effectiveness. But major breakthrough in this line of reasoning came only with Stewart who defined productivity, "as the ratio of performance towards organisation objectives to the totality of input parameters". He suggested aggregating a number of productivity measures including surrogate ones which would be at first developed through "nominal group technique", a structured group process (3). Mason (1978) emphasized different measures needed to be taken in different environmental conditions which have profound effect on productivity. He recommended use of bounded productivity measures in certain conditions (4). Thinking along the above line enables Riggs and Felix (1983) to bring out 'Productivity by objectives' (PBO) model in which productivity of a firm is measured by its achievement over a number of objectives related criteria that the said firm has established in its 'key Result areas' (14). Each criteria has a scale of 0 to 10 and a pre-estimated weightages attached to it. Authors have called it an 'Objectives Matrix'. Results are evaluated based on above matrix and productivity index is calculated by the formula :—

$$TPI = \frac{V_m - V_b}{V_b}$$

Where

V_m = Weighted score in measured period.

V_b = Weighted score in base period.

Practices in India

Many of the service organisations in India like Banks, Hospitals, Road Transports, Railways, etc. have been using some of the partial productivity measures especially labour ones since quite sometimes. But a comprehensive measure seems to be first developed by National Productivity Council (NPC) in connection with consultancy services provided to a few service organisations with a view to design productivity linked reward schemes during 1979-80. Since then there has been much refinement made in approach adopted (15).

Earlier approach basically consisted of application of work measurement and index number concepts. Depending upon corporate objectives and nature of work, direct functional groups providing 'end outputs', were used to be identified. 'End outputs' were then broken down into more or less homogeneous groups of outputs mostly by following Mundel's line of thinking. Average work content for each work unit of a homogeneous group was determined through direct work measurement or through analysis of past performances. Factor Efficiency (F_i) was then calculated by

$$\frac{\text{Av, output per man in ith group}}{\text{Maximum possible output per man in the same group.}}$$

Since most of the service organisations are labour intensive, total productivity used to be calculated by the following formula :—

$$TP = \frac{M_i . F_i}{\sum_{i=1}^{n} M_i}$$

Where M_i = Manpower in ith group.

The above approach basically takes care of efficiency. Effectiveness is therefore used to be neglected. Further, an organisation has a number of objectives to be fulfilled. On realisation of above limitations, NPC has gradually brought out an approach which can be termed as a hybrid model, made up with combination of work measurement, Index Number and PBO concepts. In the new approach, NPC considers other objectives, besides manpower utilization, like Inventory turnover, Administrative expenses, outstanding recovery, number of beneficiaries, etc. If P_i is a ratio or index or value in respect of any of the above objective criterion, TPI is then calculated by the following formula :—

$$TPI = \sum \frac{P_{i(m)}}{P_{i(b)}} \times W_i$$

Where W_i = Weightage for ith parameter.

Weightages for the above model are normally decided through discussion with various levels of employees. Some of the considerations that are kept in mind while deciding weightages are as follows :—

(i) Number of employees involved.
(ii) Degree of effort required for achieving incremental improvement in the factor.
(iii) Scope for improvement.
(iv) Degree of alignment with the corporate aims and objectives.
(v) Degree of independence from outside influences.
(vi) Perception of the factor as a motivating force by the employees.
(vii) Cost benefits analysis.

Like the above approach, Sardana and Prem Vrat (1983) have developed a 'Performance objectives—productivity' (POP) model in the context of manufacturing set up. They have also attempted use of 'Goal Programming' to find out 'satisfying' weightages of factors. Unfortunately authors have not yet demonstrated use of above model in service set-up. But some research work undertaken by students of NPC—TIPIE two year courses of post graduate diploma in Industrial Engineering have shown immense possibility of use of POP model in service organisations (16).

NPC has developed a methodology for productivity measurement in various industries for the purpose of interfirm comparison & productivity awards (17). The above methodology considers absolute values & growths in selected partial productivity measures and aggregates them with the help of weightages decided by Jury. Some qualitative aspects are also considered and evaluated through similar approach to point rating method and finally they are combined with quantitative scores. This approach also has sufficient flexibility to be used in service organisations.

Very recently an approach consisting of both qualitative and quantitative factors to measure productivity of a group of Agricultural Development Officers (ADO's) has been outlined by Talukdar and Laharia (18). The qualitative and quantitative productivity scores are added after converting them into standard scores to arrive at total productivity measure.

Comments on Indian Practices

Earlier approach of NPC basically estimates labour productivity which is a partial productivity measure. Though most of the service organisations are highly labour intensive, there are still other inputs like capital, land, equipments, etc. which are expensive. These non-labour inputs are required to be efficiently and effectively used and therefore those are to be included in productivity measures. In that case, models advocated by Sumanth & others could be of relevance.

Again, Factor Efficiency (F_i) is calculated based on 'standards' developed for each of the homogeneous group of activities. But really how homogeneous is this group to be ? Field observations have shown that there could be considerable variation in work content for same group of activities done at differents work environment. Even fifth order work unit as per Mundel's approach, requires to be differentiated and measured. But it is a huge task.

Since work measurement takes long time, F_i is often calculated on the basis of past performance. But efficiency achieved in past need not be very high. So F_i is unduly high.

Both the approaches adopted by NPC in India and for that matter, most of the approaches documented are based on index numbers and show only relative positions. These can not help in interfirm comparison. These also can not ensure optimum consumption of inputs to render a given level of outputs.

NPC's hybrid approach essentially depends upon proper identification of objective related performance criteria. But many of the Indian service organisations are not very explicit in their objectives and even when those objectives are clear, they do change fast. Therefore, identifications of proper parameters are very difficult. Further, interrelationship among these

objective parameters and their co-relations with tangible service outputs are also very dfficult to be established and so whole purpose of productivity measures through the hybrid approach becomes vitiated.

But the most vexed problem is deciding weightages. Structured approaches like Nominal Group Technique, Delphi technique, etc. may have to be adopted. But limited understanding of these aspects with different groups of Indian employees may not contribute to the desired extent. Alternatively, impact of each of the chosen factors on one or a set of each of common utility parameters may have to be estimated and weightages are to be decided based upon the estimated extent of impacts.

Further, bounded productivity measures, if used, are believed to be giving highly inconsistent values because of simple fact that target fixation in India is highly subjective and often pessimistic one. This is one of the major shortcomings even with POP model. Again, POP model does not adequately take into account all the factors of production and only key effectiveness areas are included. POP model may not be very useful in Indian organizations which are still working with very low level of resources utilization.

Subjectivity is the single most impediment in use of any qualitative criteria for the purpose of productivity measurement.

Summarising above comments on major types of models related to Productivity Measurements, one can get a comparative picture as shown in following Table No. 1.

TABLE NO. 1

A Comparison of Indian Model

Sl. No.	Item	NPC approach (Earlier)	NPC approach (Latter)	POP	Approach in Productivity Awards
1.	Aspects of Measurement	Efficiency	Efficiency & Effectiveness	Efficiency & Effectiveness	Efficiency & Effectiveness
2.	Resources Considered	Labour	All Significant	All Significant	All Significant
3.	Nature of Productivity Ratio	Partial	Partial Surrogate	Partial Surrogate	Partial Surrogate
4.	Similar International Model	Labour Productivity	Productivity by Objectives (PBO)	Productivity by Objectives (PBO)	Total Factor Productivity
5.	Major Limitations	Partial Productivity only considered	Weightages difficult to decide	Little emphasis on Effieiency	Weightage Subjective
6.	Context of use	Productivity Linked Bonus Scheme	Productivity Linked Bonus Scheme	—	Productivity Award
7.	User Agency & Designer	Selected Public Sector Service organisations by National Productivity Council	Selected Public Sector Service organisations by National Productivity Council	Research work by IIT, Delhi	National Productivity Council

Since there has been much emphasis being given at present in India on productivity monitoring, measurements of productivlty not only at firm level but also at operational units are becoming imperative. An integrated framework combining approaches of Mundel and Sumanth may be highly effective in Indian service organisations.

Conclusion

It has been recently found out that results on productivity measurement differ significantly with models of measurement used (19). So, there is a need to evolve proper model. But, as seen above productivity measurement at firm level has not yet come to a final shape, not only in India but also in advanced countries like USA, UK, Japan, etc. where much attention to this aspect has been given since mid seventies. Our country has started emphasizing it since declaration of 1982 as Productivity Year. Now our 7th Five Year Plan has taken productivity improvement as one of the principal sources for growth. Each firm is required to be on guard for its performance in terms of productivity. Professionally speaking, the above action calls for continuous measuring and planning for productivity. If this is so, there will be definitely fast development of appropriate productivity measurement models and service organisations, it is hoped, will not be lagging behind in the above evolution process.

SYMBOLS USED

TP	=	Total Productivity
TPI	=	Total Productivity Index
PP	=	Partial Productivity
PPI	=	Partial Productivity Index
O_j	=	jth Output
P_j	=	jth rate of benefits (average)
I_i	=	ith Input
P_i	=	Cost of 1th input
b, m		As sub scripts-Base & measure periods.
m, n over summation sign		
	=	nos of outputs and inputs respectively.
W_i	=	Weightage for ith input.

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Towards Self-Sufficiency in Food

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The paper focusses on as to what has been done, with what success and also what should be done, regarding the food problem in the country.

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India has been living with food shortages for a very long period. During the period of the second world war, production of foodgrains was less than demand and consequently prices of foodgrains registered phenomenal increase. Even at the time of independence, food situation was serious. To solve this problem, government resorted to imports of foodgrains. Though rationing system was maintained in cities, yet the distribution structure was highly inefficient and full of flaws. Also, a large proportion of population was unable to achieve the minimum nutritional level. According to the Second World Survey of the Food and Agricultural Organisation (F.A.O.)[1], the food of Indians should contain 2300 calories per day. However 9 out of every 11 persons in this country, are unable to acquire this minimum desirable nutritional level. To come out of the situation, government has accorded highest attention to agriculture. Gradually, the situation has changed and now the country has stepped in the self-sufficiency in foods. The present paper is an attempt to review the country's position in foodgrains.

The Concept

Self-sufficiency in food[2] refers to a stage of sufficient availability of food through domestic production. It is distinct from a stage of sufficiency which may include borrowed, bartered or bought food to reach the optimum level of availability. It is further not intermittent but a sustained state where performance matches the potential on a regular basis. It assumes a level, an average level, of consumption

which may be expressed in terms of quantity or quality of food, and may be compared with other stages of history or other climes and countries. In the process of attainment of desired level of consumption in future, it is a positive concept meaning thereby that the equilibrium between demand and supply of food is proposed to be achieved not by the negation or curtailment of demand but by the satisfaction of wants often taking into consideration the existing and the prospective dietary habits, income levels and nutritional awareness in the consuming groups and areas.

There are two different specific aspects of self-sufficiency—quantitative and qualitative. In the first place, the production of foodgrains should be adequate to meet the requirements of consumption and at the second, there should be sufficient nutritious element in the diet of an average man. So, the idea of self-sufficiency implies a level of consumption, which may mean a level necessary for normal working efficiency, a level comparable or equivalent to that of developed countries, or a level considered adequate or good from the nutritional and health point of view.

Strife for self-sufficiency in food has been the basic feature of state policy since independence. A formal declaration of self-sufficiency in food as a national objective was made in 1948 by Pt. Jawahar Lal Nehru, when food situation was serious, demand was considerably more than supply, and the productivity per hectare and per worker was extremely low. The technique employed for production were age old and traditional. For instance, there were only 7 tractors per lakh hectare of gross cropped area in 1950-51. The number of all engines and irrigation pumpsets per lakh hectares was only 62 and 16 respectively in that year. Because of low productivity, agriculture merely provided 'subsistence' to the farmers and had not become 'commercialized'. There was a yawning gap between demand for and supply of food articles. For instance, the demand for foodgrains in the year 1950-51, was more than 60 million tonnes whereas the production was only 50.8 million tonnes. On the face of such a critical situation it was but indispensable to accord highest attention to this area. Here, it was the birth of the State efforts to increase the production of foodgrains in the country. Since then the aim of self-sufficiency in food has continuously been stressed upon and now, we are on the door of the target.

Trends in Production and Distribution

The production of foodgrains in India assumed a slow and steady increase during 1950-51 and 1984-85. In the year 1950-51 there was a yawning gap between demand and supply of foodgrains. The only measure to bridge the gap was import of foodgrains. For this reason highest priority was accorded to agriculture during the period of First Five Year Plan. The output of foodgrains in the terminal year was 65.8 million tonnes which was above the target laid down for that year. Consequently, the domestic supply situation improved somewhat and imports were heavily curtailed. But due to rapid increase in population the increase in foodgrains production were inadequate to meet the demand for foodgrains in the subsequent years and India had to go in for large-scale imports. Thus the net imports of foodgrains which were 1.37 million tonnes in 1956 rose to 7.39 million tonnes in the year 1965. Gradually and slowly the situation has improved. During and after the year 1977 the production has increased substantially. Imports have been curtailed and buffer stocks have been created. During the year 1978, 79 and 80, the imports of foodgrains were negative.

The year 1983-84 witnessed impressive recovery in foodgrains with both Kharif and rabi crops touching new peaks. Foodgrain production during 1983-84 at a record level of 151.5 million tonnes not only surpassed the previous high of 133.3 million tonnes attained during 1981-82 but also exceeded the year's target of 142 million tonnes, by a wide margin of 9.5 million tonnes or 6.7 per cent. According to the all-India final estimates the overall foodgrains production during 1983-84 registered a growth rate of about 17.0 per cent over the previous year as compared to the annual compound growth rate of 5.7 per cent in the first three years of the Plan and the compound annual growth rate of 3.9 per cent in the Sixth Five Year Plan.

The production has decreased to 148.0 million

tonnes in the year 1984-85. The main reason for this decrease is the unsatisfactory weather conditions during the year. The onset of South-West monsoon was generally in time in most parts of the country. However, the precipitation was uneven and erratic in many areas, and parts of West Bengal, Bihar and Orissa were affected by excessive rain. In Punjab, Haryana and Uttar Pardesh, the monsoon was erratic and insufficient since mid July (1984). On the whole, the weather conditions during 1984-85 were unfavourable, though not so adverse as in 1982. The fact that despite adverse climatic conditions the production of foodgrains could be of 148.00 million tonnes speaks about the success of Government efforts to augment agricultural production. The trends in the output, imports and net availability (demand) of foodgrains have been presented in the Table :

TABLE

Trends in Production and Distribution[a]

(Million Tonnes)

Year	Gross Output	Net Output	Net Imports	Net Availability@
1951	50.8	NA	NA	60.00
1956	63.2b_1	60.67	1.37	62.64
1961	74.0b_2	72.04	3.49	75.69
1966	81.0b_3	63.30	10.31	73.48
1971	108.42	94.87	2.01	94.31
1976	121.03	105.90	0.67	95.83
1977	111.17	97.27	0.10	99.00
1978	126.41	110.61	(—) 0.60	110.25
1979	131.90	115.41	(–) 0.20	114.85
1980	109.70	95.99	(—) 0.34	101.83
1981	129.59	113.39	0.63	114.26
1982	133.30	116.63	1.58	116.88
1983*	129.52	113.33	4.07	114.65
1984*	151.54	132.60	2.37	130.49
1985c	148.00	NA	NA	NA

NA : Not available

* — Provisional

@ — Net availability = Net Production + Net Imports — Change in Government Stocks.

b_1 (1951-56) Average; b_2 (1956-61) Average

b_3 (1961-66) Average.

c — RBI Annual Report, 1984-85.

Note: Table has been compiled from 'Economic survey 1984-85'; 'Report or currency and Finance—1983-84, Vol-I Economic Review' and 'Annual Report of RBI, 1985.'

Review of State Efforts

The adverse climate conditions during 1984-85 could not affect much the production of foodgrains and we could produce as much as 148.00 million tonnes during this period. This is the result of integrated and continuous efforts on the part of our government. The agricultural production strategy continued to lay emphasis on increasing productivity by extending area under irrigation, promoting use of fertilisers, expanding area under improved seeds, increased application of plant protection measures and emphasis on agricultural extension etc. A sketch of the progress of these measures[7] would highlight the devotion of the State to achieve the target of self-sufficiency.

High-Yielding Varieties Programme (HYVP)

During mid 1960's new high yielding varieties of wheat were developed in Mexico. As a result of these high yielding varieties the production of wheat can be raised to very-high levels. Because of the promise of increasing, agricultural production and productivity held by new varieties of seeds, many countries starting adopting them on an extensive scale. This new agriculture strategy was put into practice in India in 1966 and was termed as HYVP. Initially it was implemented in a total area of 1.89 million hectares, which rose to 52.5 million hectares in 1983-84. The target for 1984-85 has been fixed at 56 million hectares.

Improved Seeds

During the year 1983-84, about 57 lakh quintals of certified seeds of improved varieties have been distributed as against 42 quintals in 1982-83. High priority has been accorded to seed development programme and an outlay of Rs. 40.86 crores has been provided for this purpose during the sixth five year plan. National seeds programme which covered nine

States (Punjab, Haryana, Uttar Pradesh, Bihar, Orissa, Maharashtra, Karnataka, Andhra Pradesh and Rajasthan) was launched in 1977 with the assistance of the World Bank for strengthening the existing infrastructure for seed production, processing and distribution.

During 1983-84, for the first time, the government distributed breeder seeds of cross pollinated crops (Maize, bajra, sunflower etc.) to private seed producers. An advance supply plan has been introduced to ensure timely supply of seeds in each State.

Irrigation

The area under irrigation during 1983-84 was 65.6 million hectares as against 63.6 million hectares at the end of 1982-83. The approved financial outlay for 1983-84, was about Rs. 1,743 crores for major and medium irrigation and Rs. 738 crores for minor irrigation as against Rs. 1516 crores and Rs. 624 crores, respectively, in 1982-83.

Centrally sponsored schemes for strengthening the State Ground and Surface Water Organisation in respect of procurement of equipment for exploration and development with 50 per cent matching assistance from the Centre was sanctioned by the Central Government during 1982-83. A centrally sponsored scheme for assisting small and marginal farmers in the construction of dugwells, shallow tubewells, purchase of pumpsets, etc., with an outlay of Rs. 250 crores has also been taken up during 1983-84.

Command Area Development Programme

The centrally sponsored Command Area Development Programme aims at (i) bridging the gap between irrigation potential created and utilisation thereof and (ii) raising the efficiency of water use and productivity from irrigated lands. At present, the programme covers 102 projects in 17 states and one Union Territory. A new incentive scheme, with provision of total outlay of Rs. 25 crores, offering cent per cent grants to state Governments for constructing field channel has been introduced.

Fertilisers and Manures

The consumption of fertilisers in 1983-84 has crossed the target of 72.0 lakh tonnes to 78.0 lakh tonnes as compared to the consumption of 63.9 lakh tonnes in 1982-83. Indigenous production of fertilisers is estimated to be about 45.3 lakh tonnes in 1983-84. To enable the institutional agencies in the states to handle larger quantities of fertilisers, short term credit amounting to Rs. 260 crores was made available to States during 1983-84 as against Rs. 250 crores last year. The use of organic fertilisers, as a means of supplementing the availability of chemical fertilisers continued to receive special attention.

Plant-Protection Measures

The Central Locust Warning Organisation, launched ground and aerial operations on a massive scale which helped in restricting the infestation by locust swarms. Under Roving Survey Work for monitoring the pest and disease situation, 19 Central Surveillance Stations and 13 Central Plant Protection stations scanned an area of 3.5 lakh hectares in 14 states. During 1983-84 two more Central Biological Control Stations were set up bringing the total number to eleven. One parasite Multiplication Laboratory was also set up at Bangalore. The consumption of pesticides during 1983-84 was estimated at 72,000 tonnes as against 50,000 tonnes in 1982-83. Under the Centrally Sponsored Scheme for Control and Eradication of Pests and Disease, Central assistance amounting to Rs. 3.80 crores has been extended to cover an area of 36.67 lakh hectares during 1983-84.

Agricultural Machinery and Implements

The agricultural implements and machinery sector has made rapid progress in our country. The Indian tractor industry has an installed capacity of 1.0 lakh tractors per annum, making it one of the biggest in the world. In 1983-84, more than 75,000 tractors were sold. In the field of power tillers, the present installed capacity is about 16000 per annum and about 50,000 power threshers are manufactured annually in the small scale sectors.

During 1983-84, more than 20,800 seed-cum-fertiliser drills have been distributed and 2.67 lakh other implements/hand tools as part of the thrust given to the development of dry land agriculture.

A centrally sponsored scheme to popularise improved animal-drawn implements and hand tools has been launched with an estimated cost of Rs. 11.35 crores. The Tractors Training and Testing Station, Budni and Tractor Traning Centre, Hissar continued their operations of testing a large range of agricultural machinery and implements and training of farmers, mechanics and technicians etc. For the benefit of Southern States, a new Institute for Training and Testing at Garladinne in Andhra Pradesh is being set up.

Agro-Industries Corporation

The State Agro-Industries Corporations were established in 17 States during the Third and Fourth Five Year Plan periods with the objective of designing, developing and manufacturing suitable mechanical aids for agriculture, processing of agricultural inputs. The total turnover of the corporations has reached about Rs. 400 crores in 1982-83 as against Rs. 350 crores in the preceding year.

Agricultural Extension

During 1983-84, agriculture extension was more professionalised to provide a direct and effective transfer of available recommendations through close linkage between research, extension service and farmer, ensuring at the same time effective feedback of field problems so that research becomes more practical and field oriented. Information literatures and audio-visual aids including films and slides, on agricultural topics were continued to be produced to help the field extension workers to educate the farmers. Pamphlets on fertilisers, pesticides, wheat and rapeseed-mustard entitled 'know your farm' were introduced in 1983-84. Training and Visit (T & V) system of extension was particularly responsible for introduction of new crops in non-traditional areas, introduction of new-rotations and increasing the intensity of cropping. The professional extension system is sought to be strengthened through the National Agricultural Extension Project.

Soil and Water Conservation Programme

Soil and water conservation programmes to prevent degradation and increase productivity of land have been in operation both under the Central and State Sector since the first Five Year Plan. An area of 26.52 million hectares was treated with various soil conservation measures at a cost of Rs. 944 crores still 1982-83.

The centrally sponsored scheme of integrated watershed management in the catchment areas of flood prone rivers of Gangetic basin is being implemented on the basis of identified priority watersheds. Under this scheme, an area of 43,000 hectares was treated at a cost of about Rs. 6.94 crores by the end of 1982-83. During the year 1983-84 an area of 52,000 hectares was treated with an outlay of Rs. 11 crores.

Besides, the Central Government, the State Governments, especially of Gujarat, Orissa, Tamil Nadu and Uttar Pradesh, took several steps to tackle the problems of soil erosion. water stress conditions, ravines, salinity, overgrazing and shifting sand dunes.

Dryland Farming

Dryland farming is practised on about three fourths of the net cultivated area in the country. Under the comprehensive strategy for dryland farming, selected microwatersheds are taken up for intensive integrated development through a multi-disciplinary approach including crop production, horticulture, social forestry, pasture development and land and water management. About 68,000 seed-cum-fertiliser drills were distributed against the target of 19,600 besides distribution of 1.47 lakh other agricultural implements suited to dryland areas.

Drought Prone Areas Programme (DPAP)

The basic objectives of DPAP are :

(i) promoting a more productive dryland agriculture on the basis of the soil-water-climate resources of the area,

(ii) development and productive use of water resources of the area

(iii) soil and moisture conservation,

(iv) afforestation and

(v) livestock development including development of pasture and fodder resources.

This programme now covers 511 blocks in 70 districts of 13 States. The allocation in the Sixth Five Year Plan for this Programme was Rs. 350 crores to be shared equally by the Central and State Governments.

Desert Development Programme (DDP)

The DDP was started in 1977-78 with the objective of controlling desertification and development of conditions for raising the level of production, income and employment of the people of the area covered under it. This programme covers hot deserts of Rajasthan, Haryana and Gujarat and cold deserts of Jammu and Kashmir and Himachal Pradesh spread over 126 blocks. The allocation in the Sixth Five Year Plan for this Programme is Rs. 100 crores to be shared equally by the Central and State Governments.

Targets of the Seventh Plan

The draft Seventh Plan[4] has been approved by National Development Council on 9th November, 1985. The Seventh Plan seeks to emphasise among others policies and programmes which will accelerate the growth in foodgrains production. An expanded food security system based on rapid increases in foodgrains production, especially in the underdeveloped regions, public procurement, buffer stocking, and public distribution is a key component of the Seventh Plan. No foodgrains imports are envisaged because existing high levels of stocks, expected increase in production and reduced impact of possible droughts with further extention of irrigation.

The aim of self-sufficiency in food will be continued during Seventh Plan. In planning for food self-sufficiency, adequate and balanced attention would be paid to cereals, pulses, oil seeds, fruits and vegetables and protective foods like milk, eggs, meat and fish.

In order to attain the target of self-sufficiency special efforts will be made for effecting a break through in rice output, especially in the eastern region, for enhancing the productivity and reduce instability of production dryland areas by laying emphasis on development of water sheds and adoption of improved practices, for intensification of research and management programme for production of oil seeds and pulses and for raising the productivity of small and marginal farmers. Programme of afforestation will also receive special attention during the Seventh Plan.

The major programme thrusts in the Seventh Plan are :

(i) Special Rice Production Programme in the Eastern region;

(ii) National Watershed Development Programme for rainfed agriculture;

(iii) National Oilseeds Development;

(iv) Development of Small and Marginal farmers and

(v) Social Forestry.

The implementation of these major areas would require concerted efforts in several areas influencing agricultural production. The areas requiring special attention during the Seventh Plan are:

(i) Water Management,

(ii) Research and Extention,

(iii) Credit Institutions,

(iv) Agricultural Price Policy and

(v) Farmer's Participation.

Conclusion

'Indian agriculture today is universally regarded as a success, having shown considerable dynamism in the past decade. Facts tell this story better than any one can. Foodgrains production has advanced from a level of about 50 million tonnes in the fifties to over 150 million tonnes in the Sixth Plan. In a decade and a half, we have gone from import dependence in food to self-sufficiency. With our food stock, we can improve the nutrition of our people,'[5] since the

declaration of self-sufficiency as a national objective in 1948, Government has continuously been striving for its attainment through various strategies and production oriented measures. High-Yielding varieties have been developed, seeds of improved varieties have been distributed, better irrigation facilities have been provided, the prices of fertilisers were reduced and production campaigns giving the crop specific guidelines for successful implementation of production programmes have been undertaken. Operations have been launched on a massive scale to restrict the infestation by locust swarms. Teams of experts have been deputed to various states for assisting the farmers for availability of electricity for running the tube-wells, pumpsets and getting the irrigation in the commands of canals. The agricultural implements and machinery sector has made rapid progress. Farmers have been assisted by distributing them various machines, implements, tools etc. and providing them training for the use of these equipments. Special efforts have been made to educate the farmer through pamphlets, informations literature and audio visual aids including films and slides. The effectiveness of these measures is evident from the fact of production of foodgrains in 1983-84. The output of 1984-85 shows the diminution in dependence of our agriculture on weather when despite adverse climatic conditions we could attain a sizeable production of foodgrains.

Our present Government, like past, has also accorded enough attention to the attainment of the aim of self sufficiency. The targets of Seventh Plan have evidenced this fact. Prime Minister Shri Rajiv Gandhi considers agriculture as the backbone of our economy. He said in his speech at N.D.C. on 8th November, 1985, "The task before us is to bring about faster and more even agricultural growth. We have to extend the green revolution to the eastern region and to dry-land areas".

The Food and Agricultural Organisation (FAO) in its study[6] 'Agriculture : Towards 2000' estimated that India has the capacity to feed 2,621 million people by the turn of the century, 2.5 times the estimated population of 1,036.6 million, if irrigation targets kept and land is managed properly.

By 2000 AD, India is expected to have a population density of 3.23 per hectare and the study has found that with increased output from irrigated lands, India can support a population density of 3.24, An intermediate and high levels of inputs, the corresponding figures would be 5.62 and 8.18.

These facts unanimously agree to the fact that we have knocked the door of self-sufficiency and by the end of 20th Century we not only will be feeding our population adequately but our's would be an exporting country in foodgrains.

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Strategies for Increasing Agricultural Productivity

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The author in this paper presents in a concise manner the current strategies for increasing agricultural productivity through development of organic manures and bio-fertilisers.

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I. Introduction

Most Indian soils are generally deficient in terms of organic matter status. Tropical conditions characterised by high temperature and very often high humidity cause rapid oxidation of native and applied source organic matter resulting in losses thereof from the soil. A judicious and periodical supply of organic matter is, therefore, necessary to allow the natural recuperation process to proceed so as to ensure better physical and biological health of soil. Improvement of soil properties as a result of application of organics takes place by way of (i) improvement of soil structure (ii) increased water holding capacity (iii) increased chelating capacity for micro-nutrients and (iv) increased cation exchange capacity. Similarly, biological condition of soil is improved by way of increased population flux of macro-flora particularly in the Rhizosphere region, increased supply of humic materials with high cation exchange capacity, enhanced soil binding properties, increased release of organic acids with the ability to mineralise macro-and micro-nutrients in the soil for ready uptake by the plants.

It is a well established fact that the organics, involving various potential and diverse systems of urban and rural compost, digested bio-gas slurry, sewage/sullage, mechanised compost, crop residues as mulch, green manuring crops, biofertilisers etc., can play a significant role in the improvement of physical, chemical and biological condition of soil. Organic

matters derived from renewable organic wastes can be developed and propagated in a decentralised manner involving relatively simple and low cost technology with attendant low energy repuirements. Although chemical fertilisers meet most of the nutritional requirements of crops, a significant proportion of its needs can be met through a judicious and balanced combination of chemical fertilisers, organic manures, biofertilisers, green manuring system etc. The extent and the manner in which organic can be blended with required doses of fertilisers under different agroclimatic regions and particularly under diverse and multiple cropping system will form the basis of an integrated Nutrient Supply System. A brief discription of the various approaches to this concept is outlined below with distinct emphasis on the role that organic can play in improvement of soil fertility resulting in correspondingly higher agricultural productivity.

II. Current Potential of Organic Manures & Biofertilisers

With a view to achieve the targetted production of 185 million tonnes of foodgrain equivalent by the 7th Plan period as estimated by the Planning Commission the nutrient demands (NPK) are placed at the level of 14.0 million tonnes by the terminal year of the plan period. Of this estimated demand, the current domestic production level of fertiliser nutrients is approximately 6.5 million tonnes as opposed to the consumption level of 9.0 million tonnes of plant nutrients. The difference between the demand and production of fertiliser is met through imports involving a huge investment of foreign exchange. There is, therefore, a clear need to supplement the use of chemical fertilisers by organic fertilisers produced from low cost and renewable sources in the country.

India has a vast potential of organic waste resources in various forms which can supplement the use of chemical fertilisers. The dominant forms of organic wastes include : animal dung, animal urine, bone meals, slaughter house wastes, poultry droppings, crop residues, oilcakes, urban garbage, sewage/sullage effluents etc. According to a conservative estimate, the total quantum of urban waste is estimated at 15 million tonnes in terms of composable materials and that of 8 million gallons per day of sewage effluents. Similarly, the potential of rural wastes is estimated at 650 million tonnes. Of this potential, the current rates of utilisation are only of the order of 6.70 million tonnes and 240 million tonnes respectively in the forms of urban and rural compost and 250 mgd for sewage effluent. The figures between the potential vis-a-vis utilisation would clearly be indicative of an enormous scope of development of various forms of organic manures that can be produced from organic wastes materials available in the urban and rural area in the country.

The other important renewable sources of nutrients (mainly nitrogen) are those that are branded as 'biofertiliser'. The various biofertiliser sysetems which through experiments have shown ability to fix atmospheric nitrogen or have the ability to transform nutrients from apparently non-available sources include; Rhizobium spp. Azotabactor spp. Azospirillum spp.; Phosphate Solubilising bacteria/fungi, Blue-green algae, Azella etc. Under India conditions, as established through research, the most effective biofertiliser forms with proven agronomic efficiency include Rhizobium and Blue-green algae. Various experiments and field trials conducted by different Agricultural Universities and All India Co-ordinated Project of Indian Council of Aricultural Research have shown that Rhizobium has the ability to fix about 60-65 kg of nitrogen per hectare to legume crops and Blue green algae can contribute about 25 kg biological nitrogen to wet land paddy under suitable agro-ecological and management condition. The country has about 30 million ha. under pulses and leguminous oil-seeds (viz. groudnut, soyabean) and 16.8 million ha. under paddy cultivation. The annual requirement of Rhizobium and Blue-green algae cultures to cover these areas under legume and wet land paddy systems will be of the order of 50,000 tonnes of Rhizobium and 1.68 lakh tonnes of BGA cultures respectively. Aganist this requirement, the current production is estimated at 650 tonnes of Rhizobium and 500 tonnes of BGA cultures.

The potential of plant nutrients (NPK) that can be derived through appropriate organic recycling programmes in respect of major organic resources such as animal dung, urine, urban solid wastes, sewage/sullage and biofertilisers may be depicted in the following tabular form :

Organic Resources	Quantity (million tonnes/ annum)	Plant Nutrients (million tonnes)			Total (million tonnes) (N+P+K)
		N	P	K	
Cattle and buffalo dung urine	1002	1.50	1.00	0.53	3.03
	658	1.32	0.06	1.33	2.71
Urban solid wastes	15	0.22	0.15	0.22	0.59
Sewage/sullage	10,000 (in m littres/day)	0.22	0.07	0.15	0.44
Biofertilisers	2.30	2.30	—	—	2.30
		5.56	1.28	2.23	9.07

According to the estimates of the International Fertiliser Development Corporation (IFDC) the nitrogen fertiliser requirements of less developing countries by 1985 was 26 m. tonnes of nitrogen which would be 65 m. tonnes by the year 2000 AD. Of this, at least 20% is estimated, that could be supplied through biological nitrogen fixation. To attain such a level of nitrogen supply through biological nitrogen fixation is a challenge to the research scientists in the developing countries such as ours.

III. Promoting the Development and use of Organic Manures

The continuous escalation in the prices of petroleum-based feed stock material over past decade had made it imperative for the country that our future strategy should be so framed that it ought to help in decreasing reliance on "energy-intensive" and "cost-prohibitive" ingredients used in manufacturing of fertilisers. An alternate strategy should, therefore, be evolved to exploit full potential of organics and renewable biological resources to produce supplementary forms of organic fertilisers. This proposition can be met by devising a nutrient supply system consisting of development and use of organic manures exploiting organic wastes biofertilisers etc. in conjunction with chemical fertilisers.

Realising the importance of using organic waste as a potential source of nutrient, the Government have been laying considerable emphasis for its fullest and effective utilisation in a phased manner over the plan periods. During the 5th Five Year Plan, Ministry of Agriculture had implemented an Integrated Project on Development of local Manurial Resources. The main programmes under the scheme were : (i) Setting up of Family size (4—6 cum) Bio-gas plants, (ii) Urban and Rural composting (iii) Mechanised Compost Plants. (iv) Sewage/sullage utilisation. Implementation of these programmes resulted in setting up of 70000 bio-gas plants. Besides, 144 sewage/sullage utilisation schemes were at various stages of implementation and 8 mechanised compost plants installed. However, as per the decision of National Development Council these schemes were transferred to the State Sector from April, 1979, for their implementation by the State Government.

According to the progress reports received from the State Governments on prescribed proforma the production of rural and urban composts during 1985-86 were of the order of 240 million tonnes and 6.5 million tonnes respectively.

IV. Research and Technology Gap and Future Direction of Work in the Field of Organic Manures and Biofertiliser Development

The salient feature of different future line of R & D work that will have to be undertaken on priority basis in the field of organic manures and biofertiliser

development are suggested as follows with a view to augment effective mobilisation and conversion of organic resources to plant nutrients which in turn can attribute to increasing agriculture productivity to a significant degree. In the present context discussion would be confined to 4 major areas of development in field namely urban composting, Rural composting, Bio-gas slurry utilisation and biofertiliser development.

A. *Mechanised and Semi-mechanised Compost and their enrichment programme*

Collaborative work done between IARI, MCD, Delhi and other Municipalities have stablished that urban compost, with low nutrient status (2—2.5% NPK), can be enriched by mixing with sullage (digested) in the ratio of 2 : 1. Mixing should ideally follow composting for a recommended period to minimise pathogenic load. Rajasthan Agro-Industries Corporation manufactured Gypso-compost by blending compost with gypsum which are reported to be effective in reclaiming Alkali soils. Maharashtra Agro-Industries Corporation has prepared a Project to produce Organo-mineral complexes of different grades (N—P—K) by fortifying mechanised composts with varying proportions of chemical fertilisers in granulation plants located in the vicinity of mechanised compost plants. Several field trials on field crops have also been conducted with combined application of Mechanised compost/FYM with ground rock phosphate after composting the mixture. It would be worthwhile for the manufacturers to evolve suitable methodologies and techniques to commercialise the use of mechanised compost which is currently facing problem of marketing due to high cost of production, bulky nature and low-nutrient status of compost and associated high transportation cost.

A technical group was constituted in the Ministry of Agriculture to assess the technical viability and economic feasibility of existing (11) mechanised compost plants installed so far in the country, as also to suggest the appropriate designs which would be cost effective. The technical group, inter alia, suggested the following for efficient and economic operations of compost plants in the country :—

(i) Blue print of 30 tonnes per day capacity of semi-mechanised compost plant should be prepared by the National Environmental Engineering Research Institute with a view to its economic operation and decentralised production.

(ii) Blue print of enrichment of mechanised compost (i.e. organo-mineral complexes) be prepared involving blending of compost with fertiliser materials in the granulation units with techno-economic and result-oriented data on field trials.

(iii) Detailed pilot study on compost plants of smaller capacity to be set up at the periphery of towns/cities to be prepared by Appropriate Technology Deptt. of I.I.T., New Delhi, along with enrichment of compost with economics thereof.

According to the recommendation of the technical group concerted efforts should be made to devise new or modified designs of compost plants which are semi-mechanised and of lower energy requirement and low intake capacity. These plants may be installed in medium to smaller township and also in the rural areas and in the periphery of cities township. To implement this concept there is a need to conduct pilot scale demonstration as well as critical evaluation of the performance of semi-mechanised/mini-compost plants from the technical and economic angles. Such studies may be entrusted to some competent organisations like NFERI, NCAER, National Institute of Agricultural Engineering etc.

Composting is inextricably linked with garbage collection, disposal and preliminary processing. The municipalities/local bodies should be in a position to render built-in institutional arrangements in this regard. Since garbage collection and its safe and economic disposal has a direct relevance with environmental sanitation, the Ministry of Health, Ministry of Environment, Department of Urban Development as well as local municipalities/Corporations should be closely associated with such multidisciplinary programmes and sufficient funds should also be augmented to support the programme effectively and in a co-ordinated manner.

B. *Enrichment of Compost*

Rural compost produced by conventional methods are normally of low nutrient status. For its application to commercial crops as well as short-duration high-yielding crops it would be necessary that the compost material be enriched. Several methods of enrichment of compost are currently available and more being developed by Agricultural universities and resarch institutes. However, it is generally observed that the field worthiness in respect of these techniques are not yet fully established. Some of the accomplished techniques developed through the efforts of All India Co-ordinated project on Microbial decomposition and recycling of farm and city waste of ICAR are as follows :

(i) Liming of compost peats with dolomite, basic slag etc.

(ii) Enrichment with rock phosphate, bone meal, dried blood etc., (for phosphate supplementation).

(iii) Enrichment with feldspar, water hyacinth etc. (for potassium supplementation).

(iv) Microbial technique of enrichment of compost with Azotobacter, P-Solubilisers, cellulose decomposing bacteria etc. (for rapid composting).

For preparation of Azo-compost, the most efficient strain is *Azotobacter chroococcum*. Azotobacter helps in nitrogen enrichment when inoculated after the thermophilic phase of composting. Among the various phosphorus solubilising micro-organisms, the dominant species, namely, *Pseudomonas*, *Microococcus*, *Bacillus*, *Flavobacterium*, *Pencillium Fussarium*, *Sclerotium*, etc., are found to be most efficient in converting insoluble phosphate into soluble forms.

In India, there is a vast reserve of rock phosphate. But, because of relatively poor phosphate content its industrial use to prepare phosphatic fertilisers is somewhat restrained. To utilise rock phosphate directly to field crops, one of the efficient methods would be to partially decompose rock phosphate by subjecting it to inoculation of efficient strains of phosphate by subjecting it to inoculation of efficient strains of phosphate solubilisers within composting peat before the converted and enriched product could be transferred in the field for manuring purpose. In this case only basal application will be generally adviseable.

C. *Bio-gas slurry utilisation*

In most of the developing countries bio-gas plant is basically regarded as a source of energy for fuel but in Chinese concept it is more important as a source of organic manure, where these units are referred to as "Mini-manure factory". In China, both bio-gas slurry as well as digested bio-gas sludge are settled at the bottom of bio-gas plant and used as a manurial source. In some of the provinces in China digested bio-gas sludge is also mixed up with dried Azola to provide as a suppplement to animal feed. Under the 7th Five Year Plan, the Department of Non-Conventional Energy Sources has proposed to set up about 5.5 million family size bio-gas plants. No doubt, when installed, these plants will produce an enormous quantity of bio-gas slurry which can be harnessed as a rich source of manure. There is, therefore, a need to develop new technologies which can ensure proper conservation of digested bio-gas sludge and its scientific application to field crops. In this context, there is a need to develop a high degree of coordination and rapport between the Ministry of Agritulture, State Department of Non-conventional Energy Sources on one hand and between the Agricultural Universities and ICAR Institutes as well as voluntary organisations like KVIC, AFPRO etc. on the other hand for implementation of this useful technology.

D. Biofertiliser Technology

Organised reaserch in the field of biological nitrogen fixation was initiated by Indian Council of Agricultural Research in early sixties, which was followed up by different agricultural universities at later stages. Biofertiliser development, production and testing were done in a more organised manner during the Sixth Plan through an All India Co-ordinated Project on Biological nitrogen fixation operated at eleven centres in the country.

Recently, the Senior Scientific Panel of the Indo-USA Collaborative Research Programme has identified

under Agricultural Section, three projects on Biological Nitrogen fixation relating to Rhizobium including their genetic aspects, VAM-fungi, Blue green algae and Azolla.

In the country there is a considerable scope for large scale production and propagation of biofertilisers to promote its use in integrated nutrient supply system for enriching soil fertility and reducing investment on chemical fertilisers. For extensive use and effective propagation of this technology, Ministry of Agriculture have lanuched a National Project on Development and use of biofertilisers during the Sixth Plan for production, and promotion of Rhizobium and blue-green algae culture. For strengthening the National Biofertiliser Scheme a UNDP Project on Technical Development and Demonstration of Biofertiliser has also been approved at a Project cost of US $ 772,000.

The major objectives under the National biofertiliser scheme are :

(a) To produce, distribute and promote use of effective strains of Rhizobium and blue green algae.

(b) To organise field demonstration and training programmes and efficient use of biofertilisers.

(c) To create an agency for quality control of biofertilisers.

(d) To provide technical support to institutions other than Government agencies who are engaged in production/distribution of biofertilisers.

Under the National Project it is targetted to produce about 600 tonnes of Rhizobium cultures and another 600 tonnes of blue-green algae inoculants annually during the 7th Five Year Plan period through the establishment of one National Centre, 6 Regional Centres and about 60 blue-green algae production sub-centres in the country. Through the production of the targetted quantities of biofertilisers it would be possible to cover about 1,200,000 hectares of pulses and legume oil-seed crops and 40,000 hectares of wet-land rice annually. With a view to enlarge the scope of production and supply of a large number of efficient strains of Blue-green algae (BGA) nuclear inoculum in the country the Department of Biotechnology has sanctioned a scheme for establishment of a National Culture bank for BGA at IARI, New Delhi. Microbial culture collection, testing and evaluation facility would also be available at the Microbial culture collection centre at IMTECH, Chandigarh.

In India, although the agronomic efficiency of Rhizobium and blue green algae have been well established through research and demonstration programmes, it is however, observed that the other groups of micro-organisms namely, Azotobacter, Azospirillum, Azolla etc. are also found to be effective for some selected crops under certain favourable agro-climatic conditions. No Consolidated information, however, is available regarding their agronomic efficiency with reference to area, soil types specific crops as well as specific strains of organisms that are found to be effective. It will, therefore, be worthwhile to conduct an indepth study regarding the techno-economic feasibility on production and promotional uses of these biofertilisers in the country.

A National Seminar on Development and Use of Biofertiliser was organised in October, 1985, by the Ministry of Agriculture to highlight the various aspects relating to research and development of biofertilisers in the country. The following rocommendations were made in respect of development and promotional uses of biofertilisers during the seminar.

(i) Development of a National germplasm collection Bank for Rhizobium and blue green algae.

(ii) As far as possible biofertilisers production should be decentralised activities.

(iii) To promote the use of biofertilisers through national demonstration, training, programmes, field visits, audiovisual aids etc.

(iv) The production units should have the in-built infrastructure for quality testing of Biofertilisers.

(v) Production programme should be taken up for such of those strains that have been found to be effective under a defined set of soil, crop,

ecological and environmental conditions and should preferably involve a selection of strains from local flora.

(vi) Appropriate legislation should be enacted to prescribe the standards of approved biofertilisers to check on the quality.

(vii) The Fertiliser Industries should be effectively involved in marketing, distribution and promotion of biofertilisers.

A holistic approach should be made both by the Central and State Government agencies regarding the manner in which such recommendations relating to biofertiliser development, demonstration and promotional uses could be translated into practice through appropriate Action Plans.

V. Action Plans for future Development of Organic Manures and Biofertilisers

Through the implementation of various programmes relating to development and use of organic manures and biofertilisers it is estimated that a nutrient (N, P & K) generation to the tune of 47.70 lakh tonnes could be achieved per annum from exploitation of renewable organic resources to supplement the use of chemical fertilisers in an integrated manner. Estimated at current level of production (i.e. 1985-86) the relative contribution of plant nutrient which can be derived through the application of urban compost, rural composts and biofertilisers may be summed up as follows :

Assuming that the inputs-output ratio of fertiliser : foodgrains be placed at the level of 1 : 9, the estimated additional foodgrain production that can be attained from the application of organic fertilisers (judiciously blended with chemical fertilisers) could be of the order of 42.93 million tonnes. Considering the fact that this estimated figure approximately corresponds to the additional targetted food production level of the country during the 7th Five Year Plan period the contribution of organic fertilisers in increasing agricultural productivity could be regarded as substantial.

In the light of descriptions cited in the previous sections on various developmental programmes implemented by the Government of organic manures and biofertiliser development, the following strategies may be evolved for undertaking future line of work for further development in the field aiming at higher agricultural productivity of the country in 2000 A.D.

(a) Accurate estimation of potential of different forms of organic waste materials available in the country to produce organic manures vis-a-vis the present rate of their utilisation through various organic recycling programmes.

(b) Estimation of the potential of different forms of biofertilisers vis-a-vis the present state of production in the country by various Government and non-Government agencies.

(c) Advising on the latest scientific technology available for improved method of urban and rural composting including the methods of

(in lakh tonnes)

Urban Compost Production	Nutrients (NPK)	Rural Compost Production	Nutrients (NPK)	Biofertilisers (Rhizobium & (BGA)	Nutrients (N only)
66.69	1.33	229.70	46.00	0.12	0.37

sampling and testing for determining the nutrient contribution as well as agronomic efficiency of compost.

(d) Conducting systematic studies on relative efficiency and economics in respect of various enrichment programmes on urban and rural compost materials using different sources of organic wastes with diverse chemical, bio-chemical and microbial characteristics.

(e) Systematic studies on the improved designs of semi-machanised compost plants to minimise the production cost of compost as well as pilot scale studies on the techno-economic feasibility of mini-compost plant for its popularisation in a decentralised manner in the periphery of smaller cities/townships.

(f) Systematic study on the techno-economic viability of commercialising mechanised compost blended with digested sewage sludge or with fertiliser materials in the form of organo-mineral complexes.

(g) Systematic evaluation of different strains of Rhizobium and BGA for determining their agronomic use efficiency in different agro-climatic regions under various cropping systems.

(h) Systematic evaluation on the techno-economic feasibility and agronomic efficiency of other forms of nitrogen fixing and phosphate solubilising micro-organisms viz. Azotobacter, Azospirillum, Azolla systems, phosphate solubilising bacteria, VAM-fungi, etc.

(i) Devising appropriate quality standards as well as methods of testing for quality control of different nitrogen fixing micro-organisms involved in biofertiliser production in the country.

Productivity
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Economies of Scale and Technical Change

LAKHWINDER SINGH
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The authors in this paper identify the sources of growth of the manufacturing sector of Punjab. Based on an empirical study the recommendations made by the authors about the production structure management are worth considering.

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Industrialisation in modern times is considered to be the most important device by which developing countries can make their growth rapid and reliable. Its expansion is known to be vital for overall economic development. The process of industrial development depends considerably upon the growth in employment, increase in capital stock, economies of scale and technical progress. The intensity of these sources of growth, however, varies across the industries.

In the present paper an attempt has been made to identify the main sources of growth of the manufacturing sector of Punjab and also five select individual industries of the state viz. food products, cotton textile, basic metal and alloys, transport equipment and parts and electricity. The estimates of the elasticities of output with respect to various inputs, returns to scale and technological progress provide the basis for drawing inferences regarding the nature of the growth of industries.

Earlier studies which have been attempted at the All India level based on cross section date [1] & [2] and other relying on time series data [3–5] have found that constant returns to scale are prevailing in manufacturing industries. However, contrary to these results, some other studies [6–10] have observed the presence of increasing returns to scale in the Indian manufacturing sector. In case of individual industries a study[11] has found evidence of increasing returns to scale in 17

industries, constant in 2 industries and diminishing returns to scale in 10 industries. Similar variations in economies of scale were observed by some more studies[12] & [13]. On the contrary a recent study[14] has found that constant returns to scale are present in most of the cases.

Methodology

For the underlying purpose we have used the available family of Cobb-Douglas and Constant Elasticity of Substitution (CES), production functions which satisfy the minimum neo-classical criteria[15]. The widely used Cobb-Douglas production function with neutral technical progress[16] and random error term is written as :

$$V = A\, e^{gt+u}\, L^{\alpha} K^{\beta} \qquad (I)$$

$\alpha+\beta$ gives the returns to scale.

Where V is output and K and L are Labour and capital respectively. A is efficiency parameter, α, and β are the elasticities of output with respect to labour and capital respectively. g and u are the rate of neutral technological progress and random error term respectively. The Cobb-Douglas production function represented by (I) is not a convenient form for direct estimation by ordinary least squares method and is usually converted into a logarithmic form :

$$\log V = \log A + \alpha \log L + \beta \log K + gt + u \qquad (1)$$

$\alpha+\beta$ gives the degree of returns to scale. But the form represented by (1) suffers from the problem of multi-collinearity between independent variable log K and log L. As a consequence of this problem, ordinary least squares estimate becomes less precise because their standard errors become unduly large. The usually estimated form of Cobb-Dougles production function which takes care of the problem of multicollinearity between log K and log L and also reduces heteroscedasticity of the variance of u is correlated with log L is :

$$\log (V/L) = \log A + \beta \log (K/L) + gt + u \qquad (2)$$

However, equation (2) assumes constant return to scale. For allowing changing returns to scale, the coefficient of log (L) can be included in the function :

$$\log (V/L) = \log A + \beta \log (K/L) + m \log + gt + u \qquad (3)$$

where $m = \alpha + \beta - 1$.

A positive value of m indicates increasing returns to scale, while a negative value of m indicates decreasing returns to scale. The Cobb-Douglas production function is based on the most restrictive assumption of unitary elasticity of substitution which may not be a realistic one. This assumption is relaxed in the case of CES production function which can be written as :

$$V = \gamma \left[\delta K^{-\rho} + (1-\delta) L^{-\rho} \right]^{-\frac{\nu}{\rho}} \qquad (ii)$$

where V is outpat, K and L are capital stock and labour respectively, and γ, δ, ρ and ν refer to efficiency distribution, substitution and return to scale parameters. A major problem with the CES production function, is that, unlike Cobb-Douglas production function we cannot transform it into linear form through operations such as by taking logarithms. Therefore, the estimates of equation (II) shall have to be obtained by other methods. One of the methods usually applied involves specifying the side relations which can be obtained through marginal conditions and taking logarithms, we have :

$$\log (V/L) = \beta_0 + \beta_1 \log w + \beta_2 \log L + u \qquad (4)$$

where $\beta_0 = \frac{\nu}{\nu+\rho} \log (\delta\nu)$, $\beta_1 = \frac{\nu}{\nu+\rho}$ and

$$\beta_2 = \frac{\rho(\nu-1)}{\nu+\rho}$$

In the equation (4), β_2 can be used to find out returns to scale. When the coefficient of log L, is zero, then $\rho(\nu-1)=0$, for $\rho>0$, which means $(\nu-1)=0$ and hence $\nu=1$. One may adopt the following two stage estimation procedures. First, we can test the hypothesis $\beta_2=0$. If this is not so, then $\rho=0$ and $\nu\neq1$. If, however. $\beta_2=0$ is true then we can test for $\beta_1=1$. If this is not true then $\rho\neq0$ and hence $\nu=1$. If $\beta_1=1$ is not true, then $\rho=0$ and hence ν could take any value.

Data Base

The paper is concerned with the present Punjab reorganised on linguistic basis in November 1966. The main source of data used in this work for the period 1967-68 to 1979-1980 is the Annual Survey of

Industries (ASI). For the subsequent two years 1980-81 and 1981-82, we took recourse to unpublished data made available by the Economic and Statistical Organisation, Punjab. The analysis here is concerned with the large manufacturing industry, that is, census sector as is defined in the ASI.

The variable output (V) has been defined as gross value added. Net value added figures have not been taken since depreciation figures are not reliable. Thes figures, unfortunately, do not reflect the actual capital consumption and is accounting entity governed by the tax law and other practices. Labour (L) has been represented by the number of employees consisting of the supervisory staff and the workers. The data on man hours could not be availed of since these were available only for workers. Gross fixed assets have been used as the measure of capital (K) rather than net fixed assets because of the reasons specified. V/L is the labour productivity and K/L is the capital intensity. Wage rate (w) is wage bill of employees divided by their numbers. The data on various variables have been adjusted for price changes with suitable indices.

Empirical Results and Discussion

The estimates based on logarithmic regression of value added per unit of labour on capital-labour ratio, without time variable, is given in Table 1. This formulation assumes constant returns to scale. The elasticity of output with respect to capital is given by the coefficient β. $1-\beta$ gives the implied elasticity of output with respect to labour. The value of coefficient β is quite small and is not significant for the large manufacturing sector. This does mean that the main source of growth in output is labour and not capital. Among the individual industries, basic metal and alloys registered a highly significant value of the elasticity of output with respect to capital. The electricity industry observed the negative value of the coefficient of capital but the remaining industry observed the positive but insignificant values. On the whole, the fit as given by R^2 is not good.

In order to capture the technical progress, a time trend variable has been included in equation (2) and the results are given in Table 2. Introduction of the time variable leads to rather implausible estimates. The coefficient of capital turns out to be negative and is insignificant for the large manufacturing sector. The coefficient of time is positive in three cases viz. large manufacturing sector, cotton textile industry and electricity industry. It is only significant in the case of large manufacturing sector. In the case of food products and basic metal and alloys industries, the cofficient of time is negative and significant. It is also negative but insignificant in the case of transport equipment and parts industry. In a nutshell, the coefficient of neutral technical progress does not seem to be an important variable and hence has been dropped in subsequent models.

Table 3 gives the estimates of the returns to scale derived from equation (3). The estimates clearly show the presence of increasing returns to scale in the Punjab large manufacturing sector. Among the individual industries only electricity industry has a positive but insignificant value of the coefficient of labour. The coefficient of labour is negative and significant in the case of food products which clearly shows decreasing returns to scale. In the other three industries, namely cotton textile, basic metal and alloys, and transport equipment and parts the coefficient is negative but insignificant. Thus, we can conclude that the four individual industries namely cotton textile, basic metal alloys, transport equipment and parts, and electricity are enjoying constant returns to scale.

The estimates of returns scale derived from the side relations of the CES production are given in Table 4. Through this, the scale parameter is identified in all the cases. Constant returns to scale prevails in the large manufacturing sector as also in electricity and cotton textile industries. The basic metal and alloys industry shows increasing returns to scale. While the remaining two industries, namely food product, and transport equipment and parts, show decreasing returns to scale.

Conclusions

The main findings of the study may now be briefly enumerated.

TABLE 1

Estimates of the Cobb-Douglas production function (logarithmic regression of value added per unit of labour on capital-labour ratio) 1967-68 to 1981-82

Sector/Industry	Constant	β	R^{-2}	F (1, 13)
Manufacturing Sector	1.4529** (3.0438)	0.1426 (1.1520)	0.0197	0.2625
Food products Industry	1.0782 (0.8747)	0.4505 (1.0544)	0.0063	0.0826
Cotton Textile Industry	1.1357** (3.7268)	0.2291 (1.6992)	0.1186	1.7508
Basic metal and alloys industry	0.3107 (1.0361)	0.6007** (5.1731)	0.6478	23.9182**
Transport epuipment and parts industry	1.6364** (4.5024)	0.1517 (1.0486)	0.0059	0.0782
Electricity industry	2.3747 (1.0323)	—0.0637 (0.1350)	—	—

Figures in parentheses are 't' values
* statistically significant at 5 per cent level
** statistically significant 1 per cent level.

TABLE 2

Estimates of the Cobb-Douglas production function (logarithmic regression of value added per unit of labour on capital-labour ralio and time), 1967-68 to 1981-82

Sector/Industry	Constant	β	g	R^{-2}	F (2.12)
Manufacturing sector	3.5740** (3.4753)	—0.4970 (1.6376)	0.0424* (2.2535)	0.2606	2.1157
Food products industry	1.5487* (2.2380)	0.4502 (2.0264)	—0.0587** (6.0060)	0.7313	16.3319**
Cotton textile industry	2.1830 (2.4141)	—0.3443 (0.7046)	0.0303 (1.2301)	0.1192	0.8124
Basic metal and alloys industry	—1.4079 (2.1127)	1.5231** (4.4022)	—0.0799* (2.7707)	0.7677	19.8314**
Transport equipment and parts industry	0.7328 (1.3274)	0.5976* (2.3402)	—0.0264 (2.0256)	0.2039	1.5374
Electricity industry	4.0876 (1.3505)	—0.4601 (0.7025)	0.0271 (0.8810)	—	—

Figures in parentheses are 't' values
* statistically significant at 5 per cent level
** statistically significant at 1 per cent level

TABLE 3

Estimates of Cobb-Douglas production function (logarithmic regression of value added per unit of labour on capital-labour ratio and labour, 1967-68 to 1981-82

Sector/Industry	Constant	β	m	R^{-2}	F (2.12)
Manufacturing sector	—1.7521	—0.2576	0.4080*	0.2604	2.1133
	(I.1916)	(1.2438)	(2.2670)		
Food production industry	6.5275**	0.0432	−0.4606**	0.7363	16.7534*
	(5.9438)	(0.1883)	(6.0804)		
Cotton textile industry	1.1372	0.2421	—0.0029	0.0422	
	(0.7549)	(1.1975)	(0.0170)		
Basic metal and alloys industry	1.9091	0.8629**	−0.2559	0.7017	14.1183*
	(2.0585)	(4.7896)	(1.8055)		
Transport equipment and parts industry	3.0543**	0.3301	—0.2059	0.1829	1.8437
	(3.7446)	(2.0549)	(1.9046)		
Electricity Industry	1.7394	—0.1481	0.1020	—	—
	(0.6031)	(0.2748)	(0.3796)		

Figures in parentheses are 't' values
* statistically significant at 5 per cent level
** statistically significant at 1 per cent level

TABLE 4

Estimates of CES production function (logarithmic regression of value added per unit of labour on wage rate and labour) 1967-68 to 1981-82

Sector/Industry	β_0	β_1	β_2	R^{-2}	F (2,12)
Manufacturing sector	—0.4766	0.9133**	0.1337	0.5908	8.6638**
	(0.5910)	(3.5573)	(1.8286)		
Food production industry	5.9906**	0.3011	—0.4229**	0.7703	20.1290**
	(7.2811)	(1.3198)	(6.5622)		
Cotton textile industry	—0.6522	0.4928*	0.1819	0.2217	1.7098
	(0.5577)	(2.1819)	(1.6709)		
Basic metal and alloys industry	—1.4813	0.6771	0.3015*	0.3024	2.6009
	(1.2133)	(1.7258)	(2.3429)		
Transport equipment and parts industry	2.9566**	1.1452**	—0.2262**	0.5519	7.3920**
	(4.9735)	(4.1566)	(3.0372)		
Electricity industry	1.0845	1.0803*	—0.0174	0.2559	2.0634
	(0.5406)	(2.5856)	(0.0880)		

Figures in parenthesis are 't' values
* statistically significant at 5 per cent level
** statistically significant at 1 per cent level

The contribution of capital to output growth is quite low. The sign of the coefficient is even negative in most of the cases except basic metal and alloys industry. Thus the labour factor is mainly responsible for the growth of output in the industrial sector. The neutral technical progress does not seem to be an important contributing factor rather it was negative in most of the cases. These results are in conformity with the total factor productivity of Punjab manufacturing sector[17]. The large manufacturing sector as a whole shows clear evidence of constant returns to scale. Among the five individual industries, the cotton textile and electricity industry also show constant returns to scale and is in accord with the large manufacturing sector. While the other two industries, food products and transport epuipment and parts show decreasing returns to scale. The only industry which is enjoying increasing returns to scale is basic metal and alloys.

The results of the study, in general, suggest that the output growth in this sector has been achieved through the increased factor inputs and not through the technological progress and economies of scale. If this pattern remains unaltered, then every increase in output would mean a greater strain on the economy, that is, a proportionately higher dose of investment would be required for every additional unit of output. The overall result can be a low rate of growth and high costs of industrial production which cannot be without an unfavourable effect in the long run. In the planned development economies the production structure ought to be so which will increase the efficiency of input use and returns to scale and not that of capital intensity.

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Resource-Mix Appraisal

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This paper documents the analysis about marginal productivity contributions of the various resources in each product line and evaluates their constraining influences on economic efficiency of the Business.

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The massive expenditure for creation of milk market infrastructure in public sector goes a long way to maximise the welfare functions of both producers and consumers of milk by liberating them from the clutches of predatory milk vendors. Further, the throughout capacity of existing public sector dairy plants accounts for not more than 10 per cent of the total milk produced in the country.[1] The economic viability of these dairy plants is of vital importance for their sustained growth even though these are not meant to maximize their own profitability.

At the nascent stages of dairy development in the country, lack of proper knowledge regarding productivity contrtbutions of various processing resources might be the major cause of distortions in the optimum resource-mix. As a consequence of imperfection of knowledge of resources' productivity, there appears every likelihood of either more or less than optimum use of resources in the manufacturing of various milk products. It is, thus, of utmost importance to delineate the relative importance of each quantifiable resource for efficient milk processing and manufacture of milk products. The research on this aspect has not

1. Mudgal, V.D. (1981), 'Commitments for Dairy Development Through Animal Production Research', Paper presented at the XVII Dairy Industry Conference held at Ahmedabad, February 19-21, 1981.

proceeded beyond costing of milk products ([2], [3], [4] and [5]). Similarly, some studies on packaging and energy saving methods appeared to be too specialised and location specific to draw interference for domestic dairy industry in India.[6]

The present study was, therefore, conducted to document, rank and analyse marginal productivity contributions of various resources in each product line for the selected milk plant and evaluate their constraining influences on economic efficiency of plant business.

Methodology

This study pertains to composite milk plant of public sector from the milk intensive state of North-Western India*. The plant under study had gone into stream in 1974 with installed processing capacity of one and a half lakh litres of milk per day. The handling capacity of the plant, however, did never exceed 75,000 litres of milk per day since its inception. The product-mix of this factory constituted ghee, white butter (WB), table butter (TB), whole milk powder (WMP), skim milk powder (SMP), ice cream powder (ICP), standardised milk (SM), double toned milk (DTM), sweetened flavoured milk (SFM), lassi, paneer and milk cake).

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* The name of the selected plant is kept deliberately secret as desired by the plant authorities.

The product-wise installed capacity of the plan was 5, 4 and 3 tonnes per day for powder, butter and ghee respectively. Bottling plant of this factory had capacity of filling 12,000 bottles or sachets per hour.

The Data

Commensurate with the objectives of this study sequential data on monthly inventory of the plant under study were noted from the records for five years period beginning from April 1974 to March 1979. Besides, data on procurement prices of resources and sale prices of products were collected too.

Processing functions

The availability of resources was analysed with respect to their procurement prices using regression techniques. Five alternative forms of functions for each milk product chosen were tried, out of these one model was eventually selected against the criteria of 'Goodness of fit'. The models were of the following alternative forms :

Linear (L) :

$$Y_{tk} = a_k + \sum_{i=1}^{n} b_{ik} X_{itk} \qquad \text{(i)}$$

Cobb Dougles (CD) in natural log form :

$$\ln Y_{tk} = \ln a_k + \sum_{i=1}^{n} b_{ik} \ln X_{itk} \qquad \text{(ii)}$$

Log-Inverse (LI) in natural log form :

$$\ln Y_{tk} = a_k - \sum^{n} (b_{ik}/X_{itk}) \qquad \text{(iii)}$$

Log-Log-Inverse (LIL) in natural log form :

$$\ln Y_{tk} = a_k + \sum_{i=1}^{n} \left[(b_{ik}/X_{itk}) + (C_{ik} \ln X_{itk}) \right] \qquad \text{(iv)}$$

Transcendental (TRAN) in natural log form :

$$\ln Y_{tk} = \ln a_k + \sum_{i=1}^{n} \left[(b_{ik} \ln X_{itk}) + (C_{ik} X_{itk}) \right] \qquad \text{(v)}$$

Where,

$\ln Y_{tk}$ = Natural log of gross returns from the sale of processed product 'k' in month 't'.

$\ln X_{itk}$ = Natural log of value of the ith resource used in product 'k' in month 't'.

$\ln a_k$ = Intercept in natural log form

a_k = Intercept

The Variables

The set of regressors employed in different product-wise functions, comprised expenses on milk, fuel, labour, electricity, sugar, citric acid and packaging material including bottle breakage.

Specification of the 'Best-Fit' function

The 'best fit' form of function was subjected to step-wise deletion of variables characterised with non-significant regression coefficients with a view to overcome the problem of multicollinearity on one hand and to raise the significance levels of parameter estimates through making available more degrees of freedom on the other.

Result and Discussion

The forms of functions eventually selected against criteria of 'goodness of a fit' were CD for SFM, TRAN for paneer and butter, L for DTM, WMP and Lassi andLLI for SMP and milk cake. The results of regression analysis are presented in Table 1. The

TABLE 1

The Results of Regression Analysis

Product	SFN	Paneer	SMP	Lassi	Milk Cake	Butter	DTM	WMP
Type of function	CD	TRAN	LLI	L	LLI	TRAN	L	L
Intercept/ Constant	0.8716	—0.2322	0.9349	—329.0836	1.0088	2.8743	—5226.49	—72428.11
Regression Coefficients	*4/*							
b_{is}								
b_1	1.0272†*2/*	0.9806†	—	3.1418†	—	0.7761†	1.5524†	3.5290†
	(0.1420)*3/*	(0.0923)		(0.4332)		(0 0669)	(0.0425)	(0.2010)
b_2	0.1062	0.3060†	—	—	49 8732†	0.2022**	9.4882**	—47.3897†
	(0.0814)	(0.0627)			(13.7919)	(0.0765)	(3.5387)	(6.7904)
b_3	—	—	—	5.2912**	—	—	—	—
				(2.4117)				
b_4	—0.2579†	—	—	—1.6855**	32.7941†	—	—	—
	(0.0797)			(0.7238)	(11.8742)			
b_5	—	0.0432*	— 880 8431*	—	—18.1986†	— 0 4430†	—	1.8086†
		(0.0212)	(489.3453)		(5.9071)	(0.1110)		(0.6070)
b_6	0.1121†	—	406.2711**	—	1.2365†	0.2084**	4.8913†	—
	(0.0276)		(186.7091)		(0.2745)	(0.0836)	(0.9156)	
b_7	0.1272†	—	—	18.4631†	—	—0.1188†	54.0676†	—
	(0.0393)			(9.6693)		(0.0125)	(5.7962)	
b_8	—	—0.2146**	—	—	—	—	—	—
		(0.0805)						
b_9	—	—	0.0002†	—	—	—	—	—
			(0.0001)					
b_{10}	—	—	—	—	—54.0655†	—	—	—
					(15.7195)			

(*Contd.*)

TABLE 1—*Contd.*

Product	SFM	Paneer	SMP	Lassi	Milk Cake	Butter	DTM	WMP
Type of function	CD	TRAN	LLI	L	LLI	TRAN	L	L
Regression Coefficients								
C_{is} / C_1	—	—	1.1295† (0.0857)	—	0.8491† (0.0842)	—	—	—
C_2	—	—0.0004† (0.0001)	—0.2496† (0.0525)	—	0.2716† (0.0576)	—0.0001 (@) *1/*	—	—
C_3	—	—	—	—	—	—	—	—
C_4	—	—	—	—	—	—	—	—
C_5	—	—	0.0825†	—	—	0.0012† (0.0003)	—	—
C_6	—	0.0012* (0.0006)	(0.0114)	—	0.1111† (0.0255)	—	—	—
C_7	—	—	—	—	—	0.0001† (@)	—	—
C_8	—	—	—	—	—	—	—	—
C_9	—	—	0.1329** (0.0628)	—	—	—	—	—
C_{10}	—	—	—	—	—0.1619** (0.0601)	—	—	—
R^2	0.985	0.998	0.998	0.998	0.999	0.982	0.998	0.993
$\overline{R^2}$	0.984	0.997	0.997	0.998	0 998	0.979	0.997	0.993

1/ @ Represents the figure < 0.0001

2/ † means one per cent, ** means 5 per cent and * means 10 per cent level of statistical significance.

3/ Figures in parentheses are standard errors.

4/ The order of independent variables is as follows :

1 Fat+SNF (Rs) 3 Bottle breakage (Rs) 5 Fuel (Rs) 7 Aluminium foil (Rs) 9 Packaging material (Rs)
2 Labour (Rs) 4 Sugar (Rs) 6 Power (Rs) 8 Citric acid (Rs) 10 Polythene (Rs).

discussion of these resutts is made for each selected product as follows :

SFM

The expenditure on milk, aluminium foil and power was found to witness the positive significant contributions in gross returns of SFM. The negative but significant regression coefficient of sugar expenditure witnessed on the other hand, its disproportionately high outlay. Expenditure on labour input was also having positive contribution in gross returns but its effect remained obscured in the sample.

Paneer

The positive signs of regression coefficients indicated that augmentation of expenditure on milk, labour, fuel and power would enhance the level of gross returns of paneer. The curtailment of expenditure on citric acid would prevent its wastefulness.

SMP

The gross returns from SMP were observed to respond favourably to an increment in expenditure of

milk and packaging material at their mean level usage. The expenditure on labour and fuel witnessed to be relatively excessive.

Lassi

The paucity of funds for milk, bottles and aluminium foil was found to constrain the gross income from lassi. The negative sign of regression co-efficient of sugar portrayed the misappropriation of funds on sugar in the manufacture of lassi.

Milk Cake

Milk, labour, power and fuel were identified as resource augmenting constraints in the manufacture of milk cake whlie sugar and polythene were found to be waste preventing constraints.

Butter

The perusal of butter processing function revealed that milk and power were items of resources augmenting constraints. Labour at its higher level, but fuel and aluminium foil at lower levels of usage were characterised as waste preventing constraints.

DTM

The stringent supply of resources witnessed the only constraint to profitability of DTM. The highest constraining influence on profitability was due to inadequate availability of aluminium foil followed by that of labour, power and milk.

WMP

Milk, labour and fuel simultaneously explained 99.3 per cent variability in the gross returns of WMP. Expenditure on milk and fuel was observed to be less than optimum on one hand and on labour it was found to be disproportionately higher.

Marginal Analysis

The estimates of MVP's of resources at their respective geometric mean levels were obtained for each milk product and the results are set out in Table 2. The perusal of this table revealed wide fluctuations in the MVP's of each resource across milk products. Besides, major differences were observable in MVP's of resource-mix of each milk product. These MVP's were also witnessing divergence from unity.

TABLE 2

Marginal Value Products of Various Processing Resources at Geomoetric Mean Levels for Each of the Selected Milk Product

(Rupees)

Sr. No.	Milk Products	SFM	Paneer	SMP	Lassi	Milk cake	Butter	DTM	WMP
	Resources								
1	Milk (Fat + SNF)	3.57	1.48	2.13	3.14	2.13	1.65	1.55	3.53
2	Labour	2.89	7.19	—16.52	—	2.97	8.69	9.49	—47.39
3	Sugar	—3.58	—	—	—1.69	—0.61	—	—	—
4	Power	17.63	8.23	—2.28	—	16.41	6.05	4.89	—
5	Aluminium Foil	19.97	—	—	18.46	—	23.90	54.07	—
6	Citric acid	—	—14.77	—	—	—	—	—	—
7	Fuel	—	2.78	—0.89	—	0.84	36.90	—	1.81
8	Packaging material	—	—	8.66	—	—	—	—	—
9	Bottle breakage	—	—	—	5.29	—	—	—	—
10	Polythene	—	—	—	—	—0.24	—	—	—

This revealed the extent of inefficiency in the existing resource use pattern of a plant.

Further examination of Table 2 indicated that expenditure on milk had MVP greater than unity, in case of all the milk products showing less than optimum milk procurement in the study plant. The relatively excessive allocation of funds for labour was observed in case of WMP and SMP whereas paucity of funds for labour appeared to constrain the profitability of DTM, butter, paneer, milk cake and SFM. The wasteful expenditure on sugar reflected by negative MVP's in all relevant milk products could have augmented profitability of the plant had it been allocated to those resources with higher positive MVP's.

The highest constraining impact was observed owing to disproportionately lower availability of power in case of SFM which was followed by that in milk cake, paneer, butter, and DTM. Contrarily, disproportionately, higher allocation of funds for power was revealed by the negative MVP of SMP. Aluminium foil turned out to be the most limiting resource for all products involving its usage. The relatively excessive use of funds was observed in case of citric acid. The investment on fuel appeared relatively more close to the optimum levels in case of paneer, SMP, WMP and milk cake in comparsion to that for butter where it could have highly constrained profitability due to its highest MVP (Rs. 36.90).

The packaging material for SMP and bottle breakage were found at great variance with their respective optimum levels in view of their MVP's being greater than unity. The negative MVP of polythene bags witnessed its relatively over use in the preparation of milk cake packets.

At this stage, it is partinent to succinctly epitomise the identification of constraining resources on the basis of their respective MVP's. The summary of resource classification on the basis of their constraining infiuences on milk product lines of the study plant is presented in Table 3.

TABLE 3

Classification of resources according to their degrees of constraining influences on product-lines

S. No.	Products	Categories of resources			
		Category I Weak constraints	Category II Waste preventing constraints (High Degree)	Category III Weste preventing constraints (Low Degree)	Category IV Resource augmenting constraints
1	SFM	Fuel Bottle-breakage	Sugar	—	Milk, labour, power and aluminium foil
2	Paneer	Polythene	Citric acid	—	Milk. labour, power and fuel
3	SMP	—	Labour, power and fuel	—	Milk and packaging material
4	Lassi	Power, labour and fuel	Sugar	—	Milk, aluminium foil and bottle-breakage
5	Milk cake	—	Sugar and ploythene	Fuel	Milk, labour and power
6	Butter	—	—	—	Milk, labour, power, aluminium foil and fuel
7	DTM	Fuel and bottle-breakage	—	—	Milk, labour, power and aluminium foil
8	WMP	Packaging material, tins and power	Labour	—	Milk, and fuel

It can be readily observed from Table 3 that fuel is almost uniformly weak (Category I) in posing constraining impact on the manufacture of SFM, lassi, and DTM. Similarly, sugar can be identified as a waste preventing resource iu the manufacturing of SFM, lassi and milk cake. Finally, in category IV which is composed of resource augmenting constraints, supply of milk can invariably be identified as most important constraint. The frequent occurrences of negative signs of regression coefficients prevents for further use of this analysis for optimisation of resource-mix of each milk product.

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Industrialisation of Hill Areas

DR. S.S. KHANKA

This paper brings out the relevance of industrialisation of Bhimtal-Ranibagh area of Nainital with a view to improve the levels of living of the Hill people by providing them with more employment and income.

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Introduction

One of the basic objectives of hill areas industrialization has been to improve the levels of living of the hill people by providing them more productive employment and income. With this objective in view, this papers examines the relevance of industrialization of Bhimtal-Ranibagh area of Nainital district to the available human resources.

That resources multiply when they are seized and used; and die when neglected is a known fact. Because of the reasons described elsewhere (Singh, 1985), agriculture cannot be made viable enough to use the human resources adequately. Thus, the industrial sector is looked upon to solve the regional problems of unemployment and poverty. It is advocated that the hill areas offer most suitable conditions for the establishment and developmeat of pollution-free and skill-intensive industries requiring light material such as, electronics, watches, precision goods, etc. The State Government's announcement to make the Bhimtal region an 'Industrial Complex' and a proposal of establishing 12 industries between Bhimtal and Ranibagh is a major step in this direction. Those believing in an integrated development feel the necessity of an impeccable and perspicacious recoinnaissance of hitherto established industries so as to fathom their relevance and necessity for solving the problems of hill development in an immaculate way. In order to examine the relevance of industrialization in terms of income and employment, in the

Kumaun Himalaya, we have conducted a sample study of three industries; viz., Teletronics Limited, Bhimtal, U.P. Digitals, Ghorakhal and The Hindustan Machine Tools Limited (HMT), Ranibagh. All these are located below 1500 m in Nainital district.

The Human Resources

Contrary to a high sex-ratio exceeding 1000 in other parts of Kumaun region—Almora and Pithoragarh districts, the sex-ratio is considerably low at 899 in Bhimtal area as a whole which varies from 658 in Sundi to 985 in Mehra Gaon (Table 1). This is partly due to the reason that the majority of male workers serve in nearby towns and are used to go and return to their villages daily.

Possibly higher rate of female mortality is another reason

The literacy level in the Bhimtal area is markedly higher than not only in the Kumaun region, but also in Uttar Pradesh and India. As a whole, there are 3 literate persons out of every 4 persons living in ihis area. The male literacy is as high as 85 per cent and the female literacy 65 per cent (Table 2). However, about four-fifths of total literates possess an educational qualification less than intermediate level. It is also seen from Table 2 that the maximum percentage of literates is constituted by those with primary level education in both the sexes. Compared to the females, males, of course, show higher literacy at all the educationals level after the primary level. On the whole, nearness of area/villages to urban centres together with the majority of male workers serving in the nearby urban centres seem the main attributing factors to such a high literacy rate found in this area.

The three industries viz, Teletronics Limited, Bhimtal, U.P. Digitals, Ghorakhal and the HMT, Ranibagh are set up at a distance of 22 km; 16 km and 31 km respectively from Nainital town. The nearest railway station for all these industries is Kathgodam. The survey was undertaken through the questionnaires at employees level. The questionnaires were distributed among the employees for filling in their own convenience during September-November, 1985. While the size of sample was 50 per cent of total employees in Teletronics Limited, Bhimtal and U.P. Digitals, Ghorakhal in each, it was about 10 per cent in the HMT, Ranibagh mainly due to a large number of employees in this industry.

TABLE 1

Population, Sex-Ratio and Migrants in the Five Sample Villages of Gaula Catchment

Villages	Number of Households	Persons	Sex-ratio, i.e. Number of females per 1000 males	Migrants
1. Siloti	38 (5.52)	210	735	48 (22.86)
2. Chanoti	28 (6.93)	194	848	04 (2.06)
3. Mehragaon	143 (6.33)	905	985	90 (9.94)
4. Salari	28 (5.89)	165	964	01 (0.61)
5. Sundi	22 (6.18)	136	658	01 (0.73)
Total	259 (6.22)	1610	899	144 (8.94)

N.B.: (i) Figures in parentheses in column 2 denote family size, i.e., number of persons per household.

(ii) Figures in brackets in column 7 denote incidence of migration. i.e., percentage of migrants to total population. In the present analysis, migrants includeonly those who moved outside their villages in persuit of jobs.

TABLE 2

Population by Levels of Education in the Five Sample Villages of Gaula Catchment

Educational Levels	Siloti			Chaunoli			Mehragaon			Salari			Sundi			Total		
	P	M	F	P	M	F	P	M	F	P	M	F	P	M	F	P	M	F
Illiterate	38	13	25	63	24	39	213	63	150	43	12	31	42	18	24	399	130	269
	(18)	(12)	(28)	(32)	(23)	(44)	(23)	(14)	(33)	(26)	(14)	(38)	(31)	(22)	(44)	(25)	(15)	(35)
Literate without Educational Level	11	4	7	15	10	5	62	34	28	23	16	7	22	12	10	133	76	57
	(5)	(3)	(8)	(8)	(9)	(6)	(7)	(7)	(6)	(14)	(19)	(9)	(16)	(15)	(19)	(8)	(10)	(7)
Primary	43	26	17	46	19	27	260	116	144	58	25	33	35	22	13	442	208	234
	(20)	(21)	(19)	(24)	(18)	(30)	(29)	(25)	(32)	(35)	(30)	(41)	(26)	(27)	(24)	(27)	(24)	(31)
Junior High School	32	15	17	36	26	10	156	89	67	27	20	7	24	18	6	275	168	107
	(15)	(12)	(19)	(19)	(25)	(12)	(17)	(20)	(15)	(16)	(24)	(9)	(18)	(22)	(11)	(17)	(20)	(14)
High School	33	27	6	18	14	4	84	60	24	10	9	1	12	11	1	157	121	36
	(16)	(22)	(7)	(9)	(13)	(4)	(9)	(13)	(6)	(6)	(11)	(1)	(8)	(13)	(2)	(10)	(14)	(5)
Intermediate	24	15	9	8	6	2	77	50	27	3	2	1	1	1	0	113	74	39
	(12)	(12)	(10)	(4)	(6)	(2)	(9)	(11)	(6)	(2)	(2)	(1)	(1)	(1)	—	(7)	(9)	(5)
Graduation and above	29	21	8	8	6	2	53	44	9	1	0	1	—	—	—	91	71	20
	(14)	(18)	(9)	(4)	(6)	(2)	(6)	(10)	(2)	(1)	—	(1)	—	—	—	(6)	(8)	(3)
Total	210	121	89	194	105	89	905	456	449	165	84	82	136	82	54	1610	848	762
	(100)	(100)	(100)	(100)	(100)	(100)	(100)	(100)	(100)	(100)	(100)	(100)	(100)	(100)	(100)	(100)	(100)	(100)

N.B. (i) P stands for Person, M for Male and F for Female.

(ii) Figures in parentheses denotes percentage to total.

The Survey Findings

Total Employment by Sex

Table 3 gives data on total employment by sex and rural-urban distribution in the three industries. On the whole, out of every 10 persons employed, there were 7 males but this male-female ratio of employees was 9 : 1 in the HMT, Ranibagh. On the other side, there are 6 female employees per 4 male employees in the U.P. Digitals, Ghorakhal. The better suitability of female fingers in assembling the watch parts seems the possible reason for greater representation of the females. Nearly three-fourth of the total employees hail from rural areas. However, movement from the rural areas is greater in male population. The reasons are not far to seek.

Employees' Residential Base

A close look at employees' proportions by their residential bases indicates that more than four-fifth of the total employees are from the Kumaun region and nearly one-third of this is from the Bhimtal area itself (36 per cent). This tends to buttress the widely-accepted phenomenon that distance deters mobility. That the propensity to move is low among females is also suggested by their larger share in 'within the Bhimtal region' than their proportions in the next two residential bases (see Table 4). Contrary is true of male employees. With regard to employees' residential bases, another interesting feature to be noted is that while the residential base is within Bhimtal region, the majority of male and female persons hail from the rural areas but in the case the residential base under-

TABLE 3

Total Employment by Sex and Rural-Urban Distribution

Industries	T=Total R=Rural U=Urban	Total Employment Person	Male	Female
I. Teletronics Limited	T	119 (100)	88 (74)	31 (26)
	R	94 (79)	71 (81)	23 (74)
	U	25 (21)	17 (19)	8 (26)
II. U.P. Digitals, Ghorakhal (1978)	T	101 (100)	46 (45)	55 (53)
	R	69 (68)	33 (72)	36 (65)
	U	32 (32)	13 (28)	19 (35)
III. The Hindustan Machine Tools Ltd., Ranibagh (1985)	T	93 (100)	85 (91)	8 (9)
	R	62 (67)	59 (69)	3 (37)
	U	31 (33)	26 (31)	5 (63)
ALL (I+II+III)	T	313 (100)	219 (70)	94 (30)
	R	225 (72)	163 (74)	62 (66)
	U	88 (28)	56 (26)	32 (34)

N.B : Figures in parentheses denote percentage to total.

TABLE 4

Percentage Distribution of Employees by their Residential Bases

Industries	T=Total R=Rural U=Urban	Within Bhimtal Region*			Outside Bhimtal Region but within Kumaun Region			Outside Kumaun Region		
		P	M	F	P	M	F	P	M	F
I. Teletronics Limited, Bhimtal	T	48	42	64	34	39	23	18	19	13
	R	61	52	87	32	38	13	7	10	—
	U	—	—	—	44	41	50	56	59	50
II. U.P. Digitals. Ghorakhal	T	35	26	42	52	54	51	13	20	7
	R	41	30	50	52	58	47	7	12	3
	U	22	16	26	53	46	58	25	38	16
III. The Hindustan Machine Tools Limited, Ranibagh	T	24	19	75	63	68	12	13	13	13
	R	12	7	100	77	81	—	11	12	—
	U	48	47	60	36	38	20	16	15	20

N.B. : (i) P denotes Person, M Males and F Females.

(ii) *In the present study, the Bhimtal region encompasses all those areas from where employees came to work in these industries and return to their places every day.

goes a change from Bhimtal region to within and outside Kumaun region, more employees hail from urban areas.

Employees' Marital Status

If one is to view the employees' marital status by their residential bases as ilustrated in Table 5, two main features are important to note. First, when the residential base has been Bhimtal area, the flow of both unmarried male and female employees is larger from rural areas as compared to that of urban areas. This holds good also for male employees belonging to Kumaun region other than Bhimtal area. Second, in the case of female employees, the flow of married female employees from urban areas dominates with a change in residential base to within and outside Kumaun region. Opposite is the case with regard to male employees when the residential base is outside Kumaun region. Evidently, the influx of married male employees is considerably larger from urban areas of outside Kumaun region. This can be due to the reasons like as such that most of the times people do not choose to serve in the hills for various reasons and postings in the hills is generally seen a form of punishment (Anonymous, 1980). Like everywhere else, the chronic overt unemployment is mainly found in urban areas in Kumaun region also (Khanka, 1984). These give a clue to understand why mainly married males from outside Kumaun region are bound to serve in these industries as their last economic resort. This fact is also confirmed by the employees' unwillingness to serve in these industries for various reasons as is shown by Table 9.

Employees' Levels of Education

One way of examining the pattern of employment in these industries may be the employees' levels of education. Expectedly, there has not been illiterate employees in all the three industries except in U.P. Digitals, Ghorakhal which employs 2 illiterate persons (15 per cent) out of a total of 13 employees coming even from outside Kumaun region. Of course, an increasing proportion of employees with an increase in their educational levels is generally noticed in all industries and residential bases, yet as many as 7 males for every 10 males of intermediate level of education employed from within Bhimtal and Kumaun

TABLE 5

Employees' Residential Base and their Marital Status

(in Per cent)

Industries	T=Total R=Rural U=Urban	Within Bhimtal Region				Outside Bhimtal Region but within Kumaun Region				Outside Kuman Region			
		Male		Female		Male		Female		Male		Female	
		M	UM	M	UM	M	UM	M	UM	M	UM	M	UM
I. Teletronics Limited, Bhimtal	T	51	33	60	67	32	46	30	19	17	22	10	14
	R	56	46	75	93	32	46	25	7	12	8	—	—
	U	—	—	—	—	25	46	50	50	75	54	50	50
II. U.P. Digitals, Ghorakhal	T	25	28	22	63	54	54	64	37	21	18	14	—
	R	26	36	14	73	58	57	79	27	16	7	7	—
	U	20	12	29	20	40	50	50	80	40	38	21	—
III. The Hindustan Machine Tools Limited, Ranibagh	T	9	20	67	80	73	68	33	—	18	12	—	20
	R	—	8	—	100	83	81	—	—	17	11	—	—
	U	20	52	67	50	60	33	33	—	20	15	—	50

N B. : (i) M denotes Married and UM Unmarried.

regions in HMT, Ranibagh are worth noticing. The possible reason for such a high percentage of employees of this educational level is that this recently set-up industry in 1985 has a procedure to recruit persons as apprentice for a period of one year for which the highest qualification prescribed is intermediate level of education.

Much more than that, the lowest percentage of employees with some sort of technical education belonging to Bhimtal and Kumaun regions, on the one hand, and the highest percentage of employees with technical education coming from outside Kumaun region, on the other, are testimonies enough to the fact that there has been a lack of required technical local manpower so far to man these industries in the region. Furthermore, that there has been an utter lack of technical female education in the Kumaun region has also been well underlined by their absence in total employment in all the industries except in Teletronics Limited, Bhimtal where too only 4 out of a total of 31 female employees are with some sort of technical education. Indisputably, such evidenced scarcity of technical manpower in the region assumes added importance with regard to setting-up of such skill-intensive industries in the region.

TABLE 6

Employees by Levels of Education, Sex and Residential Base

(in Per cent)

Residential Base	Levels of Education	Teletronics Limited, Bhimtal			U.P. Digitals, Ghorakhal			The Hindustan Machine Tools Limited, Ranibagh		
		Persons	Male	Female	Persons	Male	Female	Persons	Male	Female
I. Within Bhimtal Region	1	—	—	—	—	—	—	—	—	—
	2	9	13	—	6	17	—	4	—	17
	3	14	22	—	11	34	—	4	—	17
	4	14	19	5	20	17	22	8	5	16
	5	33	22	50	11	17	9	58	72	16
	6	16	5	35	46	—	69	22	17	34
	7	16	19	10	6	15	—	4	6	—
	8	100	100	100	100	100	100	100	100	100
II. Outside Bhimtal Region but within Kumaun Region	1	—	—	—	—	—	—	—	—	—
	2	2	13	—	—	—	—	—	—	—
	3	13	3	14	2	4	—	2	2	—
	4	12	11	14	23	36	11	23	22	100
	5	12	11	14	26	12	39	66	67	—
	6	26	19	58	36	20	50	5	5	—
	7	35	43	—	13	28	—	4	4	—
	8	100	100	100	100	100	100	100	100	100
III. Outside Kumaun Region	1	—	—	—	15	11	25	—	—	—
	2	—	—	—	8	11	—	—	—	—
	3	5	6	—	—	—	—	—	—	—
	4	—	—	—	8	11	—	15	15	—
	5	—	—	—	8	—	25	15	15	—
	6	57	59	50	23	11	50	31	31	=
	7	38	35	50	38	56	—	39	39	—
	8	100	100	100	100	100	100	100	100	—

* 1. Illiterate; 2. Primary; 3. Junior High School; 4. Matriculation; 5. Intermediate; 6. Graduation; 7. Technical; 8. Total.

Narure and Type of Employees' Employment

On the whole, about four-fifth of the total employment is classified as technical except in the Teletronics where only about one-third of the total employment is technical. Notwithstanding, an important distinction between technical and non-technical employment gleaned from the Table 7 is worth mentioning. While the maximum proportion of non-technical employment is availed by the Bhimtal based people (more true of female employees), that of technical employment is availed by the people of Kumaun region other than Bhimtal region (dominated by male employees). With regard to female technical employment, it is interesting to observe that out of every 10 female technical employees, as many as 9 are from Kumaun region itself. In this regard, a revertion to Table 6 well explains the fact that the lopsided employment distribution heavily skewed in favour of technical employment is not, however, due to the possession of any technical qualification of employees before joining the particular industry, but that the imparting of technical training to the new entrants to these industries has been the main contributing factor to such a high hike in their proportion in the total employment. The evidence of the U.P. Digitals, Ghorakhal as noted earlier together with the underway evidence of the HMT, Ranibagh where all trainees working as operators stated their employment as technical, confirm such a large magnitude of so-called technical employment.

Further, a close look at types of employment and nature of employment brings forth an interesting relationship between the two. About four-fifth proportion of permanent employees holding so-called technical employment in the U.P. Digitals and the HMT together with a corresponding figure of only one-third in the Teletronics well tend to establish the relationship that more the technical employment, more is the permanent employment and vice-versa. This holds good for whatever the residential base is. Again, in the Teletronics Limited itself, a larger proportion of permanent (34 per cent) than non-permanent (20 per cent) employment of total tenhnical employment further fortifies the above relationship between the two. Very possibly, this is due to the same reason that in the case of employees particularly coming from outside Kumaun region, while they constitute a sizeable proportion (about 15 per cent) of non-permanent employees even in the case of technical employment, their proportion particularly of male non-permanent employees is quite in non-existence in the case of non-technical employment.

Income

The role that these industries play in income generation is illustrated in Table 8. A close look at the percentage distribution of employees by levels of their monthly earnings between technical and non-technical particulary in the U.P. Digitals and the Teletronics reveals that while about the three-fifth of total technical employees fall in the earning group of Rs. 500—Rs. 1,000, a similar concentration is noticed in the lower earning level of Rs. 300—Rs. 700 in the case of non-technical employees. This aptly goes to fortify the widely—held belief that technical employment is more income yielding than non-technical employment.

The HMT, Ranibagh, of course, exhibits a quite income distribution pattern where about nine-tenth and three-fifth employees are concentrated in the initial earning group of Rs. 300—Rs. 500 respectively in the case of technical and non-technical employees for which the reasons are given earlier. Evidently, the maximum of this concentration in all the three industries and in both the employments is constituted by the employees whose residential base is Kumaun region. Nevertheless, it is interesting to observe that not only the higher earning posts are by and large mainly held by males but also that too by those from outside the Kumaun region.

Employees' Satisfaction Dissatisfaction with their Present Job and Place of Work

An enquiry into the extent of employees' satisfaction/dissatisfaction with regard to their present job and place of work will be an important Yardstick for fathoming the industrial success and relevance to the regional development. It is seen from the Table 8 that as a whole, more than 50 per cent of employees are not satisfied with their present jobs so far and in

TABLE 7

Extent of Employment by Technical and Non-Technical, Permanent and Non-Permanent Basis By Sex and Residential Base

(in Per cent)

Nature of Employment	Residential Base	P = Person M = Male F = Female	Teletronics Limited, Bhimtal			U.P. Digitals, Ghorakhal			The Hindustan Machine Tools Limited, Ranibagh		
			Total	Permanent	Non-Permanent	Total	Permanent	Non-Permanent	Total	Permanent	Non-Permanent
I. Technical	Within Bhimtal Region	P	37	35	40	34	34	33	15	16	13
		M	23	26	18	22	24	17	15	16	13
		F	69	75	67	41	40	50	—	—	—
	Outside Bhimtal Region but within Kumaun Region	P	44	43	45	56	57	50	72	72	74
		M	54	48	64	61	63	50	72	72	74
		F	23	25	22	53	54	50	—	—	—
	Outside Kumaun Region	P	19	22	15	10	9	17	13	12	13
		M	23	26	18	17	13	33	13	12	13
		F	8	—	11	6	6	—	—	—	—
	Total (I)	P	36	34	20	88	88	86	77	83	63
		M	34	34	34	78	79	75	85	84	88
		F	42	36	45	96	96	100	—	—	—
II. Non-Techincal	Within Bhimtal Region	P	54	48	62	42	30	100	43	25	67
		M	52	43	67	40	25	100	23	18	50
		F	61	72	54	50	50	—	76	100	72
	Outside Bhimtal Region but within Kumaun Region	P	29	27	31	25	30	—	38	50	22
		M	31	30	33	30	37	—	54	54	50
		F	22	14	27	—	—	—	12	—	14
	Outside Kumaun Region	P	17	25	7	33	40	—	19	25	11
		M	17	27	—	30	38	—	23	28	—
		F	17	14	19	50	50	—	12	—	14
	Total (II)	P	64	66	62	12	12	14	23	17	37
		M	66	66	66	22	21	25	15	16	12
		F	58	64	55	4	4	—	100	100	100

consequence nearly three-fourth of them are willing to leave the present job even if a job of the same rank is available to them elsewhere. The incidence of dissatisfaction is higher at 58 per cent and 76 per cent respectively in the Teletronics and the U.P. Digitals. On the other side, the percentage of dissatisfied employees (13 per cent) and of those willing to leave the present job (33 per cent) both are relatively much low in the HMT, Ranibagh. The HMT, Ranibagh has been just set-up and there is a flood of recruiting apprentices as operators and those too of intermediate qualification. Obviously, in such an initial stage of an industry, the question of the employees' dissatisfaction with regard to jobs is not much likely to arise.

A break-up of the employeee dissatisfaction into reasons (see Table 9) shows that the majority of employees, irrespective of their residential bases indicates the problems of basic civic life-necessities like lack of housing, education, health and transport facilities as a major reason of their dissatisfaction. Among these too, the problem of housing is the most acute, particularly for those with the residential base outside the Bhimtal region but within the Kumaun region. Out of every 10 employees dissatisfied due to the housing problems, as many as 6 belong to this category. This plight can be understood in terms of their too low earnings to enable them to afford a high rent (see Table 8). Similarly, a sizeable proportion of employees even of Bhimtal region itself are dissatisfied due to housing problems. Unable to bear high house rent out of their meagre earnings, they continue to go and return daily to their native places. A sizeable proportion of employees particularly those of coming from outside Bhimtal region is also found dissatisfied either due to an inappropriate job or due to lack of promotional prospects therein. Overall, the percentage of employees dissatisfied with their present jobs due to various reasons is the highest (51 per cent) among those whose residential base is outside Bhimtal but within Kumaun region. On the other side, while the percentage of dissatisfied employees hailing from outside Kumaun region is the lowest (about 14 per cent), among the total dissatisfied employees, a higher proportion (83 per cent) of this category is willing to leave the present job.

A similar kind of incidence of dissatisfaction is noticed, by and large, with regard to the employees' place of work as well, nevertheless the industry-wise overall incidence of dissatisfaction turns out to be quite distinct with that of present job. For instance, while the overall extent of dissatisfaction with regard to place of work accounts for about 27 per cent and about 41 per cent respectively in the Teletronics and the U.P. Digitals, it amounts to about 53 per cent in the HMT. In fact, to the extent of 51 per cent of the total dissatisfaction accounted for by housing problems alone has peaked up in the overall extent of dissatisfaction in this industry. Haldwani-cum-Kathgodam being an over-crowed urban township, the problems of housing is inevitable.

Employees' Activity Status Before Joining the Present Industries

With regard to the employees activity status before joining the present industries, three main features are important to note. First, in the case of Bhimtal residential base, the majority of the employees more especially females were unemployed followed by students. Second, the activity status of the majority of the employees especially of males was students followed by unemployed while the residential base changes to Kumaun region. Third, the maximum employees coming from outside Kumaun region are employed as their activity status which suggests that persons coming from outside Kumaun region come mainly to better their jobs. Also, the absence of females as their employed activity status of females especially in the Teletronics and the HMT is indicative of their lower mobility as compared to their male counterparts.

Summing UP

We do not hold the opinion that industrialization and regional development are quite antithetic to each other. Our contemporary wisdom suggests that industrialization abets socio-economic development. However, industrialization in the hills has had an impact which is far from totally positive and, thus hampers overall regional development in various ways. In the given set-up, such topsy-turvy industrialization seems hardly contributing its expected mite to eradicate the twin problems of poverty and unemployment

TABLE

Employees' Monthly Earnings by Sex, Residential

	TECHNICAL						
	Within Bhimtal Region		Outside Bhimtal Region but within Kumaun Region		Outside Kumaun Region		Total
	Male	Female	Male	Female	Male	Female	
1	2	3	4	5	6	7	8
I. *Teletronics Limited, Bhimtal*							
<300	—	—	—	—	—	—	—
300—500	12	50	63	—	25	50	10 (29)
500—700	50	—	25	—	25	—	4 (12)
700—1000	40	50	50	50	10	—	16 (46)
1000—1500	—	—	33	—	67	100	4 (12)
1500 & Above	—	—	—	—	100	—	1 (11)
Total	7 (20)	4 (12)	12 (34)	3 (9)	7 (20)	2 (5)	35 (100)
II. *U.P. Digital, Ghorakhal*							
<300	62	67	38	33	—	—	11 (12)
300—500	14	—	79	—	7	—	14 (16)
500—700	—	26	67	68	33	6	22 (25)
700—1000	25	48	25	45	50	7	35 (39)
1000—1500	—	—	67	—	33	—	6 (7)
1500 & Above	—	—	100	—	—	—	1 (1)
Total	8 (9)	22 (25)	22 (25)	28 (31)	6 (7)	3 (3)	89 (100)
III. *The Hindustan Machine Tools Limited, Ranibagh*							
<300	—	—	—	—	—	—	—
300—500	18	—	77	—	5	—	65 (90)
500—700	—	—	—	—	—	—	—
700—1000	—	—	33	—	67	—	3 (4)
1000—1500	—	—	—	—	100	—	1 (2)
1500 & Above	—	—	33	—	67	—	3 (4)
Total	12 (17)	—	57 (72)	—	8 (11)	—	72 (100)

8

Base and Technical and Non-Technical Employment

(in Per cent)

NON-TECHNICAL						
Within Bimtal Region		Outside Bhimtal Region but within Kumaun Region		Outside Knmaun Region		Total
Male	Female	Male	Female	Male	Female	
9	10	11	12	13	14	15
64	100	36	—	—	—	15 (18)
50	—	50	50	—	50	8 (9)
63	83	32	17	5	—	31 (37)
38	57	31	29	31	14	20 (24)
14	—	57	—	29	—	7 (8)
—	—	—	—	100	—	3 (4)
30 (36)	15 (18)	22 (26)	5 (6)	10 (12)	2 (2)	84 (100)
50	—	—	—	50	—	4 (33)
25	—	75	—	—	100	5 (42)
100	100	—	—	—	—	2 (17)
—	—	—	—	100	—	1 (8)
—	—	—	—	—	—	—
—	—	—	—	—	—	—
4 (34)	1 (8)	3 (25)	—	3 (25)	1 (8)	12 (100)
—	—	—	—	—	—	—
43	83	29	17	28	—	13 (62)
—	—	—	—	—	—	—
—	—	—	—	—	—	—
40	—	60	—	—	—	5 (24)
—	—	—	—	100	—	3 (14)
5 (24)	5 (24)	5 (24)	1 (4)	5 (24)	—	21 (100)

TABLE 9

Employees Satisfaction/Dissatisfaction with their Present Job

(in Per cent)

Industry/Residential Base	Satisfied		Dissatisfied (Why*)							Those who will leave the present job
	Male	Female	1	2	3	4	5	6	Total	
I. Teletronic Limited, Bhimtal										
(i) Within Bhimtal Region	52	50	9	26	—	50	72	—	32 (46)	28 (87)
(ii) Outside Bhimtal but within Kumaun Region	30	20	54	53	100	17	25	—	26 (38)	21 (81)
(iii) Outside Kumaun Region	18	30	37	21	—	33	3	—	11 (16)	9 (82)
Total	40 (45)	10 (32)	11 (16)	19 (27)	1 (1)	6 (9)	32 (47)	—	69 (100)	58 (84)
II. U.P. Digitals, Ghorakhal										
(i) Within Bhimtal Region	30	50	—	37	33	32	—	—	26 (34)	14 (52)
(ii) Outside Bhimtal but within Kumaun Region	50	36	50	57	17	63	—	—	42 (54)	34 (81)
(iii) Outside Kumaun Region	20	14	50	6	50	5	—	100	9 (12)	8 (88)
Total	10 (22)	14 (25)	2 (3)	49 (63)	6 (8)	19 (25)	—	1 (1)	77 (100)	55 (71)
III. The H M.T. Ltd., Ranibagh										
(i) Within Bhimtal Region	21	86	29	—	—	—	—	—	2 (17)	—
(ii) Outside Bhimtal but within Kumaun Region	64	14	57	100	—	—	—	67	7 (58)	2 (29)
(iii) Outside Kumaun Region	15	—	14	—	—	—	100	33	3 (25)	2 (67)
Total	76 (89)	7 (87)	7 (58)	1 (8)	—	—	1 (8)	3 (26)	12 (100)	4 (33)

* 1. Not according to the qualifications/lack of promotional prospects; 2. Housing Problems;
3. Lack of educational and health facilities; 4. Lack of transport facilities;, 5. Lack of entertainment facilities; 6. Any other (including temporary job, managerial problems, far from the native place, limited vacation etc.)

N.B. : Those who did not respond at all were considered satisfied.

stalking the land. It is also evident that when a sophisticated industry is located in a backward area, problems of training and discipline arise (Kalbagh, 1985). In fact, its is not because of lack of industrial culture, but is really because the lack of skills. Obviously, if there is a mismatch between the technology package and the user's skills, the technology will fail. In fact, the technology package is like a school text-book, a fifth standard boy can make little sense from the 8th standard book. This means that the different technologies should be arranged according to the level of skills presumed to be available to the user.

TABLE 10

Employee's Activity Status Before Joining the Present Industry by Sex and Residential Bases

(in Per Cent)

Residential Base/Activity Status	Teletronics Limited Bhimtal			U.P. Digitals Ghorakhal			The H.M.T. Ltd., Ranibagh		
	P	M	F	P	M	F	P	M	F
I. Within Bhimtal Reigon :									
Student	33	10	54	35	—	40	34	25	83
Unemployed	54	50	65	41	36	54	18	17	50
Employed	39	39	—	15	18	—	18	18	—
II. Outside Bhimtal but within Kumaun Region :									
Student	52	80	28	59	86	55	45	53	—
Unemployed	34	38	25	49	54	36	79	81	50
Employed	25	25	—	38	36	50	36	36	—
III. Outside Kumaun Region:									
Student	15	10	18	6	14	5	21	22	17
Unemployed	12	12	10	10	10	10	3	2	—
Employed	36	36	—	47	46	50	46	46	—
Total (I+II+III)									
Student	18 (21)	11 (10)	35 (11)	48 (49)	15 (7)	76 (42)	41 (38)	38 (32)	75 (6)
Unemployed	59 (70)	57 (50)	65 (20)	39 (39)	69 (28)	20 (11)	47 (44)	49 (42)	25 (2)
Employed	23 (28)	32 (28)	—	13 (13)	24 (11)	4 (2)	12 (11)	13 (11)	—

N.B. : (i) P denotes Person, M Males and F Females.
(ii) Figures in parentheses denote absolute numbers.

This grading can be considered as *Technology Ladder*. Of course, technology can help but is not the only answer. Then, how to make the change-over is really the problem.

The ongoing conflicts over natural resources and lurking virmins to the regional hedge through such industrialisation seem no longer to be shrouded and ignored. Strictly speaking, it does not seem that industries are established the real need basis in this ecologically sensitive and environmentally vulnerable region too. It is seen that, to the extent the need basis becomes secondary, the opening of industries could well be a popular item for political bargaining, seemingly justifying the need basis. As such, it is not unusual for a political contestant to promise the regional people to bring an industry to their doors for their all-round betterment if they voted

for him. That is why it is not surprising to find that, in fact, less potent a region like ours on real need basis, greater is the clamour for dragging industries in the region because it 'symbolises' development in an apparent sense and becomes conspicuous for the purpose of political manoeuvring. In this regard, the fight of citizens' groups in Dehra Dun and Mussoorie, a case in the Supreme Court with regard to the very relevance of limestone quarrying to the local population is worth citing. The expert who in 1977 had stated quarrying was ecologically safe now stated of the same quarry that "the lease area is situated right in the immediate catchment area of a nullah and is thus subjected to conspicuous denudation by flow of water. Rectification of the situation calls for a permanent closure of this mine". To this has also been added the recent opposition of the Government's ambitious scheme titled 'Greater Nainital Authority' by the local people as an example of such manoeuvring. These quarrels well underline the fact that especially hill-areas industrialization calls for much more than licensing and investment, if it is to be called planned industrial development.

As industrialization abets socio-economic development, a recipe of some electric measures is submitted by way of conclusion for making industrialization more relevant to the overall regional development. In order to man these industries, technical education in the hills should be shaped in such a manner that it may suit industrial needs of the region. And the the lines of training programmes should match with that of the recruitment of manpower in the industries introduced. Special features of the hill areas should be taken into account in structural aspects of location and construction. Should industrialisation become necessary, comprehensive and precipicacious risk and technology assessments be undertaken and thorough social economic and environmental cost-benefit analysis carried out before embarking on the venture. This means that economic activities should be injected in the hills to the extent that local ecosystem's carrying capacities can bear. We must be no more obvious to the stark reality that it is one thing to balance an empty suitcase upon one's head and quite another to balance that case when it is packed with books. On the whole, it can succinctly be summed up as such that the very relevance of hill industrialisation to the regional development would be to develop the region without destruction and soothing social tensions, if not so, at least to maintain them *in status quo*. Obviously, if better eco-development vis-a-vis industrialisation is a priority area, then it has to be recognized that a fresh start has to be made.

The author wishes to express my gratitude to Dr. S.P. Singh, Principal Investigator, Gaula Catchment Ecodevelopment Project, Kumaun University, Nainital and Shri A.D. Moddie and Prof. K.S. Valdiya respectively President and Secretary, C.H.E.A., Nainital who took keen interest at all stages and have been a source of great encouragement and supoort to complete this study.

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EXECUTIVE READINGS

Zero Quality Control : Source Inspection and the Poka-Yoke System
Shigeo Shingo

Published by :
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Reviewed by :
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This book is a great gift to the manufacturing industry from Mr. Shigeo Shingo, inventor of the SMED (Single Minute Exchange of Die) system and the *Poka Yoke* (Mistake Proofing) system and a key developer of the Tayota Production System. In this book the author has proved through illustrative practical examples that achieving Zero-defects is absolutely possible and to improve productivity, total quality approach is the easiest way. As one reads through the text of this brilliant book, the amazing simplicity in the application of the *Zero Quality Control* (Zero QC) system gets revealed. Mr. Shingo has invented and perfected the practical application of this system which totally eradicates the chances of defects occurring during manufacturing. To achieve this ideal production system of Zero QC, the first step is to establish *Source Inspection* which looks at errors before they become defects and either stops the system for correction or automatically adjusts the error condition to prevent it from becoming a defect. The second step is to establish the *Poka-Yoke* (in English 'Mistake Proofing' and pronounced as 'POH-Kah YOH-kay) system into the operation which looks at a defect, stops the production and gives immediate feed back so that the root cause of the error is totally eliminated. It includes setting up of devices which also signal and prevent defects from occurring.

Both these steps, lead to attainment of zero-error performance. Mr. Shingo, apart from quoting innumerable examples throughout the text has also systematically tabulated 112 cases with full details of the *Poka-Yoke* devices used.

The approaches have tremendous potential and applicability in our Indian industry especially from the point of view of his ideas being very simple and are also inexpensive. This explodes the myth that the cost of reducing defects in production increases exponentially while achieving zero-error level or the ideal situation. Out of the 112 practical cases cited in the book, 56 cases (fifty percent) involve an average expenditure of just $ 31.50; further astonishingly, 92% (103 Nos) of the cases covered, cost less than $ 1000.

In our country, some of the industries exhibit big hoardings at the entrance gates of the company that they have crossed a certain number of days 'ACCIDENT-FREE'. Through the approaches advocated by Mr. Shingo, it is

possible to place another hoarding adjacent to the safety-record indicating that the number of days/ weeks/years the company has achieved 'DEFECT-FREE'.

This book must be read by all the industrialists and especially by small entreprenuers who are likely to have an impression that any efforts towards Zero QC would mean very heavy investment and expenditure. The book would also inspire industrial engineers all over the country as Mr. Shingo has adopted the industrial engineering approach.

In the last chapter (8th) of the book Mr. Shingo brings out a systematic analysis of the distinctive character of Japanese Management compared with that of 'western' (USA/European). He points out that the peculiar nature of Japanese Management with respect to *work motivations* may be difficult for the other cultures to implement but the *work methods* characteristic of Japanese Management can be positively introduced universally.

The secret of Japanese success is basically centred on the concept of *Zero*. Hence the production systems are designed, developed and operated to achieve Zero-Quality Control through *Source Inspection* and *Poka-Yoke* system; Zero-Inventory with *just-in-time* approach and Zero-breakdowns through condition monitoring and condition based maintenance practices.

This 305-page book was originally published by Japan Management Association, Tokyo in 1985 in Japanese and the translated edition in Engligh in 1986. The book has since been translated into several European languages.

It should be possible for bringing out a cheaper and popular Indian edition to reach the millions who would be benefitted by this book.

Non-traditional Manufacturing Processes
By Gary F. Benedict

Published by
Marcel Dekker, INC.
270 Madison Avenue
New York 10016
Edition 1987
Price $ 79.75
PP 381

Reviewed by
KR Chari
Regional Director
National Productivity Council
Hyderabad

Have you got problems of machining specific materials ?

—Low Product Quality ?
—Severe Competition ?
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—Excessive Reworking ?
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Well, for all these and many more questions you may find answers in the book titled "Non-Traditional Manufacturing Processes", by Gary F. Benedict from Marcel Dekker, Inc.

If you are too late in picking up a few or all of these processes, well a few years later you may find these processes in the traditional manufacturing processes handbooks. Though we may be knowing many more such processes of material removal, forming and joining but might have discarded them as we thought they are impractical at commercial levels. It is the acumen, perseverence and determination of some, who have converted them into practical feasibilities and the fact that many companies are really using these processes is self-justifying.

Non-traditional manufacturing processes use high velocity material jets, pulsed magnetic fields, light beams, and electro-chemical reactions—just a few of the new tools currently applied for cutting, welding, deburring and forming.

Many manufacturers, however, are unaware of these methods and their benefits; even manufacturers familiar with them are often unaware of all these process options available or the most recent advances described in current literature.

'Non-traditional Manufacturing Processes' provides readers with the most up-to-date and comprehensive survey of the topics covering newer machining, forming and joining processes!

Emphasizing the expansion of manufacturing capabilities and

optimum cost-effectiveness by applying the latest teachnologies of non-traditional manufacturing processes, this practical reference organizes the methods by type of process—mechanical, chemical, electro-chemical and thermal, so that readers can grasp relationships among techniques...covers the principles, equipment, capabilities, operating parameters, and applications of each process...facilitates implementing specific programs by offering a handy appendix of non-traditional processes manufacturing companies and their addresses...and much more.

This is a MUST READING for Manufacturing engineers, process planners, and technologists; industrial, design, process development, mechanical, automotive, and aerospace engineers; materials scientists and metallurgists; executives and managers of manufacturing firms; under-graduate, technical school, and introductory graduate courses in manufacturing processes, planning, and production; and in-house and professional courses on manufacturing and industrial engineering.

The book will sure help the reader in opening up avenues for further development of newer processes in future.

Agricultural Change and Rural Poverty : Variations on a Theme

By Dharam Narain

Edited by
John W. Mellor and Gunvant M. Desai

Published for the International Food Policy Research Institute by Oxford University Press, Delhi, Jai Singh Road, New Delhi 110001.
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PP 233

Reviewed By :
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The poverty problem is complex, dynamic and pervasive in nature. The controversial causal relation of new technology in agriculture with the incidence of rural poverty has added a new dimension to the complexity of this problem. The poverty in one part of the world being a serious threat to the prosperity anywhere, it requires the active participation of even rich nations in the global poverty elimination programme.

The mitigation of poverty requires deep insight into its enormously complex causes. It is a formidable task to disentangle the relative influences of causal factors on incidence of poverty in the face of data constraints, econometric problems and conceptual issues relating to the definition of poverty. The book under review being a fine collection of 18 papers contributed by eminent economists discussed in a workshop in New Delhi during 11-14 April, 1982 is a commendable step in this direction.

Much of this book draws on central themes set out by the late Indian economist Dharam Narain. The inclusion of comments and counter-comments on these papers at appropriate places in the book further enhances the usefulness of this book. There are, however, some contradictions which need a mention here. While Srinivasan observed (Chap. 5) that "The 'recovery' error on the left hand side, in the unlikely event of its exactly equating the error on the right hand side for every observation, the bias owing to errors in the explanatory variable disappears", Ahluwalia contrarily maintained in Chapter 7 that due to correlation in error of left hand side with the error of explanatory variable on the right hand side, the two errors have a positive covariance and that this will produce an upward bias in the estimated coefficient on price. These arguments are not only contradictory but are also inconsistent with the econometric logic. It is generally agreed that the measurement errors, both in the dependent as well as in explanatory variable, result in underestimation of true slope parameter when the errors are independent of each other. Even the presence of correlation between the errors would tend to mitigate the negative bias in the estimate of true slope parameter. The true nature of net bias in the slope parameter estimate would be determined by the relative strength of negative and positive effects of the bias.

Some of the findings in the book may have only limited utility because of the misspecification of the mathematical relations. For instance, the incidence of poverty has been regressed against time as the only explanatory variable in equation 1.1 of Chapter 1 to prove

the hypothesis of no discernible trend between the mid 1950s and the early 1970s in the incidence of poverty in rural India. It is doubtful if the hypothesis has been confirmed correctly on the basis of non-significance of the coefficient of time. It may not be entirely attributable to the lack of trend in poverty but also to the exclusion of important variable, i.e., consumer price index for agricultural labourers. This argument, however, stands proved in equations 1:4 and 1:5. The foregoing criticism of the specification of the model is equally applicable to the equation on page 70 where agricultural net domestic product per head of the rural population in log terms is regressed against time.

The improved agricultural performance being endogenous in nature, its inclusion in the set of regressors without purging out its stochastic component is likely to give biased results. The use of simultaneous equation models would have been more appropriate in this situation. Mellor's (Chap. 4.) assumption that the agricultural production is a linear homogeneous function of land and labour may perhaps be implausible over the long time period where the change of technology is likely to cause shifts in production function which may not be captured by a single long time function. Such a single function is likely to be hybrid in nature and may misrepresent the results depending on the intensity of effect of technology.

Notwithstanding the lapses which demonstrate the complexities of the problem, the book provides interesting readings on a wide range of conceptual, empirical and policy issues related to the problem of rural poverty. The book is a valuable document for reference for the planners, policy makers and research scholars in the discipline of agricultural economics. The get up of the book is excellent indeed.

Fundamentals of Leasing and Lease Financing

By PK Ghosh & GS Gupta

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Leasing as a source of finance is gaining in importance during the last few years. There is a tremendous need for capital investment in machinery and equipment due to fast changing technology and need for modernisation. Due to high corporate taxes, industrial and business undertakings are finding it difficult to generate sufficient funds from internal resources. The rigorous norms imposed by the financial institutions, their time consuming nature and paucity of funds from internal resources are making leasing an attractive source for funds.

The book under review, brought out by two eminent scholars, in timely. There is a great need from the corporate world to know the basics and intricacies involved in leasing and their tax implications. "Fundamentals of leasing and lease Financing" serves this purpose eminently.

Though leasing is in its infancy in India, it is growing by leaps and bounds. From about 150 registered leasing companies in the country in 1984, they have grown to more than 300 since then. Public Financial Institution like. ICICI. IFCI and several nationalised and non-nationalised banks have also entered this fertile field. The International Finance Corpn. is promoting joint ventures in leasing in the country. Leasing business is estimated to meet at least 5% of the capital investment in the country.

Leasing is a mutually beneficial form of acquiring assets by the lessee as well as lessor. The lessee acquires the use of equipment and is saved from outright financing and the lessor retains legal right to the equipment during the lease period and gains the advantage of claiming tax benefits. It is this differentiation of the use of asset from its ownership that provides the basic impetus to modern equipment leasing. However, due to changing tax laws, legal status and tax benefits relating to finance lease cannot be predicted with certainty. The relevant tax laws have not yet been crystalised.

As in any investment decision,

the least cost alternatives are sorted out by the investors. The lease versus purchase alternative is the heart of the book which is dealt in some detail in appendix to chapter-II. Leasing is inherently much more flexible than a sale and provides a number of options to both the lessor and the lessee.

The success or otherwise of this nascent business depends on the analytical skills, organisational structure and managerial efficiency of the Leasing Companies. Evaluating risk foreseeing the tax benefits and structuring the lease are the vital areas, which are described in brief but deserves better treatment, perhaps in later editions. The accounting procedures not being standardised is still a ticklish issue. The accounting standards as proposed by international Standard Committee of UK and Financial Accounting Standards Board of USA were described in brief. For meaningful interpretation of financial statements of lessee companies, the lease commitments, i.e. lease payments under finance lease and non-cancellable operating leases with a term of more than one year should be disclosed in summary from giving the amounts and period in which the payments will become due. The capital structure of leasing companies should have been dealt more thoroughly.

To promote a healthy growth of leasing, the need for well structured legal framework and issue of suittable guidelines from the Reserve Bank of India were emphasised.

The doubts expressed, i.e. "the leasing has also been threatened by nationalised banks, promoting subsidiary companies for leasing purposes" may be unwarranted as it may add stature to the leasing business itself and in the long run only the fittest will survive.

The book on the whole is well documented and should be of great help to students as well as professionals.

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1987 XXVIII, 3, 325-331

A Select Bibliography on Robotics

MANJUNATHA K.

The first part of the Select Bibliography deals with the Robotics in general. The second part deals with the Robots, followed by the last part dealing with industrial robots.

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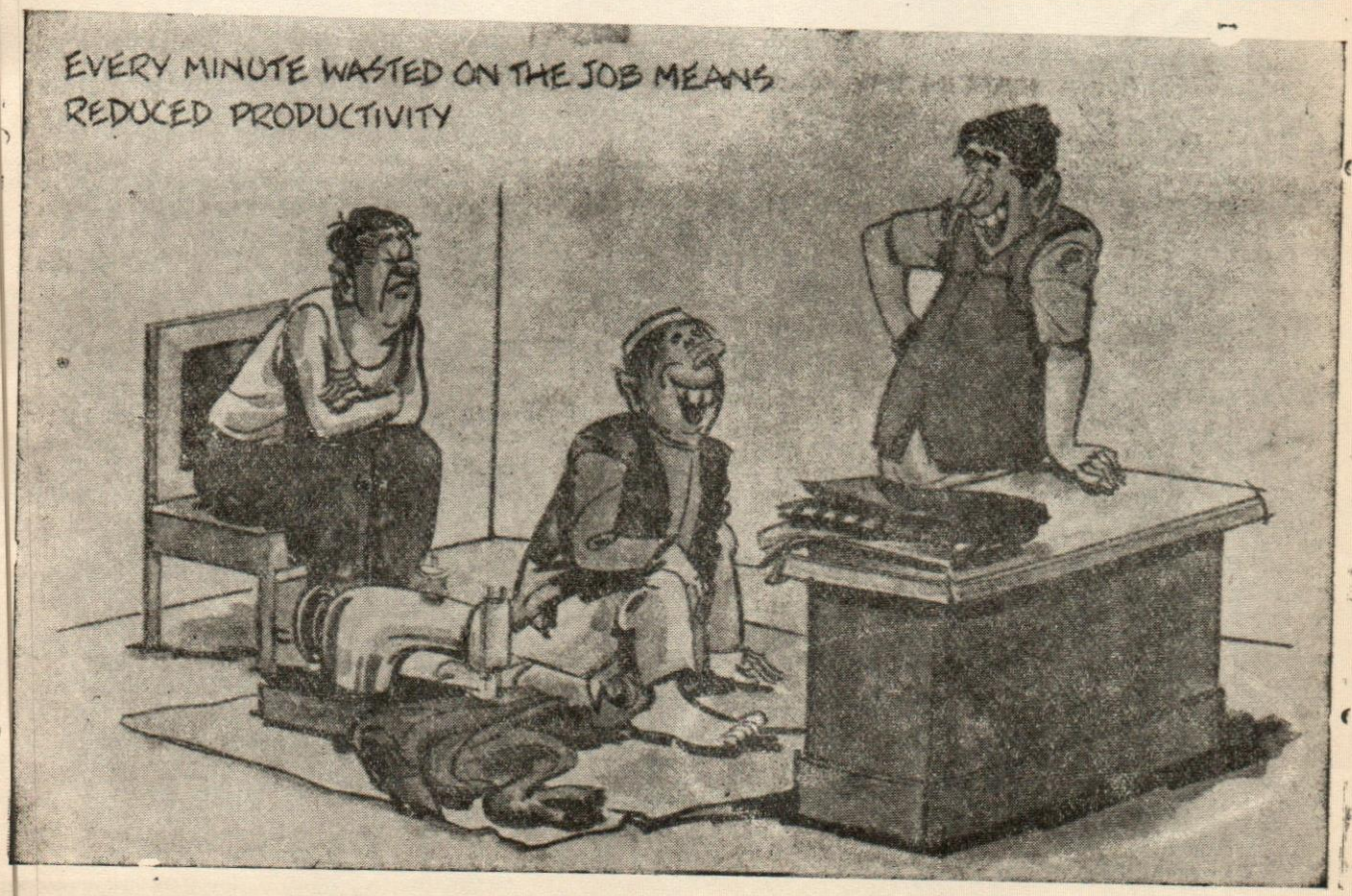

PRODUCTIVITY IS NOT

SOMEBODY ELSE'S RESPONSIBILITY

IT IS EVERYBODY'S CONCERN

LET US MAKE PRODUCTIVITY

A WAY OF LIFE