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Special Report

Subcontracting Practices by Indian Industries – A Survey

NPC Research Division

Inspired by the Japanese and Korean successes, subcontracting has been recommended for developing countries like India, as a mechanism for widespread industrialisation and employment generation. Considering the extent of subcontracting, stability of buyer-supplier relation and the nature of assistance rendered to the subcontractors, as revealed from the present study, subcontracting seems to be beneficial to both the parent as well as the subcontractor units in India. But on account of variety of reasons like policy factors, limited growth and diversification of Indian industries, limited thrust on productivity and product quality and lack of maturity of the small industries, subcontracting in India continues to be at a disorganized and underdeveloped stage.

Prepared by a team consisting of N.K. Nair, Director, A.K. Barman, Dy. Director and Iswar Pradhan, Assistant Director all from the Research Division of National Productivity Council, Lodi Road, New Delhi-110 003.

To survive and grow in globally integrated markets, Indian industries are increasingly adopting the best practices of the successful organizations especially from the industrially developed countries like Japan, South Korea, USA and Singapore. Modern managerial practices like Just-in-time (JIT), Flexible Manufacturing System (FMS), Total Quality Management (TQM), Quality Circles (QC), Kaizen, Benchmarking etc. are being increasingly resorted to in order to conform to international business standards and practices. Efforts at adapting such practices are changing the outlook of Indian industries with respect to the organisation of industrial production and marketing. Large producers are now concentrating on their 'core' activities, which usually include design, marketing and assembly, while subcontracting or sourcing externally an increasing range of inputs, components and services. Subcontracting which is widely practised in Japan is considered a major source of the competitiveness of Japanese industries when compared to their American and European counterparts (Ohnishi, 1992; Kam, 1991). Widespread development of subcontractors has also been identified as a major factor behind the successful growth of small scale industries in Japan. Recognising this, subcontracting has been encouraged at the governmental as well as industry levels in the developing countries in recent years. International agencies like UNIDO, UNCTAD, APO, OECD, ESCAP, the World Bank etc., have also been directly or indirectly involving themselves in fostering subcontracting linkages in these countries.

In India, similar attempts can be noticed from the Bureau of Public Enterprises (BPE) guidelines, the establishment of sub-contracting exchanges (16 in number in the major industrial centres) and the provision of various incentives/facilities to the subcontractors. But, subcontracting has not become so widespread in India as to be qualified a success. There are some who argue that the parent firms exploit the weak position of the small firms, that subcontracting was intended to act as a buffer from business fluctuations, that it helps to keep labour

movement under control, that it helps in deriving the benefits of low labour cost, or a combination of all these (Nagaraj, 1989; Bose, 1996; Nambiar, 1996). Efforts to create and foster a large number of ancillary units with their heavy dependency on the large units, especially from the public sector, during the late seventies and early eigthties, unfortunately, had a hangover effect on both the parent units and the subcontractors in later years; mutual distrust has prevented them from entering into healthy and interdependent relationships or strategic alliances, although such forms of business relations are highly successful elsewhere in the world (NPC Research Division, 1996).

Mutual distrust has prevented them from entering into healthy and interdependent relationships or strategic alliances, although such forms of business relations are highly successful elsewhere in the world.

Subcontracting in Japan

The protagonists of subcontracting, however, have a different view that subcontracting leads to a symbiotic co-existence of large and small industries in their respective areas of specialisation. The parent firm (buyer) derives advantages due to reduced costs, easy implementation of systems like flexible manufacturing system (FMS), and just-in-time (JIT), insulation from market fluctuations etc., whereas, the subcontracting firm (supplier) enjoys benefits like assured market, managerial and technological assistance etc. (NPC Research Division, 1995). For example, in 1988 there were 713 thousand firms in the Japanese manufacturing sector employing 13 million persons in comparison to a total of 371 thousand firms employing 24 million persons in the U.S. during the same year. In Japan, 58 per cent of the entire workforce was engaged in industries which employ less than 100 workers, whereas in the U.S., the percentage was only 20 (Minato, 1994). Such a high degree of small industry development in Japan has become possible because of heavy reliance on subcontracting by large firms and the correspondingly high percentage of small and medium industries that undertake subcontracting. In Japan, the percentage of small and medium industries undertaking subcontracting work increased from 59 in 1971 to 61 in 1976 and further to 66 in 1981 of the total manufacturing (table 1). Large firms often take good quality and timely delivery for granted, and constantly pressurize their regular subcontractors to lower costs and prices to maintain international competitiveness. Subcontractors are willing to

The long term business relationships in Japan, contrary to outside perception as being based exclusively on human connections and continuing patronage, thrive on strict economic rationale.

comply with these tough conditions because of the more of less guaranteed business and also the scope for upgrading to higher value-added activities. The long term business relationships in Japan, contrary to outside perception as being based exclusively on human connections and continuing patronage, thrive on strict economic rationale (Yu, 1993).

Table 1: Trends in Subcontracting among major industries in Japan

	Percentage of Small & Medium Industries undertake subcontracting work				
Industries	1996	1971	1976	1981	1987
Textile	70.8.	75.9	84.5	84.9	80.1
Apparel	73.6	71.4	83.9	86.5	79.3
Metal Products	66.3	71.7	74.8	78.6	71.1
General Machinery	70.7	75.8	82.7	84.2	75.0
Electric Machinery	81.4	78.9	82.3	85.3	80.5
Transport Machinery	67.1	77.9	86.2	87.7	81.2
Precision Machinery	72.4	70.7	72.4	80.9	71.1
Printing & Publishing	–	51.0	50.8	59.0	–
Iron & Steel	–	66.0	70.4	72.0	–
Non-ferrous metals	–	69.8	68.7	73.6	–
Total manufacturing	–	58.7	60.7	65.5	–

Source : Ohnishi (1992) & Kam (1991)

However, even in Japan, subcontracting is not always as rosy as it has been projected to be; there are many cases of large firms exercising their market power against their subcontractors (Sato, 1986), leading to the enactment of a Law on Prevention of Delay in Payment of Subcontracting Charges and Related Matters in 1956 and another Law on the Promotion of Subcontracting Small and Medium Enterprises in 1970 (Kam, 1991). Under the 1970 Law, the Subcontracting Enterprises Promotion Association was also created with part of its objective being to help settle complaints and disputes related to subcontracting practices. The appreciation of Yen and the higher competitiveness of suppliers from the neighbouring states, have also strained the long-standing subcontracting relationships in recent years in Japan (MITI-SME Agency, 1989).

Korean Example

In spite of such limitations, the success of the subcontracting system in developing small and medium industries along with large industries in Japan has become a lesson for others. Korea, for instance, has successfully emulated the Japanese practice of subcontracting in order to promote her local supporting industries. In the early years, major Korean industries like Samsung, Daewoo and Lucky-Goldstar, were producing almost everything in-house, from electronic components and electrical accessories to semiconductors and precision engineering parts (Amsden, 1989). Faster development of subcontracting activities in Korea has been observed particularly during 1980s. The proportion of firms that engage subcontractors has increased from 38 per cent in 1982 to 43 per cent in 1986 (table 2). Rate of subcontracting is the highest in the electrical/electronics industry (77 per cent). In order to promote subcontracting, Government of Korea had introduced a 5 year plan for localisation of machinery, components and materials during 1987-91. Under the plan, specific items were identified and designated for localisation and various financial assistance, technical guidance and industrial/technical information dissemination programmes were implemented to help subcontractors produce these items.

Table 2: Sub-contracting Percentage in Korea's Manfacturing Sector

Sector	1982	1986
Fabricated metal products	45.9	48.3
Machinery & Equipment	56.6	63.5
Electric machinery	61.0	76.8
Transport Equipment	51.2	73.8
Total Manufacturing	37.7	43.0

Source: Kam (1991)

Indian Scenario

Inspired by the Japanese and Korean successes, subcontracting has been recommended, for developing countries like India, as a mechanism for widespread industrialization and employment generation (UNIDO, 1974; APO, 1986). The experience of subcontracting as revealed by some large units in India shows mutually reinforcing gains to the participants (both the parent as well as the subcontractors). For example, Maruti Udyog owes, to a large extent, its fast growth in the passenger car manufacturing field to successfully phasing out its manufacturing operations to the subcontractors. Maruti practices the Japanese philosophy and subcontracts three fourth of its total components. It is transparent to vendors and suits the specific needs of the small entrepreneurs especially relating to the prompt clearance of their dues. It also facilitates transfer of technology by bringing together the Indian vendors with the Japanese counterpart (Suzuki) for pursuing the desired goals (Kulshreshta, 1994). Modi Xerox also has a similar experience, in its commitment to improve quality, cost and delivery (QCD) on a continuous basis. The company took a step ahead by promoting and executing Total Quality Management (TQM) by their suppliers, to create a supplier base which can meet international QCD standards and support the follow on products which the company would introduce in future (Venkatraman, 1994). Similar efforts at technology transfer, and ensuring timely and fair share to the subcontractors are revealed from the experiences of some other companies like, Eicher Tractors, Mahindra & Mahindra, Laxmi Machine Works and so on (NPC Research Division, 1994).

In this background, the present paper attempts to examine the nature and extent of subcontracting as practised by the Indian industries.

The Survey

The analysis, here, is based primarily upon the information collected through a structured questionnaire mailed to and received from large and medium scale industrial units in India. Information was sought from about 500 industrial units selected on a random basis. However, the total number of filled-in questionnaires received and found suitable for analysis, even after a round of reminder to all the non-respondent units, was only 40, out of which, the number of units engaged in the business of subcontracting is only 22 (55 per cent) (Appendix 1). Besides these, partial responses were also received from 14 non-subcontracting units. The comparatively poor response ratio to the questionnaire itself could be interpreted as an evidence to the lack of popularity of subcontracting, so far as the Indian industry is concerned. The survey is primarily focussed on the business behaviour of a cross-section of the actual or potential parent units only. The term subcontracting unit/non-subcontracting unit used for the purpose of the present study refers to the units which subcontract/do not subcontract any part of their operations, respectively.

Some of the general characteristics of the sample units (viz. size, net value addition of production and industry group) are outlined in tables 3–5. Contribution of the sample industries to the economy, judged in terms of net value addition to production, reveals higher performance of subcontracting units compared to their non-subcontracting counterparts (table 4). If the distribution of respondent units is of any indica-

Table 3: Distribution of respondent units according to their size in terms of value of plant & machinery.

Industry group	value of P & M in Rs. lakhs (as on 31st March 1995)					
	upto 500	500-1000	1001-2000	2001-3000	>3000	Total
Subcontracting						
Automobile	–	–	1	–	2	3
Industrial Machinery	1	–	–	–	2	3
Machine Tools	–	–	–	–	2	2
Internal Combustion Engines	1	1	–	–	–	2
Mining & Construction Equipments	1	–	1	–	–	2
Telecommunication Equipments	1	1	1	–	1	4
Electrical Machinery	1	1	–	–	1	3
Ship building & Reappearing	–	1	–	–	2	3
Sub total	**5(22.7)**	**4(18.2)**	**3(13.6)**	**–**	**10(45.5)**	**22(100)**
Non-subcontracting						
Electrical Machinery	1	1	–	–	–	2
Electronics Control Equipments	–	–	–	–	1	1
Paper	–	–	–	–	2	2
Chemical	1	–	–	1	5	7
Petroleum	–	–	–	1	1	2
Iron & Steel	–	–	–	–	1	1
Railway Wagon	–	–	1	–	–	1
Construction	–	–	–	–	1	1
Aircraft Maintenance/repair Services	–	1	–	–	–	1
Sub total	**2(11.1)**	**2(11.1)**	**1(5.6)**	**2(11.1)**	**11(61.1)**	**18(100)**
Total	**7(17.5)**	**6(15.0)**	**4.(10.0)**	**2(5.0)**	**21(52.5)**	**40(100)**

Note: Figure in brackets are percentages to total.

Table 4: Distribution of respondent units according to their net value addition as % to the value of production (1994-95)

Industry group	net value addition as percentages to the value of production					
	<20	20-40	40-60	60-80	>80	Total
Subcontracting						
Automobile	–	2	1	–	–	3
Industrial Machinery	–	–	1	–	2	3
Machine Tools	–	–	2	–	–	2
Internal Combustion Engines	–	–	2	–	–	2
Mining & Construction Equipment	–	1	–	–	1	2
Telecommunication Equipment	–	3	1	–	–	4
Electrical Machinery	1	–	2	–	–	3
Ship building & Repairing	–	–	1	2	–	3
Sub total	**1(4.5)**	**6(27.3)**	**10(45.5)**	**2(9.1)**	**3(13.6)**	**22(100)**
Non-subcontracting						
Electrical Machinery	–	2	–	–	–	2
Electronics Control Equipment	–	1	–	–	–	1
Paper	1	–	1	–	–	2
Chemical	–	3	4	–	–	7
Petroleum	1	–	–	–	–	1
Iron & Steel	–	–	1	–	–	1
Railway Wagon	–	–	–	–	1	1
Construction	–	–	–	–	1	1
Aircraft Maintenance/repair Services	–	–	–	1		1
Sub total	**2(11.8)**	**6(35.6)**	**6(35.5)**	**1(5.9)**	**2(11.8)**	**17(100)**
Total	**3(7.7)**	**12(30.8)**	**16(41.0)**	**3(7.7)**	**5(12.8)**	**39(100)**

Note: Figure in brackets are percentages to total.

Table 5: Distribution of respondent units according to industry group

Industry Group	No of Sub-contracting units		No of Non-sub contracting units		Total	
Automobile	3	(13.6)	–		3	(7.5)
Industrial Machinery	3	(13.6)	–		3	(7.5)
Machine Tools	2	(9.1)	–		2	(5.0)
Internal Combustion Engines	2	(9.1)	–		2	(5.0)
Mining & Construction Equipment	2	(9.1)	–		2	(5.0)
Telecommunication Equipment	4	(18.2)	–		4	(10.0)
Electrical Machinery	3	(13.6)	2	(11.1)	5	(12.5)
Ship building & Repairing	3	(13.6)	–		3	(7.5)
Electronics Control Equipment	–		1	(5.6)	1	(2.5)
Paper	–		2	(11.1)	2	(5.0)
Chemical	–		7	(38.9)	7	(17.5)
Petroleum	–		2	(11.1)	2	(5.0)
Iron & Steel	–		1	(5.6)	1	(2.5)
Railway Wagon	–		1	(5.6)	1	(2.5)
Construction	–		1	(5.6)	1	(2.5)
Aircraft Maintenance/repair Service			1	(5.6)	1	(2.5)
Total	*22*	*(100)*	*18*	*(100)*	*40*	*(100)*

Note: Figure in brackets are percentages to total.

tion, subcontracting seems to be prevalent mostly in the engineering sector of the Indian industries (table 5). On inquiring into the reasons for not subcontracting, it was found that 61 per cent of the non-subcontracting units have their own production facilities to meet the existing demand and another 33 per cent of the units do not have scope for subcontracting on account of vertically integrated production processes (table 6). Industries like paper, iron & steel, and chemicals are mostly vertically integrated, and hence, have no scope for subcontracting. However, non-availability of subcontractors has not been suggested by any non-subcontracting respondent company as a reason for not subcontracting.

However, non-availability of subcontractors has not been suggested by any non-subcontracting respondent company as a reason for not subcontracting.

Table 6: Distribution of non-subcontracting respondent units according to their reasons for not subcontracting

Industry group	Reasons for not subcontracting				
	Vertically integrated process (no scope)	Availability of own production facilities	Unacceptable standards of sub-contractors	sub-contractors not available	Total
Electrical Machinery	–	2	–	–	2
Electronics Control Equipment	–	1	–	–	1
Paper	2	–	–	–	
Chemical	3	4	–	–	7
Petroleum	–	2	–	–	2
Iron & Steel	1	–	–	–	1
Railway Wagon	–	1	–	–	1
Construction	–	–	1	–	1
Aircraft Maintenance/ repair Service	–	1	–	–	1
Total	6(33.3)	11(61.1)	1(5.6)	–	18(100)

Note: Figures in brackets are percentages to total.

Extent of Subcontracting

Subcontracting is feasible in industries, where the production involves discrete (divisible) processes and/or the final product is constituted by a number of parts and sub-assemblies. Depending upon the degree of divisibility of the production process, the level of technology required for each process and the scope to produce efficiently part of the production at small scale/subcontractor unit level, the extent of subcontracting would vary across industries. Extent of subcontracting, measured by the value of subcontracted products as percentage to the value of production, has been found to be the highest in mining & construction equipment industries (67 per cent), followed by automobile industries (52 per cent), ship building & repairing industries (17 per cent), internal combustion engines (15 per cent). machine tools (10 per cent) (table 7). The extent of subcontracting for all the sample units has averaged at 36 per cent of the value of production. However, in view of the fact that electrical machinery is a typical candidate in subcontracting, lower degree of the practice in this industry is paradoxical. Any conjucturisation, however, is difficult because of the extremely low number of total respondents, arising out of the mailed questionnaire approach.

Table 7: Distribution of respondent sub-contracting units according to the extent of subcontracting (value of subcont acting as % to the value of production) (1994-95)

Industry Group	Average Subcontracting Percentage	No of respondents
Automobile	52.01	3 (13.6)
Industrial Machinery	26.32	3 (13.6)
Machine Tools	10.25	2 (9.1)
Internal Combustion Engines	14.53	2 (9.1)
Mining & Construction Equipment	67.41	2 (9.1)
Telecommunication Equipment	3.18	4 (18.2)
Electrical Machinery	3.19	3 (13.6)
Ship building & Repairing	17.43	3 (13.6)
Total	36.14	22 (100)

Note: Figure in brackets are percentages to total.

The number of components subcontracted by firms (industry-wise) shows that 75 per cent of the units subcontract more than 2000 components each (table 8). All automobile units are found to be subcontracting more than 4000 components each. Half of the respondent units maintained more than 100 subcontractors each. Out of this, 24 per cent and 14 per cent of the respondent units have subcontractors in the ranges of 200-400 and more than 400, respectively (table 9).

75 per cent of the units subcontract more than 2000 components each.

Table 8: Distribution of respondent sub-contracting units according to the no, of components subcontracted

Industry group	Number of components			
	upto 2000	2001-4000	>4001	Total
Automobile	–	–	3	3
Industrial Machinery	–	1	2	3
Machine Tools	–	–	–	–
Internal Combustion Engines	–	–	–	–
Mining & Construction Equipment	–	1	–	1
Telecommunication Equipment	3	–	1	4
Electrical Machinery	–	1	–	1
Ship building & Repairing	–	–	–	–
Total	3(25.0)	3(25.0)	6(50.0)	12(100)

Note: Figure in brackets are percentages to total.

Reasons for Subcontracting

In order to identify major reasons for subcontracting the respondent units were asked to rank the following six reasons in order of importance:

* No or insufficient in-house facilities
* High level of technology possessed by subcontracting firm
* To meet the fluctuations in market demand
* To lower the cost of production
* Because of product reservation policy of the government
* Others

The responses (table 10) show that lack of in-house facilities and lowering the cost of production are the two major reasons for subcontracting, accounting for about two thirds of the respondent units. An industry-wise analysis of the responses reveal the following (table 11):

Table 9: Distribution of respondent sub-contracting units according to the number of subcontractors

Industry group	Number of subcontractors					
	upto 50	51-100	101-200	201-400	>400	Total
Automobile	–	–	1	–	2	3
Industrial Machinery	–	1	1	1	–	3
Machine Tools	1	–	1	–	–	2
Internal Combustion Engines	–	2	–	–	–	2
Mining & Construction Equipment	1	–	1	–	–	2
Telecommunica-tion Equipment	2	1	–	1	–	4
Electrical Machinery	1	–	1	–	1	3
Ship building & Repairing	2	–	–	–	–	2
Total	7(33.3)	4(19.0)	5(23.8)	2(9.5)	3(14.3)	21(100)

Note: Figure in brackets are percentages to total.

Table 10: Distribution of sub-contracting units according to the reasons for sub-contracting

Reasons	Preferences (Upto 4)			
	Ist	2nd	3rd	4th
No or insufficient in house facilities	9 (37.5)	3 (15.8)	6 (40.0)	–
High level of technology possessed by subcontracting fire	2 (8.3)	2 (10.5)	2 (13.3)	2 (33.3)
To meet the fluctuations in market demand	2 (8.3)	7 (36.8)	2 (13.3)	2 (33.3)
To lower cost of production	7 (29.2)	6 (31.6)	5 (33.3)	1 (16.7)
Because of product reservation policy of the government	2 (8.3)	1 (5.3)	–	1 (16.7)
Others	2 (8.3)	–	–	–
Total	24 (100)@	19 (100)	15 (100)	6 (100)

Note: Figure in brackets are percentages to total.

@ Includes first preference given to two reasons by two respondents.

Table 11: Industry-wise distribution of respondent subcontracting units according to the most important reason for subcontracting

Industry group	Reasons code						
	01	02	03	04	05	06	Total
Automobile	2	2	–	–	–	–	4
Industrial Machinery	1	–	1	1	–	–	3
Machine Tools	–	–	1	–	1	–	2
Internal Combustion Engines	–	–	–	2	–	–	2
Mining & Construction Equipments	–	–	–	2	–	–	2
Telecommunication Equipments	3	–	–	–	–	1	4
Electrical Machinery	1	–	–	1	–	1	3
Ship building & Reparing	2	–	–	1	1	–	4
Total	9(37.5)	2(8.3)	2(8.3)	7(29.2)	2(8.3)	2(8.3)	24(100)@

Note: * Reason Code:

01 = No or insufficient in house facilities
02 = High level of technology possessed by subcontracting firm
03 = To meet the fluctuations in market demand
04 = To lower cost of production
05 = Because of product reservation policy of the government
06 = Others

@ Includes first preference given to two reasons by two respondents (one from the automobile and the other from the ship building & repairing industries).

* Automobile industries subcontract mainly because of lack of in-house facilities and the high level of technology possessed by the subcontractors
* Except in the case of machine tool industries and ship building & repairing industries, product reservation is not a major reason for subcontracting
* Meeting fluctuations in market demand through subcontracting seems to be the most important reason in the case of industrial machinery and machine tool industries.

Method of Subcontractor Identification

All the respondent units relied on their own efforts for identification of subcontractors. Only 18 per cent of the sample units selected subcontractors with the help of the Subcontracting Exchanges promoted by the Government of India. Fourteen per cent of the respondent units encouraged their employees to undertake subcontracting work. This shows that the 16 Subcontracting Exchanges in the major industrial centres in India do not play any significant role in identifying the subcontractors.

All the respondent units relied on their own efforts for identification of subcontractors.

Nature of Buyer-Supplier Relation

Buyer-supplier relation is of crucial importance for the success of subcontracting; long term relationships can be established only when the interests of both the parties are met. Major issues in this respect broadly relate to the quantum of demand, price negotiations, maintainability of product quality and efficient delivery and payment of bills. How well the participants settle these issues among themselves is reflected in factors like the degree of sourcing, duration of business, component supplier ratio and the likes. The inquiry undertaken here focuses more on the resultant relations rather than on the underlying causes.

Duration of business relationships was reported by 21 respondent units (table 12). When the 50 contracts covering 5576 subcontractors, are classified according to their duration of business, 38 per cent are found to have been for more than 5 years. Another 18 per cent

Table 12: Distribution of contracts according to the duration to their business with the subcontractors

Duration	Percentage of subcontractors						No of subcontractors involved
	<20%	20-40%	40-60%	60-80%	> 80%	Total contracts	
Upto 1st year	9 (81.8)	1 (9.1)	–	1 (9.1)	–	11 (22.0)	343 (6.2)
2-3 Years	9 (81.8)	–	–	1 (9.1)	1 (9.1)	11 (22.0)	438 (7.7)
3-5 Years	6 (66.7)	3 (33.3)	– –	–	–	9 (18.0)	1232 (22.1)
5 Years	–	1 (5.3)	5 (26.3)	4 (21.1)	9 (47.4)	19 (38.0)	3563 (63.9)
Total	24 (48.0)	5 (10.0)	5 (10.0)	6 (12.0)	10 (20.0)	50 (100)	5576 (100)

Note: Figure in brackets are percentages to total.

Table 13: Distribution of contracts units according to the percentage of off-take from their subcontractors production

Percentage of offtake	Percentage of subcontractors						No. of subcontractors involved
	< 20 %	20-40%	40-60%	60-80%	> 80%	Total contracts	
100	5 (22.2)	1 (11.1)	–	1 (11.1)	2 (22.2)	9 (18.8)	713 (19.3)
75-100	7 (87.5)	–	1 (12.5)	–	–	8 (16.7)	542 (14.7)
50-75	3 (37.5)	3 (37.5)	2 (25.0)	–	–	8 (16.7)	1149 (31.1)
25-50	4 (33.3)	4 (33.3)	1 (8.3)	–	3 (25.0)	12 (25.0)	860 (23.3)
<25	6 (54.5)	1 (9.1)	1 (9.1)	1 (9.1)	2 (18.2)	11 (22.9)	431 (11.7)
Total	25 (52.1)	9 (18.7)	5 (10.4)	2 (4.1)	7 (14.6)	48 (100)	3695 (100)

Note: Figure in brackets are percentages to total

has been for durations between 3 and 5 years. In terms of the subcontractors covered under different class of contracts, 46 per cent of the subcontractors have buyer-supplier relation with a single parent unit for more than 5 years. Short-term relation in the ranges of up to 3 years and 3-5 years of business duration is noticed in the case of 14 per cent and 22 per cent of the subcontractors respectively. These could be considered as indicative of the fair degree of trust that exists between the parent units and their subcontractors in India. However, this could not be compared with those existing in Japan where 94 per cent of the subcontractors, reported in 1988, were having stable relations for more than 5 years with their parent company (Kam, 1991).

Percentage of cff-take from subcontractors production shows the degree of the subcontractors' dependence upon the parent company. The 17 respondent units for which data were reported covered 48 contracts and involved 3695 subcontractors. When classified according to the off-take by the respondent units as percentage of the subcontractors' production (table 13), the distribution did not show any clear pattern. Only about 19 per cent of the contracts covering an equal proportion of the total subcontractors involve cent per cent off-take of the total production of the subcontractors, implying that there has been no severe dependency of the subcontractors on a single parent unit.

There has been no severe dependency of the subcontractors on a single parent unit.

Large firms, the world over, are realising the benefits of a slimmer supplier base over a huge number of suppliers. Slimmer supplier base is beneficial on account of reduction in procurement and logistics, costs, concentration of economic leverages within a few suppliers, reduction in excessive inventory costs etc. which result from a large number of suppliers. Elsewhere in the world, rationalisation of suppliers has been carried out by an established supplier rating system. It is found from the present survey that, in India, about 68 per cent of the respondent units have such rating systems, although it is not known to what extent they are used to develop effective buyer-supplier relationships. Rating of the suppliers is based on factors like past performance and quality control systems adopted by the parent units. Supplier rating, if properly arrived at and used, could be highly beneficial to the participants of subcontracting. Based on the ratings, the parent company can group the suppliers into different grades to provide them differential treatment. Similar practice is observed in Maruti Udyog. Depending upon the criticality of the component with respect to the final product performance and the grades of the suppliers, Maruti accepts materials from some subcontractors at the entry-point itself and without testing, sends the same directly to the on-line production centre. Immediately after accepting the materials from the subcontractors, the purchase register is updated at the same time through an on-line computer network at the entry point. Payments to the suppliers are released within 7 days from the day of material delivery. Maruti assures efficiency and effectiveness of the practice by undertaking periodical review and quality audits of the supplier units. It insists on and also helps suppliers develop their quality system and acquire ISO 9000 certification. It is reported that more than 50 per cent of the suppliers to Maruti have been awarded the ISO 9000 certificate. This shows how supplier rating system can be used to reduce the cost of transaction, inventory, quality testing and other logistics by the parent unit. The subcontractors, besides achieving the confidence of the parent units, benefit from quick acceptance of the material, timely payment and other assistances.

Supplier rating system can be used to reduce the cost of transaction, inventory, quality testing and other logistics by the parent unit.

In a situation of long-term subcontracting with high trust on the subcontractors, a single supplier for a component is considered to be the ideal practice. However, considering the incidence of infrastructural bottlenecks, especially in communication, transport and finance, component-supplier ratio of 1:2 could be treated as the most cost-efficient and reliable practice. Component-supplier ratios of the respondent units show the prevalence of multiple sourcing as high as 4 and more subcontractors for a single component (table 14). Out of a total of 31 contracts revealed by 13 respondent units, the supplier-component ratio has been 1 in the case of 22.6 per cent cases, and 2 in the case of another 22.6 per cent. The remaining 55.8 per cent cases involved ratios of more than 2 of which 29 per cent involve 4 and more. This reflects the preference for multiple sourcing for components by the respondent units.

This reflects the preference for multiple sourcing for components by the respondent units.

Table 14: Distribution of contracts according to the components to supplier ratio.

Component-Supplier Ratio	Percentage of components					
	< 20 %	20-40%	40-60%	60-80%	> 80%	Total
1:1	3 (42.9)	1 (14.3)	1 (14.3)	2 (28.6)	–	7 (22.6)
1:2	2 (28.6)	4 (57.1)	–	–	1 (14.3)	7 (22.6)
1:3	4 (50.0)	2 (25.0)	–	–	2 (25.0)	8 (25.8)
1:4 & above	2 (22.2)	2 (22.2)	–	1 (11.1)	4 (44.4)	9 (29.0)
Total	11 (35.5)	9 (29.0)	1 (3.2)	3 (9.7)	7 (22.6)	31 (100)

Note: Figure in brackets are percentages to total.

Table 15: Distribution of respondent sub-contracting Units according to the type of assistance provided by them to the subcontractors.

Assistance type	Industry group code*								
	A	B	C	D	E	F	G	H	No. of units
Financial assistance									
– participation in equity	–	–	–	–	–	–	–	–	1 (4.5)
– Working capital loan	2	1	–	–	1	–	–	–	4 (18.2)
– guarantor of loans	–	–	–	–	–	–	–	–	– –
– guarantor for Bill discounting	3	1	1	1	1	–	–	–	7 (31.8)
– Partial payment in Advance	–	1	–	–	–	–	–	1	2 (9.1)
– Others	–	–	–	–	–	1	–	1	2 (9.1)
Supply of rawmaterials	3	3	2	2	2	3	3	2	20 (90.9)
Design & drawing	3	2	2	2	2	4	3	2	20 (90.9)
Training of personnel for Skill development	1	1	1	1	1	1	1	–	7 (31.8)
Deputation of executive to sub-contractor unit	2	2	1	2	1	2	2	–	12 (54.5)
Managerial skill development	1	–	2	1	–	–	–	–	4 (18.2)
Total Units	3	3	2	2	2	4	3	3	22 (100)

Note: Figures in brackets are percentages to total

*Industry group code:
A = Automobile
B = Industrial Machinery
C = Machine Tools
D = Internal Combustion Engines
E = Mining & Construction Equipments
F = Telecommunication Equipments
G = Electrical Machinery
H = Ship building Repairing

Assistance Provided

Subcontracting units, because of their limited knowledge with respect to techno-managerial skills and limited risk bearing capacity may require special assistance in many forms to produce and deliver quality output efficiently. Quality control, production methods of new products and process design and improvement are the three major technological services offered by parent companies for improving the performance of the subcontrators. Technology transfer can play an important role in improving the quality of parts and components, lowering the cost of production and meeting the delivery in time. Considering the low risk bearing and resource mobilising capacity of small subcontractors, financial assistance, whether direct or indirect, by the parent units is of great help to the development of subcontractors.

Types of assistance provided by the respondent units show that more than 90 per cent of them provide assistance in design and drawing and supply of raw materials (table 15). Other types of assistances provided by the sample units to a significant extent include, deputation of executives to subcontractor units (55 per cent), guarantor of bill discounting (32 per cent), working capital loan (18

Table 16: Distribution of respondent sub-contracting units according to subcontractors involvement in parent companies various activities

Industry group	Activities				
	Design & system development	product/process development	other technical managerial development	Other	Total respondents
Automobile	3	3	1	–	3
Industrial Machinery	3	3	1	2	3
Machine Tools	2	2	–	–	2
Internal Combustion Engines	1	2	–	–	2
Mining & Construction Equipments	1	2	–	–	2
Telecommunication Equipments	4	4	–	1	4
Electrical Machinery		2	–	–	3
Ship building Repairing	2	2	1	1	3
Total	16(72.7)	20(90.9)	3(13.6)	4(18.2)	22(100)

Note: Figures in brackets are percentages to total.

Table 17: Distribution of respondent subcontracting units according to average defect percentage of subcontracted components

Industry group	Average defect percentage				
	< 2	2-5	5-8	>8	Total
Automobile	1	1	1	–	3
Industrial Machinery	–	1	2	–	3
Machine Tools	–	1	–	1	2
Internal Combustion Engines	–	1	–	1	2
Mining & Construction Equipments	–	–	1	–	1
Telecommunication Equipments	2	–	–	1	3
Electrical Machinery	1	–	–	–	1
Ship building Repairing	–	–	–	–	–
Total	4(26.7)	4(26.7)	5(33.3)	2(13.3)	15(100)

Note: Figure in brackets are percentages to total.

Table 18: Distribution of respondent subcontracting units according to the average defective percentage of subcontracted components

Defective Percentage	Ist major Component	2nd major Component	3rd major Component	4th major Component	5th major Component	All Components
	2 (18.2)	4 (36.4)	2 (20.0)	1 (11.1)	1 (12.5)	4 (26.7)
2-5	5 (45.5)	4 (36.4)	7 (70.0)	5 (55.5)	5 (62.5)	4 (26.7)
5-8	2 (18.2)	3 (27.3)	1 (10.0)	1 (11.1)	1 (12.5)	5 (33.3)
8	2 (18.2)	–	–	2 (22.2)	1 (12.5)	2 (13.3)
Total	11 (100)	11 (100)	10 (100)	9 (100)	8 (100)	15 (100)

Note: Figure in brackets are percentages to total.

per cent) and managerial skill development (18 per cent). Assistance for equity and partial payment in advance are provided by 1 and 2 units respectively out of a total of 22 respondents. None of the respondents serves as a guarantor of loans to any of their subcontractors. Thus, there is a clear pattern of more non-financial assistance by the parent units to their subcontractors. This reveals the limited trust that prevails on the part of the parent units on their subcontractors.

For obvious reasons involvement of subcontractors in the activities of parent companies is found to

be high in design and development (73 per cent) and product and process development (91 per cent) (table 16). In the case of other areas, subcontractors involvement is limited only to a few cases.

This reveals the limited trust that prevails on the part of the parent units on their subcontractors.

Quality System

As a result of liberalisation and global integration, Indian industries are poised to perform in line with international standards and practices in price, quality and service to ensure their growth and survival in a competitive environment. Keeping in view the parent units requirements, subcontracting units necessarily have to comply with the quality management systems in order to exist side by side with the parent units. In order to assess the quality achievements of the subcontractors, the sample respondent units were asked to provide the defect percentages for the major 5 subcontracted components along with the average for all subcontracted components. It is found that at least 53 per cent of the respondent units encounters less than 5 per cent defective components (table 17). Defective percentages for the major 5 components are found to be lower than that of the all components (table 18).

An Appraisal

The results of the survey thus show that subcontracting is being practised systematically by most of the industries which responded to the survey. Considering the extent of subcontracting, stability of buyer-supplier relation and the nature of assistance, particularly of the techno-managerial type rendered to the subcontractors, subcontracting seems to be beneficial to both the parent as well as the subcontractor units. The question that obviously arises now is, why then has subcontracting not become a widespread and popular practice in India? As evident from the Second Census of Small Scale Industries in 1987-88, only 0.5 per cent of the total SSIs are ancillary units (a major subset of subcontractors) which contribute to less than 1 per cent of the total SSI production (DCSSI, 1992). A recent survey undertaken by National Productivity Council also shows that subcontracting is not widely practisced in India (NPC Research Division, 1996). This may be analysed in the light of the experiences of Japan and Korea on the one hand; and India's own experience on the other. Subcontracting in Japan and Korea evolved through 4 phases; floating relations, dominant-subordinate relations; co-operative relations and strategic relations (Minato, 1994). Under the first, small firms had poor resources and large firms had no desire to incorporate them into the production process. Outsourcing was resorted mainly to adjust to fluctuations in demand. Trust was negligible. During the second phase, small firms were incorporated into the large firm's system to meet huge demand expansions. Parent firms provided the resources to their subcontractors who, in turn, where heavily dependent on the resources of the parent firms, and subjected to their severe control. In the third phase, subcontractors had accumulated their resources and improved their skills. However, parent firms still retained power, resources and took the initiative in the interfirm system. It is only in the fourth phase that balanced bargaining power and mutual reliance emerged within the system. Different types of resources are now exchanged to achieve advanced joint tasks and also to realise higher rate of interfirm productivity. Subcontracting in India may be placed either in the first or second phase. Explanations to the limited subcontracting based on India's own experience may include, at the theoretical level, policy factors, limited growth and diversification of Indian industries, limited thrust on productivity and product quality because of protected market and lack of maturity of the small industries in terms of cost, quality and delivery.

Subcontracting seems to be beneficial to both the parent as well as the subcontractor units.

Subcontracting in India may be placed either in the first or second phase.

The debate on large versus small industries in still unresolved to a considerable extent in India. Complementary nature of the relationship between large and small industries has not yet been fully appreciated. The industrial policies formulated in India, therefore, have not clearly established strong and efficient linkages between large and small industries. Even without government policy interventions subcontracting would have been increasingly resorted to, had Indian industries been experiencing faster growth rates, as happened in Japan and the NIEs. The protected market in India has also insulated Indian industries against the pressure to reduce cost of production, improve product quality and

meet delivery in time. Under such circumstances subcontracting is resorted only to a limited extent in India.

The situation has, however, changed drastically especially after the opening of Indian economy to the rest of the world since mid-1991. Policies like entry of multinationals, liberalisation of imports, delicencing and decontrol of industries etc. mandate Indian industries to produce and deliver products efficiently. As a result of the increased competition attempts of Indian industries to introduce new products, add new features to the existing products, reduce unit cost of production, organise faster delivery and timely after sale service etc., have become more deliberate and well planned than they were before. This warrants flexibility in designing, assembling and production to add higher value to products in terms of price, quality and delivery. Sourcing more quantities of parts/components and processes from within the in-house production system requires high capital investment. It also leads to high inventory costs which in turn erode the profitability of the unit. Systematic development of subcontracting, in such a situation, facilitates sourcing of right parts/components at the right time and at lower cost.

Conclusion

Existence of subcontracting practices as a means to reduce unit cost of production for large indian (especially engineering sector) organization is clearly evident from the present survey. The extent of subcontracting in India has been significantly higher in industries like mining & construction equipment, automobiles ship building & repairing, internal combustion engines and machine tools, although it is not comparable to that in Japan and Korea. The benefits of subcontracting , however, prove to be substantial to the subcontractors, most of them the small scale sector. Lack of in-house facilities and lowering cost of production are the two major reasons for subcontracting. So far, the government sponsored Subcontracting Exchanges have had only a limited role in promoting the practice the country.

The nature of the buyer-supplier relationship that emerged from the survey is of a long-term nature and has been beneficial to both the parties, although of varying degrees across industries. Multiple sourcing to the extent of 4 and more suppliers for a single component by the parent units on the one hand and the evidence of the absence of heavy dependence of the subcontractors upon a single parent unit on the other, reveal that neither party is heavily dependent upon the other. The assistance provided by the parent units mostly involves only technomangerial and raw-material inputs. The limited involvement of the parent units in the finances of the subcontractors shows long-term buyer-supplier trust of the Japanese type is yet to develop in India.

Subcontracting, although observed to be beneficial to the participants in Japan, Korea and India has, however, been resorted to by the Indian industries only to a limited extent in the pre-reform (1991) period. The limited exposure of Indian industries to competition in terms of cost, quality and delivery of international standards could be treated as largely responsible for such a state of affairs. As the industrial scene in post-reform era is fast changing towards global competition, in the house market there appears an urgent need and also vast scope for widespread adoption of subcontracting as a technique to improve the performance of Indian organisations.

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Appendix 1

List of Respondents

Subcontracting Units

ABB ABL Limited, Durgapur
Alfa Lavel (India) Limited, Pune
Bajaj Auto Limited, Pune
Bharat Electronics, Bangalore
Bharat Electronics, Kotwara
Bharat Heavy Electricals Ltd., Ranipur-Hardwar
Bharti Telecom Limited, Ludhiana
Bharti Telecom Ltd., Gurgaon
Biecco Lawrie Limited, Calcutta
Cochin Shipyard Ltd., Cochin
Hooghly Dock & Port Engineers Limited, Calcutta
Ingersoll-Rand (India) Limited, Bangalore
Laxmi Machine Works, Coimbatore
Mahindra & Mahindra Ltd., Mumbai
Mazagon Dock Limited, Mumbai
Power Build Limited, Vallabh Vidyanagar, Gujrat
Praga Tools Ltd., Secunderabad
The Premier Automobiles Ltd., Pune
Tungabhardra Steel Products Limited, Tungabhadra Dam
WIDIA India Limited, Bangalore,
Worthington Pump India Ltd., Calcutta
Yuken India Limited, Bangalore

Non-subcontracting Units

Bharat Radiators Ltd., Mumbai
Bharat Wagon & Engineering Company Ltd., Patna
Bongaigaon Refinery & Petrochemicals Ltd., Dhaligaon, Assam
Cormandel, Fertilisers Ltd., Secunderabad
Cyanamid India Limited, Mumbai
Electra (India) Limited, Meerut
Gammon India Limited, Mumbai
Hindustan Aeronautics Limited, Overhaul Divisun, Bangalore
Hindustan Newsprint Limited, Kottayam Distt.
Hindustan Paper Corporation Limited, Calcutta
Hindustan Photo Films Mfg. Co. Ltd., Ootacamund (TN)
Indian Oil Blending Limited, Mumbai
ITI Limited, Palakkad
National Fertilizers Limited, Vijaipur Unit. Guna
Orissa Durgs & Chemicals Limited, Bhubaneswar
SAIL Bokaro Steel Plant, Bokaro city
The Fertilisers & Chemicals Travancore Limited, Cochin
Uaranium Corporation of India Ltd., Singhbhum □

Education at the Close of the Twentieth Century

Bikas C. Sanyal

Globalization of societies has led to the emphasis on the ideas and respect for human rights and dignity, non-violence, peace, environment protection etc., in the content of education. On the other hand, the education system has to co-operate with the industries to generate new technology to respond to the changes in the scientific and technological domain. This paper looks at the possible implications of globalization and structural adjustment programmes on education system and the various strategies open to the countries in tackling these issues.

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Objectives of Education

In ancient India, the purpose of education in Taxila and Nalanda was to impart spiritual and mental skills to the students. Later, the Al-Azhar University of Egypt and the Universities of Fès and Rabat of Morocco had the same basic purpose, i.e., protection and preservation of Islamic culture and civilization were given a more pronounced place than instruction for material well-being.

It is said that it was prohibited in the past to use the diploma of the University of Al-Azhar for any gainful profession. One may observe a similar situation in the Medieval Universities of Europe. Except for the University of Salerno, Italy, where medical science was being taught as early as the ninth century, all the other universities of Bologna, Paris, Oxford, etc., were emphasizing spiritual and moral studies. In a keynote address, Charles Carter referred to the extent of indifference of the universities towards material well-being by saying that: "It is only two centuries since doctors were trained by apprenticeship (in the United Kingdom) and Adam Smith was protesting at the folly of transferring their training to universities" (Carter, 1975). But as time passed, the objectives of education and its role in society were extended and modified to suit the particular societal context. The end of the eighteenth century saw the rise of polytechnics in Europe to serve socio-economic needs for skills. Elsewhere, two events marked a similar change in higher education during the nineteenth century, i.e., the Land Grant College (Morrill) Act of 1862 in the USA promoted the establishment of institutions of education for useful and mechanical arts and the Meiji Restoration in Japan promoted considerations of public utility and efficiency in its institutions of education.

Objectives and functions are now changing rapidly, since it is perceived that the best way education can serve society is to prepare people capable of tackling the

emerging problems that beset them. These problems are moral and ethical on the one hand and materialistic on the other, related to the basic necessities of life, namely food and nutrition, health and sanitation, housing and shelter. These basic needs can only be satisfied through economic activity, and the education system is required to provide the necessary skills in order that these basic needs may be supplied. In a static, subsistence economy, education may only need to bother about mind and character; in an information, industrial and commercial economy, it has to cater for 'matter' as well. Jacques Delors, the former President of the European Commission and French Minister of Economy and Finance, wrote in his report to UNESCO, as the Chairman of the UNESCO International Commission on Education for the Twenty-first Century: "Under the pressure of technological progress and modernization, the demand for education for economic purposes has been constantly on the rise in most countries." (Delors,1996). Clearly, education today cannot justify its existence by providing only academic learning for mental or spiritual development; it has to convey the necessary skills for economic development in addition to cultural and social development, in order that natural resources might be explored and exploited, products stored and distributed, services managed, and resources conserved for future generations. Such skills would not only enable solutions to be found to present problems but also prepare young people to work on the unpredictable, complex and dynamic problems of the future. However, the relationship between education and development has not been that simple. Researchers have different points of view:

Education today cannot justify its existence by providing only academic learning for mental or spiritual development; it has to convey the necessary skills for economic development in addition to cultural and social development.

One view is that education provides people with the skills to develop and manage the economy and related services, and therefore investment in education is an investment in human capital, that is, in the productive capacity of the people. This is known as the 'human capital theory'.

Another concept is that education not only provides skills for performing vocational tasks but also promotes social values by encouraging upward mobility in the society, and thus acts as a screening device to select the ablest people for the best social roles or jobs.

A third view is that productivity is an attribute of jobs, not of people; people are matched to jobs by criteria which may be associated with education, but education is not a determinant of productivity. This approach has been called the 'labour market segmentation theory'.

There is also a fourth view, related to the third, according to which the idea of correspondence between education and social role is an illusion existing only in the minds of graduates and has little to do with their performance in active life. The usual practice of recruiting the educated for certain jobs on the basis of their educational qualifications leads new job-seekers to believe that they are entitled to such jobs.

These four points of view on education and productivity may be divided as follows:

The first two accept the idea of education's contribution to the social and economic development of people, whereas the second two raise doubts about the role of education in this development (Sanyal, 1987). It is obvious that the first two points of view dominated the development of education until the eighties.

In the nineties, remarkable changes have taken place in many areas affecting educational planning and management directly and indirectly. Changes have taken place in the ideological and political domains, in the societal domain, in the economic domain and scientific and technological domains. These changes have constituted the agenda of the world conferences and international summit meetings in places such as Jomtien (on education in 1990), in Rio de Janeiro (on environment, in 1992), in Cairo (on population, in 1994), in Copenhagen (on sustainable development in 1995), and most recently, in Istanbul (in June 1996) on human settlements. These changes are redefining the role of education in society and the process of planning and managing it.

Role of Education

After the Second World War and until very recently, the world was broadly divided into two ideological philosophies, one following the capitalist system and the other socialist.

Recently we have observed the rejection of the communist ideology in the former Soviet Union and Eastern European Countries. But this was the ideology which shaped the events of the twentieth century more than any other. With the ending of the Cold War, perhaps large sums of money will be saved from military expenditure

and directed towards the social sectors. The countries now may concentrate on the welfare of the human race, including the provision of education to all – one of the priority items on the agenda of international agencies. But to dismiss communism as an anti-democratic and repressive ideology will be a mistake. One cannot ignore the progress the human race made under certain communist regimes. Russia is free of serfdom and agricultural slavery – most of its people are literate, having access to free basic education. China can boast of its culture of equality, food self-sufficiency and a high rate of literacy (82 per cent as against India's 52 per cent in 1995). Most of the countries following this ideology had given priority to health care and education of their people – the two most important elements of human resources which the employers of a capitalist system are under no obligation to provide for. Communism, in theory, was a response to a passionate desire for justice which is needed now more than ever. As one journalist observed: 'As societies get richer, the contradictions of development become more acute. And at that point people start searching for something more.' (The Nation, 1991). Just as communism did not meet the economic needs or political aspirations of the people where it had its practical origin, so capitalism does not meet the spiritual needs or provide the basis for a sustainable culture. Education then bears the responsibility for providing that 'something more' – the 'spirituality' which will emphasize peace and tolerance, equality among different social segments and justice. As market mechanisms take over in the mode of government, there is an urgency for a critical analysis of the relationship between money, power and alienation.

The ideological and political changes on the one hand and the development of communication technology on the other have resulted in remarkable changes in the societal domain.

Changes in the Societal Domain

The World has become a global village today with the development of communication technology. No country can remain isolated with its own systems of values, culture, tradition and social norms today. They cannot sacrifice and abandon their own cultural identities either. The education system of a country cannot ignore this trend. The educational programmes of a country can no more be defined in terms of the needs and aspirations of the country alone. Globalization of societies has called for an education system which has to reconcile the international system of values such as universal moral and ethical considerations of tolerance, solidarity and human rights with the local and national value system. Education has to avoid being dominated by one powerful culture, e.g., that of the market oriented society. It has to take into account the diversity of cultures (Hallak, 1996). This requires changing the traditional missions of the education system and enlarging them to include social insertion, preparation for work and for "good citizenship". Changes in the societal domain have led to economic changes.

Globalization of societies has called for an education system which has to reconcile the international system of values such as universal moral and ethical considerations of tolerance, solidarity and human rights with the local and national value system.

Economic Changes: Consequences

The eighties have seen economic situations fall to their nadir in most developing countries. Average annual growth rate of GNP per capita during 1980-1994 decreased in twenty-three of the forty-four reporting countries belonging to low-income economies and in twenty-two of fifty-one countries of the middle-income economies (table 1).

Table 1: Number of countries where GNP per capita decreased in real terms during 1980-1994

Country group	Number	Total	%
Low-income economies	23	44	52
Middle-income economies	22	51	43
High-income	2	24	8
Total	47	119	

Source: World Development Report 1996, World Bank, Washington D.C., 1996

One can observe that the poor countries became poorer during this period. Sub-Saharan Africa and Latin America have seen their worst economic situations in relative terms in recent years. In declining economies, debt servicing took away a higher share of export earnings. In 1980 there were only ten countries whose share of debt service exceeded 30 per cent of earnings from exports of goods and services as against 19 in 1994 (World Bank 1996). In 1994, the percentage soared in the following countries: Algeria, 56 per cent; Hungary, 53 per cent; and Congo, 51 per cent. The share for India increased from 10 per cent in 1980 to 26.9 per cent in 1994.

Without resources to cover foreign exchange requirements, many developing countries turned to the

International Monetary Fund (IMF) for assistance. The number of countries needing such relief in 1979 was only ten; by 1988, the number had increased to 55. Today some 30 African Countries and more than two-thirds of all developing countries have taken loans from the IMF for foreign exchange requirements. According to Michel Camdessus, the former Managing Director of IMF, this was the result of a 'silent revolution' in economic thinking and policy-making of most developing countries, where, as a result of ideological changes, restrictive insular regimes are giving way to more liberal market-oriented, outward-looking economies (Sengupta, 1991). IMF loans are conditional in that the countries have to accept adjustment policy reforms to correct financial imbalances to lay the foundations for renewed growth. These reforms include the following: the abolition or liberalization of foreign exchange and import controls; devaluation; domestic 'anti-inflationary' programmes, including: control of bank credit; control of the government deficit; curbs on spending; increases in (indirect) taxes and in prices charged by public enterprises; the abolition of consumer subsidies; the control of wage increases so far as it is within the government's power; and dismantling of price controls; and greater hospitality to foreign investment. The most direct reflection of these measures was reduction in government expenditure. Other effects are: reduction in the role of the State; reduction in social security; and reduced availability of hard currency.

However, many adjustment programmes have affected adversely the provision of basic social services such as education, health and nutrition. The international community has followed these developments with anxiety.

Impact of Adjustment Programmes

Negative effects

In the absence of concrete comparative data it is difficult to obtain a precise measure of the contribution of the structural adjustment programmes to the overall deterioration of the education sector. One cannot be sure whether 'without some form of adjustment, the situation might have been worse' (UNICEF,1987). We shall first examine the evolution of public expenditure on education as a result of control of government spending, and give, wherever possible, some concrete evidence of the impact of the adjustment programmes. It can be observed from table 2 that there has been a sharp decline in public expenditure on education in developing countries. In current United States dollars, Southern Asia, spending least, has also reduced per capita public expenditure on education. Reduction in public expenditure led to a decline in access to education, both in Sub-Saharan Africa and Latin America for which empirical evidence is available (Reimers, 1991; Tilak, 1990). However, the countries in Asia have been able to keep the decline in access under control.

Table 2: Per capita public expenditure on education[1] (current United States dollars) and average annual rate of inflation[2] (per cent, range for the period)

Country group	1980	1993	Inflation % (range)
Developed	500	1089	2.5–5.0
Developing	32	43	30.0–65.0
Southern Asia	13	12	5–13

(1) *Source: UNESCO: UNESCO Statistical Year-book, UNESCO, Paris, 1995, Table 2.11.*

(2) International Monetary Fund: World Economic Outlook, October, 1994, Washington D.C., various tables.

The adjustment programmes, at their initial stage, up to the mid-eighties, called for across-the-board reductions in government expenditure. The pattern of allocation within education followed the path of least resistance (Lewin,1987). So the lower the educational level, the less was the allocation.

The decline in expenditures also led to deterioration in quality of education, since it affected capital expenditure more than recurrent expenditure. Books, equipment and infrastructure development and maintenance had a very low share of the public allocation. Teachers' salaries which accounted for nearly the entire recurrent expenditure were also reduced in real terms because of salary freeze and the inflationary effect of some of the adjustment programmes, reducing their motivation and thereby their effectiveness in the classrooms. This contributed further to the deterioration of educational quality.

Imbalanced allocation was worsened by the tendency of bilateral educational aid towards prestigious and 'visible' targets such as research institutes, universities, etc., without permanent recurrent support. The diversion of the already diminished domestic recurrent budget allocation for maintenance of basic education facilities towards the maintenance of these bilateral 'elite' institutions serving the privileged few, makes the situation worse. According to one World Bank study, external funding for education in Africa subsidized 50 per cent of the capital and recurrent costs of technical/vocational and higher education – but only two per cent of primary and four per cent of the costs of general secondary and teacher education (UNESCO, 1988). Empirical analysis also demonstrated that the adjustment programmes, because of the disengagement of the State, made

universalization of primary education more difficult and contributed to inequities in the distribution of education by keeping the children of poor families out of school (Reimers, 1991).

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Empirical evidence does not show any significant decrease in the role of the State in educational development, the private sector still playing a minor role. Due to the decline in real wage and household income as a result of the adjustment programme, community participation has decreased in basic education. However, deterioration in quality of public education has led to some increase in private education for the richer sections of the society, but this is small in comparison with the total educational efforts in a country.

The reduced availability of foreign exchange for education, as a result of the adjustment programme, has led to higher levels of education experiencing additional difficulties in getting the foreign equipment necessary for their programmes, spare parts for maintaining the existing workshops and laboratories, and also in maintaining necessary interaction among academic counterparts through conference attendance, study tours, etc. UNESCO statistics also demonstrate a reduction in the number of students studying abroad in most of the countries adopting structural adjustment.

The positive effects

On the positive side, in recent years incorporation of the safety net for social sectors and particularly the implementation of the Jomtien Charter (WCEFA, 1990) has been correcting some of the negative effects of these programmes in education. This is clear in the recent reports of the President of the Word Bank on World Development. Emphasis on the market alone has been toned down in these reports which recommend 'a market-friendly approach to development in which governments allow markets to function well,and in which governments concentrate their interventions on areas in which markets prove inadequate'. It is understood that 'Markets alone generally do not ensure that people, especially the poorest, receive adequate education, health care, nutrition and access to family planning'. So safety nets are being designed to protect the basic consumption goods essential for human resource development—education being one of them. After Jomtien, the World Bank announced its decision to increase the funds available for 'education for all' programmes annually by US$ 1.300 million (Mayor, 1991). The role of the State in education, especially basic education, has to remain important. In the modified adjustment programmes, negative effects on education are expected to be reduced in the near future.

Other positive effects of the programmes are as follows:

- The adjustment programmes oblige the countries to become more performance oriented by improving their managerial capacity. Educational institutions are being increasingly equipped with tools to achieve more with the same or even less. A management culture is being instilled among citizens—a culture which identifies wastage and attempts to reduce it in all aspects of life, starting with the institutions themselves.
- To a certain extent, under the protection of the safety net, educational programmes are achieving greater equity. Those who can pay are now being urged to pay, be they the students in respect of their tuition, boarding and pocket expenses, or the staff in respect of their car and housing expenses; and finally,
- A rational incentive structure is being developed to help citizens is general and students and staff of the education system in particular, to be achievement motivated which may result in increased productivity in the future, helping the programmes achieve their laid-down objectives.

One could observe some of these positive effects in South Asia. The above changes due to structural adjustment have also led to a significantly new phenomen in the globalization of the economies; placing less importance on where natural resources are located and more on human resources; less importance on basic knowledge-still needed—but more on behavioural and attitudinal skills; less importance on existing divisions of labour among countries and more on ability to compete and take larger shares in the world economic activity; finally less importance on traditional segmentation of economic activities, primary, secondary and tertiary and more on the growing integration

of the processes of production, distribution and even consumption (Hallak, 1996). The task of the educational planner will, perhaps, continue to emphasize the need for basic skills development but the priorities attached to different skills will significantly change the content, method and structure of the educational delivery systems having implications for educational planning.

Scientific & Technological Changes: Consequences

Recent scientific and technological innovations are changing our consumption pattern and life style radically. Our society as a whole is passing through an adjustment process. Education has an important role in this process (Sanyal, 1990): Although the progress of biotechnology is reducing the problem of food shortages and improving health facilities, in some areas it is creating environmental and ethical problems. Progress in material science is not only leading to automation and restructuring of employment patterns, work style and types of jobs through the use of 'micro-chips' and 'fibre optics' but is also believed to be capable of bringing about economies in consumption of energy and reduction of environmental hazards, the two principal areas of concern of present-day technological development.

Advancement in information technology is making the world a smaller place through the use of satellites.

This development has affected the employment structure of the workforce as has the economic adjustment programme through the abolition of the guaranteed employment scheme in some countries (especially in Eastern and Central Europe and some developing countries). Technological development has made goods and services more education intensive in terms of production inputs. It is estimated that the manufacturing costs of semiconductor chips are about 70 per cent knowledge (i.e., research development and testing) and only 12 per cent labour. In some pharmaceutical products, labour costs account for only 15 per cent and knowledge costs 50 per cent (Drucker, 1986). Another study reveals that 15 per cent of overall productivity growth in American and Japanese industry comes from changes in the use of labour, 25 per cent from capital investment, but no less than 60 per cent, from technological change (Dennison, 1988).

The changes in technology have had an impact on the relative productivity of different types of labour. Some applications of technology require better educated workers, particularly where technology is embodied in forms of capital that complement education. But technology can also be used as a substitute for education. Computers have reduced the educational requirements of analysts by carrying out the measurement, manipulation and analysis tasks previously done by human beings. Technological development has led to more worker participation in decision- making in order to increase productivity by releasing workers from repetitive routine work (which is done by computers) for such tasks as deciding on product quality, production-scheduling and assessing production needs—tasks which need numeracy, literacy, reasoning, communication and problem-solving skills calling for ever higher levels of education among workers. It has been argued, especially in the USA employment forecasts, that the economy will need higher levels of skills as time passes but only in certain areas. Employment shifts apparently have raised the aggregate skill requirement of jobs while forces like technological development leading to automation may have helped lower skill requirements at least for some jobs. This leads to the conclusion that technological development is not likely to change significantly the average level of skills required in the employment market of the industrialized countries in the near future. However, new technologies and new forms of organisation will require new types of skills.

Technological development therefore has an influence on the planning of education, through its impact on the employment and qualification structure of the work force. The impact of technological development on employment is positive when the rate of increase in the level of output exceeds that of productivity. However, the quantity of labour needed for a given amount of output decreases at successive steps of technological progress resulting in loss in employment. A general decline in employment is accompanied by some increase in the highly skilled manpower demand in other areas, especially in industries like micro-electronics (Carnoy, 1987). The overall loss in employment in a particular industry is often offset by a time lag with additional employment in the generation of new products and production of the new technology in those countries which are involved in both production and use of the new technology. In developing countries, dependent on imported technology, the displaced labour cannot be used in this way. Unless they develop local technological capability they will continue

Technological development is not likely to change significantly the average level of skills required in the employment market of the industrialized countries.

to export employment through import of technology (Varghese, 1988).

This displaced labour added to those displaced by the abolition of the guaranteed employment scheme (prevailing in some countries before the adoption of the economic adjustment programme) has accentuated the problem of unemployment of graduates. Another impact of technological development on employment is the polarization within the labour force—highly educated labour being employed in research and development, generation and application of new technology and their relative absence from production lines where mostly unskilled and low skilled people are employed (Carnoy, 1987). Concentration of skill level shifts from middle supervisory skills to increasingly high and low range skills (Varghese, 1988). This, therefore leads to skill enrichment for a few and deskilling for many. This affects the employment prospects of new entrants and of the employed because of rapid obsolescence of their skills, and calls for emphasis on studying the impact of scientific and technological development on educational systems in its structure, content and method as well as for provision of retraining facilities of the employed.

In respect of the delivery system, countries are adopting new technology in education; from closed circuit television to satellites in different types of distance learning systems. Education can now be made available on a mass scale at cheap cost.

Structurally, more institutions of education, especially at the technical and vocational secondary level and at third level are co-operating with industry and business not only to improve upon the relevance of education for the market but also to increase the employability of the graduates, especially in the face of the abolition of guaranteed employment schemes and the rapid obsolescence of skills due to rapid technological changes. One striking feature of this development is a change in the concept of education: the distinction between information and knowledge is now diminished by the growing role of the informal and non formal education systems using new technology and fast communication of information.

Implications for Educational Management

In response to political and ideological changes

Now that the Cold War is over, there should be an all-out effort among the international, national and local agencies to divert a part of the savings from the military expenditure towards education—the basic instrument of human resource development. The countries undergoing ideological and political changes from 'socialism' to 'capitalism' are required to revise the content of their education, emphasizing a market approach. Disciplines seriously affected will be law, economics, political science, philosophy, sociology and history. New courses are to be prepared on management, privatization, banking, commerce and accountancy. All the countries of the world have to give special emphasis to studies related to peace, democratic values, national integration, tolerance, non-violence, moral, ethical and spiritual considerations. UNESCO has designed training materials on some of these topics which can be used by the countries as guidelines.

Governments have to be vigilant as regards the distributive aspects of education. Deprived groups should be identified for affirmative action. Rigorous vigilance will be needed against crime and corruption in a period of transition to market economy.

Countries which are changing their political systems also have to change their system of government from 'democratic centralism' to a viable and efficient democratic system. Political and management scientists have to design viable alternatives given the specific country context. The education system will have to assume its proper share of responsibility in that venture.

Implications for societal changes

The globalization of societies has led to the emphasis on the ideas of respect for human rights and dignity, rejection of violence, culture of peace, human solidarity, protection of the environment and tolerance in the content of education. The diversity of knowledge and culture, tradition and customs need education to be multidisciplinary and multi-linguistic. Education has to provide for understanding of the history of other countries and minority groups within the countries. The individual becomes the centre of learning. The education system has to incorporate these aspects in formulating the curriculum.

The globalization of the society calls for new methods of instruction. The report of the UNESCO International Commission on Education for the Twenty-first Century, suggested that any educational vision for the Twenty First Century should have as foundations four pillars: learning to know, learning to do, learning to live together and learning to be. These requirements call for new methods of instruction. Emphasis will have to be placed more on the quality of human relations inside the school to encourage students to participate in the definition and articulation of the concept of a society in the context of a global economy. Teaching/learning strategies should be proactive making use of incentives allowing for multiplicity

of concepts and conflicting views and adopting problem solving techniques. The teachers' role will change from the educator to the facilitator. They have to teach learners how to select information, process and synthesize it and how to find one's way in conflicting and contradictory situations. They have to facilitate the students taking advantage of easy access to the infinite stock of information and knowledge to promote their vision of the world and role in the society. When the environment changes so fast the teachers are required to help students find their roots, build references and gain strength to adapt themselves to an increasingly complex world in continuous evolution.

Any educational vision for the twenty first century should have as foundations four pillars: learning to know, learning to do, learning to live together and learning to be.

The globalization of the society has played an important role in the internationalization of education. The mobility among students and teachers, uniformity and standardization of teaching materials and equipment are becoming increasingly important for planners. The technological development leading to the diversified delivery systems is also requiring diversified educational structure. Traditional and non-traditional delivery systems are occurring simultaneously in educational institutions and the formal and non-formal systems complementing each other more today.

Implications of economic adjustment programmes

To reduce the problems inflicted on the developing countries by the structural adjustment programme, the idea of a multilateral mechanism has been suggested involving the major industrial countries, international agencies and the country carrying out the programme. The former two groups form a support group for the latter to 'review the efforts of adjusting countries, assist them with their difficulties and provide guidance to help keep them on track. Countries performing well would receive incentives to continue doing so while laggards would have reason to rise to the challenge of reform' (Sengupta, 1991). An initial step can be made by assisting the developing countries in improving the statistical information base, including the data necessary for monitoring employment, education, health/nutrition, etc. (UNESCO, 1988). This information should be used by the international and national agencies to enhance their capability to make optimal use of scarce educational resources.

Basic education should be kept completely out of adjustment programmes with a protective package having implications also for other levels and types of education (e.g., salary of teachers). The State should have the primary responsibility of controlling its quality and availability in co-operation with non-governmental organisations. The private sector should be encouraged to take responsibility at the secondary technical and vocational levels as well as at the tertiary level of education. A strong monitoring system should be maintained by the State for control of quality and equity. If one of them deteriorates the State should intervene with corrective measures.

Countries should take advantage of the positive aspects of the structural adjustment programme by : increasing the cost-effectiveness of educational programmes; reducing wastage through abolition of unnecessary programmes and posts of employment, introducing discriminatory fee-paying systems or student loans, replacing car and housing facilities of staff; exploring rational alternatives such as provision of loans; re-organizing delivery systems through the use of modern technology; sharing teaching/learning strategies with the private sectors, especially the business and industry sectors, through emphasis on 'on-the-job training', reducing residential boarding facilities of students, etc. (Sanyal, 1995).

The money saved from programme measures, received from other sources or diverted from other sectors, should be allocated according to rational priorities. Basic and non-formal education should have priority over tertiary education, capital expenditure should regain its proper share, and expenditure on textbooks, equipment and other supplies and maintenance of equipment should be ensured.

A cadre of management specialists should be prepared to take the responsibility of managing institutions as well as agencies and offices responsible for educational activities, especially to make the best of the increased allocation to education. In respect of university management, it is necessary to provide flexibility and autonomy and to expand available financial resources by developing alternative sources of university financing including private contributions, productive ventures and user fees (Sanyal, 1995). The globalization of the economy calls for critical review of the content, method and structure of education, keeping in mind the priorities attached to different skills.

Implications of scientific and technological changes

To respond to the change in the scientific and technological domain, the education system has to co-

operate with the industries to generate new technology. The industries have to furnish specialized skills on-the-job and liberate the students from the formal system of education because these skills are too specific for the education system to provide. Such co-operation should be extended not only to developing programmes of training and research but to administering them jointly. Industrialized countries are going through this process. Others like Brazil, Mexico, and the Republic of Korea, have started working on these lines. The best example of an efficient way of bringing the worlds of school and work together is seen in the Federal Republic of Germany. The 'Dual System' of company-based training through apprenticeship combined with part-time attendance at school for 16-19 year olds has linked industry's needs with those of basic general education and is the secret of Germany's industrial performance. Other examples of education/industry co-operation are: 'Science Parks', now popular in many countries-developed (USA, United Kingdom, France) and developing (Republic of Korea and India); co-operative education programmes of the USA; PACE (European Programme of Advanced Continuing Education) and COMMETT (Community Action Programme for Education and Training in the Field of Technology of the European Community); Integrated Graduate Development Programme, Teaching Companies and the Open College of the United Kingdom (Sanyal, 1991).

In order to assist developing countries, since their education system is not equipped to generate new technology, they have to depend upon developed countries for the production of the new technology, the creation of knowledge base and the skills needed to use these technologies at the initial stage of technological development. With the goal of being technologically self-reliant, these countries have to start by developing certain skills to make use of technology imported from abroad. Even at this stage they have to depend upon foreign experts to give training to use, and manage, the imported technology. At the next stage, they have to depackage the technology and adapt it to the local environment with an added knowledge base created during the first stage. At the final stage these countries will develop a local knowledge base for production and diffusion of technology. The education system has to respond to the needs of these different stages (Sanyal, 1991). It may be necessary for the national educational institutions to establish with linkages with international enterprises as well.

To cope with technological development, education is required to be flexible in structure, more general in content to be adaptable to changing skill requirements to prepare 'educable' rather than 'educated' citizens and more diversified in delivery methods which will take advantage of developments in the labour market.

The system should also focus on imparting skills in entrepreneurship, organize employment orientation courses with industries, organize placement services and offer career guidance and counselling.

To reduce the problem of unemployment in general and educated unemployment in particular as a result of the adjustment programme, educational institutions should assess their own actions to see if they contribute to imbalances between supply and demand; respond to indicators of imbalance where appropriate; work co-operatively among the different levels and types of education; seek to assure as much learning value as possible from work-study assignments and train students of all levels and types how to combine subject matter interests in the development of marketable skills (Sanyal, 1985). The system should also focus on imparting skills in entrepreneurship, organize employment orientation courses with industries, organize placement services and offer career guidance and counselling.

In respect of content, the new types of skills that are essential for the preparation of the citizens of a technological society are: communication and negotiation skills; skills for critical thinking; interpersonal skills; skills for understanding the evolution of decision-making in society; and ethical and value skills. The last item becomes extremely important in a technological society and the related labour market. "In an information and knowledge based economy, in a world where a revolution is taking place in the field of biotechnology, at a time when the balance of power between the individual and the community or the State is undergoing drastic change, concern for ethical considerations is not an idealistic luxury, but rather a collective duty and major challenge for all educators, particularly those at the post-secondary level. The impact of ethics can be measured in high-technology areas such as biology and medicine, as well as in the arcane vagaries of computerization, a phenomenon which is affecting all spheres, including private life. If we neglected to make a connection between basic ethics and technological progress, we would be ushering in an era of "barbarism with a human face". (Dennison, 1988).

The above skills are needed in addition to the skills of: exploration; exploitation (production and transformation); management; and conservation of raw materials and natural resources needed for economic development of the countries. The advent of new technologies,

therefore, exerts forces which pull and push for change on the systems of education.

Developments in information technology are helping to bring the education system closer to the production system as mentioned. They can also promote co-operation among universities themselves allowing for increased mobility among students of different universities. The programme of 'ERASMUS' (Action programme of the European Community for the Mobility of University Students) is an example (Sanyal, 1991). In a similar higher education reform, students of the universities of the United Kingdom will be able to begin a course at one college and continue it at another because courses will now be given in modules or self-contained units of learning. Thirty-four universities had agreed to the change in principle (Crequer, 1991). Other universities should follow these examples to make the best of the higher education system and the students capabilities. Development in information technology should also be used to improve upon management practices of universities and schools through the use of computerized management information system.

UNESCO, in its Division of Engineering Sciences and Technology, having taken advantage of developments in information technology, has been preparing a teaching/learning package consisting of textbooks, video and audio cassettes, softwares and slides in engineering sciences for use of the Member States. Countries can now select the best teachers in certain disciplines and arrange for live dissemination of their teaching throughout the country with the use of satellites. Lectures can also be disseminated through cassettes (audio/video). Countries should utilize the new technologies to make education available for all through the use of distance learning systems.

Rapid obsolescence of skills due to accelerating technological development calls for the arrangement of retraining of workers at all levels every now and then. Continuing education will have to be emphasized as an integral part of the education system of all countries. This also becomes important in the context of an ageing population where an individual will have to live a significant part of life after retirement from formal employment. Education for leisure will be a new topic to be developed. The universities of developing countries are recommended to establish co-operation with their counterparts of developed countries on the lines of the UNITWIN project of UNESCO, already active in certain Member States in the area of instruction, research and public service (UNESCO, 1991).

Finally, countries have to give increasing emphasis to training and research in planning and management of education given the challenges that the education systems are having to face in this period of adjustment and change. Education is now regaining its importance in so far as financial allocation is concerned, especially from international and bilateral aid agencies. Management skills are essential to administer the funds effectively. In this period of adjustment and change, educational planners and managers have an enormous challenge to face.

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Fertility Transition in Kerala: Implications for Educational Planning

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Fertility trends in Kerala have brought in their wake a whole gamut of demographic changes. However, the planners have consistently failed to take these into consideration while directing the educational programme in the state. The article presents the need for and the recommended direction of a new educational plan for the state in view of the observed and forecast estimates.

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Kerala's demographic transition has been on the record for quite sometime and the applicability or replicability of this achievement has also been tried at several instances. Kerala has reached its low level of fertility and mortality through various determinants. Some of them are: natural population density, high female literacy rate, extensive health care facilities of public and private sectors distributed equally in rural and urban areas, a well organised and effective family planning program, tremendous success of the Maternal and Child Health and Universal Immunization program and many more (Bhat & Irudaya Rajan, 1990; Zachariah, 1984; Krishnan, 1976; Nair, 1974; Zachariah et. al, 1994). As of 1993, Kerala's total fertility rate is estimated at 1.7 per woman and the infant mortality rate per thousand live births is 13, the lowest in the country (Irudaya Rajan, 1996; Zachariah & Irudaya Rajan, 1996a).

Unfortunately, Kerala's remarkable achievement in the demographic front has not brought any radical change either in the economy or in the society. Domestic and international migration are on the increase. There were 618000 emigrants from Kerala as of 1991. (Zachariah et. al, 1994); the rate of net migration from Kerala stood as –0.16 in 1971, increased to –0.22 in 1981 and –0.31 in 1991 (Bhat & Irudaya Rajan, 1990; Zachariah & Irudaya Rajan, 1996a). Surprisingly, the rate is on the increase from decade to decade. What are the demographic, social, economic, psychological and political implications of the national and international migration of Malayalis? Not even a single comprehensive study has yet been attempted in this direction among the social scientists of Kerala. In 1997, the Centre for Development Studies, with the financial support from the Indo-Dutch Program on Alternative Development (IDPAD), Netherlands, is planning to undertake a large scale study covering all the districts to address the above question (Zachariah et. al, 1997).

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The second and most pressing problem of Kerala's economy is the ever increasing unemployment, specially educated unemployed. We have no reliable data on unemployment. Two consecutive surveys carried out by the Department of Economics and Statistics have revealed that the number of unemployed women as a percentage of the labour force has soared from 14 per cent in 1965-66 to 49 in 1987 (Parakash, 1989). According to the 1987-88 National Sample Survey, more than 10 per cent of the unemployed in India are from Kerala though it accounts for only 3.4 per cent of the country's population. Moreover, the number of unemployed women in the ages, 15-34 has increased from 33.6 thousands to 368.8 thousands between 1961 and 1981. The 1991 census data on unemployment are yet to be processed. If the applicants in employment exchanges are taken as proxy, the number of female job seekers increased from 6.22 lakhs in 1981 to 16.25 lakhs in 1991. As of 1991 census, the work participation rates for Kerala men and women are 47.58 and 15.85 respectively (Gulati & Irudaya Rajan, 1996).

With the above background, it is necessary to assess the long term implications of low fertility in Kerala on sectors such as education, health, social security, employment etc. A serious attempt in this direction has already been made (Zachariah & Irudaya Rajan, 1996b). This study was focussed on the fertility transition and its implications on educational planning. As studies examining the determinants of demographic transition in Kerala are plenty in literature, a review is not presented (for more details, see Zachariah & Irudaya Rajan, 1996a).

Fertility Transition

Reliable data on fertility trends of Kerala is available since the introduction of the Sample Registration System (SRS) during the 1970s. However, estimates made by several authors using the census data are available for different periods. The census based estimates shown here are from Bhat (1987). Since this set of estimates diverges significantly from the 'official' ones quoted routinely by many authors, it is imperative that we explain the reasons behind our choice. The 'official' estimates for the pre-SRS era are either based on estimates of infant and child mortality of highly suspect quality, or arrived at by extrapolations of unsatisfactory kind. On the other hand, the estimates shown here are based on estimates of infant and child mortality derived from the usually reliable 'Brass' method which uses data on children ever born and surviving from census or surveys (United Nations, 1983). Another reason for the choice is that for the decade 1971-81, the census-based estimates are fairly close to the estimates derived from the SRS. The census-based estimates are presented in table 1 and the annual series of fertility indicators derived from the Sample Registration System are provided in table 2.

Firstly, over the last 40 years or so, fertility has been on a continuous decline. Crude Birth Rate

Table 1: Estimates of fertility, Kerala, 1951-81

Decade	Crude Birth Rate	Total Fertility Rate
1951-61	43.9	5.6
1961-71	37.1	5.0
1971-81	28.1	3.4

Source: Bhat & Irudaya Rajan (1990)

Table 2: Fertility indicators for Kerala

Year	TFR	GRR	CBR
1971	4.1	2.0	31.1
1972	4.2	2.1	31.2
1973	3.9	1.9	29.2
1974	3.3	1.6	26.8
1975	3.4	1.6	28.0
1976	3.4	1.7	27.8
1977	3.1	1.5	25.8
1978	3.0	1.5	25.2
1979	3.1	1.5	25.8
1980	3.1	1.5	26.8
1981	2.8	1.4	25.6
1982	2.7	1.3	26.2
1983	2.6	1.2	24.9
1984	2.6	1.3	22.9
1985	2.4	1.2	23.3
1986	2.3	1.2	22.5
1987	2.3	1.1	21.7
1988	2.2	1.1	20.3
1989	2.1	1.0	19.8
1990	2.1	1.0	19.0
1991	2.0	1.0	18.0
1992	1.9	1.0	17.0
1993	1.7	1.0	16.6

Source: Irudaya Rajan, (1989; 1996).

Total Fertility Rate (TFR) denotes the average number of children that would be born to a woman during her life time, if she passes through her child bearing years conforming to the age specific fertility rates of the year. Gross Reproduction Rate (GRR) is the average number of female children that would be born to a woman during her life time, if she has passed through her child bearing years conforming to the age specific fertility rates of the year.

(CBR) per thousand population estimated as 43.9 during 1951-61, declined to 28.1 during 1971-81 whereas the Total Fertility Rate (TFR) per woman has declined from 5.6 children to 3.4 during the same period. As stated, since 1971, the annual series on fertility indicators are available (table 2). According to the SRS, the CBR declined from 31.1 in 1971 to 25.6 in 1981 (5.5 points) and to 16.6 in 1993 (9.0 points). The TFR has also registered the same decline through out the period under study. For instance, the TFR was 4.1 children per woman in 1971, 3.1 children in 1980 and 2.1 children in 1990. Kerala has achieved the replacement level of fertility in the beginning of 1990s. As Kerala reached the TFR of 2 by 1991, many demographers in India and abroad thought that further decline is most unlikely. Against their predictions, Kerala's fertility level is still on the decline with a TFR of 1.7 per woman by the year 1993. We firmly believe that the TFR is likely to reach 1.5 per woman in 1996-2001, 1.4 in 2001-06 and 1.0 in 2021-26 (for more details see table 3). Based on the above assumptions, we have projected Kerala's Population from 1991 to 2051 (Zechariah & Irudaya Rajan, 1996a). Some results of the projections are used in this paper extensively.

Table 3: Fertility Assumptions in the Projections

	1991-96	1996-2001	2001-06	2006-11	2011-16	2016-21	2021-26
TFR	1.7	1.5	1.4	1.3	1.2	1.1	1.0

Note: The TFR is assumed to be constant at 1.0 during 2026-2056, prepared by K.C. Zachariah and S. Irudaya Rajan of the Centre for Development Studies, Trivandrum.

Birth rate by districts are not available from the Sample Registration System due to the very small sample size. Bhat (1996) has indirectly estimated the fertility for all districts of Kerala using 1981 and 1991 censuses. According to the estimates, the TFR varies from 1.6 in Ernakulam to 3.4 in Malappuram during 1984-90 (table 4). As of 1990, only five districts (Palakkad, Malappuram, Wayanad, Kannur and Kasaragod) in Kerala have registered TFR level above 2.0. The remaining districts in Kerala already have the below replacement level of fertility. Once all districts in Kerala reach the TFR level of 2.0, Kerala's TFR is expected to decline still further. Another study conducted by the Centre for Development Studies, reveals that the TFR in Malappuram has declined very sharply from 5.76 to 3.67 (36 per cent) between 1975-80 and 1986-91 (Zachariah et. al, 1994). The registered decline is almost the same for Ernakulam and Palakkad.

Fertility being on a strict declining trend during the last 20 years in the state, its immediate impact can be seen clearly by studying the growth of children in the

Table 4: Levels and Trends in Fertility in districts of Kerala

	Total Fertility Rate		
	1974-80	1984-90	%Decline
Thiruvananthapuram	2.3	1.8	21.7
Kollam	2.7	1.8	33.3
Alappuzha	2.3	1.6	30.4
Pathanamthitta	–	1.7	–
Kottayam	2.4	1.7	29.2
Idukki	2.9	1.8	37.9
Ernakulam	2.4	1.6	33.3
Thirssur	2.5	1.9	24.0
Palakkad	3.4	2.4	29.0
Malappuram	4.3	3.4	20.9
Kozhikode	3.0	2.0	33.3
Wayanad	3.8	2.3	39.5,
Kannur	3.5	2.1	40.0
Kasaragod	–	2.5	–
Kerala	2.9	2.0	31.0

Source: Bhat, (1996).

age group 0-4, 0-14 and the proportion of children to the total population. Tables 5 to 9 provide some data in this regard. Table 5 outlines the proportion of children (0-14) to total population reported in the last four censuses carried out in Kerala for all districts since its inception in 1 November 1956 (Detailed age structure for Kerala for the period 1961, 1991 and 2021 is available in table 6). According to the 1991 census, Kerala has 14 districts while it was 9 in 1961, 10 in 1971 and 12 in 1981. All the districts in Kerala have shown a decline in the proportion of children between consecutive census periods. The highest decline of 18.4 percentage points was noticed in the district of Kottayam, followed by Er-

Table 5: Proportion of Children (0-14) in the districts of Kerala, 1961-91

	1961	1971	1981	1991	Decline 1961-1991
Thiruvanantha-puram	43.6	39.3	32.3	27.7	15.9
Kollam	44.1	40.4	34.0	28.0	16.1
Alappuzha	42.0	38.0	31.8	25.9	16.1
Pathanamthitta				26.2	–
Kottayam	43.2	40.1	31.7	24.8	18.4
Idukki			35.6	28.8	–
Ernakulam	42.4	39.5	32.3	25.7	16.7
Thirssur	42.0	40.6	34.1	27.3	14.7
Palakkad	40.8	39.7	36.4	31.9	8.9
Malappuram		43.4	41.6	39.0	–
Kozhikode	42.9	40.7	36.4	30.4	12.5
Wayanad			38.8	33.0	–
Kannur	42.4	41.3	37.6	31.7	10.7
Kasaragod				34.8	–
Kerala	42.6	40.3	35.0	29.6	13.0

Note:: Estimated by the authors from the census data.

Table 6: Percentage distribution of population by five-year age groups and sex for Kerala, 1961, 1991 and 2021.

	1961		1991		2021	
	Male	Female	Male	Female	Male	Female
0-4	15.29	14.61	9.53	8.79	4.17	3.56
5-9	14.84	14.07	10.16	9.43	4.84	4.21
10-14	13.48	12.97	11.00	10.38	5.51	4.82
15-19	8.25	8.70	10.30	10.50	5.81	5.29
20-24	8.11	8.84	10.33	11.07	5.69	5.55
25-29	7.22	8.04	8.83	9.46	6.08	6.06
30-34	6.24	6.45	7.31	7.18	7.15	7.27
35-39	6.06	5.89	7.08	7.01	7.50	7.53
40-44	4.55	4.36	5.34	4.90	7.70	7.89
45-49	4.31	4.12	4.60	4.59	8.17	8.14
50-54	3.33	3.29	3.66	3.65	8.86	8.46
55-59	2.63	2.60	3.26	3.45	8.40	7.76
60-64	2.18	2.28	2.93	3.08	6.88	6.83
65-69	1.42	1.48	2.28	2.53	5.12	5.74
70-74	0.97	1.05	1.40	1.57	3.62	4.40
75+	1.09	1.22	1.76	2.14	4.50	6.48

Source: Calculated by the authors form the 1961 and 1991 census data; 2021 data are taken from the projections made by K.C. Zachariah and S. Irudaya Rajan of the Centre for Development Studies, Trivandrum.

nakulam, Alappuzha and Kollam and the lowest was reported in case of Palakkad. The proportion of children in Kerala has declined marginally from 42.6 per cent in 1961 to 40.3 in 1971 and has experienced a tremendous decline of 35.0 per cent in 1981 to 29.6 in the latest 1991 census. Over the period of 40 years, Kerala has reduced its child population by 13 per cent.

The number and proportion of children below 14 years for the periods 1901 to 2051 are presented in table 7. Since 1961, the proportion of children in the total population is on a decline till the latest 1991 census and the trend is expected to continue according to the projections made at the Centre for Development Studies. Surprisingly, between 1961 and 1971, the number of children has increased by 1390 thousands, the increment in the next decade is in order of 306 thousands; almost 1084 thousands decline between 1971 and 1981. For the first time in the history of Kerala, the number of children has declined by 284 thousands during 1981-91 (8901 thousnads in 1981 and 8617 thousands in 1991). What are its exact implications for the educational planning in Kerala?

Table 7: Number and proportion of children below 14 years in Kerala, 1901-2051

Year	Number (000's)	Change	Proportions
1901			37.62
1911			40.29
1921			40.83
1931			43.45
1941			41.12
1951			40.36
1961	7205		42.62
1971	8595	+1390	40.26
1981	8901	+306	34.97
1991	8617	-284	29.64
2001	6927	-1690	22.17
2011	5569	-1358	17.25
2021	4309	-1260	10.01
2041	2256	-757	8.36
2051	1635	-621	7.19

Note: Till 1991, the data are compiled from the respective censuses by the authors. For the period 2001 to 2051, the figures are from the projections made by K.C. Zachariah and S Irudaya Rajan of the Centre for Development Studies, Trivandrum.

To probe further into the absolute decline of children below 14 years in Kerala, we provide an absolute increase/decrease among total population and children below 4 years from the last four censuses (table 8). Though the total population for Kerala is on the increase from 16.89 millions in 1961 to 29.07 millions in 1991, the absolute increase in every decade is on the verge of decline. For instance, Kerala added 4.45 million in during 1961-71, declined to 4.10 million between 1971

Table 8: Increase/Decrease among total population and children (0-4) for kerala, 1961 and 1991

	Total Population	Change	0-4 Population	Change
1961	16899663		2527160	
1971	21346472	+4446809	2855404	+328244
1981	25451256	+4104784	2720731	-134673
1991	29074050	+3622794	2661820	-58911

Source: Calculated by the authors from various census reports.

and 1981 and reduced further to 3.62 million during the last decade. On the other hand, the children below 4 years have shown an increase only during 1961-71 by 0.33 million. Between 1971 and 1981, the numbers have declined sharply by 0.14 million and the latest decade reported the decline to the tune of 0.06 million. Thus one of the reasons for the marginal increase in the total population of Kerala is due to the fast and continuous reduction in fertility. Kerala's share in the country's population has declined from 3.72 in 1981 to 3.44 in 1991.

The absolute number of children below 4 years is reported to be declining in almost all districts of Kerala between 1981 and 1991 except the two districts of Thiruvananthapuram and Malappuram. Difficulties arise while carrying out the district level analysis due to the creation of a new district, Pathanamthitta, has been formed from the districts of Kollam, Alappuzha and Idukki whereas Kasaragod is from the district of Kannur. Districts like Ernakulam and Kottayam are not disturbed at all by the introduction of new districts. The absolute numbers of children below 4 years have declined by 11,316 in Kottayam and 14,790 in Ernakulam (more details about each district, see table 9).

Table 9: Absolute decline of children in 0-4 ages, 1981 and 1991

	0-4 Age 1981	group 1991	Absolute Decline
Thiruvananthapuram	258997	266190	+7193
Kollam	287947	205150	28797
Alapuzha	218663	156430	62243
Pathanamthitta		97520	
Kottayam	151306	139990	11316
Idukki	104402	96150	8252
Ernakulam	236290	221500	14790
Thirssur	236066	230830	5236
Palakkad	235540	232130	3410
Malappuram	334917	392620	+57703
Kozhikode	247914	239130	8784
Wayanad	68480	66340	2140
Kannur	340109	205720	134389
Kasaragod		1121130	
P+K+A+I	611012	555240	+55772
K1+K2	340109	317850	22259
Kerala	2720731	2661820	58911

Notes: Pathanamthitta (P) is formed form the districts of Kollam (K), Alappuzha (A) and Idukki (I); Kasaragod (K1) is formed form the district of Kannur (K2); Calculated by the authors form the 1981 and 1991 census data.

Education Transition

Thus the fertility transition in Kerala during the last forty years has had an impact on the age structure (see Fig. 1) specially among children below four and fourteen years. It is well documented that not only has the proportion of children to total population declined but also the absolute number of children below four years of age is on the decline in almost all the districts of Kerala, excepting Thiruvananthapuram and Malappuram districts. With this background, let us assess the educational transition in Kerala. Table 10 provides the literacy rates by sex for Kerala for the last 90 years. Not only have the literacy levels among males and females increased over a period of time, but also the sex differentials have narrowed down. The difference between male and female literacy which was almost 20 points in 1931, declined to seven points in 1991. This is the general literacy rate of persons above six years of age. What about the enrolment among the boys and girls in Kerala?

Table 10: Literacy Rates for Kerala

Year	Males	Females	Difference
1901	19.15	3.15	16.00
1911	22.25	4.43	17.82
1921	27.88	10.26	17.62
1931	30.89	11.00	19.89
1951	49.79	31.41	18.38
1961	54.97	38.90	16.07
1971	66.62	54.31	12.31
1981	75.33	65.70	9.63
1991	93.62	86.17	7.45

Sources: Irudaya Rajan & James, 1993.

There has been of course a steady rise in the school enrolment rates. But this was a long-term trend and not one that just happened in the late 1950s or early 1960s. In 1961-62, the enrolment in primary schools in Kerala as a percentage of the population in ages 6-10 was 102. In other words, hundred per cent enrolment in Kerala has been achieved as early as in 1960s. The planners and policy makers in Kerala have failed to take advantage of one of the first consequences of demographic transition, the fertility transition (Bhat & Irudaya Rajan, 1990; 1992). As a result of past declines in fertility, when there was no growth in the population of school-going ages during the 1970s and 1980s, more resource was pumped into the educational sector. As enrolment rates were already high by 1970 in the primary and secondary levels, the increase in expenditure hardly produced any further change in enrol-

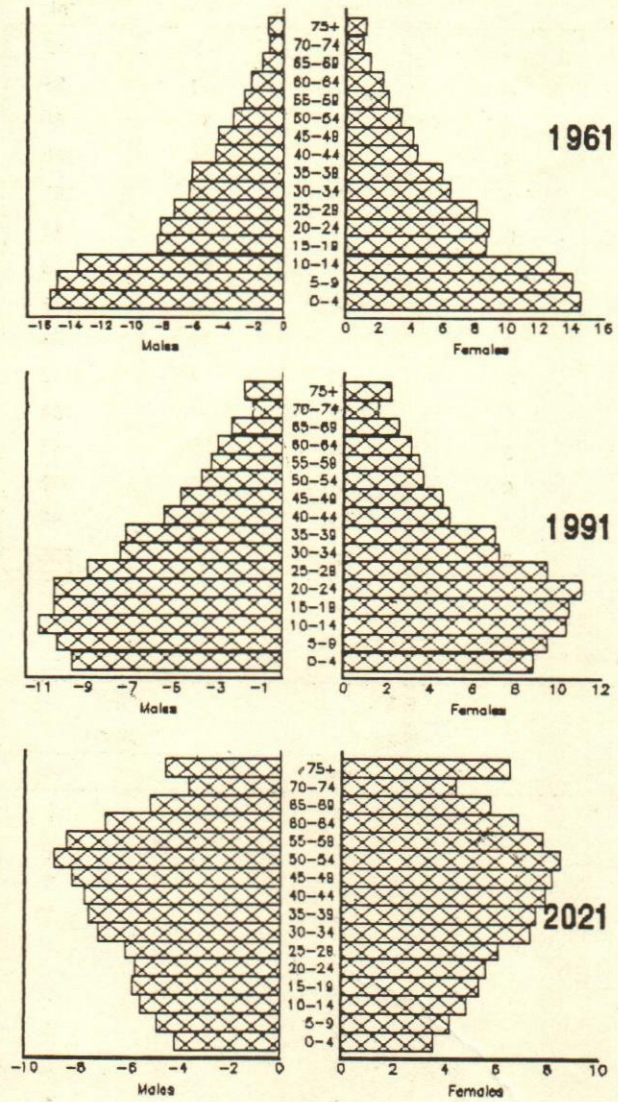

Fig. 1. AGE Pyramids for Kerala

ment rates. For instance, between 1961 and 1987, the population in the age interval 5-14 increased by 30 per cent. But during the same period real expenditure in education increased by more than 300 per cent. Can such increase be justified through the increase in enrolments? Certainly not. The total enrolment in primary and secondary levels increased by only 75 per cent during 1960 and 1987 [Government of, Kerala, 1989]. Neither was the emphasis shifted from basic education to higher or technical education during the period. Tables 11 and 12 review the education expenditure by primary and secondary levels, number of students in schools, number of school teachers, student-teacher ratio and cost per student among primary and secondary level students. The

Table 11: Student-teacher ratio and cost per student

	Number of Students in School (in lakhs)	Number of Schools Teacher (in lakhs)	Student-Teacher Ratio *	Cost per Student (Rs.)	
				Primary	Secondary
1970-71	48.00	1.42	33.8	85.91	176.25
1971-72	49.36	1.46	33.8	89.26	187.29
1972-73	51.56	1.51	34.1	94.51	194.15
1973-74	52.71	1.54	34.2	102.24	211.70
1974-75	53.59	1.59	33.7	117.52	217.90
1975-76	52.85	1.62	32.6	170.02	361.32
1976-77	53.54	1.64	32.2	186.16	386.02
1977-78	54.94	1.67	32.9	193.61	363.02
1978-79	53.38	1.74	30.6	201.21	356.34
1979-80	55.81	1.75	31.9	238.27	369.34
1980-81	56.02	1.75	32.1	265.24	454.25
1981-82	56.50	1.78	31.7	298.18	536.37
1982-83	56.45	1.81	31.2	326.13	589.41
1983-84	56.48	1.84	30.7	414.43	737.60
1984-85	56.81	1.85	30.7	414.43	737.60
1985-86	57.16	1.88	30.4	479.23	906.91
1986-87	57.17	1.91	29.9	563.03	1043.00
1987-88	57.88	1.93	30.1	593.03	1130.0
1988-89	58.52	1.90	30.8	638.32	1137.00
1989-90	58.83	–	–	804.93	1268.67
1990-91	59.01	1.91	30.9	872.69	1600.00
1991-92	59.07	1.91	30.9	953.40	1600.00
1992-93	58.68	1.90	30.9	1074.41	1856.00

* Number of students per teacher

Source: Government of Kerala, 1994.

Table 12: Educational expenditure pattern, Kerala (in crores)

				Proportion	
	Primary	Secondary	Total	Primary	Secondary
1982-83	141.24	77.51	218.75	64.57	35.43
1983-84	160.84	88.25	249.09	64.57	35.43
1984-85	178.86	100.56	279.42	64.01	35.99
1985-86	210.64	125.11	335.75	62.74	37.26
1986-87	240.00	140.17	380.17	63.13	36.87
1987-88	244.52	166.50	391.12	62.52	37.48
1988-89	284.52	163.60	448.12	63.49	36.51
1989-90	305.17	182.23	487.40	62.61	37.39
1990-91	384.16	229.51	613.67	62.60	37.40
1991-92	409.00	242.00	651.00	62.83	37.17
1992-93	458.00	295.00	753.00	60.82	39.18

Source: Government of Kerala, 1994.

Table 13: District wise number of uneconomic schools

	Government			Aided			
	HS	UP	LP	HS	UP	LP	TOTAL
Thiruvananthapuram	2	4	27	0	2	7	42
Kollam	0	2	16	0	1	16	35
Alappuzha	0	6	42	0	3	35	86
Pathanamthitta	1	10	40	1	10	108	170
Kottayam	1	16	58	1	19	74	169
Idukki	0	5	25	0	1	12	43
Ernakulam	1	5	38	1	8	50	103
Thirssur	1	2	17	0	7	49	76
Palakkad	0	1	14	0	0	13	28
Malappuram	0	0	5	0	0	7	12
Kozhikode	0	6	41	0	5	111	163
Wayanad	0	1	10	0	0	2	13
Kannur	0	6	59	0	8	227	300
Kasaragod	0	1	28	0	0	20	49
Kerala	6	65	420	3	62	733	1289

Source: Government of Kerala, 1994.

Table 14: Effective strength of uneconomic lower primary schools (standards i to iv)*

	E.S 99-75		E.S 74-50		E.S 49-25		E.S 24-01	
	G	PA	G	PA	G	PA	G	PA
Thiruvananthapuram	14	1	8	5	2	1	2	0
Kollam	8	8	5	5	2	1	0	0
Alappuzha	23	1	12	15	4	2	0	0
Pathanamthitta	13	40	12	52	3	5	1	1
Kottayam	22	25	21	41	5	7	2	1
Idukki	7	2	13	7	4	3	1	0
Ernakulam	15	25	13	22	5	2	0	0
Thirssur	8	28	4	18	3	3	2	0
Palakkad	6	8	6	4	2	0	0	1
Malappuram	0	4	4	3	0	0	0	1
Kozhikode	15	65	21	33	2	7	1	0
Wayanad	1	1	1	1	2	0	0	0
Kannur	28	81	27	67	2	9	0	0
Kasaragod	18	12	8	7	2	1	3	0
Kerala	178	318	155	280	38	41	12	4

* Minimum effective strength required is 100 to run a lower primary school.

E.S: Effective strength G – Government school PA – Private aided school.

Source: Government of Kerala, 1994

number of students enrolled in the schools has shown lot of fluctuations during the last 20 years, but beginning 1992-93, the actual number of enrolment has come down; school teachers have increased from 1.42 lakhs in 1971 to 1.91 lakhs in 1992. The student-teacher ratio has come down from 34 to 31 during the same period. The cost per student at the primary level has increased twelve-fold and at the secondary level by ten-fold. Surprisingly, the proportion of money allotted at primary and secondary levels is almost constant over a long period of time. By emphasising more on primary level education, the successive

governments in Kerala have failed to invest on secondary, higher secondary and technical level of education. This is a failure of the educational planning process in Kerala.

By emphasising more on primary level education, the successive governments in Kerala have failed to invest on secondary, higher secondary and technical level of education. This is a failure of the educational planning process in Kerala.

As the government has ignored the fertility transition in Kerala, what are the implications? Tables 13–15 list some of the side effects of the wrong educational policy pursued by the successive governments in Kerala.

An uneconomic school is defined as one which does not satisfy the requirement of Para I of Rule 22(4) of Kerala Education Rules which warrants that the minimum strength per standard in Lower Primary/Upper Primary/Higher Secondary shall be 25, and the minimum strength per standard in Sanskrit and Arabic schools shall be 15. As of now, there are 1289 uneconomic schools in Kerala (table 13). The number of lower primary schools accounted for 89 percent (1153) of the uneconomic schools. Of them, 491 are in government sector and 798 in the private aided sector. Why is there a growing number of uneconomic private aided schools in Kerala? The highest number of private unaided schools is found in Kannur (227) and Kozhikode (111). To run a lower primary school from standard I to IV, the minimum effective strength of students required is 100. As of 1994,1026 lower primary schools have not qualified for this minimum effective strength. Among them, 496 schools had the effective strength between 75 and 99, 435 schools between 50 and 74 and 92 schools below 50. The management-wise data are presented in table 14. As stated earlier, 63 per cent of them are private aided schools. A committee constituted by the Government of Kerala to study the problem of uneconomic schools, recommended the closure of 870 schools immediately. The district wise distribution can be seen in table 15. Out of 870 schools recommended for closure, 600 are in the private aided sector.

In this context, let us review the report published in the national newspaper in 1995 (The Hindu, July 26, 1995). The Education Minister Mr. E.T. Mohammed Basheer of the earlier United Democratic Front (UDF) has said in the Assembly that there is no question of uneconomic schools in the State being closed down

Table 15: Number of School that may be closed after granting exemption

	Government	Aided	Total
Thiruvananthampura	19	6	25
Kollam	8	11	19
Alappuzha	44	33	77
Pathanamthitta	41	109	150
Kottayam	39	54	93
Idukki	8	3	11
Ernakulam	31	40	71
Thirssur	12	45	57
Palakkad	2	7	9
Malappuram	1	6	7
Kozhikode	37	108	145
Wayanad	0	0	0
Kannur	24	176	200
Kasaragod	4	2	6
Kerala	270	600	870

Source: Government of Kerala, 1994.

Table 16: Standard-wise enrolment in 1992-93 and projected children for standard-wise in 2001

Category	Present Enrolment (1992-93)	Projected Population in 2001	Actual Decline	% Decline of Population to present Enrolment
I	566126	527587	38539	6.80
II	599350	528589	70761	11.80
III	606882	530531	76351	12.58
IV	599427	531194	68233	11.33
Lower Primary level	2371785	2117901	253884	10.70
V	621971	532056	89915	14.46
VI	630259	534988	95271	15.12
VII	655294	531653	123641	18.87
Upper Primary level	1907524	1598697	308827	16.19
VIII	608369	526072	82297	13.53
IX	546747	525340	21407	3.93
X	434011	524060	+90049	+20.75
Higher Secondary level	1589127	1575472	13655	0.85
Total	5868436	5292070	576366	9.82

Source: Government of Kerala, 1994.

because of fall in student strength. The Minister also disputed the allegation that more and more schools were becoming uneconomic because of the government's education policy. If that were so, the 1987-91, government by Left Democratic Front (LDF) would have to bear as much responsibility as the present government for such a state of affairs. According the Economic Review 1988-89, there were 835 uneconomic schools in the State with Kannur accounting for the highest number of such schools followed by Pathanamthitta. The number had risen to 891 in 1989-90 and still further to 964 during 1990-91 with Kannur still occupying the top position. The Minister also contended that the phenomenon had little to do with sanctioning of unaided schools and said this was borne out of the experience. However, the previous Government had taken a decision not to close uneconomic schools some time ago and will stand by the same. The present government's stand on uneconomic schools and its closure is yet to be seen.

In the first phase of UDF rule (1991-93), the Government has closed 67 schools of which 63 were lower primary schools and four upper primary schools. Among them, 45 were in the Government sector and the rest in aided sector. Later, the Department of Education has recommended the closure of another 89 uneconomic schools with student strength below 50. The number of students was between 4 and 49 in these schools. Later the government cancelled closure of these schools due to political pressure.

The Expert Committee appointed by the Government of Kerala has estimated that the school age population (5-14) will decline to 52.92 lakhs in 2001 (table 16). The standard-wise schools age group children projected, would indicate that the children available for standard I in 2001 will be 5.27 lakhs as against 5.66 lakh children enrolled in Standard I in 1993. This would mean that the decline will be 38539. At the lower primary level (5-8 years), population would be 21.17 lakhs as against the present enrolment of 19.07 lakhs students. At the upper primary level, children are projected to decline to 15.98 lakhs against the current enrolment of 19.07 lakh students. The high school level population is projected at 15.75 lakhs in 2001 as against the present enrolment 15.89 lakhs. Effectively, the situation emerging is that there will be 5.76 lakh children less than the present school enrolment in 2001 A.D.

The situation emerging is that there will be 5.76 lakh children less than the present school enrolment in 2001 A.D.

Recommendations

The senior author of this paper was a member of an Expert Committee on school age group population and its implications on educational policy and planning appointed by the Government of Kerala at the instance of the Minister for Education. The Committee has submitted its report in June 1994. Other members of the committee include the late Professor R. Ramkumar, Head, Department of Demography and Population Studies (retired), University of Kerala and S. Harichandran, Chief, Social Service Division, State Planning Board, Thiruvanathapuram (Government of Kerala, 1994; for an interesting review of the full report see James, 1995). The report has already received the attention of the present government. We review some of the recommendations for the benefit of the readers of this journal.

Expansion of general stream of education not needed

There are two major streams of education after the secondary level – general and technical. Technical streams include institutions such as the ITCs, ITIs, technical high schools and polytechnics. In the general section, in addition to the pre-degree classes in colleges, there are vocational and ordinary higher secondary schools. In Kerala, nearly 2.75 lakh students pass out from SSLC (both regular and private) annually. Of these, 52.42 per cent are being enrolled under the regular system. Besides, 90,000 student are under private registration at the pre-degree level. The regular stream of higher education infrastructure consists of 80 higher secondary schools, 174 Arts and Science colleges and 186 vocational higher secondary schools. Thus the effective infrastructure is available in 440 institutions other than polytechnics, ITIs etc, the number of which exceeds the recommended number of schools for the state as a whole.

The problem of surplus teachers is a pointer towards reconsidering whether we need to continue all the teacher training institutes.

The problem of surplus teachers is a pointer towards reconsidering whether we need to continue all the teacher training institutes like B.Ed centers, TTC training centers and so on. As the absorption of more teachers in this sector is limited, there is an urgent need to restructure the existing institutions. The possibilities of providing further training to teachers such as refresher courses, reorientation programs, teaching in subjects such as computer education, basic electronics etc. will have to find a place in the curriculum of the 21st century.

Construction of school buildings should be more need based

The 1986 All India Fifth Educational Survey conducted by the National Council of Educational Research and Training revealed that among the 6096 primary schools in Kerala, 4256 have pucca buildings. 1050 have partly pucca buildings, 528 have kachcha buildings and 262 have thatched huts. Out of 3259 upper primary schools, 2385 had pucca buildings, 764 had partly pucca buildings and 120 thatched huts. During 1986-93, 550 school buildings were completed, of which, 230 were LP school buildings, 150 UP schools and 170 high school buildings.

All uneconomic schools (870) which are under threat of closure at any time, have permanent building facilities. Such buildings which remain vacant are to be put to alternative uses of government offices functioning in rented buildings. For instance, schools closed at Punnapuram and Nandavanam in the city corporation area of Thiruvanathapuram are now used by the Kerala Audio Visual Reprographic Centre and Directorate of Secondary Education respectively.

With regard to other facilities, 3266 primary schools, 235 upper primary schools and 1878 secondary schools have playground facilities and 4658 primary schools and 2538 upper primary schools have drinking water facility. A recent study by the Kerala Government Teachers Association in late 1980s revealed that 908 government schools did not have clean drinking water facilities and 1700 did not have latrine facilities. A time bound action plan needs to be formulated and all out efforts are to be made towards providing the basic amenities in schools.

Existing protected teacher : A great drain on exchequer

There were 4350 protected teachers in 1983. With great efforts, this had declined to 2101 in 1993. Among them, 1172 are primary school teachers, 651 special teachers and 278 high school teachers. All protected teachers are in the private aided schools. Assuming an average salary of Rs. 35,000 per annum, the total drain on the exchequer on such protection amounts to over Rs. 7 crores per annum. Services of these protected teachers have to be utilised for tutorial or remedial education.

Decline of school children will render about 25000 teachers as surplus

Even at the current enrolment level, there are protected teachers and uneconomic schools. There are 1.9 lakh teachers in Kerala and the teacher-pupil ratio is 1:30.9 whereas the all India ratio is as high as 1:34. A more specific analysis reveals that in the government and aided sectors, there are 1.85 lakh teachers with 57.07 lakh students. Assuming the current level of enrolment in the private unaided sector, the likely enrolment in government and private aided sectors together will be about 46.71 lakhs. If the teacher-student ratio is maintained at 1:30, the number of teachers required will be 1.6 lakhs. Thus on account of the fall in the number of school going children, about 25000 teachers will be rendered surplus. This particular situation would lead to a serious breakdown and crisis in the school education system of Kerala. Unless policy measures are initiated in the right direction not only will the situation become out of hand but also psychologically it will be a frustrating experience for the teaching community. The State on this account will face a serious problem of financial drain amounting to about Rs.90 crores approximately per year (assuming an average salary of about Rs. 35,000 per annum per teacher).

Absorption of protected/surplus teachers in retirement vacancies

As outlined earlier, Kerala has uneconomic schools, protected teachers and this situation will be aggravated further on account of the consistent decline in fertility levels thus producing more surplus teachers. The feasible option is that the government should consider restricting fresh appointment in at least 50 per cent of the retirement vacancies in another 5 to 7 years. A study carried out by the State Planning Board revealed that during 1993-97, about 27000 teachers are likely to retire. It may not be a difficult proposition to adjust about 20000 teachers by the turn of this century. A decision in this regard should vigorously be enforced irrespective of the demand of the management of aided schools. It is not difficult for the government which is in command to do this as their neighbouring Government of Tamil Nadu has successfully implemented a similar stand while introducing plus two pattern of education. The committee is of the view that fresh appointments in

Kerala has uneconomic schools, protected teachers and this situation will be aggravated further on account of the consistent decline in fertility levels thus producing more surplus teachers. The feasible option is to restrict fresh appointment.

the school education sector are to be stopped immediately till a balanced decision on the subject is taken by the government.

To conclude, we would like to report the latest decision of Kerala assembly on the issue of uneconomic schools (Indian Express, September 20, Thiruvanathapuram, page 5). No more unaided school and colleges will be sanctioned in the State, Minister for Education, P.J. Joseph has announced in the assembly. However, the existing institutions would not be closed. During the debate, Joseph told the former education minister E. T. Mohammed Bahseer, 'You had sanctioned 270 new courses, most of them in the private sector in the last five years'. We feel that the educational planning should be based on the people's needs rather than the need of the people's representatives.

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Feasibility of Elementary Education for All

G. Rama Rao

Education is the key to national prosperity and welfare—no investment is likely to yield greater return than investment in human resources of which the most important component is education. Elementary education, the first eight years of schooling, lays the foundation of personality developing attitudes, social confidence, capabilities and learning skills. This study analyses the enrolment ratios in schools in a few states and presents policy imperative.

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The provision of free and universal elementary education for every child has been a dream of long standing with the people of this country. More than a century ago (September 1882), the first effective public statement towards this end was made by Sir Dadabhai Naoroji, the grand old man of India, in his evidence before First Education Commission. This case has been taken up time and again by several national leaders such as Gopal Krishna Gokhale, Mahatma Gandhi, Raja Gopalachari etc. While adopting the Constitution of India in 1950, the goal was to provide free and compulsory education to all children upto the age of fourteen years in the next ten years. It was embodied as an article 45 in the Directive Principle of State Policy. The target dates to achieve Universal Elementary Education have been revised from time to time. The Working Group set up by Planning Commission set it by the end of sixth plan (1984). The Kothari Commission revised it to be achieved latest by 1986. The National Education Policy (1986) set the goal that all children who attain the age of 11 years by 1990 should have had five years of schooling or its equivalent through the non-formal stream and by 1995 all children will be provided free and compulsory education upto fourteen years of age. The revised policy formulation (P.O.A., 1992) envisaged that free and compulsory education of satisfactory quality should be provided to all children up to fourteen years of age by the end of this century (Govt. of India 1992-97). The credibility of such resolutions has suffered due to inept approaches and inadequate actions.

There has been considerable all round increase in the elementary school enrolment of both sexes in almost all the states in India during the past four decades. The level and rate of increase in the enrolment ratios, however, differ significantly across the states. On the basis of enrolment ratios at primary and middle school classes, low ratio states are Bihar, Uttar Pradesh, Rajasthan, Madhya Pradesh while rest of the states come under high school enrolment ratio.

Two low school enrolment ratio states viz Bihar and Uttar Pradesh and two high ratio states viz Kerala and

Table 1: Growth of Enrolment in Primary Education for India and its selected states: 1960-61 to 1990-91

	Enrolment in Classes I-V Fig. in 000s			Girls to Boys %	Enrolment Ratio			Annual Geometric Growth Rate		
	Boys	Girls	Total		Boys	Girls	Total	Boys	Girls	Total
Bihar										
1960-61	2445	739	3184	30.2	76.0	24.1	50.7	–	–	–
1970-71	3144	1068	4213	34.0	80.6	29.1	55.7	2.6	3.4	2.8
1980-81	4710	1987	6697	42.2	89.9	40.5	66.0	4.1	6.4	4.7
1990-91	5723	2842	8565	49.7	107.6	55.0	81.7	2.0	3.6	2.5
Uttar Pradesh										
1960-61	3200	843	4043	26.3	80.8	48.4	65.6	–	–	–
1970-71	6858	4007	10865	58.4	109.6	70.1	90.8	7.9	16.9	10.4
1980-81	6801	2909	9710	42.8	81.8	40.3	62.5	–0.08	–3.2	–1.1
1990-91	8890	5050	1394	56.8	98.5	62.2	81.3	2.7	5.7	3.7
Kerala										
1960-61	1281	1110	2391	86.7	98.8	98.8	98.8	–	–	–
1970-71	1757	1567	3324	89.2	124.7	114.6	119.7	3.2	3.5	3.3
1980-81	1650	1556	3212	94.0	109.9	104.5	107.2	–0.6	–0.1	–0.3
1990-91	1623	1533	3156	94.5	103.6	101.3	102.5	–0.2	–0.1	–0.2
Tamil Nadu										
1960-61	2126	1224	3350	57.6	99.7	58.0	78.9	–	–	–
1970-71	2884	2175	5059	75.4	117.8	93.4	105.9	3.1	5.9	4.2
1980-81	3480	2866	6346	82.4	122.0	103.3	112.8	1.9	2.8	2.3
1990-91	4182	3581	7764	85.6	141.1	126.5	134.0	1.9	2.3	2.0
India										
1960-61	23593	11401	34994	48.3	82.6	41.4	62.4	–	–	–
1970-71	35739	21306	57045	59.6	95.0	60.5	78.6	4.2	6.5	5.0
1980-81	45286	28488	73774	62.9	95.8	64.1	80.5	2.4	2.9	2.6
1990-91	58095	41024	99119	70.6	115.3	86.0	101.0	2.5	3.7	3.0

Source: Annual reports of Education and selected Educational Statistics published by the Ministry of Education.

Tamil Nadu were selected for a study. The past and current situation were reviewed and the current and past trends of wastage in primary and middle school classes were analysed.

Primary School Education

The progress made in school enrolment in the last three decades was remarkable through out India as well as in the selected states of the study. The number of children enrolled in primary classes (I-V) (all India) increased from 350 lakhs in 1960-61 to 991 lakhs in 1990-91, registering an increase of 2.8 times during the period (table 1). For the same period the number of girls had increased by 3.6 times, while for boys it was 2.5 times Government of India, 1985-86; National Family Health Survey, 1995).

Bihar showed a gradual increase in primary school enrolment from 31.84 lakhs in 1960-61 to 85.65 lakhs in 1990-91, yielding an increase of 2.7 times. The enrolment of girls increased by 3.8 times during the past three decades, whereas, for boys it was 2.3 times. During the period 1971-81, the enrolment, particularly, for girls had increased at a faster rate compared to the other two decades. The primary enrolment in Uttar Pradesh increased dramatically from 40.43 lakhs in 1960-61 to 108.6 lakhs in 1970-71 and surprisingly, declined to 97.1 lakhs in 1980-81. There was sharp reduction in the enrolment of girls during the decade 1971-81 in Uttar Pradesh as compared to boys. The reason for such a decline particularly for girls has to be critically examined. The enrolment in Kerala increased from 23.9 lakhs in 1960-61 to 33.2 lakhs in 1970-71. From 1970-71 onwards, it marginally declined due to the

rapid decline in fertility in past two decades. In Tamil Nadu, the primary school enrolment showed a gradual increase from 33.5 lakhs in 1960-61 to 77.64 lakhs in 1990-91. By and large, the annual growth rate of primary school enrolment for India and selected states with the exception of Bihar state had increased rapidly during the period 1961-71 compared to the other decades. Further, in the past three decades, the annual enrolment rate of girls increased at a faster rate than that of boys in all the selected states of India.

The index of relative enrolment (sex ratio of enrolment is defined as the number of girls enrolled in primary classes per 100 boys enrolled) reveals a clear cut distinction between developed states such as Kerala and Tamil Nadu and developing states like Uttar Pradesh and Bihar. For Bihar, the percentage of girls to 100 boys enrolled in primary classes for the years 1960- 61 and 1990-91 were 30 and 50 respectively and for Uttar Pradesh 26.3 and 57. On the other hand, for Kerala, the index of relative enrolment has increased from 87 in 1960-61 to 94 in 1990-91. At the national level, the index of relative enrolments in 1960-61 and 1990-91 years were 48 and 71 respectively. This clearly indicates that the enrolment of girls in primary classes for Bihar was not only lagging far behind Kerala and Tamil Nadu but also behind the national and Uttar Pradesh level.

In this paper, the Gross enrolment ratio for primary classes I-V is defined as the number of students who are enrolled in class I-V irrespective of age. The gross enrolment ratios of boys for primary classes I-V in Bihar state for the year 1960-61 and 1990-91 were 76 and 108 respectively, whereas, the corresponding ratios for girls were 24 and 55. On the other hand, for Kerala, the respective enrolment ratios for boys in the year 1960-61 and 1990-91 were 98.8 and 103.6 and for girls 98.8 and 101.3. Tamil Nadu had shown a remarkable progress in primary school enrolment in the past three decades for both sexes, particularly girls. The reason for the enrolment ratios to be more than 100 is, because the ratios take into account all children irrespective of age, enrolled in primary classes I-V to the total children in the age group 6-10. According to the annual reports of Education of India in 1970-71, around 23 per cent of children in Kerala and 27 per cent of children in Bihar who were on the rolls in primary classes do not belong to the age group 6-10. Unfortunately, no such data has been published by the Ministry of Education. The gap between boys' and girls' enrolment ratio in Bihar was much more than the gap existing at the national level and also in other selected states of the study.

Middle School or Upper Primary School Education

In the post Independence period, a remarkable progress was achieved in middle school education for both boys and girls. Prior to Independence, primary education was generally considered as that meant for masses and secondary education for a select group. Villages at that time had only primary schools but after Independence many primary schools were upgraded either as middle or secondary schools. In 1960-61, 67.05 lakhs of children in India were enrolled in middle school classes. For this period, the enrolment of boys in India increased by 4.1 times and for girls by 7.6 times. The middle school enrolment of boys and girls for Bihar and Uttar Pradesh states in the past three decades had increased by 3.2 and 4.3 times, whereas, the corresponding figures for girls were 10 and 11 times. It is pertinent to note that in all the selected states of India with the exception of Kerala, the annual enrolment rates of boys and girls, particularly for girls during the decade 1961-71 had increased at a faster rate as compared to annual enrolment rates during the decade 1971-81. In the decade 1981-91, the enrolment rates of middle school VI-VIII for Bihar, Uttar Pradesh, Tamil Nadu and India had picked up and showed an increasing rate particularly for girls.

In Bihar, one girl out of every nine boys was enrolled in middle school classes in 1960-61; the relative position of girls improved considerably during the past three decades and by 1990-91, it became one girl out of three boys. The position of Uttar Pradesh is more or less the same as that of Bihar. On the other hand, in Kerala, three girls for every four boys were on the rolls in the year 1960-61; the gap between the sexes in the middle school enrolment narrowed down further in the past three decades and by 1990-91, nine girls for every ten boys were attending middle school classes. The index of relative enrolment for Tamil Nadu was 43 in 1960-61 and increased to 74 per cent by 1990-91. However, inspite of the rapid increase in the enrolment of girls in middle school classes, girls are still lagging far behind boys in Bihar and Uttar Pradesh as compared to Kerala and Tamil Nadu.

Inspite of the rapid increase in the enrolment of girls in middle school classes, girls are still lagging far behind boys in Bihar and Uttar Pradesh as compared to Kerala and Tamil Nadu.

The middle school enrolment ratio is computed as the total number of children enrolled in classes IV-VIII to the total children in the age group 11-13 years. In the year 1960-61, one out of four children 11-13 years of age in India were enrolled in middle school classes and by the year 1990-91 sixty per cent of them were on the

Table 2: Growth of Enrolment in Middle school Education for India and its selected states: 1960-61 to 1990-91

	Enrolment in Classes I-V Fig. in 000s			Girls to Boys %	Enrolment Ratio			Annual Geometric Growth Rate		
	Boys	Girls	Total		Boys	Girls	Total	Boys	Girls	Total
Bihar										
1960-61	479	56	535	11.7	29.3	3.8	17.1	–	–	–
1970-71	727	146	873	20.1	33.3	6.9	20.4	4.3	10.1	5.0
1980-81	1046	283	1329	27.1	39.4	11.6	26.0	3.7	6.8	4.3
1990-91	1560	561	2121	36.0	53.5	19.4	36.5	4.1	7.1	4.8
Uttar Pradesh										
1960-61	750	110	860	14.7	30.9	5.0	18.6	–	–	–
1970-71	1802	416	2218	23.1	52.2	13.6	34.1	9.2	14.2	9.9
1980-81	2402	651	3053	27.1	56.3	18.0	38.7	2.9	4.6	3.2
1990-91	3240	1230	4470	37.9	64.8	27.6	47.3	3.0	6.6	3.9
Kerala										
1960-61	398	297	605	74.6	67.7	49.1	58.3	–	–	–
1970-71	550	459	1009	83.5	73.4	61.9	67.7	3.3	4.5	5.2
1980-81	834	759	1593	91.0	94.4	84.4	89.4	4.3	5.2	4.7
1990-91	962	908	1870	94.4	107.3	104.1	105.7	1.4	1.8	1.6
Tamil Nadu										
1960-61	444	192	636	43.2	41.8	18.3	30.1	–	–	–
1970-71	805	440	1245	54.7	56.6	31.5	44.2	6.1	8.6	6.9
1980-81	1148	694	1842	60.5	69.4	42.9	56.3	3.6	4.7	4.0
1990-91	1814	1344	3159	74.1	108.0	83.1	95.8	4.7	6.8	5.5
India										
1960-61	5074	1631	6705	32.1	33.2	11.3	22.5	–	–	–
1970-71	9426	3889	13315	41.2	46.3	19.9	33.4	6.4	9.1	7.1
1980-81	13934	6790	20724	48.7	54.3	28.6	41.9	4.0	5.7	4.5
1990-91	20844	12439	33283	59.7	73.4	46.1	60.1	4.1	6.2	4.9

Source: Same as Table 1.

rolls. At the national level, one out of every nine girls and one out of every three boys aged 11-13 years were on rolls in middle school classes in the year 1960-61 and the corresponding enrolment rates for boys and girls have increased to 73 and 46. Two important points emerge from table 2. Middle school enrolment ratios in Bihar and Uttar Pradesh were very low as compared to Kerala and Tamil Nadu for both boys and girls, particularly for girls. The gap between two sexes is much more in Bihar and Uttar Pradesh as compared to Kerala and Tamil Nadu.

Wastage in School Education

Wastage (including stagnation) is the greatest bane of school education, particularly primary education. This wastage includes drop outs or failure once or more than once before reaching the next class. In addition to total enrolment, it is necessary to achieve universal retention i.e., to ensure that the child enrolled in class I at the age of 6 continues to get promoted every year from class to class to remain in school till the age of 14.

In addition to total enrolment, it is necessary to achieve universal retention.

In the Third World Countries including India, the problem of enrolment and retention of children in school till the

completion of the primary level is very acute. Drop outs remain the policy maker's nightmare. It is more difficult to retain the children at school than to get them enrolled. In order to have a clear idea about the extent of wastage in elementary classes (I to VIII), a cohort approach was applied. In this approach a group of children in class I in a given year in followed to class II next year and in class III in the third year and so on. Of every 100 boys enrolled in class I in the year 1971-72, 67 were in class II in the year 1972-73; 39 per cent in class V in the year 1975-76 and only 26.6 per cent in class VIII in 1978-79. On the other hand, the respective retention rates of girls in class II, class V and class VIII were 65, 34, and 19. This indicates that in India one third of boys and half of the girls who were enrolled in Class I either dropped out or continued in the same class. Only one fourth of the cohort of boys enrolled in class I could reach class VIII, whereas, among the girls, only one fifth could do so.

In India one third of boys and half of the girls enrolled in Class I either dropped out or continued in the same class.

Two important points emerge from the analysis of the cohort approach: The wastage was more from class I to class II in Bihar and Uttar Pradesh, whereas, it is not the case with Kerala and Tamil Nadu. The retention rates from class I to class II for boys as well as girls for all India and the selected four states of India with the exception of Uttar Pradesh were more or less same. The respective retention rates for boys and girls for Bihar, Kerala, Tamil Nadu and India were 50, 105, 80 and 65. For Uttar Pradesh, the retention rates of boys and girls in class II were 64 and 55. Retention rate of 105 in class II in Kerala was probably due to repetition in class II. The possible reasons for the heavy wastage from class I to class II in Bihar and Uttar Pradesh could be the heterogeneity of the age composition of students in class I and over crowding. According to the educational statistics in India in 1970-71, only 34.6 per cent of children in class I belonged to the age and the remaining two-thirds to older age groups (Rama Rao, 1970). Generally, primary school teachers and other agencies identify all the children in the neighbourhood areas of the primary school who are in the school age group but do not go to school and enroll them in class I at the beginning of the school year. A very large number of these children stop going to school after a short period of time due to various reasons. As a result, these children remain virtually illiterates (Chattopadhyay, 1995).

It would be necessary to study in detail the intervention programmes (if any) introduced or implemented in Uttar Pradesh for the dramatic reduction in wastage from class I to class II and also to examine whether it would be feasible to implement same in Bihar.

It is gratifying to note that in the initial cohort of class I years 1975-76 as well as 1980-81, the percentage of wastage in education from class I to class II had decreased for both boys and girls for all India as well as in the selected states with the exception of Bihar state. For instance, the respective retention rates for boys from class I to class II in Uttar Pradesh state for the cohort years 1970-71, 1975-76, and 1980-81 were 63.9, 63.8 and 89.6, whereas, for girls the corresponding rates were 54.8, 57.8 and 85.8. The reduction in wastage from class I to class II in Uttar Pradesh state for the initial cohort of 1980-81 was remarkable; however, there was no significant change in Bihar in the past two decades. It would be necessary to study in detail the intervention programmes (if any) introduced or implemented in Uttar Pradesh for the dramatic reduction in wastage from class I to class II and also to examine whether it would be feasible to implement same in Bihar. For Kerala and Tamil Nadu only marginal increase was noticed during the three cohort years.

The retention rates for all India from class I to class VIII for the initial cohort year of 1971-81 were 39 and 26 respectively, whereas, for girls the rates were 34 and 19. There is clear cut distinction between developed and developing states. The retention rates of boys and girls in class V and class VIII for Kerala and Tamil Nadu were high compared to Bihar and Uttar Pradesh. The gap in retention rates between boys and girls had increased over classes—particularly after class V onwards for Bihar and Uttar Pradesh and such a gap between the sexes was not observed in Kerala.

It is a matter of some satisfaction that in the initial cohort of 1975-76 and 1980-81, there was considerable improvement in the school retention rates for all India as well as the four selected states. For instance, in Bihar, the retention rates of boys from class I to class VIII had increased from 16.5 in 1970-71 to 26.8 in 1980-81, whereas, the corresponding figures for girls were 8.8 and 20.3. In Kerala 90 per cent of boys and girls who joined class I in 1980-81 remained on the rolls in class VII in 1986-87 and the corresponding figures for boys and girls in Tamil Nadu were 61 and 50.

Table 3: Cohort Enrolment Retention rates for the classes I-VIII for India and selected states

	Class I	Class II	Class III	Class IV	Class V	Class VI	Class VII	Class VIII
Boys	**1971-72**	**72-73**	**73-74**	**74-75**	**75-76**	**76-77**	**77-78**	**78-79**
Bihar	100	52.4	–	31.9	21.2	24.9	18.7	16.5
Kerala	100	105.1	–	92.1	77.7	74.7	69.3	60.5
U.P.	100	63.9	–	44.3	34.7	29.5	25.8	23.3
T.N.	100	79.0	–	63.7	55.2	50.9	41.4	35.1
India	100	67.2	–	45.1	39.3	34.6	30.0	26.6
Girls								
Bihar	100	50.3	–	28.1	32.3	20.0	10.6	8.4
Kerala	100	107.2	–	93.0	81.0	73.1	68.6	58.9
U.P.	100	54.8	–	30.8	22.7	12.1	9.7	8.8
T.N.	100	81.3	–	58.4	47.5	37.8	30.6	25.3
India	100	65.3	–	40.6	33.8	26.5	22.5	19.3
Boys	**1975-76**	**76-77**	**77-78**	**78-79**	**79-80**	**80-81**	**81-82**	**82-83**
Bihar	100	62.4	54.4	43.8	36.4	30.3	26.2	23.2
Kerala	100	100.0	99.7	97.0	93.8	89.5	89.2	80.6
U.P.	100	63.8	45.7	39.0	33.2	34.9	32.4	30.9
T.N. 100	100	72.9	57.7	48.5	43.0	40.3	35.9	34.0
Girls								
Bihar	100	60.5	52.4	40.3	29.0	22.1	17.9	14.8
Kerala	100	99.7	98.4	95.5	89.4	85.5	85.5	77.7
U.P.	100	57.8	30.3	23.7	18.7	14.8	14.2	13.8
T.N.	100	87.3	78.2	76.3	61.2	44.4	37.3	30.9
India	100	68.3	52.0	43.5	36.5	31.0	27.7	25.0
Boys	**1980-81**	**81-82**	**82-83**	**83-84**	**84-85**	**85-86**	**86-87**	**87-88**
Bihar	100	58.4	49.0	40.6	36.5	30.5	26.8	N.A.
Kerala	100	104.0	100.3	99.4	98.5	94.4	89.5	N.A.
U.P.	100	89.6	81.5	73.7	65.4	57.0	52.4	N.A.
T.N.	100	88.1	85.6	86.2	78.7	74.5	60.6	N.A.
India	100	77.2	64.8	57.9	52.2	48.0	41.6	N.A.
Girls								
Bihar	100	56.6	47.9	39.2	32.7	25.1	20.3	N.A.
Kerala	100	102.9	99.7	98.1	96.1	92.6	90.3	N.A.
U.P.	100	85.8	76.9	66.7	56.1	43.1	40.5	N.A.
T.N.	100	89.5	85.9	84.5	74.7	60.9	50.5	N.A.
India	100	74.2	62.8	54.5	47.5	41.3	35.0	N.A.

Source: Computed from annual reports of Education in India.

Table 4: Age specific enrolment ratio by sex for all India and selected states

States	Enrolment Ratio in the age group 6-10					
	Boys		Girls		Total	
	1978	1986	1978	1986	1978	1986
Bihar	70.59	94.23	37.16	50.90	54.37	72.66
Kerala	86.49	87.20	85.47	86.11	85.99	86.66
Uttar Pradesh	72.82	75.02	30.00	45.83	52.42	61.13
Tamil Nadu	94.45	98.07	80.42	94.11	87.63	96.22
India	76.27	86.43	51.28	64.59	64.13	75.89
	Enrolment ratio in the age group 11-13					
Bihar	39.15	45.71	11.77	16.12	25.90	31.31
Kerala	79.61	85.91	73.80	85.51	76.75	85.71
Uttar Pradesh	44.72	52.28	12.25	25.60	29.62	39.85
Tamil Nadu	62.77	97.83	38.07	69.62	50.66	84.39
India	53.44	63.11	29.29	38.41	41.72	51.17

Source: NCERT IV & V All India Educational Surveys 1978 & 1986.

The possible reasons for high drop out rates among girls were: the traditional prejudice against girls education and the practice of early marriages in Bihar and Uttar Pradesh.

The possible reasons for high drop out rates among girls were: the traditional prejudice against girls education and the practice of early marriages.

Age Specific School Enrolment Ratio

The gross enrolment ratio includes over-age and under age children in the enrolment. In the absence of net enrolment ratios, age specific enrolment ratios[1] (ASER) may be useful for school enrolment projections. The age specific enrolment ratios give an idea about how may children in the particular age groups and enrolled into school.

Data on age specific enrolment rates was collected by the Fourth and Fifth all India Education Surveys carried out by NCERT. According to the Fifth All India Education Survey in India, three fourths of children in the age group 6-10 were attending school – 14 per cent of boys and 35 per cent of girls were not on the rolls (NCERT, 1978 & 1986).

There is a significant variation in the ASER of children in the age group 6-10 years between developed and developing states particularly with respect to girls. In the year 1986, the position of boys was relatively better in Bihar than in Uttar Pradesh. In Uttar Pradesh one fourth of the boys and half of the girls aged 6-10 years were not on rolls.

According to the estimates of Fifth All India Educational Survey, slightly more than fifty per cent of children in the age group 11-13 were attending school in India. The percentage of boys (63) and girls (38) attending school differ significantly. In Bihar and Uttar Pradesh around 50 per cent of boys and 25 per cent of girls were pursuing education, whereas, in Kerala and Tamil Nadu the age specific enrolment for boys ranged from 86 to 98 per cent and for girls between 70 and 85.

School Enrolment Projections

Ministry of Education considers all the children in the age groups 6-10 and 11-13 years as primary school-going age group, and middle school going age group respectively. For projecting the school going population, it is necessary to first estimate age-sex specific population projections. The base year for the population projections in this study is 1991. The age distribution of 1991 census has not yet been published and only total figures by sex are available. Hence, the percentage distribution of age-

1. Age specific enrolment ratios (ASER) give the enrolment ratio for a particular age group. The drawback of ASER is that the numerator consists of enrolment in different classes. Still ASER would be useful to planners and policy makers when projections of age specific enrolments for the age groups 6-10, 11-13 and 6-13 are required but not separately for primary and middle school levels.

sex population projected for the year 1991 by Standing Expert Committee projections is considered for the base year. In order to tally the 1991 projected population total with the 1991 census total counts, a correction factor is computed by taking the ratio of 1991 census total figures to 1991 projected population. The age–sex distribution of 1991 projected population is multiplied by a correction factor. The age-sex population distribution for the period 1991-2021 at five year intervals is projected by component method. The quinquennial age sex population for the five year age groups 0-20 are converted into single years by applying Sprague formula. From the projected single year age sex population, school going population i.e., 6-10, 11-13 years are computed (Rama Rao, 1996). The school going population by sex for the period 1996-2021 for India and selected four states is shown in table 5.

Projections of Age Specific School Enrolment Ratios

Data on age specific school enrolment by sex for the age groups 6-10, 11-13 years is collected by All India Educational Surveys for India. The trend of age-sex specific enrolment rates obtained in the past three educational surveys is utilised to estimate 1991 age specific enrolment ratios. The age-sex specific school enrolment and enrolment ratios for India and selected states for the year 1991 are computed. The age specific school enrolment ratio of boys aged 6-10 years for all India in the year 1991 was 88.9 and the corresponding rate for girls was 72. The respective ratios in the age group 6-10 for boys and girls for Bihar state were 94.7 and 60.9, for Kerala 90.9 and 88.6; and for Uttar Pradesh 80.0 and 58.0. The above findings clearly indicate that the gap between boys and girls in the age specific school enrolment ratios was very wide for Bihar and Uttar Pradesh, whereas, for Kerala and Tamil Nadu, there was hardly any difference in school enrolment ratios between the sexes. The age specific school enrolment rates of India for boys and girls in the age group 11-13 for the year 1991 were 70.1 and 48.4 respectively.

Analysis

In this paper, age specific school enrolment rates for boys and girls in the age groups 6-10, 11-13 years are projected for the period 1991-2021 at five year intervals under three assumptions:

Under assumption i it is assumed that the 1991 school enrolment ratios of boys and girls in the age group 6-10, 11-13 years would gradually increase to 100 by the target year 2001. Under assumption ii, that the year for the same target is 2011 and under assumption iii it is 2021. In this paper, 1991 age specific school enrolment ratios are projected as they are, without any corrections for under and above age groups. The school enrolment projections are estimated by multiplying the projected school enrolment ratios with corresponding projected school going population. The age specific school enrolment estimates for the ages 6-10, 11-13 and 6-13 years are obtained for India and selected states, namely, Bihar, Kerala, Tamil Nadu and Uttar Pradesh, separately by sex at five year interval for the periods 1996-2021 with the mentioned assumptions.

The respective number of boys and girls enrolled in school in the age group 6-10 years for Bihar state in 1991 were 54.75 lakhs and 32.24 lakhs which would, under assumption i by 2001, increase to 68.78 lakhs of boys and 64.52 lakhs of girls. The additional number of boys and girls required to achieve hundred per cent enrolment by 2001 under assumption i are 14.0 and 32.27 lakhs respectively. Under assumption ii, 19.5 lakhs of boys and 37.4 lakhs of girls have to be admitted by 2011 and under assumption iii, 14.3 lakhs of boys and 32.10 lakhs of girls have to be enrolled by 2021. Decline in the enrolment from 2011 year onwards is mainly due to reduction in fertility which results in decline in school going population.

It would be extremely difficult for Bihar and Uttar Pradesh to achieve hundred percent enrolment for boys and girls in the age group 6-10 years, particularly for girls, by 2001 as the present (1991) enrolment of girls has to be doubled by the end of this century to achieve the target. However Kerala and Tamil Nadu could attain the goal of Universal Primary Education by 1996. They would go on to reach the goal of universal elementary education for boys as well as girls by 2001 without much additional efforts. Two factors have contributed to this satisfying state of affairs: The age specific school enrolment ratios for boys and girls in the age group 11-13 years are already around 70 to 90 per cent in 1986. The fertility for these two states is declining at a fast rate resulting in a reduction in school going population.

According to the estimates worked out for Bihar under assumption i the enrolment of boys in the age group 11-13 years would have to increase from 15.78 lakhs in 1991 to 39.79 lakhs in 2001. The corresponding estimates under assumptions ii and iii would be 44.0 lakhs by 2011 and 43.7 lakhs by 2021 respectively. The additional number of boys and girls required to achieve hundred per cent enrolment by 2001 would be 24.0 and 30.0 lakhs respectively and to achieve this goal by 2011, the number would be 28.0 and 37.5 lakhs respectively; by 2021 under assumption iii it would be 27.9 and 32.7 lakhs respectively. In view of the past trends of enrolment for Bihar and Uttar Pradesh it appears that it would

Table 5: Projection of school going population (' 100) by sex as on 1st March, for the year 1996, 2001, 2016 and 2021

Year	6-10			11-13			6-13		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
					Bihar				
1996	65413	59543	124956	36564	33100	69664	101977	92643	194620
2001	68788	64522	133310	39791	36289	76080	108579	100811	209390
2006	72678	68296	140974	41418	39159	80577	114096	107455	221551
2011	74253	69710	143963	44003	41284	85287	118256	110994	229250
2016	73295	68634	141929	44516	41796	86312	117811	110430	228241
2021	69106	64354	133460	43711	40913	84624	112817	105267	218084
					Uttar Pradesh				
1996	98474	88343	186817	55400	49008	104408	153874	137351	291225
2001	106450	97036	203486	59698	53668	113366	166148	150704	316852
2006	112863	103404	216267	64538	58969	123507	177401	162373	339774
2011	114307	105128	219435	68091	62377	130468	182398	167505	349903
2016	110219	101628	211847	68272	62813	131085	178491	164441	342932
2021	100842	93184	194026	65281	60221	125502	166123	153405	319528
					Kerala				
1996	14726	14470	29196	9214	9002	18216	23940	23472	47412
2001	13345	12877	26222	8720	8592	17312	22065	21469	43534
2006	14251	13619	27870	7808	7492	15300	22059	21111	43170
2011	14741	14016	28757	8750	8361	17111	23491	22377	45868
2016	14965	14148	29113	8852	8411	17263	23817	22559	46376
2021	14883	13991	28874	8987	8487	17474	23870	22478	46348
					Tamil Nadu				
1996	27334	25933	53267	18510	17515	36025	45844	43448	89292
2001	24805	23386	48191	15763	14978	30741	40568	38364	78932
2006	25411	23917	49328	14625	13763	28388	40036	37680	77716
2011	26565	24971	51536	15409	14513	29922	41974	39484	81458
2016	27111	25501	52612	16033	15074	31107	43144	40575	83719
2021	26781	25200	51981	16264	15307	31571	43045	40507	83552
					India				
1996	542792	513107	1055899	314101	296443	610544	856893	809550	1666443
2001	548906	511888	1060794	326913	309115	636028	875819	821003	1696822
2006	565664	526728	1092392	328082	304869	632951	893746	831597	1725343
2011	563828	525691	1089519	340801	317593	658394	904629	843284	1747913
2016	540709	504591	1045300	335985	313418	649403	876694	818009	1694703
2021	489515	457247	946762	320698	299387	620085	810213	756634	1566847

Source: Rama Rao G. School age Projections for Major States in India: 1996-2021.

Table 6: School enrolment projection for age groups 6-10, 11-13 & 6-13 by sex for period 1996-2021

India		Enrolment Number (fig. in '00)						Additional Enrolment (fig. in '00)					
		Boys			Girls			Boys			Girls		
Year	Level	6-10	11-13	6-13	6-10	11-13	6-13	6-10	11-13	6-13	6-10	11-13	6-13
1996	I	512748	267158	779907	441502	219975	661478	56039	71997	128037	91245	91688	182933
	II	497726	243687	741414	405700	181741	587442	41017	48526	89544	55442	53454	108897
	III	492719	235863	728583	393766	168997	562764	36010	40702	76713	43508	40710	84219
2001	I	548906	326913	875819	511888	309115	821003	92197	131752	223949	161630	181828	342458
	II	518524	278055	796579	440454	229378	669832	61815	82894	144709	90196	101091	191287
	III	508396	261770	770166	416642	202800	619442	51687	66609	118296	66384	74513	140897
2006	II	550009	303566	853575	489975	265548	755524	93300	108405	201705	139717	137261	276979
	III	534354	279050	813404	453223	226228	679451	77645	83889	161534	102965	97941	200906
2011	II	563828	340801	904629	525691	317593	843284	107119	145640	252759	175433	189306	364739
	III	543022	306845	849868	476784	262977	739761	86313	111684	197998	126526	134690	261216
2016	III	530709	319247	849980	481119	286469	767588	74024	124086	198110	130861	158182	289043
2021	III	489515	320698	810213	457247	299387	756634	32806	125537	158343	106989	171100	278089
						Bihar							
	I	63689	28923	92613	47902	20459	68361	8935	13139	22075	15653	14223	29876
1996	II	62827	25103	87931	42082	14138	56220	8073	9319	17393	9833	7902	17735
	III	62540	23830	86370	40141	12031	52173	7786	8046	15832	7892	5795	13688
2001	I	68788	39791	108579	64522	36289	100811	14034	24006	38040	32273	30053	62326
	II	66975	31476	98452	51907	22430	74338	12221	15692	27913	19658	16194	35853
	III	66371	28705	95076	47703	17810	65513	11617	12921	24538	15454	11574	27029
2006	II	71720	37090	108811	61620	31681	93301	16966	21306	38273	29371	25445	54816
	III	70762	32763	103526	54944	24204	79148	16008	16979	32988	22695	17968	40663
2011	II	74253	44003	118256	69710	41284	110994	19499	28218	47717	37461	35048	72509
	III	72948	37873	110822	60624	30773	91397	18194	22089	40283	28275	24537	52912
2016	III	72651	41415	114066	64161	36475	100636	17897	25631	43528	31912	30239	62151
2021	III	69106	43711	112817	64354	40913	105267	14352	27926	42278	32105	34677	66782
						Tamil Nadu							
1996	I	27138	18355	45494	25331	15511	40842	–2687	2268	–419	–2020	3439	1418
	II	27040	18278	45319	25030	14509	39539	–2785	2191	–594	–2321	2437	116
	III	27008	18252	45260	24930	14175	39105	–2818	2165	–652	–2421	2103	–317
2001	I	24805	15763	40568	23386	14978	38364	–5021	–323	–5345	–3966	2906	–1059
	II	24627	15631	40259	22843	13264	36107	–5198	–455	–5654	–4508	1192	–3315
	III	24568	15587	40156	22662	12693	35355	–5257	–499	–5757	–4689	621	–4067

(Contd. table 6)

(Contd. table 6)

		Enrolment Number (fig. in '00)						Additional Enrolment (fig. in '00)					
		Boys			Girls			Boys			Girls		
Year	Level	6-10	11-13	6-13	6-10	11-13	6-13	6-10	11-13	6-13	6-10	11-13	6-13
2006	II	25320	14563	39884	23639	12975	36615	–4506	–1522	–6028	–3712	904	–2808
	III	25229	14502	39732	23362	12188	35550	–4596	–1583	–6180	–3989	116	–3873
2011	II	26565	15409	41974	24971	14513	39484	–3216	–677	–3939	–2381	2441	60
	III	26438	15323	41761	24584	13406	37990	–3387	–763	–4151	–2767	1334	–1432
Year	Level	6-10	11-13	6-13	6-10	11-13	6-13	6-10	11-13	6-13	6-10	11-13	6-13
2016	III	27046	15988	43034	25303	14499	39802	–2779	–98	–2878	–2048	2427	379
2021	III	26781	16264	43045	25200	15307	40507	–3045	177	–2868	–2152	3235	1083
						Kerala							
1996	I	14059	8680	22739	13645	8462	22108	262	1136	1399	527	1116	1643
	II	13726	8413	22139	13233	8192	21426	–70	869	799	115	846	961
	III	13615	8324	21939	13096	8102	21199	–181	780	599	–22	756	734
2001	I	13345	8720	22065	12877	8592	21469	–452	1176	724	–241	1245	1004
	II	12741	8214	20955	12143	8076	20220	–1055	671	–384	–975	730	–244
	III	12539	8046	20586	11899	7905	19804	–1257	503	–754	–1219	559	–660
2006	II	13928	7581	21510	13231	7267	20498	131	38	170	112	–78	33
	III	13606	7355	20961	12843	7042	19886	–190	–187	–378	–275	–303	–578
2011	II	14741	8750	23491	14016	8361	22377	943	1206	2150	897	1014	1912
	III	14296	8611	22708	13483	8026	21510	499	868	1368	365	680	1045
2016	III	14739	8681	23420	13879	8242	22122	942	1137	2080	760	896	1657
2021	III	14883	8987	23870	13991	8487	22478	1085	1443	2529	872	1140	2013
						Uttar Pradesh							
1996	I	88636	44951	133588	69804	32622	102426	15609	13316	28925	22976	17876	40852
	II	83717	39727	123445	60534	24429	84964	10690	8092	18782	13706	9683	23390
	III	82078	37985	120064	57445	21698	79143	9051	6350	15401	10617	6952	17590
2001	I	106450	59698	166148	97036	53668	150704	33422	28062	61485	50208	38922	89130
	II	95815	48438	144254	76672	35724	112397	22788	16803	39592	29845	20978	50832
	III	92270	44685	136956	69885	29742	99628	19243	13050	32294	23057	14996	38054
2006	II	107225	58452	165677	92554	49110	141665	34198	26816	61015	45726	34365	80091
	III	101587	52366	153954	81704	39252	120957	28560	20731	49291	34876	24506	59383
2011	II	114307	68091	182398	105128	62377	167505	41279	36455	77735	58300	47631	105931
	III	106694	59529	166223	90420	48473	138893	33667	27894	61561	43592	33727	77320
2016	III	136548	63979	170528	94519	55812	150331	33521	32344	65866	47691	41066	88757
2021	II	100842	6581	166123	93184	60221	153405	27814	33645	61460	46356	45475	91831

be difficult to achieve the goal of Universal Elementary Education for both the sexes by 2001; for boys it may be possible by 2011 but for girls only by 2021. The Government, Panchayat Raj, community leaders and Non-Governmental Organisations have to strive hard and introduce innovative programmes to improve the quality and quantity of education. In addition to formal school system the non-formal system has to be expanded, improved and strengthened to fulfil the goal of universal elementary education.

In addition to formal school system the non-formal system has to be expanded, improved and strengthened to fulfil the goal of universal elementary education.

Summary & Conclusion

There has been an all round increase in school enrolment of both the sexes in almost all the states of India in the last three decades. The level and rate of increase in enrolment ratios however differ significantly across the states. Although considerable progress in school enrolment has been achieved in Bihar and Uttar Pradesh in the past four decades, still one out of every five children in the age group 6-10 years was not enrolled in primary classes (I-V) in 1990-91. The gross enrolment ratio of boys and girls in primary classes (I-V) in Kerala and Tamil Nadu and also boys in Bihar and Uttar Pradesh have achieved hundred per cent. In Uttar Pradesh and Bihar, around fifty per cent of the girls were not attending primary schools in the year 1990-91.

The middle school enrolment ratio of both boys and girls not only differed significantly between developed and developing states but also the gap between both the sexes was much more in developing states as compared to the developed states. The disparities in the primary and middle school enrolment ratios between the sexes were much more in low female literacy states of Bihar and Uttar Pradesh as compared to high female literacy states of Kerala and Tamil Nadu.

The drop out rates particularly from class 1 to class 2 were more in Bihar, whereas, in Kerala and Tamil Nadu, they were only marginal. The following are some of the factors responsible for the low enrolment and high drop outs in educationally backward states:

- Poverty does not permit children to continue studies especially if the earnings of the children are necessary for maintaining the family. It has been observed that there is a sharp drop in attendance during peak agricultural seasons particularly during the months of October and April.
- The excessive involvement of children particularly girls in domestic work and sibling care does not permit them to attend school regularly leading to the final withdrawl from school.
- Community related factors like early marriage and taboo on movement of post pubertal girls are hinderances for girls' education. According to NFHS survey, 40 to 45 per cent of female children in the age group 15-19 were married in Uttar Pradesh, Madhya Pradesh and Bihar states in 1993.
- Preference is given for boy's education rather than for girl's because of the parents' lower educational and occupational aspirations for daughters as compared to sons. Girls' education is caught in the poverty-gender-caste/tribe combine triple jeopardy.
- Absence of separate girls' schools with in easy walking distance particularly in rural and remote tribal areas, and lack of women teachers are deterrents in the path of girls' education.
- It is possible to achieve universal primary education for boys and girls in Kerala and Tamil Nadu in the near future. In order to achieve the same goal in Bihar and Uttar Pradesh by 2001, the present (1991) enrolment of boys has to be increased by 20 per cent, while for girls it has to be doubled. For the boys in the age group 11-13 years it has to be increased by 2.5 times and for girls by five times. It would be extremely difficult for the formal system to fill this goal, particularly for girls, by 2011.
- Inspite of arduous efforts made by the Government, still a large number of children have not been able to complete their education up to VIII. It has been realized that universalization of primary and middle school for every child in the age group 6-13 cannot be achieved exclusively through formal education and non-formal education has to be supplemented to the regular school system. The present single point entry system must be replaced by multiple point entry system, under which older children aged 9, 11 and 14 can join a separate school.

It should be possible for older children to join the prescribed course at any time and also to complete the course in a shorter period. Part time courses should be

arranged to suit the convenience of children who are required to work.

It has been observed that there is a sharp drop in school attendance during the peak agricultural seasons, so vacation and examination months should be fixed to suit the needs of local people.

Tamil Nadu government introduced a Mid Day Meal programme for school children in the early 80's which brought about a dramatic reduction in the drop out rate among school children particularly from the lower socio-economic families. The Government of India recently introduced the Mid day meal Programme through out the country but the success mainly depends upon the honesty and integrity of the panchayat and community leaders and school authorities in implementing it.

Acute poverty and the custom of early marriage are main obstacles for the girl to continue her education in schools. It is a prerequisite for the government to develop proper strategies to raise the female age at marriage and also to introduce suitable financial incentive programmes to school going children coming from poor families. The Government of Tamil Nadu has introduced the Marriage Bonus Scheme to increase the female age at marriage. This bonus scheme can be modified by linking delayed female marriage with continuation of education in schools for a period of minimum eight years. This modified bonus scheme is worth trying and may help reduce the gap in school enrolment between the sexes.

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Focus

Resource Requirements of Education in India

Jandhyala B.G. Tilak

The Government of India promises to allocate six per cent of national income on education in India in the Ninth Five Year Plan onwards. Will it be feasible for the government to do so? Secondly, will it be adequate? The present paper is concerned with the second question. It presents detailed estimates of resource requirements for education sector upto the end of the century, i.e., 2000 AD. Both plan and non-plan expenditures are estimated. Besides presenting an analysis of recent past trends, using alternative assumptions, the study provides overall estimates of resource requirements of the education system, by levels of education. It has been found that the total expenditure on education will have to be stepped up significantly. On the whole, the estimated requirement of resources for education form about eight per cent of GNP in 2000 AD.

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The Context

The National Policy on Education (1986) has reiterated the nation's resolve, as recommended by the Education Commission (1966) and promised in the National Policy on Education 1968 by the Government of India, to invest six per cent of the national income in education from the Eighth Five Year Plan onwards. The Policy modified in 1992, while echoing the same commitment however, has postponed the execution to the ninth Five Year Plan. Realisation of the goal, compared to the present four per cent of gross national product (GNP) that is being invested in education, requires scaling up of the allocation of resources substantially in the next few years.

Secondly, the new economic policies, particularly structural adjustment policies and globalisation require increasingly more manpower. It is being realised both by the Government and the international agencies involved that the success of the programme critically depends upon human resource development, particularly education (Tilak, 1992). In other words, the new economic policies necessitate higher levels of investment in education.

Thirdly, the sustenance of the several programmes launched during the post 1986-Policy period requires significant increase in the allocation of resources to education, some of the notable programmes in this context being the operation blackboard, and the District Primary Education Programme (DPEP) in the case of elementary education, vocationalisation of secondary education, and improvement of quality in higher education and development of open learning systems.

Fourthly, as education was brought into the concurrent list, and as the National Policy on Education 1986 promised "meaningful and challenging partnership" between the centre and the states, both the central government and the states have a responsibility to

make special efforts to finance education and to realise the several goals, including the target of investing six per cent of national income in education.

How much resources should be allocated to education? Though a few earlier exercises on estimates of requirements of resources for education are available, the need for fresh exercises is obvious, as the earlier ones about a decade old, and the economic conditions have changed considerably during this period, and some of them are confined to elementary education[1]. Earlier attempts were also not as detailed and as technically sound as is attempted here. Following a 'normative' approach based on cost functions and enrolments, the present study makes an estimate of resource requirements of the education system in India by plan and non-plan categories of expenditures.

Role of the Finance Commission

The centre-state shares in financing education (and other sectors) depend upon their respective fiscal capacities. The level of spending on education in a state depends upon the amount of resource transferred from the centre to the states, besides its own budgetary resources. Such transfers from the central government take place through the Planning Commission, and the Finance Commission, besides other grants. The Planning Commission is normally concerned with plan allocations only, and the Finance Commission with the non-plan expenditures only. Non-plan expenditure on education has increased over the years, and presently forms more than 80 per cent of the total (plan plus non-plan) expenditure on education, and hence the role of the Finance Commission becomes increasingly important.

The Finance Commission has to recommend the allocation of resources to the states based on their requirements, as forecasted by the states themselves for already existing educational institutions. The states submit to the Finance Commission their requirements on the non-plan account for a five year period, keeping in view their own budgetary positions and the requirements of various sectors, including the education sector. The Finance Commission receives these detailed estimates from the states, in general "distrusts the state estimates which are based on solid experience", scrutinises them, and "provides its own estimates based on unspecified criteria differentially applied to different states" (Majumdar, 1987, p. 5).

It has been found that the Finance Commission has an important but restricted role to play in improving the mechanism of allocation of resources to the states, as it has to provide resources only for the maintenance of the system and structures that have already been created. Such expenditures, also known as 'committed expenditures', are in a sense given and cannot be altered significantly. Hence the degree of freedom the Finance Commission enjoys is limited (Tilak, 1989). This however does not mean that Finance Commission cannot contribute to improvement in the system, and that it cannot specifically consider equity, even though non-plan expenditure on educationally advanced states should be higher. Strengthening of the existing infrastructure and facilities, better maintenance of the existing schools and colleges which are treated as non-plan activities, also contribute to the upgradation of educational levels of the states (Panchamukhi, 1989). The Sixth Finance Commission for instance, gave some weightage to the backward states, taking into account the unfinished tasks in elementary education (Finance Commission, 1973). The Seventh Finance Commission considered poverty and the inverse of state domestic product (SDP) per capita while making its reassessments (Finance Commission, 1978). The Eighth Finance Commission included the requirements for upgradation of the standards of administration in education in its awards and allocated additional resources for clearing the backlog in the construction of school buildings and for providing teachers for single teacher schools (Finance Commission, 1983). The Ninth Finance Commission (1988) (in its first report referring to 1989-90) also provided for construction of school buildings in ten educationally backward states, according to the norms of the Operation Blackboard[2]. Thus the Finance Commission could play a significant role in pursuing equity in education (Tilak, 1989).

Finance Commission has an important but restricted role to play in improving the mechanism of allocation of resources to the sates, as it has to provide resources only for the maintenance of the system and structures that have already been created.

1. For a review of the earlier estimates, see Tilak and Varghese (1992), which was prepared for the National Development Committee on Literacy (Planning Commission, New Delhi).

2. But no such provision was made in the second report that referred to the period 1990-95. See Finance Commission (1990).

Strengthening of the existing infrastructure, better maintenance of the existing schools and colleges which are non-plan activities, also contribute to the upgradation of educational levels.

Earlier analyses (e.g., Tilak, 1989) have found that the allocations by the Finance Commissions correspond neither to the needs of the system, nor to the economic capacities of the states. The actual method adopted by the Finance Commission in recommending their awards is not known. But the general presumption is that the Commission has to work on a very limited data base and probably so does the Planning Commission. The present study attempts at filling up this gap, by providing very detailed data for about a decade beginning from 1980-81 and ending with the most recent period for which reliable statistics are available, 1991-92. The estimates are hoped to be useful to the Planning Commission in making proper allocation of resources to education in the Ninth Five Year Plan.

Generally, the Finance Commissions have been recommending their awards to fill the gap between the projected receipts and the expenditures in the revenue accounts of the states. In many cases these projections were mere extrapolations of the past trends. The Finance Commissions also seem to have followed no explicit criteria other than scrutinising these state forecasts, based on the requirements of the state governments under the revenue account to meet expenditure on administration and non-plan commitments or liabilities, provision for wages and salaries for government employees, commitments on interest charges on debts, transfer of resources to local organisations, maintenance of capital assets, maintenance of plan schemes completed in the earlier plan, and requirement of the backward states for upgrading standards in general education (Raghavan, 1982). However, the Ninth Finance Commission was required for the first time to adopt a "normative approach" on the requirements of various states and in the awards of the Finance Commission. Accordingly, the Ninth Finance Commission has made its recommendations in several sectors based on cost functions.

Scope & Methodology

The paper presents projections of requirement of resources for education in India. The projections are made state-wise, apart from presenting the projections for the country as a whole. The period ranges from the latest year for which data are available till the end of the present century, 2000 AD. The projections are made not only by levels of education, viz., elementary, secondary[3] and higher, but also by plan and non-plan (and total) categories of expenditure. Based on the available data on plan and non-plan expenditures on various levels of education in the country, two alternative types of projections of expenditure are attempted here:

First, assuming that the rate of growth realised during the 1980s continues during the 1990s, mere projections of likely trends in plan, non-plan and total expenditure on education are made until the end of the century, i.e., upto 1999-2000. These projections are also presented in current and constant prices, and both by levels of education. These estimates are referred to for convenience here as 'projections' or 'projected expenditures.' They can be treated as just extrapolations projecting the past into future. They are obviously oblivious of the recent policy changes and their effects on education. Neither the unit costs of education, nor the enrolments explicitly figure in these calculations. Hence these estimates may be viewed as the minimum levels the expenditure on education should grow to during the 1990s.

Alternatively, taking the unit costs of education explicitly, and the enrolment targets into account, the total requirements of expenditure on education can be estimated. For instance, the Ninth Finance Commission adopted a "normative approach" and estimated cost functions in making their awards. Following the same approach, the requirements of resources in each state are forecasted here, by estimating the following equation:[4]

$$\ln C = \alpha + \beta (E) + \varepsilon \qquad (1)$$

where ln C represents the unit costs in logarithmic (natural) form, E the enrolments, α the intercept, β the regression coefficient, and the error term.

Total resource requirements can also be estimated with the help of the following equation:

$$\ln TC = \alpha + \beta (E) + \varepsilon \qquad (2)$$

where TC represents the total costs of education, and other as mentioned in the case of Eq. 1.

3. It may be noted that secondary education refers to post-upper primary education, as upper primary education is already included in elementary education.

4. The Ninth Finance Commission has fitted a multiple regression equation that includes, besides enrolments or enrolment ratios, student-teacher ratio, salary differences, price differences and density of population as independent variables.

Equation 2 gives the total requirements directly. Taking the values of α and β and substituting the past enrolments in the equation by the enrolment targets, total costs can be estimated. On the other hand, in Eq. 1 the method is more elaborate. Both should yield same results. Equation 1 is used here.

Rates of growth are estimated in the present study through out, unless otherwise mentioned, using a semi-log regression equation of the form

$$Y = \alpha \beta^t \quad (3)$$

where Y is the expenditure on education for which the rate of growth is estimated, t the time period, α and β are respectively the constant and regression coefficient estimated, being defined as 1 + (r/100), r being the rate of growth.

Rates of growth estimated based on such an equation are generally believed to be better than those estimated by alternative methods (Gujarati, 1990).

The main source of data on plan and non-plan expenditure on education in India and in the states has been Analysis of Budget Expenditure of Education, published by the Ministry of Human Resource Development[5]. In the present context, this is supplemented by published and unpublished data collected from the Department of Education, Ministry of Human Resource Development. The data on enrolments are collected from Education in India and Selected Educational Statistics. GDP or GNP and state domestic product (SDP) deflators are derived from data on SDP available in current and constant prices in National Accounts Statistics (Central Statistical Organisation). Population projections are drawn from the Report of the Standing Committee of Experts on Population Projections (October 1989), and other Census reports.

Estimates for All-India

Trends in expenditure on education

Table 1 presents available statistics on the trends in expenditure on education in India, classified under plan, non-plan and total categories, and each subdivided into centre, state and total. They are also given by level of education – elementary, secondary, university and higher, technical, and total.

The rates of growth are very impressive, except in case of non-plan expenditure on elementary education. The expenditure of the central government on education increased at an annual rate of growth of 25 per cent and of the states by 17 per cent. The centre's plan expenditure on elementary and secondary education increased at very high rates of growth, 48 per cent and 72 per cent per year respectively. This is partly due to added emphasis being given by the centre for elementary education, particularly during the post-1986 Policy period. But all these are in current prices.

The figures in current prices are converted into constant (1980-81) prices with the help of national income deflators and are given in table 2. The trends in expenditures in 1980-81 prices are also impressive, even though the rates of growth are much less obviously, compared to those in current prices. The real rate of growth of expenditure in education has been more than eight per cent – 8.3 per cent in the expenditure of the states, and 15 per cent in the expenditure of the centre. Plan expenditure increased at a faster rate of growth, 14 per cent, compared to non-plan expenditure which increased at 7.25 per cent per year. Thus the real rate of growth in expenditure on education is higher than the growth in general economic indicators and also the population.

Both in current and constant prices, the rate of growth in non-plan expenditure by the centre on elementary education has been negative. A relatively low rate of growth in the same is expected, as states meet a very large part of the non-plan expenditure on education in general and elementary education in particular, and hence the central expenditure could be small. But a negative rates of growth is not expected. Between 1984-85 and 1989-90, the centre's allocation to non-plan expenditure on elementary education became very insignificant. It is only since the beginning of the 1990s, a reversal in the trend could be noted.

Projections of expenditure on education

As mentioned, two types of alternative estimates on projections are made. First, a linear trend is fitted into the future, and these estimates are given in table 3 in current prices, and in table 4 in constant prices. According to these estimates, the total expenditure on education will have to increase to Rs. 17 thousand crores in 2000 AD in 1980-81 prices from about Rs. 7 thousand crores in 1991-92, i.e., the total expenditure on education will have to be more than doubled.

5. A subsequent publication, viz., Budgetary Resources for Education 1951-52 to 1993-94 (MHRD, 1995) gives data on government expenditure on education in detail. However, this publication does not give us details on total government expenditure (including all Ministries) on education by levels. It only gives the Department of Education's expenditure on education by level and the expenditure of other Ministries on education in lump sum.

Table 1: Expenditure on education in India (Rs. in crores) at current prices

Year	Plan			Non-Plan			Total (Plan + Non-Plan)		
	Centre	State	Total	Centre	State	Total	Centre	State	Total
Elementary									
1980-81	4.8	86.1	91.0	4.10	1442.2	1446.3	8.9	1528.3	1537.3
1981-82	7.5	96.0	103.4	3.19	1554.1	1557.3	10.7	1650.1	1660.8
1982-83	17.5	141.5	158.9	5.49	2007.7	2013.2	23.0	2149.1	2172.1
1983-84	17.2	201.7	218.8	6.32	2250.1	2256.5	23.5	2451.8	2475.3
1984-85	25.5	238.1	263.6	3.36	2588.0	2591.4	28.8	2826.2	2855.0
1985-86	23.0	243.6	266.7	0.68	3181.0	3181.6	23.7	3424.6	3448.3
1986-87	32.6	313.6	346.2	0.54	3534.9	3535.5	33.2	3848.5	3881.7
1987-88	212.6	360.3	572.9	0.76	4283.1	4283.9	213.4	4643.4	4856.7
1988-89	239.2	474.8	714.0	0.50	4825.3	4825.8	239.7	5300.1	5539.8
1989-90	216.3	749.8	966.1	0.62	5921.6	5922.2	217.0	6671.3	6888.3
1990-91	229.6	677.8	907.4	2.05	6915.2	6917.2	231.7	7593.0	7824.6
1991-92	278.8	717.5	996.3	2.08	7048.8	7050.9	280.9	7766.3	8047.2
Growth Rate (1980-81 to 1991-92)	47.70	22.14	25.86	–13.93	16.18	16.18	41.91	17.35	17.35
Secondary									
1980-81	1.5	43.9	45.4	19.18	972.3	991.5	20.7	1016.3	1036.9
1981-82	1.9	65.5	67.3	21.80	1136.3	1158.1	23.7	1201.7	1225.4
1982-83	2.9	90.2	93.0	30.64	1388.9	1419.6	33.5	1479.1	1512.6
1983-84	3.2	134.1	137.3	39.78	1551.4	1591.2	42.9	1685.5	1728.4
1984-85	7.4	180.0	187.3	45.46	1787.3	1832.7	52.8	1967.2	2020.0
1985-86	14.9	84.6	99.5	66.54	2127.9	2194.4	81.5	2212.4	2293.9
1986-87	37.8	126.7	164.5	92.67	2344.0	2436.6	130.5	2470.6	2601.1
1987-88	146.5	164.7	311.1	98.07	2810.4	2908.5	244.5	2975.1	3219.6
1988-89	186.1	281.5	467.5	126.29	3384.2	3510.5	312.4	3665.7	3978.0
1989-90	173.0	436.2	609.3	144.29	3967.9	4112.2	317.3	4404.1	4721.5
1990-91	169.2	364.7	533.9	214.36	4491.9	4706.2	383.6	4856.6	5240.1
1991-92	218.0	429.6	647.7	237.85	4727.1	4964.9	455.9	5156.7	5612.6
Growth Rate (1980-81 to 1991-92)	71.60	20.92	27.12	27.12	16.18	16.18	36.34	16.18	17.35
University & Higher									
1980-81	32.5	43.1	75.6	66.3	341.8	408.1	98.8	384.9	483.7
1981-82	40.7	41.6	82.3	69.0	426.5	495.5	109.7	468.1	577.8
1982-83	46.4	61.1	107.6	79.7	493.9	573.6	126.1	555.1	681.2
1983-84	48.8	70.4	119.2	92.4	565.4	657.8	141.2	635.8	777.0
1984-85	74.4	99.6	174.0	106.7	643.0	749.7	181.1	742.6	923.7
1985-86	82.6	62.7	145.3	123.3	778.1	901.4	205.9	840.8	1046.7

(Contd. Table 1)

(Contd. Table 1)

Year	Plan			Non-Plan			Total (Plan + Non-Plan)		
	Centre	State	Total	Centre	State	Total	Centre	State	Total
1986-87	108.3	72.0	180.3	144.9	875.6	1020.5	253.1	947.6	1200.7
1987-88	146.6	74.4	221.0	183.3	1040.5	1223.8	329.9	1114.9	1444.8
1988-89	143.9	110.0	253.9	1147.7	418.7	1566.4	562.6	1257.7	1820.3
1989-90	150.1	141.0	291.1	336.2	1582.6	1918.8	486.2	1723.7	2209.9
1990-91	128.8	121.9	250.7	336.1	1696.3	2032.4	464.9	1818.2	2283.0
1991-92	152.3	123.5	275.8	320.9	1821.7	2142.6	473.2	1945.1	2418.4
Growth Rate (1980-81 to 1991-92)	16.18	10.52	13.88	19.72	16.88	17.35	18.35	16.88	16.88
Technical									
1980-81	16.2	15.3	31.5	33.4	72.1	105.5	49.6	87.3	137.0
1981-82	19.9	19.1	39.0	38.4	77.3	115.7	58.3	96.4	154.7
1982-83	30.8	24.5	55.3	43.9	92.5	136.4	74.7	117.0	191.7
1983-84	28.9	33.4	62.2	51.3	100.1	151.4	80.1	133.5	213.6
1984-85	40.0	44.9	84.9	61.2	115.7	176.9	101.2	160.6	261.7
1985-86	75.3	44.0	119.2	74.1	152.1	226.2	149.4	196.0	345.4
1986-87	68.5	64.6	133.1	84.2	159.9	244.0	152.7	224.5	377.2
1987-88	167.4	60.5	228.9	96.1	205.3	301.4	263.5	265.8	529.3
1988-89	167.9	77.7	245.6	114.2	217.3	331.5	282.1	295.1	577.2
1989-90	136.3	102.9	239.2	142.4	268.7	411.1	278.7	371.5	650.3
1990-91	158.7	121.7	280.4	154.0	333.0	487.0	312.7	454.6	767.3
1991-92	183.9	180.7	364.6	160.4	366.0	526.4	344.3	546.7	891.0
Growth Rate (1980-81 to 1991-92)	27.12	23.37	25.86	16.18	16.18	16.18	20.92	18.53	19.72
Total									
1980-81	69.5	220.9	290.3	154.4	2929.5	3084.0	223.9	3150.4	3374.3
1981-82	85.8	262.4	348.2	154.9	3286.9	3441.9	240.7	3549.4	3790.1
1982-83	124.3	367.8	492.1	178.3	4092.1	4270.3	302.6	4459.9	4762.5
1983-84	139.7	498.0	637.7	213.0	4603.8	4816.8	352.7	5101.7	5454.5
1984-85	202.3	635.2	837.5	243.1	5273.2	5516.3	445.3	5908.5	6353.8
1985-86	246.5	513.5	759.9	282.0	6415.0	6697.0	528.5	6928.5	7457.0
1986-87	302.8	676.4	979.2	345.4	7125.7	7471.1	648.2	7802.1	8450.3
1987-88	771.6	749.7	1521.4	430.1	8478.7	8908.8	1201.8	9228.4	10430.2
1988-89	884.7	1080.1	1964.8	710.8	9733.1	10443.9	1595.5	10813.2	12408.7
1989-90	831.0	1576.9	2407.9	681.1	11955.3	12636.3	1512.1	13532.1	15044.2
1990-91	885.6	1453.6	2339.2	762.2	14199.3	14961.5	1647.8	15653.0	17300.7
1991-92	1030.7	1654.9	2685.6	771.2	14920.9	15692.1	1801.9	16575.8	18377.7
Growth Rate (1980-81 to 1991-92)	31.00	19.72	23.37	18.53	16.18	16.18	24.61	17.35	17.35

Note: Rate of Growth (%) estimated on the basis of Semi-Log equation.

Table 2: Expenditure on education in India (Rs. in crores) at 1980-81 prices

Year	Plan			Non-Plan			Total (Plan + Non-Plan)		
	Centre	State	Total	Centre	State	Total	Centre	State	Total
Elementary									
1980-81	4.8	86.1	91.0	4.10	1442.2	1446.3	8.9	1528.3	1537.3
1981-82	6.8	87.3	94.1	2.90	1413.5	1416.4	9.7	1500.8	1510.4
1982-83	14.8	119.4	134.1	4.63	1693.9	1698.6	19.4	1813.3	1832.7
1983-84	13.3	156.7	170.0	4.91	1748.1	1753.0	18.2	1904.8	1923.0
1984-85	18.4	172.2	190.6	2.43	1871.7	1874.1	20.8	2043.9	2064.8
1985-86	15.5	164.3	179.8	0.46	2156.0	2156.4	16.0	2309.7	2325.7
1986-87	20.6	198.1	218.6	0.34	2232.4	2232.7	20.9	2430.5	2451.4
1987-88	123.0	208.4	331.4	0.44	2478.1	2478.5	123.4	2686.5	2810.0
1988-89	128.2	254.4	382.8	0.27	2586.6	2586.9	128.5	2841.2	2969.7
1989-90	107.0	370.9	478.0	0.31	2929.7	2930.0	107.3	3300.6	3407.9
1990-91	102.3	302.1	404.4	0.91	3081.5	3082.4	103.2	3383.6	3486.8
1991-92	109.7	282.2	391.9	0.82	2772.4	2773.2	110.5	3054.6	3165.1
Growth Rate (1980-81 to 1991-92)	36.94	12.75	16.18	-20.55	7.25	7.25	31.00	8.33	8.33
Secondary									
1980-81	1.5	43.9	45.4	19.2	972.3	991.5	20.7	1016.3	1036.9
1981-82	1.7	59.5	61.2	19.8	1033.4	1053.2	21.5	1093.0	1114.5
1982-83	2.4	76.1	78.5	25.9	1171.9	1197.7	28.3	1248.0	1276.2
1983-84	2.5	104.1	106.6	30.9	1205.3	1236.2	33.3	1309.4	1342.8
1984-85	5.3	130.1	135.5	32.9	1292.6	1325.4	38.2	1422.7	1460.9
1985-86	10.1	57.0	67.1	44.9	1435.1	1480.0	54.9	1492.1	1547.1
1986-87	23.9	80.0	103.9	58.5	1480.3	1538.8	82.4	1560.3	1642.7
1987-88	84.7	95.3	180.0	56.7	1626.0	1682.8	141.5	1721.3	1862.8
1988-89	99.7	150.9	250.6	67.7	1814.1	1881.8	167.4	1695.0	2132.4
1989-90	85.6	215.8	301.4	71.4	1963.1	2034.5	157.0	2178.9	2335.9
1990-91	75.4	162.5	237.9	95.5	2001.6	2097.2	170.9	2164.2	2335.1
1991-92	85.7	169.0	254.7	93.5	1859.2	1952.2	179.3	2028.2	2207.5
Growth Rate (1980-81 to 1991-92)	58.41	11.63	17.35	17.35	7.25	7.25	25.86	0.07	0.08
University & Higher									
1980-81	32.5	43.1	75.6	66.3	341.8	408.1	98.8	384.9	483.7
1981-82	37.0	37.8	74.8	62.8	387.9	450.7	99.8	425.8	525.5
1982-83	39.2	51.6	90.8	67.2	416.7	484.0	106.4	468.3	574.7
1983-84	37.9	54.7	92.6	71.8	439.3	511.0	109.7	493.9	603.6
1984-85	53.8	72.0	125.8	77.2	465.0	542.2	131.0	537.1	668.1
1985-86	55.7	42.3	98.0	83.2	524.8	607.9	138.9	567.1	706.0

(Table 2 Contd.)

(Table 2 Contd.)

Year	Plan			Non-Plan			Total (Plan + Non-Plan)		
	Centre	State	Total	Centre	State	Total	Centre	State	Total
1986-87	68.4	45.5	113.8	91.5	553.0	644.5	159.9	598.4	758.3
1987-88	84.8	43.0	127.9	106.0	602.0	708.1	190.9	645.1	835.9
1988-89	77.2	59.0	136.1	224.4	615.2	839.7	301.6	674.2	975.8
1989-90	74.2	69.8	144.0	166.3	783.0	949.3	240.6	852.8	1093.3
1990-91	57.4	54.3	111.7	149.8	755.9	905.7	207.2	810.2	1017.4
1991-92	59.9	48.6	108.5	126.2	716.5	842.7	186.1	765.0	951.2
Growth Rate (1980-81 to 1991-92)	7.25	2.02	5.13	10.52	7.25	8.33	9.42.	7.25	7.25
Technical									
1980-81	16.2	15.3	31.5	33.4	72.1	105.5	49.6	87.3	137.0
1981-82	18.1	17.3	35.4	35.0	70.3	105.3	53.1	87.6	140.7
1982-83	26.0	20.7	46.7	37.1	78.0	115.1	63.1	98.7	161.7
1983-84	22.4	25.9	48.3	39.8	77.8	117.6	62.2	103.7	165.9
1984-85	28.9	32.4	61.4	44.2	83.7	127.9	73.2	116.1	189.3
1985-86	50.8	29.6	80.4	50.0	102.6	152.6	100.8	132.2	233.0
1986-87	43.3	40.8	84.1	53.2	100.9	154.1	96.4	141.8	238.2
1987-88	96.9	35.0	131.9	55.6	118.8	174.4	152.4	153.8	306.2
1988-89	90.0	41.7	131.7	61.2	116.5	177.7	151.2	158.2	309.4
1989-90	67.4	50.9	118.3	70.5	132.9	203.4	137.9	183.8	321.7
1990-91	70.7	54.2	124.9	68.6	148.4	217.0	139.3	202.6	341.9
1991-92	72.3	71.1	143.4	63.1	143.9	207.0	135.4	215.0	350.4
Growth Rate (1980-81 to 1991-92)	17.35	13.88	16.18	7.25	7.25	7.25	11.63	9.42	10.52
Total									
1980-81	69.5	220.9	290.3	154.4	2929.5	3084.0	223.9	3150.4	3374.3
1981-82	78.0	238.7	316.7	140.9	2989.4	3130.4	219.0	3228.1	3447.1
1982-83	104.9	310.3	415.2	150.4	3452.6	3603.0	255.3	3762.9	4018.2
1983-84	108.5	386.9	495.4	165.5	3576.6	3742.1	274.0	3963.5	4237.6
1984-85	146.3	459.4	605.7	175.8	3813.7	3989.5	322.1	4273.1	4595.2
1985-86	166.2	346.3	512.5	190.2	4326.6	4516.8	356.4	4672.9	5029.3
1986-87	191.3	427.1	618.4	218.1	4500.1	4718.2	409.4	4927.2	5336.6
1987-88	446.4	433.8	880.2	248.9	4905.5	5154.4	695.3	5339.3	6034.6
1988-89	474.2	579.0	1053.2	381.0	5217.5	5598.6	855.3	5796.5	6651.8
1989-90	411.1	780.1	1191.3	336.9	5914.8	6251.8	748.1	6695.0	7443.0
1990-91	394.6	647.8	1042.4	339.6	6327.4	6667.1	734.3	6975.2	7709.5
1991-92	405.4	650.9	1056.3	303.3	5868.6	6171.9	708.7	6519.5	7228.2
Growth Rate (1980-81 to 1991-92)	20.92	10.52	13.88	9.42	7.25	7.25	15.03	8.33	8.33

Note: Rate of Growth (%) estimated on the basis of Semi-Log equation.

Table 3: Projected expenditure on education in India at current prices. Based on actual growth rate during 1980-81 to 1991-92 (Rs. in crores)

Year	Plan			Non-Plan			Total (Plan + Non-Plan)		
	Centre	State	Total	Centre	State	Total	Centre	State	Total
Elementary									
1992-93	584.1	1012.3	1596.4	0.66	8604.2	8604.8	550.0	10404.6	10954.6
1993-94	862.6	1236.5	2099.1	0.57	9996.6	9997.2	780.6	12209.9	12990.4
1994-95	1274.1	1510.2	2784.3	0.49	11614.4	11614.9	1107.7	14328.4	15436.1
1995-96	1881.8	1844.6	3726.4	0.42	13494.0	13494.4	1571.8	16814.6	18386.4
1996-97	2779.4	2253.0	5032.4	0.36	15677.8	15678.1	2230.5	19732.1	21962.6
1997-98	4105.2	2751.8	6856.9	0.31	18215.0	18215.3	3165.3	23155.8	26321.1
1998-99	6063.2	3361.0	9424.3	0.27	21162.8	21163.1	4491.8	27173.6	31665.3
1999-2000	8955.3	4105.2	13060.5	0.23	24587.7	24587.9	6374.1	31888.5	38262.6
Secondary									
1992-93	757.5	523.2	1280.7	340.36	6002.9	6343.3	765.1	6374.1	7139.2
1993-94	1299.8	632.7	1932.5	432.68	6974.4	7407.1	1043.1	7405.7	8448.8
1994-95	2230.5	765.1	2995.6	550.04	8103.1	8653.1	1422.3	8604.2	10026.4
1995-96	3827.6	925.2	4752.8	699.24	9414.4	10113.7	1939.1	9996.6	11935.7
1996-97	6568.2	1118.8	7687.0	888.91	10938.0	11826.9	2643.9	11614.4	14258.3
1997-98	11271.1	1352.9	12624.0	1130.03	12708.2	13838.2	3604.7	13494.0	17098.7
1998-99	19341.3	1636.0	20977.3	1436.55	14764.8	16201.3	4914.8	15677.8	20592.6
1999-2000	33189.9	1978.3	35168.2	1826.21	17154.2	18980.4	6700.9	18215.0	24915.9
University & Higher									
1992-93	221.4	151.4	372.8	502.7	2143.1	2645.8	727.8	2416.3	3144.1
1993-94	257.2	167.3	424.6	601.8	2489.9	3091.8	862.6	2807.4	3670.0
1994-95	298.9	184.9	483.8	720.5	2892.9	3613.4	1022.5	3261.7	4284.2
1995-96	347.2	204.4	551.6	862.6	3361.0	4223.7	1212.0	3789.5	5001.5
1996-97	403.4	225.9	629.3	1032.8	3904.9	4937.7	1436.6	4402.8	5839.4
1997-98	468.7	249.6	718.4	1236.5	4536.9	5773.4	1702.8	5115.3	6818.1
1998-99	544.6	275.9	820.5	1480.3	5271.1	6751.4	2018.3	5943.2	7961.5
1999-2000	632.7	304.9	937.6	1772.2	6124.2	7896.4	2392.3	6905.0	9297.3
Technical									
1992-93	311.1	202.4	513.4	200.3	403.4	603.8	492.7	639.1	1131.8
1993-94	395.4	249.6	645.1	232.8	468.7	701.5	595.9	757.5	1353.3
1994-95	502.7	308.0	810.7	270.4	544.6	815.0	720.5	897.8	1618.4
1995-96	639.1	379.9	1019.0	314.2	632.7	946.9	871.3	1064.2	1935.5
1996-97	812.4	468.7	1281.1	365.0	735.1	1100.1	1053.6	1261.4	2315.1
1997-98	1032.8	578.2	1611.0	424.1	854.1	1278.2	1274.1	1495.2	2769.3
1998-99	1312.9	713.4	2026.3	492.7	992.3	1485.0	1540.7	1772.2	3313.0
1999-2000	1669.0	880.1	2549.1	572.5	1152.9	1725.4	1863.1	2100.6	3963.8
Total									
1992-93	1790.1	2100.6	3890.7	1022.5	17500.8	18523.3	2835.6	21590.3	24425.9
1993-94	2344.9	2514.9	4859.8	1212.0	20333.0	21545.0	3533.3	25336.5	28869.8
1994-95	3071.7	3010.9	6082.7	1436.6	23623.6	25060.1	4402.8	29732.6	34135.4
1995-96	4023.9	3604.7	7628.6	1702.8	27446.7	29149.4	5486.2	34891.6	40377.8
1996-97	5271.1	4315.6	9586.8	2018.3	31888.5	33906.8	6836.3	40945.6	47781.9
1997-98	6905.0	5166.8	12071.7	2392.3	37049.1	39441.4	8518.5	48050.1	56568.7
1998-99	9045.3	6185.7	15231.0	2835.6	43044.9	45880.5	10614.8	56387.3	67002.1
1999-2000	11849.0	7405.7	19254.7	3361.0	50011.1	53372.1	13226.8	66171.2	79398.0

Table 4: Projected expenditure on education in India at 1980-81 prices. Based on actual growth rate during 1980-81 to 1991-92 (Rs. in crores)

Year	Plan			Non-Plan			Total (Plan + Non-Plan)		
	Centre	State	Total	Centre	State	Total	Centre	State	Total
Elementary									
1992-93	223.6	387.6	611.2	0.25	3294.5	3294.7	210.6	3983.8	4194.4
1993-94	304.9	437.0	741.9	0.20	3533.3	3533.5	275.9	4315.6	4591.5
1994-95	415.7	492.7	908.5	0.16	3789.5	3789.7	361.4	4675.1	5036.5
1995-96	566.8	555.6	1122.4	0.13	4064.3	4064.4	473.4	5064.4	5537.9
1996-97	772.8	626.4	1399.2	0.10	4359.0	4359.1	620.2	5486.2	6106.4
1997-98	1053.6	706.3	1759.9	0.08	4675.1	4675.2	812.4	5943.2	6755.6
1998-99	1436.6	796.3	2232.9	0.06	5014.1	5014.1	1064.2	6438.2	7502.4
1999-2000	1958.6	897.8	2856.5	0.05	5377.6	5377.7	1394.1	6974.4	8368.5
Secondary									
1992-93	17.8	200.3	218.2	130.3	2298.5	2428.8	292.9	2440.6	2733.6
1993-94	28.2	223.6	251.9	152.9	2465.1	2618.1	368.7	2617.6	2986.3
1994-95	44.7	249.6	294.3	179.5	2643.9	2823.3	464.1	2807.4	3271.4
1995-96	70.8	278.7	349.5	210.6	2835.6	3046.2	584.1	3010.9	3595.0
1996-97	112.2	311.1	423.2	247.2	3041.2	3288.3	735.1	3229.2	3964.3
1997-98	177.7	347.2	524.9	290.0	3261.7	3551.7	925.2	3463.4	4388.6
1998-99	281.5	387.6	669.1	340.4	3498.2	3838.5	1164.4	3714.5	4878.9
1999-2000	445.9	432.7	878.5	399.4	3751.8	4151.2	1465.6	3983.8	5449.4
University & Higher									
1992-93	84.8	58.0	142.7	192.5	820.6	1013.1	278.7	925.2	1203.9
1993-94	90.9	59.1	150.1	212.7	880.1	1092.8	304.9	992.3	1297.2
1994-95	97.5	60.3	157.9	235.1	943.9	1179.0	333.6	1064.2	1397.8
1995-96	104.6	61.6	166.1	259.8	1012.3	1272.1	365.0	1141.4	1506.4
1996-97	112.2	62.8	175.0	287.1	1085.7	1372.9	399.4	1224.1	1623.6
1997-98	120.3	64.1	184.4	317.3	1164.4	1481.8	437.0	1312.9	1749.9
1998-99	129.0	65.4	194.4	350.7	1248.9	1599.6	478.2	1408.1	1886.3
1999-2000	138.4	66.7	205.1	387.6	1339.4	1727.0	523.2	1510.2	2033.4
Technical									
1992-93	129.0	78.3	207.3	76.7	154.5	231.2	188.7	244.7	433.4
1993-94	151.4	89.1	240.5	82.3	165.7	247.9	210.6	267.7	478.3
1994-95	177.7	101.5	279.2	88.2	177.7	265.9	235.1	292.9	528.0
1995-96	208.5	115.6	324.1	94.6	190.6	285.2	262.4	320.5	583.0
1996-97	244.7	131.6	376.3	101.5	204.4	305.9	292.9	350.7	643.7
1997-98	287.1	149.9	437.1	108.9	219.2	328.1	327.0	383.8	710.8
1998-99	337.0	170.7	507.7	116.7	235.1	351.8	365.0	419.9	784.9
1999-2000	395.4	194.4	589.9	125.2	252.1	377.4	407.5	459.4	866.9
Total									
1992-93	685.4	804.3	1489.7	391.5	6700.9	7092.4	1085.7	8266.8	9352.5
1993-94	828.8	888.9	1717.7	428.4	7186.8	7615.2	1248.9	8955.3	10204.2
1994-95	1002.2	982.4	1984.6	468.7	7707.9	8176.6	1436.6	9701.2	11137.7
1995-96	1212.0	1085.7	2297.7	512.9	8266.8	8779.6	1652.4	10509.1	12161.6
1996-97	1465.6	1199.9	2665.5	561.2	8866.2	9427.3	1900.7	11384.4	13285.2
1997-98	1772.2	1326.1	3098.3	614.0	9509.1	10123.1	2186.4	12332.6	14519.0
1998-99	2143.1	1465.6	3608.7	671.8	10198.5	10870.4	2514.9	13359.7	15874.7
1999-2000	2591.5	1619.7	4211.2	735.1	10938.0	11673.1	2892.9	14472.4	17365.3

The second type of estimates referred to as 'requirements' are made based on more sound basis – enrolment projections and unit costs of education.

Enrolment projections

Enrolment projections are made for elementary, secondary and higher education, and all the three sets have to be estimated following different methods. The actual enrolments for the past and the projections for the future are given in table 5. In case of elementary education, instead of making any fresh projections, since the target has been universalisation of elementary education by the turn of the century, population in age-group 6-14 as estimated by the Population Projections Committee for 2000 AD is taken, and interpolations are made for intermediate years.

With increased emphasis on elementary education, it is likely that the growth in elementary education will have a positive effect on secondary education. Accordingly, projections have been made based upon realised growth in the recent past. But it is not a simple extrapolation. The method adopted to project enrolment at the secondary level of education is as follows: we have actual enrolment for 13 years period beginning from 1980-81 onwards. The ratios between enrolment at the elementary and secondary levels have been worked out for the 13-year period beginning from 1980-81 to 1991-92. In a restricted sense, they can be called 'inter-level/stage transition ratios', though transition ratios normally refer to the ratios between enrolment in the final grade of a given level of education, and the enrolment in the first grade of the next cycle of education.

It is clear that these ratios are not static. They do change significantly.[6] It is assumed that these ratios will grow during the remaining period of the decade at the same rate as was realised in the past, i.e., the rate of growth in the ratio between enrolment at the elementary and secondary level of education for the past is taken as the basis to make projections for the period form 1992-93 to the year 1999-2000.

This method of projecting enrolments in secondary education may have its own limitations. However one of the positive points in its favour is the fact that enrolments in secondary level are not seen independent of enrolments in elementary level. Even when changes in the ratio may not be considerable, the change in student numbers can be large if the goal of universalisation of elementary education is achieved. Given the recent focus on the elementary education, it is expected that enrolments and retention at the elementary level will improve. Such improvements may reflect in increased enrolments in secondary education.

Given the recent focus on the elementary education, it is expected that enrolments and retention at the elementary level will improve. Such improvements may reflect in increased enrolments in secondary education.

In case of projections of enrolments in higher education,[7] the data are based on Select Educational Statistics, though it is feared that this probably does not include all higher education.[8] The realised rates of growth in higher education during the 1980s are reasonably high. Given the intentions of the government to contain the growth in higher education, it is felt that the best assumption that can be made in this context is to allow the same rate of growth for the remaining period of the decade. Assuming the same enrolment, projections are made in higher education. The enrolment projections estimated thus are given in table 5.

Resource requirements: forecasts

On the basis of per student expenditure on education in 1980-81 prices (table 6) and the enrolments trends in the past (table 5), the cost function (Eq. 1) is estimated. The results of the estimated equations are given in table 7. With the help of these results and enrolment projections, the requirement of resources are estimated, which are given in table 8. A few important points are strikingly clear:

The country has to spend Rs. 14 thousand crores in 2000 AD on elementary education in 1980-81

6. The ratios are also not the same across all the states.

7. The available statistics on higher education are listed under two categories, viz., 'university and higher', and technical education. Tables 1 to 4 refer to these two types distinctly. But while estimating the requirements of higher education, some of the required data are available in aggregate form. So we were unable to maintain subsequently the distinction between the two types of higher education, however important it is. For the sake of simplicity, 'higher' education is referred to include both, while 'university and higher' refers to non-technical higher education.

8. There exist sizeable differences in total enrolments in higher education between Selected Educational Statistics and Education in India (both published by the MHRD). But the later publication, which is relatively more comprehensive is not available for the period after 1984-85. This constrained us to rely upon the former.

Table 5: Enrolments in education

Year	Elementary	Secondary	Higher
1980-81	78,823,964	24,633,848	4,231,662
1981-82	80,632,545	25,762,001	4,502,778 *
1982-83	84,721,788	27,896,858	4,791,266
1983-84	89,787,123	30,114,568	4,843,869
1984-85	94,154,156	31,547,190	5,027,345
1985-86	97,440,813	32,530,565	5,251,841
1986-87	100,445,098	33,168,950	5,629,095
1987-88	103,713,248	36,115,334	5,825,158
1988-89	105,735,396	36,951,195	6,128,326
1989-90	108,150,010	38,013,334	6,497,891 *
1990-91	110,179,229	40,475,994	6,889,743
1991-92	114,259,034	41,090,927	6,260,638
1992-93	123,976,228	41,212,448	6,581,506
Projected Enrolments			
1993-94	129,640,575	49,992,618	7,248,805
1994-95	135,563,720	53,128,896	7,538,781
1995-96	141,757,487	56,461,928	7,840,357
1996-97	148,234,241	60,004,057	8,153,996
1997-98	155,006,912	63,768,401	8,480,183
1998-99	162,089,019	67,768,900	8,819,418
1999-2000	169,494,700	72,020,369	9,172,224

* Interpolated Figures.

prices, compared to Rs. 3.2 thousand crores in 1991-92, i.e., the allocations to elementary education have to be increased by about five times in real prices. If the past trends are allowed to continue, the expenditure on elementary education may be of the order of only Rs. 8.4 thousand crores in 2000 AD.

In case of secondary education, the requirements based on normative approach are about double the projections based on linear trends. The expenditure on secondary education should also increase by about five times from Rs. 2.2 thousand crores in 1991-92 to Rs. 10.5 thousand crores in 2000 AD in 1980-81 prices.

In case of higher education, the differences in the two sets of estimates are not very large. As per the estimates of the requirements, the allocation to higher education has to increase from Rs. 1.3 thousand crores in 1991-92 to Rs. 22.9 thousand crores in 2000 AD in 1980-81 prices. The 'projections' put this figure at Rs. 20 thousand crores for 2000 AD.

Table 6: Per student expenditure on education in india at 1980-81 prices

Year	Plan	Non-Plan	Total
Elementary			
1980-81	11.54	183.48	195.02
1981-82	11.67	175.66	187.32
1982-83	15.83	200.49	216.32
1983-84	18.93	195.24	214.18
1984-85	20.25	199.05	219.30
1985-86	18.46	221.31	238.68
1986-87	21.77	222.29	244.05
1987-88	31.96	238.98	270.94
1988-89	36.20	244.66	280.86
1989-90	44.20	270.92	315.11
1990-91	36.70	279.76	316.46
1991-92	34.30	242.71	277.01
Secondary			
1980-81	18.43	402.49	420.92
1981-82	23.77	408.83	432.60
1982-83	28.14	429.34	457.48
1983-84	35.41	410.50	445.89
1984-85	42.95	420.15	463.09
1985-86	20.62	454.95	475.58
1986-87	31.32	463.93	495.24
1987-88	49.84	465.94	515.79
1988-89	67.83	509.27	577.10
1989-90	79.30	535.20	614.50
1990-91	58.78	518.13	576.91
1991-92	60.52	463.94	524.46
Higher			
1980-81	252.97	1213.64	1466.61
1981-82	244.93	1234.67	1479.60
1982-83	286.86	1250.29	1537.15
1983-84	290.94	1297.81	1588.75
1984-85	372.43	1332.95	1705.38
1985-86	342.08	1458.05	1800.13
1986-87	351.58	1418.66	1770.24
1987-88	445.91	1514.83	1960.74
1988-89	436.96	1660.13	2097.09
1989-90	403.75	1773.95	2177.71
1990-91	343.45	1629.45	1972.90
1991-92	402.32	1676.74	2079.06

Table 7: Cost function: regression results

Ln (C) = a + b (E) + e

All-India

Level of Education	Expenditure Category	Constant	Regression Co-efficient	t-Values	R-Square	N
Elementary	Plan	–0.43	0.0000 ***	10.00	0.8944	12
	Non-Plan	4.26	0.0000 ***	7.80	0.8554	12
	Total	4.14	0.0000 ***	8.24	0.8765	12
Secondary	Plan	1.21	0.0000 ***	5.03	0.7163	12
	Non-Plan	5.64	0.0000 ***	4.80	0.69.06	12
	Total	5.57	0.0000 ***	5.62	0.7614	12
Higher	Plan	4.83	0.0000 ***	3.77	0.5874	12
	Non-Plan	6.46	0.0000 ***	9.31	0.8968	12
	Total	6.63	0.0000 ***	8.02	0.8656	12

Note: * significant at 1% level ** significant at 5% level *** significant at 10% level N – Number of observations

Cost function: regression results of selected states

Level of Education	Expenditure Category	Constant	Regression Co-efficient	t-Values	R-Square	N
Andhra Pradesh						
Elementary	Plan	7.07	0.0000	0.50	0.0319	9
	Non-Plan	222.47	0.0000	–0.33	0.0170	9
	Total	229.54	0.0000	0.14	0.0044	9
Secondary	Plan	–40.07	0.0000 ***	4.83	0.7747	9
	Non-Plan	370.34	0.0000 **	2.24	0.4111	9
	Total	330.27	0.0001 ***	3.35	0.6028	9
Higher	Plan	5.63	0.0000	–2.14	0.0001	9
	Non-Plan	8.29	0.0000	–2.16	0.4008	9
	Total	8.36	0.0000	–2.25	0.4195	9
Assam						
Elementary	Plan	–6.52	0.0000 *	2.17	0.3432	12
	Non-Plan	27.61	0.0001 **	2.86	0.4406	12
	Total	21.09	0.0001 **	2.81	0.4364	12
Secondary	Plan	–16.91	0.0001 **	2.27	0.3373	12
	Non-Plan	579.90	–0.0002	–1.77	0.2375	12
	Total	562.99	–0.0001	–0.60	0.0352	12
Higher	Plan	5.46	0.0000	1.50	0.3296	12
	Non-Plan	7.49	0.0000	0.20	0.0038	12
	Total	7.60	0.0000	0.40	0.0198	12
Bihar						
Elementary	Plan	–30.54	0.0000 ***	5.00	0.6791	8
	Non-Plan	–270.57	0.0001 **	2.35	0.4766	8
	Total	–301.11	0.0001 **	2.46	0.5033	8
Secondary	Plan	–18.09	0.0000 **	2.63	0.4306	10
	Non-Plan	207.54	0.0004 ***	5.00	0.7557	10
	Total	–225.62	0.0004 ***	5.37	0.7816	10

(Table 7 Contd.)

(Table 7 Contd.)

Level of Education	Expenditure Category	Constant	Regression Co-efficient	t-Values	R-Square	N
Gujarat						
Elementary	Plan	–23.70	0.0000	0.67	0.0561	10
	Non-Plan	–131.49	0.0001 ***	4.00	0.6758	10
	Total	–155.19	0.0001 ***	3.53	0.5998	10
Secondary	Plan	4.50	0.0000	0.75	0.0797	10
	Non-Plan	–82.70	0.0006 ***	4.74	0.7386	10
	Total	–78.20	0.0006 ***	4.76	0.7394	10
Higher	Plan	5.73	0.0000	–2.33	0.4036	9
	Non-Plan	7.45	0.0000	–0.50	0.0197	9
	Total	7.57	0.0000	–0.50	0.0476	9
Haryana						
Elementary	Plan	–173.13	0.0002 ***	4.25	0.6937	10
	Non-Plan	–333.10	0.0007 ***	4.92	0.7501	10
	Total	–506.22	0.0009 ***	7.29	0.8691	10
Higher	Plan	7.36	0.0000	–1.71	0.2990	9
	Non-Plan	8.61	0.0000	–0.88	0.1046	9
	Total	8.88	0.0000	–1.06	0.1466	9
Himachal Pradesh						
Higher	Plan	4.08	0.0001	0.97	0.1053	10
	Non-Plan	8.09	0.0000	–0.17	0.0033	10
	Total	8.06	0.0000	0.08	0.0005	10
Karnataka						
Elementary	Plan	–29.48	0.0000 **	2.33	0.3601	12
	Non-Plan	–31.27	0.0000 ***	6.50	0.8203	12
	Total	–42.75	0.0000 ***	11.75	0.9369	12
Secondary	Plan	0.80	0.0000	1.38	0.1551	12
	Non-Plan	206.81	0.0003 **	4.25	0.6405	12
	Total	207.61	0.0003 ***	6.13	0.7866	12
Higher	Plan	6.75	0.0000	–6.00	0.6287	12
	Non-Plan	8.27	0.0000	–3.00	0.5620	12
	Total	8.45	0.0000	–3.00	0.6507	12
Kerala						
Elementary	Plan	–3.31	0.0000	0.13	0.0022	10
	Non-Plan	832.01	–0.0001	–0.87	0.0860	10
	Total	828.70	–0.0001	–0.71	0.0587	10
Secondary	Plan	95.17	0.0000	–1.55	0.2251	10
	Non-Plan	11.49	0.0001 ***	1.34	0.1828	10
	Total	11.49	0.0001 ***	1.03	0.1800	10
Higher	Plan	8.61	0.0000	–3.60	0.6334	10
	Non-Plan	7.00	0.0000 *	2.00	0.5923	10
	Total	7.01	0.0000 *	2.00	0.3828	10

(Table 7 Contd.)

(Table 7 Contd.)

Level of Education		Constant	Regression Co-efficient	t-Values	R-Square	N
Madhya Pradesh						
Elementary	Plan	–10.23	0.0000 *	2.00	0.6317	10
	Non-Plan	4.23	0.0000 ***	4.00	0.7786	10
	Total	–6.00	0.0000 ***	10.00	0.8789	10
Secondary	Plan	–6.69	0.0000 *	2.15	0.3778	10
	Non-Plan	424.64	0.0002 *	2.10	0.3514	10
	Total	417.95	–0.0001	–1.59	0.2435	10
Higher	Plan	–1.36	0.0000 ***	4.67	0.7585	10
	Non-Plan	5.35	0.0000 **	2.50	0.5148	10
	Total	4.98	0.0000 ***	4.00	0.7451	10
Rajasthan						
Elementary	Plan	–26.19	0.0000 ***	3.25	0.5931	9
	Non-Plan	210.20	0.0000 ***	1.36	0.2726	9
	Total	184.01	0.0000 ***	3.17	0.5689	9
Secondary	Plan	–42.59	0.0001 **	2.87	0.5457	9
	Non-Plan	189.83	0.0000 **	2.63	0.4969	9
	Total	147.24	0.0001 ***	3.72	0.6640	9
Tamil Nadu						
Elementary	Plan	–81.51	0.0000 ***	3.25	0.5492	10
	Non-Plan	–140.42	0.0000 ***	5.38	0.8019	10
	Total	–221.94	0.0001 ***	7.00	0.8619	10
Secondary	Plan	–25.81	0.0000 **	2.80	0.4494	10
	Non-Plan	72.24	0.0001 ***	4.25	0.7015	10
	Total	46.44	0.0001 ***	4.30	0.6957	10
Higher	Plan	9.86	0.0000	–3.40	0.6009	10
	Non-Plan	7.03	0.0000	1.33	0.1486	10
	Total	7.89	0.0000	0.33	0.0036	10
Tripura						
Higher	Plan	6.21	0.0000	–0.52	0.0326	10
	Non-Plan	7.44	0.0000	0.38	0.0184	10
	Total	7.70	0.0000	0.30	0.0118	10
Uttar Pradesh						
Elementary	Plan	–85.97	0.0000 ***	4.00	0.6687	10
	Non-Plan	–179.82	0.0000 ***	3.50	0.6039	10
	Total	–265.79	0.0000 ***	3.50	0.6215	10
Secondary	Plan	–18.39	0.0000	0.89	0.0840	10
	Non-Plan	–553.88	0.0002 ***	4.12	0.6765	10
	Total	–572.27	0.0003 ***	3.80	0.6399	10
Higher	Plan	2.95	0.0000	0.83	0.0990	9
	Non-Plan	4.60	0.0000 **	3.00	0.6145	9
	Total	4.86	0.0000 **	3.00	0.5516	9

(Table 7 Contd.)

(Table 7 Contd.)

Level of Education	Expenditure Category	Constant	Regression Co-efficient	t-Values	R-Square	N
West Bengal						
Elementary	Plan	-24.70	0.0000 **	1.00	0.1395	9
	Non-Plan	-274.48	0.0001 ***	4.14	0.7170	9
	Total	-299.19	0.0001 ***	5.82	0.8145	9
Secondary	Plan	9.69	0.0000	0.53	0.0031	9
	Non-Plan	39.84	0.0000	0.23	0.1761	9
	Total	49.53	0.0000	0.26	0.1715	9
Higher	Plan	1.61	0.0000	-2.00	0.2842	9
	Non-Plan	5.87	0.0000	-2.00	0.5394	9
	Total	5.87	0.0000	-2.00	0.0867	9

The total expenditure on education in 2000 AD will have to be Rs. 25.8 thousand crores in 1980-81 prices, compared to Rs. 7.2 thousand crores in 1991-92, i.e., in real terms, it should increase by about 3.6 times, while between 1980-81 and 1991-92 the total expenditure in the country in real terms was just doubled. It should be noted that our estimates based on even normative approach should be viewed as under-estimates for reasons that would be explained later.

If the GNP increases at a real rate of growth of five per cent in 1990s (from Rs. 222 thousand crores in 1992-93 to about Rs. 312 thousand crores in 2000 AD), crude quick calculations will reveal that the total expenditure on education as estimated here will form more than eight per cent of GNP in 2000 AD in India.

State-wise Estimates

Trends in expenditure on education

The same method is adopted to work out the resource requirements for education for each state.[9] Table 9 presents the estimates on expenditure on education in real prices in a summary form by level of education—the actual expenditure in 1980-81, 1989-90 and the estimates of requirements of resources in 1999-2000 AD, all in 1980-81 prices. This gives us an idea of the magnitude of the task ahead in allocation of resources, compared to the past performance.

The past trends in expenditure on education in several states—both in current and constant prices—were not very smooth. Particularly in case of plan expenditure the trends are very much erratic, though non-plan expenditure do not show such serious erratic trends. Small amounts are allocated during the initial years of a Five Year Plan period to save the plan resources on maintenance of the system during the plan period, and substantial amounts are allocated in the last one or two years in an attempt to exhaust the total Plan outlays; again at the beginning of the next Five Year Plan period, small amounts are being allocated. This procedure identified by researchers earlier (e.g., Tilak, 1987), produces zig-zag trends in the growth in plan expenditure on education. The growth in non-plan expenditure is not so erratic.

The realised annual rates of growth were generally high both in current and constant prices in several states. As expected, rates of growth in constant prices are obviously less than rates of growth in current prices. But for this, there are no uniform patterns emerging.

The estimates of resource requirements based on cost function are higher than the trend projections made (but not presented here) which are based on rates of growth realised in the recent past in as many as eight states, viz., Bihar, Haryana, Kerala, Maharashtra, Orissa, Punjab, Uttar Pradesh, and West Bengal. This is comparable to the estimates at all-India level. It means that if the allocation of resource follow the past trends, they will not be adequate to meet the educational objectives, particularly the universalisation elementary education in these states. It may be underlined that the estimates based on cost function are based on more objective criteria of enrolment targets and unit costs of education, and such a norm based approach should be preferred to other approaches, based on no specific criteria.

However, in Andhra Pradesh, Assam, Gujarat, Karnataka, Madhya Pradesh, Tamil Nadu and Rajasthan the projections based on recent rates of growth are higher than the requirements estimated through cost function,

9. However, only the estimated resource requirements are given in table 9. Interested readers may refer to Tilak (1994) for all details.

Table 8: Estimate of total expenditure requirements for education at 1980- 81 prices (Rs. in crores)

Year	Plan	Non-Plan	Total
Elementary			
1992-93	753.31	3733.96	4487.28
1993-94	969.11	4171.79	5140.90
1994-95	1258.58	4675.08	5933.66
1995-96	1650.79	5255.68	6906.47
1996-97	2187.74	5927.96	8115.70
1997-98	2930.91	6709.39	9640.30
1998-99	3971.23	7621.35	11592.58
1999-2000	5444.89	8690.07	14134.95
Secondary			
1992-93	286.33	2101.51	2387.84
1993-94	662.13	2892.44	3554.57
1994-95	886.04	3215.76	4101.81
1995-96	1202.95	3585.36	4788.31
1996-97	1658.48	4009.48	5667.96
1997-98	2324.17	4498.12	6822.29
1998-99	3314.05	5063.50	8377.55
1999-2000	4813.50	5720.55	10534.04
Higher			
1992-93	274.84	1118.22	1393.06
1993-94	342.19	1360.38	1702.58
1994-95	375.36	1477.29	1852.64
1995-96	412.61	1607.02	2019.63
1996-97	454.57	1751.28	2205.85
1997-98	501.96	1912.07	2414.03
1998-99	555.61	2091.68	2647.29
1999-2000	616.53	2292.80	2909.34
Total			
1992-93	1314.48	6953.69	8268.17
1993-94	1973.43	8424.62	10398.05
1994-95	2519.98	9368.13	11888.11
1995-96	3266.35	10448.06	13714.40
1996-97	4300.80	11688.72	15989.52
1997-98	5757.03	13119.59	18876.62
1998-99	7840.89	14776.53	22617.43
1999-2000	10874.92	16703.42	27578.33

suggesting that these states performed well in the recent past, and if the same trends continue, the resource position of the elementary education system would be very good. Thus for some states the requirements are higher than extrapolations, and for some other states, the extrapolations are higher than the cost based requirements.[10]

In several states the rate of growth required during the remaining period of the decade is higher than the rate of growth realised during 1980-81 and 1991-92. However, there are a few important exceptions, such as Assam, Gujarat, Karnataka, Madhya Pradesh, and Tamil Nadu. The task is stupendous in case of Bihar and Haryana where the required rate of growth is nearly four times the rate of growth experienced in the past. The situation in Punjab seems to have been severely affected during the 1980s by the social and political unrest. Even in Kerala, the rate of growth in enrolments has to be significantly reversed, from negative –0.18 per cent per annum during the 1980s, to 5.05 per cent during 1992-93 to 1999-2000. Compared to the status towards the end of the 1980s, the levels of expenditure on elementary education need to be significantly stepped up in many states in the next few years and the trends need to be sustained. Particularly in case of Haryana, Madhya Pradesh, Punjab and West Bengal, the expenditures have to be nearly doubled, and so is the case of Uttar Pradesh, where it has to be significantly increased.

A few estimates need a special comment, as the estimated requirements of resources fall into a pattern that cannot be easily explained:

According to the estimates of the Standing Committee on Population Projections, the population, particularly in the 6-13 age group, in Tamil Nadu is likely to decline. The declining trend is to continue even after the turn of the century. So with the target of universalisation of elementary education, the projected trends in enrolments show a negative rate of growth. This has produced a declining trend in plan, non-plan and total expenditure on elementary education in Tamil Nadu.

Secondly, the enrolments in elementary education in Kerala already exhibited a declining trend during the 1980s. One might have expected a similar trend to continue. But the target enrolments (based on the estimates of population of 6-13 age-group, as estimated by the Standing Committee) by 2000 AD require a reversal of the trends in enrolments. The results of the cost function based on the declining enrolments in the past, produce awkward results regarding requirements of resources in the future. Hence instead of using the cost function, we have considered the 1989-90 level of per student expenditure (in 1980-81 prices), and the projected enrolments

10. It is interesting to note that the Finance Commission (1988) also found similar differences between 'normative' and actual expenditures on education, for more or less the same states.

Table 9: Expenditure on education in India in selected states: actuals in 1980-81 and 1989-90 and the forecasts of requirements for 1999-2000 (Rs. in crores)

State	Elementary Education			Secondary Education		
	1980-81	1989-90	1999-2000	1980-81	1989-90	1999-2000
Andhra Pradesh	101.38	177.53	315.58	66.78	119.72 *	414.72
Assam	37.98	134.99	225.76	30.76	55.21 **	74.20
Bihar	96.17 +	320.72	1793.33	34.41	88.21	551.77
Gujarat	91.41	191.50	334.24	52.28	116.15	268.66
Haryana	26.98	59.56	1008.45	–	–	–
Himachal Pradesh	24.23	49.18	–	14.25	30.29	–
Jammu & Kashmir	14.71	35.46	–	19.35	25.70 *	–
Karnataka	93.49	186.62	270.32	35.58	107.94 **	244.63
Kerala	114.94	149.16	220.09	59.85	83.56	470.78 +
Madhya Pradesh	34.33	98.24	190.84	24.97	38.74	34.13
Maharashtra	178.99	363.24	1196.52	127.43	127.43	1203.91
Orissa	44.67	118.62	246.71	39.48	45.47	66.25
Punjab	51.04	88.66	293.28	66.31	133.81	316.51
Rajasthan	77.57	155.75	351.40	44.59	97.71 *	154.34
Tamil Nadu	117.36	223.49	191.30	61.37	168.82	307.56
Tripura	5.64	20.34	–	6.75	22.67	–
Uttar Pradesh	171.45	517.29	2180.66	109.72	311.32	1425.37
West Bengal	93.28	177.26	621.78	93.76	209.89*	621.55
All India	1537.30	3407.90	14134.95	1036.90	2335.10	10534.04

(Table 9 Contd.)

State	Higher Education			Total		
	1980-81	1989-90	1999-2000	1980-81	1989-90	1999-2000
Andhra Pradesh	51.34	93.14 *	119.95	226.45	397.42 *	842.08
Assam	9.60	23.49 **	65.94	82.62	245.63 **	368.65
Bihar	11.12	67.32	–	205.20	495.58	–
Gujarat	20.73	54.35	67.59	172.77	370.28	670.49
Haryana	11.95	27.67	44.92	71.38	149.83	–
Himachal Pradesh	3.77	7.30	9.88	43.74	89.84	–
Jammu & Kashmir	5.96	11.11 *	–	41.97	75.38 *	–
Karnataka	34.86	70.38 **	158.41	169.30	368.88 **	673.35
Kerala	31.33	49.21	119.80	210.98	289.26	810.67
Madhya Pradesh	10.21	29.96	62.66	71.48	167.76	340.62
Maharashtra	64.57	118.13	343.51	386.09	811.16	2743.93
Orissa	16.81	18.56	85.35	106.10	207.13	585.99
Punjab	15.38	37.21	309.84	137.18	263.29	981.91
Rajasthan	17.08	35.51 *	–	143.48	297.20 *	–
Tamil Nadu	49.94	100.13	125.97	235.07	499.13	624.83
Tripura	1.23	4.33	7.43	14.85	51.51	–
Uttar Pradesh	43.13	93.70	158.77	346.92	939.37	3767.77
West Bengal	43.73	64.53 *	71.32	242.95	469.03 *	1043.47
	483.70	1093.30	2909.34	3374.30	7443.00	27578.33

Note: + 1981-82, * 1988-89, ** 1991-92 ++ non-plan expenditure only 1980-81 Actuals 1999-2000 estimated requirements

in making the estimates regarding requirements of resources in the future. The estimates of requirements of resources for secondary education also make it clear that compared to the past, in many states, the expenditure on secondary education have to be increased substantially. This is true with respect to both plan and non-plan expenditure. For example, in Andhra Pradesh, the non-plan expenditure on secondary education has increased from 42 crores in 1980-81 to Rs. 76 crores in 1987-88 (in 1980-81 prices) which has to increase to about Rs. 340 crores by the turn of the century. In some states the enrolment at the secondary level has been increasing but allocation of resources is not commensurate with this trend. Hence the per student expenditure declines. This is more so when per student expenditure is taken at constant prices. The non-plan expenditure, however, shows a less erratic pattern than plan expenditure.[11]

Except in Assam, Karnataka, Rajasthan and Tamil Nadu, in all the other states the expenditures on secondary education have to grow at a much faster rate than in the past. In Haryana, Kerala, Bihar and Andhra Pradesh, the expenditure should increase very fast. For example, in Bihar, the expenditure on secondary education increased by 2.5 times from Rs. 34 crores in 1980-81 to Rs. 88 crores in 1989-90 in 1980-81 prices, but this has to increase to Rs. 552 crores by 2000 AD. In Haryana, compared to an increase from Rs. 29 crores to Rs. 56 crores during the 1980s, it has to be Rs. 433 crores by the turn of the century. In Kerala and Andhra Pradesh also, according to the estimates made here, the task seems to be stupendous. In the remaining states, the required rate of growth is higher than the rate of growth realised in the 1980s.

Except in Assam, Karnataka, Rajasthan and Tamil Nadu, in all the other states the expenditures on secondary education have to grow at a much faster rate than in the past.

In higher education if the past trends in enrolment are allowed to continue, the increase in the requirements of resources seem to be somewhat modest, compared to the past trends in expenditure on higher education on the one hand, and the requirements of other levels of education as estimated here on the other. For instance, in Tamil Nadu the expenditure on higher education doubled from Rs. 50 crores in 1980-81 to Rs. 100 crores in 1991-92 in 1980-81 prices; and this has to increase to Rs. 126 crores by the end of the century. Similar of trends in requirements can be noted in case of Uttar Pradesh, West Bengal, Himachal Pradesh, Haryana, Gujarat and Andhra Pradesh. Even in other states, e.g., Orissa and Madha Pradesh, the trends maintained in the 1980s have to just continue. It is only in Kerala and Maharashtra, and to small extent in Assam, the rates of growth in the 1990s have to be higher than those experienced in the 1980s.

The estimates on requirement of resources of various levels of education are added to obtain the total requirements for the education sector under plan, non-plan and total categories. It is clear from table 9 that in all the states, the requirements of resources for education are sizeable, though the educational targets set are modest – universalisation of elementary education, balanced development of secondary education in relation to elementary education, and continuation of the same rate of growth in higher education.

The requirements of resources for education are sizeable, though the educational targets set are modest.

Concluding Observations

Firstly, our estimates of requirements of resources based on 'normative' approach should be viewed as under estimates for several reasons. Since the estimates are based on the unit costs of education of the 1980s, it may be noted that our estimates are oblivious of new programmes being launched to improve quality, equity and efficiency in education. These programmes will have to be sustained, and the requirement of resources on these counts would be additional.

In elementary education where there is under optimum demand for education, the target of universalisation of elementary education, and corresponding estimates on enrolment projections my be viewed as reasonably good. But it should be noted that these estimates on elementary education do not make any allowance for enrolment of over and under-age children in primary and upper primary schools, which is a very dominant phenomenon in the Indian education system. Earlier estimates revealed that the gross enrolments in primary education are about 25 per cent higher than net enrolments, and in case of upper

11. Hence in the case of certain states like Kerala only the total expenditure is estimated and plan and non-plan expenditure are not estimated separately.

primary education 40 per cent higher (Kurrien, 1983). It means that the enrolments in primary education need to be adjusted by 25 per cent upwards, and those in upper primary education by about 40 per cent to make allowance for under and over-age children. Thus the projected requirements of expenditure on education given in table 5 need to be adjusted upwards by 25-40 per cent to arrive at the actual requirements of elementary education.[12] This is not attempted here. But it is sufficient to note that the actual requirements of resources would be 25-40 per cent higher than estimates made here.

In case of higher education, the margin of error may be larger. Our estimates allowed the past rates of growth to continue in the near future. The rate of growth in higher education may be higher than the past rate due to increased emphasis on elementary and secondary education, which will correspondingly push up the enrolments in higher education even during the next 6-7 years. The likely growth in demand for higher education may be higher, also due to the new economic policies including liberalisation and globalisation, that would lead to higher demand for higher educated manpower. Our assumption here is based on the government intention of containing the public expenditures on higher education, as revealed in the most recent annual budgets. But it may be difficult to contain the growth of expenditure on higher education, as is already being experienced.

Our forecasts refer to the period 1992-93 to 1999-2000. We do not have detailed data on the actual trends in enrolments and expenditure during 1992-93 to 1995-96 (and even for a few earlier years in a few states). If the actual trends are at a lower level than the projected ones, the required growth during the remaining period of the decade will be higher than estimated here.

Finally, it may be noted that these projections of requirements of resources are based on a simple and crude methodology, without considering the specific programmes, and items of expenditure. But they are based on a sound logic of unit costs, enrolments and past trends in the same.

12. One may expect that the difference between gross and net enrolments would decline over the years as we march closer towards universalization of elementary education. (NSSO 1991). But the recent estimates also showed a difference of similar magnitude. See for instance, Mehta (1994). Since the phenomenon of over and under age children is not likely to disappear by the turn of the century, non-allowance for this means that our estimates of enrolment projections and correspondingly the estimates on requirements of resources are under estimates to that extent.

Though education is regarded as "a unique investment in the present and the future" and it presents "a crucial area of investment for national development and survival" (National Policy on Education, 1986, p. 3 and p. 29), rarely has the education sector in India received any special treatment as far as allocation of resources is concerned. As a result, many educational goals remain unfulfilled. Educational levels of the population, and/or literacy levels are being rightly viewed as an important indicator of measuring levels of development in general, and human development in particular (UNDP, 1993). For instance, the Finance Commission and/or the Planning Commission may consider to incorporate this variable in measuring the overall backwardness of the states, along with, inter alia, state domestic product per capita and poverty ratio in allocating resources to states. In view of the increasing importance of human resource development in general and education in particular, in the success of the adjustment programme, the government has to pay special attention to the needs of the education sector, specifically all layers of education.

Given the need to lay special thrust on elementary education,[13] universalisation of which has been repeatedly postponed and it still elusive, it is necessary that the government accords a high priority to elementary education, for improvement in quality and quantitative expansion. The District Primary Education Programme makes this clear.

Further, as long as the backlog exists in the construction of school buildings, and provision of basic inputs like the Operation Blackboard material, it is necessary that the government through Finance Commission and Planning Commission makes, in addition to actual unit cost based allocation of resources, grants for construction of school buildings, and provision to teachers in single and two teacher schools. Appropriate norms on cost per school (with a desirable level of infrastructure and facilities) are to be developed and considered while making provision for establishment of schools.

Allocation of resources should provide for the requirements of the states for modernisation of administration, e.g., computerisation of records, which is important both at the institutional level, and also at the macro (state and national) level.

Since our estimates based on actual trends in unit costs of education do not take into account these considerations separately, it is necessary that the actual allocation to education in various states need to be much

13. Recognizing the need, the Government of India hosted the Education for All Summit of Nine High Population Countries in December 1993.

higher than estimated here. Thus the projection that about eight per cent of national income has to be allocated to education, may have to be viewed as a lower estimate.

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Regime Changes & Public Policy on Education

I. Ramabrahmam & K. Jhansi Rani

Whenever the ruling elite is in crisis, it talks of reforms. This is particularly striking in third world countries. Likewise Indian ruling elite has raised the issue of 'reform' whenever its interests are threatened. Education Policy is one such area. This paper seeks to explore the efforts made in the past in the policy arena of education, their success and short comings in the educational sphere, the focus of each policy, issues of confrontation between Centre-States, areas of concern and a general view of educational policies and programmes initiated since independence.

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Late J.P. Naik, an eminent educationist cited two reasons for the slow progress in the field of the education – the political and the educational. As education is a sub-system of the social system it cannot be revolutionised unless a social revolution takes place first or simultaneous revolution takes place in both fields. This is because there is a strong correlation between changes in the education system and changes in the social system.

Genesis of National Education Policies

Conventionally people speak of changes in the educational system which would lead to socio-economic changes. In this context the talk of 'revolutionary changes' is not uncommon. There are others who say that the conventional formulation puts the cart before the horse. For them education being a sub-system of the social system, revolution in education can be thought of only as a consequence of a revolution in the social structure itself.

The basic difficulty with the Indian education policy seems to be two fold: education is regarded as the instrument for social change and some critics question the causal implications of this equation. They believe that unless society itself is altered by a package of strategies the nature of the education cannot be changed. It may be a fundamentalist argument. It must be stated that a policy of trying to change a social system through education is not in itself invalid howsoever conventional and old fashioned it may sound to others. The other is the lacunae in the Indian education policy itself i.e., a manifest failure in appreciating or perceiving the magnitude of change to be brought about through policy instruments (granting that through changes in educational policy, a transformation in social system can be brought about). For instance, the vastness and magnitude of illiteracy in India never seems to have been fully grasped by policy makers until pointed out by

the now famous Human Development Index (HDI) reports. Of course the problem is articulated through various schemes but policy enunciation is different from evolving programmes. According to analysts, policy formation was attempted with incrementalism as the reigning paradigm. Educational decisions were based on the concept of stability with change and in an evolutionary and reformist perspective. (I. Ramabrahmam, 1995).

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It was argued that the partition of the country had created a delicate situation in which the very survival of the country was at stake. It was felt desirable to postpone all decisions to a later date and to converge all efforts to consolidate freedom. Unfortunately, none of the issues like Mahatma Gandhi's call for disbanding Congress; his model for development which he mentioned in Hind Swaraj, was reopened. On the contrary, Western model of development based on science and technology, modernization of agriculture and heavy industralization were given priority.

In the administration too, reforms suitable to our system were not attempted and only a change in nomenclature from Indian Civil Service to Indian Administrative Service was made. These decisions were taken in the interests of ruling groups which came to power in 1949. The westernized class created by the British developed a national pride. Some writers called this change in India from 'western to the westernized'. These classes were determined to rule with such attention to the welfare of the poor and underprivileged social groups as can be legitimately expected from enlightened rulers. With this the revolutionary perspective in rebuilding society was ruled out and the country had to settle down to a reformist, evolutionary and gradual process of modernization and development.

Incrementalism Vindicated

To achieve the real purpose of freedom, the social development of people even by evolutionary and reformist method, which according to theoreticians of Public Policy is called incrementalist approach, there was a need then for a comprehensive plan of educational development which would make optimum use of the available resources. Unfortunately, no such policy was available in 1947 although, as a matter of fact the need

To achieve the real purpose of freedom, there was a need for a comprehensive plan of educational development which would make optimum used of the available resources.

for a such direction was foreseen as early as 1937, and the National Planning Committee was appointed by the Indian National Congress under Nehru in 1940. Later the stress of political events forced the Committee to wind up. Surprisingly, the attempts of the colonial British government to produce a long-term educational plan document succeeded.

The Central Advisory Board of Education under the leadership of Sir John Sargeant, the then educational advisor to the Government of India, prepared a report on 'Post War Plan of Educational Development in India (1944). This proposed a national system of education for the country over a period of 40 years (1944-84). However, political events overtook everything else and the Sargeant plan never took off the ground. The educational development of India after independence had to be planned and implemented ab initio.

Obviously this absence of comprehensive and sufficiently detailed plan to act upon proved deleteuous. The government of free India could have appointed an Education Commission (as it ultimately did in 1964). But this decision was not taken then and developments in education in the country were attempted for nearly two decades (1947-65) without any direction and firm policy. This ad-hocism is certainly one of the important factors responsible for the sony state of affairs in the educational scenario of this country.

Developments in education in the country were attempted for nearly two decades (1947-65) without any direction and firm policy. This ad-hocism is one of the important factors responsible for the sony state of affairs in the educational scenario.

The government of independent India did not take steps to create a sufficiently critical mass of active and competent workers who could help to plan the transformation of education system. Our country has not produced an Ivan Illich or a Paulo Freirie.

Absence of Policy Decisions regarding Priorities

An examination of the inter-se priorities between different sectors of education reveals that personal and social factors played a more important role than rational choices. Nehru had great faith in Universities and in higher education and believed that higher education must be developed on priority basis, in the larger interests of the country. According to J.P. Naik, he did not show deep commitment either to elementary or adult education. Universal elementary and Adult Education ought to have been accorded the highest priority because along with adult franchise it would have helped in the process of effective political decision-making like electoral choices and through that achieve the real transfer of power to the masses which was the overt aim of the national leadership.

However, of the two sectors of education i.e. primary and adult education, the neglect of adult education was more conspicuous. Primary education managed to claim relatively more of attention because it constitutes the first and indispensable rung of the ladder for formal and institutionalized education. In other words, primary school education forms part of the elite education system and bourgeoisie democratic cultures could not really afford to neglect the conventionally important channels of elite education i.e., education at college and university levels. In the manner, primary education, paradoxically enough, satisfied both the claims of democratic conscience on the one hand and elitist demands on the other. It is not without significance that primary education was raised to the prestigious pedestal of being incorporated into the chapter on Directive Principles of State Policy of the Indian Constitution.

Demand for National Commission on Education

In the sixties, many aspects of public policies came under introspection, critical evaluation, and revision. This was because the sixties saw two wars fought by India, one with China in 1962 and another with Pakistan in 1965. The Chinese aggression of 1962 and the weak response of India on the occasion came as a rude shock to every one and created a mood of introspection in which the very validity of all our developmental efforts was seriously questioned. Education was no exception and people began to ask as to why we had lagged behind in education although in 1949 the educational situation in the two countries was almost similar.

The Chinese success in the war made Indians credit the Chinese socio-political system with a great level of achievement. Whatever be the truth in the assessment of the Chinese situation now (particularly in view of the current denigrating reappraisal of the Chinese success by the Chinese themselves), there was no doubt that many an Indian attributed to China's all round success to education. The commitment of the Chinese to the revolutionary cause, as exemplified by the degree of mobilization in the Chinese military and civilian cadres, made Indians reflect on education as an effective mobilizer of people to certain types of enduring commitments, not necessarily ideological. Thus the concept of education to the masses once again surfaced in a conspicuous manner. The Sino-Indian war challenging the existing complacence over various aspects of public policy in India was only one of the reasons for a rethinking on educational policy. There was of course, the already existing realization that a comprehensive educational policy had to be formulated in the country.

The commitment of the Chinese to the revolutionary cause, made Indians reflect on education as an effective mobilizer of people.

The old demand for the appointment of an Education Commission which would comprehensively examine the educational scene in our country revived. The then Minister for Education at the Centre, Sri M.C. Chagla responded to the general mood and appointed the Education Commission, with Dr. D.S. Kothari, the noted Physicist and Educationist as the Chairman. The main purpose of the Commission was to suggest a national pattern of education and the general principles and policies for the development of education at all stages and in all aspects.

Policy Responses before 1965

This was the sixth commission appointed by the Government of India. The first was the Indian Education Commission (1882) which dealt mainly with school education. It reviewed the progress of education in the country since the Education Dispatch of 1854 and laid down broad guidelines for the development of education over the next two decades (1882-1902). The second was the Indian University's Commission (1902) which reviewed the development of higher education since the establishment of three Universities at Bombay, Madras and Calcutta in 1857 and made recommendations for the reorganization of Indian Universities. The third was the Calcutta University Commission (1917-19) which reviewed the development of secondary and higher education in

Bengal and made suggestions for the reorganization of the Calcutta University and the establishment of a new University at Dacca. The fourth, and the first to be appointed in the post-independence period was the University Education Commission (1948-49) which reviewed the development of higher education in the country and made proposals for future expansion and improvement. A similar function for secondary education was performed by the Secondary Education Commission (1952) which was the fifth in the series.

A strong demand was made in the fifties and early sixties that the Government of India should appoint a Commission to examine all aspects of education. It was in response to this demand that the Central Government appointed the Education Commission (1946- 66) at the initiative of M.C. Chagla, the then Minister of Education at the Centre and entrusted it with the task of looking into the entire spectrum of education (except legal and medical education). This was therefore, the first Commission in our educational history to look comprehensively at almost all aspects of education. The commission headed by Dr. D.S. Kothari had prepared a blue print of educational development in India spread over 20 years (1966-86).

One can appreciate the modesty of a National Commission by examining the following statement. "Many of the things we say here have been said before, notably by the University Education Commission. The real need is action".

With the report of the education commission in hand, the government took further steps in the process of formulating a national policy on education. In order to raise the subject of education above party considerations and also with a view to obtaining consensus among political parties, the then Minister of Education, Dr. Trigun Sen, constituted a Committee of Members of Parliament belonging to all political parties with the expectation that the Members of the Committee would provide a working draft of the national policy on education. It was also thought that the National Policy on Education would pave the way for the national education act.

The report of the Commission entitled 'Education & National Development' is hailed as teacher's magnacarta. It is also referred to as the conscience of the nation in the field of education.

Though the National Policy on Education 1968 evolved on the basis of education Commission's report watered down most recommendations of the late Kothari Commission, it is hailed as an important milestone in improving the quality of education. The 10+2+3 pattern is the result of this policy. Well before an evaluation of the impact of the first national policy on education 1968 was attempted (the review should have been initiated in 1973-74 as stated in the national policy 1968), the government then headed by late Mrs. Gandhi fighting for its survival lost interest in education in general and the national policy 1968 in particular. The Banks Nationalization, devaluation and our role in freeing Bangladesh received higher political attention than mundane issues like the policy on education. A good number of states opposed the 10+2+3 pattern until recently. The first policy on education of 1968 therefore was more or less confined to limbo.

The government headed by late Mrs. Gandhi fighting for its survival lost interest in education in general.

The best critique of our educational systems can be obtained by a casual glance at 'Challenge of Education: A Policy Perspective' released on August 2, 1986.

The Janata Party which came to power in 1977 at the Centre prepared a draft National Policy on Education in 1979. What we should remember in this context is that the 1968 policy comprising important initiatives and directions which should have come up for review and evaluation in 1973 remained unassessed. Independent of any review another national policy was evolved in 1979. Thus we had a second national policy on education in less than 12 years although it took about 21 years to formulate a policy after independence. The 1968 policy declared that "the Government of India is convinced that a radical reconstruction of education on the broad guidelines recommended by the Education Commission is essential for economic and cultural development, of the country, for national integration and for realising the ideal of a socialistic pattern of society. This will involve a transformation of the system to relate it more closely to the life of the people; a continuous effort to expand educational opportunity; a sustained and intensive effort to raise the quality of education at all stages; an emphasis on the development of science and technology and the cultivation of moral and social values. [National Policy on Education: 1968 para 3].

Further the policy document sounds loud with the statement that "the government accordingly resolves to promote the development of education in the country in accordance with the following principles.

- Free and Compulsory Education [On this policy statement, the Govt. of India can claim 100% enrolment if quantitative indicates are the only criteria. However, mere enrolment is widely regarded as not an achievement in itself].
- Status Emoluments and Education of Teachers (For more than 6 lakh schools). The teachers are still unhappy about the emoluments even in 1996.
- Development of Languages. The need for its uniterm implementation stands.
- Equalisation of Educational Opportunity. Gender, caste and other problems are still cropping up.
- Identification of Talent. Though structural innovations are made, functionally the system suffers from absence of mechanisms for identification of talent in rural areas.
- Work Experience and National Service. Though much emphasised, the NSS and other activities remain outside the curriculum still.

No report is available on the success or otherwise of pious declarations made in National Policy on Education 1968, except perhaps the mandatory annual reports of the Ministry of education placed before the parliament.

The Draft National Policy – 1979

The Janata Party, as pointed out earlier, brought out another national policy in 1979. Divided into 22 items, the draft policy document addresses itself to several issues, notable among them being the realignment of priorities within education. It made no reference to the Socialist pattern of society. It gave greater weightage to adult education vis-a-vis other sectors. Higher education received less allocations. With the change of guard at the Centre, there occurred a concurrent change in the education policy too.

Come 80s, we have one more policy on education. It is referred to as New Education Policy 1986 (NEP-86) (and also as National Policy on Education 1986.)

Para 1.8 of the New Education Policy 1986 is self-explanatory. While there are impressive achievements in education "the general formulations incorporated in 1968 policy did not, however, get translated into a detailed strategy of implementation. As a result, problems of access, quality, quantity, utility and financial outlay accumulated over the years have now assumed such massive proportions that they must be tackled with utmost urgency" (NEP 1986 para 1.8).

The NEP-1986 marked a significant step in the history of education in post-independent India. It aimed to promote national progress, a sense of common citizenship and culture and to strengthen national integration. It laid stress on the need for a radical reconstruction of the education system, to improve its quality at all stages and gave much greater attention to science and technology... (NEP:1986: para 1.4)

The extent of success is again limited to the mandatory annual reporting. Attempts are made to obtain public opinion on various aspects of the New Policy on Education. For example, there is a debate even about the renaming of the ministry of education as 'Human Resource Development Ministry' objecting to the pejorative sense it carries as a human being is much more than a "resource".

The concept of Navodaya Vidyalayas (operational forms of community education, Common Schools, Neighbourhood schools proposed by the Kothari Commission, see in this context the draft national policy on education 0 1979 para 2.7, 2.8, .29), Centres of excellence, greater emphasis on technology as an input for bringing in rapid change etc. are pointers to the ruling elites perceived state of urgency to bring in reforms in a sector where change is gradual and slow if not incremental.

Item number 11.5 of the New Education Policy 1986 declared that "the implementation of the various programmes of the New Policy must be reviewed every five years". Late Rajiv Gandhi's government could not last till the deadline set for evaluation.

Politics of Educational Reform

Politics overtook the national policy implementation; Mr. V.P. Singh who became Prime Minister ordered for a quick appraisal of NEP – 1986 in 1989 itself even before the 5 year deadline for evaluation. Several commentators felt that it is too short period to judge the effectiveness of a policy (The Hindu, May 9, 1990). There can be no two opinions about the need for periodical reviewing of national policies. But such an experience ordered by the Government should not be undertaken at too short an interval.

It was presumed that the review ordered by the government was warranted by the need for re-directing the educational policy so as to carry out what was referred under "social tasks" in the National Front's election manifesto.

Despite the third attempt, education is still at crossroads because of resource constraints, resistance to in-

stitutional change and lack of political will. The National Front's coming to power saw the appointment of Acharya Ramamurti Committee in 1990. Whether it should be regarded as a concurrent evaluation of NEP-86 or not is left to critical observers. To quote "It has been clearly within the perception of the committee that much of what is contained in its report has already been dealt with by commissions and committees which were called upon to go into the educational policy from time to time from the 19th century on-ward. Implementation was the only problem".

Education is still at crossroads because of resource constraints, resistance to institutional change and lack of political will.

Before action could be initiated on the recommendations made by Ramamurti Committee, there was again a regime change at the Centre. The Congress-I which came back to power at the centre in 1991 appointed a Committee headed by the then Chief Minister of Andhra Pradesh Shri N. Janardhan Reddy. This Committee, of course was appointed by Central Advisory Board of Education (and is referred to CABE Committee). The hidden agenda for this committee was simple. To keep aside the report of Ramamurti Committee and its recommendations and re-endorse the 1986 policy and its prescriptions as the Congress-I was the architect of the New Policy of 1986.

Forty eight years of Independence have seen the appointment of a number of Commissions and Committees. Every change in regime got reflected on vital fields like education. Our education is a clear case of a Niagara of reports on educational/policy reforms and a Sahara of action. Added to this is the issue of resources.

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Touching on the resource crunch, the 1986 policy reiterated that "education will be treated as a crucial area of investment for national development and survival." The NPE 1968 laid down that the investment on education be gradually increased to reach a level of expenditure of 6% of national income as early as possible. ...It will be ensured that from Eighth five year plan onwards, it will uniformly exceed 6% of the national income.

Tables 1 and 2 bring out the resource position:

Table 1: Expenditure on Education as % of GNP

Year	Edn-Commission's Recommendations	Actual Expenditure
1965-68	2.9	2.9
1970-71	3.4	3.1
1980-81	5.0	4.0
1986-87	6.0	3.2
1990-95	6.0	3.2

Table 2: Share of Education in 5 year plans

First Plan	7.86
Second Plan	5.83
Third Plan	6.87
Annual Plan	4.86
Fourth Plan	5.04
Fifth Plan	3.27
Sixth Plan	2.70
Seventh Plan	3.55
Eighth Plan	3.95* (Tentative)

Report of the Committee for Review of NPE-86 p. 362

* Culled from various news paper reports.

inaugurating the first national conference on Accreditation Procedures in Technical education in February 1995, the then Union Education Secretary Mr. S.V. Giri announced a six fold increase in the outlay for education during the Ninth plan (The Hindu, February 11, 1995). Mr. Giri's announcement, though welcome, calls into question the current agenda of education as it is conditioned by uncertain availability of funds even to maintain the existing programmes. The pendulum seems to be swinging too far if one has to take into account the current crises faced by educational planners owing to LPG (Liberalisation, Privatisation and Globalisation) policy as the institutions are asked to finance their increased salary bill through self financing etc.

A Look into the Future

A careful examination of the manifestos of different political parties for the 1996 Lok Sabha election shows wide concurrence with regard to several aspects related to development of education without fixing any deadlines

or priorities for their effective implementation. The future of education depends on the nature of power relations. Congress-I reiterated its resolve to allocate 6 per cent of the GDP to education, in addition to providing educational opportunities to pavement dwellers, migrant labourers and child workers. It also promised to wipe out illiteracy through total literacy campaigns by 2001, besides vocationalising the plus two stage.

The BJP too announced allocations upto 6 per cent of GDP for education. Outlining the need for associating the non-governmental groups in the universalisation of elementary education, the party promised autonomy to universities and banning of donations for admission into professional courses. The CPI promised achievement of Universalisation of elementary education and stated that total literacy would be achieved within the stipulated period. Along with CPM, it opposed privatisation of education. The CPM announced that if it comes to power it would allocate 10 per cent of the national budget to education. It wanted states to allocate 30 per cent of their respective budgets for education. The Telugu Desam Party of Chandrababu Naidu had no item on education in its manifesto while its rival headed by Lakshmi Parvati felt that effective steps should be taken to promote patriotic fervour and students should be given military training.

Thus we notice that as far as manifestos of political parties are concerned, most of them seem to be of the view that higher allocations take care of all problems of education. Resources no doubt are important but would that be enough? A number of issues affecting educational sector can be solved only by a national consensus and not by resources alone.

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Higher Technical Education—Linkages Between Academia & Industry

V.S. Raju

Academic institutions have been traditionally viewed as sources of educated manpower. However, the quality of graduates is generally found to be deficient in industry orientation, due to the absence of industry exposure for both the students as well as the faculty. The author discusses how industry-institute interaction can be fostered for the betterment and benefit of both players.

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With the liberalisation of the Indian economy, Indian industry is facing global challenges. Survival and growth in all sectors of economy depend on how fast it can catch up with the rest of the world in efficiency of operation and competitiveness in cost and quality. In this context the need for interaction between industry on the one hand and the academia on the other is now fairly well recognised, in several debates, discussions and articles on the subject. (Appleton 1995., Rungta 1995; Swaminadhan 1994; Indo British Seminar 1995, IIM, 1995; UNESCO Study Report 1996)

Since independence, there has been an impressive growth in the academic infrastructure in the country. We have some 195 Universities, 6 Institutes of Technology, (IITs) 4 Institutes of Management (IIMs) 17 Regional Engineering Colleges and a large number of other institutions. Until recently, however, the interaction of industry with these institutions has been rather limited except for some notable instances.

The lack of interest in interaction with the academia on the part of industry is attributed to the environment of controls and restrictions that existed prior to the implementation of the New Economic Policy, and the industry's lack of commitment to indigenous R&D. However, the situation has changed dramatically after liberalisation. The threat of competition has forced the Indian industry to look for expertise within the country, in our institutions of higher learning and research establishments, to help in technology development, absorption, adaptation and other exercises to provide the competitive edge. Industry is now willing to participate in curriculum development and practice oriented training for

Industry is now willing to participate in curriculum development and practice oriented training for students.

students. Development of in-house R&D strength has become a priority in many industrial enterprises.

There is also another crucial angle to the new dispensation. The priority for allocation of financial resources of the State has shifted from industry and business to infrastructure development and social services. Even in the higher allocation in education and human resource development being proposed for the Ninth Five Year Plan, emphasis is likely to be on primary education and vocational training, rather than on higher and technical education. The Institutes of Technologies, Engineering Colleges and Universities are aware of the constraints in government budgetary support and need for generation of resources from industry.

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Industry Perspective

While the objective of any business enterprise is to earn profits, an enlightened enterprise is to provide increasing benefit to its own employees and to society in general. The focus and timescale in industry, however, tend to be sharp and short. For industry, close interaction with research labs and academic interactions would provide an invaluable opportunity to access the expertise and knowledge in addressing various problems—be it in nature of research, short term consultancy or manpower training through continuing education, refresher courses and technology update. An important benefit of this interaction is also the improvement in the products coming out of the academic institutions; these products being the most crucial input for the industrial growth.

From the perspective of long term growth, however, it is the emphasis on research and its eventual commercialisation that have been the vehicle for technological and economic progress of nations. Development of any nation depends crucially on the extent to which its scientists and technologists can keep ahead of the rest of the world, through scientific discoveries, inventions and innovations, by changes in the use of materials and processes, reducing cost and adapting to the unprecedented technological break-throughs elsewhere. Long term commitment to R&D is now being recognised as essential by almost all industry sectors. The existing infrastructure for research in the governmental laboratories and academic institutes can come in handy for industry, especially for small and medium sector

The scientific community must accept the industry ethos of timeliness, focus and cost consciousness, and the industry leaders must respect the inherent thirst for knowledge generation and challenge that drives the scientists and academic talents.

enterprises who can make use of it for their own R&D. Even for larger industries, who may have in-house R&D facilities, long term scientific research can best be sponsored to these institutions on collaborative and cooperative platforms. What is required is a change in the mindset on both sides. The scientific community must accept the industry ethos of timeliness, focus and cost consciousness, and the industry leaders must respect the inherent thirst for knowledge generation and challenge that drives the scientists and academic talents.

Source of Technological Manpower for Industry

It is estimated that more than 50,000 engineering graduates passed out of the Institutes and colleges every year in the country. A vast majority (80% or more) of them eventually get employment in the industry both in private sector and public sectors. Hence the needs of the industry must constitute an important factor in the design of the curricula, and pre-graduation training programme of students. The National Policy on Education adopted by the Parliament in 1986 and the draft Technology Policy Statement of 1993 have emphasised the need for interaction between the industry and the academia in curricula design exercises in both technical and management development programmes, to project the needs of industry or the user system.

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Benefits of Interaction

From the point of view of academic institutes, interactions with industry are most welcome. Firstly, it would improve the contemporary relevance of technical education imparted to students. Many industry units have acquired state-of-the-art technology, in hardware and

software, imported from abroad. Close interactive relationship with such units would help academic faculty to have access to them. Secondly, apart from a few premier institutions like IITs, basic infrastructural facilities such as laboratories or workshops are generally poor in our colleges and there is need for enormous infusion of capital to rectify the situation. Success in fruitful interaction with industry would brighten the prospect of substantive industry funding for renovation and setting up of new facilities. Thirdly, practical training for students in industry needs to go beyond observation of operations to tackling real life shop-floor problems. The industry is willing to refer live problems not only for Master's and Doctoral level work, but also for short B.Tech. projects. There has to be, of course, sufficient interaction between the faculty and industry professionals to be able to identify such problems jointly, and get them assigned and paid for as industrial consultancy or sponsored projects. Fourthly, contributions made to the industrial R&D and technology development will strengthen the inherent developmental capabilities in our institutions, and industry's dependence on foreign technology suppliers will diminish considerably. Such interactions will also enhance the technology forecasting capability in a collaborative environment amongst the scientists, academicians and the industry professionals.

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Manpower for R&D and Teaching

An important concern at present is the availability of right manpower for industrial R&D, for the research laboratories and faculty for academic institutes. In the last decade or so, there has been a perceptible decline in the number of people entering these professions. Almost every department in all the IITs has a large number of vacancies in the faculty positions. Almost all the CSIR labs suffer from adverse age-mix in their scientist community. Even the in-house industrial research organisations tend to be manned more by people from the ranks, rather than fresh young minds. This situation is the outcome of the failure of the society in general and the government and the industry in particular, tc encourage pursuit of R&D knowledge as a remunerative and challenging career prospect. In a free market syndrome, the brightest and the most resourceful graduating students are lured away in production, sales and management jobs in industry, where remunerations are often several times more than what academic bodies and research organisations can offer. A strategy has to be chalked out to bridge this gap and make the pursuit of R&D and teaching more challenging, satisfying and remunerative so as to attract the very best.

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Interaction: Modalities

In the Indian context, IITs are one of the earliest to promote and have Institutional mechanisms for working with the Industry. IIT Madras was the first to start a Centre for Industrial Consultancy and Sponsored Research, in 1973. As on today, all the five IITs and Indian Institute of Science have well laid out mechanisms and procedures with the result that such interaction has grown substantially during the last 3-5 years and is expected to increase exponentially in the near future. Some of these mechanisms are:

- Consultancy
- Associations with Industry
- Industry Lectures to Students of IITs
- Joint Student Projects
- External registration of Staff from Industry (for higher degrees)
- Visiting Professors from the Industry (to the Institute)
- Technology Development Missions
- Joint development and operation of (sophisticated) facilities
- Joint Academic Programmes

Consultancy

Industries from all sectors avail the expertise and facilities of the Institute through any one of the following avenues:

- Institutional consultancy
- Retainer consultancy

- Research based industrial consultancy

Institutional consultancy: These are specific assignments that can be executed readily utilizing the professional knowledge and expertise of the faculty and facilities at the Institute.

Retainer consultancy: The expertise of IIT faculty is utilized by the industries by retaining them as consultants for advice/guidance on any aspect of interest to the industries concerned for a specific duration. For example, at IIT Madras more than twenty-four industries from all over the country availed this service during the year 1993-94, involving 35 faculty.

Research based industrial consultancy (RBIC): Assignments which require applied research fall under this category. Under RBIC an industry or a group of industries can jointly sponsor a project of interest to them in an area where they agree to share the know-how generated. The project duration will be for a period ranging from six months to three years. During 1993-94 more than twenty-three companies entered into an agreement for pursuing projects under this programme with IIT Madras.

Associations with industry

Two models are mentioned:

Industrial Associateship Scheme (IAS) at IIT Madras: The Industrial Associateship Scheme was started in IIT Madras in 1987 to further strengthen the linkages with industry. In 1994-95 over 350 industries/organisations from all over the country have become members of this scheme. The Institute, under this scheme, provides access to the following facilities to their industrial associates:

- Technology Appreciation Programmes (TAP)
- Technology Requirement Programmes (TRP)
- Library and Information Services
- Short-term Courses
- Get-together Programmes

Foundation for Innovation and Technology Transfer (FITT) at IIT Delhi: FITT is a Registered Society (since 1992), its basic objective being to facilitate transfer of technologies developed at IIT Delhi to the Industry and also promote joint development of technologies between the IIT and the industry. The Governing Council of FITT has representatives from Industry, Industry Associations, Financial Institutions along with three nominees of IIT Delhi Senate and one from the Ministry of Human Resource Development.

Industrial lecture programme (at IIT Madras and Delhi)

Under this programme, senior managers from Industry are invited to deliver lectures (7×2 hrs = 14 hrs in a semester) as a part of one-credit course for the B.Tech. students. The purpose is to give an overview to the students as to what is happening in the Indian industry and also create an awareness among them with regard to work opportunities in the Indian industry. A faculty of the Institute is associated with this programme, and there is a short evaluation of the students on the information given in the lecture, and due credit is given. The speaker is requested to give an overview of the industry (e.g. fertilizer industry, cement industry, etc.); the international status, the status in India, the type of the activities in the industry and the opportunities that would exist for IIT graduates if they work for them. This facilitates students opting for summer training in the Industry to be followed by taking up a project (for the work of the students) in association with the Industry.

Joint projects as part of the project work of the students

The B.Tech. students of the IIT system have a major project in their final year where they spend an equivalent of one full semester. The topic is chosen by the students in consultation with the industry and a faculty member of the Institute. There is joint guidance. The Industry also supports this project by way of making available its facilities, and providing some assistance in instrumentation, fabrication etc. Similarly, the M.Tech. programme also provides a full semester for project, with a similar arrangement available for undertaking projects of relevance in Industry.

External registration of Engineers and Scientists

The R&D personnel from Industry are encouraged to register themselves at the IITs for higher degrees of M.Tech., Ph.D. etc. The candidates are expected to work on topics of relevance to the Industry and also of interest to the IIT faculty. There are joint guides, one from the Industry and one from the IIT. The work has, of course, to satisfy the IIT norms required for the award of a degree.

Visiting professors from industry

The scheme of Honorary Visiting Professors at IIT Delhi invites distinguished persons from industry and

other organisations to the Institute. The Honorary Visiting Professors/Faculty are required to spend at least 15 hours per year at the Institute, interacting with the students and faculty. In case of Adjunct Faculty, they usually teach at least half a course in association with one of the faculty members of the Institute. Most often, the difficulty here is the inability of the senior personnel from Industry to spare the required time. In the recent pasts, however, there is considerable progress in this direction with better participation by the industry professionals in this programme.

Technology development missions

Under this scheme, started by Planning Commission and Government of India the five IITs and Indian Institute of Science have taken up starting with 1995 technology development in a mission mode in the following areas:

- Food processing engineering
- Integrated design and competitive manufacturing
- Photonic devices and technologies
- Energy efficient technologies and devices
- Communications, networking and intelligent automation
- New materials
- Genetic engineering and biotechnology

The concepts are that the missions should be goal oriented, industry driven, focussed on deliverables, group effort/interdisciplinary, linkage bound (industry-academic-user), market oriented, compatible with national priorities and concurrent with global technology perception. These are developed through partnership with industry in the sense that deliverables are specified by industry, and the industry contribution equals 25 per cent of the total cost; this scheme encourages joint development work and sharing of profit of know-how transfer. The total outlay for the seven missions, including that of the industry contribution is about Rs.80 crores. These missions have given a major boost in interaction between the industry and the academia.

Joint development & operation of sophisticated facilities

This is a step which is most promising. Industry and institutions should jointly develop and operate the facilities of mutual interest. These are best located on the campuses as large manpower, by way of outstanding students and faculty as well as many allied facilities are available on campus. This is also a cost-effective way, and will greatly enhance the interaction between the industry and the institutions.

At IIT Delhi discussions are under way with several industries and results are expected very soon. An outstanding model of this type is a cooperative venture between the Department of Ocean Development (DOD), Government of India, and the Indian Institute of Technology Madras in shaping a National Institute of Ocean Technology (NIOT) at Madars. DOD has strengthened the facilities of IIT Madras which are of relevance to NIOT, by giving substantial funds as required, and the facilities so created as well as the allied facilities of IIT Madras will be jointly used by NIOT and IIT Madras.

Joint academic programmes

In the fast changing technological world there is always need for human resource development in frontier areas. This calls for new academic programmes which the institution cannot carry out alone; partnership with industry is essential. One example is the Master's Programme in Microelectronics and VLSI Design which was started at IIT Delhi this year i.e. July 1996. This programme is fully funded by the industry. The industry gives the money required for training the students, Rs. 2 lakhs per student admitted. Admission is on the basis of merit through an open selection. Fellowships are also provided. As a major partner in this programme, the Philips Semiconductors has also donated a Philips VLSI Laboratory costing Rs. 1 crore. They have also given a Philips Chair at IIT Delhi, which would mean a one time donation of Rs. 20 lakhs. 13 students have been admitted into this programme, 9 of them sponsored by Philips and 4 others by other industries. The students will do projects of interest of sponsoring industries and be known as scholars of the latter. However, there is no commitment on the part of the students to join these industries.

Recommendations

The academic institutions must take the interaction with the industry as an institutional goal. It is to be realised that interaction with industry involves a substantially different method of working compared to normal academic or research activities. Institutions have to evolve their own internal mechanisms to speedily and successfully implement industry related assignments. The industry on the other hand must accept its obligations to the nation by committing enough resources for development of indigenous capabilities in science and technology. A mechanism has to be put in place to encourage the

A mechanism has to be put in place to encourage the involvement of industry in technical education, manpower training and national R&D programmes.

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Some of the action points are as follows:

- Academic institutes should set up autonomous marketing arms or equivalent mechanisms that can operate on a commercial ethos of flexibility and procedural simplicity.
- Industry houses, in return, should take up interaction with academic institutions as a matter of policy and organise in-house cells/departments specifically to do this.
- Faculty members should be encouraged to work on assignments with industry as short term consultancy project or long term R&D problems. In addition, they should also be motivated to spend a length of time in industry, as an integral part of their duties and responsibilities.
- Faculty should be allowed to retain a reasonable portion of consultancy fees and other earnings from industry.
- Industry's involvement in Technical Education will be enhanced by introduction of Sandwich Courses at the UG level, and other innovative schemes at PG level.
- Industry professionals with wide experience are to be involved in curriculum development and student projects, and also as visiting/adjunct faculty.
- Industry lecture series should be introduced as part of the curriculum of pre final year and final year students of all streams of Engineering and Applied Sciences.
- Regular user oriented programmes are to be organised in the institutions for continuing education, upgradation of knowledge and qualification, and re-training of industry personnel, on a self financing (or net revenue earning) basis.
- Institutions should regularly organise open-house for the industry and publicise their in-house capabilities.
- Industry and institutions are to be encouraged to jointly develop, own and use infrastructural facilities.
- Industry, or a group of industries (consortium) may adopt an institute, or a specific course in the institute, and provide necessary support and assistance for running the same.
- Industry can institute academic chairs in institutions, and endowments to provide for scholarships and improvement of infrastructural facilities.
- Industry, in association with faculty of institutes, should identify real life and shop floor problems to be undertaken by students as UG or PG projects and also support these projects.

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Higher Education & Employment of the Educated in India

N.V. Varghese

India experiences a seemingly conflicting phenomenon of continued expansion of enrolments in higher education even when employment opportunities for university graduates are declining. The empirical analysis presented in the paper shows that despite a decline in the number of jobs requiring university degrees, the share of university graduates in employment has increased. This, the paper argues, is primarily due to the qualification escalation process taking place in the labour market. An escalation of educational qualification for jobs increases individual's demand for higher education.

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Higher education system throughout the world expanded considerably in the 1950s and 1960s. Employment opportunities of the university graduates were also increasing during this period. During the seventies unemployment among the university graduates became a world-wide phenomenon (Sanyal: 1987). Growth in student enrolment in higher education declined in many countries in the 1980s (Altbach: 1984). University systems through-out the world responded to such a situation by introducing various innovations and reform measures (Altbach: 1982; Sanyal: 1995; Varghese: 1991).

Higher education in India expanded remarkably in the post-independence period. Initial stages of expansion in enrolment were associated with increasing job opportunities for the educated. Over a period of time job opportunities for the educated declined; but enrolments in higher education continued to expand. This paper is an attempt to analyse the labour market for the educated so as to provide an explanation for the continued expansion of higher education in India.

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Expansion of the System

Higher education system all over the World expanded considerably in the post World War II period. India is not an exception to this phenomenon. At present India has 218 universities (including institutions deemed to be universities), around 7500 colleges employing around 250 thousand teachers and enrolling around 4.6 million students.

The expansion of the system shows (Table 1) that the 1950s was a period of high growth rates. Higher education in India experienced the highest rate of growth in the 1960s. However, the subsequent decades witnessed declining rates of growth. The decline in growth rates in the seventies was very steep. In fact, the growth rate in the seventies was almost 1/4 of what it was in the sixties. The decade of eighties has shown signs of recovery in growth rate in higher education although it is much lower than what it was in the sixties.

Higher education in India experienced the highest rate of growth in the 1960s. However, the subsequent decades witnessed declining rates of growth.

Table 1: Growth of Higher Education in India

Period	Growth Rates (%)
1950-51 to 1960-61	12.6
1960-61 to 1970-71	13.4
1970-71 to 1980-81	3.5
1980-81 to 1990-91	4.9

Source : UGC Reports (Various years).

An analysis of distribution enrolment by stages (Table 2) shows that the under-graduate level is the predominant sector in higher education. In the 1950s, under graduate level accounted for 87.2% of the total enrolments in higher education; its share has increased to 89.4% in 1990-91; enrolment in post graduate level accounts for less than 10% and that in research is around 1% of the total enrolment. It can be seen that the pattern of distribution of enrolment in higher education by levels has remained more or less the same.

Table 2: Enrolment in Higher Education by Stage (%)

	Under-Graduate	Post-Graduate	Research	Total
1950-51	87.2	12.0	0.8	100.0
1960-61	88.0	11.0	1.0	100.0
1970-71	90.9	8.4	0.7	100.0
1980-81	88.7	10.1	1.2	100.0
1990-91	89.4	9.5	1.1	100.0

Source: UGC Reports (Various Years).

Majority of the enrolment is in Arts, Science and Commerce faculties (Table 3). These faculties together accounted for 87.8% of the enrolments in 1960-61; their share declined to around 82% in 1990-91. Within this group the share of Commerce faculty has doubled from 10.2% in 1960-61 to 20.1 in 1990-91. This increase in share of the Commerce faculty was mostly at the expense of the Science faculty whose share declined from 32.7% in 1960-61 to around 19.6% in 1990-91. Professional education accounted for around 9% in 1960-61 and its share increased to around 11.7% in 1990-91. In terms of absolute increase, the Arts, Science and Commerce faculties continued to be dominant. Even in relative terms, these faculties still account for more than 80% of total enrolment in higher education.

Table 3: Faculty-wise Enrolment (%)

	1960-61	1970-71	1980-81	1990-91
Arts	44.9	44.4	40.5	40.4
Science	32.7	31.7	19.4	19.6
Commerce	10.2	11.5	20.1	21.9
Engineering	3.6	3.0	4.7	4.9
Medicine	2.7	3.3	4.0	3.4
Education	1.5	1.8	2.6	2.3
Agriculture	1.3	1.4	1.4	1.1
Others	3.1	2.9	7.3	6.4
Total	100.0	100.0	100.0	100.0
(in 00s)	556.6	1953.6	2752.4	4425.2

Source: UGC Reports (Various years).

Employment in the Organised Sector

Most of the educated in India are employed in the organised sector (Khan: 1979). Employment in the organised sector accounts for nearly 10% of the total. Employment in the organised sector grew at a rate of 3% during 1961 to 1985. The sixties experienced a rate of growth of 3.75% followed by continuously declining rates of growth in the seventies (2.73%) and in the eighties (1.48%). The growth rate in the public sector was higher than that in the private sector and it could improve its share in total employment in the organised sector from 58% in 1961 to 70% in 1985. More importantly, public sector accounted for nearly 78% of the increase in the employment in the organised sector during this period.

In 1985, nearly 75% of the employment in the public sector was accounted by the industrial divisions of Services (47%), Transports and Communication (17%) and Manufacturing (10%). Between the 1960s and 1980s, nearly 80% of the total growth in employment in the public sector was accounted by these three industrial divisions. Nearly 60% of the employment in the private

sector is accounted by the industrial division of Manufacturing, nearly 90% of the growth in employment in the private sector. An analysis of employment in the organised sector (Varghese, 1994) thus shows that the industrial divisions of Manufacturing, Services and Transport account for substantial share of employment in the public sector and they continue to account for nearly three fourth of the additional employment generated. Therefore, these are the industrial divisions within the organised sector which could provide employment for the educated in India.

Employment & Unemployment of the Educated

The Central Institute for Research and Training in Employment Services of the DGE and T under the Ministry of Labour, New Delhi brings out an annual publication entitled Bulletin of Job Opportunities in India. It provides information on the number and types of job opportunities available for the university graduates, post-graduates and diploma holders. It collects and collates information about vacancies from all the sources of recruitment like Employment Exchanges, Public Service Commissions, Staff Selection Commissions etc. This annual publication also provides information on the out-turn of graduates, post-graduates and diploma holders from universities and institutions of higher learning. The data presented in the remaining part of this section is based on this source.

Table 4 provides data on vacancies for and out-turn of university graduates during the decades of 1970s and 1980s. The changes in the number of job vacancies over a period of time does not show any consistent trend; it increases in certain years and declines in other years. However, the general trend seems to be a situation of declining number of vacancies over the years and it is more so in the late eighties. In 1972 the total number of vacancies was around 82,000 and in 1989 it has declined to 41,422. The number of vacancies in 1989 is almost half of that in 1972. This decline in the number of vacancies has become sharper from the mid-eighties onwards.

The out-turn from the universities shows an increasing trend and this trend is consistent over the years. The out-turn increased from 5.89 lakh in 1972 to 1.5 millions in 1989 i.e. it increased by more than 2.5 times during this period. The declining trends in the number of vacancies and consistently increasing trend in the number of university graduates have led to a widening gap between job opportunities and out-turn form the universities. Annual vacancies as a share of annual out-turn has declined drastically from 13.91% in 1972 to 2.65% in 1989. Such a widening gap reflects increasing unemployment among the university graduates in India.

Table 4: Vacancies and Out-Turn

	Vacancies	Out-Turn	Percentage
1972	81980	589359	13.91
1973	83633	698762	11.97
1974	56533	788888	7.17
1975	49232	734829	6.70
1976	60705	765588	7.93
1977	62071	826760	7.51
1978	67726	849544	7.97
1979	81717	909691	8.98
1980	63948	965231	6.63
1981	73383	987270	7.43
1982	75674	1014273	7.46
1983	83095	1127820	7.37
1984	71973	1157072	6.22
1985	66207	1272888	5.20
1986	47828	1445999	3.31
1987	56684	1512316	3.75
1988	59389	1513369	3.92
1989	41422	1564278	2.65

Source: Bulletin of Job Opportunities.

Table 5: Vacancies by Private and Public Sector (%)

	Public Sector*	Private Sector	Total
1965	89.79	10.21	100.00
1972	87.41	12.59	100.00
1980	82.00	18.00	100.00
1984	79.89	20.11	100.00
1989	77.62	22.38	100.00

*includes central, state and local body organisations.
Source: Bulletin of Job Opportunities

An interesting trend that can be noticed is that share of the private sector has increased over the years. The share of the private sector in graduate employment has more than doubled during the quarter of a century ending in 1989 i.e. from 10.21% in 1965 to 22.38% in 1989.

The trends indicate that there is a decline in job vacancies. Both public and private sectors experienced declining job vacancies especially from the mid-eighties. However, the decline was steeper in case of public sector and hence private sector could increase its share in the employment of university graduates. In other words, the increase in private sector in total job vacancies is the result of a relatively steeper decline in job vacancies in the public sector. In fact job vacancies in the private sector declined from 16500 in 1987 to 11000 in 1988

and further to 9300 in 1989. However, it is to be noted that between 1965 and 1989, job vacancies in the private sector increased from 6400 to 9300.

Both public and private sectors experienced declining job vacancies especially from the mid-eighties.

It is interesting to note that during the decades of seventies and eighties the rate of growth of employment in the organised private sector declined; so also its share in the total employment. However, its share of employment of the university graduates has increased during this period. This is primarily due to the qualification escalation process taking place in the private sector. The qualification requirements for the same jobs, especially in the general education based jobs, have increased over the years. For example, an analysis of education occupation data in the private sector shows that the share of university graduates in the Professional, Technical and Related workers increased from 9.4% in 1967 to 59.9% in 1977 and that in the Administrative, Executive and Managerial workers category increased from 4.6% to 44.6% during the corresponding period (Prakash and Varghese: 1985; Varghese: 1988; Varghese: 1989a). While the increase in educational qualifications of the employees requiring general education is a general phenomenon experienced both in the private and public sectors, such increase in educational qualification of Professional and Technical and Related workers is specific to the private sector. In fact during the corresponding period the share of university graduates in Professional and Technical workers category in the public sector declined from 35.9% to 21.9%. In other words, the increase in the share of employment of the graduates in the private sector is more a phenomenon of qualification escalation process than a result of increase in the jobs requiring higher level education.

A larger share of employment in the public sector is accounted by the state governments. However, over the years, the share of state government in total public employment has declined. This is true especially after the mid-eighties (Table 6). For example, job vacancies in the central government were around 16400 in 1965 which declined to 14000 in 1989. Job vacancies in the state sector declined from around 39600 to around 11600 during the corresponding period. Therefore, the decline is primarily due to the fall in employment opportunities in the state sector. While decline in job vacancies is experienced both in the Central and State Government sectors, the decrease was significant in the State Government sector. Between 1965 and 1989, the decline in employment in the state sector was around 12 times more than that in the Central Government sector.

Table 6: Employment in the Public Sector (%)

	Central Govt.	State Govt.	Total
1965	29.3	70.3	100.00
1972	18.8	81.2	100.00
1980	22.1	77.9	100.00
1984	20.6	79.4	100.00
1989	43.7	56.3	100.00

Source: Bulletin of Job Opportunities.

Table 7: Vacancies by Specialisation (%)

	1965	1972	1980	1989
Engineers	30.5	29.9	27.8	24.6
Technology	1.0	0.9	1.5	0.4
Agricultural Scientists	7.7	4.6	5.2	4.2
Medical	8.4	9.9	11.1	7.7
N. Scientists	5.4	8.5	5.6	4.0
S. Scientists	29.9	32.0	32.4	32.1
Others	14.1	14.2	16.4	27.0
Total	100.0	100.0	100.0	100.0

Source: Bulletin of Job Opportunities.

Table 7 shows that the share of all categories of specialisation except Social Scientists in the total job vacancies declined. The single category which has gained substantially is the 'Others'. Since we do not have adequate information on this category, it may be difficult to comment on the pattern. However, when we analyze the pattern of job vacancies by private and public sectors (table 8) one finds that the share of Social Scientists has declined in the public sector from 29.2% in 1965 to around 21.6% in 1989. On the other hand one notices an increase in the share of Social Scientists in the private sector from 37.2% to 68.5% during this period. Nearly 90% of the Social Scientists in the public sector is employed in the State Sector in 1972. When there is a decline in the employment in the State Sector, it is natural to expect a decline in the share of Social Scientists in the Public Sector. This becomes more clear when we look at Table 9 which it shows a declining share of the State Sector in job vacancies. In fact, within Public Sector, State Government Sector employs a larger share of graduates of all specialisation.

Table 8: Employment by Specialisation

	Public Sector				Private Sector			
	1965	1972	1980	1989	1965	1972	1980	1989
Engineers	31.3	31.0	29.1	29.2	23.5	21.4	21.9	8.8
Technologists	0.8	0.8	1.5	0.5	2.8	2.2	1.6	0.3
Agricultural Scientists	8.2	5.0	6.0	5.3	2.8	1.8	1.4	0.2
Medical	9.0	10.9	13.0	9.5	3.3	3.1	2.5	1.6
N. Scientists	7.9	8.7	5.6	4.2	12.6	7.5	5.6	3.3
S. Scientists	29.2	29.9	28.1	21.6	37.2	46.5	51.6	68.5
Others	13.6	13.7	16.7	29.7	17.8	17.5	15.4	17.3
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table 9: Employment Pattern: Central and State Govt. (%)

	1972		1980		1989	
	CG	SG	CG	SG	CG	SG
Engineers	27.2	72.8	26.1	73.9	75.3	24.7
Technology	41.3	58.7	23.7	76.3	53.8	46.2
Agricultural Scientist	19.7	80.3	7.7	92.3	69.7	30.7
Medical	12.9	87.1	21.9	78.1	49.7	50.3
N. Scientists	25.8	74.2	37.8	62.2	82.1	17.9
S. Scientists	9.2	90.8	13.7	86.3	32.9	67.1
Others	18.9	81.1	29.5	70.5	49.5	50.5
Total	18.8	81.2	22.1	77.9	56.3	43.7

Source: Bulletin of Job Opportunities.

Table 10: Unemployment of the Educated (%)

Year	Matric	Under Graduate	Graduate & above	Total
1953	76.9	10.4	12.7	100.00
1960	78.8	12.0	9.2	100.00
1970	60.5	24.4	15.1	100.00
1980	55.2	25.8	19.0	100.00
1989	58.0	25.1	16.9	100.00

Unemployment among the educated is increasing in India. Educated job seekers in 1989 was 16.7 million. In terms of share of different levels of educated, the matriculates accounted for the largest share in the educated unemployment in India. However, over the years, their share has declined. For example in 1953, matriculates accounted for 77% of the educated unemployed and their share declined to 58% in 1989. Correspondingly, unemployment among other levels are increasing. The under graduates constituted 10% of the educated unemployment in 1953 and in 1989 they constituted 25% among graduates and post-graduates i.e.; unemployment is slowly but steadily spreading to all levels of education. An analysis of unemployment by faculties shows that Arts, Science and Commerce faculties account for more than 80% of the total graduate unemployment.

Implications for the Education Sector

Analysis in the previous sections shows two seemingly conflicting trends: First, enrolment in higher education continues to expand even when job opportunities for university graduates are declining. Second, the share of university graduates in total employment is increasing. It seems conflicting because the evidence on job opportunities is based on notification of vacancies while the latter is based on the data on actual recruitment and posting. It implies that there is a trend towards recruiting more of university graduates even when qualifications notified were less than that of university graduation. This is true of both public and private sectors. The argument in this paper is that the labour

market experiences a qualification escalation process. This is reflected more at the time of recruitment than at the time of notification for jobs.

There is a trend towards recruiting more of university graduates even when qualifications notified were less than that of university graduation. This is true of both public and private sectors.

Many Studies have noted that qualifications for the same jobs have increased over a period of time (Varghese, 1989a). Blaug, et. al (1969) notes it as upgradation of qualifications; Dore (1976) explains it interms of 'diploma disease' and Oxenham (1981) calls it 'Paper Qualification Syndrome'. The qualification escalation process may either be due to a devaluation of education (Punchamukhi: 1975) or due to excess supply of higher educated persons (Srivastava and Oxenham: 1978) or both (Varghese: 1982). Whatever be the reasons, the single significant factor contributing to this phenomenon is the qualification based preferential hiring practice followed by the employers. In fact employers use educational qualifications more as a screening device to facilitate recruitment than as a measure of job performance. This option is open to the employers because of large scale unemployment among the university graduates. In other words, when there is widespread unemployment among the educated, persons with qualification levels higher than what notified apply for the post. The employers use educational qualifications as a screening mechanism to short list potential candidates for interviews. In general, the qualification levels used to short list candidates will be higher than what was indicated as the minimum levels of qualification. This leads to the phenomenon of educational inflation or qualification escalation in the employment market. It is a situation characterised by enhancing of education qualification without any change in the job content and description or in the job notification.

When there is widespread unemployment among the educated, persons with qualification levels higher than what notified apply for the post.

In our earlier studies (Varghese, 1988; 1994), it was found that this phenomenon is common in the organised sector employment especially in the general education based occupations. More importantly, this phenomenon is stronger in general education based occupations in the private sector. The empirical evidence analyzed in this paper supports this phenomenon of qualification escalation. This may be one of the major reasons for substantial increase in the share of Social Scientists in the private sector employment in the seventies and eighties. In other words, the arguments is that the increasing share of general education based graduates in the employment market does not necessarily reflect an increase in jobs requiring these qualifications. More importantly, it reflects a situation of higher level educated persons increasingly taking up jobs which actually require only lower level qualifications i.e. increasing share of university graduates in total employment is at the expense of the employment of under-graduates and matriculates.

Increasing share of general education based graduates in the employment market does not necessarily reflect an increase in jobs requiring these qualifications. It reflects increasing share of university graduates in total employment at the expense of the employment of under-graduates and matriculates.

What will be its implications for the education sector? Will the demand for higher education increase or decrease under such circumstances? Normally it is expected that enrolments to higher education should increase when employment prospects for higher educated are increasing. This is reliable argument in the context of the human capital theory. However, this logic does not seem to work in the Indian context. Perhaps, what is operating in India is as follows: when there is widespread unemployment, employers use education as a screening device and in the process educational qualification for the same job escalates; once qualification levels escalates, jobs expectations remaining the same, individual demand for higher levels of education will increase (Varghese: 1986; 1989b). Education becomes a convenient instrument to improve one's labour market competitiveness. Under such conditions, if one is not pursuing higher levels of education one's relative position in the labour market weakens. The options for the prospective employees are either to remain unemployed with lower levels of education and thus reduce chances of being employed in future or going for higher levels of education and improving once own chances of

The options for the prospective employees are either to remain unemployed with lower levels of education reduce chances of being employed or going for higher levels education and improving once own chances of getting employed.

getting employed. I would tend to argue that individuals more often exercise options in favour of the latter leading to an increased individual demand for education. This explains why India experiences a conflicting situation of increasing unemployment among the university graduates and continuing private demand for education.

The option before the public authorities is either to restrict entry into higher education or regulate the recruitment process. Public authorities in India did not exercise any of these options. Perhaps, they could not withstand the public pressure to expand higher education (Varghese: 1989b) and hence what is attempted in India is: (i) to expand higher education outside the traditional institutionalised structure through establishing Open Universities and expanding correspondence courses; and (ii) regulate entry into

Public policy response to labour market process, a conducive condition for continued expansion of the higher education system even when job opportunities for university graduates are declining.

professional courses through admission tests. The other policy measure advocated, but not implemented, is delinking degrees from jobs. Thus public policy response to labour market process also provides a conducive condition for continued expansion of the higher education system even when job opportunities for university graduates are declining.

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Decreasing Third World Efficiency: First World Professors Can be the Cause

Albert A. Blum

Work aspirations and modalities of managing/discharging official obligations differ widely across the varying cultural ethos of the West and the East. Hence teaching American values of individualism, and non-reverence to bureaucracy to Eastern managers raised in paternalistic, authoratarian environments, is a sure way of sowing seeds of dissent and sabotaging growth and productivity, remarks the author in a humorous vein.

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If the United State wants to protect its superiority over many third world competitors, one place to go is where potential third world managers still congregate as they seek further economic progress for their countries – namely, American universities. It is there that Americans can inadvertently sabotage developing countries' economic growth by first training them and then helping them secure positions back home where they will become unwittingly subversive by sowing the seeds of discord while teaching their students what Americans have taught them. And American professors can go abroad to teach and thus act directly as a disruptive force.

Values: Western Vs Eastern

While in Asia, for example, I used to discuss at universities and executive programmes a host of American theories about motivation that, if followed, was supposed to result in increased productivity. Many Far Eastern managers at these sessions responded by claiming that American motivation theories were irrelevant in the Far East since they felt that only one basic need motivated most employees – money. They claimed a Far Eastern manager becomes self-actualized not through creative work experiences but by securing a salary increase – the more money made, the more self-actualization.

Far Eastern managers claimed that American motivation theories were irrelevant since only one basic need motivated most employees – money.

Self Actualization

I argued back that this was a self-fulfilling stereotype. By the end of our discussion, a few students, troubled,

began to agree that not only did they need more pay but that they also needed to have friends with whom to work; that their jobs had to be enriched; and if management did not satisfy these and other needs, there was no reason to work harder. And thus productivity may have declined as a result of that troubling educational experience.

At another seminar at which I spoke one Sunday morning, those attending told me that their spouses did not mind their working Sundays as long as they brought back home more of that ubiquitous item, money. This was in response to my having discussed the role of the family in increasing productivity and why spouses should not be workaholics, but instead should care and be involved more in their family's lives. After that lecture (and a host of American TV programmes), I began to imagine this "guilty" manager returning home apologetically from the seminar with a bunch of flowers and with a promise not to work another Sunday away from home. The spouse, of course, would be completely confused by the change in behaviour but, as a result, would begin to wonder how to take advantage of this new inexplicable guilt.

Appraisal Systems: Positive or Negative?

And what if an American-trained Ph.D. discussed appraisal systems? He would lecture about the importance of praise or positive reinforcement along with the need to treat with special care and concern negative criticisms or punishments. The third world students would shuffle in their chairs as the Ph.D. talked. Finally, one would raise his hand (as one did with me) and say that his fellow countrymen do not worry about positive reinforcement because, after all, everyone is supposed to do his or her job well. Managers, therefore, only pronounce negative judgment (often, in public) because a subordinate is supposed to be told when he is failing at his job, something not needed when he is doing it well.

Nevertheless, again, I raised doubts in the students' minds. They had been told that the latest research in the United States indicates that good work is not to be assumed but rather something to be praised so that the employee would continue to do it. Moreover, a manager should be sensitive to the hurts caused to workers when he tells them how poorly they are doing—particularly when he makes these judgments in public. No doubt after such a seminar, many of the participants would no longer be convinced that good work was a norm and that hard work was to be expected. Instead, if their bosses did not praise them the next day, they would become unhappy and if their supervisor publicly admonished them for some failure, they would sulk, become defensive, and less productive.

The fact that one of the students had raised his hand to ask a question was another proof of the success of the insidious nature of American teaching and training. Many third world students (particularly in Asia, with India as an exception) usually study, sit, and scribble notes about what is said but rarely ever raise their voice in class to protest a word uttered by a lecture. But not in a class run by Americans who believe in communication and conflict, as they insist that their students ask questions.

Did they stop asking questions outside the classroom? Some students, in fact, once started as a result of the classroom experience, asked their managers such questions as why they were doing what they were doing the way they were doing them—just like American subordinates at times ask their managers. Who knows how much productivity might be lost by such a basic change in relationships?

Individualism Vs Paternalism

What other things do American-trained teachers try to teach? In the paternalistic society so frequently found in third world countries, American professors might discuss the importance of individualism—a clearly subversive idea in a society where individualism is denigrated. Imagine the effects of other American approaches? Imagine, for example, a group of third world managers attending a programme like the Aspen Centre for the Humanities. Consider the effects if 50 top third world executives discussed Plato rather than productivity, ethics rather than economics, Bach rather than bookkeeping, as many American managers have done while satisfying their souls looking at the mountains in Colorado.

In the paternalistic society so frequently found in third world countries, American professors might discuss the importance of individualism—a clearly subversive idea in a society where individualism is denigrated.

What other insidious ideas emanate from American training? Americans believe and practice academic freedom. They often ignore bureaucratic rules. They discuss ideas with students. They challenge such concepts as paternalism, and authoritarian

managements or governments. They debate whether democracy, however imperfectly applied, is also relevant to the workplace in that people ought to have a voice in decisions affecting what happens at their jobs. They argue about the roie of ethics in business. All of these issues—and more—have been a part of the American workplace and of American education for years now. They are both a reflection and a cause of some of the claimed decline in the United States' commitment to "hard" work. Moreover, some of these issues are confusing in that they have no "right" answers but Americans are often trained to have a tolerance for ambiguity. Americans may as a result of their behavior be paying a price in lost sales, higher labour costs, a declining rate of increasing productivity and a narrowing economic gap between it and other countries. But the price may also be paid elsewhere as American managerial and political principles become diffused throughout these other countries by their teachers whom Americans educate and by Americans, themselves, teaching abroad. Whatever the negative impacts, these surely are also positive influences.

□

Feature

Pay Satisfaction of R&D Personnel: Does Money Matter?

Pulak Das

This study examines the three forms of financial rewards viz. monthly gross salary, monthly take home salary and yearly profit based bonus on pay level and benefit dimensions of pay satisfaction. Using a sample of 159 pay satisfaction responses from the R&D personnel of two public sector undertakings in India, the study found that among the three forms of monetary rewards considered, gross salary has significant positive effect on pay level satisfaction, while the yearly profit based bonus shows positive effect on only the benefit satisfaction. It is further observed that the sensitivity of the pay level satisfaction towards the take home salary is more than that towards gross salary.

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That R&D personnel are being recognised as a separate occupational group in Indian manufacturing organisations is becoming increasingly evident by the rapid growth in investment on in-house R&D and the growing number of professionals taking R&D jobs as a career. The investment in in-house R&D has shot up from Rs. 200 crores in 1980 to Rs. 950 crores in 1990 employing more than 40,000 highly trained professionals (Department of Science and Technology, 1988-89; 1992). The annual expenditure on in-house R&D now accounts for as much as 23 per cent of the total expenditure on R&D including institutional, governmental and industrial sectors. In terms of the capacity to provide employment to qualified engineers and scientists, this sector now accounts for more than 30 per cent of the total R&D related jobs. Because R&D jobs require highly qualified manpower, the qualification mix of this sector is significantly higher than that of the other sectors. The shares of Ph.D's, Masters and Graduate engineers in in-house R&D are 5.21 per cent, 27.54 per cent and 67.22 per cent respectively compared to 1.94 per cent, 14.01 per cent and 84.11 per cent respectively in all the industries together.

The significant changes of the job market and work environment have spawned an emerging body of research literature on the subject. These works deal with the characteristics of the organisations for R&D effectiveness (Krishnaiah, 1993); technology perception of team leaders (Iya, 1992); job satisfaction in R&D environment (Dhawan & Roy, 1993); age and seniority as a factor in the perception of work norms of scientists (Pruthi, 1993) etc. Despite the wealth of literature dealing with the various dimensions of R&D work, one is surprised by the paucity of attention given to pay aspiration and pay satisfaction of the professionals who man and manage these laboratories. There have been only a few studies showing a positive relation between pay and pay satisfaction of these professionals (Dreher, 1981; Gomez-Mejia & Balkin, 1989). However, all these

works use a unidimensional pay satisfaction construct, making it difficult to identify the area of compensation policy where remedial measures are most warranted and organisational intervention strategy is likely to be most fruitful. The present research is an attempt to understand the role of different forms of monetary reward on two dimensions of pay satisfaction of R&D professionals in some public sector undertakings while controlling the personal and other job characteristics e.g. education, age, marital status, gender, prior work experience, team leadership and experience in the current position.

Pay Satisfaction: Dimensionalities

Lawler's (1971) comprehensive model of pay satisfaction emphasizes the role of the discrepancy between the perceived amount of pay that is expected and the perceived pay that is actually delivered by the organisation. The higher the perceived pay received over that of the perceived pay expected, the higher is the pay satisfaction. The perception of pay expected depends on a social comparison process whereby the individual takes into account a number of reference standards e.g. the pay that the individual feels he deserves due to his contribution to the organisational activities, the reservation pay below which the individual will sever his/her association with the organisation, the pay received by others doing the same work in the organisation, and the pay received by others doing similar work in other organisations in the region (Rice, et al. 1990). The perception of pay is mainly a function of the actual pay received from the job. A higher personal input in the form of higher educational qualification, skill, higher job responsibility or age raises the perception of pay that one deserves and can lead to a lowering of pay satisfaction under constant pay. Even an increase in average salary of people doing similar work in other organisations in the neighbourhood can affect the pay satisfaction negatively through its effect on the reference standards used to calculate the perceived pay expected (Cappelli & Sherer, 1988). Similarly, an upward change of actual pay under constant personal input and organisational environment is likely to raise the pay satisfaction.

A higher personal input in the form of higher educational qualification, skill, higher job responsibility or age raises the perception of pay that one deserves and can lead to a lowering of pay satisfaction under constant pay.

Research on pay satisfaction has brought in two major modifications to Lawler's model. The first refinement was suggested by Dyer & Theriault (1976). Their proposal based on the earlier works by Goodman (1974) was that the pay satisfaction is the combined effect of perceived equity of pay as conceptualised by Lawler and the perceived adequacy of the pay system administration. Adequacy of the pay system administration was defined as the employee perception of the appropriateness of the pay criteria, understanding of pay criteria, accuracy of performance assessment and adherence to pay policy contract. Thus a simple improvement of perceived pay equity by way of increased pay out may not be a guarantee to higher pay satisfaction unless such pay out is perceived as due to accurate performance assessment and according to the pay and job contract. There have been a number of studies showing the importance of perception of pay for performance on pay satisfaction (Heneman, Greenberger & Strasser, 1988).

A simple improvement of perceived pay equity by way of increased pay out may not be a guarantee to higher pay satisfaction unless such pay out is perceived as due to accurate performance assessment and according to the pay and job contract.

The second modification was suggested by Heneman & Schwab (1979) on the question of dimensionality of pay satisfaction. Drawing on their earlier works, they suggested a five dimensional structure for pay satisfaction construct – the pay level; pay growth; pay structure or relative pay; pay administration and pay as benefit. The satisfaction with pay level refers to the perceived satisfaction with the direct wage and salary satisfaction with pay growth refers to perceived satisfaction with the change in pay level. Satisfaction with pay structure is defined as the perceived satisfaction with internal and external pay hierarchy while satisfaction with pay administration is the perceived satisfaction with the way individual pay is decided in a hierarchy of jobs. Satisfaction with benefits concerns perceived satisfaction of indirect payments made to the employees. Their view was that in any organisation one can have a general attitude towards pay as well as certain specific attitudes towards selected areas of the pay policy.

Empirical research on the dimensionality issue (Judge, 1993) has unequivocally established the multidimensional character of pay satisfaction. However,

confusion still persists as to the exact number of such dimensions due to the varying pay practices across different organisations and even across job levels within the same organisation (Scarpello et al, 1988).

R&D jobs have the unique quality of being homogeneous both in terms of activity sets and in terms of the necessary skills across many levels of the conventional job hierarchy (Achison & French, 1967). Unlike other routine tasks of the organisation, it has a well defined boundary with a clearly stated objective and a fairly perceptible end to the execution of the goal. In terms of the personnel goal and personal aptitude, R&D professionals are reported to have different orientation vis-a-vis other professionals with more identification with the profession and peers and less with the organisation (Lovelace, 1986). Such distinct job characteristics and personnel goals combined with the rapid growth in employment opportunities outside their own organisation are likely to have significant impact on their perception of performance and attitude towards monetary rewards.

Personnel & Pay Policies

R&D personnel as a separate occupational group in manufacturing organisations in India face certain unique organisational characteristics with a few distinct behavioural implications. One striking feature of in-house R&D in India is the absence of any structured personnel policy (Ministry of Industry, 1979; Bharol, 1989) taking into account the nature of the jobs and the professional training and aspiration of the people who man them. As a result, most organisations follow the same policies that they follow for their other professionals. The jobs in the R&D unit and the career of the personnel are organised in the same hierarchical manner as in other units of the organisation. The recruitment is usually at the bottom of a hierarchy of grades with fresh engineering graduates and post-graduates, the higher grades are filled usually by way of promotion from lower grades. Promotion to higher grades is based on a mixture of seniority and performance in the existing grade. There is no separate recruitment or promotion policy for the R&D unit. The personnel for the R&D unit is chosen by the management from the general pool of professionals of the organisation.

The total pay package of the R&D professionals in the public sector consists of four major components viz. a gross salary measuring the total financial entitlement of the individual on account of his works in the organisation; a take home salary measuring the regular disposable income; a yearly incentive bonus based on the annual profit made by the organisation and the total number of mandays worked by the individual in the preceding year and a package of fringe benefits which are the same for all personnel over a range of grades or job levels. These benefits include retirement benefits, holiday allowances, health care facilities and allowances, etc. The total payments on account of fringe benefits is neither tied with performance nor with seniority. However, some of the benefit payments e.g. retirement benefits increase with the increase in gross salary. The take home salary is not a separate component of salary in a strict sense because it is derived from the gross salary after adjusting for deductions on account of income tax, rent for using company housing, compulsory savings, company loan, insurance premium etc. However, because of its sensitivity to the amount of total deductions from gross salary and because of its direct bearing on the welfare of the employee, it can be considered a separate component of the pay outcomes.

There are three possible ways by which these pay policies can interact with the R&D work environment and affect the level of pay satisfaction.

It is quite evident that the pay and career development policies are framed for all professionals in the public sector organisations irrespective of the nature of the job and the aspirations of the personnel. As such it fails to take into account the unique characteristics of the R & D environment and the special aptitude of the personnel who prefer job in such environment. Jobs in in-house R&D are usually organised in the form of a project with a fixed specified goal and headed by a team leader of considerable expertise and skill and manned by a few subordinates. The success or failure of such a project is not only known and visible to all members of the team but become the credit or the liability of the whole team irrespective of seniority or contribution of any individual member. Under a mixed criteria based system (Ministry of Industry, 1979; Ministry of Finance, 1986) as is practised in the R&D environment of Indian public sectors, the gross salary is a measure of one's seniority in the organisation as well as a measure of one's relative performance in the organisation. Measuring the contribution of any individual member in a team based production is not only difficult but is also fraught with the danger of either overestimation or underestimation with its consequent behavioural implications (Pritchard, et al, 1972). It has been observed that in R&D environment a team based aggregate reward system has higher positive behavioural impact than an individual performance based reward (Gomez-Mejia & Balkin, 1989). Further, individual performance based recognitions in the form of promotion and higher salary are given only after an interval of time. Thus these recognitions might fail to reflect fully the performance and contribution of the individual. And, even if it is assumed that such recognition does fully reflect the per-

formance of the individual during the intervening period, the long time gap between performance and recognition can obscure the relation between the two. Because the key to the positive effect of higher salary on pay satisfaction is the perception of pay system administration generated from the financial reward the following hypotheses have been made:

Measuring the contribution of any individual member in a team based production is not only difficult but is also fraught with the danger of either overestimation or underestimation with its consequent behavioural implications.

Hypothesis 1: Recognition of performance by way of gross salary may not have any significant impact on the pay satisfaction.

A point of possible interaction between the pay outcome and the environment is the role of yearly incentive, based on company profit. Profit sharing, stock ownership and project based bonus are a few of the most commonly used incentive strategies in R&D organisations (Balkin & Gomez-Mejia, 1984). Because of a direct linkage between the success of the project and the project based bonus, such incentive strategies show greater perceived behavioural impact than the other two. Unlike total organisational performance, individual team members and team leaders can exercise considerable control over the outcome of their project. A project based bonus encourages the members to contribute their best individual effort to bring the project to a fruitful end. A company-profit based reward system does not consider the fate of any individual project and hence fails to reward the effort of the people involved in a successful project. It raises the absolute level of financial entitlement of all members of the organisations irrespective of their actual or potential performance. Such a payment is likely to be perceived more as a benefit than a reward for performance. Thus we hypothesise:

Hypothesis 2: Company aggregate profit based bonus is likely to have positive effect on the benefit satisfaction of the R&D personnel.

A third point which has not received much attention in pay satisfaction literature is the role of take home salary vis-a-vis the gross salary. Take home salary is the gross salary less the deductions on account of tax, compulsory saving, pension fund, insurance premium or deduction due to use of company housing. Most of these deductions are involuntary in nature and are due to overall government policy, nevertheless, they do affect the well being and state of living of the individual due to their direct effect on one's disposable income. The ability of the individual to satisfy his or her basic necessities depends more on the disposable income and less on the gross income. As such, individual satisfaction with organisational reward is likely to be more elastic with respect to this component of pay at least in those facets that measure their reactions to the standard of living. Thus we hypothesise:

Hypothesis 3: The variations of the pay level satisfaction of the R&D personnel due to variations of take home salary is likely to be higher than that due to variation of gross salary.

The primary purpose of the present study is to assess empirically, the relative impact of the three forms of organisational rewards viz. monthly gross salary, monthly take home salary and yearly profit based bonus on two dimensions of pay satisfaction viz. pay level and benefit dimensions while controlling other correlates of pay satisfaction identified in the literature. The control variables included in the study are educational qualifications (Heneman, 1985), prior work experience (Shapiro & Wahaba, 1978); job responsibility (Lawler, 1971), gender (Sauser & York, 1978); marital status (Hemmasi, et al, 1992; Dreher, et al, 1988), age (Dreher, 1981; Glenn, et al, 1977) and experience in current position (Allen & Keaveny, 1981; Dreher et al., 1988).

Method

As part of a bigger study on pay and pay satisfaction, data was collected from the R&D personnel of two public sector undertakings. Both the organisations are specialized in the manufacture of mechanical engineering goods and are located in the same region of the country within a distance of 100 kilometres. Both are quite comparable in size with yearly sales turnover of about Rs. 730 crores and Rs. 750 crores respectively with a work force of about 17,000 and 20,000 each. In terms of their impact in the job market, these two organisations together make the largest employers of mechanical engineering graduates and post-graduates in the region. As such, they are model employers and leaders in the professional job market for mechanical engineers in the region.

The compensation and personnel policies of all the public sector undertakings in India, are framed by the Bureau of Public Enterprises (Ministry of Industry, 1979). The overall policy for recruitment, pay, promotion and number of grades between the entry grade and the highest grade is the same in both the organisations considered here. Thus for all practical

purposes, the personnel in these two organisations can be assumed to have identical organisational and economic environment.

The R&D units of public sectors in India support the overall production and innovation needs of their respective organisations and are usually located in the same complex. There is no separate compensation or personnel policies for the R&D unit. However, within the total organisation, R&D unit enjoys some amount of autonomy with regard to personnel policies and there is virtually no inter-transfer of personnel between the R&D unit and other units of the organisation. The personnel hierarchy in the R&D units of these organisations consists of a total of 7 grades starting from the entry grade to the head of the unit. For every grade there is a minimum and a maximum pay covered by an annual automatic increment of about 3 per cent. The overlap in pay between adjacent grades is as much as 70 per cent. The recruitment in the R&D unit is usually done at the bottom of the grade hierarchy with fresh engineering graduates and post-graduates. The filling of vacancies in higher grades is mainly by way of promotion from lower grades with occasional direct entry from outside in the middle ranks. The promotion to higher grades takes into account the following four criteria with varying weights in different grades:

- Number of years of service completed in the existing grade over and above the minimum years of service required for the grade.
- Additional qualification over and above the entry level qualification if any.
- Performance rating during the preceding three years.
- Suitability as assessed by a promotion committee.

The total pay package consists of a gross salary signifying the total regular income of the individual and a number of fringe benefits which include compulsory payment to a personnel saving fund, in proportion to gross salary, retirement benefits in proportion to salary drawn at the time of retirement, payable medical expenses for self and family members, holiday allowances, company transport on nominal payment for attending office, subsidized food during working hours, company housing for personnel working in remotely located factories, house building loan facilities etc. and a yearly 'incentive bonus' which is a fraction of the company profit distributed over all the officers of the organisation adjusted according to one's contribution to total mandays worked in the company in the preceding year. The annual industrial bonus is guided by the Payment of Bonus Act (Ministry of Industry, 1965) that covers all employees below the rank of officers in all industrial establishments including public sector undertakings and makes it mandatory for all industrial organisations in India to pay a minimum percentage of annual gross salary of all workers as bonus. R&D personnel come under the category of officers and are not entitled to any industrial bonus under the Payments of Bonus Act. The annual profit distributed to R&D personnel as 'incentive bonus' is in no way connected with the minimum bonus payable to industrial workers under the Payment of Bonus Act.

The sample consists of a total of 171 engineers from the R&D units of the two public sectors, covering over more than 60 per cent of the total qualified personnel in their respective R&D units. Persons having at least six months or more of service in the organisation at the time of the survey and at least a Bachelors degree in Engineering or equivalent were requested to participate in the study. Out of 171 responses, 12 participants did not provide their personnel data and hence the remaining 159 responses were used in the analysis.

Out of the 159 respondents, 96 had Bachelors degree and 63 had Masters in engineering, 64 had prior work experience before joining their existing organisation, 65 were working as team leaders while the rest were team members, 125 were married, 154 were males and 5 females, 86 reported to have received company profit based bonus while the rest received no bonus. The age of the participants in the sample ranged from 23 years to 57 years with a mean of 36.4 years. The experience of the personnel in their current position ranged from 1 year to 8 years with mean of 2.67 years. The monthly gross salary ranged from Rs. 2900 to Rs. 8500 with a mean of Rs. 5556. The monthly take home salary ranged from Rs. 900 to Rs. 5800 with a mean of Rs. 3146.

The pay satisfaction was measured by means of a pretested questionnaire which was administered personally by the author. The questionnaire was administered in groups of 25 to 30 personnel in each group with explanations about the objective of the study and the way each item in the questionnaire was to be answered. The questionnaire had two parts—Part 1 measuring the pay satisfaction and Part 2 collecting personnel information.

The five point Likert format with 1 = strongly disagree and 5 = strongly agree was utilized to measure pay satisfaction. The pay satisfaction measure was based on the earlier works of Mathur (1982) and Heneman (1985). Only one issue was considered while making the present questionnaire. The questionnaire focussed on how well the pay system satisfied the absolute need for money, driven by the basic

Table 1: Mean, standard deviation and simple correlation of the dependent and explanatory variables in the sample

	Mean	Std.	1	2	3	4	5	6	7	8	9	10	11
Pay level	6.02	2.64	(0.76)										
Fringe benefit	23.4	6.71	0.23	(0.77)									
Monthly gross salary	5556	1430	0.15	–0.29									
Monthly take home salary	3146	960	0.26	–0.35	0.61								
Industrial Bonus	0.54	0.50	–0.16	0.27	–0.08	–0.45							
Education	0.40	0.49	00	–0.13	0.15	0.22	0.05						
Prior work experience	0.40	0.49	0.10	0.16	0.18	0.04	0.06	–0.11					
Age	36.4	7.61	0.01	–0.07	0.73	0.17	0.21	–0.15	0.27				
Team Leadership	0.41	0.49	–0.06	0.01	0.43	0.15	0.20	0.11	0.02	0.45			
Gender	0.97	0.17	–0.23	–0.10	0.22	0.01	0.12	0.15	0.07	0.28	0.15		
Marital status	0.79	0.41	–0.05	–0.17	0.55	0.20	0.23	0.01	0.15	0.54	0.31	0.08	
Experience in current position	2.67	1.67	0.17	–0.20	0.27	0.25	–0.14	0.05	0.02	0.13	0.01	0.12	0.25

() Reliability coefficient.

biological requirements of the individual. Again, because in most organisations, the absolute need for income is answered by two types of payment viz. by a regular salary and by a package of benefits, the satisfaction of the absolute need was measured by questions targeted at these two forms of payments separately. Thus the total questionnaire was designed to evoke responses from the participants on the two areas of the compensation satisfaction viz. pay level satisfaction; fringe benefit satisfaction. The final use of the questionnaire was preceded by extensive consultation with the managers and scientists of R&D units and a pilot study on a sample of 117 personnel in another public sector undertaking.

The satisfaction with pay level was measured by 3 statements. The participants were asked to compare their absolute need for income for an appropriate living with the income available from the organisation by way of salary. A typical question on this dimension was "the total monthly earning from my job is sufficient to meet my present and future needs." The reliability coefficient of the items in this dimension was 0.76.

The satisfaction with fringe benefits was measured by 9 statements. The participants were asked to compare the various benefits that exist in their respective organisations with what they desired. A typical item on this dimension read "the retirement benefits that exist in this organisation are quite satisfactory". The reliability coefficient on this dimension was 0.77.

The demographic continuous data e.g. monthly gross salary, monthly take home salary, age and experience in the current position along with the categorical data e.g. educational qualification (Masters = 1, Bachelors = 0) whether they had worked before (yes = 1), sex (male = 1) marital status (married = 1), job characteristics (team leader = 1) were also collected directly from the participants. R&D personnel in Indian public sectors are not entitled to industrial bonus under the Payment of Bonus Act (Ministry of Industry, 1965). However, because of the common source of fund and identical method of distribution of both the industrial bonus under the Payment of Bonus Act and the 'incentive bonus' for the officers, many R&D personnel perceive their 'incentive bonus' as industrial bonus. As such, the bonus question was measured by a 'yes-no' type response with 'yes' corresponding to a perception of existing incentive payment as industrial bonus.

Analysis

The comparative effects of different forms of pay on different dimensions of pay satisfaction were analysed by the method of multiple regression. The dependent variables were the sum of the items of, pay level satisfaction and fringe benefit satisfaction. Each dependent variable was estimated as a function of the following variables: monthly gross salary, monthly take home salary, perception of the incentive payment as industrial bonus, educational qualification, prior work experience,

job hierarchy (team leadership), sex, marital status, and number of years in the current position. Because of high correlation between age and gross salary, the variable age was not used as an explanatory variable.

The means, standard deviations and the inter-correlations among all the variables are shown in table 1.

Results

The results of the multiple regression of pay level and fringe benefit satisfaction against other variables are shown in table 2. It can be seen that the total explanatory power of the regression equations varies from 18 per cent for pay level satisfaction to 24 per cent for benefit satisfaction. This is comparable with 12 per cent found by Dreher (1981) and 21 per cent found by Gomez-Mejia & Balkin (1984) using unidimensional pay satisfaction construct and 7 objectively defined variables.

On the role of pay on pay level satisfaction, all the three types of pay viz. gross salary, take home salary and bonus have positive coefficients. However, only the coefficient of gross salary is statistically significant. Thus under constant personnel input and job characteristics, increased gross salary leads to increase in pay level satisfaction. Thus our Hypothesis 1 is not supported by the data.

The standardized coefficient of take home salary is quite comparable in magnitude with the corresponding coefficient of the gross salary and both are of same sign. Considering the fact that the range and standard deviation of the take home salary are considerably less than that of the gross salary, it appears that the pay level satisfaction is more sensitive to the variations of take home salary than that of the gross salary. Thus Hypothesis 3 has only a modest support from the data.

The coefficient of the perception of 'incentive bonus' as industrial bonus has significant ($p < 0.05$) and positive coefficient in the regression of fringe benefit satisfaction. This indicates that among the personnel those who perceived the existing 'incentive bonus' as industrial bonus are relatively more satisfied than those who thought otherwise. Thus Hypothesis 2 is well supported by data.

Among the control variables, we find that work experience has a significant positive effect ($p < 0.01$) on benefit satisfaction. This is consistent with Lawler's model and Goodman's (1974) observation that one is inclined to use previous work history which might provide an easy and reliable reference to compare and contrast the existing pay.

Table 2: Standardized beta coefficients and t-statistics for multiple regression equation of pay level and benefit satisfaction against the explanatory variables

Explanatory variables	Dependent variables: Pay level and benefit satisfaction	
	Pay Level Satisfaction	Benefit Satisfaction
Monthly gross salary	0.200	–0.149
	(1.619)*	(1.256)
Monthly take home salary	0.175	–0.136
	(1.547)	(1.246)
Industrial bonus dummy	0.053	0.206
	(0.566)	(2.27)**
Educational qualification dummy	–0.011	–0.064
	(0.134)	(0.837)
Prior work experience dummy	0.099	0.203
	(1.297)	(2.750)***
Team leadership dummy	–0.081	0.116
	(0.945)	(1.414)
Gender dummy	–0.270	–0.090
	(3.528)***	(1.217)
Marital status dummy	–0.211	–0.155
	(2.191)**	(1.664)*
Experience in current position	0.015	0.055
	(1.16)	(0.73)
R^2	0.1816	0.2370

() t-statistics, * $p < 0.10$, ** $P < 0.05$, *** $P < 0.01$.
Two tailed test.

The personnel characteristics like gender show a strong ($p < 0.01$) negative relation with the pay level satisfaction. This shows that with same level of pay, women are more satisfied than their male colleagues. This is very much in keeping with the previous findings which reported a higher level of job and pay satisfaction for women than men (Sauser & York, 1978; Gomez-Mejia & Balkin, 1984). It is particularly interesting to observe that the higher pay satisfaction of women was only in the pay level dimension and not in the benefit dimension. This suggests that possibly professional women have lower financial need than men. However, considering the small number of only 5 women in the sample, this inference should be read with caution.

The marital status has a significant negative effect on both the pay level ($p < 0.05$) and the fringe benefit ($p < 0.10$) satisfaction. Thus under constant

pay and benefit, the married personnel are less satisfied than their unmarried colleagues. This is comparable with the findings of Dreher, et al (1988) who observed a negative effect of higher family responsibility on pay level and benefit satisfaction. Because the pay level satisfaction measures the individual response to the comparison of need for income with the income available from the organisation, this negative effect of marital status indicates that with marriage there is upward shift in the need for disposable income. Similarly, the significant negative effect of marital status on the benefit satisfaction indicates that possibly marriage raises the perceived occupational and other life hazards which require a compensatory payment in the form of better perks and benefits. As the type, form, and quantity of fringe benefits in public sector organisations are the same for all officers irrespective of seniority or salary, a negative effect of marital status under constant pay can be due to this heightened sense of job related and other social hazards after marriage.

Discussion & Implications

The present study was undertaken with the objective of examining the effects of different forms of financial rewards viz. gross salary, take home salary and yearly aggregate profit based bonus on the pay level and benefit satisfaction.

Apart from the low explanatory power of both the regression equations confirming Dreher's observation that it is futile to attempt an explanation of pay satisfaction using more number of objectively defined variables, our result supports Heneman & Schwab's suggestion (1985) that the variables believed to be related to pay satisfaction may not correlate equally well with all the facets of pay satisfaction. The standardised beta coefficients for salary related variables in our regression equations are quite different in pay level and benefit dimensions. The coefficients of gross salary is 0.20 in the pay level satisfaction while it is –0.149 in the benefit dimension. The coefficient of take home salary is 0.175 for pay level but is –0.136 in the benefit satisfaction. The coefficient of the perception of industrial bonus is 0.205 in benefit satisfaction but is only 0.053 in the pay level dimension. It is to be observed that two of the three pay related variables have highly significant and positive coefficients with at least one of the two dimensions of pay satisfaction. And, the third variable of take home salary has quite a large coefficient in one dimension though it is not significant statistically. This is comparable with the positive correlation found between pay level and pay satisfaction for professionals (Dreher, 1981) and for R&D personnel (Gomez-Mejia & Balkin, 1984; 1989) using unidimensional construct and for managers and technical employees (Judge, 1993) using a multidimensional construct. This shows that irrespective of job and social environment, attitudes towards organisational financial rewards are positively related with all its different forms.

On the comparative sensitivity of different dimensions of pay satisfaction to different forms of pay, we find that under constant personal input, pay level satisfaction is relatively more sensitive to variations of take home salary than that of the gross salary. Our study is the first study of this kind in India—as such this result cannot be compared with any other previous findings. However, this high sensitivity of the pay level satisfaction to change in take home salary appears quite logical and makes the point that financial adequacy is an important criteria in individual's evaluation of pay outcome even for professionals with average annual income far exceeding the national average.

Pay level satisfaction is relatively more sensitive to variations of take home salary than that of the gross salary.

The sensitivity of fringe benefit satisfaction is maximum and positive with respect to industrial bonus which confirms the observations of Gomez-Mejia and Balkin (1989) that when a payment is made to all irrespective of performance, it is likely to be perceived as another kind of benefit. The industrial bonus for the R&D personnel in Indian public sector undertakings is a small fraction of the aggregate profit distributed according to one's attendance in the company and not according to any individual or team performance. As a result, one can fail to relate such payment with any individual or collective action or activity. The immediate gain from such bonus is that it raises one's disposable income and level of living. Thus the positive effect of company-profit based bonus makes the point that any financial reward that raises the financial entitlement of all personnel irrespective of performance or seniority is likely to be perceived as a benefit.

The coefficients of both the gross salary and the take home salary are quite high and negative in the regression of benefit satisfaction though they are of lower statistical significance. This indicates that increasing the gross salary or take home salary under constant personnel input and job demand will decrease the satisfaction with the benefit package. This result is quite meaningful in view of the findings of Dreher et al. (1988). Using a sample of State Law Enforcement personnel, they found a significant posi-

tive relationship between benefit coverage and benefit satisfaction. Individual gross salary in the organisation represents not just the total financial share of the individual but also a measure of one's contribution to the goal of the organisation. Because the total benefit payment (except the retirement benefits!) in the organisation of our study is the same for all personnel irrespective of seniority or salary, the benefit coverage or payment goes down with increase in salary. In other words, benefit payment as a percentage of one's total contribution to the cause of the organisation goes down with increase in gross salary. Thus a negative relation between the gross salary and benefit satisfaction is possibly an indication that one expects the benefit payment to go up in proportion to one's worth in the organisation.

Two issues of considerable managerial implications emerge from the present study. First is the role of take home salary vis-a-vis the gross salary. Our research shows that when it comes to personnel welfare and standard of living, the total cash reward plays a far more important role than the gross salary. Without altering the actual salary, pay level satisfaction can be raised significantly by raising only the take home salary. Because the cash reward depends on various deductions at source some of which are connected with the overall government policy; this attitude towards the take home salary vis-a-vis the gross salary can be considered as general and applicable to all personnel whose net income are significantly affected by compulsory deductions of salary at source due to government policy. Thus a change in government policy with a reduction on these deductions is likely to pay a higher dividend on the behavioural front than modification of the actual pay.

A change in government policy with a reduction on deductions is likely to pay a higher dividend on the behavioural front than modification of the actual pay.

Secondly, aggregate profit based bonus is likely to be perceived as a benefit rather than a reward for performance. And, like all other benefits, the behavioural impact of such payment is likely to be limited only in terms of reduced personnel mobility with little effect on performance and motivation (Mitchel, 1983). Significant impact of bonus payment on the pay level satisfaction can occur if such payment is linked with either individual or team performance and by making sure that such payment exceeds the standard established by State legislation.

Significant impact of bonus payment on the pay level satisfaction can occur if such payment is linked with either individual or team performance.

Furthermore, the selective effects of some of the control variable reinforce the arguments and suggestions of Dreher et al. (1988) & Heneman (1985) for the continuing need to examine the linkage between the dimensions of compensation satisfaction and important behavioural outcomes e.g. decreased motivation, intention to quit or actual turnover.

As a final point, the result of the present study should be viewed in the context of a few potential limitations. Firstly, the study was based on the response of personnel working only in public sector organisations. Though both the public sector and the private sector in India follow the same type of policies regarding pay and career growth yet the absolute pay, their growth rate and the type of benefits available are considerably different from that of the private sector. As was noted by Trivedi & Mookerjee (1989) there is more discretionary reward and real transfer of income due to factor productivity in the private sector than in the public sector. Secondly, the study was based on cross-sectional data, hence drawing causal inference on the relation between pay and pay satisfaction is suspect. Because job satisfaction, performance and value orientation are known to enhance the perception of the reward system, establishing a definite relation between pay and pay satisfaction requires a longitudinal study where these other relevant factors can be adequately controlled.

Apart from the limitation due to the choice of organisations, our study also suffered from the lack of a control sample of professionals working in other non R&D functions of the same organisations. Because the personnel policies are the same for both the R&D as well as non R&D personnel a control sample from other functions of the same organisation would have confirmed our findings of the unique effect of R&D environment.

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Feature

Organisational Health Survey

Debdulal Dutta Ray

Difference in organisational health perception by the employees of organisations in private and public sectors was determined in the study. Results show that more employees in private organisation perceived higher physical, mental and social wellbeing of their organisation than employees in public sector.

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Organisational health refers to a relatively but quasi-enduring state of physical, mental and social wellbeing of organisation and not merely an absence of strike and lockout (Dutta Roy, 1989). Survey of organisational health is a prelude to organisational change or organisational intervention. Bennis (1966), Miles (1970), Pareek and Rao (1977), suggested organisational health survey before prescribing any suggestion for organisational change. Through survey, OD consultants could understand quantitatively how the employees perceive their organisation's physical environment, interpersonal relationship, and the organisation's relationship with its task agents (customers, shareholders, suppliers etc.), what will be the priority areas for change and how the organisational health perception affects the quality of working life (Dutta Roy, 1989; 1992; 1991). In brief, OD consultants could use organisational health data as a mirror for organisational change.

Organisational health refers to a state of physical, mental and social wellbeing of organisation and not merely an absence of strike and lockout.

Objectives of an organisation determine its management practices (Etzioni, 1964). Since the objectives of private and public organisations are different (Rainey et al., 1976, 1983), one might expect some differences in organisational health perception between these sectors. On the basis of this assumption, it was hypothesized that there would be significant differences in the organisational health perception of the employees of organisations in private and public sectors.

Methodology

Data (N = 389) were collected from different hierarchies (Managers = 81; Supervisors = 132; Staff = 176) of two heavy engineering organisations in private and

public sectors. Respondents were approached individually and were requested to fill out the questionnaire according to given instructions. They were told that the collection of data was only for research purposes and their individual identities would be confidential. Suggestive interview technique was followed for collection of data from staff at the lowest categories.

The sample organisation in private sector (PSO) is manufacturing steel tubes and the one in public sector (PBSO) is producing steel, hot rolled and cold rolled coils. In terms of rate of production, PSO was higher than PBSO. Both are situated in Bihar.

Organisational health scale used (Dutta Roy, 1989) was a Likert type five point scale with 57 items covering eleven areas of organisational health. The areas are adequate physical environment (PH), awareness of organisation (OA), autonomy in making decisions (AU), participation in problem solving (CR), evaluation of organisational performance (EV), interpersonal trust among different hierarchies (TR), involvement in organisation (OI), coping with environmental uncertainty (COP), organisational need satisfaction (OS), awareness of changes in task environment and its effect on organisation (EA), satisfactory relationship with task agents (ES). The sum of all the areas reflects the total organisational health score (TOH), the sum of eight areas (OA, AU, CR, EV, TR, OI, COP, OS) reflects the mental health score, and the sum of EA and ES the social health perception score. High score (above 3) on the organisational health scale indicates higher organisational wellbeing. Reliability and construct validity were estimated through Chronbach's alpha. The alpha value ranged from 0.50 to 0.84 (Dutta Roy, 1989).

Analysis of Data

Initially frequencies of respondents who gave more than 3 on response continuum were estimated. The frequencies were converted into proportions. The hypothesis was tested by using z-test for proportions. The critical ratio of each health characteristic is given in table 1. Proportions were converted into percentages in order to describe the data.

Results

Table 1 shows that the employees of PSO and of PBSO were significantly different in perceiving organisational health attributes. More employees (TOH = 89.45) in PSO perceived that their organisation was healthy as against 51.28 per cent employees of PBSO. 85.93 per cent employees in PSO thought that physical working conditions at their work place (PH) were conducive for safe and comfortable activities. While only 51.58 per cent employees of PBSO found their physical environment adequate.

Table 1: Significance difference between proportions across PSO and PBSO

	PSO (n = 199)	PBSO (n = 190)	CR
Physical health (PH)	85.93	51.58	7.33*
Mental health (MH)	92.46	55.26	8.39*
Social health (SH)	62.31	39.47	4.50*
Oganisational awareness (OA)	82.41	48.95	6.97*
Autonomy (AU)	72.86	44.74	5.64*
Creative opportunities (CR)	92.46	52.11	8.94*
Evaluation (EV)	74.87	45.26	5.97*
Trust (TR)	87.44	59.47	6.27*
Coping (COP)	80.4	46.32	6.99*
Organisational satisfaction (OS)	88.94	46.84	8.93*
Organisational involvement (OI)	86.93	53.16	7.30*
Task environment awareness (EW)	37.69	31.05	1.38
Satisfactory relationship with task environment (ES)	90.95	55.26	7.98*
Total organisational health score (TOT)	89.45	51.58	8.22*

*$p < 0.01$

Almost every employee in PSO (92.46 per cent) perceived high mental wellbeing (MH) of their organisation, as against a mere 55.26 per cent employees in PBSO. Of eight areas of mental health, less than 50 per cent employees of PBSO perceived freedom in making decision related with job (AU = 44.74 per cent), opportunity in appraising their performance towards organisational objectives (EV = 45.26 per cent), ability of organisation to cope with environmental uncertainty (COP = 46.32 per cent), organisational need satisfaction (OS = 46.84 per cent), and awareness of organisation's objectives and functional processes (OA = 48.95 per cent). Compared to the employees of PSO, a small number of employees in PBSO got the opportunity to attend problem solving sessions in the departments (CR = 52.11 per cent), felt involvement in the organisation (OI = 53.16 per cent), and higher interpersonal trust (TR = 59.47 per cent).

No significant difference in task environment awareness (EA) was found between the employees of both organisations. But in perceiving satisfactory relationship (ES) between the organisation and its task environment

Feature

Factors Determining Equity Prices in India – An Econometric Analysis

Rudra P. Mohapatra & Promod K. Sahu

The present study has been conducted with a view to identifying and quantifying the impact of a selected number of fundamental and technical factors on the prices of equity shares in India during the period 1980 to 1991. This task is accomplished with the help of step wise multiple regression analysis. It is found that fundamental factors like yield, size and earning per share are important determinants explaining around 90 per cent variations in the prices of equity shares. Further, technical factors like index of industrial production, showing the state of the general economic conditions and the security price index, indicating the state of the stock market are also important determinants (explaining around 89 per cent of the variations).

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Profit hunting in the stock market is a top game. To be successful in this game requires the knowledge of the forces that cause ups and downs in the prices of stocks and shares. These forces are unremittingly at work and they have varying power, intensity and duration. They grow out of events, conditions and circumstances and acquire potency as a result of the acts of men, companies and governments throughout the world.

Indian Share Market Scenario

In the last ten years, the number of share-holders in India has increased from 2 million to 15 million, the share market capitalisation Rs. 7500 crores to Rs. 1,50,000 crores and the number of listed companies on the stock exchanges from 1500 to 5800. Investing population wise, India ranks third in the world, next only to the United States and Japan which have 50 million and 25 million shareholders respectively (Venugopalan, 1992). All these figures show that the equity cult has spread in different parts of our nation and millions of our people invest their savings in the stock market. What as earlier the exclusive concern of the rich and privileged class is now becoming a matter of day to day interest of millions of middle and low income groups of our population. In the last few years the liberalisation measures initiated by our government have paved the way for the opening out of the Indian economy to the international market. Measures like the abolition of the

The equity cult has spread in our nation. What was earlier the exclusive concern of the rich and privileged class is now becoming a matter of interest of millions of middle and low income groups.

office of the Controller of Capital Issues, granting powers to the Securities and Exchange Board of India (SEBI), full convertibility of the rupee, disinvestment of shares of public sector undertakings, allowing the setting up of private sector mutual funds, commencing of operations of OTC Exchange of India, elimination of restrictions in foreign equity participation etc. would surely lead to the widening of the horizon of the Indian capital market. However despite such scope, investment knowledge seems to be very much lacking with the Indian public. With a view to educating the investing public at large, many excellent books have been written on the fundamental and technical approaches to investing in the stock market (Sur, 1979; Papariya, 1981; Grewal, 1983; Vasaswy, 1984; Grewal and Grewal, 1986; Vasaswy, 1987; Raghunathan, 1991; Chandra, 1992; Mehta, 1992). Most of these books have concentrated on short term trading techniques and stock selection with a view to guiding the investing public in general. Moreover, a number of empirical works have also come out attempting to explain and measure the effects of possible quantifiable factors on market price of equity shares (Desai, 1965; Srivastava, 1966; Sarkar, 1971; Kumar and Mohan, 1975; Ojha, 1976; Chandra, 1978; Zahir, 1982; Krishan, 1984; Dixit, 1986; Chawla and Srinivasan, 1987; Zahir, 1992; and Mohapatra and Sahu 1993). However, nothing conclusive is yet known about the significance of the factors having a bearing on the share price behaviour in the Indian stock market. As such, the stock market's pricing behaviour is an issue which needs continuous review through intensive empirical research works. Hence a study was attempted to measure quantitatively the impact of a selected number of factors on the price behaviour of equity shares.

Factors Affecting Equity Prices

There exists a considerable conflict between the followers of the two different stock market schools of thought. The first led by Graham *et al*, (1967), holds the view that fundamental analysis is the surest way of making a successful investment in equity shares in the long run. Fundamental analysis being a conservative and non-speculative approach based on certain fundamental factors, is not swept by what is currently happening in the stock markets in different parts of the World. According to this approach, an investor first makes an indepth study of the various fundamental factors of an industry/company where he intends to make his investment. On the other hand, the other school of thought holds the view that the technical aspects of the stock market are more important than the fundamental aspects. Thus the various factors affecting equity prices can be classified into two broad groups: fundamental factors and technical factors. Factors belonging to the first group include dividend per share, earning per share, book value per share, yield, return on investment, size, risk, growth, cover and so forth. Zahir (1992), calls these factors the internal factors. Impact of some of these fundamental factors on the market price of equity shares has been tested in most of the empirical studies. Some of the key indicators coming under the purview of technical factors are security price index, index of industrial production, Gross National Product, (GNP), money supply, bank rates, industrial relation, fiscal and tax policy and so forth. These according to Zahir (1992) are the external factors and also assume importance in studying share price behaviour.

Dividend per share

In India there are many investors who buy shares with the objective of earning a higher income from their investment. Their prime concern is with the amount that a company gives as dividends. Dividend per share is considered as the fundamental factor having the strongest influence on the equity price. Most of the empirical studies in India also support this fact (Desai, 1965; Srivastava, 1966; Sarkar, 1971; Kumar & Mohan, 1975; Ojha, 1976; Zahir, 1982; Krishan, 1984; Dixit, 1986; Chawla & Srinivasan, 1987; and Zahir, 1992). It is very often believed that a company even with weak fundamentals can catch the fancy of investors, for a short period, if it manages to pay higher dividend. As such a strong positive relationship is expected between dividend per share and share price.

Earning per share

Earning per share is the most commonly used and widely known of all the fundamental indicators. It indicates the earning power of a company on a per share basis. It is also an index of the profit which the company is earning on its equity. The philosophy that lies behind the importance of this fundamental factor is that stock prices are basically influenced by anticipation of a change in corporate earnings. Though dividend is an important consideration, yet more importance is given to earnings. For it is argued that "dividend must follow earnings and will change as earnings change." In other words, stock prices rise or fall as stock traders and investors change their confidence in the future of earnings. This variable has turned out to be a significant determinant of share

Stock prices rise or fall as stock traders change their confidence in the future of earnings.

price in the empirical works of Dixit, (1986) and Zahir (1992).

Book value per share

Another important ingredient of the fundamental investment analysis is the book value per share. This variable gives an indication of the investments made by the shareholders in the company. It also acts as an index of the long term soundness of the financial health of the company. Most of the investors in equity shares usually give priority to this variable for their own investment decisions. This variable as an important determinant of share price is used in Zahir (1982; 1992); Krishan (1984); and Dixit (1986). It is expected to have a positive relationship with the share price.

Yield

Investors are not really interested in dividends but in the relationship that dividends bear to the market price of the company's shares. This relationship is best expressed by the ratio called "yield". It is generally an important investment indicator having a direct bearing on equity share price. It indicates the percentage of return through dividends that an investor can expect on his investment made at the prevailing market price of the company's shares. It is negatively associated with the share price i.e. the lower the yield, the higher is the share price. This variable has received emphasis in Zahir (1982; 1992) and Krishan (1984).

Return on investment

One of the important indicators available to the investors for their assessment of the price behaviour in the stock market is the return on investment. This variable indicates the overall return on the total assets employed in the business. It is expected to have a positive relationship with the share price. Dixit (1986), found this variable to be significant, having a positive relationship with the share price.

Size

Size is also an important fundamental factor having a direct bearing on share price. Most of the investors usually rely on this variable, while taking their investment decisions. Normally one associates the size of the company in terms of total net assets with its long term stability. It is therefore to positively affect the market price of the shares. Chandra (1978); Dixit (1986) and Zahir (1992) have used this factor as an important explanatory variable in their estimated regression equations.

Security price index

Security price index, as an important technical factor generalises the overall conditions prevailing in the stock market at a particular point of time. The buoyant and depressed stock market conditions can be judged from the security price indices. Zahir (1992), found it to be a significant determinant having a positive relationship with the share price.

Index of industrial production

So far as the influence of data on the index of industrial production is concerned, there appears to be some sort of relationship between them and the stock prices. This is because most of the times interested circles in the stock market look to it as an important indicator of investment in shares. As such, the higher the rate of growth in industrial production, other things being equal, the more favourable is it for the stock market. However according to some, statistics of industrial production do not have much influence on stock prices. Till today no empirical testing has been made to examine its impact on the stock market and on the price of shares.

Gross national product

GNP, one of the important concepts in economics, measures the economic performance of the whole economy. It represents the aggregate value of goods and services produced in the economy, in other words GNP tells us about the total goods and services produced in the country on an annual basis. Hence, it will be good if the GNP is on the increase, though it is said that "a man does not live by GNP alone". It is very difficult to correlate GNP with the stock prices and nothing conclusive is yet known about the impact of this variable on the prices of equity shares. However, Chandra (1992) opines that, the higher the rate of growth in GNP, other things being equal, the more favourable it is for the stock market. This variable is expected to have a positive relationship with the share price.

Money supply

Money supply is very often used as an index of the prevailing economic conditions. If the money supply is increasing, it is likely to result in inflation. However, rapid inflation is not a very desirable phenomenon from the investors' point of view. Hence they should keep a track of both the aspects. Zahir (1992) found this variable to be a significant determinant having a positive relationship with the prices of volatile shares.

Methodology

This study was undertaken to identify and quantify the influence of a selected number of fundamental and technical factors like dividend per share, earning per share, book value per share, yield, return on investment, size, index of security prices, index of industrial production, gross national product and money supply on equity share prices in India. It was carried out with a judgment sample of 43 companies selected for this purpose covering a time period of 12 years i.e. from 1980 to 1991. Step wise multiple regression analysis was extensively used to draw inferences.

It was decided to choose companies on the basis of purposive sampling rather than taking the whole strength into account. To maintain uniformity of the sample all the statutory companies, government companies and private limited companies were excluded. It was decided to include in the sample such public limited companies which provide continuous financial information for the entire period and give due representation to the population. Care was taken to keep all the categories of listed shares—viz active, partly active and inactive ones. The list of Group A shares consists of the most frequently traded and active ones. The list of such shares is periodically reviewed by the stock exchange authorities and frequently finds place in their weekly supplementaries (Investment service). A list of 22 active companies was chosen from one such supplementary (The Stock Exchange Official Directory, Monday, 14th Sept, 1992). Steps were taken to select 21 companies other than those belonging to Group A (partly active and inactive ones) for giving due representation to all the classifications of the listed shares in the sample. Thus on the whole 43 sample companies were selected for examining the share price behaviour in the present study. The sample covered a wide range of industries namely general engineering, electrical goods, chemicals, paper and paper products, trading, aluminium and steel, cotton textile and miscellaneous (See Appendix for the list of sample companies). Moreover, most of these sample companies were very much in the news for their price fluctuations (High/Low) in the recent past.

It is a time series study based on secondary data pertaining to the time period 1980 to 1991. The financial information of the sample companies has been derived mainly from the various volumes of Bombay Stock Exchanges Official Directory for the purpose of analysis of the fundamental factors. However, data relating to technical factors like securities price index, index of industrial production, GNP and money supply have been collected from the various volumes of Reserve Bank of India Bulletins and Report on Currency and Finance.

In the present study, step wise multiple regression analysis has been used to estimate separately the impact of a selected number of fundamental factors and technical factors on the price behaviour of equity shares. This technique has been used mainly to decide separately how many factors (both fundamental and technical) need inclusion as independent variables in the estimated equations for studying the variations in share prices. The Log-Linear Model has been considered for the estimation of regression parameters.

Model for Fundamental Factors:

$$\text{Log } Y = \text{Log } a + b_1 \text{Log } x_1 + b_2 \text{Log } x_2 + b_3 \text{Log } x_3 + b_4 \text{Log } x_4 + b_5 \text{Log } x_5 + b_6 \text{Log } x_6 + U \quad (1)$$

Model for Technical Factors:

$$\text{Log } Y = \text{Log } a + b_1 \text{Log } x_7 + b_2 \text{Log } x_8 + b_3 \text{Log } x_9 + b_4 \text{Log } x_{10} + U \quad (2)$$

Where
- Y = Average share price[1]
- x_1 = Dividend per share[2]
- x_2 = Earning per share[3]
- x_3 = Book value per share[4]
- x_4 = Yield[5]
- x_5 = Return on investment[6]
- x_6 = Size[7]
- x_7 = Security price index[8]
- x_8 = Index of industrial production[9]
- x_9 = Gross National Product[10]
- x_{10} = Money supply[11]
- U = The error term

1. Average share price—Our dependent variable in the present study is the average share price. The best price measure for our purpose would have been the weighted average of prices in all the transactions during the financial year of the company. The computation of such an average however involves a lot of information which is not easily available or not available at all. Realising this fact some studies in India have used the arithematic average of the highest price and the lowest price over the financial year of the company as a measure of the average price. We too have followed the same measure in the present study for the purpose of analysis.
2. Dividend per share—This fundamental factor is used in the present study as an important explanatory variable. It is expressed in percentage. It is expected to have a positive relationship with the share price.

All the fundamental factors as explanatory variables used in the present study are taken with one year lag (n-1), as these variables are expected to affect the next year's market price of share. For the purpose of analysis data relating to the fundamental factors were collected for each company from 1979 to 1990. However share price data relates to the period 1980 to 1991. Since the technical factors used in the study as important explanatory variables are supposed to affect the market price of share in the same year, the data in respect to them relates to the period 1980 to 1991. The regression equations used in this study were fitted by the method of OLS.

Limitations of the study

The study is based on data collected from secondary sources. As such it possesses all the inherent limitations of the published data. Non availability of data for the entire study period has restricted the size of the sample. Thus, the limitations of the small sample are also very much present in the study. Another important limitation of the time series data used in the present study is the auto-correlation of errors. Presence or absence of auto-correlation problem in the study has been tested by the DW statistics. However, no attempt has been made to remove them, in case their existence is felt. It is also unlikely that, the multicollinearity among independent variables might give rise to unexpected signs of the estimated co-efficients. Further the step wise procedure used in this study for selecting variables to include in a model is an extreme example of brute empiricism. It also suffers from being overly influenced by the specific characteristics of the variables being examined (Foster, 1978).

Results of Empirical Analysis

The results of estimated step wise multiple regression equations are presented in table 1 and 2. In table 1 step wise regression estimates of a selected number of fundamental factors as independent variables regressed separately on the dependent variable are presented. Table 2 discloses the step wise regression estimates of various technical factors as independent variables on the dependent variable. This has mainly been done with a view to decide how many fundamental variables and technical variables can be used in the models of good fit for studying the variations in share prices.

Results of step-wise regression tests (fundamental factors)

The regression co-efficients of almost all the fundamental factors as independent variables are found to be statistically significant at 0.01 per cent level with the hypothesized positive or negative signs (table 1). Moreover the F ratios in all the cases are also found to be statistically significant. However, eq. (1.5) with return on investment (x_5) as the independent variable has the unexpected negative sign, but is found statistically significant at 0.05 per cent level. Eq. (1.4) with yield (x_4) as the independent variable has the maximum adjusted R^2 (0.8678), whereas eq. (1.5) with return on investment (x_5) as the independent variable has the minimum adjusted R^2 (0.3460). Eq. (1.6) with size (x_6) as the explanatory variable ranks second next only to yield (x_4) variable in explaining the variations in the price of equity shares. In this case the adjusted R^2 is 0.8489. Earning per share (x_2) as an independent variable in eq. (1.3) is found to explain well the variations in the price of equity shares, as in this case the adjusted R^2 is 0.8072. Eq. (1.1) with dividend per share (x_1) as the independent variable has the last but one rank among all the fundamental factors taken up in this study. It is evident from the results disclosed in step 1 of table 1 that yield variable (x_4) turned out to be the most powerful fundamental factor explaining, the variations in the prices of equity

3. Earning per share—As an important fundamental factor, this variable (ratio) indicates the earnings of the company on a per share basis. It is also expected to have a positive relationship with the share price.

4. Book value per share—This variable indicates what each share of company is worth according to the books of accounts of the company. This fundamental factor is expected to have a positive relationship with the share price.

5. Yield—It is expected to have a negative relationship with the share price. Here it is measured as :
Yield = (Dividend per share/Market price per share) x 100

6. Return on investment—This variable is expected to have a positive relationship with the share price. In the study it is measured as Net income/Total Assets.

7. Size—Here total assets of the company as measured by the balance sheet total has been used as a measure of the company size in the present study. This variable is expected to have a positive relationship with the share price.

8. Security price index—Here the RBI security price index (ordinary share) is used taking 1970 as the base year. Necessary adjustments have been made while computation of the indices. This variable is expected to have a positive relationship.

9. Index of industrial production—Data for this variable have been collected from the RBI Report on Currency and Finance (various issues)1970 is taken as the base year. This technical factor is expected to have a positive relationship with the share price.

10. Gross National Product—In the present study GNP at factor cost (Rs. in crores) is taken. This variable is also expected to have a positive sign.

11. Money supply—Here money supply represents currency with the public (Rs. in crores). Data relating to this variable have been collected from the various issues of Report on Currency and Finance. This variable is also expected to have a positive sign.

Table 1: Results of step wise Regression Tests (Fundamental Factors only)

	Intercept	x_1	x_2	x3	x_4	x_5	x_6	R^2	Adjusted R2	DW	F Ratio	Equation
1	2	3	4	5	6	7	8	9	10	11	12	13
Step 1	–0.741	+2.317* (4.617)						0.6807	0.6483	0.956	21.314*	1.1
	0.455		+1.286* (6.859)					0.8247	0.8072	2.002	47.046*	1.2
	–0.712			+1.357* (4.765)				0.6943	0.6638	1.059	22.707*	1.3
	3.131				–1.189* (–8.554)			0.8798	0.8678	1.708	73.173*	1.4
	1.094					–1.099** (–2.611)		0.4054	0.3460	1.144	6.818**	1.5
	–3.296						+0.610* (7.922)	0.8626	0.8489	1.842	62.757*	1.6
Step 2	3.129	+0.001 (0.002)			–1.189* (–3.861)			0.8798	0.8531	1.707	32.928*	2.1
	2.050		+0.594*** (2.056)		–0.766** (–3.207)			0.9182	0.9000	2.348	50.504*	2.2
	2.343			+0.296 (0.923)	–0.999* (–4.007)			0.8902	0.8658	1.768	36.471*	2.3
	2.283				–0.907* (–8.419)	–0.600* (–7.281)		0.8926	0.8687	1.631	37.407*	2.4
	0.086				–0.681** (–2.482)		+0.293*** (2.064)	0.9184	0.9003	1.846	50.647*	2.5
Step 3	0.394	–0.415 (-0.678)			–0.787** (–2.433)		+0.327*** (2.133)	0.9228	0.8939	1.862	31.888*	3.1
	0.428		+0.357*** (1.191)		–0.580*** (–2.048)		+0.192*** (1.190)	0.9302	0.9040	2.184	35.518*	3.2
	–0.107			+0.155 (0.519)	–0.618*** (–1.987)		+0.272*** (1.869)	0.9211	0.8915	1.825	31.114*	3.3
	–0.319				–0.625 (–1.401)	+0.074 (0.164)	+0.342 (1.029)	0.9187	0.8882	1.860	32.124*	3.4
Step 4	0.548	–0.210 (–0.320)	+0.320 (0.921)		–0.644*** (–1.981)		+0.222 (1.131)	0.9312	0.8918	2.131	23.674*	4.1
	0.389		+0.343 (0.958)	+0.023 (0.070)	–0.573*** (–1.914)		+0.912 (1.095)	0.9302	0.8903	2.177	23.326*	4.2
	1.001		+0.382 (1.097)		–0.648 (–1.469)	–0.101 (–0.212)	+0.119 (0.310)	0.9306	0.8910	2.161	23.470*	4.3
Step 5	1.065	–0.535 (–0.431)	+0.352 (0.913)	–0.197 (–0.318)	–0.798 (–1.285)		+0.264 (1.054)	0.9323	0.8759	2.157	16.527*	5.1
	–0.638	–0.515 (–0.290)	+0.206 (0.288)		–0.575 (–1.074)	+0.239 (0.187)	+0.434 (0.373)	0.9316	0.8745	2.1286	16.335*	5.2
Step 6	1.561	–0.474 (–0.244)	+0.397 (0.355)	–0.226 (–0.238)	–0.845 (–0.662)	–0.085 (–0.043)	+0.195 (–0.121)	0.9323	0.8511	2.160	11.482*	6.1

Note: Figures in parentheses represent 't' value.

* Significant at .01 per cent level.

** Significant at .05 per cent level.

*** Significant at .10 per cent level.

shares in the present study. This is followed by indicators like size (x_6), earning per share (x_2), book value per share (x_3) and dividend per share (x_1). The results further disclose that return on investment (x_5) as an important fundamental factor turned significant, but having an unexpected negative relationship with share price. A multiple regression analysis would provide a better evaluation.

Yield variable turned out to be the most powerful fundamental factor explaining, the variations in the prices of equity shares.

Based on the regression results disclosed in step 1, of table 1, eq. (1.4) with yield (x_4) variable was chosen as the first independent variable to enter into the regression model in step 2 of table 1. Here also the task is to separately regress the yield variable (x_4) and each of the other five variables (x_1, x_2, x_3, x_5, x_6) against the dependent variable (Y), the share price. It is evident from the results that, the size variable (x_6) when added to eq. (1.4) with yield variable (x_4), turned significant and explains the most, the variations in the dependent variable (Y), the share prices of all the combinations examined in the second step. It increases the adjusted R^2 from 0.8678 to 0.9003. It is further evident that, the earning per share variable (x_2) when added to eq. (1.4) with yield variable (x_4) also turned statistically significant and increases the adjusted R^2 to 0.9000. Thus both eq. (2.6) (with yield and size) and eq. (2.2) (with yield and earning per share) need consideration for choosing the model of good fit at this stage of analysis. Both the equations explain 90 per cent variation in the dependent variable. However on statistical ground eq. (2.6) has been preferred over eq. (2.2) as the equation of good fit for further analysis in step 3 of table 1.

In the third step we regressed eq. (2.6) with yield (x_4) and size (x_6) variables and each of the remaining four other variables namely x_1, x_2, x_3 and x_5 against the dependent variable (Y), the share price. It is evident from the results using the adjusted R^2 criteria and the statistical significance of the independent variables that, the inclusion of the earning per share (x_2) variable with eq. (2.6) increases marginally the value of adjusted R^2 from 0.9003 to 0.9040. Further the co-efficient of (x_2) variable also turned to be statistically significant at 0.10 per cent level. However when we started adding the other three variables (x_1, x_3 and x_5) with eq. (2.6) having x_4, x_6 variables, the adjusted R^2 started declining marginally in all the cases. This induced us to choose eq. (3.2) with x_4, x_6 and x_2 as independent variables, as the model of good fit for further consideration. This equation (3.2) reveals that 90.4 per cent of the variation in the dependent variable is explained by the above mentioned three variables (x_4, x_6 and x_2) and the remaining 10 per cent variation is explained by some of the other variables not included explicitly in this regression equation. This further discloses that increase in the earnings per share by one percentage point would push up the average price of equity shares by 36 percentage points. One percentage increase in yield leads to 58 percentage point decline in the prices of equity shares. Size variable has a positive impact to the tune of 19 percentage points.

In the fourth step, we regressed separately eq. (3.2) with variables (x_4, x_6 and x_2) and each of the remaining three variables (x_1, x_3 and x_5) against the dependent variable (Y). When we started adding the variables x_1, x_3 and x_5 one by one with eq. (3.2), surprisingly the adjusted R^2 in all the cases suffered a marginal decline. Moreover, the regression co-efficients of these three newly added variables turned statistically insignificant. These results restricted us from proceeding further. However we planned for looking ahead following the logic of Cochran (1964). He is of the view that one should be very careful about assuming that because a variable is insignificant at one stage it will also be insignificant at another stage of analysis. This implies that even the insignificant variables may turn out to be very important when combined with other variables. Thus of all the combinations of equations evident in step 4, eq. (4.1) with the highest adjusted R^2 were chosen for further consideration.

In step 5 we again started regressing eq. (4.1) with variables (x_4, x_6, x_2 and x_1) and each of the remaining two variables (x_3, x_5) against the dependent variable (Y). Here also we found results similar to that of step 4. In this step the adjusted R^2 in both the equations (5.1) and (5.2) also suffered a marginal decline and the corresponding co-efficients of both the independent variables (x_3, x_5) turned insignificant. However on statistical grounds eq. (5.1) was retained for further analysis.

In step 6 when return on investment (x_5) as an independent variable was added in eq. (5.1) with variables (x_4, x_6, x_2, x_1, x_3). The adjusted R^2 again suffered a marginal fall from 0.8757 to 0.8511 and the co-efficient of the variable (x_5) turned insignificant with a wrong sign.

The step wise regression analysis of the fundamental factors, induced us to choose eq. (3.2) with yield (x_4), size (x_6) and earning per share (x_2) as important independent variables, to examine the variations in the

Table 2: Results of step wise regression tests (Technical Factors only)

	Intercept	x_7	x_8	x_9	x_{10}	R^2	Adjusted R^2	DW	F Ratio	Equation
1	2	3	4	5	6	7	8	9	10	11
Step 1	0.793	+0.590* (5.965)				0.7806	0.7587	1.598	35.578*	(T-1.1)
	−1.140		+1.463* (9.223)			0.8948	0.8843	1.981	85.069*	(T-1.2)
	−7.179			+0.713* (8.514)		0.8788	0.8667	2.013	72.483*	(T-1.3)
	−7.982				+0.829* (8.614)	0.8812	0.8694	1.838	74.205*	(T-1.4)
Step 2	−2.042	+0.332 (1.259)	+2.206* (3.617)			0.9106	0.8907	2.196	45.821*	(T-2.1)
	−1.272		+1.432*** (1.192)	+0.015 (0.026)		0.8948	0.8714	1.981	38.284*	(T-2.2)
	−0.378		+1.622 (1.084)		−0.092 (−0.107)	0.8949	0.8716	1.987	38.336*	(T-2.3)
Step 3	−3.884	+0.307 (1.244)	+1.845 (1.498)	+0.207 (0.343)		0.9119	0.8788	2.251	27.593*	(T-3.1)
	−4.987	+0.315 (1.252)	+1.712 (1.178)		+0.340 (0.379)	0.9121	0.8792	2.168	27.687*	(T-3.2)
Step 4	−5.127	+0.326 (1.175)	+1.661 (1.041)	+0.011 (0.140)	+0.242 (0.204)	0.9124	0.8623	2.201	18.225*	(T-4.1)

Note: Figures in parentheses represent 't' values

* Significant at .01 per cent level

** Significant at .05 per cent level

*** Significant at .10 per cent level.

equity share prices. Although the other fundamental variables like dividend per share (x_1), book value per share (x_3) and return on investment (x_5) are important determinants of share price as revealed in other studies, they have turned out to be insignificant in this study. This is seemingly because of the problem of multicollinearity (Farrar & Glauber, 1967).

Results of step wise regression tests (technical factors)

We regressed all the four selected technical factors (x_7, x_8, x_9, x_{10}) separately against the dependent variable (Y), the share price (table 2). The regression co-efficients of all the technical factors taken as independent variables were found to be statistically significant at 0.01 per cent level with their expected signs. Moreover, the F ratios in all the cases were also found to be statistically significant. Further, the DW values exhibited no auto-correlation problem in any of the cases. However eq. (T-1.2) having index of industrial production (x_8) as the independent variable has the maximum adjusted R^2 (0.8843), whereas eq. (T-1.1) having the security price index (x_7) as the independent variable has the minimum adjusted R^2 (0.7587). The co-efficient of the index of industrial production is much bigger in size as compared to the co-efficient of the security price index, probably indicating a greater impact of index of industrial production variable on the prices of equity shares. This inference still needs in-depth examination. A multiple regression analysis would provide a better explanation.

The security price index (x_7) when added to eq. (T-1.2) with index of industrial production (x_8) explained the most variations in the dependent variable (Y) of all the combinations examined in this step. It increased the value of adjusted R^2 from 0.8843 to 0.8907. When we added the other variables (x_9 and x_{10}) with eq. (T-1.2), the value of adjusted R^2 started declining marginally. This induced us to choose eq. (T-2.1) as the model of good fit for further consideration. It is interesting to note here that the security price index was the least important technical factor as disclosed by the value of adjusted R^2 in step 1 of our analysis. However, in step 2, it turned out to be the second more important technical factor next only to index of industrial production. This result confirms the view point of Cochran (1964), that seemingly less important variables on a univariate basis may be very important when combined with other variables.

We again regressed eq. (T-2.1) with variables (x_8 and x_7) and each of the remaining two variables (x_9 and x_{10}) against the dependent variable (Y). The value of adjusted R^2 in all the cases suffered a marginal decline. Moreover, the regression co-efficients of the newly added variables also turned insignificant. In step 4, when we regressed all the four variables (x_7, x_8, x_9, x_{10}), against the dependent variable (Y), we found the results similar to that of step 3.

The step wise regression analysis of the technical factors induced us to choose eq. (T-2.1) with index of industrial production and security price index as important independent variables to examine the variations in the equity share prices. The other technical factors like GNP and money supply have not been proved important factors for examining share price behaviour in the present study.

Conclusion

The results of the univariate analysis disclose that all the fundamental factors (DPS, EPS, BPS, Yield, ROI and Size) and technical factors (Security price index, Index of industrial production, GNP and Money supply) have a significant bearing on the prices of equity shares in India. However the results of multivariate analysis disclose that fundamental factors like yield, size and earning per share are the most significant determinants explaining around 90 per cent of the variations in the prices of the equity shares. Further, technical factors like index of industrial production and security price index also account for around 89 per cent of the variations in the prices of equity shares. From the findings of the study it is evident that both the fundamental and technical analysis have their own significance from the stand point of the investors.

Yield, size and earning per share are the most significant determinants in the prices of the equity shares.

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Appendix

List of Sample Companies

List of Group A Companies (Active and highly traded ones)

1. Bajaj Auto
2. Larsen & Taubro
3. Mahendra & Mahendra
4. Tata Engg. & Locomotives
5. Voltas Ltd.
6. Glaxo India Ltd.
7. Gujarat Alkalies & Chemicals
8. National Organic Chemical Industries
9. Tata Chemicals
10. Hindustan Lever
11. Bombay Dyeing
12. Century Textiles
13. PEICO
14. SIEMENS INDIA
15. I.T.C.
16. East India Hotels
17. Ashok Leyland
18. Atlas Capco
19. Tata Iron & Steel
20. Indian Aluminium
21. Brooke Bond India Ltd.
22. Straw Products Ltd.

List of Other than Group A Companies (Partly active and inactive ones)

23. Avery India Ltd.
24. Bimeral Bearings Ltd.
25. K.S.B. Pumps
26. Motor Industries Ltd.
27. Bombay Burmah Trading Corporation Ltd.
28. Indo Burma Petroleum Co. Ltd.
29. TIDE Water Oil Company Ltd.
30. General Electric Company of India.
31. Crompton Greaves
32. Chloride India
33. Bharat Bijlee
34. Bajaj Electricals
35. Dunlop India
36. FGP Ltd.
37. The Indian Hotels Company Ltd.
38. Pudumjee Pulp and Paper Mills Ltd.
39. Ballarpur Industries Ltd.
40. Rollatainers
41. Boots Co. India Ltd.
42. Mafatlal Industries Ltd.
43. Rohit Pulp and Paper Mills

□

Feature

Likes & Dislikes of Taguchi Methods

Jiju Antony

This paper is focussed on the strengths and weaknesses of Taguchi's methodology for improving the quality of products and processes. The weaknesses presented in the paper are focussed on technical issues and do not strictly apply to Taguchi's Quality Engineering philosophy. Although the quality engineering ideas and methods advocated by Taguchi have received considerable attention from engineers and managers in manufacturing companies, statistical analysis methods proposed by Taguchi are unnecessarily complicated and technically flawed. Quality engineering here refers to producing high quality products at low costs by making them insensitive to various sources of variation.

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Genichi Taguchi is a Japanese engineer and quality consultant who has developed a practical and strategic approach for designing quality into products and manufacturing processes. Engineers introduced to Taguchi methods have reported an impressive number of successes with many industrial case studies.

Taguchi's Definition of Quality

Taguchi (1986) defines quality as "the minimum loss imparted by any product to society after being shipped to a customer, other than any loss caused by its intrinsic function". By loss Taguchi refers to the following two categories:

* Loss caused by variability of product's functional performance.
* Loss caused by harmful side effects.

The variation in a product's functional performance at the consumer's end would result in a loss not only to the consumer but also to anyone who is affected by the product's performance. For example, if a specific model of car does not start in cold weather, then the car's owner would suffer a financial loss if he has to call a mechanic from the garage. The car's owner will also most likely be late for work and suffer yet another financial loss. His employer also suffers a loss as he would lose the services of the employee who is late for work. An example of a loss caused by a harmful side effect would be the emission of toxic fumes from the car's exhaust which pollutes the atmosphere.

Taguchi's Quality Philosophy

Quality improvement by reducing variability

Taguchi views quality improvement as an essential activity if an organisation is to stay in business and be competitive in the global market place. Improving quality here connotes reducing variability in the func-

Improving quality connotes reducing variability in the functional performance of a product's quality characteristics.

tional performance of a product's quality characteristics. Taguchi employs the use of Statistically Designed Experiments (SDE) to accomplish this task. Statistically designed experiments are used to identify different sources of variation due to external disturbances (called noise factors) and then reduce the effects of these noise factors on the product's performance variation. In other words, making products and processes insensitive (i.e., robust) to environmental variations, manufacturing variations etc. is the key element in Taguchi's Quality Philosophy.

Making products and processes insensitive (i.e., robust) to environmental variations, manufacturing variations etc. is the key element in Taguchi's Quality Philosophy.

Quadratic loss function analysis

Taguchi argues that 'traditional specifications' that simply require staying between a lower limit and an upper limit, invite the idea that all values within the specification are equally desirable. If the characteristic is within specification, the product is acceptable and is shipped. If the characteristic is outside specification, the product is unacceptable and the problem is detected by either the manufacturer or the customer. In many situations, a nominal value (or target value) may be given, but hitting the target value has not gained an importance beyond just being within the specifications. Any deviation from this target value of a product's characteristic incurs a loss to society in monetary units (Lochner & Matar, 1990). Taguchi's contribution is the application of the loss function to the measurement of quality. Taguchi represents such losses as a simple quadratic function:

$$L(y) = K^{*}(y - T)^2$$

where: L(y) is the loss in monetary units

K is a constant usually to be determined by cost per unit when the product is outside its specifications (K is also called quality loss coefficient)

y is the performance characteristic of a product

T is the specified target value for the performance characteristic of the product

$[y-T]^2$ is the mean squared deviation from the target T

Minimising L(y) by producing all product characteristics as close as possible to the target will improve quality.

Taguchi's quality engineering system

Taguchi divides quality engineering activities into two categories: on-line quality control and off-line quality control activities for improving the quality of both products and processes. On-line quality control activities are those technical aids employed during actual production or manufacturing and involve: process diagnosis and adjustment, prediction and correction and finally measurement and action. Off-line quality control activities are those technical aids employed during product design and development stages. Taguchi developed a three stage design approach for improving the product and process quality called the System design, the Parameter design and the Tolerance design.

On-line quality control activities are those technical aids employed during actual production or manufacturing and involve: process diagnosis and adjustment, prediction and correction and finally measurement and action.

System design

System design is the initial phase of any engineering design which basically uses both scientific and engineering knowledge to develop a functional prototype (Antony, 1995). The prototype describes the product/process design characteristics or parameters. Initial selection of parts, materials, components, and manufacturing technology is made at this phase of the design. The objective here is to use the best available technology to achieve the desired product or process performance and thereby meet customer requirements at the lowest cost.

Parameter design

Parameter design proposed by Taguchi is a cost-effective approach for reducing variation in products and

processes by making effective use of experimental design methods. This is the key stage of off-line quality engineering system because it can be used for improving the product/process quality while reducing costs. The ultimate objective of this stage is to minimise manufacturing and product lifetime costs by minimising performance variation. In other words, one should determine the best combination of design parameter (also called control factors) levels that will make the product or process robust (i.e., insensitive to external disturbances called noise factors).

Tolerance design

In tolerance design, tolerances are established around the target values established during parameter design. The goal is to set tolerances while still keeping the product's functional characteristics within specific bounds. Tolerance design stage determines the trade-off between the quality loss and the costs associated with products. For example, the narrower the tolerance band, the more costly it becomes to manufacture the product. On the other hand, the wider the tolerance band, the larger the quality loss and therefore greater the risk of product non-uniformity.

Taguchi's Contribution to Quality Engineering

Taguchi has made major contributions to quality engineering some of which are as follows:

Developed a methodology to make products and manufacturing processes robust to different sources of variation

Taguchi utilises robust parameter design to meet the following objectives:

Making products insensitive to environmental conditions such as ambient temperature, relative humidity, dust, etc.

* Making products insensitive to manufacturing imperfections.
* Making products insensitive to variations from component-to-component, unit-to-unit, etc.
* Minimising product's functional performance variability around a specified target value.

Formulated a complete methodology for quality improvement

Taguchi formulated a methodology which incorporates both engineering and statistical aspects of quality. The methodology will commence with a brief statement of the problem and end up in a confirmatory run/experiment to verify the optimal factor settings in achieving the objective of the experiment. His methodology assimilates both long term and societal concerns, rather than the narrow interests of an individual, small group, or specific corporation. The strength of his methodology lies in the simplicity in application, ease in understanding, and the readiness with which it can be used whenever needed.

Instituted the simultaneous study of both the mean and the variance

Traditional experiments, were primarily concerned about the factors or design parameters affecting the mean of the quality characteristic of products/processes. Taguchi gave equal importance to factors affecting both mean performance and performance variability. He established the concept of a crossed (Inner x Outer array) design, in which control factors or design parameters are placed in the inner array and noise factors (or hard-to-control factors) in the outer array. Through these inner x outer array designs, he instituted the simultaneous study of both the performance mean and the variance.

Carried out a study on the cost associated with variability using loss function analysis

Taguchi used loss function analysis in evaluating quality loss in monetary units. Any deviation in the quality characteristic of a product incurs a loss to the user or manufacturer. The top management remains unaware of the impact of these deviations (or variabilities) on costs. Taguchi used a quadratic loss function analysis in establishing a means of communication between technical and managerial people.

Taguchi Methods: Strengths & Weaknesses

Strengths

Revealed that Experimentation produces results: Experiments are generally carried out to gain information by analysing the processes or product designs. For example, in a certain injection moulding process, the main concern for engineers was to study the parts shrinkage problem. Experience may tell us that several factors such as barrel temperature, injection speed, type of plastic resin being used, etc. may be responsible for this problem. An experiment will help the engineers under these circumstances to determine which of these factors affect shrinkage the most. Taguchi has shown how to improve process/product

quality through successful experiments in an industrial environment.

Pioneered new tracks for quality engineering research: Taguchi introduced a new direction for quality engineering research by introducing innovative ideas in improving product/process quality, reducing performance variability, and so on. Thousands of engineers and managers in various organisations have been taught about performance variability and its role in final product quality and customer satisfaction.

Popularised the concept of robust design: Taguchi showed the importance of robust design to engineers in manufacturing companies with numerous case examples. He accentuated designing products to be robust against the uncontrolled external disturbances that causes excessive variability in the product's functional performance. Taguchi has developed a method for examining a product's performance over a variety of conditions that the product may encounter during its manufacture and throughout its useful life through designed experiments.

Introduced the loss function analysis to evaluate quality: The loss function provides a numerical evaluation of product quality. Taguchi encouraged engineers and managers to apply his loss function concept in various engineering applications. Loss function allows the explicit communication of variability as measured by a variance to be converted to an average loss per component or item in monetary units. Chan et al (1991) has shown the applications of loss function in various engineering situations.

Developed a methodology readily accessible to the engineering community: Taguchi formulated a strategic methodology for quality improvement so that the engineering community can easily understand the practical application of his methodology for solving various quality problems. The completeness, the ease, and specificity of the methodology are important factors in its success. Taguchi's methodology has been applied successfully by several experimenters and quality practitioners for optimisation, variability and tolerance problems.

Weaknesses of Taguchi Methods

Little Emphasis on Interaction Effects: Two factors are said to interact with each other if the effect of one factor on the output (i.e., response) is dependent on the level of the other factor and vice-versa (Gunst & Mason, 1991). In many manufacturing processes, understanding the interaction effect among the factors is the key to improvement. Taguchi suggested treating interaction effects as noise (Lochner, 1991). This is quite surprising, especially when we consider the strong emphasis Taguchi has placed on exploiting non-linearity effects and curvature effects in the functional relationships of product's characteristics. The advice given by Taguchi to treat interactions as noise' or 'choose the right quality characteristic to avoid interactions' is confusing because interactions are interactions and noise is noise, it is as simple as that. Research has shown that Taguchi's method for selecting the best product or process design is based on the assumption that there are no interaction effects present. Therefore there is no guarantee that Taguchi's method would pick very good designs especially when highly fractionated designs are used for optimisation problems. This problem can be rectified by selecting an appropriate design for the problem and then by using modern analytical (or graphical) techniques to detect whether interaction effects are statistically significant or not.

Failed to recommend randomisation: According to Dorian Shanin (Bhote, 1990), randomisation is deemed as an experimenter's insurance policy. Using the concept of randomisation, one can evenly distribute the external sources of variation among the factors under consideration. In other words, randomisation can ensure that all levels of a factor have an equal chance of being affected by these external sources of variation. These external sources of variation are due to noise factors in the experimental environment.

While cost considerations may preclude complete randomisation, restricted randomisation, such as blocking techniques, should be considered. Restricted randomisation provides adequate protection against unknown sources of bias without imposing burdensome constraints on the conduct of the experiment.

Use of linear graphs quite often lead to misleading conclusions: Linear graph is a graphical tool developed by Taguchi to aid in identifying columns of an experimental design matrix which contains interaction effects. They are difficult to use and even when used correctly can lead to inefficient designs. Taguchi's linear graphs do not provide the complete confounding relationships (especially for highly fractionated designs) among the factors or interactions. Therefore one may not be able to determine the true effect of a factor or its interaction with other factors. A more efficient approach to identifying the complete confounding relationships in two-level designs is to use a defining relation and confounding or alias structure as explained in Box et al (1978).

Accumulation analysis and minute analysis are unnecessarily complicated and inefficient: Taguchi

suggested a complicated method for analysing ordered categorical data called the accumulation analysis. A weld characterised as bad, fair, good or excellent is an example for categorical data. Extensive research has shown that this method is inefficient and unnecessarily complicated and therefore should not be recommended. The traditional scoring method is not only simpler but also more efficient. Taguchi also advocates minute analysis for the analysis of data from life testing. The application of minute analysis is based on the assumption that the data must be statistically independent. But the life testing data is not statistically independent and therefore the analysis is seriously invalidated.

Use of inappropriate Signal-to-Noise ratio: Taguchi recommends the use of a 'Signal-to-Noise ratio' for analysing experiments in which both the mean and the standard deviations are under study. Here 'Signal-to-Noise ratio' is a measure of the predictive performance of a product/process in the presence of noise factors. This ratio takes into account both factors affecting mean response (or location effects) and factors affecting standard deviation or variance (or dispersion effects) as a single measure. Therefore it is often hard to separate those factors affecting mean response and those affecting standard deviation. It is a good practice to analyse factors affecting mean and variance separately for arriving at satisfactory conclusions rather than solely depending on Taguchi's 'Signal-to-Noise' ratio.

Disregarded modern powerful graphical and analytical methods for rapid understanding: Taguchi neglects some of the powerful modern analytical and graphical tools for performing the statistical analysis of data from experiments. For example, the use of exploratory data analysis, probability plotting, residual analyses, outlier detection methods, common variance stabilising data transformations, cube plots, response plots, etc. were completely ignored. All these modern data analysis techniques could be easily used and should be used within a modern strategy for quality improvement.

Discouraged the adaptive, sequential approach to experimentation: Taguchi's crossed inner and outer array experiments are "one- shot" experiments (pick the winner) and generally require an enormous amount of experimentation (i.e., size of the experiment) and resources. If some initial assumptions go wrong at any stage of the experiment, a significant waste and loss of management support may result. An alternative approach is to conduct experiments sequentially, for example build up from two-level full or fractional factorial experiments can be more effective in identifying critical variables or factors early in the experimentation process so that subsequent follow-up experiments can be clearly focussed. Therefore it is advisable to conduct a sequence of smaller experiments at the beginning stage to understand the process behaviour rather than trying to learn everything about a process from one large experiment. The description of the sequential, adaptive approach to experimentation can be found in Box et al. (1978).

Conclusions

Although the methods proposed by Taguchi have received ample attention over the last few years, some of his analysis methods are found to be technically flawed. This study has analysed both the important contributions that Taguchi has made as well as the important criticisms of his methods. The interested reader is advised to consult some texts on experimental design and Taguchi methods for further details.

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Feature

Indian Biotechnology Industry: A Preliminary Analysis

T.R. Madanmohan & G. Balaji

Biotechnology is an emerging industry, with applications across several industries. Though the industry is unique, biotechnology products share characteristics of the relevant market with non-biotechnological products. This study summarises the tentative results of the strategic postures adopted, and the performance of business units in Indian biotechnology industry.

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Biotechnology is unique in that it emerged from the science base, within universities and institutes, rather than within industry. Second, it is a recent innovation: the two scientific discoveries underpinning its subsequent development, recombinant DNA and monoclonal antibodies (MAbs), were discovered only in mid 1970's. Third, biotechnology is a process innovation, it provides the basis for the discovery of new products, but is not a product in itself. Biotechnology is the engineering of changes in the genetic structure of micro-organisms and the technology is still very young and has longterm impact on multiple industries including agriculture. Government of India has setup a National Biotechnology Board within Department of Science and Technology to support and direct the Biotech Industry. The Board has been expanded into a fully fledged Department of Biotechnology in 1986. From less than twenty firms in early eighties the industry has grown to over 160 firms. Our understanding of the industry dynamics is at best, rudimentary. This study aims to identify the strategic postures adopted, the technology strategy and the performance of business units in biotechnology industry.

Biotechnology is a process innovation, it provides the basis for the discovery of new products, but is not a product in itself. Biotechnology is the engineering of changes in the genetic structure of micro-organisms.

Research Design

The design of 'deliberate sampling for heterogeneity', was adopted in which a target population of firms, situations and times ensured representation of a wide range of case histories from within

each class (Cook and Campbell, 1979). Firm size and product type were the variants but all were from biotechnology industry. Thirty-six firms were approached through a letter about the focus of the study, and its expected outcome. About nineteen firms responded positively, but due to various reasons only eleven firms participated in the study. For secondary data the study used Department of Biotechnology reports, Biotechnology Consortium of India (BCIL) publications and journals (including business journals).

Industry Features

Biotechnology being an emerging industry, the products share the characteristics of the relevant market with non-biotechnological products, some of the most significant features including embryonic firms and spin-offs, early entry barriers, and technological uncertainty (Porter, 1985).

Biotechnology in India is largely confined to agricultural products such as tissue culture and is dominated by multiple organisations. Educational institutions and R & D labs form a major part of the sector indicating the expanse of federal involvement in the sector. While there is a sizable number of firms in the private sector too, a significant part of them (over 34%) are involved in trading of the biotech products rather than actual manufacturing. Table 1 and 2 list the distribution of biotech firms in India.

Table 1: Biotech companies in India

Type of Organisation	Number
Government Institution	3
Labs (CSIR + DBT + ICMR)	50
Labs ICAR	54
Educational Institutions	81
Private Biotech firms	160
Public Biotech firms	15

Source: Department of Biotechnology, and Trade Journals

Table 2: Product-wise distribution of Indian bio-tech firms

Product Focus	No of firms
Plant and Agricultural Biotechnology	76
Industrial Biotech	23
Human health	12
Animal: leather and Animal husbandry	16
Biochem. Engineering	7
Basic and emerging Sciences	47

Source: Department of Biotechnology, and Trade Journals (Only manufacturing firms included)

Biotechnology in India is largely confined to agricultural products such as tissue culture and is dominated by multiple organisations.

Challenges in Commercializing Biotechnology

There are several entry barriers which characterize an industry at an early stage of its development. Daly (1985), based on an analysis of U.S. biotech firms, reported proprietary technology, cost of R&D and access to distribution channels as the major entry barriers. Table 3 lists the entry barriers in Indian biotech industry. Most Indian biotech products are process application rather than product oriented. Examples include tissue culture of high yielding sugar-cane, type-II binding ulcer drugs, etc. Hence patents and proprietary nature of technology are not considered an entry barrier. However, lack of sufficient technical prowess is a major factor inhibiting the growth of the sector. Another important aspect is the enforcement of product standards in the industry. Case in point is development of a product standard on Plant Tissue Culture. The executives in the industry argue that enforcement of a product standard based on the process as in the case of leaf protein IS 8222 # 1976, would increase the average cost of cultured products. Table 4 shows the comparative costs with imported technology with process specifications

Table 3: Entry barriers for Biotechnology

*	Technical prowess with limited resources
*	Distribution channels
*	Commercial focus
*	Timely acquisition of downstream capability
*	Capital-intensity
*	Regulatory environment

Source: Executive Interviews

Table 4: Comparative costs of sugar cane tissue culture technology with and without standards

Cost head	Imported technology (lakhs)		Indigenous
	with FAD standard	Without	Without
Cost of collaboration	40	40	NA
Greenhouses (to FAD spec)	8	5	5
Lab (consumables)	5	3	1.5
Cost/plant (Rs.) (with 1.5 Mill plant output)	10	6.5	1.50

Source: Frontier Biotech

and indigenous technology for sugarcane culture. Ministries concerned with implementing product standards should realize that multiple incompatible standards can co-exist in a quasi-equilibrium in a market thus offering multiple cost curve for firms to compete. While multiple standards may disintegrate the industry, given the few strategic cost advantages biotechnology industry has, it may be useful from the point of view of increasing the viability of the industry to allow multiple standards.

Proprietary technology, cost of R & D and access to distribution channels the major entry barriers.

Table 5: Comparative financial data on selected public biotech firms 1995 (Rs.'000)

Firm	Revenue	Expenses	EPS	Total Assets
Citurgia Biochemicals	53.42	45.90	0.662	68.49
Transgene Biotech	6.87	4.40	0.341	15.05
Monozyme India Ltd.	3.99	3.44	0.099	5.38

Source: Company Annual Reports

Table 6: Cash drain relative to loans for selected firms 1995 (Rs.'000)

Firm	Total Loans	Cash flow	Yearly change in working capital	Cumulative deficit
Citurgia Biochemicals	62.05	224.9	17.79	10.46
Transgene Biotech	15.05	116.4	43.75	50.05
Monozyme India Ltd.	5.49	31.44	26.62	3.38
Indrani Biotech	1.03	17.89	12.11	3.45
Hindustan Agrigenetics	1.23	12.12	31.55	13.33

* Cash flow is the sum of income or loss plus non-cash expenses such as depreciation.

Source: Company Annual Reports

Financing

A significant number of biotech firms being first-generation entrepreneurial organisations (over 34% of these from academia), external finance plays a vital role. Before attempting to analyze the dynamics of the capital flows let us look at financial performances of the firms in the industry and how they have been financing their growth. Majority of the firms (over 86 per cent) fueled their growth by borrowings and not by equity trading. As seen from tables 5 and 6 the working capital requirements are typically met by borrowings from the institutions. Some evidence also exists where the capital loans are inter-corporate loans with management control. Tables 7 and 8 show the average returns.

Table 7: Return on capital investment

Multiples of Original investment	No. of firms
5-10 times	6
2-5 times	17
Upto twice	19
Partial loss	19
Total loss	4

Source: IFCI Reports and Trade Journals

Table 8: Venture capital investment

Target rates of return	Compounded rates of return		
(Number of years before investment was realised)	30%	40%	50%
3 years	17	2	5
5th year	9	8	1
> 6 year	4	8	2

Technology Strategy

As mentioned, technology strategy is construed as the integration of functional strategies. The extent of investment made by the firm reflects the focus of inventive activity. Table 9 shows the corporate R&D investments of firms. A large chunk of firms (over 50% constituting of small and medium firms) were found to allocate their R&D investment towards manufacturing development activities.

Table 9: Distribution of corporate allocation

Allocation objective	
Improve inventory	2
Marginal product changes	9
New products	1

The effects of current operating profits can influence the managerial emphasis on continuous or long term R&D efforts. Table 10 shows the distribution of current operating profits on R&D expenditure for long term efforts. A significant majority of the firms

reported the effect of current sales on current R&D activities. Only a small number of firms reported strategic long-term R&D outlook. Though most of their efforts were inward looking, these had cascading effects on organisational slack (in one firm the ROA increased by 20%).

Table 10: Distribution of R&D long-term expenditure

Size of firm	**R&D long term allocations**		
(paid up capital in Rs. million)	Low	Medium	High
< 5	1	1	2
5-10	2	1	3
> 10	4	2	2

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Feature

Diversification of Enterprises: The Measurement Problem

G. Mythili

Manufacturing enterprises diversify their activities either due to technological (cost saving) reasons or strategic reasons to prevent competition in the market. Different factors responsible for diversification have to be decomposed quantitatively in order to be meaningful for policy design. Hardly are there studies which highlight this factor. What one encounters on the measurement side is that the existing classification of input and output and other information by Industrial Classification Code does not give enough scope for such quantitative analysis.

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Manufacturing business enterprises diversify their activities, the reasons for which can be broadly categorised as technological i.e. more effective use of resources as advocated by Marshall on the lines of joint production having the advantage of common inputs, the strategic behaviour of the incumbent firm seeking profit by reducing contestant's entry and the financial advantage by means of reduction of risk. The empirical works on diversification always try to emphasize the problem in the alternative measurement of diversification as a whole. The studies hardly project the importance of separation of different factors. Unless the factors are isolated, it is difficult to determine effective policy instruments in the sphere of regulation or deregulation, which would maximize society's welfare.

Concept & Definition

In principle, a unit which produces more than one product is a multi-product firm. They are classified as horizontally integrated, vertically integrated and diversified firms. A firm which produces products that are closely substitutable (e.g. different brands of soap) is horizontally integrated, while if the products have significant input-output relation the firm is vertically integrated. The firms with products which are neither closely substitutable nor enjoying input-output relation are said to be diversified. They may be related either in their production process or demand or distinctly different with respect to these two factors. In the former case, it is product extension diversification and in the latter, it is conglomerate diversification. The term 'diagonal diversification' has also been discussed in the literature. It consists of provision within the same organisation of auxiliary goods and services required for the several main processes or lines of production. For example, a firm may have its own power house to generate electricity or a machine tool making unit since such things are required for running

almost every processing activity. In this paper the term 'diversification' has been used regardless of the nature of product diversity.

The firms with products neither closely substitutable nor enjoying input-output relation are said to be diversified.

There always arises trouble in defining 'single product'. The question is, should it be related to single 'production unit' (e.g. plant) or 'decision making unit' or 'financial unit'. The definition and classification of firms, enterprises and industries have always proved to be a difficult task for economists. It depends on the purpose of study which very often may not match the industrial classification code. If the product is defined in relation to its demand characteristic, then the right criterion is to group together all products which have large cross elasticity of demand. One industry comprises producers of similar main products. Each industry consists of number of units called firms—a firm being a single decision making unit. Any behavioural study should keep a firm as an individual unit. However the industrial classification code groups together the physical units called establishments. In the late 60's there was a change in defining the individual unit and it was tied to ownership. One or more firms under common ownership were grouped together to form one enterprise and the decision making unit was taken to be at the 'enterprise' level.

Reasons for Product Diversification

Economies of scope

Technical consideration may dictate an industry to manufacture several product classes under one firm as a joint product than in different isolated single product firms. This idea which was first advocated by Marshall, was based on the argument that the existence of common inputs like public inputs or sharable inputs provides scope for producing several products in a single firm. The inputs can be efficiently utilized by producing all these products under one unit due to cost sharing and hence cost saving advantage. This was later conceptualized as 'Economies of Scope' by Baumol, Panzar and Willing (1982). A firm is said to enjoy Economies of Scope when

$$C(Y_1 + Y_2) < C(Y_1, O) + C(O, Y_2)$$

where 'C' represents cost of production[1]. Economies of Scope may arise either in the production of closely substitutable products or distinctly diversified products. This holds not only for physical assets but also for managerial experience and expertise. Such business skills at the top management level are very often not product specific and it pays to diversify. As Penrose (1959) explains some assets are product specific and some assets have value in producing more number of goods and services. The latter category of assets can be put to other uses too, including the leasing of those assets to other firms. Then the question arises as to why the firms choose to use it themselves. Market failure is a factor responsible for this. When a firm believes that internal organisation of production will be more optimal than the sale or lease of the asset in the market, then it results in multi-product activity. Factors like indivisibility of capital assets and sunk costs (refer Sankar, 1992) also provide scope for diversification. Penrose (1959) was of the view that diversification could not be conceived of changes in the products only; but would also involve changes in the technological base and market areas.

Firm strategy

In general, there are two factors which have proved to be effective for raising barriers to entry. They are the potential for predatory pricing and information loss on profits. There are many studies which have shown that diversification increases these opportunities to effect barriers.

Firms which have the potential for predatory pricing (Demonstration effect) in that they can present to the entrant that the post entry pricing behaviour of existing firms will be directed towards lowering prices to a level below costs, can maintain long run monopoly profits. Since, in a diversified firm, it is feasible to make up the loss arising from one activity by a gain from another activity, such opportunities of predatory pricing is higher in diversified industry. Information loss on profits is also another factor erecting barriers to entry. Because diversified firms may use the provision of consolidated reporting, the existence of excess profits of specific product lines need not be revealed. Rhodes (1973) has made an interesting study on this aspect and his final analysis supported the hypotheses that there is a systematic association between diversification of firms in an industry and industry margins and that the association is attributable to barriers to entry.

1. For more discussion on the cost characteristics of the multi-product firm, see Sankar (1992)

Diversified firms may have particular advantages over specialized firms when it comes to entry into a new market. A diversified firm can more readily stand an initial period of loss making in a new market until it establishes itself. Diversified entry is likely to provide an important supplementary force tending to promote competition in situations where entry by a few specialist firms would be difficult. Such entry, ceteris paribus would tend to increase competition and lead to lower price-cost margin.

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Group interdependence is also one factor which explains diversification. The diversified firm may take group decisions which will result in different prices for its subsidiaries compared with specialized firms. A diversified firm which produces several products may adopt a policy of tying the sale of one product to that of another. Though such tie-in-sales restricts the consumer's choice, it may not necessarily result in additional welfare loss.

Risk factor

The third factor is related to the reduction of financial risk: not having 'all eggs in one basket'. The bad fortune in one line of activity can be offset by goodluck elsewhere so that the overall chance of extremely good or poor result is reduced. If the rate of return is known with certainty (perfect market) then there is no gain from diversification. In the case of uncertain return, variability is reduced if the return from two activities are negatively correlated. It may be that, in certain cases, positive correlation is expected because the firms will face the same uncertain climate. However if there is a negative relation then the reason for engaging in diversification is to reduce the variability in the performance of the firm facing uncertain return. This was first addressed by Heady (1952) in a different field. Whatever be the individual factor responsible for diversification, the common ground for this is to increase or maintain the long run profitability of the enterprise.

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Alternative measures of diversification

Amey (1964) makes an interesting distinction between diversification due to market factors and diversification due to technical factors. According to him, threshold of diversification does not need to occur after one product class. Technological factors may compel an enterprise to manufacture several products which, he claims, is confused with market related product diversification. The technical considerations in the form of cost saving was later conceptualized by Baumol, Panzar and Willing (1982) and known as 'Economies of Scope'. It is the cost saving by having multiproducts in a single enterprise rather than having them in isolated different enterprises. Even in this there are two categories. It can be cost saving which is implicit in the technology itself or it can be cost saving due to efficient organisation of resources, management and other related factors.

Measures of Diversification

Berry (1971) applied the Herfindahl index of concentration to measure product diversification by a firm. It takes the form $D_1 = \sum_{i=1}^{N} P_i^2$ where P_i is the proportion of enterprise's output classified to the ith industry.

N = total number of industries in which the enterprise operates. Lower the value of D_1 higher will be the diversification.

It is obvious the minimum value of $D_1 = 1/N$ in which case the enterprise is diversified equally in N number of industries and maximum value of $D_1 = 1$ in which case, the enterprise's activity is completely specialised in one industry. The number equivalent of $NE = 1/D_1$ helps to see the degree of inequality among the P_i's. This can be accomplished by comparing NE and N. Other measures that are proposed are:

$D_2 = N - 1$ $\qquad$ $D_3 = B/(A + B)$ $\qquad$ where

A = enterprise's primary output

B = enterprise's non primary output

D_2 will indicate the number of non primary industries in which the enterprise operates. The number equivalent can also be defined using D_3, i.e. $NE_3 = 1/(1 - D_3)$. If one were to compare D_1 with D_2 and D_3 with respect to

the quantitative importance to the enterprise for its participation in various industries, then the considerable inequality among P_i's suggest that D_2 and D_3 could be seriously misleading.

A number of alternative measures have also been put forth:

$$D_4 = 1 - x_1 = \sum_{j=2}^{k} (x_j/x), \text{ where}$$

$$\text{Total employment } x = \sum_{j=1}^{k} x_j$$

x_1 = employment in primary activity and

x_j = employment in j^{th} activity

The maximum value of $D_4 = (k - 1)/k$. This happens when an enterprise diversifies equally in all k industries. The minimum value is '0' for a specialised firm. However this suppresses information on the distribution of the firm's secondary activities.

The next index is Berry's Index defined as

$$D_5 = 1 - \sum_{j=1}^{k} (x_j/x)^2$$

$$\text{Min } (D_5) = 0$$

$$\text{Max } (D_5) = (k - 1)/k$$

This is analogous to the one already reported using the enterprise's output.

Another index is Entropy Index defined as

$$D_6 = - \sum_{j=1}^{k} s_j \ln s_j$$

The particular feature of this measure is its usefulness in its decomposability into, within and between group components. If there are 'm' sectors, then

$E^t = E^b + \sum_{i=1} S_i^m E_i^w$ where E^t, E^b and E_i^w are entropy diversification indices for total, between and within sector i diversification. With this, one can assess whether a firm tends to diversify mainly within its own sector captured by the second term.

The next index is the Utton's Index given by

$$D_7 = 2(S_1 + 2S_2 + ...+kS_k) - 1$$

where S_1 .....S_k are arranged according to its activity level. In this, more weights are given to less important secondary activities.

Empirical Literature

Gort (1962) attempted at finding the relationship between diversification and technical activity within a firm or industry and found it positive in US manufacturing industry in 1951. His contention was that the firms classified to a primary industry with high technical activity and high concentration would make use of ideas generated by research and innovation in other industries. Amey's (1964) analysis also corraborated this hypothesis. He found a strong positive correlation between diversification and technical activity in his early U.K. study. Gorecki (1974) also investigated the reasons for diversification in U.K. manufacturing industry in 1963. He found a positive association between research intensity and diversification which was stronger in consumer goods industries. There was no statistically significant evidence that either market growth or market concentration affected the degree of diversification in U.K. manufacturing industries.

Contrary to the theoretical expectation, the firm's marketing expertise and its accumulated stock of goodwill do not provide it with increased scope for diversification. Gorecki held the view that the reason for this was that high advertising intensity is associated particularly with consumer goods industries and that firms in such industries tend to diversify into distribution rather than into other manufacturing industries: Gorecki's diversification index relates only to manufacturing employment. More evidence was also available for the positive association between research activity in the primary industry and diversification. A study also shows that management control is positively associated with conglomerate acquisition and this corraborates the view that managers pursue diversification policies to reduce employment risk.

Contrary to the theoretical expectation, the firm's marketing expertise and its accumulated stock of goodwill do not provide increase scope for diversification.

Several studies have suggested that industry profitability is higher when participant firms are more diversified. The available evidence of US industries suggests that there may be a positive association between profitability and the diversification of firms in an industry, atleast when sufficiently disaggregated data are used. This result may be attributable to a variety of monopoly power or cost-reducing effects. In the absence of a general theoretical framework of analysis it is not very relevant to speculate over the interpretation of the findings.

There may be a positive association between profitability and the diversification of firms in an industry, attributable to a variety of monopoly power or cost-reducing effects.

Empirical Work

A few examples were used to explore the cost saving reason for diversification. For this data pertaining to Annual Survey of Industries was used in which some firms provide evidence for economies of scope. However the data has its own limitations that ASI data contain. At the factory level, the total input costs and return and the factories are classified according to the Industrial Classification Code. The factory is assigned the product code which it produces as the primary product. Only if the break-ups of cost and return data for the secondary products are also provided, one can identify and quantify the different factors responsible for diversification. With such reservations of data, it was examined to what extent the multi product firms provide evidence for economies of scope. The results are provided in Table 1. It is clear that the multi product firm with relatively substitutable products or with strong input output relation (vertical integration) proved to be the case of activities extended to many products due to cost saving reason.

Table 1: Expansion of activities by industries and their economies of scope

Product Name	Industry category under which it is a secondary product	Cost per rupee of Return	
		Single product firm	Multi product firm
Petroleum Product	Organic heavy Chemicals	0.91	0.84
Furniture and Fixtures	Wood and wood prod. excl. furniture	0.52	0.36
Leather Footwear	Leather and leather products excl. footwear	0.83	0.53
Vanaspathi Oil	Edible Oil excl. Vanaspathi	1.17	0.83

Final Remarks

The results are only tentative because as we have mentioned earlier, from the ASI data it is not very clear whether a particular product is produced by a single-product firm or a multi product firm. Moreover, since the data has been provided in value units, price effect is also in-built in the measure. Hence it is not possible to adjust for quality variation. Particularly, for products like steel and fertilizer, this analysis is not very meaningful as each firm charges a different price.

When a firm diversifies, it has a certain well defined motive. If the motive lies in the strategical behaviour of firms to put barriers to entry, explicitly or implicitly, it causes market concentration. However, if the economies of scope dictate a firm to pursue diversification activities, it should certainly be encouraged. Thus the diversification motive has important implications for policy design. Unless the motives could be properly isolated, it will not serve policy purpose. Hardly any empirical study highlights this factor. This existing data provided by ASI and other supplementary sources do not give scope for appropriate classification that could be used for isolation of different factors. Hence no specific generatalization can be made in explaining firm behaviour on this at this stage.

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Feature

India's Foreign Technical Collaborations: Pattern & Growth

Vikram Chadha

The paper marks three distinct phases in the growth of India's foreign technical collaborations since independence, and analyses the underlying factors giving rise to a certain pattern therein. The main conclusion is that excepting the period 1971-80, which was a phase of selective approach towards foreign collaboration, the remaining phases have been marked by heavy import of foreign technology through collaborations under one pretext or another. Whereas in the pre-economic reform phase, technical collaboration was justified in the name of rapid development based on heavy capital intensive industrialisation, in the post reform phase the argument has been the technological modernisation of Indian industry to produce competitive goods for capturing export markets.

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Technology transfer from rich to poor countries takes place through the formation of technical collaborations between the two. However, the dynamics of contemporary development evinces a lopsided distribution of gains from such collaborations favouring the developed nations (Sagasti, 1979: Nayar, 1983). Many LDCs show sporadic policy resolves for endogenous technological development through domestic R&D effort which reflects their antipathy towards the exploitative content of such agreements. Nevertheless, under the subtle impact of the current wave of global opening up, most developing countries have been induced or drawn into the realm of inter-national technology transfer.

Since the beginning of the planning era, technology imports through technical collaborations have played a significant role in India's industrial and economic development. Inspite of the emphasis on the achievement of technological self-reliance in the long run, through domestic R&D effort, the planners have leaned heavily on technology transfer through collaborations with foreign manufacturers to support India's development programmes.

The planners have leaned heavily on technology transfer through collaborations with foreign manufacturers to support India's development programmes.

However, since the mid 80s, particularly from the beginning of the 90s, there has been an ostensible shift in India's policy, in the wake of globalisation and liberalisation of the Indian economy. It becomes worth exploring the nature, extent and growth of India's foreign technical collaborations, in the pre and post New Economic Policy era.

Phase I : Selective Approach

After independence, India adopted a broad front technology policy, which warranted import of technology to meet short run technological requirements of some critical areas of the economy. Nevertheless, the long term objective was the achievement of technological self-reliance. It was also clearly mentioned that foreign investment proposals (including foreign collaborations) would be permitted only if they infuse new technology. However, while granting approvals, minority foreign investment participation would be preferred so that "new technology could be disseminated by Indians, with a view to promoting further growth of the economy on the basis of indigenous effort" (Ghosh, 1992).

Despite the initial rhetoric of achieving technological self-reliance and dispensing with foreign technology and capital, the ambitious Second and Third Five Year Plans, based on Mahalnobis strategy of development of giving a big push to the economy with heavy capital intensive industrialisation, necessitated technical and financial tie-ups with foreign manufacturers to feed large industrial plants in steel, fertilizer, oil, chemicals, cement, machine tools sectors. As a sequel to this strategy, a large number of foreign technical collaborations were formed.

Between 1948-60, total number of foreign collaborations approved was 1080. In the 1960-70, out of a total of 2477 foreign collaborations approved, 1677 were Pure Technical Collaborations (PTCs), while the remaining also involved equity investment. Over 1961-70, total remittances on account of payment of royalties and technical fees for technical collaborations tripled from Rs. 8.83 crores to over Rs. 25 crores. The spurt in these remittances may be explained by the devaluation of Indian rupee in 1966, despite the fact that owing to the pressure on the economy in the wake of China aggression and Indo-Pak war and droughts of 1960s, the number of foreign collaborations approved was declining, eg., they declined from a peak of 403 in 1964 to only 131 in 1968 and to 183 in 1970. Nevertheless, this pattern of seeking advanced technical support through technical collaborations was consistent with the heavy industry strategy of the Second and Third Five Year Plans, which required a base of modern technology (Balasubramanayam 1974; RBI, 1974 and DSIR, 1990).

The seventies was a very critical phase in the Indian economic development. Firstly the war with Pakistan in 1971, and then the great international oil price escalation of 1972 made a great dent in India's foreign exchange reserves. In order to conserve foreign exchange and to regulate its outflow, Foreign Exchange Regulation Act (FERA) was introduced in 1973, under which the foreign exchange holdings in the jointly held Indian firms were to be diluted below 40 per cent. Simultaneously, the 1973 Technology Policy laid emphasis on the use of indigenous technology developed through domestic R&D, and importing technology only sparingly. DSIR was assigned to assist FIB in granting approvals to only those technical collaborations which led to inflow of essential technologies (Ghosh, 1992). But, the 1973 Industrial Policy, for the first time, permitted foreign companies to enter into the core sectors of the economy though in a restricted manner and under the watchful supervision of the Foreign Investment Board. This resulted in a spurt in the formation of foreign collaborations, as a sequal to which the Hathi Committee was appointed in 1975 to study the role and status of such collaborations in drugs and pharmaceuticals.

The 1973 Technology Policy laid emphasis on the use of indigenous technology developed through domestic R&D, and importing technology only sparingly.

The Committee was highly critical of the role of foreign companies in the technical development of the industry in India.[1] Government setup a Technical Evaluation Committee to assist FIB in screening foreign collaboration approvals. The Committee consisted of officials from CSIR, DGTD and DST to make the assessment, if the technical collaboration proposed was really indispensable. The noose on foreign collaboration agreements was further tightened in the 1977 Industrial Policy because the Licensing Policy Enquiry Committee had indicted that many technical agreements had been entered into in non-essential activities. 393 industries were deleted from the list where foreign collaborations were allowed. Thus this period marked the selectivity of technology imports (Mehta, 1995).

Growth & Trend of Collaborations

Table 1 presents the growth of foreign technical collaborations and remittances abroad on account of

1. The Committee objected that the foreign collaborations preferred to bring technology from the parent company even if it could be developed and acquired at lower costs domestically. Moreover such technology was 15 to 20 years old. The Committee also critized the Government's policy to enter into foreign collaboration for technological development, because the same technology could be procured from international markets at much lower cost and with less restrictive conditions than posed by the collaborators.

royalties and technical fees during 1971-80. The table shows that during the decade 1971-80, the total number of foreign collaborations approved had doubled from 245 to 526. The number of pure technical collaborations also more than doubled and their proportion in the total collaborations went up from over 81 per cent to over 86 per cent in this period. Two important landmark years may be mentioned in this decade:

- In the year 1974, following the decision to allow foreign collaboration in the core sector in 1973 Industrial Policy, the number of collaborations escalated from 265 to 369 and the number of PTCs jacked up from 231 to 304.
- As a sequel to the 1980 Industrial Policy, which may be said to have laid the foundation of external liberalisation in the Indian Industry[2], the number of foreign collaborations went up from 267 to 526 in 1981 out of which over 86 per cent were PTCs. As a result of this, payments on account of technical fees increased from Rs. 44 crores to about Rs. 105 crores during 1981.

Table 2 depicts the sector-wise distribution of foreign collaborations during 1971-80. The largest proportion of foreign technical collaborations (around 20 per cent of total) was accounted by Electrical and Electronic Sector and Industrial Machinery manufacturing sector, while Transport and Chemical sectors accounted for around 10 per cent during 1971-80. Due to liberalised technology import policy of 1980[3], all sectors in Indian Industry entered into increasing number of technical collaborations.

Table 3 highlights the direction of India's foreign collaborations during 1971-80. USA, UK and Germany were the prominent partners in India's technological development. With the beginning of global liberalisation in India since 1980, there was obviously a quantum jump in the number of technical collaborations with all countries.

2. The outward orientation or external liberalisation of the Indian industry was contemplated on account of rising GDP; rising saving rate at 23.2 per cent; easing balance of payment situation; growing demand for white goods and other luxury goods by the expanding middle classes (Ghosh, 1992).

3. The 1980 Industrial Policy liberalised import of technology as it includes capital goods in OGL; allowed import of design/drawings upto Rs. 20 lakhs against Import Replenishment Licenses; permitted to call global tenders for capital goods in 13 specified core industries irrespective of local availability; delegation of power to approve a technical collaboration involving technical inflow upto Rs. 50 lakhs to administrative ministries rather than FIB (Kumar, 1987).

Phase II: NEP & Repercussions

The decade 1981-90 is a watershed in the Indian economic history. This phase characterised the gradual but resolute trend towards globalisation and domestic and international opening up of the economy, which culminated in the adoption of what came to be called the New Economic Policy (NEP). Firstly, the slashing of import duty on project inputs in fertilizer and power equipment sector from 105 per cent to 45 per cent and to 25 per cent in 1985 and then the removal or relaxation of restrictions on the import of capital goods and technical know-how as provided in the 1988 and 1990 Industrial policies opened vistas for the formation of technical collaborations with foreign companies. Now, technical collaboration could be formed without government clearance, subject to maximum royalty payment of 5 per cent of domestic sales and 8 per cent of export earnings. Similarly, now such technical collaborations with foreign equity holdings up to 40 per cent may be automatically approved, if the value of capital goods to be imported does not exceed 30 per cent of the value of plant and machinery. (Chadha, 1993; DSIR, 1990; B.M., 1988).

Table 4 shows that in 1985, the total number of collaborations jumped from 740 to 1041 out of which pure Technical Collaborations (PTCs) were 785. The sudden increase might have been due to a dose of liberalisation of 1985. But the slack after that, till 1990 may have been caused due to the alarming deterioration of foreign exchange reserves. The pattern of technical remittances on account of technical collaborations shows that dividend remittances formed 40-50 per cent, technical fee formed 30-40 per cent, while royalty payments formed 10-20 per cent of the total technical payments over 1981-90.

Table 5 depicts sectorwise distribution of foreign collaborations during 1981-90. The table shows that out of a total of 7593 collaborations formed, over 23 per cent were in Electrical and Electronics industry, followed by over 18 per cent in industrial machinery sector and about 12 per cent each in Chemical and Mechanical Engineering areas of manufacture. However, if we take stock of the sector-wise lump sum payments/technical fee remittances abroad, over 37 per cent were accounted by Chemical Sector and over 12 per cent by Metallurgical industry, while Electrical and Electronics bore only little over 14 per cent of lump sum payments (DSIR, 1991).

Similarly, if we look at the country-wise distribution of India's foreign technical collaborations during 1981-90, we find that 21.1 per cent were settled with USA,

Table 1: India's foreign technical collaborations and remittances of technical payments abroad

Year	Total No. of Collabo-rations	Pure Technical collabo-rations	Collaborations involving foreign-equity	Profits and Dividends (Rs. crores)	Royalty (Rs. crores)	Technical know-how fee (Rs. crores)	Interest (Rs. crores)
1971-72	245	199 (81.22)	46	48.81	5.86	13.90	12.13
1972-73	257	220 (85.60)	37	54.62	7.33	11.33	15.60
1973-74	265	231 (87.17)	34	59.42	6.21	14.08	16.27
1974-75	359	304 (84.68)	55	25.65	8.46	12.56	36.70
1975-76	271	231 (85.24)	40	45.20	10.49	25.66	24.65
1976-77	277	238 (85.92)	39	67.86	15.88	37.80	25.11
1977-78	267	240 (89.89)	27	78.14	19.50	28.14	22.70
1978-79	307	257 (83.71)	44	64.59	12.65	55.53	31.44
1979-80	267	235 (88.01)	32	65.29	9.53	43.97	25.22
1980-81	526	453 (86.12)	73	68.02	8.88	104.93	22.32

Note: Figures in brackets are percentages of total.

Source: Kumar, N., "Technology Policy in India", in P.R. Brahmananda and V.R. Panchmukhi (Eds.) The Development Process of the Indian Economy, Himalaya 1987, pp. 461-92.

Table 2: Industry-wise distribution of technical collaborations during 1971-80

Year	Chemical	Electrical & Electronics	Industrial Machinery	Mechanical Engineering	Machine Tools	Metallurgical	Textile	Transport	Total
1971-75	177	205	242	89	80	90	39	138	1395
	(6.34)	(14.70)	(17.35)	(2.13)	(5.73)	(2.15)	(2.80)	(9.89)	
1976	32	63	57	13	19	12	2	19	277
	(11.55)	(22.74)	(20.58)	(4.69)	(6.86)	(4.33)	(0.72)	(6.86)	
1977	23	67	74	4	10	7	2	19	267
	(8.61)	(25.09)	(27.74)	(1.50)	(3.75)	(2.62)	(0.75)	(7.12)	
1978	30	48	76	7	20	18	2	22	307
	(9.77)	(15.64)	(24.76)	(2.28)	(6.51)	(5.86)	(0.65)	(7.17)	
1979	24	52	72	15	14	12	–	26	267
	(8.99)	(19.48)	(26.97)	(5.62)	(5.24)	(4.49)		(9.74)	
1980	52	114	121	29	26	31	6	41	526
	(9.89)	(21.67)	(23)	(5.51)	(4.94)	(5.89)	(1.14)	(7.79)	

Note: Figures in brackets are percentages of total.

Source: DSIR, Foreign Collaborations, New Delhi: Ministry of Science and Technology, 1990, p. 2.

Table 3: India's foreign collaborations by country

Year	USA	UK	West Germany	Japan	France	Italy	East European Countries	Switzerland
1971	43	55	43	35	16	4	15	14
1972	62	38	49	27	16	8	16	15
1973	48	53	60	36	13	5	13	10
1974	79	59	68	28	22	16	9	34
1975	55	54	59	23	13	10	8	27
1976	69	54	58	10	17	8	12	22
1977	54	59	55	20	14	9	11	23
1978	58	61	58	28	23	13	13	18
1979	48	63	55	12	17	16	13	14
1980	125	110	100	34	24	25	21	38
Total	641	606	605	253	165	114	131	205

Source: Economic Intelligence Service, Basic Data Relating to Indian Economy, New Delhi: CMIE, Aug., 1994, Table Nos. 20, 2-1-3.

Table 4: India's foreign technical collaborations and remittances of technical payments (1981-90)

Year	Total No. of Collabo-rations	Pure Technical Collabo-rations	Collaborations involving Foreign Equity Participation	Fees for Technical Know-how (Rs. crores)	Royalities (Rs. crores)	Dividends (Rs. crores)	Total (Rs. crores)
1981	389	333 (85.60)	56	42.57 (33.18)	15.47 (12.06)	70.26 (54.76)	128.30
1982	588	475 (80.78)	113	52.51 (38.37)	18.03 (13.18)	66.31 (48.51)	136.85
1983	673	544 (80.83)	129	53.08 (33.71)	30.52 (19.38)	73.86 (46.91)	157.46
1984	740	592 (80.00)	148	13.39 (13.50)	9.92 (10.00)	15.89 (76.50)	99.20
1985	1041	785 (75.41)	256	69.41 (43.30)	10.39 (6.48)	80.49 (50.22)	160.29
1986	960	704 (73.33)	256	36.53 (30.91)	18.20 (15.40)	63.46 (53.69)	118.19
1987	903	644 (71.32)	259	50.33 (36.25)	25.47 (18.34)	63.06 (45.41)	138.46
1988	957	668 (69.80)	289	40.80 (27.58)	32.12 (21.71)	75.01 (50.71)	147.93
1989	639	427 (66.82)	212	29.75 (18.03)	44.37 (26.89)	90.91 (55.09)	165.03
1990	703	502 (71.41)	201	76.97 (34.43)	49.53 (22.16)	97.06 (43.42)	223.56

Note: Figures in brackets are percentages of total.

Source: (i) DSIR, Foreign Collaborations, New Delhi: Ministry of Science and Technology, 1990, p. 1.

(ii) Economic Intelligence Service, Basic Statistics Relating to Indian Economy, New Delhi: CMIE, Aug. 1994, Table 20.

Table 5: Sectorwise distribution of foreign collaborations 1981-90

Year	Alternate/ Renewable Energy Sources	Chemicals	Electricals & Electronics	Industrial Machinery	Mech. Engg.	Machine Tools	Mettallurgical	Textile	Transport	Consultancy & R&D	Misc.	Total
1981	–	27	55	96	49	5	9	5	19	–	42	389
1982	3	54	134	110	125	6	36	7	24	7	82	588
1983	5	76	149	144	69	24	24	3	34	11	134	673
1984	4	85	162	169	99	27	32	7	25	10	120	740
1985	14	69	315	215	89	38	54	13	52	20	162	1041
1986	5	135	246	87	145	28	69	16	54	–	175	960
1987	4	138	227	165	83	24	35	11	39	9	168	903
1988	3	136	243	170	92	24	55	25	40	18	151	957
1989	2	80	111	74	75	11	35	11	18	25	197	639
1990	2	76	146	159	66	8	31	8	38	84	85	703
Total	42 (0.6)	876 (11.7)	1788 (23.8)	1389 (18.4)	892 (11.9)	195 (2.6)	380 (5.1)	106 (1.4)	343 (4.6)	184 (2.4)	1316 (17.5)	7593

Notes: (i) Figures in brackets are percentages of total.

(ii) The 1981 figures do not include 82 technical collaborations approved by administrative institutions, but are included in total.

Source: DSIR, Foreign Collaborations, New Delhi: Ministry of Science and Technology, 1990, p. 2.

Table 6: Countrywise technical remittances (Royalty & Technical Fee) on account of technical collaborations with India (1981-90) (Rs. crores)

Year	UK	USA	Germany	Japan	France	Others	Total
1981-82	10.28 (37.11)	15.57 (15.78)	9.99 (3.10)	2.91	3.32	15.97	58.04 (70.26)
1982-83	9.74 (33.94)	22.29 (18.28)	12.27 (5.15)	4.91	7.31	14.02	70.54 (66.31)
1983-84	11.05 (42.38)	28.68 (15.71)	13.1 (6.24)	5.63	8.21	16.93	83.60 (73.86)
1984-85	3.29 (42.48)	6.06 (14.82)	1.83 (5.35)	1.44	0.42	10.27	23.31 (75.89)
1985-86	26.09 (42.27)	25.33 (13.81)	5.58 (6.64)	6.21	0.68	15.91	79.80 (80.49)
1986-87	4.23 (32.77)	15.62 (13.45)	4.53 (4.59)	4.53	0.50	25.42	54.73 (63.46)
1987-88	16.66 (41.39)	18.29 (7.95)	3.46 (4.32)	8.12	1.09	28.18	75.80 (63.06)
1988-89	11.65 (40.36)	15.91 (13.90)	14.26 (6.25)	15.52	2.58	13.00	72.92 (75.01)
1989-90	10.21 (55.50)	18.05 (11.86)	7.07 (9.39)	21.65	1.73	15.41	74.12 (75.01)
1990-91	23.27 (63.02)	27.34 (10.93)	24.65 (5.73)	5.70	4.72	40.82	126.50 (97.06)

Note: Figures in brackets are the amounts remitted on account of dividend payments.

Source: Economic Intelligence Service, Basic Statistics Relating to Indian Economy, New Delhi: Centre for Monitoring Indian Economy, New Delhi: Centre for Monitoring Indian Economy, Aug. 1994, Tables 20.9A & B.

18.5 per cent were accomplished with the help of Germany, followed by over 15 per cent with UK and 9.7 per cent with Japan (DSIR, 1990). Thus, there was only marginal change in the direction of India's foreign technical collaborations. Whereas in the preceding decades, UK was the foremost technical collaborator with Indian manufacturing, now Germany and USA have taken the lead.

Table 6 presents the country-wise remittances on account of technical collaborations with India during 1981-90. It highlights that the maximum flow of technical remittances had been towards USA. Due to the more liberalised economic scenario during 1990-91, technical payments have spurted with the large number of collaborations during this year. Surprisingly the largest increase has been to Germany during 1990-91, for which technical payments have trebled. However, the remittances of technical payments by collaborations supported by UK far exceeded the technical payments by other countries. This is due to the better accomplishment of UK companies, most of which produce consumer durables and plough back high profits on account of increasing demand from middle income groups.

Another feature during 1981-90 has been that the remittance of dividends by collaborative ventures with more than 40 per cent foreign equity has varied between 58 per cent and 70 per cent, while dividend remittances by collaborative companies with less than 40 per cent foreign equity ranged between 29 per cent and 46 per cent during 1981-90. Thus collaborative ventures with larger foreign equity participation were more profitable and siphoned away a larger share from Indian resources (CMIE, 1994).

Collaborative ventures with larger foreign equity participation were more profitable and siphoned away a larger share from Indian resources.

Phase III: Implications

The New Industrial Policy of 1991 further liberalised the process and prospects of the formation of foreign technical agreements. Now automatic approval for such technical collaborations involving foreign equity upto 51 per cent would be granted in priority areas like metallurgical industries, industrial and electrical machinery, X-ray equipment, electronics and telecommunication etc. Such collaborations should involve lump sum payment not exceeding Rs. 1 crore and royalty payment not more than 5 per cent of domestic sale and 8 per cent of export earnings. Besides that the CIF value of imported capital goods required should not exceed 25 per cent of total value of plant and equipment with maximum value of Rs. 2 crores.

Measures such as devaluation of 1991; full convertability of Indian rupee in 1992; lowering of import duties on capital goods from 150 per cent in 1991 to 110 per cent in 1992 and 85 per cent (and to even 25 per cent to 35 per cent in some categories of capital goods) in 1993, gave inducement to foreign manufacturers to enter into equity based technical collaborations with Indian companies, particularly to produce sophisticated consumer goods for the large Indian market. The delicensing of industries in 1991, the scope of which was further expanded in 1993 to include luxury goods and white goods industries, gave a further stimulus to the formation of technical agreements with foreign manufacturers (Chandiramani, 1994). The signing of GATT in 1994 has integrated India with the world economy through unrestricted trade. However, India must show its product superiority, to be able to export in the international markets.

Post NEP Scenario

Table 7 shows a rapid increase in the number of foreign collaborations from 950 in 1991 to 1476 in 1993, and in the first 8 months of 1994, these had totalled upto 1061. Whereas during 1970s, the proportion of PTCs in the total number of collaborations was over 80 per cent, after 1985 it declined to the range of 60-70 per cent. In 1990s, one can notice a consistent fall in the proportion, while there is considerable rise in technical collaborations involving foreign equity. It can be understood that after the NEP permitted majority foreign equity participation in such collaborative ventures, it would always be to the benefit of the foreign collaborator to invest in equity because it provides a certain measure of control on management and decisions as also on the remittances on account of technical payments and dividends.

Table 8 shows that during 1991-94, USA had settled about 37 per cent of total collaborations which involved 37 per cent of total foreign investment approved. But UK and Germany formed 22 per cent each of collaboration, though investment approved was only 3 to 6 per cent. Switzerland was a major entry in the area of foreign collaboration with India after NEP. This is only an extension of the earlier pattern i.e. USA, UK, Germany and Japan and now Switzerland have been mainly providing technical support to India.

Table 7: Foreign technical collaborations approved and foreign investment involved (1991-94)

Year	Total No. of Foreign Collaborations	Pure Technical Collaborations	Collaborations involving Equity	Foreign Investment Involved (Rs. crores)
1991	950	661 (69.58)	289	530
1992	1520	828 (54.57)	692	3890
1993	1476	691 (46.82)	785	8860
1994 (upto Aug.)	1061	409 (38.55)	652	2460 (upto June)

Source: (i) Jain, N.K., Manual for Foreign Collaboration and Investment in India, New Delhi: Nabhi Publications, 1995.

(ii) Indian Investment Centre, Monthly Newsletter, 1994.

Table 8: Countrywise breakup of foreign collaborations and foreign investment approved

Country	Foreign Collaborations Approved (1991-93)	Foreign Investment Approved (1991-94 June) (Rs. crores)
USA	804 (36.88)	5854.84 (37.21)
UK	490 (22.48)	945.16 (06.06)
Germany	532 (24.40)	621.53 (03.95)
Japan	272 (12.48)	988.19 (06.28)
Switzerland	196 (08.99)	1171.88 (7.45)
France	146 (06.70)	198.10 (01.26)
Italy	184 (08.44)	280.16 (01.78)
Russia	48 (04.95)	123.57 (0.79)
Total	2180	15735.69

Note: Figures in brackets are percentages of total.

Source: Jain, N.K., Manual for Foreign Collaboration and Investment in India, New Delhi: Nabhi Publications, 1995.

Table 9 shows that in the post NEP period, maximum proportion of technical collaborations has been formed in the field of chemicals (12.56 per cent), followed by industrial machinery (11.30 per cent) and electrical equipment (10.78 per cent) and so on. However, the maximum proportion of foreign investment in these collaborations during this period was approved for oil refining, power sectors and chemical etc. This is again an extension of the earlier pattern of sectoral distribution of foreign collaborations, with only one difference that their relative proportion has declined. This may be so because now many new fields have cropped up where new technical collaborations are being finalised.

It would always be to the benefit of the foreign collaborator to invest in equity because it provides a certain measure of control on management and decisions as also on the remittances on account of technical payments and dividends.

Concluding Observations

After the vehement rhetoric against the impact of foreign capital and technology subsided, the imperative of rapid development based on modern industrialisation and agricultural development spurred us to join hands with developed countries in seeking their technical and financial assistance in surmounting our growth problems and dilemmas. Excepting for a brief period following the failure of the Third Plan, when the number of collaborations declined, India's foreign technical collaborations have maintained a steady growth. This trend continued even during the period of selectivity (1971-80), when India was facing a serious resource crunch.

However, the proportion of Pure Technical Collaborations among total number of foreign collaborations has remained very large. This means that those technical collaborations which allowed equity participation to foreign collaborators in the joint ventures have remained relatively fewer in number. This was done deliberately so as to prevent the majority foreign equity holder from exercising control on management and to impose restrictive clauses for further technical development based on indigenous R&D. However, after the NEP, since 1991 the proportion of technical agreements involving foreign equity has far exceeded the pure technical agreements, may be because of relaxations concerning automatic approval to collaborative projects involving foreign equity upto 51 per cent, which is always in the interest of the foreign collaborator.

The total outflow of royalties, technical fees, interests and dividends etc. on account of foreign technical

Table 9: Sectorwise breakup of foreign investment and technical collaborations approved (1991-94 June)

Name of Industry	Technical Collabo-rations	Financial Collabo-rations	Total	Amount of Invest-ment Approved (Rs. crores)
Mettallurgical Industry	121	78	199 (4.47)	1503.03 (9.63)
Power	0	7	7 (0.16)	2230.40 (14.28)
Oil Refinery	26	28	54 (1.21)	2415.06 (15.47)
Electrical Equipment	318	162	480 (10.78)	417.89 (2.68)
Computer Software Industry	32	147	179 (4.02)	636.30 (4.08)
Electronics	63	66	129 (2.90)	164.21 (1.05)
Telecommunications	51	27	78 (1.75)	189.44 (1.21)
Automobile Industry	111	48	159 (3.57)	417.97 (2.68)
Industrial Machinery	361	142	503 (11.30)	228.07 (1.46)
Machine Tools	35	26	61 (1.37)	36.65 (0.23)
Agricultural Machinery	18	3	21 (0.47)	05.55 (0.04)
Mechanical Engineering	94	72	166 (3.72)	100.41 (0.64)
Fertilizers	14	02	16 (0.36)	02.66 (0.02)
Chemicals	357	202	559 (12.56)	1095.30 (7.01)
Drugs & Pharmaceuticals	43	38	81 (1.82)	88.44 (0.57)
Textiles	50	98	148 (3.33)	390.40 (2.50)
Total	2333	2118	4451	15614.37

Source: Jain, N.K., Manual for Foreign Collaborations and Investment in India, New Delhi: Nabhi Publications, 1995, p. 14.

collaborations has been increasing. This is on account of rising technical charges involved in collaborative agreements, devaluation of Indian rupee and also due to the rising number of foreign technical collaborations as such. However, remittance of dividends and profits has far exceeded the payment of other constituents of technical payments over the years.

On the issues of rising technical remittances, one view is that such technical payments are a serious drain on the scarce resources, because such remittances far exceed the amount that India receives by way of technical payments on its own foreign investments and technical ventures abroad. But another view is that, firstly such technical payments form a very small percentage of India's export earnings and secondly, if the total net contribution of imported technology in terms of net value added in national income is measured, then such technical imports through collaborations will not look expensive. In other words, total linkages generated by foreign technical collaborations have to be reckoned with. Thus, the question of technology import hinges on the productivity

of imported technology.[4] Moreover, a ceiling on royalty payments may not enable us to bring in appropriate and efficient technologies. Similarly, the question of in-essentiality of imported technology[5] is also ill founded because once such consumer goods industries were established, as a matter of economic policy, these could not be denied access to state-of-art technologies in the international market, which were not available at home (Balasubramanyam 1984 and Nayar, 1983).

The question of technology import hinges on the productivity of imported technology. A ceiling on royalty payments may not enable us to bring in appropriate and efficient technologies.

Nevertheless, the most beneficial effect of foreign collaborations for Indian economy would be in the field on infrastructure like power and transport, a trend which has already begun.

It has been alleged that we have tried to enter into technical collaborations to import technology instead of accessing such technology in international open market because such technology imports would be cheaper and less restrictive in terms and conditions. But the reality is that USA and UK or a group of countries no longer enjoy a monopoly as exporters of technology, Japan, Germany and Switzerland are being associated increasingly. Our analysis also shows a wide dispersion of collaborations over countries and over time. Thus technology import through collaborations may not be exploitative. Rather technology may be received as a package than merely on partial basis.

Finally, it has been objected that India's foreign collaborations have not helped in bringing latest technology to India, nor has it helped in training our technicians or in assimilation of foreign technology.[6] May be such a view was relevant to India's view,whatever industrial and technological development we have made since independence could perhaps be unimaginable had it been made to depend only on domestic R&D. So foreign technical assistance did help us in modernising our sectors. Moreover, in the present scenario of globalisation, where enterprises are free to produce in whatever way they like, they are free to buy their inputs and sell output anywhere globally and when the whole world is like an integrated economic system, it no longer matters whether a technology was transferred or assimilated in a country or not. It is going to become a purely competitive question of survivability. So we have to look for our own competitive advantage and acquire and develop relevant technologies to produce and sell our goods to the best of our capability, no matter from where and how we procure our technologies.

4. On the basis of RBI Survey in 1969-70, of 247 Indian companies having technical collaborations, Nayar (1983) estimates that every Re. 1 in technical fees and royalty made possible production worth Rs. 132. Similarly, total technical payments remitted abroad on account of technical collaborations in each year during 1960 to 1976 was less than 1.5 per cent of total export earnings.

   Similarly, another survey of 90 firms which involved foreign technical collaborations and were set up during 1983-94 shows that outflow of foreign exchange on account of royalties and the technical payments increased from Rs. 138.81 crores in 1989 to Rs. 193.09 crores in 1991. But inflow of foreign exchange due to export and import substitution by these firms increased over the same period from Rs. 316.64 crores to Rs. 483.36 crores (NCAER, 1994).

5. Ghosh (1992) provides evidence on this issue.

6. Pillai (1978) and Goyal (1979) observe that technology transfer through collaboration is a myth. There are many restrictive clauses in the agreement which choke any meaningful R&D for assimilation of transferred technology. In many cases, it happens to be a collaboration between a subsidiary of MNC and its parent company which blocks any benefits being spread out in the economy. Now the latest decision to allow a MNC subsidiary to pay technical fees and other payments to its parent company will accelerate the outflow of foreign exchange and profits (Mehta, 1995).

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Feature

Low Cost Horticultural Technologies for Rural Women

Vijay Sethi & S.B. Maini

India is blessed with a wide variety of fruits and vegetables; 20-40 per cent of this production is lost during various post harvest operations. Proper management and processing can play an important role in horticulture and salvage a significant part of this loss. Fruit and vegetable processing industry is an important agrobased industry. Preservation of fruits and vegetables by conventional methods like canning, freezing, dehydration and aseptic and laminate packaging not only increase the cost of the preserved material but also require special skill and machinery. Low cost and low energy management and processing technologies will bring the preserved products within the reach of a much wider section of the population. Adopting some of the simple methods of preservation such as chemical preservation, pickling , lactic fermentation, sundrying etc. will not only help in getting better returns by value addition and reducing post harvest losses but also generate more employment at the village level on cottage scale.

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In developing countries, women are a great force, contributing to agricultural production and thereby playing a crucial role in activities such as livestock production, agro-forestry, fishing etc. By and large, they have remained silent workers or as invisible hands in this process. Women can make a significant contribution in rural development thereby enhancing the gross national product. They can effectively participate in several specialized trades like fruit and vegetable nurseries, skilled operations in horticulture gardens and in post harvest operation such as harvesting, grading , packing and marketing provided training for latest skills is imparted to them (Sethi & Bisaria, 1995).

Women can make a significant contribution in specialized trades like fruit and vegetable nurseries, horticulture gardens and in post harvest operation, provided training for latest skills is imparted to them.

Horticulture: Present Status

India produces all types of fruits and vegetables due to its wide range of agro-climatic conditions. At present, India is the largest producer of fruits and second largest producer of vegetables after China. However, 20-40 per cent of this production is lost during various post harvest operations such as handling, grading , packing, storage, transport, distribution and processing. Women can play an important role in post harvest management right from harvest and can salvage a large part of this loss. It will help in higher availability of this dietary material which comes under protective foods at lesser cost and improve the nutritional status of our vast population.

Farm Women in Horticulture Development

With a view to providing continuing focus on issues related to farm women and to sensitizing scientists, extension workers, farmers and farm women for the first time on 4th December, 1989, the day was celebrated as Women in Agriculture Day in India and abroad and made a permanent annual feature by International Federation for Women in Agriculture (IFWA). It has also been observed that nearly 80 per cent of economically active rural women are associated with horticulture production (Prasad et al., 1988). Hence, if the rural women are trained in some of the simple and low cost energy techniques for proper management of fresh fruits and vegetables at post harvest level, it will help in reduction of losses, better returns to the growers and reasonable price to the consumers both for fresh and processed products (Sethi & Maini, 1989). These methods will centre around evaporative cooling, storage, solar drying, chemical preservation by food additives, simple methods of processing, pickling, lactic fermentation and proper utilization of horticultural wastes.

If the rural women are trained in simple and low cost energy techniques for proper management of fresh fruits and vegetables at post harvest level, it will help in reduction of losses, better returns to the growers and reasonable price to the consumers both for fresh and processed products.

Proper Management of Produce

Careful handing, packaging and storage of fruits & vegetables

* Careful handling of produce is important to avoid bruises, cuts, scratches and abrasion injuries which may spoil the appearance, make the damaged parts inedible and lead to infections and decaying.
* Harvesting at proper maturity, proper grading and curing will increase the storage and marketability of fresh produce.
* Curing of onion and potato prior to storage will enhance their shelf life.

Appropriate packaging is a prerequisite for retaining the quality of produce or its products. Improved packaging also extends the marketability of fruits and vegetables to the advantages of growers, traders and consumers. In India different types of containers are used for packing different fruits and vegetables. The superiority of corrugated fibre board boxes for apple, plums, mango and other fruits for transport and storage has already been proved at various centres in India (Anand & Maini, 1982; Maini, 1983; Joshi and Roy, 1984; Maini et al., 1984 a, 1988 b). Packing of individual fruit either in paper, ventilated polyethylene bags, tissue paper, fungistatic wrappers or wax paper showed better quality and less shrivelling than unwrapped fruit (Adsule and Tandon, 1983). For transportation of mango, among the different types of containers, plastic crates were found to be better from the point of view of reducing bruising loss and pretransit wrapping of H.M. film in mango gave encouraging result in delaying ripening and increasing shelf life.

Precooling of mango to 12-15°C in cold water with 500 ppm Bavistin increased the shelf life. In case of Cv. Alphonso, it also reduced the incidence of spongy tissue and delayed ripening. Post harvest application of Bavistin (0.1%) and Topsin-M (0.1%) was found to be most effective in controlling the storage diseases in mango and Nagpur mandarin. Storage losses in onion due to spoilage could be reduced by storing onion in perforated plastic crates stacked in ventilated room/shed (Indo-USAID report).

Evaporative cool storage

Evaporative cooler or desert coolers based on evaporative cooling system can be used much more effectively under high temperature and low humidity condition prevailing in Northern India for storage of fruits and vegetables. As this system requires no electricity or very less amount as compared to mechanical refrigeration system, it is a cheaper and effective form of storage of fruits and vegetables at village level. This system also helps in reducing shrivelling losses as humidity is 90-95 per cent. This system has been successfully utilized in storage of horticulture commodities (Maini et al. 1984c; Roy and Khurdiya, 1985).

Processing Technologies

In India only 1.3 per cent of the total production of 104 million tonnes of fruits and vegetables is processed. Processing industry has not expanded due to the high cost of the processed products. Simple technologies to preserve fruits and vegetables can be adopted in the rural countryside (which holds about 70 per cent of population) with limited skills and resources. Some of these technologies are as follows:

Solar drying of fruits and vegetables

Solar energy as such or its concentration in solar driers can be effectively utilized for drying fruits and vegetables at village level by women workers. It is one of the cheapest and endless forms of energy for processing. At present many products are prepared at village level such as raw mango powder (Amchur), mango leather (Ampapad), dried pomegranate seeds (Anardana) etc. However their quality is not upto the mark and can be improved by proper blanching, sulphuring, drying in solar driers and finally packing in flexible films for better retention of quality. Khurdiya and Roy (1986), observed better retention of sulphur dioxide in both ber and potato slices in a solar drier. Maini et al, (1984a), developed an inexpensive field solar drier which can be utilized at village level for drying fruits and vegetables by using an easily stretchable and foldable tubular model of drier with a glossless black polythene which was stitched to a sheet of bubble polythene. Accumulated moisture was removed by operating an electric fan. Potato chips (2mm thickness) dried properly in the drier had golden yellow colour. For efficient drying, not only temperature but also the removal of built up humidity by introducing proper ventilation and circulation of air is important (Maini et al., 1985).

Solar energy as such or its concentration in solar driers can be effectively utilized for drying fruits and vegetables at village level.

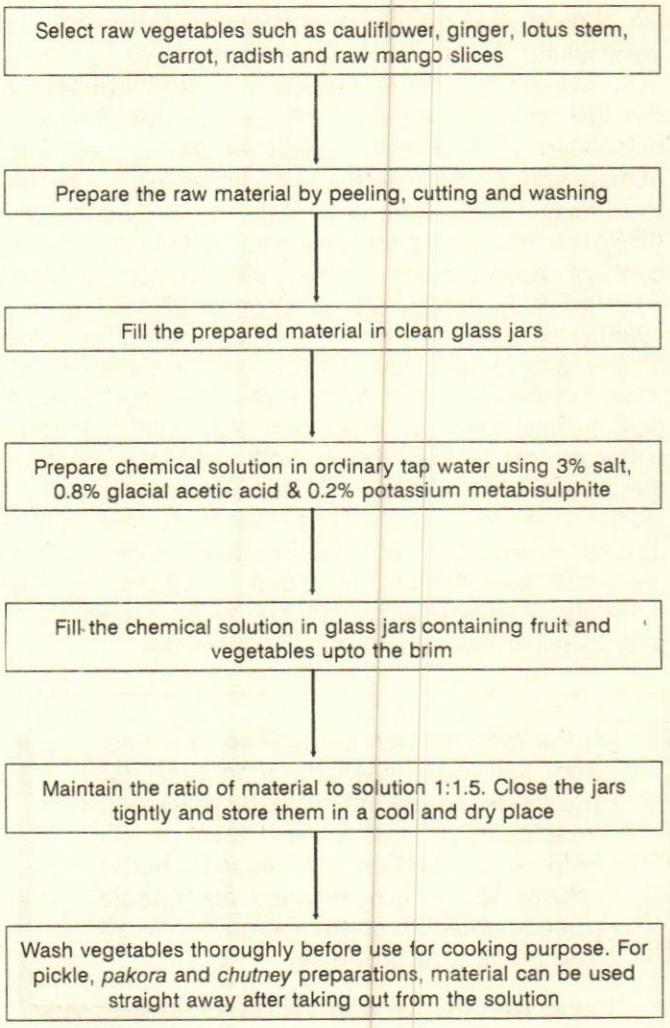
Chemical preservation of fruits and vegetables

Steeping method

Raw vegetables like cauliflower, carrot, cucumber, longmelon, radish, turnip, lotus stem, ginger can be preserved for culinary purpose and pickling, in a chemical solution without much cost (Sethi & Anand, 1982; Sethi, 1990a, 1994) table 1. This method makes use of a simple solution that consists of 3 per cent salt, 0.8 per cent glacial acetic acid and 0.2 per cent potassium metabisulphite (KMS).

For raw mango slices (peeled or unpeeled), steeping preservation in a chemical solution containing 5-10 per cent salt, 1.2 per cent acetic acid and 0.1 per cent KMS was found to be better than dry salting. Addition of 0.5 per cent calcium chloride helped in better retention of texture of slices during subsequent storage. Dry salting showed more softening and browning of slices (Sethi, 1991).

Table 1: Preservation of fruits and vegetables through steeping method



Amla fruits can be successfully preserved in a chemical solution containing 10 per cent salt and 0.04 per cent potassium metabisulphite for use in salad or pickle preparation.

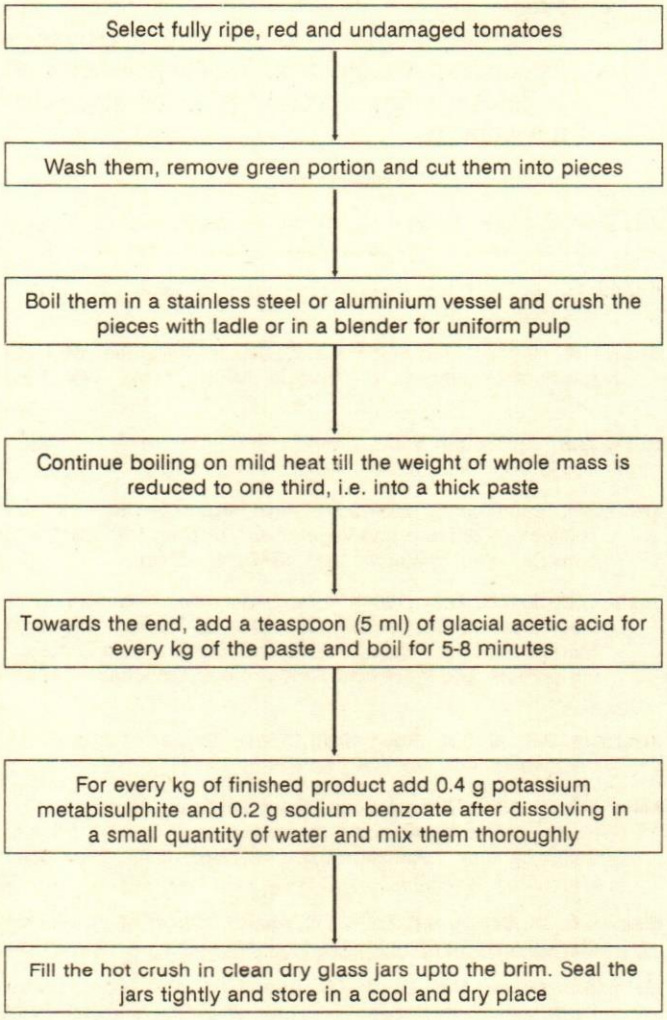
Whole White European button mushrooms could be preserved successfully for culinary purpose and pickling without any spoilage at ambient condition in chemical solution (Sethi et al., 1991; Sethi, 1994). Blanching before preservation was found to be essential. Chemical solution consisted of salt (2%), sugar (2%), citric acid (.5%), ascorbic acid (1.5%) and KMS (0.1%). Preserved mushrooms retained good colour, flavour and texture upto 6 months.

Preparation of whole tomato concentrate (crush)

It is better to preserve whole tomato pulp alongwith seeds and peels for culinary purpose as well as for the preparation of various products. Whole tomato pulp

concentrated to 2½ per cent to 3 fold concentrations and preserved with 0.5 per cent glacial acetic acid and 200 ppm each of sulphur dioxide and sodium benzoate retained acceptable quality when stored at 25 + 5°C for one year with little loss in colour and vitamins (Sethi & Anand, 1982; Sethi, 1994) (table 2).

Table 2: Preparing tomato crush



Storage of fruit pulps/juices

Fruit pulps can be prepared at village level preserved by chemical preservatives and stored for subsequent use as squashes, jams, fruit, leathers etc. when the fruits are available in plenty at cheaper rates. It will save transportation costs also as peels, seeds, cores etc. are removed during preparation of pulp and only pulp can be transhipped to the factories. Pulps or juices of peaches, plums, jamun, phalsa, apricots, guavas, mangoes (ripe and raw), citrus fruits and tomato can easily be preserved and stored after heating to 80-85°C and preserving them with citric acid (1.0%) and KMS 0.1%) or sodium benzoate (0.1%) (Sethi, 1986; Sethi & Maini, 1991; Sethi, 1994). There is no need of citric acid in acidic fruits. They can be stored in glass bottles or jars and whenever needed, pulp or juice can be converted into squash, jam or other preparations. Spiced tomato juice and spiced raw mango beverages can be prepared by adding salt, spices and preservatives for use in off season.

A method has been standardised to preserve litchi fruit pulp for beverage preparation (Sethi, 1985; 1994). Pulp was found to be acceptable organoleptically for 6 months at room temperature (25 to 35°C) and upto 12 months at low temperature (4-5°C) when it was heated to 85°C and then preserved with 500 ppm sulphur dioxide (SO_2). Low temperature storage was better than room temperature for colour and flavour retention. A Method has also been standardised for utilization of litchi pulp for squash preparation and storage (Sethi & Anand, 1983; Sethi, 1993).

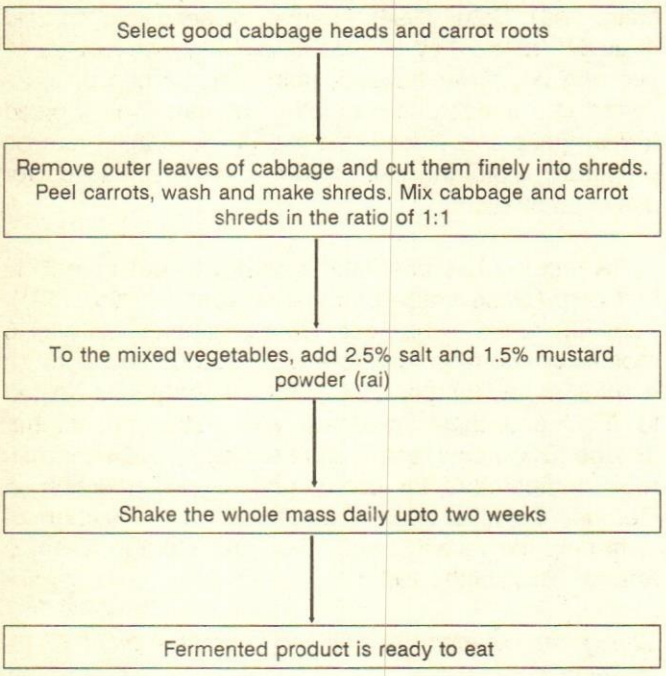
Quality improvement for fruit and vegetable pickles, chutneys and sauces

Pickles, chutneys and sauces can be easily prepared at village level on a large scale women as these are being prepared in each home at present. However, their quality can be improved by introducing technologies and chemicals such as use of 0.5 per cent acetic acid as an antiseptic to control spoilage alongwith sodium benzoate (750 ppm) as preservative in vegetable sauce (Gupta et al., 1971); steam blanching in amla and turnip before pickling (Ghorai, 1991) and use of sugar instead of jaggery in turnip pickle (Narayana & Maini, 1989). Food grade plastic jars (pearlpet) can be used for packing pickles instead of stone and glass jars to avoid breakage and enable easy handling.

Preservation of vegetables by lactic fermentation

Fermented foods have many advantages like prolonged shelf life, requiring less time for cooking and increase in acceptability, palatability and digestibility of the product (Mukherjee, 1988). Lactic fermentation can be easily carried out by women at rural level on longmelon, cauliflower, carrot, beet root, spinach, cabbage alongwith different concentrations of salt and mustard powder (Brassica juncea). Addition of mustard acts as a selective preservative. It suppresses the undesirable micro-organisms but promotes lactic acid producing bacterial growth (table 3). In best roots the earthy taste can be masked to some extent by mixing equal amount of cabbage during fermentation (Sethi & Anand, 1971; & 1984; Sethi, 1990; 1994).

Table 3: Fermenting cabbage-carrot mixture



Black carrot juice can also be fermented which is a refreshing cooling drink in summer. Addition of 3 per cent salt + 1.0 per cent mustard + 0.015 per cent sodium benzoate + 0.01 per cent KMS to 1:1 carrot juice and water mixture was found to be the best for preserving the fermented beverage. It can be further spiced and diluted before use. The beautiful crimson colour drink can be exploited on a commercial scale (Sethi, 1990; 1994).

Future Strategies

- Improved agricultural implements should be introduced for better crop management and reducing drudgery in crop operations.
- New innovations in low cost technologies should be made in horticulture which women workers can use without difficulty.
- Horticulture needs skilled manpower. Hence, education and training of women in crop production, handling, storage, packaging, hygiene, sanitation and processing technology is imperative for meeting the future challenges. For this purpose training programmes on pre and post harvest technologies using the technique 'Learning by doing' and 'Teaching by doing' should be conducted.
- Appropriate technology in floriculture nurseries, mushroom cultivation, preparation of value added products from fruits, vegetables and spices can supplement income and generate employment at farm level.
- Educational programmes regarding nutritional and quality parameters of horticultural crops will enhance higher consumption of these protective foods and hence better health.
- Processing of fruits at farm level will help in better utilization of waste as animal feed, biogas or as compost, thereby reducing the pollution load in cities where processing factories at present are working.

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Feature

Bivoltine & Multivoltine Silk Rearing in Karnataka: Comparative Economics

Arun & Syed Anis Ahmed

Factors like Socio-economic suitability of sericulture to the small farm size, favourable agro-climatic condition, low investment, quick returns and high market demand have favoured the expansion of sericulture sector in countries like India. The National Sericulture Project (NSP) launched in 1980-81, aimed at increasing raw silk production and popularising the adoption of the Bivoltine (BV) mulberry rearing. However, this failed in the traditional silk producing regions (South interior districts of Karnataka state) due to poor performance of BV and wider acceptance of Multivoltine. Keeping this in view, the paper attempts to understand the economics of rearing bivoltine against multivoltine silk in the traditional areas.

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Sericulture in Karnataka accounts for 65 per cent of India's production (Rao, 1992). India being second in the world next to China produced 10000 tonnes by 1991-92 and 17,000 tonnes by the end of 1995. Of the commercially known silk varieties, viz., Eri, Muga, Mulberry and Tasar, mulberry silk contributes to 90 per cent of raw silk production in India.

In Mulberry silk, there are three races, viz., univoltine (UV), bivoltine (BV) and multivoltine (MV). In tropical countries like India multivoltine is predominant (almost 95% of the total mulberry silk produced). Bivoltine silk race, which has been newly introduced is native to Japan and China and quality of silk is superior.

Karnataka is the largest silk producing state, accounting for 58 per cent of mulberry area and 60-65 per cent of mulberry silk production in India. The National Sericulture Project (NSP) launched in 1980-81 with World Bank assistance aims at increasing BV silk production. However, the adoption of BV has failed in traditional areas due to poor performance (Anonymous, 1990). The paper attempts to understand the economics of rearing BV against MV in Bangalore rural and urban districts.

Methodology

To compute the economics of silk rearing, primary investigation was undertaken in rural and urban districts of Bangalore, close to the BV cocoon market. The area being well-known for sericulture, a study could facilitate investigation of the reasons for the non-performance of BV vis-a-vis MV, the underlying assumption being the ready availability of and access to a ready market for both types of cocoons. A sample of 40 farmers rearing BV and MV was interviewed. The economic analysis was made for single BV crop sold for reeling with that of single MV crop (The study assumes that there is no significant dif-

ference is the cost of cultivating mulberry garden for purpose of leaves. This prevents the need for comparing the costs in BV and MV mulberry cultivation).

Results

The study analyses the findings separately for physical input-output comparison and cost and returns comparison of bivoltine and multivoltine silk cocoon production.

Physical input-output comparison

The details of physical input-output comparison of BV and MV silk rearing for the sample farmers are presented in table 1.

Table 1: Physical Input-Output in BV and MV silk cocoon production (per farm)

Input-Output	Unit	Average of Sample	
		Bivoltine	Multivoltine
Inputs			
Area	acre	1.70	1.43
Disease Free Laying (DFL)	No.	213.80	229.68
Mulberry Leaves*	Kgs	3137.80	2306.99
Human Labour	Manday	405.90	107.80
Mountages	No.	76.48	95.94
Outputs			
Cocoon	Kgs	78.48	82.60
Fodder	Cartload	2.50	1.11
Litter	Cartload	5.12	3.20

Note: * Significant at 95 per cent level.

Area

The average area under mulberry for BV farmers was 1.7 acres and for MV farmers 1.43 acres. i.e., 0.27 acres more in BV (16.08%).

Laying

The average number of Disease Free Laying (DFL) reared by BV sample farmers was 213.8 as compared to 229.68 in MV, the difference of 15.88 DFL representing 7.4 percentage lower in number in case of BV farmers.

Feeding (mulberry leaves)

On an average a BV farmer fed 830.51 Kgs more leaves than the MV farmer (26.47% higher consumption). This difference was found statistically significant.

Labour

There is no significant difference in the human labour employment which worked out to 105.9 mandays for BV farmers and 107.8 mandays for MV farmers.

Output (cocoon production)

The outputs of BV and MV farmers were not statistically significant. The cocoon yield realised worked to 78.88 Kgs for BV farmers while it was 82.6 Kgs in MV. The by-product viz., fodder and litter production was not of significance.

In table 2, the average input use and output realised in physical terms are compared and contrasted on per acre mulberry and 100 DFL basis for BV and MV

Table 2: Physical Input-Output in BV and MV silk cocoon production (per acre per 100 layings)

Input-output	Unit	Quantity per acre Mulberry		Quantity per 100 laying	
		BV	MV	BV	MV
Input					
Area	Acre	1.0	1.0	0.80	0.62
DFL	No.	125.54	160.73	100.00	100.00
Mulberry leaves	Kgs	1842.34	1614.41	1467.49	1004.46
Human labour	Manday	62.18	75.44	49.53	46.94
Family Labour	-do-	44.16	61.52	35.18	38.28
Hired labour	-do-	18.02	13.92	14.35	8.66
Mountages	No.	44.91	67.11	35.77	41.77
Output					
Cocoon	Kgs	46.32	57.80	36.89	38.63
Fodder	Carload	1.47	0.78	1.17	0.48
Litter	-do-	3.01	2.24	2.40	1.39

Note: BV – Bivoltine MV – Multivoltine

Table 3: Cost and returns in bivoltine and multivoltine silk cocoon production (per 100 Laying)

Cost

Particulars	Bivoltine			Multivoltine		
	Cost Rs.	Percent of operation cost	Percent of Total cost	Cost Rs.	Percent of operation cost	Percent of Total cost
Operation Costs						
Cost of Layings (DFL)	180.45	3.81	3.49	238.24	8.17	7.32
Mulberry leaves	1516.42	44.32	40.51	992.16	34.01	30.46
Human labour	1261.69	36.88	33.70	1181.62	40.51	36.28
Family labour	896.11	26.19	23.94	963.62	33.44	29.28
Hired labour	365.55	10.69	9.76	218.00	7.47	6.69
Mountages	198.85	5.81	5.31	224.65	7.70	6.90
Miscellaneous	106.75	3.12	2.85	82.25	2.82	2.53
Marketing	165.59	4.84	4.42	162.56	5.57	4.99
Interest on working Capital	41.67	1.22	1.11	35.52	1.22	1.09
Total	3421.42	100.00	91.39	297.01	100.00	89.57
Fixed Cost						
Apportioned cost and depreciation on rearing house and equipment	156.67		4.19	163.36		5.02
Interest on fixed capital	165.28		4.42	176.29		5.41
Total fixed cost	321.95		8.61	339.65		10.43
Total cost	3743.37		100.00	3256.66		100.00
Returns						
Main Product						
Cocoon		2855.29			2988.81	
Incentive from government at Rs. 5/Kg.		18.45			00.00	
By-product						
Fodder		394.80			179.60	
Litter		512.50			375.64	
Total Gross Returns		3947.04			3544.00	

Table 4: Comparative economics of bivoltine (BV) and multivoltine (MV) silk cocoon production

Particulars	BV	MV	BV - MV
Yield of Cocoon per 100 DFL, Kg	36.89	38.63	-1.75
Average price Per Kg of cocoon, Rs	77.40	77.37	0.03
Gross returns per 100 DFL, Rs	3947.04	3544.05	402.99
Gross cost per 100 DFL, Rs	3743.37	3256.66	486.71
Net return per 100 DFL			
Including imputed family labour costs, Rs	203.67	287.39	-83.72
Excluding imputed family labour costs, Rs	1099.81	1251.01	-151.20
Net return per acre Mulberry			
Including imputed family labour costs, Rs	255.69	461.92	-206.23
Excluding imputed family labour costs, Rs	1380.70	2010.75	-630.04
Net return per Kg of cocoon			
Including imputed family labour costs, Rs	5.52	7.44	-1.92
Excluding imputed family labour costs, Rs	29.81	32.38	-2.57
Net returns per rupee of investment			
Including imputed family labour costs, Rs	0.0544	0.088	-0.0338
Excluding imputed family labour costs, Rs	0.2910	0.3841	-0.0901

farmers. The comparison based on quantities per acre of mulberry has a limitation, due to the fact that farmers sell mulberry leaves if it is in excess of their requirement and purchase the same at times of shortage. Hence, comparison based on 100 DFL is better and this also facilities cost and returns comparison in BV and MV rearing.

Costs and returns

The costs and returns of rearing BV and MV 100 DFL are presented in table 3. The operational cost accounts for 91.39 per cent and 89.55 per cent of the total cost of production in BV and MV respectively. The total cost of rearing 100 DFL is Rs. 3743.37 for BV and Rs. 3256.66 for MV. The difference in the cost structure is attributed to the cost of mulberry leaves as observed (more quantity of leaves in BV). The returns realised from the sale of BV cocoons are Rs. 2855.29 and Rs. 2988.81 for MV. The BV rearers receive an incentive of Rs. 5 for every kilogram of cocoon produced for reeling purpose from the government of Karnataka (Rs. 184.45). The gross returns from BV and MV are Rs. 3947.04 and Rs. 3544.05, from 100 DFL respectively.

Gross returns and cost for BV are higher when compared to MV. However, the net returns are lower for BV farmers. Thus, MV rearing is a better economic proposition when compared to BV rearing for commercial purposes.

The comparative economics of BV and MV farmers is summarised in table 4. The average yield of cocoon per 100 DFL was 36.89 Kgs and 38.63 Kgs for BV and MV farmers respectively. There is no significant difference between average prices received; however, the BV farmers receive Rs. 5 per kilogram of cocoon produced as incentive. It can be observed from the table that gross returns and cost for 100 DFL of BV are higher when compared to MV. However, the net returns per 100 DFL, net returns per acre of mulberry, net returns per kilogram of cocoon and net returns per rupee of investment are lower for BV farmers. Thus, MV rearing is a better economic proposition when compared to BV rearing for commercial purposes (reeling).

Drastic fall in silk prices being attributed to cheap import and smuggling of Chinese silk. Protection of domestic silk industry is essential to achieve self reliance.

Conclusions

It can be inferred that MV rearing is more economical and beneficial when compared to BV. However, this inference is made cautiously, since the above analysis pertains to BV that is sold for reeling purpose. If the BV cocoons were sold for seed cocoon, the prices of which are generally higher, the returns would be entirely different. But, as BV seed production is outside the purview of the present study, such an analysis has not been carried out.

The analysis of net returns indicates that cocoon production is not very lucrative. In this connection, it must be mentioned that the present study was conducted during the period when the sericulture industry was facing price recession, the drastic fall in silk prices being attributed to cheap import and smuggling of Chinese silk. In fact, the silk cocoon prices were lower in 1993 compared to the prices that prevailed during 1991 and 1992. Thus, protection of domestic silk industry is essential to achieve self reliance. Dependence on import can be avoided through proper enforcement and price stabilisation would be an incentive for growth of this industry.

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Feature

Consumer Preference to Full-fat Soyflour: An Insight to Market Potential

S.D. Kulkarni, S.K. Sawarkar, N.G. Bhole & Vijay D. Kulkarni

Full-fat soyflour, produced by bean heat treatment, just enough to inactivate the soybean lipoxygenase enzymes, was evaluated for consumer acceptability. The supplied sample was liked by almost all the respondents and reported to be a highly useful ingredient for use in conventional food products. Average monthly requirement of 1 kg per 3 member family was initially established. It has a potential to contribute 8 per cent of proteins needed. Establishment of soybean processing units would not only provide employment in rural areas locally, but also enable the poor to derive the nutritional advantages of a rich source of an inherent excellent protein quality. The supplementation would improve the poor–protein diet in quality at a reasonable price. The product pattern suggested by the survey indicates innovative interaction in national nutrition through soybean.

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Soybean was introduced in India in 1960s mainly to meet the protein needs of an ever increasing population. The production of soybean has increased by 135 times from 0.014 in 1970 to 2 million tonnes in 1991, with an average productivity of 1 t/ha (Kulkarni, 1992). In 1993, the production of 4.5 million tonnes was estimated with an export potential of Rs. 1800 crores (Ethiraj & Bhargava, 1993). Soybean contains 40 per cent good quality protein and 20 per cent edible oil. It assumes great significance in meeting the protein-energy needs of Indian population particularly when the production of plant protein source – pulses – is almost stagnant. Per capita availability of pulses has gone down from 75 g/day in the fifties to 24 g/day (Kulkarni, 1991) as against the moderately recommended intake of 45 g/day (ICMR, 1984). For effective utilization of the reasonably priced, high protein source – soybean, an orientation in its processing pattern to provide products suitable for incorporation in traditional food is essential. Tackling the off-flavour was a major problem faced. Full-fat soyflour was produced after total inactivation of the off flavour causing enzyme-lipoxygenase. Consumer response survey was conducted in 1992 to ascertain the acceptability profile to estimate the prospects of nutritional improvement and the market potential for the establishment of soybean processing units in different areas of the country.

Soybean assumes great significance in meeting the protein-energy needs of Indian population particularly when the production of plant protein source – pulses – is almost stagnant.

Materials & Methods

Undamaged whole grains, of cultivar JS-7244 variety of soybean were used for the study. For determination of

moisture content of the whole soybean samples, a 10 g sample, in a preweighed moisture box, was placed in an oven set at 105°C for 16 hours and weighed after cooling (Roberts & Roberts, 1972).

Heat treatment

Soyproducts are often associated with off flavour/beany flavour mainly developed due to the action of lipoxygenase enzyme system. Soybean samples at innate moisture content of about 10 per cent (dry basis) were heat treated in hot air oven at predecided temperature and duration (Kulkarni, 1992) to give lipoxygenase–free product to check the off flavour development. After completion of heat treatment, the sample was immediately transferred to the desiccator for final cooling. The Primarily Processed Product (PPP) i.e. optimally heat treated soybean was milled to a size–25 ISS and used as full-fat soyflour for the survey.

Consumer acceptability

To assess the product acceptability by the targeted consumer groups, three areas from two states of India were selected:

- Urban-1: Bhopal, state capital city, located in soybean growing area (Madhya Pradesh State) where the population was aware about soybean and its nutritional advantages.
- Urban-2: Aurangabad, industrial city, located in non-soybean growing area in Maharashtra State where few people were expected to be aware of soybean and its nutritional aspects.
- Rural area: Tuljapur and nearby villages in typical non-soybean growing rural area in Maharashtra state where total unawareness regarding soybean was prevalent.

These regions are referred to as Urban-1, Urban-2 and Rural respectively in the text. Ten samples, in each category, were distributed amongst different socio-economic groups. Participants were requested to prepare food products of their choice using PPP soyflour, in their homes. For conducting this study in the rural area, help was solicited from the Tata Institute of Social Sciences (Rural Campus) Tuljapur (Maharashtra State). Suitable questionnaire was developed for the purpose, and used to gather information on family background such as economical and educational status, awareness of the product and opinion, based on the use of the product in dietary article of their choice, willingness to buy the product and indication of the preferred price and probable purchase per month etc.

Results & Discussion

For soyflour supplied through this study, the feedback information revealed various aspects of preferences of representative consumers from different socio-economic groups and regions. The Details are as follows:

Background of population

The overall background of people who participated in the study as representative consumers, varied appreciably. Over 80 per cent of the housewives were graduates or post graduates in Urban-1, as against 40 per cent and 10 per cent respectively in Urban-2 and rural area. Around 40 per cent housewives were in the age group of 31-40 years and 25 per cent each in the age group of 20-30 and 40-50 years and the rest above 51 years. People from urban-1 and urban-2 area were economically sound, with more than 90 per cent respondents having a monthly income of more than Rs. 2000 as compared to the rural area where all were having income less than Rs. 2000. Most of the population, (over 80 per cent) from urban areas was engaged in service whereas, more than 60 per cent of the rural population was dependent on agriculture. The family size was mostly restricted to less than five in 77 per cent cases. The background of respondents indicated a typical representation of almost all sections of the Indian society. The awareness of soybean and its nutritive value was found related to the level of education and earlier acquaintance to the crop. Only 30 per cent of the total consumers were aware of the high nutritive value of soybean. The breakup of respondents in various regions with respect to the experience in consuming the soyflour indicates that 42 per cent in rural area as compared to 38 per cent in urban-2 and 20 per cent in urban-1 area had not consumed soyflour earlier.

Response to lipoxygenase free full-fat soyflour

The product supplied as a test sample to respondents from three regions was used in food items defined by themselves. The colour and texture of PPP soyflour sample was liked by the consumers. Flavour and odour were acceptable to 100 per cent consumers from the urban areas and 90 per cent from the rural area. Around 97 per cent of the respondents liked the flavour of the product. A variety of conventional food products viz. pithale, pakora, chapati, poori etc. were prepared by the respondents.

The use of soyflour was found to be convenient in food preparations. It was used for preparation of pithale by 100 per cent rural respondents and over 85 per cent of

the urban. In general 90 per cent of sample population used PPP soyflour for pithale, a product prepared by 100 per cent replacement of Bengal gram flour used conventionally. This reveals very high acceptability and suitability of lipoxygenase-free soyflour for a traditionally consumed popular dietary article – pithale. Another product-pakora-tried by 10 per cent respondents shows some scope. However, it is a snack item and does not form a food article of daily diet. Use of PPP soyflour in supplementation of chapati was tried by 100 per cent consumers from urban-1 area and about 60 per cent of total respondents from all the regions. Around 66 per cent of respondents categorised the PPP soyflour based products as good or very good. Even the remaining 33 per cent found it acceptable. None of the respondents reported any health disorder after consumption of lipoxygenase free soyflour based food. Around 67 per cent of the consumers indicated the desire to purchase the PPP soyflour, if the product, with the same quality standard, is made available in the local market. The indicated monthly requirement was in the range of 0.5 to 1 kg by 63 per cent respondents. Around 83 per cent of consumers were inclined to have the soyflour in the range of 0.5 to 5 kg per month. The response might have been influenced by the cautionary approach, commonly found in the introduction of a new product.

Information gathered was analyzed with respect to the influence of factors, like age group, education and economic condition. The indicated monthly requirement and price level were found to be independent of the above factors. However, awareness of nutritive value was related to the educational status. For popularization of the PPP soyflour among the masses, most of the respondents indicated that though the product is good, the public needs to be made aware of its nutritive value. Also, they opined that availability of the same quality flour – as test sample – should be ensured.

Price analysis

The survey revealed that around 90 per cent respondents were in favour of a Rs. 10/kg price which was comparable to Bengal gram flour. This is mainly because PPP soyflour is likely to replace the Bengal gram flour in food uses. Until the consumers are convinced of its very high nutritive value and consequential cost saving in family nutrition, the product will have to be made available at a price comparable, if not equal, to Bengal gram flour (besan). To achieve this, it is necessary to minimize the product cost on account of transportation of raw material – soybean – to city/urban areas for processing and then again to rural areas for supply/distribution, high cost equipment, and marketing costs. It is advisable to establish processing units in the rural as well as urban areas to fulfill the demands of the local population. This approach will not only minimize the cost of production but will give the poor, who badly need nutritional improvements, a chance to derive the nutritional benefits of soybean at a relatively lower cost.

It is advisable to establish processing units in the rural as well as urban areas to fulfill the demands of the local population.

Estimation of soyflour requirement & unit capacity

On the basis of the present survey, an indication of the potential demand of PPP soyflour can be obtained. A reasonably good potential market forecast is indicated in favour of PPP soyflour. The average monthly requirement of 4 kg (3-5), 2 kg (1- 3), 0.8 kg (0.5-1), and 0.3 kg (< 0.5) was indicated respectively by 3 per cent, 13 per cent, 67 per cent and 7 per cent respondents. Average monthly requirement values of 0.3 to 4 kg indicated by respective percentages of consumers were used to estimate Overall Monthly Requirement (OMR) by a formula as follows:

$$OMR = \frac{\sum_{i=1}^{n} Q_i R_i}{\sum_{i=1}^{n} R_i} \qquad (1)$$

Where,

Q : Quantity of PPP soyflour required per month (kg)

R : Respondents or consumers (per cent)

The monthly requirement worked out to 1.04 kg/family. Considering the average family size of three members, the monthly requirement of 1 kg PPP soyflour/family/month, the protein availability is improved by about 5 grams resulting in meeting 8 per cent of the daily protein requirement. The daily requirement of PPP soyflour was estimated for different locations surveyed (table 1) taking into account the expectancy realization of 25, 50 and 75 per cent. The estimated location based demand delineates the scope and defines the capacity for the establishment of a processing unit for PPP soyflour in urban and rural area. Initially, a rural unit may cater to the needs of a cluster of villages and subsequently, a group of

Table 1: Estimates of daily requirement* of PPP soyflour for locations surveyed

(in 100 kg)

Location	Population (in 1000)	No. of families (in 1000)	Realization level, %			
			25	50	75	100
Urban-1	1000	333	28	56	83	111
Urban-2	400	133	11	22	33	44
Rural	20	7	1	1	2	2

* Figures rounded off to the nearest digit

two or three villages can have one such unit with a capacity of 100 kg PPP soyflour/day (table 1). At urban 1 and 2 locations, PPP soyflour unit to 3 TPD and 1 TPD capacity respectively, can be established considering even 25 per cent realization of response indicated. This would also provide presently nonexistent direct avenue of utilization of soybean as additional human food and employment in urban and rural areas. Increase in awareness of its direct use for food would motivate farmers toward soybean cultivation.

Conclusions

The study revealed that the respondents from the areas surveyed including producers of soybean and the poor people are in favour of use of full-fat soyflour in conventional food products. The cereal preponderant diet of the poor would be enriched qualitatively, as incorporation of soyflour would significantly improve the overall protein quality.

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Feature

Financial Planning Using Goal Programming

Sanjib Chowdhury

The business objective in earlier days was mostly confined to a single goal—profit maximization. Today's business is complex and has to satisfy multiple goals. It is even more challenging for oil and gas exploration/ exploitation industry as investment in exploration is associated with uncertainty. This paper develops a financial planning model using goal programming for oil and gas exploration/exploitation industry.

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Oil and gas exploration/exploitation industry is unique in that it has deterministic input and probabilistic output unlike conventional industries wherein both input and output are deterministic. Oil exploration is a complex process, beginning with prognostication and involving a host of activities such as geological, magnetic, gravitational, and seismic surveys, and culminating in exploratory drilling. Oil exploration is a capital intensive, high risk, and high technology activity. Investment in exploration is associated with uncertainty. It is not known if it will lead to discovery of oil and gas reserves within a stipulated time. Even if discovery is made, the production cannot start immediately as the reserves are to be delineated, and its commercial viability is to be established. Depending on the out-come, the field is developed and production facilities are built before production starts. All these are capital intensive and time consuming activities. Such inherent features associated with this industry make it different from other industries, rendering its financial accounting also being different from conventional accounting.

Goal Programming

The business enterprises of today have to satisfy multiple-objectives, profit maximization, being just one of them besides other financial goals. Linear programming is generally used for optimization of a single objective and is unable to solve non-homogeneous, multi-objective problems. Charnes and Cooper (1961, 1975) introduced the concept of goal programming (GP) which is an extension of linear programming to solve non-homogeneous, multi-objective, conflicting

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goal problems. Ijiri (1965) incorporated the concept of goal ranking and used generalized inverse procedure to solve it. Lee (1972) presented a simplex procedure to solve the GP problem with priority factor. Mao (1969) borrowed the goal ranking scheme from both Ijiri and Lee, and formulated the multi-year profit planning and financial budgeting model.

Kornblutz (1973), Lin (1980), and Zanakis and Gupta (1985) provide excellent and comprehensive bibliographic survey on GP. Kornblutz's survey is primarily concerned with solution procedure. Lin's categorisation is based on the subject matter such as accounting, finance, marketing, manpower planning, operation, management etc. Zanakis and Gupta classify the GP articles according to technique and application area and reveal their characteristics, literature trend and future need. Zeleny (1981) and Alvard (1983) discuss the pros and cons of goal programming.

The ability of GP to handle multi-objective problems and answer 'what-if' questions with relative ease and convenience makes it an attractive decision-making tool. Powerful linear and non-linear GP packages are available now-a-days and may be used to solve a wide variety of GP problems with slight modification.

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Formulation of the Model

The objectives of the present model are:

- To allocate limited financial resources satisfactorily under various heads of oil and gas exploration/exploitation industry.
- To integrate financial parameters with operational activities and also to integrate financial statements, namely, income statement, balance sheet, and fund flow statement.

The notations of decision variables, coefficients/multipliers, deviational variables, and Right Hand Side (RHS) values of goal constraint equations are given in tables 1, 2 and 3, respectively.

Table 1: Notations used for decision variables

Decision variables	Notations
Revenue	x_1
Total cost	x_2
Net worth	x_3
Outside fund (Debt)	x_4
Capital employed	x_5
Operational fund	x_6
Capital acquisition	x_7

Table 2: Notations used and values for coefficients/multipliers

Name of coefficients/multipliers	Notations	Values used for the model
Average interest rate payable on outside fun l	y_1	0.08
Corporate tax rate	y_2	0.5
Fraction of total fund as new borrowing	y_3	0.13
Fraction of outside fund as repayment of loan	y_4	0.074
Fraction of revenue as investment in exploration	y_5	0.1
Fraction of revenue as investment in production	y_6	0.06

Table 3: Notations used for deviational variables and R.H.S. values

Notations used for corresponding deviational variables	Name or Definition	Notations used for corresponding R.H.S. values
d_1^-, d_1^+	Revenue	a_1
d_2^-, d_2^+	Total cost	a_2
d_3^-, d_3^+	Net income	a_3
d_4^-, d_4^+	Net worth	a_4
d_5^-, d_5^+	Outside fund (Debt)	a_5
d_6^-, d_6^+	Capital employed	a_6
d_7^-, d_7^+	Deviation in source and application of total resources	–
d_8^-, d_8^+	Operational fund	a_7
d_9^-, d_9^+	Capital acquisition	a_8
d_{10}^-, d_{10}^+	Deviation in source and application of total fund	-
d_{11}^-, d_{11}^+	Return on investment	a_9
d_{12}^-, d_{12}^+	Return on equity	a_{10}
d_{13}^-, d_{13}^+	Profitability ratio	a_{11}
d_{14}^-, d_{14}^+	Debt equity ratio	a_{12}
d_{15}^-, d_{15}^+	Debt capital ratio	a_{13}
d_{16}^-, d_{16}^+	Interest coverage	a_{14}

Goal Constraints

Income statement

Revenue (x_1)

Oil and Gas revenue is indicative of the production level and the source of finance for exploration and production activities. Overachievement of revenue (d_1^+) is allowed but underachievement (d_1^-) is to be minimised.

$$x_1 + d_1^- - d_1^+ = a_1 \quad (1)$$

Total cost (x_2)

The efficacy of a company is reflected to some extent, on its ability to hold down the total cost. Overachievement of total cost (d_2^+) is to be minimized.

$$x_2 + d_2^- - d_2^+ = a_2 \quad (2)$$

Net income

Revenue less total cost, interest, and corporate tax is the net income. The source of internal resources contributes to the growth of the business.

Net income = Revenue – Total cost – Interest – Corporate tax.

Interest payable is the product of outside fund and the average interest rate on it.

Interest payable $= y_1 * x_4$

Corporate tax is the amount to be paid on account of profit. It is a fraction of the income after interest.

Corporate tax = Corporate tax rate * Income after interest

Corporate tax $= y_2 * (x_1 - x_2 - y_1 x_4)$

Therefore, Net income $= (1 - y_2) * (x_1 - x_2 - y_1 x_4)$

Underachievement of net income (d_3^-) is to be minimised.

$$(1 - y_2)\, x_1 - (1 - y_2)\, x_2 - (1 - y_2)\, y_1 x_4 + d_3^- - d_3^+ = a_3 \quad (3)$$

Balance sheet

Net worth (x_3)

Accumulation of retained earnings over the years plus Government capital is the net worth and is the source of internal resources. Its underachievement (d_4^-) is to be minimized.

$$x_3 + d_4^- - d_4^+ = a_4 \quad (4)$$

Outside fund/debt (x_4)

Debt position shall be kept at an optimum level so that growth, operation and activity do not suffer for lack of resources. At the same time excessive debt is unsafe and may threaten the financial stability and solvency of the company. In order to minimize the overall cost of financing, it is desirable to have an optimum mix between debt and equity. Both overachievement (d_5^+) and underachievement (d_5^-) are to be minimized.

$$x_4 + d_5^- - d_5^+ = a_5 \quad (5)$$

Capital employed (x_5)

Capital employed represents the productive capacity, activity volume, stability and wealth of the company. Its underachievement (d_6^-) is to be minimized.

$$x_5 + d_6^- - d_6^+ = a_6 \quad (6)$$

System constraint

Total resources is the sum of net worth and outside fund. It passively reflects the overall capital or business dimension.

Ideally, the sources and applications of total resources should be equal. In reality, it is difficult to balance these two thereby resulting in either deficit or surplus budgeting. It is the goal of financial planners to achieve zero deviation between the sources and applications of total resources. This is a system

It is the goal of financial planners to achieve zero deviation between the sources and applications of total resources.

constraint and its overachievement and underachievement are to be minimised.

$$x_3 + x_4 - x_5 + d_7^- - d_7^+ = 0 \quad (4)$$

Fund flow

Operational fund (x_6)

It is one of the major sources of fund for exploration and production activities. Paucity of operational fund affects planned activities. Its underachievement (d_8^-) is to be minimized.

$$x_6 + d_8^- - d_8^+ = a_7 \quad (8)$$

Capital acquisition (x_7)

It is essentially a partial investment of current funds in long-term assets. Capital acquisition is closely related to the activity volume and production capacity. Its underachievement (d_9^-) is to be minimized.

$$x_7 + d_9^- - d_9^+ = a_8 \quad (9)$$

Total fund

Total fund is the sum of operational fund and new borrowing. It is disbursed through the expenditure of capital acquisition, investment in production, investment in exploration, interest, corporate tax, and loan repayment.

New borrowing is essential for financing operations and activities. It is advisable to borrow as debt is cheaper than equity because of tax implications. The amount of new borrowing may be expressed as a fraction of total fund.

$$\text{New borrowing} = y_3/(1 - y_3) * x_6$$

A fraction of borrowed loans (which usually matures in an accounting year) is to be repaid towards the repayment of outstanding loans.

$$\text{Repayment of loan} = y_4 * x_4$$

Investment in exploration is the measure of exploration activity. It is aimed at oil and gas reserves discovery. It can be expressed as a percentage of revenue. Inadequate investment in exploration will hinder the exploration activity and reserves accretion.

$$\text{Investment in exploration} = y_5 * x_1$$

Similarly, investment in production is the measure of production capacity and activity. It can be expressed as a fraction of revenue. Inadequate investment in production may adversely affect the production capacity.

$$\text{Investment in production} = y_6 * x_1$$

$$x_6 + y_3/(1 - y_3)\, x_6 - x_7 - y_5 x_1 - y_6 x_1 - y_1 x_4 - y_4 x_4 - y_2 (x_1 - x_2 - y_1 x_4) + d_{10}^- - d_{10}^+ = 0$$

Rearranging,

$$-(y_2 + y_5 + y_6) x_1 + y_2 x_2 - (y_1 - y_1 y_2 + y_4) x_4 + 1/(1 - y_3) * x_6 - x_7 + d_{10}^- - d_{10}^+ = 0 \quad (10)$$

Financial ratios

Return on investment

It is the ratio of net income to capital employed and is a measure of the overall efficiency and performance. Its integrative nature may be appreciated as it can further be split down into profitability ratio and capital turnover ratio.

$$\text{Return on investment} = \frac{\text{Net income}}{\text{capital employed}}$$

$$= \frac{\text{Net income}}{\text{Revenue}} * \frac{\text{Revenue}}{\text{Capital employed}}$$

$$= \text{Profitability ratio} * \text{Capital turn-over ratio}$$

As a result, it is a better indicator and its underachievement (d_{11}^-) is to be minimised.

$$\frac{(1 - y_2) x_1 - (1 - y_2) x_2 - (1 - y_2) y_1 x_4}{x_5} \geq a_9$$

or, $$(1 - y_2) x_1 - (1 - y_2) x_2 - (1 - y_2) y_1 x_4 - a_9 x_5 + d_{11}^- - d_{11}^+ = 0 \quad (11)$$

Return on equity

It is the ratio of net income to net worth. Its underachievement (d_{12}^-) is to be minimized.

$$\frac{(1 - y_2) x_1 - (1 - y_2) x_2 - (1 - y_2) y_1 x_4}{x_3} \geq a_{10}$$

$$(1 - y_2)\,x_1 - (1 - y_2)\,x_2 - a_{10}\,x_3 - (1 - y_2)\,y_1\,x_4 + d_{12}^- - d_{12}^+ = 0 \qquad (12)$$

Profitability ratio

It is the ratio of net income to revenue and indicates the overall profitability after taking into account all expenses and income. Its underachievement (d_{13}^-) is to be minimised.

$$\frac{(1 - y_2)\,x_1 - (1 - y_2)\,x_2 - (1 - y_2)\,y_1\,x_4}{x_1} \geq a_{11}$$

$$(1 - y_2 - a_{11})\,x_1 - (1 - y_2)\,x_2 - (1 - y_2)\,y_1\,x_4 + d_{13}^- - d_{13}^+ = 0 \qquad (13)$$

Debt-equity ratio

Debt-equity ratio measures the ability to meet the long term obligation and is expressed as the ratio of outside fund to net worth. It indicates the credit worthiness. Both its underachievement (d_{14}^-) and overachievement (d_{14}^+) are to be minimised.

$$\frac{x_4}{x_3} \leq a_{12}$$

$$-a_{12}\,x_3 + x_4 + d_{14}^- - d_{14}^+ = 0 \qquad (14)$$

Debt-capital ratio

It deals with long term capitalization and measures the relative importance of long term debt in the capital structure. It is the ratio of outside fund to capital employed. Both its underachievement (d_{15}^-) and overachievement (d_{15}^+) are to be minimised.

$$\frac{x_4}{x_3 + x_4} \leq a_{13}$$

$$-a_{13}\,x_3 + (1 - a_{13})\,x_4 + d_{15}^- - d_{15}^+ = 0 \qquad (15)$$

Interest coverage

It is the measure of industry's ability to meet its interest obligation and is expressed as the ratio of income before interest and tax to interest payable. A high interest coverage indicates less changes of default in interest payment. Its underachievement (d_{16}^-) is to be minimized.

$$\frac{x_4 - x_2}{x_3 + x_4} \leq a_{14}$$

$$x_1 - x_2 - a_{14}\,y_1\,x_4 + d_{16}^- - d_{16}^+ = 0 \qquad (16)$$

Priority Assignment

P1: Return on investment, return on equity, and profitability ratios indicate the health, performance and growth of the company. Since these ratios are of prime importance, they have been assigned maximum priority along with the system constraints.

P2: Exploration activity is aimed at discovery of oil and gas reserves. The level of reserves accretion will determine future exploration and production activities. Production of oil and gas will generate revenue which in turn will finance the operational activities. In order to meet operational targets, sufficient capital acquisition is necessary. Inadequate capital acquisition will lead to shortfall of production targets which in turn will earn less revenue thereby affecting operational fund and severely limiting exploration and production activities. Because of this, capital acquisition has been assigned second priority.

P3: Debt equity and debt capital ratios indicate the composition of the capital structure. They also help in assessing the long term financial policy. The present model primarily aims at short term plan. Therefore, they have been assigned least priority.

Interest coverage tells about the industry's ability to meet its current interest obligation. Since interest payable is within controllable limit and not in the alarming range, interest coverage has been assigned the same priority as that of debt-equity ratio.

Priority assignment is not a one time job. Sensitivity analysis is to be carried out to examine the effect of various combinations of priority structure. Priority structure reflects the current preference and importance of the variables. It changes from time to time depending on the environment and economic necessity. The priorities and the weightages assigned to each of the factors are shown in table 4.

Priority assignment reflects the current preference and importance of the variables. It changes from time to time depending on the environment and economic necessity.

Table 4: Priority assignment

Variable name	Priority	Weightage
Return on investment	p_1	1
Return on equity	p_1	1
Profitability ratio	p_1	1
Capital acquisition	p_2	1
Debt capital	p_3	1
Debt equity	p_3	1
Interest coverage	p_3	1

Objective Function

The objective function of the model comprises deviational variables, namely, return on investment, return on equity, profitability ratio, capital acquisition, and interest coverage whose underachievement are to be minimised. It further contains deviational variables like debt-equity, debt-capital ratios whose underachievement as well as overachievement are to be minimised.

Deviational variables such as return on investment (d_{11}^-) return on equity (d_{12}^-) profitability ratio (d_{13}^-), debt-equity ratio (d_{14}^-, d_{14}^+), debt-capital ratio (d_{15}^-, d_{15}^+) and interest coverage (d_{16}^-) appear in the objective function which in effect, contain within themselves such variables as revenue (d_1^-), cost (d_2^+), net income (d_3^-), net worth (d_4^-), outside fund/debt (d_5^-, d_5^+), capital employed (d_6^-), and operational fund (d_8^-). Therefore, deviational variables d_1^-, d_2^+, d_3^-, d_4^-, d_5^-, d_5^+, d_6^-, and d_8^- are not included in the objective function, as they are represented and taken care of by the deviational variables d_{11}^-, d_{12}^-, d_{13}^-,d_{14}^-, d_{14}^+, d_{15}^-, d_{15}^+, and d_{16}^-.

The formulated model is summarised as follows:

Objective function

$$\text{Min } z = P_1 (d_{11}^- + d_{12}^- + d_{13}^- + d_7^- + d_7^+ + d_{10}^- + d_{10}^+) + P_2 (d_9^-) + P_3 (d_{14}^- + d_{14}^+ + d_{15}^- + d_{15}^+ + d_{16}^-)$$

Goal constraints

1. $x_1 + d_1^- - d_1^+ = a_1$

2. $x_2 + d_2^- - d_2^+ = a_2$

3. $(1 - y_2)\, x_1\, (1 - y_2)\, x_2 - (1 - y_2)\, y_1\, x_4 + d_3^- - d_3^+ = a_3$

4. $x_3 + d_4^- - d_4^+ = a_4$

5. $x_4 + d_5^- - d_5^+ = a_5$

6. $x_5 + d_6^- - d_6^+ = a_6$

7. $x_3 + x_4 - x_5 + d_7^- - d_7^+ = 0$

8. $x_6 + d_8^- - d_8^+ = a_7$

9. $x_7 + d_9^- - d_9 + = a_8$

10. $-(y_2 + y_5 + y_6)\, x_1 + y_2\, x_2 - (y_1 + y_4 - y_1\, y_2)\, x_4 + 1/(1 - y_3) * x_6 - x_7 + d_{10}^- - d_{10}^+ = 0$

11. $(1 - y_2)\, x_1 - (1 - y_2)\, x_2 - (1 - y_2)\, y_1\, x_4 - a_9\, x_5 + d_{11}^- - d_{11}^+ = 0.$

12. $(1 - y_2)\, x_1 - (1 - y_2)\, x_2 - a_{10}\, x_3 - (1 - y_2)\, y_1\, x_4 + d_{12}^- - d_{12}^+ = 0.$

13. $(1 - y_2 - a_{11})\, x_1 - (1 - y_2)\, x_2 - (1 - y_2)\, y_1\, x_4 + d_{13}^- - d_{13}^+ = 0.$

14. $-a_{12}\, x_3 + x_4 + d_{14}^- - d_{14}^+ = 0.$

15. $-a_{13}\, x_3 + (1 - a_{13})\, x_4 + d_{15}^- - d_{15}^+ = 0.$

16. $x_1 - x_2 - a_{11}\, y_1\, x_4 + d_{16}^- - d_{16}^+ = 0.$

Subject to,

$xi, d_j^-, d_j^+ > 0$ For $i = 1, 2, \ldots\ldots\ldots, 7$

$d_j^- * d_j^+ = 0$ and $j = 1, 2, \ldots\ldots\ldots, 16$

The Indian oil and gas industry data was imputed into the model and executed using linear goal programming package developed by Ignizio (1976).

Table 5: Analysis of objectives

Priority	Achievement in			
	Run 1	Run 2	Run 3	Run 4
1	0	0	0	0
2	0.98	1.84	2.03	2.90
3	5.01	3.19	5.29	3.56

Table 6: Comparison of objective fulfilment

Priority	Deviational variables in objective function	Run 1		Run 2		Run 3		Run 4	
		Desired goal value/ estimated output	Goal value/ RHS value	Desired goal value/ estimated output	Goal value/ RHS value	Desired goal value/ estimated output	Goal value/ RHS value	Desired goal value/es- timated output	Goal value/ RHS value
$p1$	Return on investment ($d1\bar{1}$)	0.20	0.20	0.28	0.21	0.27	0.25	0.29	0.21
	Return on equity ($d1\bar{2}$)	0.20	0.20	0.30	0.30	0.29	0.29	0.29	0.24
	Profitability ratio ($d1\bar{3}$)	0.29	0.22	0.36	0.36	0.34	0.34	0.29	0.29
$P2$	Capital acquisition ($d9^-$)	11.30	11.30	7.26	7.26	5.76	5.76	7.38	7.38
$P3$	Debt equity ($d1\bar{4}$, $d1^+4$)	0.40	0.67	0.07	0.26	0.05	0.02	0.00	0.01
	Debt capital ($d1\bar{5}$, $d1^+5$)	0.29	0.39	0.07	0.20	0.05	0.02	0.00	0.01
	Interest coverage ($d1\bar{6}$)	15.50	11.80	94.70	21.70	160.00	190.00	0.00	26.00

Table 7: Variable analysis

Variables	Run 1		Run 2		Run 3		Run 4	
	Desired goal value/ estimated output	Goal value/RHS value	Desired goal value/ estimated output	Goal value/RHS value	Desired goal value/ estimated output	Goal value/RHS value	Desired goal value/ estimated output	Goal value/RHS value
$x1$	42.20	42.35	48.10	41.40	62.75	55.34	90.00	72.35
$x2$	20.48	26.95	17.76	17.76	25.90	20.41	47.00	34.60
$x3$	43.81	33.08	57.65	49.55	74.56	65.86	87.70	87.43
$x4$	17.52	22.10	4.04	13.32	4.14	1.34	0.00	1.24
$x5$	61.33	46.10	61.70	72.03	78.70	77.00	87.70	100.40
$x6$	24.85	24.95	24.27	22.23	27.14	28.69	33.30	29.10
$x7$	11.30	11.30	7.26	7.26	5.76	5.76	7.38	7.38

Results & Discussion

The analyses of results namely, 'objective function analysis' (table 5), 'comparison of objective fulfilment of deviational variables belonging to the objective function' (table 6), 'variable analysis' (table 7), and 'slack analysis' reveal many interesting features. All the runs produce unique solution.

Priority 1 is fully achieved for all the runs. Priority 2 is almost achieved in runs 1 and 3, but not fully achieved in runs 2 and 4. Priority 3 is partly achieved for all the runs (table 5).

There is no variation between the desired goal and input value for deviational variables of capital acquisition, and profitability ratio (except a slight variation in run 1). The variation between the estimated output and the right hand side values for deviational variables of return on investment is not significant and its goal is satisfactorily achieved. The variation between the aforesaid values for the deviational variables of the least priority group, namely, debt-equity, debt-government capital, and interest coverage are significant. They draw less attention, because of the least priority assigned to them (table 6).

The decision variables values obtained from computer runs 1, 2, 3 and 4 are compared with the corresponding input or RHS values for each run in table 7. No significant variation is observed and most of the variables satisfactorily fulfil the goals. The slack variable

indicates unutilised resources or additional resource requirement.

The goals in the present model are interlinked and compatible. A change in any goal value say, a change in revenue or cost will affect other goals like profitability, return on capital and so on. A GP model may have incompatible and multiple goals. But goals within a ranking must be commensurable and not across rankings. The present model vindicates this aspect.

Conclusion

The present GP model facilitates decision-making process to fulfil activity targets like, oil and gas discovery, production and related activities by allocating limited financial resources satisfactorily under various heads like capital acquisition, investment in exploration, investment in production, operational funds and others. Furthers modification and refinement of the model can be undertaken by changing the objectives, variables, priorities and resource availability.

GP like other quantitative tools does not represent perfect reality. Its solution should be interpreted in the perspective of the model and should be supplemented with intuition, judgement, and experience.

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Feature

Employment Generation from Animal Husbandry among Tribal Women

Nita Khandekar & O.N. Kunzru

The study conducted in villages of Madhya Pradesh, covering 225 tribal women revealed that, generation of employment in animal husbandry (AH) was higher in roadside villages as compared to the villages situated in the interior and deep interior. Involvement in number of activities in AH was lower among respondents having large livestock holding. The duration of employment, involvement in number of AH activities and overall employment in AH were higher among respondents having high and medium communication behaviour scores. The study revealed that higher the extension contact, mass media exposure, urban contact, productivity of milch animals, level of aspiration and more favourable the attitudes towards productivity, income generation, employment generation, livestock rearing as an economic enterprise, more was the employment of tribal women in AH. Attitude towards minor forest produce as an economic enterprise was found to be negatively correlated to the employment of tribal women in AH.

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According to the National Commission on Agriculture (1976), next to the cultivation of crops, animal husbandry programmes have the largest employment potential. The most important feature of these programmes is that they provide subsidiary occupation, offer gainful employment at the location and make better domestic utilization of female and child labour. Employment generation, for this study, was operationalized as the level of employment of the tribal women as wage earners or non-wage earners in livestock enterprises. The employment score was calculated on three parameters viz. place of employment, duration of employment and number of animal husbandry activities involved in.

Methodology

The study was conducted in Madhya Pradesh, in 8 randomly selected villages of Tamia block and 7 villages of Pipariya block of Chhindwara and Hoshangabad districts, respectively. These villages were categorized into three groups according to their distance from the roadside. The villages located within 1 Km. from the roadside were classified as roadside (RSD) villages, between 1 to 6 Kms. from roadside as interior (INT) villages and at a distance of more than 6 Kms. from the roadside as deep interior (DIN) villages.

Results & Discussion

Table 1 presents the details of respondents involved in animal husbandry. It is evident that majority of the respondents (70.66%) in RSD villages were employed in AH at three or more places, followed by 18.67 per cent at two places and 10.67 per cent at one place only. In the INT villages, majority (43.33%) were employed at two places, 30.00 per cent were employed at one place and 26.67 per cent at three or more places in AH, whereas, in DIN villages, nearly all the respondents (93.33%) were employed at one

Table 1: Distribution of respondents in different location of villages according to employment generation in Animal Husbandry enterprises

N = 225

Location of villages	Employment in AH enterprise											
	No of Working Places			Duration*			Involvement**			Overall		
	1	2	3 & above	Low <60	Medium 60-225	High >225	Low <9	Medium 9-16	High >16	Low <5	Medium 5-8	High >8
Roadside	8	14	53	3	37	35	2	30	43	0	59	16
(n = 75)	(10.67)	(18.67)	(70.66)	(4.00)	(49.33)	(46.67)	(2.67)	(40.00)	(57.33)		(78.67)	(21.33)
Interior	18	26	16	0	55	5	0	53	7	0	59	1
(n = 60)	(30.00)	(43.33)	(26.67)		(91.67)	(8.33)		(88.33)	(11.67)		(98.33)	(1.67)
Deep Interior	84	6	0	49	39	2	56	32	2	56	34	0
(n = 90)	(93.33)	(6.67)		(54.45)	(43.33)	(2.22)	(62.22)	(35.56)	(2.22)	(62.22)	(37.78)	

* In minutes per day

** Number of dairying activities

Figures in parentheses indicate percentages.

place and only 6.67 per cent were employed at two places.

In the RSD and INT villages, majority of the respondents (49.33 and 91.67, respectively) were engaged in animal husbandry activities for a duration of 60 to 225 minutes per day and 46.67 per cent and 8.33 per cent, respectively, for a duration of more than 225 minutes per day. In the DIN villages, majority of the respondents (54.45%) were engaged for upto 60 minutes in animal husbandry activities and 43.33% for 60-225 minutes. Verma (1984), Kaur (1987) and Jayachandra (1990) had also reported similar findings.

As regards the number of activities it was found that 57.33 per cent respondents in RSD, 11.67 per cent in INT and 2.22 per cent in DIN villages were involved in more than 16 activities related to animal husbandry enterprise. It was further revealed that 40 per cent respondents in RSD, 88.33 per cent of INT and 35.56 per cent of DIN villages were engaged in 9 to 16 animal husbandry related activities. Only 2.67 per cent of RSD, but a majority of respondents (62.22%) of DIN villages were engaged in less than 9 animal husbandry relate activities.

Table 1 further reveals that animal husbandry generated medium level of employment for majority of the respondents of RSD (78.67%) and INT (98.35%) villages whereas in the DIN villages animal husbandry generated employment at low level for majority of the respondents (62.22%).

The Duncan's Multiple Range Test (DMRT) was employed to find out exactly where the differences lay for the characteristics which were found to be statistically significant.

Location of villages

Table 2 revealed that the number of places of employment in AH was significantly higher among respondents of RSD villages than the respondents of the INT and DIN villages. Significant difference was also found between the INT and DIN villages.

Table 2: Difference between least square means of employment generation in Animal Husbandry according to location of villages

Dependent	Location of villages		
	Roadside	Interior	Deep interior
No. of Working Places	2.60^a	2.14^b	1.11^c
	±0.13	±0.12	±0.12
Duration	2.26^a	2.01^a	1.59^b
	±0.10	±0.09	±0.08
Involvement (No. of activities)	2.22^a	1.90^a	1.50^b
	±0.01	±0.08	±0.07
Overall	7.34^a	5.87^b	3.99^c
	±0.23	±0.20	±0.18

Means, across the row, bearing different superscripts are significantly different.

The duration of employment and involvement in number of activities were significantly higher among the tribal women in RSD and INT villages than the respon-

dents of DIN villages. However, no significant difference was observed between the RSD and INT villages. The overall employment in AH was significantly higher among respondents of RSD villages from the INT and DIN villages. Overall employment in INT villages was also higher than in DIN villages.

Livestock holding

Table 3 indicates that the number of activities in AH was significantly higher among respondents having small and medium livestock holding than large livestock holdings. No significant difference was, however, found between the respondents of small and medium livestock holding. This difference could probably be because as the number of livestocks increased, the proportionate share of the number of activities in which the tribal women were engaged in, decreased.

Table 3: Difference between least square means of employment generation in Animal Husbandry according to livestock holding

Dependent variable	Livestock holding		
	Small	Medium	Large
Involvement in number of activities in AH	2.05^{a} ±0.07	1.91^{a} ±0.04	1.78^{b} ±0.09

Means, across the row, bearing different superscripts are significantly different.

Table 4: Difference between least square means of employment generation in Animal Husbandry according to communication behaviour

Dependent variables	Communication behaviour		
	Low	Medium	High
Duration	1.69^{b}	2.03^{a}	2.14^{a}
	±0.10	±0.06	±0.12
Involvement	1.62^{b}	1.99^{a}	2.01^{a}
	±0.09	±0.05	±0.11
Overall	5.25^{b}	5.98^{a}	5.96^{a}
	±0.23	±0.13	±0.27

Means, across the row, bearing different superscripts are significantly different.

Communication behaviour

A perusal of Table 4 shows that the duration of employment, involvement in number of activities and overall employment in AH were statistically higher among respondents having high and medium communication behaviour scores, than those having low score. There was no significant difference between respondents of high and medium communication behaviour score.

Attitude towards productivity

As seen in Table 5 the number of places of employment was significantly different among respondents having low and medium levels of attitude scores than the respondents having high level of attitude scores towards productivity. Respondents with low and medium scores of productivity attitude were probably employed in AH at more places than those having high score of productivity, attitude. No significant difference was observed between respondents having low and medium attitude towards productivity.

It can be further seen that the duration of employment, involvement in number of activities and overall employment in AH were significantly higher among respondents having highly favourable attitude toward productivity than those who had medium and low scores. There was a significant difference in these parameters among respondents having medium and low levels of attitude scores towards productivity, also.

Table 5: Difference between least square means of employment generation in Animal Husbandry according to the attitude toward productivity

Dependent variables	Attitude toward productivity		
	Low	Medium	High
Place	2.05	2.00^{a}	1.58^{b}
	±0.15	±0.06	±0.14
Duration	1.57^{c}	1.93^{b}	2.46^{a}
	±0.10	±0.04	±0.09
Involvement	1.48^{c}	1.87^{b}	2.34^{a}
	±0.09	±0.04	±0.09
Overall	5.09^{c}	5.80^{b}	6.38^{a}
	±0.23	±0.10	±0.23

Means, across the row, bearing different superscripts are significantly different.

Therefore, it can be concluded that the tribal women who had more favourable attitude towards productivity worked mostly at home for a longer duration and were involved in larger number of activities and thus had a higher overall employment score in AH and those who did not have a favourable attitude toward productivity were engaged in animal husbandry activities at places outside home.

The tribal women who had more favourable attitude towards productivity worked mostly at home for a longer duration and were involved in larger number of activities and thus had a higher overall employment score in AH.

Attitude towards income generation

As observed from table 6, only the involvement in number of activities in AH differed significantly according to the attitude towards income generation. Respondents with highly favourable attitude towards income generation were more involved in activities in AH than those having medium and low attitude scores. No significant difference was, however, observed between respondents having low and medium attitude scores towards income generation.

Table 6: Difference between least square means of employment generation in Animal Husbandry according to the attitude towards income generation.

Dependent variable	Attitude towards income generation		
	Low	Medium	High
Involvement	1.86^{b}	1.90^{b}	2.15^{a}
	±0.07	±0.04	±0.09

Means, across the row, bearing different superscripts are significantly different.

Zero Order Correlation Analysis

As shown in table 7 the more the extension contact, mass media exposure, urban contact, the more the number of places of employment of the tribal women in animal husbandry enterprise. The reason for this could be that as contact with other people and information sources increased, the tribal women were motivated to avail the opportunities to step out of their home and be employed at more places. This is not in consonance with the findings of Tripathi (1991) probably due to the fact that a broader classification of employment outside home was included by the researcher in the present study. Moreover, the tribal women enjoy a greater freedom than their rural counterparts because of the socio-cultural differences between the tribal and non-tribal social systems.

It can also be seen that the higher the productivity of milch animals, the more the places of employment of tribal women in AH enterprise. This could be because the menfolk usually go to far off places in search of work and it is left to the women to deal and cope with the tasks related to AH, both at home and outside.

Table 7: Correlation analysis between Independent variables and employment generation

N = 225

	Independent variables	Employment in Animal Husbandry			
		Place (r)	Duration (r)	Involvement (r)	Overall (r)
X_1	Family size	0.01	0.02	0.04	0.04
X_2	Livestock holding	0.05	–0.02	–0.03	–0.02
X_3	Communication behaviour	0.69**	0.75**	0.76**	0.75**
	Extension contact	0.54**	0.64**	0.65**	0.64**
	Mass media exposure	0.72**	0.70**	0.71**	0.70**
	Urban contact	0.65**	0.71**	0.72**	0.71**
X_4	Productivity of milch animals	0.41**	0.44**	0.45**	0.44**
X_5	Level of aspiration	0.37**	0.49**	0.49**	0.49**
X_6	Attitude towards productivity	0.65**	0.78**	0.79**	0.78**
X_7	Attitude towards income generation	0.30**	0.51**	0.51**	0.51**
X_8	Attitude towards employment generation	0.35**	0.35**	0.35**	0.35**
X_9	Attitude towards livestock rearing as an economic enterprise	0.39**	0.51**	0.32**	0.51**
X_{10}	Attitude towards minor forest produce as an economic enterprise	–0.27**	–0.36**	–0.38**	–0.37**

** $P < 0.01$

It was further indicated that as the aspirations of betterment increased in the tribal women, the number of places where they worked in AH tasks also increased.

The psychological variables i.e. attitude towards productivity, attitude towards income generation and employment generation and perception of livestock rearing as an economic enterprise were all found to have a positive and highly significant correlation ($P < 0.01$) with the place of employment. Increase in favourable attitude toward the studied psychological attributes led to an increase in the number of places of employment of tribal women in AH enterprise.

Attitude towards Minor Forest Produce (MFP) as an economic enterprise alone had a negative and highly significant ($P < 0.01$) relationship with place of employment indicating that the higher the favourable attitude towards MFP as an economic enterprise, the less the number of places of employment in AH. The reason for this could be that because of favourable attitude towards MFP the women devoted more time to MFP and less time was available to pursue any other activity.

The place of employment in AH was not found to be correlated with either family size or livestock holding.

Duration

The results in table 7 indicates that higher communication exposure resulted in a longer duration of employment in AH. This may be due to the reason that the respondents who had more extension contact, mass media exposure and urban contact had more information and knowledge about AH activities and practices resulting in higher employment in AH enterprises and for a longer duration of time.

The productivity of milch animals and the level of aspiration were also found to be correlated with the duration of employment in AH activities. It is obvious that the respondents whose animals achieved a higher level of productivity, had devoted and were devoting more time to their health and production tasks to achieve and sustain higher productivity. It also showed that tribal women who had higher level of aspiration worked for a longer duration of time to achieve better performance and higher productivity levels from their dairy animals.

It was further indicated that the attitude toward productivity, income generation and employment generation and attitude toward livestock rearing as an economic enterprise were positively and highly significantly correlated to the duration of employment in AH enterprises. The more favourable the attitude towards the studied psychological attributes, the more time the tribal women devoted to AH activities, so as to have higher productivity and income from their dairy animals.

The attitude toward Minor Forest Produce (MFP) as an economic enterprise was negatively correlated with the duration of employment of tribal women in AH enterprises. This showed that the tribal women who thought that MFP was, per unit of time given as input, a more economical enterprise, devoted less time in AH enterprise and obviously more time to MFP activities.

The family size and livestock holding did not have a significant relationship with duration of employment. This indicated that family size and livestock holding had no relationship with the duration of employment of the tribal women in AH enterprises. This finding is in consonance with the findings of Tripathi (1991).

Involvement

Table 7 indicates that the extension contact, mass media exposure, urban contact and communication behaviour, had a positive relationship with the involvement of tribal women in the number of activities in AH. The more information the tribal woman gets from various sources, the more number of her activities related to AH enterprise.

The productivity of milch animals and the level of aspiration were also positively correlated to the number of AH activities. The more the productivity of milch animals, the higher the number of activities; the higher the level of aspiration of tribal women, the more they worked towards achieving it by participating in more number of activities in AH enterprise.

It was seen that all the psychological variables related to the attitude, except attitude toward MFP as an economic enterprise, were positively related, while the latter was found to have a negative correlation with the number of AH activities. The findings indicate that the tribal women, who had a favourable attitude towards productivity, income generation, employment generation and livestock rearing as an economic enterprise were more involved in AH activities.

Table 7 further reveals that the family size and livestock holding were not correlated with the involvement of tribal women in number of AH activities.

Overall employment

It can be clearly seen from Table 7 that all the communication variables viz. extension contact, mass media exposure, urban contact and communication behaviour, productivity of milch animals, level of aspiration, the attitude towards productivity, attitude towards income generation, attitude towards employment generation and attitude towards livestock rearing as an economic enterprise had a positive relationship with the overall employment in AH enterprise. Tripathi and Kunzru (1993) had also reported high and positive correlation between productivity of dairy animals and employment status of rural women indicating thereby that higher the productivity of milk, higher will be the employment generation for rural women and vice-versa.

Only attitude towards MFP as an economic enterprise was found to have a negative correlation with the overall employment in AH enterprise. The family size and livestock holding had no relationship with the overall employment.

Thus, it is clear that the higher the communication level of rural women, productivity of dairy animals, aspiration level and favourable attitude of tribal women towards productivity, income, employment generation and livestock rearing as an economic enterprise, higher will be the overall employment of tribal women in AH enterprise.

Direct & Indirect Effects of Selected Independent Variables on Employment Generation

The relationship between the independent and dependent variables was found to be partially absolute and partially relative as indicated by the correlation co-efficient (r). A portion of observed relationship, is the contribution made by the other independent variables through which the independent variables exercise their influence jointly. It was, therefore, considered necessary to compute the extent of direct and indirect influence of independent variables on the dependent variables. The path analysis technique was used to generate the data for the relationship. According to Li (1955) path co-efficient is the absolute number without any physical unit, whatever the actual units of measurement for the variables. It also shows direction.

Place

Multivariate path analysis with the place of employment of tribal women as dependent variables and eight independent variables, was carried out and the results obtained are shown in Table 8.

The ranking of direct effects (Fig. 1) revealed that the highest negative effect was exercised by communication behaviour (X_3) of the respondents, followed by extension contact (X_{3a}) and attitude toward productivity (X_6).

The maximum total indirect effect was also exercised by communication behaviour, though on second and third places according to ranking were the total indirect effects exercised by the level of aspiration and the productivity of dairy animals (Table 8, Fig. 1).

Table 8 further reveals that the largest indirect effect on the place of employment of all the variable was through the communication behaviour (X_3), which in turn had its largest indirect effect through the extension contact (X_{3a}). The effect of extension contact also was the cause of the high correlation of communication with the place of employment as the communication behaviour was found to have a negative direct effect.

Duration

Table 9 shows that the maximum direct and positive effects were exercised by mass media exposure (X_{3b}), urban contact (X_{3c}) and attitude toward income generation (X_7) in that order, on the duration of employment of the tribal women in AH. (Fig. 2).

The rankings of the variable with respect to direct effects and total indirect effects, were not the same. The communication behaviour (X_3) followed by attitude towards employment (X_8) and the level of aspiration (X_5) of the respondents occupied first, second and third ranks, respectively, in total indirect effects.

Table 9 further shows that all the independent variables had largest indirect and positive effect through mass media exposure (X_{3b}).

Involvement

A perusal of table 10 reveals that the highest positive direct effect was exercised through mass media exposure (X_{3b}) followed by urban contact (X_{3c}) and extension contact (X_{3a}) on the involvement in the number of activities in AH.

Table 10 and Fig. 3 indicate that the ranks of the variables with respect to the direct effects and total indirect effects were not exactly the same. The maximum total indirect effect on the involvement in number of AH activities of the tribal women was found to be exercised by the communication behaviour (X_3) and level of aspiration (X_5). Extension contact (X_{3a}) occupied the third position in case of the total indirect effect also.

Table 8: Direct and indirect effect of independent variables on place of employment in Animal Husbandry

N = 225

Variable No.	Exogenous variables	Direct effect		Total indirect effect		Largest indirect effect through single variable	
		Effect	Rank	Effect	Rank	Effect	Variable No.
X3a	Extension contact	0.4655	II	0.0291	VIII	–0.6381	X_3
X3b	Mass media exposure	0.2388	IV	0.2026	V	–0.6813	X_3
X3c	Urban contact	0.2335	V	0.1871	VI	–0.7140	X_3
X3	Communication behaviour	–0.7446	I	1.2257	I	0.3980	X_{3a}
X4	Productivity of dairy animals	0.0780	VII	0.2604	III	–0.4057	X_3
X5	Level of aspiration	–0.0392	VIII	0.4274	II	–0.4975	X_3
X6	Attitude towards productivity	0.3347	III	0.1712	VII	–0.6505	X_3
X8	Attitude towards employment generation	0.1560	VI	0.2470	IV	–0.3604	X_3

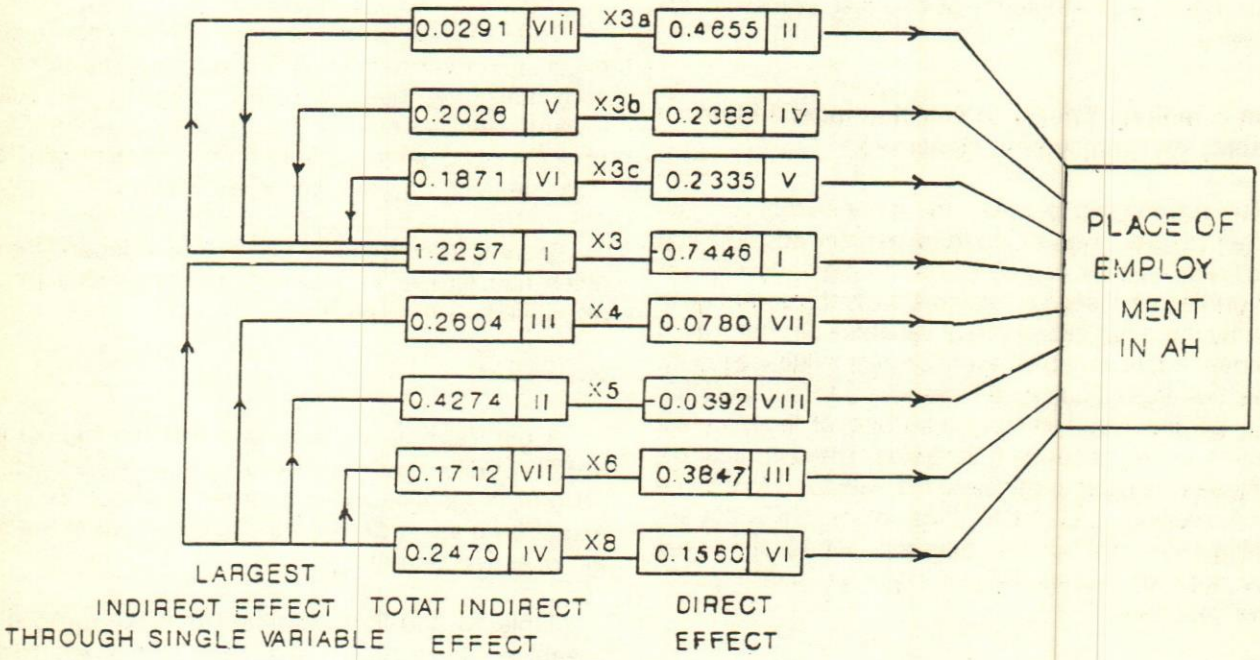

Fig. 1. Direct and indirect effect of independent variables on place of employment in Animal Husbandry

Table 9: Direct and indirect effect of independent variables on duration of employment in Animal Husbandry

N = 225

Variable No.	Exogenous variables	Direct effect		Total indirect effect		Largest indirect effect through single variable	
		Effect	Rank	Effect	Rank	Effect	Variable No.
X3a	Extension contact	0.1820	IV	0.4606	IV	0.2465	X_{3b}
X3b	Mass media exposure	0.3436	I	0.3586	VII	0.2465	X_3
X3c	Urban contact	0.2713	II	0.4360	V	0.2840	X_{3b}
X3	Communication behaviour	–0.0364	VI	0.7838	I	0.3144	X_{3b}
X4	Productivity of dairy animals	0.0352	VII	0.4061	VI	0.1705	X_{3b}
X5	Level of aspiration	–0.0924	V	0.5808	III	0.2085	X_{3b}
X6	Attitude towards income generation	0.1845	III	0.3230	VIII	0.1453	X_{3b}
X7	Attitude towards employment generation	–0.0051	VIII	0.7183	II	0.1512	X_{3b}

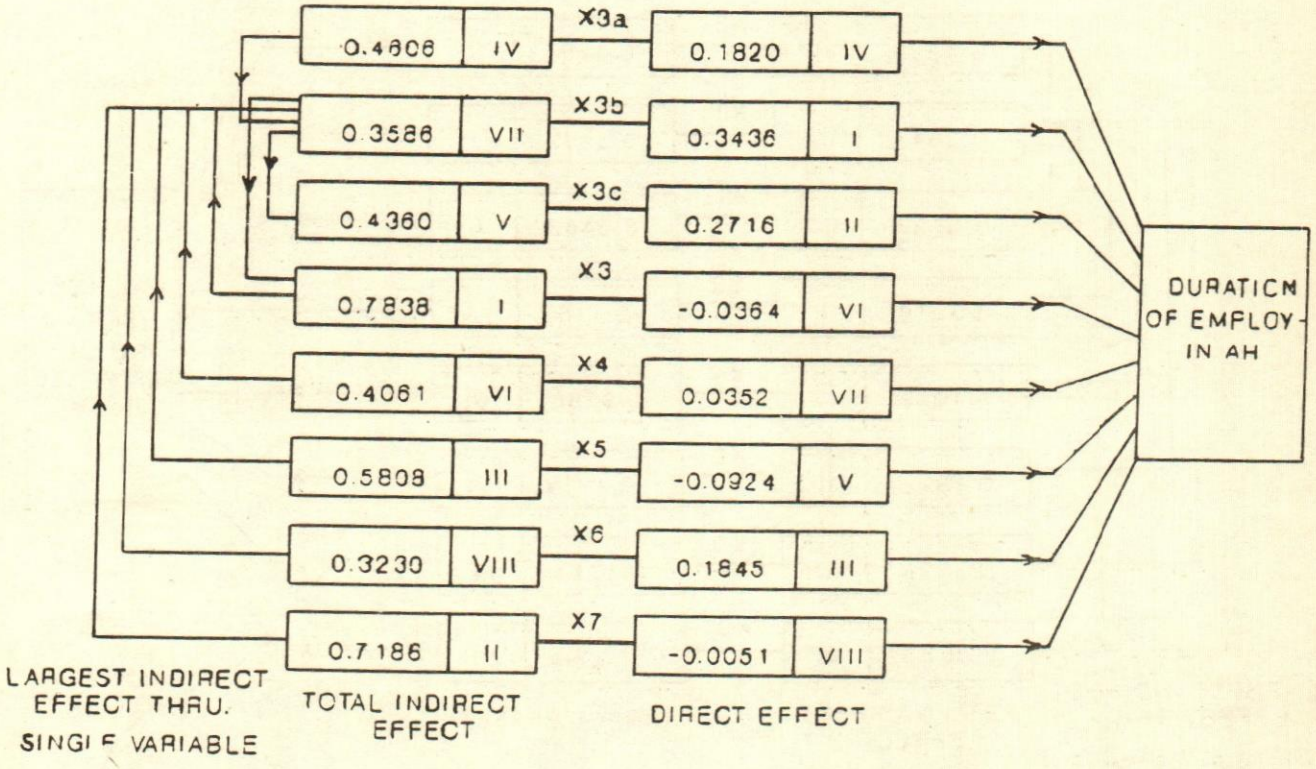

Fig. 2. Direct and Indirect effect of independent variables on duration of employment in Animal Husbandry

Table 10: Direct and indirect effect of independent variables on involvement in number of activities in Animal Husbandry

N = 225

Variable No.	Exogenous variables	Direct effect		Total indirect effect		Largest indirect effect through single variable	
		Effect	Rank	Effect	Rank	Effect	Variable No.
X_{3a}	Extension contact	0.2168	III	0.4335	III	0.2721	X_{3b}
X_{3b}	Mass media exposure	0.3792	I	0.3342	VII	0.2861	X_{3c}
X_{3c}	Urban contact	0.3462	II	0.3738	V	0.3134	X_{3b}
X_3	Communication behaviour	–0.1483	V	0.9076	I	0.3470	X_{3b}
X_4	Productivity of dairy animals	0.0388	VII	0.4098	IV	0.1881	X_{3b}
X_5	Level of aspiration	–0.1004	VI	0.5899	II	0.2301	X_{3b}
X_7	Attitude towards income generation	0.1751	IV	0.3309	VIII	0.1754	X_{3b}
X_8	Attitude towards employment generation	–0.0094	VIII	0.3633	VI	0.1668	X_{3b}

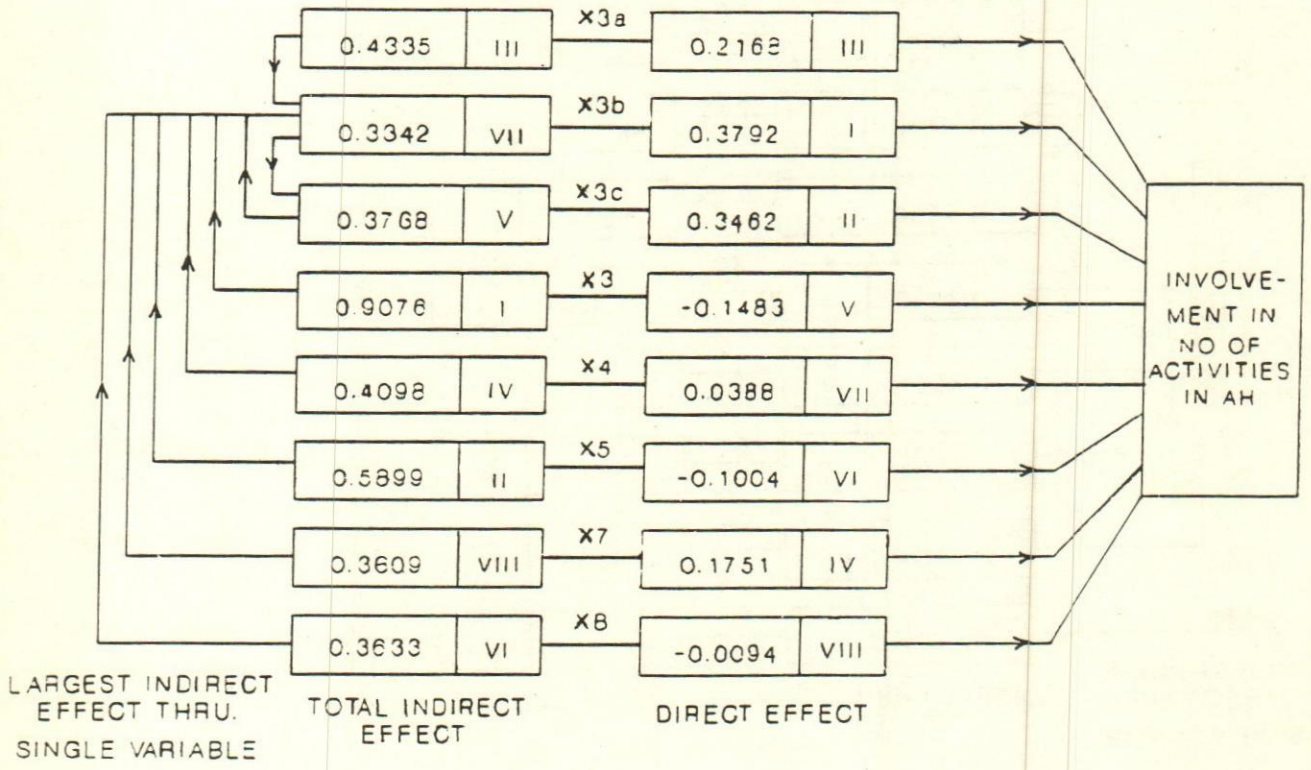

Fig. 3. Direct and indirect effect of independent variables on involvement in number of activities in Animal Husbandry

Table 11: Direct and indirect effect of independent variables on overall employment in Animal Husbandry

N = 225

Variable No.	Exogenous variables	Direct effect		Total indirect effect		Largest indirect effect through single variable	
		Effect	Rank	Effect	Rank	Effect	Variable No.
X_{3a}	Extension contact	0.2341	III	0.4091	III	0.2549	X_{3c}
X_{3b}	Mass media exposure	0.3195	II	0.3838	V	0.2915	X_{3c}
X_{3c}	Urban contact	0.3527	I	0.3782	VI	0.2641	X_{3b}
X_3	Communication behaviour	–0.0802	IV	0.8286	I	0.3383	X_{3b}
X_4	Productivity of dairy animals	0.0517	V	0.3902	IV	0.1802	X_{3b}
X_5	Level of inspiration	–0.0367	VI	0.6323	II	0.2055	X_{3b}
X_8	Attitude towards employment generation	–0.0130	VII	0.3663	VII	0.1523	X_{3b}

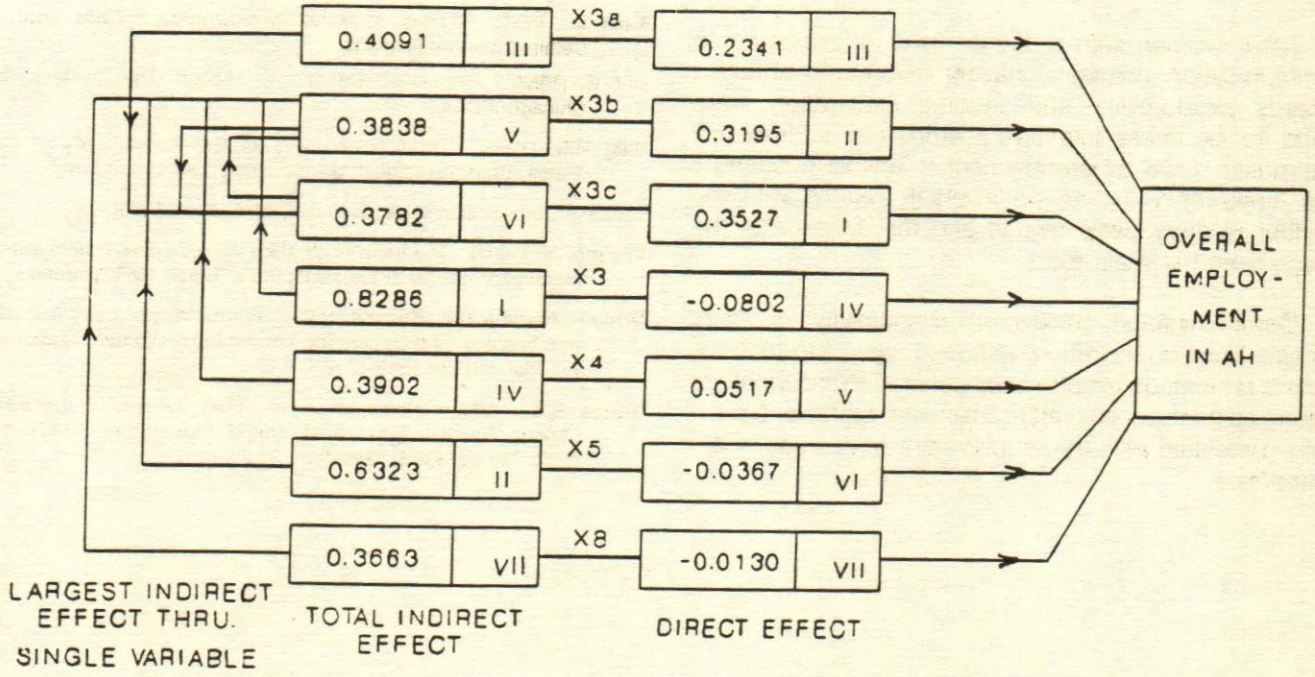

Fig. 4. Direct and indirect effect of independent variables on overall employment in Animal Husbandry

Table 10 further points out that six independent variables had largest indirect effect on the involvement of tribal women in number of activities in AH through mass media exposure. The mass media exposure and the attitude toward income generation had their largest indirect effect through urban contact.

Overall

The data in table 11 indicate that the highest direct effect of the independent variables on the overall employment in AH was exercised by urban contact (X_{3c}) followed by mass media exposure (X_{3b}) and extension contact (X_{3a}), of the tribal women.

It was seen that the ranks in case of direct and total indirect effects were not the same. The communication behaviour (X_3) had the largest indirect effect and was ranked first, level of aspiration (X_5) was second and extension contact (X_{3a}) third with respect to total indirect effect on the overall employment in AH (table 11, Fig. 4).

It can also be seen that five out of seven independent variables had their largest indirect effect through mass media exposure (X_{3b}), while mass media exposure (X_{3b}) itself and extension contact ((X_{3a}) had the largest indirect effect through urban contact (X_{3c}).

Conclusions & Implications

Tribal women with a higher level of exposure to communication channels, having favourable attitudes towards productivity and income generation were found to be more intensively employed in livestock enterprises. Level of employment in animal husbandry was, however, found to be inversely related with the number of dairy cattle owned and the distance of the village from the main road.

Communication behaviour, productivity of dairy animals, level of aspiration, attitude toward productivity, income generation, employment generation and livestock rearing as an economic enterprise were highly and positively correlated with the employment generation in AH enterprises.

Introduction of scientific livestock farming and available technologies needs to be made through organised educational and extension programmes, simultaneously providing the essential services, training and other inputs in order to introduce and initiate a sustainable change.

Animal husbandry enterprises have been recognised as a source of livelihood for the landless and of additional income for the rural poor. Since this component plays a significant role in the economy tribal population it is necessary that their animals are productive so that the income and nutritional level of the family may be augmented through increased availability of milk and other products. In order to make any headway in this tradition-bound, oppressed population, introduction of scientific livestock farming and available technologies needs to be made through organised educational and extension programmes, simultaneously providing the essential services, training and other inputs in order to introduce and initiate a sustainable change.

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Comparative Labour Productivity Levels in APO Member Countries: 1985-1994

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For more than a decade the Asian Productivity Organisation (APO) has been compiling the comparative information on labour productivity levels of its member countries so as to equip their respective policy makers to make evaluations and comparisons at regional and sectoral levels. The data is published in the APO Publication, 'Productivity Statistics: Productivity Indexes and Levels in APO Member Countries' issued annually, the latest being in 1996. For purpose of calculation the data, the Gross Domestic Product (GDP) and Employment, (employed persons by major economic activities) for most of the countries have been drawn by the APO from the 'Key Indicators of Developing Member Countries 1995' of the Asian Development Bank. (ADB). For some countries the data have been drawn from sources listed in table 1.

Labour productivity has been measured here as a ratio between output and input. In the National context, output is given by the Gross Domestic Products (GDP) of the country, whereas the input is measured by the total number of persons employed or engaged. The sectoral levels of GDP have been used as output measures in the case of the respective sectors. All output measurements have been in terms of current US dollars and 1985 constant US dollars. Member countries covered in the compilation are Republic of China. Fiji, Hong Kong, India, Indonesia, Japan, Republic of Korea, Malaysia, Mongolia, Pakistan, Philippines, Singapore, Sri Lanka, Thailand. The countries excluded due to incomplete information in this exercise are Bangladesh, Islamic Republic of Iran, Nepal and Socialist Republic of Vietnam.

In the case of India we have discarded the APO calculations because of the use of employment in organised sectors as denominators, against the sectoral GDP figures as numerators. Therefore, we have recalculated labour productivity levels both in current US dollars and in 1985 US dollars by incorporating the latest GDP data (NAS, 1996) and estimated employment based on census data for 1981 and 1991. Details of sectoral employment estimation are given in an earlier study carried out by the NPC Research Division. (Productivity Vol. 37. No. 1. 1996). The comparative labour productivity levels both in current US dollars and in 1985 constant US dollars are given in tables 2 and 3.

Compiled by
V. Anil Kumar

Table 1: Source of the respective countries data

Source of data	Country
Monthly Bulletin of Manpower Statistics Taiwan Area, Republic of China, March 1996.	China
Estimates of Gross Domestic Product 1996, Census and Statistics Dept., Hong Kong Govt.	Hong Kong
Annual Report on National Accounts, 1996, Economic Planning Agency, Govt., of Japan for GDP and Annual Report on National Accounts, 1992, 1994 and 1996, Economic Planning Agency, Govt., of Japan for employment, and Exchange rates form International Financial Statistics Yearbook, 1995 IMF.	Japan
Korea Productivity Centre, Republic of Korea.	Korea
National Productivity Corporation, Malaysia, Economic Planning Unit, Malaysia.	Malaysia
State Statistical Office of Mongolia.	Mongolia
Central Bureau of Statistics, HMG/N, 1994, Nepal.	Nepal
Department of Statistics, Ministry of Labour. Singapore, Ministry of Labour.	Singapore

Table 2: Labour productivity levels in Asian Countries, in 1985 constant US dollars

Gross Domestic Product (GDP)

Countries/Years	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Rep. of China	8357.5	8962.4	9470.3	10393.9	11043.8	11604.4	12250.3	12786.3	13418.4	13982.1
Fiji	12588.1	13808.4	13199.6	13605.2	13495.9	13845.7	13537.1	13830.8	13795.2	14361.3
Hong Kong	12828.9	13958.1	15522.1	16623.3	16911.2	17700.0	18030.6	19123.1	19415.9	20037.6
India	693.3	736.7	761.6	736.4	635.1	616.2	414.1	353.7	284.6	301.3
Indonesia	1398.3	1353.1	1378.1	1415.3	1502.0	1508.6	1631.0	1702.1	1809.8	1925.6
Japan	22916.7	23245.6	24171.6	25232.1	26619.3	27568.9	28079.6	28097.2	27857.0	28035.1
Korea	6301.1	6786.2	7175.0	7740.1	7909.8	8388.1	8920.5	9198.4	9546.2	10095.4
Malaysia	5547.7	5529.0	5654.6	5876.7	6182.9	6483.9	6831.9	7151.8	7434.4	7884.8
Mongolia	4037.5	4307.8	4297.4	4041.9	4096.8	3893.3	3476.2	3108.9	3144.3	3272.4
Pakistan	975.1	1084.3	1030.6	1086.1	1101.9	1119.9	1221.6	1264.0	1249.9	1260.1
Philippines	1552.2	1543.3	1594.3	1646.5	1720.4	1719.0	1675.7	1615.4	1614.5	1635.2
Singapore	15326.1	15767.7	16534.5	17719.0	18804.2	17778.8	18275.7	18728.6	20424.6	21705.7
Sri Lanka	1131.7	–	–	–	–	1602.7	1636.0	1683.2	1775.6	–
Thailand	1504.7	1542.7	1634.0	1740.0	1866.7	2068.1	2220.7	2229.8	2510.9	–

'–' data not available.

Agriculture

Countries/Years	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Rep. of China	2768.7	2725.0	3099.4	3449.3	3583.0	3663.3	3629.9	3617.0	4040.7	3991.4
India	341.8	347.1	345.0	329.8	294.4	277.1	188.1	165.3	130.4	138.3
Indonesia	593.7	552.4	548.6	549.4	557.6	554.1	554.5	576.0	616.0	609.9
Japan	6489.5	6625.5	6961.5	6891.1	7648.6	7918.7	7580.5	8298.4	7657.4	8381.0
Korea	3154.8	3366.6	3233.7	3619.4	3630.7	3621.6	3902.2	4238.1	4376.2	4633.5
Malaysia	3680.7	3734.3	3849.8	4030.8	4402.8	4662.4	4823.3	5354.8	5615.5	5776.9
Mongolia	1555.4	1766.6	1602.4	1607.9	1727.2	1625.8	1469.5	1341.0	1266.2	1295.8
Pakistan	550.3	544.2	580.6	568.5	587.3	588.8	688.0	711.9	660.7	659.9
Philippines	779.2	761.0	813.2	841.4	872.8	848.0	841.6	808.9	802.3	817.0
Thailand	347.9	347.8	349.4	351.8	366.7	365.1	406.2	403.4	428.2	–

(Table 2 Contd.)

(Table 2 Contd.)

Mining

Countries/Years	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Rep. of China	10037.9	10585.1	11333.1	12547.2	14722.7	17061.5	18915.9	20752.0	21253.9	22098.1
India	3022.4	3017.1	3248.8	2861.7	2670.3	2506.8	1648.2	1347.1	1078.0	1151.2
Indonesia	29373.8	–	–	–	29296.5	26345.4	27709.2	30309.9	25197.4	28881.5
Japan	32404.8	34205.7	33078.1	34450.8	33031.2	42708.5	42842.5	44314.7	44258.1	38713.9
Korea	6737.7	5925.6	5999.5	8049.3	11967.2	12702.8	15244.9	14253.6	16662.5	22476.4
Malaysia	74333.7	94053.6	94644.7	128197.3	122262.9	114568.3	120590.0	122578.0	118733.9	118514.3
Pakistan	2636.9	2463.0	2607.9	5070.9	4259.6	4665.2	5070.9	3296.1	8789.6	8451.5
Philippines	4996.4	4406.9	4122.8	4005.1	3978.4	4485.3	3869.5	4322.0	4795.5	5746.8
Thailand	13854.0	22715.8	19440.0	27435.5	28453.0	25503.4	29099.2	27134.3	31582.8	–

'–' data not available.

Manufacturing

Countries/Years	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Rep. of China	9322.5	10190.7	10764.1	11294.9	11737.4	12315.2	13420.2	13925.0	14860.4	15689.1
India	1105.8	1184.5	1229.6	1212.4	1052.9	1101.4	749.2	614.2	504.1	522.3
Indonesia	2408.4	2721.2	2900.2	3151.1	2813.5	3073.3	3290.0	3489.2	3652.1	3915.1
Japan	26852.7	26577.3	28162.2	29804.7	31017.8	32605.9	33260.2	32436.2	31825.0	32064.2
Rep. of Korea	7898.8	8643.0	8952.0	9636.3	9602.6	10473.6	11235.5	11210.5	13305.3	14564.3
Malaysia	7198.8	7686.9	8149.1	8942.4	8607.4	8748.6	9036.2	8955.4	9512.9	10121.2
Mongolia	8320.6	8130.3	8260.3	7921.4	8006.0	7507.7	6542.4	5832.5	5891.3	6706.8
Pakistan	1134.8	1264.0	1202.5	1441.9	1456.7	1493.0	1703.3	1758.4	2022.5	2070.7
Philippines	4023.8	4133.0	4035.3	4065.6	4190.9	4517.1	4115.6	3797.5	3968.9	3965.2
Singapore	14208.0	15597.9	16736.9	17753.8	18580.1	17707.1	18470.3	18728.1	10844.1	23919.1
Thailand	4125.5	4540.3	4467.2	5214.7	5369.0	5508.7	5587.6	5984.0	6065.9	–

Electricity, Gas & Water

Countries/Years	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Rep. of China	73439.0	77028.1	82515.7	90740.4	96998.4	101604.9	108499.5	114165.5	126115.3	134459.2
India	2899.1	3281.3	3415.3	3228.4	2731.2	2708.8	1867.5	1697.2	1508.6	1625.6
Japan	122732.9	120438.1	121914.2	126368.0	120652.7	128584.1	135267.1	133857.5	130614.9	131281.1
Korea	67974.3	87603.2	88746.6	83024.2	81666.2	81127.1	92805.8	99510.1	113905.7	117667.8
Malaysia	11773.7	13051.5	13773.7	15756.7	17914.0	17742.8	20160.6	22452.2	19818.8	22163.8

Construction

Countries/Years	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Rep. of China	4951.0	5265.7	5429.9	5699.0	5846.2	5904.9	5897.8	6025.4	6011.1	5800.2
India	2057.7	2227.8	2357.1	2300.1	1942.8	1841.7	1279.2	1062.2	835.1	849.0
Japan	19374.1	20213.9	22604.0	23786.1	24099.0	25178.6	25315.7	24932.8	24811.9	24193.8
Korea	7864.7	8311.5	9055.5	8835.7	9078.4	9687.1	9655.0	8966.7	9292.4	9498.4
Malaysia	3487.8	3367.6	3197.3	3428.4	3449.9	3650.1	3807.7	3900.8	4036.9	4221.9
Mongolia	2682.5	2802.4	3354.5	2786.9	2803.3	2081.4	2325.1	1510.4	1585.8	2121.3
Singapore	18487.3	14773.4	14488.5	15300.4	15294.5	15146.0	17082.9	19751.6	21554.4	23412.4

(Table 2 Contd.)

(Table 2 Contd.)

Trade

Countries/Years	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Rep. of China	6209.9	6478.2	7010.9	7259.0	7680.2	8426.2	8791.1	9369.9	10039.6	10324.5
India*	1299.9	1404.0	1426.6	1330.2	1110.0	1076.6	719.8	609 3	494.3	526.5
Japan	16707.8	16851.1	16870.7	17340.4	18435.5	19386.6	19970.4	20292.7	20045.8	19937.1
Korea	3797.1	4293.9	4743.7	5209.6	5305.3	5537.9	5786.8	5614.2	5358.3	5407.5
Malaysia	4118.6	3456.0	3451.4	3409.6	3672.0	3951.4	4455.0	4876.5	5329.3	5566.8
Singapore	11125.9	11361.4	11950.7	13719.7	14493.6	13972.2	14797.4	15041.2	16360.1	16745.3

*include Hotel and Restaurant.

Transport and Communications

Countries/Years	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Rep. of China	19337.7	10623.8	11405.6	12184.1	12790.1	13323.3	14114.9	15207.8	15835.3	16465.4
India*	1387.1	1553.1	1690.8	1712.6	1489.4	1455.8	1033.2	934.4	786.1	828.8
Japan	26223.4	26119.4	27454.5	28843.8	31334.7	31947.9	32715.8	31920.5	31328.2	32030.4
Korea	9763.7	10223.9	11075.6	11492.1	11961.4	12402.0	12965.9	13895.3	15128.7	16881.3
Malaysia	8130.0	8451.9	8724.4	9064.2	9512.3	9929.0	10579.7	10864.2	17546.0	18489.1
Mongolia	6912.4	7366.8	7703.9	74721.1	6875.0	6567.4	4371.5	3795.4	3942.5	4729.5
Singapore	20334.2	22536.8	23178.6	25741.1	26942.9	24877.0	26117.2	26800.0	28152.0	29755.5

*includes Storage also.

Table 3: Labour productivity levels in Asian Countries, in current US dollars

Gross Domestic Product (GDP)

Countries/Years	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Rep. of China	8357.5	9758.0	12713.5	15201.7	18062.2	19335.2	21258.8	24573.3	25457.8	26978.7
Fiji	12588.1	14650.0	131664.6	12930.3	12699.2	13739.7	14355.9	15109.0	15298.0	16970.7
Hong Kong	12828.9	14479.1	17551.1	20565.3	23516.9	26503.7	29551.1	34517.1	38054.1	42246.7
India	693.3	751.1	798.1	828.5	833.2	872.1	761.4	741.2	701.5	764.2
Indonesia	1398.3	1171.5	1078.5	1162.5	1286.3	1508.6	1677.1	1771.8	1992.9	2182.3
Japan	22916.7	33548.6	40693.8	48292.9	48242.1	48566.7	54488.0	58849.4	66960.0	73324.5
Korea	6301.1	7005.0	8335.4	10789.5	12650.2	13988.8	15808.3	16240.6	17160.5	19197.7
Malaysia	5547.7	4858.9	5372.7	5618.7	5926.7	6397.6	6827.2	8117.6	8497.7	9288.4
Mongolia	4037.5	4565.1	5050.0	4795.8	4681.9	2372.1	952.7	1467.1	671.2	903.3
Pakistan	975.1	1020.7	1017.1	1134.3	1093.9	1118.8	1260.5	1363.4	1310.2	1361.8
Philippines	1552.2	1450.3	1596.4	1762.4	1948.5	1966.5	1976.4	2215.1	2225.1	2538.5
Singapore	15326.1	15573.5	17173.8	20495.5	23661.2	25425.2	28586.9	31405.9	35900.3	41807.9
Sri Lanka	1131.7	–	–	–	–	1602.7	1757.8	1865.6	1978.1	–
Thailand	1504.7	1619.4	1836.6	2106.5	2360.2	2776.5	3171.1	3437.5	3883.4	–

Note: '–' Data not available.

(Table 3 Contd.)

(Table 3 Contd.)

Agriculture

Countries/Years	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Rep. of China	2768.7	3176.6	4412.4	5575.4	6852.6	6294.1	6223.4	7171.7	8099.9	8830.0
Hong Kong	3885.9	4190.7	4376.7	6050.9	5923.1	9192.5	9271.7	9482.0	10418.8	10326.1
India	341.8	353.9	361.6	371.1	386.2	392.2	345.8	346.3	321.5	350.9
Japan	6489.5	9260.1	10822.1	12507.6	13039.9	13394.3	14855.9	15960.2	17578.4	20186.3
Korea	3154.8	3310.1	3860.3	5330.7	6229.5	6702.4	7365.3	7625.9	8275.9	9914.0
Malaysia	3680.7	3281.7	3657.9	3859.7	4220.4	4600.3	4820.0	6077.9	6418.6	6805.3
Mongolia	1555.4	2033.5	2040.6	2127.3	2270.2	1103.4	294.0	1229.4	607.9	843.6
Pakistan	550.3	522.0	542.2	577.2	575.6	568.4	681.5	740.2	683.6	717.1
Philippines	779.2	695.1	801.7	876.9	980.6	953.1	916.2	1063.5	1049.1	1250.5
Thailand	347.9	380.3	449.7	514.1	533.9	553.3	669.7	679.7	681.8	–

Note: '–' not available.

Mining

Countries/Years	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Rep. of China	10037.9	11051.9	15244.8	19863.5	26192.5	30863.0	34937.2	55855.8	62830.0	44098.4
India	3022.4	3076.2	3404.6	3219.8	3503.0	3547.6	3030.4	2822.8	2657.6	2920.1
Indonesia	29373.8	–	–	–	27458.1	26345.4	28997.6	28701.4	23086.3	24166.7
Japan	32404.8	48291.8	55854.3	68991.7	63478.9	76696.9	86663.9	97839.7	109843.6	116859.3
Korea	6737.7	6270.1	6982.4	10700.8	16415.3	18332.0	23602.8	18879.3	22120.9	34081.6
Malaysia	74333.7	82653.7	89926.3	122756.9	117196.0	113044.1	120505.7	139132.1	135714.7	139611.2
Pakistan	2636.9	2831.7	3039.5	6665.6	4770.9	4975.4	5377.9	3538.3	8776.0	9487.7
Philippines	4996.4	4611.0	4795.3	4619.7	4600.5	5174.9	4245.7	4467.9	4708.4	6184.1
Thailand	13854.0	17883.2	15706.5	24455.7	28194.7	25071.8	27719.8	26517.0	32246.8	–

Note: '–' Data not available.

Manufacturing

Countries/Years	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Rep. of China	9322.5	11268.5	14061.0	16337.6	18434.6	20105.9	23021.5	26014.3	27326.5	28132.2
Hong Kong	7839.6	9310.2	11250.5	13257.6	15221.6	16836.1	17376.4	19827.3	19946.1	20099.8
India	1105.8	1207.7	1288.6	1364.1	1381.2	1558.7	1377.6	1287.1	1242.8	1324.7
Indonesia	2408.4	2390.0	2211.5	2596.9	2335.5	3073.3	3444.5	3700.9	4008.0	4580.4
Japan	26852.7	38676.4	46859.8	55464.0	55834.8	54311.1	60102.2	62661.2	69358.2	74311.6
Korea	7898.8	8732.4	9683.1	12502.1	14109.8	15061.5	16800.0	17699.8	19271.5	21773.2
Malaysia	7198.8	6755.2	7742.9	8563.0	8250.7	8632.1	9029.9	10164.7	10873.4	11922.9
Mongolia	8320.6	9238.0	9941.7	9715.0	9509.5	5026.3	1731.4	2821.7	1290.4	1887.1
Pakistan	1134.8	1262.9	1209.3	1498.6	1435.2	1535.2	1803.2	1924.4	2080.6	2162.3
Philippines	4023.8	3862.5	4004.8	4338.0	4608.5	5028.9	4808.1	5031.3	5250.9	5773.5
Singapore	14208.0	16313.9	18178.9	21789.7	24044.7	25175.6	28553.0	30024.9	35469.7	43985.4
Thailand	4125.5	4987.7	5037.9	6482.5	6976.9	7425.1	8099.1	8661.9	8968.5	–

Note: '–' Data not available.

(Table 3 Contd.)

(Table 3 Contd.)

Electricity, Gas and Water

Countries/Years	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Rep. of China	73439.0	77575.3	99829.0	106838.0	122478.3	125084.2	129314.5	155520.3	167275.1	180278.4
India	2899.1	3345.5	3579.1	3632.5	3582.8	3833.7	3433.7	3556.4	3719.2	4123.3
Japan	122732.9	188598.0	217644.6	241605.2	201822.8	193143.0	219609.4	238488.6	271920.0	301771.9
Korea	67974.3	88456.5	94493.2	95342.8	94191.4	78491.1	93111.5	102579.6	22120.9	34081.6
Malaysia	11773.7	11470.2	13087.4	15087.8	17171.7	17507.2	20146.3	25484.5	22653.2	26109.1

Construction

Countries/Years	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Rep. of China	4951.0	5569.6	7297.3	8984.4	10737.6	11232.7	11771.9	13587.0	13361.1	13305.7
India	2057.7	2271.3	2470.1	2587.8	2548.6	2606.3	2351.9	2225.7	2058.7	2153.4
Japan	19374.1	29288.2	38789.6	47385.1	46724.4	48376.5	54393.6	58873.5	67857.2	72836.8
Korea	7864.7	8530.8	10770.6	13558.7	17405.3	21767.4	26423.4	25396.1	26786.1	28945.9
Malaysia	3487.8	2959.5	3037.9	3282.8	3306.9	3601.5	3805.1	4427.6	4614.2	4973.4
Mongolia	2682.5	3445.8	4273.1	3553.4	3343.6	1410.2	620.6	553.1	257.3	530.7
Singapore	18427.3	15182.0	15788.4	17876.6	19583.7	22504.1	28152.6	36949.6	41044.2	47429.1

Trade

Countries/Years	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Rep. of China	6200.9	7129.1	9204.9	10679.1	12552.1	14038.8	15311.3	17944.4	18648.7	19733.9
India*	1299.9	1431.5	1495.0	1496.7	1456.1	1523.6	1323.5	1276.6	1218.6	1335.6
Japan	16707.8	24182.4	28462.0	3330.3	33740.7	34450.1	39114.8	42942.6	48593.3	52653.7
Korea	3797.1	4358.9	5391.9	6869.4	7886.9	8298.1	8816.9	8349.3	8109.9	8560.7
Malaysia	4118.6	3037.1	3279.3	3265.0	3519.9	3898.8	4451.9	5535.0	6091.5	6557.7
Singapore	11125.9	11263.4	12522.6	15554.8	17839.5	20437.8	23106.7	39618.1	42561.9	47472.8

*include Hotel and Restaurant.

Transport and Communications

Countries/Years	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Rep. of China	10337.7	11413.5	14961.6	18234.1	21467.7	22369.7	24797.9	29654.4	30776.3	33355.5
India*	1387.1	1583.5	1771.9	1926.9	1953.8	2060.2	1899.6	1958.0	1938.0	2102.3
Japan	26223.4	37992.8	47318.8	56321.3	56990.1	55949.6	63010.3	66313.3	73834.4	81835.6
Korea	9763.7	10702.8	12682.0	15160.0	17761.6	18395.8	19915.4	20911.8	23089.6	27453.9
Malaysia	8130.0	7427.4	8289.3	8679.6	9118.2	9796.8	10572.4	12331.4	12567.2	13820.7
Mongolia	6912.4	7775.0	8489.6	8198.1	7335.6	3869.5	963.1	1281.9	523.1	902.3
Singapore	20334.2	21465.0	23334.4	28522.4	32452.2	32435.2	37989.4	39618.1	42561.9	47472.8

*include storage also. □

Book Reviews

Human Relations and Organisational Behaviour: A Global Perspective by *R.S. Dwivedi.* MacMillan India Ltd., 1995, p. 614, Rs. 185.

Human behaviour stems from deep-rooted needs and ambiguous values of people who are different from each other in numerous ways. It can be partly understood with the aid of behavioural science which deals with the total integrated human being within the complex socio-economic-technical system. This book is an attempt to incorporate the findings of behavioural scientists and their applications to enhance the understanding of human relations in the organisational set-up.

This book is designed for management students interested in a global perspective of behavioural science as a systematic, interpretative account of human behaviour at work and in applications of behavioural science to solutions of current problems in organisational settings. The major objective of the author is to help students acquire some understanding of the behaviour of individuals and groups in modern organisations. It is the fourth edition of the book first published in 1979. In this new edition, a successful attempt has been made by the author to clarify, enhance and update the information to reflect the emerging perspectives in the fields of human relations and organisational behaviour.

The book has fifteen chapters divided into four parts. Part one presents the foundation for human relations and organisational behaviour. The author goes on to highlight the important research findings in the area of behavioural science to provide a theoretical perspective necessary for the understanding of human behaviour in organisations.

Part two, consisting of four chapters, facilitates a basic understanding of the individual as a 'whole' consisting of interrelated and interdependent parts—psychological factors, segments of psychological processes and personality. To understand the individual as a 'whole', the author deals with foundations of individual behaviour in organisations, devoting to a chapter each to the study of perception and learning, an analysis of the concept and process of motivation followed by the nature of human personality.

Part three deals with the 'group' and has been divided into six chapters. The author analyses informal organisations and group dynamics and provides a study of role, status, authority, power and conformity to norms. He also provides an understanding of the concept and process of communication in organisations. Other topics dealt with are the morale and socio-technical system in work groups and the importance of leadership and effective supervision to enhance employee motivation through improved morale.

The studies on organisational structure and job design, organisation change and development, and finally, varied innovative approaches to designing and managing organisations for accomplishing effective performance, are all covered effectively.

To facilitate student learning, there are review questions, behavioural science quiz, suggestions for further readings and cases at the end of chapters. These characteristics of this new edition of the book certainly make it a must for all management students as a basic text to understand, predict and control human behaviour in work organisations.

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Crossroads of Culture by *Pulin K. Garg and Indira J. Parikh*, Sage Publications, New Delhi, 1995, p. 222, Rs. 275.

The book under review attempts to explore the nature, quality and characteristics of the changes occurring in the agrarian ethos of India. The authors present

enough evidence to show that the culture of transience prevails in all post-colonial societies of India. They argue that this is due to the encounter with western ethos of technology.

The book attempts to answer the questions: What is this country Bharat? Who are the people who call themselves Indians? The answers to these questions are varied. The authors prove that the last two centuries have witnessed a decline of Indian ethos and the social design has become battered and ineffectual.

The authors attempt to discover what Indian identity is and what are its antecedents leading to exploration of the individuals' cognitive map of socio-psychological Infrastructure and their action choices. The authors make use these explorations as the base for reconstructing the cognitive map of Indian Society. They document the cognitive maps and their bases as held by the participants.

Then they explore the consequences of agrarian ethos and their implications for Indian Society. The consequences are Socio-psychological, consequences relating to work, Consequences for the individual and Consequences for nation building at current times.

Chapter five deals with the ethos of technology which the authors feel has confronted the Indian Society with a double edged sword. One edge has been the hope to grow and build a new heritage, while the other edge has confronted a model so alien that it has created waste and despair.

The authors record the experiences of the participants and try to infer the quality of synthesis of agrarian and technological ethos. It becomes clear from the analysis that the constituents of these ethos are unique. These unique elements are reflected in the family, education, work and other institutions and traditions of the society. It has created new structures, forms and modes of relating with people, both in the family as well as other institutions. At the societal level, it has created agrarian–technological and rural–urban distinctions. The explorations with the participants finally convince that one should understand the fundamental differences of the two ethos in terms of their underlying concepts of man, the collectivity and their relationship. However the collectivity of Indian Society has emerged into a synthesis.

In the last chapter, some of the initial boundary conditions necessary to lay the foundations of socio-psychological and psycho-cultural infrastructures are described. These are derived purely from the logic of the primary data provided by the participants and are not comprehensive. However the book will be useful to social scientists to discover more cogent perspectives and action models.

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Human Resources Development–Experiences, Interventions and Strategies by *RAO, T.V.* Sage Publications, New Delhi, p. 394. Price: Cloth Rs. 525, Paper Rs. 325.

Human Resources Development (HRD) is attracting particular attention of the corporate thinktanks the world over especially since the mid-seventies. This became a strategic concern after the revival of free market and the decline of the welfare state all over. HRD is increasingly becoming a catchword and is often looked at as a panacea for corporate ills. There is a tendency to include HRM members of the "technostructure" (as used by J.K. Galbraith) in the strategic apex thus transforming the fire fighting role of the erstwhile departments into proactive and developmental interventions.

Concretely speaking, HRD aims at creating conditions to enable people to give their best through development of their competencies, culture and commitment both as individuals and as groups so as to meet the changing and strategic requirements of the organisation. Hence HRD came to be known as a developmental approach at the organisational level. But one can think of it at the individual level as well whereby the persons concerned develop their competencies for a happier, healthier and more fulfilling life. HRD has also got attention of governments at the macro level. For example, in the early eighties India saw the renaming of the Ministry of Education at the Centre as the Ministry of Human Resource Development. At the macro level, HRD policies aim at promoting life expectancy, freedom from disease and hunger, skills for earning livelihood, sense of belonging in the development process, and the quality of life itself. Human capital formation and expenditure on developing human resources are thus now seen as investments and not as revenue expenditure even by entrepreneurs. The emergence of new concepts like human resource accounting is a consequence of this change in thinking.

While literature on HRD in organisations abounds it is not really so in the case of human resource strategies at the national, state or provincial levels. The book by T.V. Rao is a very useful contribution in this direction. Its main focus is on the developing nations.

An attempt has been made to draw lessons from the experiences of both the developing and industrialised nations. The book is based on an eight-month study conducted by the author to assist the working group on Human Resource Development set-up by the commonwealth Secretariat in 1992 under the chairmanship of Dr. Sam Pitroda.

The book consists of three parts: the challenges of human resource development; strategic interventions in HRD sectors and target groups; and strategic process interventions for human resource development. The parts are further divided into various chapters – eighteen in all. The first part consisting of three chapters deals with conceptual explanations. Among others, goals of HRD, the target groups, rationale of HRD interventions have been comprehensively explained. It also relates HRD with economic development. The possible HRD strategies and interventions too find a place in detail.

Chapters four to twelve form part of the second section of the book. This part deals with identifying the human resource sectors, target groups and the appropriate processes that should be chosen. Various areas identified include health, basic education, adult education, technical and vocational education, higher education, science and technology, environment, women empowerment and entrepreneurial skills for the poor and unemployed. Chapter seven discusses strategies for technical and vocational education, highlighting, amongst others, joint programmes with private sector, and providing autonomy to these institutions in curriculum designing and faculty development. The interventions needed in various sectors have been based on interesting discussions of past experiences. Examples from various countries have been given in support of the formulations, though HRD goals and issues have been identified at the country level. The ways of developing the target group have been discussed convincingly. A good amount of qualitative and quantitative data and case studies has been presented in most of the chapters.

The last part of the book consisting of chapters thirteen to seventeen discusses strategic process interventions that should be resorted to for realising the goals of HRD. These include using Non-Governmental Organisations (NGOs), participation through decentralization, resource mobilization, enhancing coordination by governments seeking to implement an HRD strategy and professionalism for good governance. The last chapter sets out an agenda of priorities and policies that governments should pursue.

T.V. Rao is known to have made seminal contribution to HRD in Indian organisations, even as a lot is still desired in operationalizing HRD philosophy in this country. His present book has further enhanced his stature in yet another dimension of this field i.e. macro level HRD. He has succeeded in immense measure in integrating HRD experiences from various parts of the world into a coherent perspective. The citation of case studies adds to the interest in the book that he has been able to generate. The study lays down a very useful agenda for action. At a time when the state is squeezing itself in its activities to dwarf its economic role, Rao's expectation of a supplementary role by NGOs and the private sector is noteworthy and interesting, though a fuller articulation of the nuances of this strategy could have been expected from this presentation. But surely, he has succeeded in highlighting the interdependencies of variables and eventually in evolving an integrated approach. The presentation of the book and the discussion on HRD variables, strategies and processes are articulate and interesting.

Rao is a psychologist; they are often known to overemphasize behavioural dimensions involved in economic and social aspects and processes. Often, systemic issues are not appreciated in full measure in their social scientific contextualities. One wonders whether autonomy to academics and educational institutions that Rao advocates can be a panacea for our education system where a deep systemic malaise is discernible from its working. For example, Universities in India enjoy a fair amount of autonomy, but have declined in standards. The vested interest groups have resisted any and every attempt of operationalizing HRD or other organisational changes. Indian education system is deeply intertwined with the political configurations in India, teachers having the freedom of being active participants in political parties and power politics. Every day, things turn from bad to worse. In fact, the most difficult area in operationalizing HRD is the government and quasi-government sector. And this is attributable to various structural reasons, attitudinal factors emanating from these. One would have expected from Rao a more elaborate discussion of this resistance to change and HRD. Also, the size of the book could have been curtailed to about three fourth of its present length by more careful editing.

Despite these, the book is a useful contribution to HRD in the macro perspective. A comprehensive index adds to the utility and readability. It will prove to be a very useful resource material for policy makers, administrators, researchers and academics.

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Economic Thought of The Twentieth Century and Other Essays by *P.R. Dubhashi*. Concept Publishing Company, New Delhi, 1995, p. 277, Price Rs. 400.

Development programmes in India have not benefited the poor because of faulty planning and corruption at high levels in the Government says P.R. Dubhashi, a retired IAS officer. The volume contains 35 critical papers by the author on a spectrum of economic issues. The messages conveyed are very important and relevant.

The author covers a wide range of topics such as the ideologies of development, development policies, process of plan formulation, decentralised planning, defects in implementation of plan programmes and the new economic order being advocated in the recent years.

Economic thoughts or ideologies are conceived from the prevailing economic conditions which change with the lapse of time. Ideologies of the classical and the neo-classical economists pertaining to capitalism, socialism, laissez-faire, etc. have certain limitations. No ideology can survive over long periods as the field of economics is faced with new challenges related to development, social justice, equality and protection of environment. Further, of the ideologies being pursued by the developed countries are not relevant to the developing countries.

Karl Marx had claimed that the capitalist system would collapse because of the evil of worker exploitation. Frederick Von Heyak, on the other hand, had predicted the collapse of the socialist system due to several weaknesses. The collapse of the socialist system in Russia has created an ideological vacuum which necessitates a search for or reassertion of an alternative ideology. The author proposes Gandhian ideology.

The ideology of free trade and comparative cost advantages etc. exists only on paper. Prior to British imperialism, Indian agriculture and industry were adequately developed. Industrial revolution in Britain (1760 to 1820) adversely affected the Indian economy. Under the colonial rule, the British Govt. treated India as a source of raw material and market for the products of industries in Britain. Moreover, discriminatory trade policies caused economic drain and de-industrialisation which progressively impoverished the Indian masses. This concerned our national leaders and scholars, who advocated planned development of India even before independence. The Planning Commission was expected to provide a broad frame work for the co-existence of public and private sectors. However the setting up of the planning commission ran into problems with Dr. John Mathai, the then finance minister, resigning on the pretext of conflict in the interests of the Planning Commission and the Ministry of Finance.

Working of the planning commission, plan formulation and implementation of plan programmes, and monitoring and evaluation of programmes, etc. are discussed critically in the book. The author is also critical about the interference of political parties in the plan programmes and abrupt introduction of populist schemes and programs. Rampant corruption in public life especially at high levels has adversely affected the honest and the hard working because of which the benefits of the plan programmes have not reached the poor even after four decades of planning. Hence there is a need for social discipline and work ethics.

The prices of basic inputs such as fuel, coal, power, steel, etc. are generally administered at high levels so as to generate more revenue which has led to cost-push inflation. Therefore, it is important to identify the components which are critical for cost reduction. The author feels that labour productivity and fuel efficiency are the two factors common to most of the sectors. As the rise in capital intensity has diminished capital productivity, the thrust should be on the development of small establishments which make more efficient use of resources and are also crucial for the decentralisation of industries. Regarding the agricultural sector, the irrigation and other related inputs are vital to increase productivity.

Populist policies like indiscriminate nationalisation, monopoly controls, etc. have caused economic stagnation. The World Bank and the IMF have suggested some economic reforms. Apparently the New Economic Policy in the context of liberalisation of economic activities has been influenced by the ideology of the developed countries according to which the profitability is the measure of efficiency and the loss making enterprises have no place in the competent market. A World Bank report states that the efficiency of State Enterprises has suffered due to conflicting objectives. The present system of monitoring of public sector projects has also diverted from the focus on productivity and achievement of project objectives. The author feels that inefficiency in the public sector can be countered only if we consider public service as a matter of honour, social service as a motivation for action and social responsibility of business as an example of Gandhiji's concept of business as 'a trust held on behalf of society'. He suggests cooperative economy as an alternative to competitive economy.

The author has reviewed five books on poverty. Each book explains the concept of poverty differently.

One book states that per capita quality of life is a better measure than the commonly used per capita gross national product. Another book suggests that non-fulfillment of basic needs should be treated as a yard-stick of poverty. The books also identify the causes and suggest corrective measures for the alleviation of poverty. The author points out that the trickle-down theory of development has very limited application in India. Implementation of the development programmes have mainly benefited the rich due to corruption. Hence there is a need for direct assault on poverty.

After the First International Conference on 'Human Environment', at Stockholm (Sweden) in 1972, environmental awareness has become a major concern of the global community. By misusing the banner of environmental protection the developed countries are deterring industrial progress in the developing countries. Performance of the industrial sector is vital for the development of an economy and there is a need for a New Economic Order to reduce the imbalance between the rich and the poor nations. The poor countries must be encouraged to initiate programmes necessary for their self-reliance and the developed countries must supplement these development programmes. The NAM which consists of membership mostly from the developing countries has called for a 'New International Economic Order'. The NAM countries are demanding favourable terms through restructuring of the International Financial Institutions. But the developed countries are reluctant because they are facing the problems of stagflation and increasing unemployment. The author feels that India can influence the Third World Countries through total interface and some changes in our present foreign policy.

This book is good reference material for researchers interested in development studies as it deals with many thought provoking issues for the economists and the ideologists.

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Towards An Asian Economic Area by *V.R. Panchamukhi and Rehman*, Sobhan (eds.), MacMillan, Delhi, 1995; pp. xxix + 416; Rs. 530.

One of the paradoxes of modern development in the recent past has been the loud talk of marketization, globalization, global village, free trade, World Trade Organisation on the one hand, and an unprecedented increase in the number of regional trading blocks on the other. The past forty years or so have witnessed the emergence of European Economic Community (EEC), North American Free Trade Association (NAFTA), Asian Pacific Economic Council (APEC), Association of South-East Asian Nations (ASEAN), South Asian Association of Regional Co-operation (SAARC), Latin American Free Trade Area (LAFTA), and so on as regional economic areas. The protectionism in industrially advanced nations and the formation of powerful trading blocks by them have threatened the trading interests of the less developed countries (LDCs) by hindering their world market access. The free trade world order is proving to be an unequal world order. This has compelled the LDCs to explore the possibilities of greater regional economic co-operation and integration among themselves. The North-South trading conflicts have given impetus to a greater South-South economic co-operation. The book under review is about one such effort namely, the formation of the Asian Economic Area (AEA) or the Asian Economic Community (AEC).

The book is an outcome of the Conference on "Challenges to the South in the Nineties with Special Reference to the Asian Region" organized at Delhi in March 1993 under the joint auspices of Research and Information System for the Non-Aligned and other Developing Countries (RIS), New Delhi, and South Centre, Geneva. Apart from the Foreword by Manmohan Singh, four addresses by G. Parathasarathi, K.R. Narayanan, Julius Nyerere, and Dinesh Singh, respectively, an introduction by the editors, and an account of the proceedings of the Conference, there are 31 papers in the book. These papers have been written by various experts from different parts of Asia, and they have been grouped in three parts.

Part I on Development Paradigms and Strategies has 11 papers. While some of them have discussed the development and trade experiences of the East Asian/Asian countries taken together, the others have studied the development processes individually in certain Newly Industrializing Economies (NIE), viz., Sri Lanka, S. Korea, Malaysia, Vietnam, and China. There is no essay on the development experience in India in the book. The studies in this part are meant to enable countries to choose between the State and Market as two development paradigms, and to suggest to those Asian countries which have not done so well in growth as to which development strategies and policies they should follow. The message of these studies is "that a suitable blend of the State and Market, the private and public sectors, openness and protection are required to foster rapid economic transformation..... Further, the merits and demerits of strategic integration with the global economy need to be recognised as against the approach of unreserved total integration" (p. 5). It has

been rightly pointed out in the book that the new philosophy that the free market, incentives, and competition will promote efficiency and the latter will take care of everything, is lopsided. Further, the book has rightly cautioned that all the arguments forwarded for emulating other economies for doing something need not be accepted because of the prevalence of the differences in conditions, cultural settings, and stages of development in different countries.

Part II on Select Issues has 13 essays which have discussed issues relating resources mobilization; the burden, management, and other aspects of external debt; the importance, determinants, and extent of food security in Asian countries; social aspects of development; and technology creation and transfer. We learn from these essays that the LDCs have entered into the debt trap because they have suffered from significant deterioration of terms of trade, and they have been paying back more in real terms on their original borrowings. The capital transfers to the LDCs have been declining in real terms in the recent past. The plans for the management of their debt have laid emphasis entirely on bailing out the creditors rather than helping the LDCs. Revelations made in the book regarding the food security in Asia are equally worrisome. In most of the Asian countries, the per capita availability of foodgrains out of both domestic production and imports remains grossly inadequate; they have not been able to devise mechanisms for providing access to food for the deprived sections; and the rising imports and domestic prices of foodgrains are adversely affecting the poor and vulnerable sections of society in these countries.

Part III titled Towards An Asian Economic Area has 7 papers which have discussed the agenda for the South during 1990s, and the meaning of, the need for, the problems of, and the prospects for the formation of the Asian Economic Area. The studies in this part show that so far economic co-operation has grown among the countries in East Asian and South-East Asian regions, but South Asia has remained largely outside the ambit of such co-operation. It has been emphasized that although the Asian identity was recognized long back, it was not allowed to take a viable form by the external forces. The time has now come that Asia should look within so as to find the manner in which an Asian identity could be strengthened and formalized. The setting up of the Asian Economic Region would be a good beginning.

The book is an important and useful addition to the literature on the past and future patterns of development in Asian countries. Teachers of economics, students of international trade and politics, policy makers, and negotiators in international bodies and for a would benefit greatly by reading the book. The RIS, South Centre, editors and publishers of the book deserve compliments for and congratulations on bringing out such a good volume – good in contents and get-up. In passing it may be mentioned that it would have been better to have numbered the essays in both the contents and the text, the affiliation and position of the contributors had been indicated, index had been provided, the full forms of all the abbreviations used had been mentioned, and the title page of the book had stated that it is an edited book.

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Structural Adjustment-Economy, Environment, Social Concerns, by *Shobha Raghuram* et al (Eds.). Macmillan, India Ltd., 1995, p. 324, Rs. 310.

One does not have to look far for the fallibility of economic models. The inhabitants of East Europe, for long treated as laboratory mice, have one fine day become witness to a new experiment when they had imposed upon them the invisible hand. The result is there for all to see. In Russia, as it is now once again, output has declined continuously while inflation is rampant, itself a phenomenon contrary to conventional economic wisdom. It is this somewhat pathetic response of the economy to the alleged elixir of unbridled capitalism that had led Lance Taylor to comment that 'the market met its match' in East Europe. The biggest reputational casualty of course is the International Monetary Fund which was the Master of the Ceremonies. But are we then, as good social scientists, to suggest that all was *hunky dory* in the erstwhile Soviet Union or should we now retire to the ivory tower to chuckle gleefully at the IMF's embarassment, having absolutely nothing to offer to the embattled people of Russia? This is not just some delicious predicament, it has a direct bearing on the debate on the reforms launched in India in 1991.

'Structural adjustment: Economy, Environment, Social Concerns' edited by Shobha Raghuram, Heiko Sievers and Vinod Vyasulu is a collection of essays purporting to be a critique of 'structural adjustment' as applied to India. Given the space allotted I cannot hope to comment on the 16 papers, including the Introduction by the Editors, individually. I shall only raise some issues that in my opinion have been missed. And there are two sets of issues here: first, there are the theoretical aspects of structural adjustment. Secondly, there are the Indian-economy specifics.

What the book under review lacks is a clear statement of what 'structural adjustment' is all about except to reiterate that the idea emanates from Washington, which it does of course. While structural adjustment is really a portmanteau expression for reforming the supply side of an economy, some of its constituent programmes, such as liberalisation and privatisation lend themselves to a systematic critique which we do not encounter here. Mohan Rao's paper on liberalisation is the only one that is an attempt to take on the proposals on their own terms, and then to successfully take them apart. Thus the opportunity for a frontal double-barrelled critique of the Bank-Fund structural adjustment programme has been missed. This is the first level at which the book falls short of expectations. The second level at which the book fails is the very sketchy analysis of the Indian economy. In this, of course, the book reflects the dominant trend in the profession today. Very little of the debate on the Indian economy today is based on serious empirical work. As an academic I must lament that this was not always so even as I must clarify that by 'serious empirical work' I do not mean some mindless 'parade ground drill' with heavy-duty statistical apparatus. After all, the editors could have considered the available studies of the performance of the PDS in the country or commissioned studies on the nature of public expenditure.

With hindsight today, three years after the conference(s) at which the papers in this volume were first presented, we see that compared to the economies of Latin America and Africa, so very little of the Structural Adjustment Programme dear to the Bretton Woods institutions has really been implemented in India. For instance, the public sector continues to function in exactly the same way as it did and the structure of public priorities is as lopsided as ever. But be all that as it may, it is still surprising that the editors of this volume did not consider it important to ask some searching questions about the nature of government intervention in post-Independence India. For instance,why should gentlemen farmers who do not pay the income tax, whose land holding is exempt from ceilings, and, who are permitted to sell the coffee bean at international prices be yet eligible for the fertiliser subsidy over and above the subsidies on irrigation, power and extension services? Or, would India not be a more just and civilised society if the state were to concentrate on a scheme of uniform and compulsory school education than on propping-up loss-making steel companies? The essays in the book under review cannot help us think through these questions because of an over-arching vision of Economics in India as a morality play involving the IMF.

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