

**An Outlook for India's Future  
(2000 A. D.)**

**INTERIM REPORTS  
ON  
FUTUROLOGY**

**ENERGY, HOUSING, TRANSPORT DEVELOPMENT,  
COMMUNICATIONS, URBANOLOGY, RURAL  
DEVELOPMENT, FOOD, MANAGEMENT & EDUCATION**

NIEPA DC



D05284

**NATIONAL COMMITTEE ON SCIENCE & TECHNOLOGY  
NEW DELHI  
1978**

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**National Institute of Educational** \,  
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17-B, Anand Marg, New Delhi-110016  
ICC. No. D. 5284  
Date..... 6/6/51

## PREFACE

The formation of the National Committee in Science & Technology (NCST) Panel on Futurology in mid-1973 has been the starting point of futuristic studies in India. The Panel identified nine areas, namely, (i) Energy Generation and Needs; (ii) Housing; (iii) Transportation; (iv) Communication; (v) Urbanology and Slum Problems; (vi) Rural Development; (vii) Food; (viii) Management; and (ix) Education, for study with a view to prepare scenarios for the year 2000 A.D. presenting likely and desired future perspectives and available options in these fields. It is hoped that these studies will afford the decision makers with a list of future courses of action. With this end in view the Futurology Panel hopes to prepare a series of monographs and technical reports in the field of future studies in the above areas. It also aims to encourage and stimulate future consciousness and research in a few advanced centres of study.

Nine Technical Sub-Groups of Futurology panel were constituted to prepare interim reports on the above topics. These are :—

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The Interim Reports submitted by these technical sub-groups constitute objective studies. Statements made in these Reports, however, do not yet constitute any policy position. It is hoped that these studies will provide to our policy makers in different organisations a reasonable degree of data and information and a set of technological and social alternates relevant to chose the future course of action. The Futurology Panel will welcome comments and suggestions.

NEW DELHI,  
*the 15th September, 1976.*

Sd./-  
S. C. SETH  
*Member Secretary*  
NCST Panel on Futurology

## TABLE OF CONTENT

	PAGE
<b>I. ENERGY</b>	
1. Introduction.	3
2. Energy Resources of India.	4
3. Energy Demand	5
4. Energy Utilisation	12
5. Energy Needs	13
6. Environmental Aspect & Future Energy Strategy	14
7. Scenario I	15
8. Scenario II	15
9. Preferred Scenario	16
10. Recommendations	16
11. Appendix I—List of Members	18
12. References.	18
<b>II. HOUSING</b>	
1. Introduction	21
2. Scenario I	
Present Status and Emerging Future based on Current Trends.	21
Resource Requirements	
3. Scenario II	
Preferred Future and Strategy	27
Recommendations	32
4. Appendix I—List of Members	35
<b>III. TRANSPORT DEVELOPMENT</b>	
1. General	39
2. Research on transportation futurology	39
3. Rail transport	41
4. Roads and road transport	43
5. Urban and metropolitan transport	45
6. Indian water transport and coastal shipping	46
7. Pipelines	47
8. Air transport	47
9. Inter-modal split	48
10. The nation and transportation scenario	49
11. Conclusions	51
12. Appendix I—List of members	52
<b>IV. COMMUNICATIONS</b>	
1. <i>Introduction</i>	55
2. <i>Emerging Scenario</i> —The most likely future :	55
— Knowledge-based bureaucratic society; Agrosurplus regions, Urban Complexes dominate; Limited access to one-to-one and many-to-many media; “Bombay-film” swamps other mass communication metaphors; One-way character of mass media creates Pavlovian Syndrome and passivity in the people.	

3. *Critical issues* raised by the emerging scenario : 56
- Will geographic distribution of access to communications be concentrated or spread widely ?
  - Will the availability and price structure of media systems support a small spectrum of users or many types of users and uses? Interchangeability of messages and movement.
  - What is the meaning of difference between 'hard' and 'soft' technologies and what choices should therefore be policy-derived ?
4. *Preferred Scenario*—What Policy Decisions are needed: 57
- 4.1 Issue of Geographic spread of availability of Communication media to spread information/knowhow/problem-solving ability 58
- Compensatory effort to vitalise rural areas using broad spectrum of communication devices—low power local radio transmitters more local print media, public telephones, etc.
  - Community building in urban and rural areas through multi-media Communication centres for technical learning, etc.
  - Pricing policies to favour broad-based use of postal and telecommunications over transport wherever possible;
  - Support for role of Traditional media and art forms—Music/Drama/Dance;
- 4.2 Issue of availability and price structure of media systems to support variety 61
- Role of wide variety of special-interest print publications—postal rate, paper-pricing and legal aspects;
  - Role of local daily and weekly newspapers;
  - Positive role of metropolitan newspapers and newspaper chains;
- 4.3 Issues of Technology Policy 66
- Preferred broadband telecom strategy: All trunk communications services on main intercity routes between the 25 main urban centres to be digital, including digitised voice channels; to support packet-switching.
  - Videotape sets for institutional (educational) use rather than broadcast TV : TV, in colour rather than black-and-white, to be used only in metropolitan cities, as a public information medium with on-line or rapid feedback from viewers.
  - Modular technology wherever possible—use of micro-computer chips to provide versatility to user devices, e.g. party-line telephones.
  - Expansion of telex and message—switching services and multiple newswire services in different languages.
  - Communications satellite to supplement coaxial and VHF links.
5. Appendix A—List of Members 70

<b>V. URBANOLOGY</b>	
1. Introduction	73
2. Problems of Urban Centres	74
3. <i>Scenario I</i>	
Emerging Future based on Current Trends	76
4. <i>Scenario II</i>	
Preferred Future & Strategy	78
5. Recommendations	82
6. Appendix A—List of Members	84
<b>VI. RURAL DEVELOPMENT</b>	
1. Introduction	87
2. Emerging Scenario	88
3. The Main Issues	90
4. Scenario for the Future	91
5. Footnotes	103
6. Appendix A—List of Members	105
<b>VII. FOOD</b>	
1. Scope	109
2. Population growth and urbanisation	109
3. Design of food consumption models	110
4. Food consumption as per models	111
5. Nutritional spectrum of models	111
6. Food production targets	112
7. Prospects of achieving targets for 2000 A.D.	112
8. Multiple cropping	112
9. Storage requirements	112
10. Fumigant and insecticide requirements	113
11. Storage and disinfestation service	114
12. Processing of food grains	114
13. Storage and processing of tubers	115
14. Public distribution system	116
15. Table 1 to Table 12	117-127
16. Appendix A—List of Members	128
<b>VIII. MANAGEMENT</b>	
Introduction	131
1. Management defined	134
2. What constitutes concern for future	134
3. The key task of Management	134
4. Proliferation of Management Responsibility	134
5. Leading questions concerning the Management of "A large Human System"	135
6. Futuristic Scenario	135
<b>A The Trend Scenario (Management 2000 AD)</b>	
(i) Management in Government	136
(ii) Business Management	138
(iii) Public-sector vis-a-vis Private Sector.	139

B. The Preferred Future Scenario : Management 2000 A.D.	140
7. The Future Tasks Indicating Current Decisions to Strengthen Indian Management Scene	140
8. Conclusion	141
9. Appendix A—List of Members	142
<b>IX. EDUCATION</b>	
Introduction	145
1. Aspects of Futuristic Projections	148
2. The Key Educational Issues	148
3. Two Scenarios	150
A. The Trend Scenario : Outline of Appropriate Education	150
(i) Short-Duration Courses.	150
(ii) Mode & Content of Education.	151
(iii) New Technology of Education.	151
(iv) Societal values and Evaluation.	151
(v) New Pedagogic Norms.	152
(vi) Appropriate education needs 10% of G.N.P.	152
B. Education 2000 A.D.—Accelerated Implementation Scenario of a Preferred Future :	152
4. Twentyone points	153
5. Conclusion	154
6. Appendix 'A'	
Table 1.1 : Literacy and Illiteracy 1901—1971	155
Table 1.2 : Education : Number of Schools & Enrolment : 1950-51 to 1974-75.	156
Table 1.3 : Expenditure on Education : 1960-61 to 1974-75.	158
Table 1.4 : Outturn of Science Graduates & Post Graduates: 1963-64 to 1968-69.	159
7. Appendix 'B'—List of Members	161
<b>X. DRAFT ON INTEGRATION DOCUMENT—A DISCUSSION PAPER.</b>	
Section I : Futurology Panel's Mandate and Methodology.	167
The Base Document	168
The Role of Technical Sub-Groups :	169
Section II : The Indian Imperative :	173
Societal Analysis & Key Indicators	173
Section III : Alternative Models & Choices :	179
Key Sectoral Recommendations	179
Rural Development	181
Urban Systems	182
Housing	183
Education	184
Management	186
Energy	186
Food	18
Transportation	195
Communications	199



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## I. ENERGY

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# I. ENERGY

## **Introduction**

'Energy' is a major component of the national economy and an important commodity in shaping our life style, community development and Industrial growth. Basically, energy Futurology is concerned with long range forecasting of energy resources position, energy application within a framework of reasonable life style which the country can afford for its population. Generally, the aim of this exercise is to achieve to a reasonable extent, the maximum out of the available resources and to evolve new methodologies and technologies to arrive at the required goal.

This report is the outcome of the deliberations of the expert panel, on Futurology Energy, set up by the Deptt. of Science and Technology. Two Energy Scenarios with a preferred Scenario have been drawn out keeping in view the energy demand, resources available and the technology development foreseen. The expert group has come out with various useful recommendations, which need timely actions to achieve the desired target.

It has been envisaged that coal is going to be our prime source of energy for a very long time, say, a Century or so. This indicates our considerable dependence on coal utilisation and other sophisticated coal technologies, such as improved method of coal combustion, coal gasification and synthetic oil production. The advent of 21st Century would emerge with various new energy sources such as solar, wind, tidal and geothermal. These abundant available energy resources will be non-pollutant, thus minimising the pollution problem, which is going to be one of the largest problems of the coming century. The fast breeder technology with abundantly available atomic fuels in the country will provide cheap source of energy. The development of new technologies such as MHD, HVDC transmission, super thermal power stations, gas turbines etc. are going to enhance the efficiency of the energy system.

Though it is a long way to go to achieve results of these sophisticated technologies, yet immediate actions are required to be outlined and to initiate sustained consistent R & D efforts in these fields. This exercise for energy forecasting is also concerned with the consumer behaviour and 'life styles' both in the rural as well as the urban areas.

We are 600 million people today going to be about 960 million in 2000 AD, this becomes the key and over riding factor, which would govern our total futuristic exercise in different sectors such as Food,

Clothing, Education, Energy, Housing, Employment etc. Among these food and energy development are the most important sectors requiring special attention. The work has to be initiated at the earliest to plan the future requirements, consumption availability and above all the means to meet the requirement.

Energy has become the basic ingredient of human progress. Day by day energy is becoming a precious commodity, it has to be used very carefully, keeping in view the various statistics of Energy supplies, demand, consumption and economic situation. The way energy is being used in the world, the conventional sources of energy e. g. coal, oil and natural gas, are expected to be exhausted in a century or so. Similarly the nuclear fuels though can stretch the life span considerably with the development of breeder reactor, yet its life is a finite one. The non-conventional energy sources such as Solar, Wind, Tidal and Geothermal, though having large potential, are yet to be tapped for commercial utilisation.

Thus it becomes an open challenge to our Scientists and technologists, to plan for future needs of energy and start their efforts to achieve the desired goal. The future economic growth is going to depend largely on energy—the agricultural activities, the industrial activities are going to be Energy based, in one form or the other. So the energy problem does not predominantly confine to the availability of primary resources, but to the development of these resources for their ultimate utilisation in a more efficient manner along with the other sources of energy.

A large portion of our investment are consumed into Energy Sector, and this is going to rise still further in future. This needs an appropriate fuel policy for proper use of energy sources, keeping in view the cost benefit and cost economics. In addition, adoption of a life style to utilise energy more for Industrial & Agricultural Sector rather than utilising them more for luxuries in the domestic sector appears to be inescapable.

#### **Energy Resources of India**

Coal would be the primary and basic source of energy, for the next few decades. This is the largest occurring commercial fuel. The total gross reserves being about 80 billion tonnes. It is estimated that the coal reserves may last for about 100 to 150 years.

The economically utilisable hydro electric potential is about 40 million KW, worked out on the basis of 60% load factor, or alternatively 200 billion KWH. per year.

The proved on shore reserves of crude oil are about 120 million tonnes and natural gas about 60 billion cubic metres. Recently off-shore oil reserves have been found, thus, generating fresh hopes and confidence in the country. The estimated oil reserves at Bombay high

are about 200 million tonnes, and the exploratory work is still continuing in the adjacent areas. Although, no definite estimates are available, it is hoped that by the middle of eighties, the country may be able to produce 14 million tonnes of crude on shore, and another 14 million tonnes from off shore reserves.

The uranium resources, are estimated at about 50,000 tonnes of  $U_3O_8$ , which may sustain about 10 million kw of natural uranium reactors over their life time. These reactors also yield by-product plutonium which can be used as fuel in breeder reactors, which produce more plutonium than they burn. In addition, thorium reserves are enormous and are estimated at about 450,000 tonnes which can possibly sustain about 10 billion kw of nuclear capacity. Once the fast breeder reactors are developed, the Uranium resources will amount to a total energy potential of about 1.2 to  $2 \times 10^{14}$  KWH, while the thorium deposits would amount to well above  $2 \times 10^{15}$  KWH.

The other sources of Energy are non-commercial sources such as fire wood, cow dung and vegetable wastes. Though, no reliable and exact data on the quantity being used is available for these sources, it is estimated that rural population is more dependent on non-commercial fuels, rather than commercial ones.

The third category of fuels available in India are non-conventional energy sources like solar, wind, tidal and Geothermal. Yet to be tapped commercially, these energy resources are supposed to have large potential and need an immediate initiation for exploration. These Energy resources are available in abundance and are non-pollutant one. The intensity of solar radiation is about 600 calories per  $cm^2$  per day, corresponding to about  $10^9$  kwh per  $km^2$  per year. Wind energy can be utilised in the areas where average wind speed of 8-10 kmph prevail, such as parts of coastal and hill regions, Gujarat, Maharashtra, Rajasthan and Karnataka. Hot springs in the country, which are sources of geothermal energy, have been identified to occur in 4 regions namely :

Punjab and UP

Narmada Sone Valley,

Damodar Valley in West Coast etc.

Electric power generation from tide may be possible where the tidal range exceeds 5 metres. Promising areas in the country are Gulf of Cambay. Gulf of Kutch and the Sundarban areas. The total power potential may not exceed about 1000 MW and the active amount that should be exploited economically would be even less.

### **Energy Demands**

To visualise the role of power in future, it is necessary to contemplate the entire energy spectrum, demand, availability and consumption etc. Broadly the total energy consumption in India has been

growing at an average rate 4.5% over the ten years period (1961-70) compared to the average world growth rate of over 5% per annum. Although, the total energy consumption has been growing at 4.5% per annum, which is not too low compared to world average, the per capita energy consumption in India has been rising at about 2 to 2.2% per annum, only over the past two decades, in view of the growth of population itself at the rate of 2.4%. If this rate is maintained upto the year 2000 the per capita consumption would rise to 1470 kgce comparing per capita consumption of 712 kgce in year 1970-71. This level of energy consumption will be only 30%, of the level of consumption in the advanced countries in 1967. This clearly indicates that there can be no reduction in the growing growth rate of energy until the turn of the century, since the per capita consumption even then will be far lower than the present per capita consumption in advanced countries. It would however, be our aim, to accelerate the development of energy consumption, so as to reach at least double the figure of per capita consumption i.e. 3000 kgce per capita.

With the present energy demand and consumption it is estimated that our requirement of fossil fuels and fissile fuels is going to increase tremendously. Two sets of estimate, of requirement are made for the year 1978-79, 1983-84, 1990-91 and 2000. The first set (a) assumes that oil prices will stabilise to US \$ 5 per barrel by 1978-79 as OPEC cartel would break-up and fuel substitution will take place, which is justified by such an oil price. The second set (b) is based on the assumptions that relative prices of fuels will remain at the level of early 1974, and substitution of oil products by other fuels in areas where techno-economic feasibility exists.

*Estimated Requirements of Fuels (in original units)*

	*Coal 10 <sup>6</sup> tonne	*Oil 10 <sup>6</sup> tonne	Electri- city 10 <sup>3</sup> kwh	Fire wood 10 <sup>6</sup> tonne	Animal Dung 10 <sup>6</sup> tonne	Agrī- cultural Waste 10 <sup>6</sup> tonne
1970-71	66	18	56	123	67	36
<i>Case 'a'</i>						
1978-79	135	34	120	122	65	46
1983-84	201	48	200	131	65	46
1990-91	339	77	385	122	53	46
2000-01	600	147	670	89	40	46
<i>Case 'b'</i>						
1978-79	146	30	128	32	65	46
1983-84	218	39	211	131	65	46
1990-91	365	57	398	122	53	46
2000-01	650	97	700	89	40	46

\*Including coal and oil used in generating electricity and non-energy sector.

In *Case a* the requirement of coal is expected to go up from 66 million tonnes in 1970-71, 135 mt. in 1978-79, 201 mt. in 1983-84, 339 mt. in 1990-91 and 600 mt. in 2000-01. The requirement of oil products are to go from 18 million tonnes in 1970-71 to 34 mt., 48 mt. 77 mt. and 147 mt. in 1978-79, 1983-84, 1990-91 and 2000-01 respectively. The demand for electricity is expected to grow to 120 billion kwh, 199 billion kwh, 385 billion kwh and 670 billion kwh in these years.

In *Case b* oil is being substituted by coal and electricity and the requirement of oil in 1990-91 is brought down by 20 million tonnes from 77 million tonnes in *case a*. However, to achieve this reduction addition of 26 mt. of coal and 13 billion kwh of electricity are required. The requirement of oil in 2001 for *case b* is 50 mt. less than in *case a*. This is achieved by using additional 50 mt. of coal and 30 billion kwh of electricity. Substantial reduction in oil requirement is due to reduction of use of high speed diesel oil by Transport (Rail & Road) made possible by increased electrification of railways.

The requirement of coal, oil and electricity in *case b* for 2000-01 are 650 mt., 97 mt. and 700 billion kwh respectively.

Comparing these estimates of 2000-01 it is observed that these are 10 times, 5 times and 13 times larger, than the fuel requirements in 1970-71.

#### *Required Growth in Fuel Supply (Case b)*

	Requirement in		Ratio of requirement in 2000-01 1970-71	Annual growth Rate (com- pound)
	1970-71	2000-01		
Coal *mt. . . . .	66	650	9.90	8.0
Oil mt. . . . .	18	97	5.40	5.8
Electricity 10*kwh . . . . .	56	700	12.50	8.8
MW . . . . .	14709	162000	11.00	8.3
Firewood mt. . . . .	123	89	0.72	..
Animal Dung (mt. dry) . . . . .	67	40	0.60	..
Agricultural Wastes (mt.) . . . . .	38	46	1.21	..

\*Including coal required for electricity generation.

The table shows that very large increases are required in coal mining and electricity generation. Simultaneously enhancement of transportation & transmission capacity is also necessary. This will require large investments in coal mining industry and in railways.

*Investment requirements for Coal Mines (1974-75 to 2000-01)*

	Present capacity mt/yr	1974-75 to 1978-79			79-80 to 83-84		84-85 to 90-91		90-91 to 2000-01	
		*Rs. tonne	Addl. prod. mt/yr.	Investment Rs. Crs.	Addl. prod. mt/yr.	Investment Rs. Crs.	Addl. prod. mt/yr.	Investment Rs. Crs.	Addl. prod. mt/yr.	Investment Rs. Crs.
Open cast . . . . .	20	80	19	152	27	243	80	880	180	2430
Shallow underground . . . . .	60	100	35	350	37	426	50	675	78	1400
Deep underground . . . . .	6	150	6	90	8	136	17	340	27	730
Total case b . . . . .	86		60	592	72	805	147	1895	285	4560
Similarly Total case a . . . . .			42	483	67	748	135	1726	261	4190

∞

\*An escalation of 3 percent per year assumed for subsequent periods, the investment rates in Rs/tonne become 90,155 and 170. For 1979-80 to 1983-84, 110, 135 and 200 for 1983-84 to 1990-91 and 135, 180 and 270 for 1990-91 to 2000-01.



As India is poorly endowed with prime coking coal, washeries would be required for washing the coal. It will also involve huge investments expenditure—as shown in Table :—

*Investment in washeries*

	1974-75 to 1979-80	1979-80 to 1983-84	1984-85 to 1990-91	1991-92 to 2000-01
1. Total Metallurgical coal required (mt.) . . . . .	32	53	90	190
2. Existing capacity* at the beginning (mt. yr.) . . . . .	20	27	47	83
3. Coal not requiring washing (mt)	5	6	7	10
4. Additional washery capacity required mt/Yr. . . . .	7	20	36	97
5. Investment required** in Rs. crores . . . . .	25	72	130	350

\*In terms of coal fed.

\*\*Rs. 36 tonne of Coal fed (at 60% yield rate this amounts to Rs. 60 tonne of washed coal).

In the year 1970-71 when coal consumption was 66 million tonne the number of wagons loaded were 2,101,8000 in broad gauge and 3,40,900 on metre gauge. These constitute 25% and 5% of coal wagons loaded in the two gauges respectively. Thus the estimated more than nine fold increase in the required coal production by 2000-01 will call for a massive expansion of railway capacity.

*Oil*

The steep increase in oil prices in the last two years has made the oil problem an acute one. Of the estimated annual consumption of 32 mt. in 1978-79, only 37% is expected to be received from indigenous resources. In the year 1973 our crude production had gone upto 7.2 million tonnes and consumption of petroleum products remained at 23.5 million tonnes. In the subsequent years also the trend of production and consumption is marginally increased.

The world wide energy crisis resulted in reduced consumptions with appropriate steps enforced to save crude oil. Despite reduced consumptions, the import of crude of petroleum products was about 16.9 million tonnes, involving an expenditure of Rs. 1120 crores as compared to the imports value of Rs. 345 crores and Rs. 200 crores in the years 1973 and 1972 despectively. The oil estimates for energy

and industrial sector for the 1978-79, 1983-84, 1990-91 and 2000-01 are given as below:—

*Requirement of Oil Products*

(in million tonnes)

Name of production	1978—79		1983—84		1990—91		2000—01	
	Case A	Case B	Case A	Case B	Case A	Case B	Case A	Case B
<b>I. Energy Sector :</b>								
L.P.G. . . . .	0.73	0.73	1.20	1.20	1.98	1.98	2.0	3.0
Motor Gas . . . . .	2.10	1.91	2.55	2.32	3.36	2.93	5.0	4.4
Kerosene . . . . .	3.40	3.12	4.40	3.81	6.09	5.01	9.6	8.0
A.T.F. . . . .	1.50	1.38	2.65	2.26	6.12	4.38	9.0	7.0
H.S.C.O. . . . .	10.70	8.72	15.20	12.15	27.91	19.48	66.2	38.8
L.D.O. . . . .	2.05	1.90	2.60	2.09	3.70	2.71	6.0	4.4
<b>Furnace OIL :</b>								
(i) Used for power generation and industries	5.50	4.20	7.20	4.87	10.15	6.40	16.5	9.5
(ii) Coastal Bunkers . . . . .	0.23	0.23	0.40	0.40	0.60	0.60	1.2	1.2
(iii) International bunkers . . . . .	0.18	0.18	0.35	0.35	0.40	0.40	1.0	1.0
(iv) Others . . . . .	0.33	0.33	0.45	0.45	0.70	0.70	1.2	1.2
Total . . . . .	26.72	22.70	37.00	29.90	61.01	44.59	119.5	78.0
<b>II. Other than Energy Sector (Industrial)</b>								
	7.69	7.69	10.85	8.99	16.47	12.25	25.5	19.0
Grand Total I & II . . . . .	34.41	30.39	47.75	38.89	77.48	56.84	145.0	97.0

In view of extensive on-shore and off-shore oil explorations experts reasonably believe that by mid eighties, our country may attain self-sufficiency. The fuel Policy Committee estimated demand for oil products in 1983-84 as 48 million tonnes. It is hoped that country will be able to produce about 14 million tonnes of crude on-shore and another 14 million tonnes from off-shore, in the mid eighties. Increased production of crude oil would require large investment in exploration, drilling, setting up facilities both on-shore and off-shore, laying pipe lines, tanker provision, creation of new oil refineries etc. This would need a sizeable amount of investment with major foreign exchange component. The statistical estimate have drawn that by 1985, world needs of oil would require to spend about \$ 220 million per day in the 1970 prices. In India we have to explore all the possible economic in the production and consumption of oil. It should be emphasised that future oil consumption be encouraged for producing higher value chemicals rather than being burnt as mere fuel. The following table gives the foreign exchange required to import crude oil.

*Foreign Exchange required to import crude oil*

Year	Requirement of crude oil mt.**	Domestic production of crude mt.	Imports of crude mt.	Foreign exchange	Foreign* exchange required for period ending (Rs. Crores)
1973-74 . . . . .	..	..	16	960	..
<b>Case a (price of crude oil Rs.300/tonnes)</b>					
1978-79 . . . . .	37	12	25	750	4800
1983-84 . . . . .	51	16	25	1150	4950
1990-91 . . . . .	82	25	57	1710	10300
2000-01 . . . . .	154	40	114	3420	26500
<b>Case b (price of crude oil Rs.600/tonnes)</b>					
1978-79 . . . . .	32	12	20	1200	5520
1983-84 . . . . .	41	16	25	1500	6900
1990-91 . . . . .	60	25	35	2100	12300
2000-01 . . . . .	103	40	63	3780	30200

\*Based on linear extrapolation.

\*\*Including refinery losses.

Along with this huge investment would be needed for exploratory work, laying pipe lines, introducing new refining capacity etc. which are shown as below:—

	(Price of Oil Rs 3300* tonne)			
	1973-74 to 1978-79	1979-80 to 1983-84	1984-85 to 1991-92	1991-92 to 2000-01
Investment to meet oil requirement (in Rs. crores)	1080	1455	3145	4850

On analysing the figures and data, it is seen that the required import of crude oil would be around 114 mt. in 2000-01, and would need Rs. 6440 crores.

### *Electricity*

The electricity consumption is mainly by industries, Railways and irrigation pump sets. The present level of consumption is nearly 60 billion kwh, which may increase to 120 billion kwh by 1978-79, 200 billion by 1983-84, 400 billion by 1990-91. Similarly the present installed capacity of 20 million kw may be increasing to 34, 50 and 85 million kw respectively. The major share of electricity demands will be dependent on coal based thermal and hydro electric stations. The nuclear capacity in relation to the total will be small. The development in the nuclear field need to be considerably intensified, so that it would be in a position to contribute more significant shares in the long run.

### **Energy Utilisation**

It is quite apparent that coal will have to be the main fuel in the future and technologies from surveying, mining, transportation, utilisation, waste handling etc., have to be considerably enhanced and suitably coordinated to meet the increasing demands of 2000 A.D. Consequently, the technologies for improved coal mining, handling etc., have to be developed to keep pace with the future growing demand. Though it is foreseen that bulk coal consuming industries would be near coal fields, in some cases, the transportation problem would be inescapable. Therefore, the development efforts should not only be limited to efficient rail transportation but also cover alternative modes of transportation such as coastal shipping, slurry pipe line inland waters, ropeways etc.

The efficiencies of coal consumption will also require improvement, as present day methods of utilisation are not satisfactory. It needs development of alternative and more efficient methods of utilisation such as gasification fluidised bed combustion, dual cycles etc. A deliberate step to change over to coal and electricity as the alternative supply is inevitable. Electrification of Railways, coal based fertilisers, coal gasification, low temperature carbonisation for domestic needs, rural electrification for lighting and pumping etc., are some of the technologies to be developed for long term planning.

Greater emphasis has to be placed on improving productivity and utilisation of existing generation, transmission and distribution areas. The additional energy thus available will obviate the need for installing new generation capacity. Efforts to develop larger units of 500-1000 MW Unit capacity, at fewer locations, are to be emphasised. Some of the typical measures, that can lead to higher utilisation are training of station O & M personnel, maintenance of spares and services, better station management practices, pooling and dissemination of operational experience, integrated operations of neighbouring

grid systems, identification and reduction of system losses etc. Efficient generation techniques such as Dual cycles, MHD, fluidised bed etc. are the fields, which need R & D efforts as long term programmes. The increased generation will call for development of HV A.C. and D.C. transmission systems particularly HV DC transmission systems on a national basis to enable bulk power transfer from generating to consuming centres in a more efficient manner.

In view of the present extensive consumption of non-commercial energy sources such as cowdung, fire wood etc., alternative energy supplies such as solid fuel from LTC, Bio Gas, Solar Energy etc., should be developed. The use of bio gas plants which may solve rural problem of fuel as well as manure could be extensively popularised for rural areas.

### **Energy Needs**

Our energy needs will proportionately increase with rise in population. It is estimated that, if our population grows with the same rate as it grew between 1961 and 1971 by 2001. Our population will be 1110 million. Out of 1110 million, 310 million will be the urban population and 800 million will be the rural one. More energy will be needed for domestic and transportation purposes in urban sector, while in rural side it will be mainly for irrigation purposes. But overall, our main users will be industrial, transportation and agriculture sectors.

### **Domestic Needs**

According to the norms the per capita per annum energy used for domestic purposes are 40 and 38 tonnes of coal replacement for urban and rural areas respectively. This gives an idea that by 2001 energy needed for domestic purposes could be of the order of around 428 million tonne coal replacement. This takes into account the consumption of both commercial and non-commercial fuels used for domestic needs. It is estimated that about 45% will be the commercial fuel (Kerosene, Coal, LPG, Electricity) while consumption of 55% of non-commercial fuel indicates that even by 2001 the country would use large amount of firewood, animal dung and agricultural waste. Thus as usual, the use of the fire wood would result in deforestation, damaging the soil fertility and ecological balance. The animal dung, which could be used more efficiently for Bio-Gas or manure, will still be used more for burning thus reducing the available fuel value.

### **Energy for Agriculture**

The energy need for agriculture sector is mainly for water pumping for irrigation. Also the amount of Nitrogenous matter used as Fertiliser, is a form of energy used for agriculture. It is estimated that by 2000-01, 25 million pump sets would be electrified. The emphasis on Bio-Gas plants can reduce the consumption of oil to a

greater extent. Similarly, if an economical break through for solar pumps is achieved, energy problem for water pumping could be greatly eased; still we have to see the results of certain developments of solar pumps, to prove the viability of solar pumps utilisation.

The estimated amount of Nitrogenous Fertiliser required would be around 13.5 million tonnes in the year 2000-01. Out of this about 5 million tonnes would be obtained from bio-gas plant and by other means by the villagers. The remaining 8.5 million tonnes will have to be obtained from chemicals, fertilisers, requiring large amounts of Naptha. Fuel oil, Coal, Coke oven gas lignite and Electricity.

#### **Energy for Transport**

Transport sector is the largest consumer of oil, accounting for about 41% of total consumption which is still rising. It is foreseen that private vehicles, cars, scooters etc., will be increasing, thus using more energy with less utilising efficiency. At the same time, public mass transportation such as buses etc., would need less energy with considerable efficiency. It is estimated that 500 buses cost less than Rs. 5 crores, consuming 10 million litres of diesel per year and carry more passenger, trips, than 100,000 private cars costing Rs. 100 crores and consuming about 100 million litres of petrol per year. The urban planning, restricting the city sizes and making them dense and compact, not only travel will be reduced, but can also save high cost of transportation.

#### **Environmental Aspect**

With the increase of new technologies for power generation on coal, oil and nuclear energy will also create environmental hazards. Large scale burning of high ash content coal, nuclear radiations etc., have proved injurious to mankind. This may result in several chronic diseases thus affecting the health of future generation. Study of measures to check these hazards have to be initiated by the scientists and technologists. However, the advent of solar energy utilisation and other natural resources such as wind Tidal & Geothermal will be non-pollutant sources of energy, but their tapping is still to take the commercialising shape. On similar grounds the cow-dung burnt by rural people could be avoided by popularising bio-gas plants, thus solving the problem of pollution.

#### **Future energy strategy**

Though we shall continue to depend on coal and oil for a long time, initiation of R & D work on Fast Breeder Reactors and non-conventional energy sources such as solar, Wind, Tidal and Geothermal will go a long way to develop early break-through in developing new energy sources not tapped by mankind so far.

Keeping in view the best possible life style under broad framework of foreseeable resources position in the country, Some Scenarios have been suggested. These following Scenarios would predict and

unfold the spectrum of potentialities for the events, that are likely to take place in the future.

#### Scenario I

- \*The depleting conventional fuels and the need to conserve fossil fuels would initiate the interest of scientists and technologists to enter in the fields of non-conventional and renewable sources of energy.
- \*The decade of nineties would emerge with large thermal stations of 1000 MW capacity, feeding power to the National Grid.
- \*The end of 20th Century would witness the applications of Cryogenics to the electrical machines and the transmissions system, thus increasing the efficiency and reducing losses.
- \*The successful results of R & D on coal gasification, coal to oil conversion, topping cycle, fluidised bed combustion, MHD in conjunction with steam cycle etc. would lead towards better utilisation of fuels.
- \*The R & D on peaceful use of atomic energy, would yield Nuplex schemes, whereby the power would be generated, along with the desalting of water.
- \*The off-shore oil explorations have given a new hope, which may save a bulk of foreign exchange component. The oil being a precious commodity, would be encouraged to be utilised more for chemicals, rather than a mere fuel.
- \*The 21st Century would begin with the prospect of power systems mainly based on Solar Energy, supported by other regional non-conventional energy resources such as Tidal, Wind and Geothermal.

#### Scenario II

The alternate Scenario, suggests the following:—

With the increasing power demand, the higher rated thermal sets of 800-1000 MW capacity are envisaged. This would require a development in the technologies in the field of coal mining and coal transportation. Though coal is depleting day by day, still it is going to be our major fuel for the coming century. The coal utilisation in the form of gas and oil, would not only be a major break-through, but also an efficient utilisation of coal.

\*This will also bring the advent of new technologies such as MHD, Fluidised Bed, Gas Engine etc. Oil is still going to be the chief fuel for transportation and domestic sectors.

\*The use of oil for chemicals would only be encouraged, if some technology for alternate fuel is developed for transport & domestic sectors.

- \*The non-conventional energy resources such as solar, wind, tidal and geothermal are long term R & D projects and it will take a long time, till these are commercialised.
- \*The fast breeder technology is still at preliminary stage of R & D and no break through is foreseen in the near future.

#### **Preferred Scenario**

The preferred Scenario which brings us also into the zone of current day accelerated implementation is as follows:—

- \*As coal is going to be our major fuel, emphasis should be laid to develop coal technologies such as coal gasification, coal to oil conversion, fluidised bed etc. These technologies are going to open new fields such as MHD, gas engines, dual cycles etc.
- \*The R & D for non-conventional energy sources such as solar, wind tidal and geothermal could be taken as priority projects, though no immediate outcome is envisaged. These energy resources are going to prove more efficient, non-polluting and everlasting energy resources.
- \*Various institutes, organisations and manufacturing agencies should be encouraged to take up R & D in these fields of new energy resources. The academic institutes and manufacturing organisations could join hand, for a combined goal of harnessing every possible source of energy.
- \*Emphasis should be laid upon to develop rural energy needs of the remote corners where present energy approach is un-economic.
- \*A fixed amount, specially for energy development should be raised under one Energy Institute, so as to monitor and fund energy projects within the proper time schedule.

#### **Recommendations**

Following are the recommendations of the Futurology Group on Energy:—

1. A time to time survey be conducted by the various concerned Ministries, to keep abreast with the latest knowledge on reserves of conventional energy resources such as coal, oil, gas and hydro-electricity.
2. The R & D to tap New Energy Sources such as solar, wind, tidal and geothermal should be encouraged by various academic institutes such as IITs etc. and concerned public and private sector organisations. Separate funds should be allocated by Ministries, DST, CSIR etc. for R & D work on these energy resources. The break-through of which would result in an infinite source of non pollutant energy.
3. Emphasis should be laid to develop non-conventional energy sources for rural electrification. This will result into consider-



- able saving in power losses occurring in rural transmission and distribution system.
4. Efforts to instal larger units for 500-1000 MW unit capacity at Pit heads, should be emphasised.
  5. To improve upon utilization of installed generating capacity of Thermal Power Stations, typical measures such as training of station O & M personnel, pooling and dissemination of operational experience etc. should be taken up.
  6. To obtain better utilisation factor, integrated operations of neighbouring grid systems for different States should be adopted.
  7. For long term programmes R & D efforts should be initiated in the new and efficient generation techniques such as dual cycles, MHD, fluidised bed etc.
  8. The increased power generation would need the development of HV AC/DC transmission lines on national basis. A project-cum feasibility report by CET, BHEL and other concerned organisations should be prepared.
  9. The use of Bio-Gas plants should be popularised particularly for rural areas, as this will solve the rural problem of fuel and manure both.
  10. Transportation of fuel is going to pose a serious problem, alternative mode of transportation other than rail transport, such as coastal shipping, slurry pipe line, inland waters, rope ways etc. should be developed.
  11. A Survey/study for the future life style (2000-01 A.D.) the available resources, the consumption, the demand pattern for different sectors should be done by the concerned Ministries in association with academic institutes and the consultants.
  12. A stress to study the environmental aspect should be initiated, keeping in view the industrial, domestic and agricultural sectors using the conventional energy resources.
  13. Energy for Transportation—keeping in view the bulk amount of energy used by Transport sector, it should be emphasised to encourage mass transportation system rather than utilising the individual transport facilities.
  14. An emphasis should be laid upon to develop Fast Breeder Technology for nuclear energy, which with thermal reactor mix could prove a more attractive source of power than the conventional energy resources.
  15. Along with the development of energy sources, efforts are to be made to ensure conservation of energy in all sectors of economy.
  16. Total energy concept should be Introduced wherever practicable.

## APPENDIX I

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## II. HOUSING

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## II. HOUSING

### Introduction

The global problem of housing inadequacies, both quantitative and qualitative, is so overwhelming that precise data on need and supply is unnecessary for general purposes except to emphasize the magnitude of the requirements and arouse support for public action. Visual observations, in themselves, reveal the extent of the plight of the urban marginal income families whose squatter settlements ring the great and intermediate cities. The need, plus the stark realization that much of the need must remain unattended, leads to the equally obvious conclusion that conventional methods must be waived.

Of the various economic sectors, housing and construction is a major consumption sector, and it accounts for two-thirds of the gross domestic capital formation. The share of the residential sector in the construction industry ranges between 25 and 35 per cent. Yet, housing in India is inadequate and unsatisfactory. There is, thus, a need to understand the present housing situation and project demands of this sector in the future.

The cold calculations of input-output ratios have dominated postwar economic thinking in development economics. Housing, it was felt, called for a large input and yielded little output. The time is ripe, however, to shun orthodox economic theory of non-touchable attitude on housing in preference to a balanced social and economic development. There is an imperative need to recognize housing as a necessity of life next only to food and clothing, an employment stimulant, and a wise expenditure in terms of balanced growth.

### Scenario I : Present Status and Emerging Future

#### 2.0 *Prevailing Housing Situation : 1971*

Despite its achievements in different fields in the last quarter century, India has yet to adequately tackle one of its basic needs—that of housing for its teeming millions. Attempts either to understand the problem in its socio-economic environ or to evolve pragmatic standards or methods to combat it have been distressingly lacking. The 548 million people in the country live as 97 million families (households) and have for shelter 93 million houses (housing units). The housing situation in the country is not as bright as the ratio of households to housing stock (1.05 : 1) may seemingly suggest. In addition to the present shortage of four million houses in the country about 19 million houses are far below the standard of habitation. Thus, for practical purposes the total housing deficit is at least of the

order of 23 million dwelling units. Moreover, the increase in the household size from 4.9 persons in 1951, to 5.2 persons in 1961, to 5.7 persons in 1971 has, to some extent, lessened the pressure on housing stock during the past two decades. Consequently the number of persons per house has increased from 5.6 in 1951 to 5.9 in 1971. The number of rooms per housing unit have remained constant at 2.1 during the past ten years. As compared to 0.8 and 1.6 persons per room in West European and East European countries respectively there are 2.8 persons per room in India in 1971.

About two-thirds of the urban households are concentrated in the middle income group (Rs. 101-500), and 43 per cent earn more than Rs. 200 per month. Insofar as the rural households are concerned, about one-half comprise the low income group (below Rs. 100) and 82 per cent earn below Rs. 200. The average household income in urban and rural areas is Rs. 3,660 and Rs. 1,850 per annum respectively. A picture of urban affluence and rural poverty emerges from the foregoing analysis.

About 75 per cent of the households in the 'below Rs. 100' income group live in one-room or two-room accommodation. More than 85 per cent of the households in the two income groups above Rs. 500 have three or more rooms. Further, about 59 per cent of the households in the 'above Rs. 1,000' income group have five or more rooms.

In the income group 'below Rs. 100', about 77 per cent of the urban households, as compared to 91 per cent of the rural households; and in the income group Rs. 101-200, 59 per cent of the urban households, as compared to 86 per cent of the rural households, are without amenities. As expected, a much higher percentage of the urban (94 per cent) and rural (59 per cent) households are provided with amenities in the highest income group. Amenities available to the urban households in the middle income group in urban areas correspond with the level of amenities enjoyed by the highest income group in rural areas. The tenure pattern of households has not undergone much change during the past decade. Disparities in tenure status in urban and rural areas are apparent. About 94 per cent of the rural households as compared to 47 per cent of the urban households, have their own houses. The ownership rate is high in the low and highest income groups in urban areas, as compared to the middle income groups in rural areas. People who live in their own houses, whether in rural or urban areas, generally occupy more rooms.

It is observed that less than 12 per cent of the households in India live in houses built with pucca roofing materials like concrete, asbestos, G. I. Sheets, etc. Tiled and thatched-roof houses share about equally between them 76 per cent of the households. The remaining 12 per cent of the households live in houses built with other katcha roofing materials.

It has been estimated that housing deficit will be anywhere between 23 to 26 million units. The deficit of housing is maximum felt in the income group below Rs. 100. Two-thirds of total deficit accrue from this income group. It is observed that the housing deficit income group Rs. 101-200 and Rs. 201-500 is about 21 and 13 per cent respectively.

Four out of every five houses in rural India are without basic amenities such as water-taps, latrines and bathrooms. Only thirteen per cent of the rural households reside in a structure built with permanent building materials, but, surprisingly, a mere five per cent live in rented houses. Despite the concentration of India's four-fifths households and housing stock in the rural sector, its housing needs have been paid scant attention. For example, the Fourth Five Year Plan provides but less than one-fifth of the total plan outlay for rural housing. Added to this is rural poverty. In comparison, urban households have better housing structures and easier access to basic amenities. Every other urban household has a structure built with permanent and semi-permanent building materials, and has basic amenities. The majority of them are sheltered in just one or two-room houses: thus, they unwittingly add to urban congestion. But, we are adding more babies to the population than the number of shelters to the housing stock, and the housing gap widens with every passing year. The gap between the decennial growth rate of households and that of housing stock between 1951-61 and 1961-71 is bound to create unprecedented pressure on housing in the country, if it is allowed to go unchecked.

### 2.1 *Housing* : 1971-2000

Between 1971 and 2000, households are expected to increase anywhere between 102 and 125 million. Contrary to the trend in the past, the expectation is that the household size during the coming three decades will decrease from 5.7 in 1971 to 4.7 or 4.5 in 2000. The decreasing household size coupled with the increase in the per capita income evidently means a spurt in the future housing needs. Moreover, until 2000 A.D., the growth rate of households is seen higher than that of population.

In computing housing needs, care has been taken to account for inter-action of related factors such as population, economy, completions, demolitions, vacancy rate, and available housing stock, under low and high growth rates which are termed as unfavourable growth rate (i.e. low economic growth and high population growth) and favourable growth rate (i.e. high economic growth and low population growth). Different methods have been used in estimating the perspective of each factor upto 2000 A.D. Details are available from the ORG Study —A Long Range Perspective for India, Housing 2000 A.D.

The completions by 2000 A.D., is estimated at 53 million housing units under unfavourable conditions and 79 million housing units

under favourable conditions. The demolitions for the same period may vary anywhere between 1.5 million and 20 million units depending upon the demand and supply of housing. It may seem unlikely for India to achieve a positive vacancy rate during the next thirty years because of its vast housing needs.

India may reach the billion population mark just before the beginning of the next century. The available housing stock at that time is estimated to touch between 126 million and 170 million housing units. Today, 105 households manage with 100 houses. In the year 2000, 153 households may live in the same number of houses under unfavourable growth rates of related factors. The housing situation under favourable growth rates also deteriorates, i.e. there will be 120 households per 100 houses. Thus, in either case, no far-reaching improvements are likely by the turn of the century. Further, 65 to 71 per cent of the housing stock is expected to consist of houses built with semi-pucca and katcha building materials. It is observed that a minimum of 75 per cent of the rural households, as compared to 35 per cent of the urban households, are likely to have tiled—and thatched-roof houses in 2000 A.D.

The urban households with amenities increase from 50 per cent in 1971 to 63 per cent under unfavourable growth and 73 per cent under favourable growth. On the contrary, 76 per cent and 66 per cent of the rural households in 2000 A.D., under unfavourable and favourable growth will be without exclusive amenities. Moreover, the rural scene may not change significantly—66 to 76 per cent of the rural households will have no basic amenities for their exclusive use. That is to say, two-thirds of the total households in the country will be without exclusive basic amenities.

## *2.2 Desired rate of net additions to Housing Stock*

In order to meet the housing needs of the country, under favourable and unfavourable conditions of determining factors, the housing activity has to be greatly accelerated. The expected rate of completions (new houses) per 1000 population should be stepped up by 3.6 times during 1971—81, 2.6 times during 1981—91, and 2.4 times during 1991—2000 under unfavourable conditions. Under favourable conditions, the desired rate of completions should be 3.1 and 1.7 times higher than the expected rates of completions during 1971—81 and 1981—91 respectively.

The decennial rate of completions in the developed countries of the world is observed to be between 80 and 120 per 1000 population. The United Nations has also recommended a decennial addition of 100 dwellings per 1000 population for Asian and Far Eastern countries. In so far as India is concerned, even half as many completions as recommended by the UN. will considerably ease the pressure on housing in the country.



This analysis brings into focus rather depressing housing conditions in the country. Since the growth rate of households, or demand for housing, outweighs completions, people will be forced to inhabit houses otherwise only fit for demolition. Improvements on the housing front that one would generally associate with rising per capita income in the country are not likely to be realised. The emerging scenario is pretty grim characterized by housing shortages both qualitative and quantitative.

### 3.0 *Building materials & other resources requirements*

Compared to the scale of housing demand the national resources are tragically low. For instance, the income of 25% of the families in India will buy them about 2M<sup>2</sup> of built up construction, the next 50% can buy upto 5 M<sup>2</sup>. Nor is it merely a matter of finance; steel, cement, and other material resources are equally crippling constraints.

The following resources deserve attention:

1. Finance;
2. Building Materials;
3. Land; and
4. Skilled and unskilled labour.

### 3.1 *Finance*

Investments in housing have been too meagre to have any impact on the situation. It is estimated that the housing needs of the country could be fully met if expenditure on the residential sector is raised from the less than one-sixth to about one-third of the projected expenditure on the construction industry.

Households that do not afford to own houses and, therefore, need subsidy may range between 50 million to 92 million in the year 2000. (12-13 million in urban areas and 37-70 million in rural areas).

Subsidies ranging between Rs. 335 billion and Rs. 610 billion are required if all the low and middle-income groups were to be provided with a standard R.C.C. house at rates prevailing in 1971. The enormity of required subsidies calls for changes in the prevailing housing concepts. Priority should be accorded to shelter masses, specifically those in the low-income groups, in other than permanent, but fairly habitable houses. In a tropical country like ours, environment built by open space around a shelter is no way less important than a shelter provided with roof, particularly for the low income households.

Ways and means should be explored to bring down the unit costs. For example the cost of a 385 square feet of thatched house, or 200 square feet of tiled house, or 125 square feet asbestos house or 70 square feet R.C.C. houses, is approximately same. This may give an idea how a variable can be put to use for an optimum utilisation of financial resources as well as human needs. By enforcing revised

standards (as to type and area of a standard house), households that do not afford a standard house are reduced to between 17 million and 45 million. Required subsidies will accordingly come down to anywhere between Rs. 7 billion and Rs. 20 billion during 1971 and 2000. In any eventuality, the cost of a house remains beyond the paying capacity of a household in the lowest income group.

### 3.2 *Building materials*

Adding severity to an already perplexing problem is the likely shortage of key building materials. Of the four key building materials, cement and steel are produced in the organised sector, whereas, the brick and timber are not so. It is estimated that requirements of cement and steel may increase between three-folds and seven-folds by 2000 depending upon growth of population and economy. To meet the rising demand of cement and steel in the construction industry, an annual growth rate ranging between 4 per cent and 7 per cent is called for. The annual demand for bricks in the construction industry in the year 2000 will vary between 78 billion and 162 billion. Annual requirement of timber in 2000 is expected to increase four to eight times.

It is difficult to predict whether timber will be replaced by any other material, but shortage of primary species of timber may be felt. Scarcity of cement and steel in the domestic market has been in evidence in the past years because of the governmental policy to curb local demand for exports to West Asian and Far Eastern markets to earn foreign exchange. Besides, production has also not kept pace with fixed targets. It implies that production of cement and steel needs to be geared up beyond the plan targets of local and export demands are to be met. Increased production, however, presupposes allocation of larger capital investments than those presently apportioned under the Fifth Five Year Plan. Local substitutes will either have to be found or developed to overcome scarcity of cement and steel. The lime industry which has suffered a long period of neglect may have to be revived either in its conventional or newly developed forms.

### 3.3 *Land*

Space is a scarce resource.

The physical landscape of India is bound to undergo a major transformation by the year 2000 in view of constantly growing requirements of food and shelter for its multiplying millions. Total land requirements of the residential and non-residential sectors are estimated at 18.4 million to 21 million acres. This means that 4.2 million to 7 million acres of additional land will be required for new habitation centres.

Additional land requirements, when compared with India's total geographical area, look insignificant; but, a well-defined land-

policy is urgently needed especially for concentrated habitation centres which present conflicts and imbalances as acute as dearth of land. Sporadic laws on land-use enacted by various local development authorities have hardly been adequate.

### 3.4 *Labour demand*

Labour force employed in construction industry is seen to vary between 2 and 6 per cent in the developing countries and between 6 and 10 per cent in the developed countries. According to 1971 census estimates, only 1.2 per cent of the total labour force in the country is engaged in construction activity. The low proportion of labour force in the construction industry may be because of exclusion in the census data of marginal and seasonal employment. It is estimated that the labour demand in construction industry will be 5.3 million under unfavourable conditions and 6.8 million under favourable conditions. About 25 per cent of the projected labour force may constitute marginal and seasonal employment in the industry. On the basis of prevailing ratio of employment between construction and linkage industries (1 : 1.43), it is estimated that labour demand of construction industry and linkage industries in 2000 A.D., will be more than 10 per cent of the total employment in the country.

### **Scenario II : Preferred Future & Strategy**

The preferred Housing future envisages provision of decent shelter to at least the majority of our citizens with adequate potable water supply and drainage and sewerage facilities. Objective is to permit a "Lifestyle" that is harmonious with the nature and environment. This demands altogether different requirements of Rural Housing from that of Urban Housing. The common feature of the two would be extensive use of locally available materials. To optimize the use of space and other resources, type designs suiting local climatic conditions and requirements will have to be developed for Rural as well as Urban areas. Another aspect of preferred Housing Future would be the absence of bursting megalopolises achieved through implementation of Land Use Policy and Population Dispersal policy.

Detailed housing studies must incorporate the two major aspects:

- (a) Technical; and
- (b) Behavioural.

### 4.1 *Technical Aspects*

Two types of parameters have a bearing on the housing problem and they relate to—

#### 1. *Software*

Under this must be considered the evolution of house designs suitable for the conditions in the year 2000. What type of a house design would we need? This has to be viewed in the light of energy

cost (alternatively, solar energy utilization may be looked into) and conservation of other resources. Evolution of house design utilizing solar energy needs to be taken up right now.

## 2. Hardware

Development and production of substitute building materials is essential to ease the pressure on traditional materials like cement and steel. Knowhow for the production of substitute materials already exists but their public acceptance is still to be established.

Mass fabrication techniques are still not used in the country primarily because of the higher cost of components thus produced. Because of the labour intensive economy, large scale prefabrication is not advisable but it is absolutely essential that such prefabricated components be made cheaply available in the market that do not require use of cranes and other sophisticated machines in their erection. Availability of components would provide a strong incentive to construction of new dwellings.

### 4.2 Behavioural Aspects (Life styles)

Ours is a traditional society. Certain aspects of our life style are amenable to change and the others not. Detailed studies are sadly lacking in this field with the result that the design of a house is tailored more to the concepts and ideas of the architect rather than the needs and aspirations of the user. Also, what the user ideally wants may often be beyond his paying capacity.

Closely related to the Life style are the Space Norms. Human behaviour determines norms. For example, overcrowding can develop neurorisis, therefore, such a study can lead to realistic Space Norms. Anthropometric studies are thus wedded to behavioural aspects. Our space norms need to be revised in the light of space constraints.

### 4.3 National Housing Policy

All these aspects need to be given due weightage while evolving National Housing Policy. The complex housing problem requires concerted national effort, which in turn demands a well thought out and balanced National Housing Policy if we ever wish to meet the acute housing shortages in the rural as well as the urban areas of the country. *Housing policy must not be viewed simply as an instrument to provide shelter but rather as an instrument of social policy to achieve growth with social justice.* To achieve these objectives it must clearly define:

- the "Settlement Pattern" for the overall development of a region;
- proper Land-use Policy;
- ways and means to check population growth and its dispersal;
- strategies for slum/squatter clearance;

- evolve uniform need based standards by rationalising the scales of accommodation;
- provide for the production and use of new/substitute building materials; and
- ensure adequate financial provisions for housing.

It may be observed here that developing a strategy for implementation of Housing Policy is as important as the evolution of the Policy itself.

The following aspects of the Housing Policy are being specifically mentioned because of their special significance on the housing problem.

#### 4.3.1 *Population and its Dispersal*

When can we reasonably expect to achieve zero population growth? This is the most important question. A realistic expectation would be to achieve Net Reproduction Rate of 1.00 i.e. fertility decline to replacement level, by the year 2000. That would give us a population of 948.3 million at the end of the century.

Whatever the population in 2000, there is need for dispersal so that available resources could be more gainfully utilized. Population dispersal would also check migration to the cities. Population dispersal may be achieved through :

- (1) Registration-cum-Reception Centres in cities that would work in close liaison with Employment Exchanges and permit migrants to live in a city only if a job is available.
- (2) Investments in metropolises and big cities to be regulated and gradually brought down to zero so that smaller cities can grow and new settlements can come up.
- (3) Licensing policy modified to prohibit new industrial location within 50 miles of metropolitan cities. Location of industries and new industrial towns should aim at achieving balanced regional growth as far as possible so that population also gets equally distributed.
- (4) National subsidies for urban facilities like transport, communication, health care etc. to be stopped. (No rationale for subsidising a minority Urban poor against the majority rural poor).
- (5) An integrated system to be developed to plough back the rural resources into the rural sector itself.
- (6) Benefits available in urban centres like education facilities, entertainment, health care etc. to be provided in the rural areas also.
- (7) Creation of Market towns and Growth Centres for integrated rural and regional development for curbing migration to the cities.

### 4.3.2 *Land-use Policy*

All land-use in the country should be divided into the categories:—

- (i) land for agriculture,
- (ii) land for construction—residential and industrial.

Price of agricultural land should be low and permitted to fluctuate within very narrow limits only, whereas the prices of land for construction can follow market trends.

This task may be entrusted to the Land use Commission. Proper Land-use Policy shall take away from non-professionals and politicians, the power to decide the location of industries, commercial centres and other development projects etc, and thus prevent the haphazard sprouting of new colonies and cities.

### 4.3.3 *Squatter/Slum Clearance*

Migration to urban areas has caused problems of accommodation, utilities and services of a magnitude that existing centres can not meet. Migrants usually occupy whatever land is available and construct huts and shacks from materials like mud, bricks, tin, wood, canvas etc. No water supply, coupled with absence of drainage facilities, creates filthy surroundings. The huts keep multiplying to grow into a cluster and eventually into a full scale slum/squatter settlement.

Majority of the squatters are engaged in the Informal Sector activities and the others are usually industrial and construction workers. It is imperative, therefore, that any slum clearance operation should cause minimum dislocation of the dwellers. It is proposed, therefore, that—

1. All new residential colonies should make adequate provision to house the informal sector workers likely to be employed in that colony.
2. Provision of adequate housing and other necessary amenities like potable water supply, toilet facilities etc. to the construction workers should be made the responsibility of concerned contractor. He may choose to provide mobile wooden huts or any other satisfactory shelter to his construction crew.

## 4.4 *Housing Strategies*

As the conventional methods must be waived to find feasible solutions to the complex housing problems, a number of experiments have been undertaken throughout the world with variable degrees of success. The following two strategies are pertinent to the Indian context.

### 4.4.1 *Aided Self-help/Incremental Housing*

Aided self-help as a means of providing shelter is sometimes looked upon as the panacea of all the housing woes of low-income families. Aided self help is a method to utilize the many men-hours that are

available in most areas in the form of unused leisure time—and to use this enormous reserve of manpower together with some form of aid from the community, or others, so that man may, through his own efforts, using his own spare time, improve his shelter to an extent that he never could—alone and unaided.

Aided Self help can be:

Individual Aided Self-help: Each family works on its own house only.

Mutual Aided Self-help: A group of families works as a team.

Self-help/Hired Help: An experienced worker is hired to perform the main work, and the family serves as construction labourers.

*Land and Utilities—Sanitary Cores—Shell Housing—Minimal Housing*

Aided self-help is a principle which may be adapted to a wide variety of techniques, but it must be tailored to the income as well as skills, availability of leisure time, and temperament of the participants. When properly conceived, organized and administered, it can result in completely unsubsidized projects. Even when applied to those segments of the population whose income is so low as to require some form of subsidy if they are to be decently housed, it can reduce the amount of subsidy needed. The form of aid may vary but usually it consists of the following:—

- \*Aid in obtaining land and utilities;
- \*Aid in obtaining building materials and equipment;
- \*Suitable building plans;
- \*Technical supervision; and
- \*Group organization.

There are a number of shelter forms to which such aided self-help is applicable so that different levels of low-income families can be accommodated. Generally, these can be categorized as “land and utilities” (sometimes referred to as “sites and services”), “sanitary cores”, “shell” housing, and “minimal” housing.

\*Land and utilities, as its name implies, is land supplemented by water and sanitation, or access to water and sanitation. In some instances, the utilities may consist of communal water taps in the streets and communal or individual privies. In other cases, utilities may be water-borne sewage and water connections. This form places the least financial burden on the beneficiary of land tenure.

\*Sanitary cores are one step above and denote a contractor built sanitary unit containing water and latrine or water-borne sewage with the expectation that the shelter itself will be the

responsibility of the occupant. Sometimes, such sanitary units are free-standing, at other times they may be back to back at lot intersections.

\*Shell housing is expansible housing designed for expansion internally or externally as occupant's income permits. It connotes less of a complete house than the "minimal" house which may also be designed for expansion. In the latter case, the unit is more apt to be a self-contained home with the amenities but not the space standards needed for the enlarging family.

Site and Services schemes are under implementation in India under slum clearance programmes. The biggest advantage of incremental housing lies in the fact that the additions to the house can be made as and when the financial resources of the owner permit. This scheme is ideally suited to Indian conditions because the available resources at any given time are so meagre that construction of conventional house would simply be a dream.

#### 4.4.2 *Community Housing*

In India, we have a long tradition of habitation patterns which permitted, at a micro level, the community feeling especially in villages and small towns. Community feeling is enhanced by such factors as common use of spaces, unobstructed visibility, use of a common well etc. The dwelling units can therefore be so grouped as to permit use of spaces by children, men and women. The grouping can permit withdrawal and privacy if one household does not wish to participate in neighbourly life-activities. Five to fifteen houses can be clustered around each main open space.

We are interested in community housing not merely because it provides social comfort, amusement and a sense of security to the residents, but because it provides a satisfactory life style while maximizing the use of available space. It will be a step towards optimal use of resources if the community Housing concept could also incorporate idea as community kitchen and community labour pool etc.

#### **Recommendations**

Major recommendations of the Housing Group are listed as under:—

##### 1. *National Housing Policy*

It is imperative to evolve a National Housing Policy so that efforts can be directed towards a speedy solution of the housing problem.

Housing policy must not be viewed simply as an instrument to provide shelter but rather as an instrument of social policy to achieve growth with social justice. To achieve these objectives, it must clearly define:



- the “Settlement Pattern” for the overall development of townships;
- a proper land-use policy;
- ways and means for dispersal of population and to curb the influx of migrants into metropolitan cities;
- means for slum/squatter settlements clearance;
- evolve uniform need-based standards by rationalising the scales of accommodation;
- provide for the use of new substitute building materials; and
- make adequate financial provisions as investments in housing thus far have been meagre.

## 2. *Investments*

In order to achieve the U. N. recommended decennial rate of dwelling additions of 100 dwellings per thousand population more funds must be made available for housing construction.

Establishment of a Rural Housing Development Corporation on the lines of HUDCO should be expedited so that funds may be made available for rural housing as well.

## 3. *Slums Clearance*

- (i) All new residential colonies must make adequate provision for the housing of those prospective workers who will find employment in the Informal Sector activities in that neighbourhood;
- (ii) Provision of adequate housing to the construction workers should be made the responsibility of the concerned contractors.
- (iii) Squatters and slum dwellers who must be displaced and are provided with service-sites should also be provided with subsidised transport to and from their work places at least during the transition period of 3 months when they may be able to seek jobs nearer to their new abodes.

## 4. *Housing Designs & Norms*

- (1) Work should be initiated to evolve house designs that would utilize solar energy for heating and cooling purposes.
- (2) Space norms and density standards are outmoded and need to be revised for rural/urban houses.
- (3) It is essential to evolve uniform need-based standards by rationalising the scales of government accommodation. This will do away with the paradox of an aged couple, with children at the university or well settled in life, occupying a palatial 5-7 roomed villa while a junior executive with three kids finds himself crowded in a one bedroom apartment.

5. *Miscellaneous*

- (i) Single storeyed residential construction should not be permitted by public agencies at least,
- (ii) Five storeyed, walk up, row housing should be encouraged,
- (iii) The present trend of providing accommodation near the city centre to senior officers should be reversed so that lower and middle management level employees who cannot afford their own transport are accommodated nearer to their work places. This is of particular relevance in case of Delhi.

## APPENDIX I

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### III. TRANSPORT DEVELOPMENT

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### III. TRANSPORT DEVELOPMENT

#### 1. General

The stimulation of developing economies mainly depends, besides other factors, on the development of transport, which exerts a great deal of influence on the economy, enhancing productivity, inducing the market, providing stimuli to the economic activities and bringing in remote areas nearer. The nation's transportation system is both a major component of the national economy and an important factor in shaping our life style, community development and industrial location patterns. Viewing from this background of required dominant transport development, it is time to appraise as to where does the transport system in India stand and analyse to find out the lines of development for future so as to make it to occupy the proudful position to contribute to the economic and social life of about 960 million people in the year 2000 A.D. The transport system in India has often prove to be a major hurdle in the nation's march towards unity, progress and prosperity, due to the absence of comprehensive long-range planning. The need for such long-range planning was rightly emphasised by the Committee on Transport Policy and coordination in the following words, "it is essential to take a fairly long-term view, both because decisions in the field of transportation commit resources for the future and are not reversible at short notice and because allocations of traffic have the positive aim of promoting or stimulating action on the part of users and operators which may best subserve the overall interest of economy over a period of years". Since transport programmes involve huge capital investments which act as inputs for the future economic and social activities, and also to determine their course, besides being the torch-bearer of the advancement of economic civilization, a study in futurology is an essential prerequisite for long-range planning.

The predicted population of the nation is likely to be around 950 million in 2000 A.D. and the vision of transport future scenerio is likely to be three times of the existing passenger traffic and four times of the freight traffic. The passenger traffic and goods traffic are liekly to reach in 2000 A.D. staggering figures of 1000 billion passenger kilometres and 1000 billion tonne kilometres respectively.

#### 2. Research on Transportation Futurology

The future always in its wake bring a structural transformation, the seeds of which are difficult to trace either in the past or even in the present. This fact complicates the task of futurologists and render

even known econometric models less dependable for predictions of the distant future. Decisions in the field of transportation involves massive investment expenditure for new facilities and equipments and also have profound and lasting impact on regional economic development, limiting patterns of future growth and the environmental quality. Hence, the development of scientific research should be more oriented to result knowledge, insight and technique to make more effective policy decisions. The problems of transportation transcends national boundaries and are universal in their implications. So a common attack on these problems appears to be natural and desirable. More attention has to be paid to human factors, particularly to the needs and requirements of present and potential users. The provision of transport is a service to the community and adequacy of that service should be judged not merely by its engineering efficiency and profitability but also by its impact upon the country and by the extent to which the service meets the level of expectations of the people in terms of comfort, convenience, accessibility, opportunities, frequency and reliability. To fulfill broadly the desired level of service, it is absolutely essential to carry out research intensively on the futurology of transportation, so as to meet the challenges facing ahead, in the following lines :

- (a) Analysis of the existing materials and research designed to provide needed information to assess and understand the nature of transportation process, to define relevant transportation service requirements and to establish a proper set of realistic goals, objectives, standards and performance criteria for transportation systems today and in future ;
- (b) Motivated research at widening the range of alternative choices of transportation requirements to satisfy the consumers;
- (c) Research on models and methodologies aimed at improving the techniques available to appraise the consequences of alternative choices so as to take correct decisions with full knowledge of costs and benefits;
- (d) Development of engineering ability to design and demonstrate the transportation systems, their performance characteristics so as to effect economy in operation and energy to the nation;
- (e) Emphasis on the development of scientific research aimed at controlling of pollution and better standards of environmental quality;
- (f) Provision of meaningful alternatives in the form of better public transportation as compared to private transportation systems; and
- (g) High degree of emphasis on the provision of better education and training facilities on the transportation systems which would help to bring out sound transportation specialists for the future.



Before considering the warranted frontal attack to the problems on the lines mentioned, it is proper, and not out of place, to say that the time is ripe to take stock inventory of the different infrastructure and superstructure, and the hardware and software facilities available. It is not unwise to study frankly without prejudice or bias the defects and drawbacks in the existing technologies and methodologies, models and systems, principles and policies, and coordination and integration of the different sub-sectors of transport and the National Transportation Sector as a whole.

As a first step, as regards to the forecast technology, it will be better to know the gap between anticipation and materialisation in the targets of different modes and to find out what were the deficiencies in the anticipative technology and factors responsible for it. Post mortum of the Five Year Plans and Annual Plans on transportation to find out the ingredients responsible for the gap between anticipation and materialisation, would help to identify the defects and deficiencies in the forecast technology.

### 3. Rail Transport

Indian railways by and large, is the single biggest transport system in the country, owned by the Government of India and has a capital of Rs. 4000 crores at charge yielding about Rs. 1200 crores revenue. It has route kilometrage of 60000 roughly, of which 50% is of broad gauge and the rest comprising metre gauge and narrow gauge. It carries daily about 7.5 million passengers and 550 thousand tonnes of freight traffic, and employs about 14 lakh people.

Though railway is fast losing ground as the principal mode of inland transportation in the country due to the rapid expansion and gaining control of traffic flow by road haulage and other transport means, still the railways have got a dominant role to play in the freight transportation, particularly bulk commodities and long distance passenger traffic. The share of railways in the transportation of passengers over short distances in the urban and suburban agglomerations is not too little and in fact this is a means on which the rapidly growing metropolitan centres may have to depend mainly as a mode of conveyance.

Despite the fact that the railways being an organised sector are compiling enormous statistical data still the required data of right type for right management decisions to plan, expand, and co-ordinate are not readily available. This is further complicated by the absence of adequate advance informational data on the spatial and industrial pattern and its anticipated input output movement requirements, and the mode which suits best for the commodity and distance flow. Hence, there are difficulties in the precise and fairly accurate forecast technology. However an exercise is made to visualise the demand for railways in the traffic mix of the country in the year 2000 A.D. and it looks

that the railways may have to gear up their machinery to carry about 400 billion tonne kms. of freight traffic and about 300 billion passenger kms.

In this context it is time for railways to shed down unequivocal patronage commanded from Government during the last century and its role of mainly serving defence, strategic and puriton public utility services subserving its own and the national economic importance, which factor has been rightly seized of by the railways and is reflected in its Corporate Plan and modify its convention oriented services to suit the changing economic and technological needs of the nation.

A well co-ordinated and integrated National Transport Plan or atleast a White Paper on it would help to assign precisely the nature and type of service requirements of railways so as to tailer its services to synchronise with the changing environments by converting function oriented railways into systems oriented.

Analysis of the current problems and also the futuristic problems likely to be cropped up establishes the need for a series of internal overhauling and scientific reorganisation of the railways based on need oriented research and development. The concentration of traffic flow in the broadgauge and trunk lines involving a few bulk commodities and the long distance passenger travel suggests the urgency for converting the metregauge sections into broadgauge, after giving serious consideration at the national policy level whether the country's ultimate aim would be of contending with the broadgauge system or a further shift to standard gauge to keep in line with the Asian and European railway systems. In this context it is not out of place that the personalised door-to-door service and the containarisation of freight traffic should be increasingly followed by unitisation with the sound development of freight forwarded scheme. A critical study of the traffic flow pattern again suggests that the freight traffic concentrated in a few selected yards numbering not more than 10% of the terminals provides high scope for automatic handling of goods and speedy turn around of the wagons. Designing of adaptable wagons to the specific requirement of the few bulk commodities, introduction of high speed engines capable of achieving an average speed of 50 kms. which could ultimately bring down the wagon turn around period to seven days besides increasing the track capacity and the introduction of sophisticated telecommunication means are of utmost importance to strengthen the railway system with minimum investment finance. Similarly the introduction of uniclass passenger trains with added passenger amenities after jettisoning its role of pleasing the prejudiced haves, faster trains to cater the needs of long distance passengers and a new flexible concept of long distance in which the traffic which otherwise can be well served by road transport, should be discouraged, are some of the

measures which can consolidate the railway's position. With the fast changing technological advancements and the existence of a threatening oil crisis, the futuristic planning should be guided to a direct shift from steam to electric traction instead of via diesel power. Long overdue is the streamlining of its organisational machinery into systems oriented in stead of its continuing as function oriented organisation. More so, in case of its huge labour force, rapid introduction of labour saving devices like computerisation and mechanisation (after giving serious attention in working out alternate employment proposals) so as to make its wheels move smoothly and swiftly, is also warranted. As regards to the statistical data, the data bank of railways, though voluminous does not provide ready data on the cost of transportation of different units of different sections for different capacities so as to enable better guided planning for the future. Though belated, yet it is not out of time for the railways to disaggregate the macro-planning into micro-regional planning so as to enable its machinery to gear up for catering to the estimated demand by the end of this century. Cost oriented fare scheduling and systems oriented functioning of the organisation alone would help to increase its productivity and efficiency in economic viability. These measures would visualize an investment outlay of Rs. 20000 crores in the year 2000 A.D. and the railway's needs are more of consolidation and strengthening of the system instead of being expansionist, in a co-ordinated and integrated National Transport Plan.

#### **4. Roads and Road Transport**

Disaggregating road transportation scenario from urban transportation futurology, particularly in the megalopolis which needs special and particular attention and therefore treated separately, the visualisation leads to the formidable task of providing adequate infrastructure and superstructure both in terms of hardware and software, to cater to the anticipated 600 billion tonne kms. and 700 billion passenger kms. of goods and passenger traffic respectively. Considering the fast uninhibited growth of urban centres and megalopolises and their inputs and outputs movement to and from their hinterland, besides the intra-rural and inter-rural traffic flow, the quantum of traffic foreseen in a realistic manner appalls even the highly optimistic transport experts, the moment they look into the resource position.

Absence of forecast inputs such as time series statistical data on roads and road traffic, inter model travel habits of the people, income and price elasticity demand for travel etc. makes the prognosis extremely difficult. The shattered tit bits of data of the past and the industrial and agricultural input and output mix throws the light for predicting the likely traffic flow during the turn around of the century.

Between now and the turn of the century, about 6000 crores of rupees would be needed as investment finance for road construction,

development and maintenance, if they were to serve the anticipated 600 billion tonne kms. of goods traffic and 700 billion passenger kms. of passenger traffic. The forecasted traffic magnitude magnates the problems of identification of core areas, the technology hubs around which the technical advancement should revolve to resolve the formidabilities facing ahead, the judicious management of limited resources and the needed research orientation both managerial and technical to achieve integrated optimisation in the fields relevant.

An exercise into the growth pattern and an inventory of the stocks at the disposal throw better light to guide the future.

TABLE 1  
*Growth of motor vehicles and road development during different years*

Type of vehicles	No of motor vehicles in		Type of roads	Road length in km in	
	1950-51	1973-74		1950-51	1973-74
Buses . . . . .	N.A.	45957	Surfaced	157000	43000
Cars . . . . .	147916	566541	Unsurfaced	24 000	320000
Taxis . . . . .	11432	81586			
Jeeps . . . . .	N.A.	72639	Total	400000	750000
Two wheelers	27105	202473			
Three wheelers	N.A.	65210			
Trucks . . . . .	33443	315000			
Others* . . . . .	38110	..			
	308056	1955406			

\*Others' include buses jeeps and other miscellaneous vehicles.

Considering the six and a half times growth in the vehicle population, just doubling the road supply over the last quarter of a century is not simply adequate to meet the mounting demand.

Modest extrapolation after due allowance for the impact of oil crisis on the vehicular growth predicts about 7.5 million motor vehicles in the year 2000 A.D. on the conservative side of the scale. Construction and maintenance of sufficient infrastructure over which the visualised superstructures are likely to inflict high pressure mainly depend on the advance action initiated right now on the advancement of immediate, intermediate and ultimate technology and the acquisition of adequate resources both men and material.

As a prelude it is essential to examine the various inputs necessary to get the satisfactory outputs. Collection of scientific data on the traffic flow pattern is the basic prerequisite for a thorough understanding upon which the motivated action to be initiated. Systematic analysis of the infrastructure and superstructure inventory, their adequacy and their utilisation performance characteristics etc. is also scanty and warranted. Travel habits, behavioural patterns, production and requirement

areas of products and their spatial pattern are some of the factors requiring intensive study individually and in conjunction with other factors. Resource mobilisation and its optional utilisation, keeping in view of the existing structures including the kutchra roads and bullock carts—their modifications and alterations with least resource addition—are also demanding in-depth studies. The rural roads and rural transport problems are of very high magnitude considering the fact of pump priming massive public finance to make them attain the minimum tolerable level. The spatial factors aggravate the movement of traffic from the urban centres to the rural areas and *vice versa*, on the poor inadequate and scanty rural and inter-rural infrastructure. The lack of scientific attention in time on the development of this infrastructure has already resulted in huge economic loss both to the nation and to the people. Unless prompt and proper attention is given in scientifically developing rural transport, it would be difficult to move the anticipated load in 2000 A.D. Above all, the formation of a central unified agency to augment and advance research towards pragmatic application and to organise, plan and implement the programmes with result orientation in the overall context so as to avoid duplication and wastage, needs careful consideration. This needs special emphasis and more so because just a glance of the expenditure on road transport over the last two years (1974-76) has just crossed Rs. 26 crores earmarked for the entire Fifth Five Year Plan whereas the expenditure incurred on roads during the same period is barely Rs. 131 crores as against an outlay proposed at Rs. 714 crores, with three years to go. There is a gross under-estimation or over-estimation of the requirements and whatever estimation arrived at thus, is further distorted when the investment accelerator steps in.

### **5. Urban and Metropolitan Transport**

Rapid industrialisation and the pull and push factors of other economic activities around urban agglomerations and megalopolies hasten the speed of urbanisation and the resulting high density, pollution and congestion change the urban form. The demographers visualise a population strength of about 960 million for the country of which roughly about 27% will be concentrated in the urban and metropolitan centres. The metropolitan traffic flow is the most hazardous and the existing fleet are finding it increasingly difficult to be mobile on the existing limited road space. The urban population faces acutely the problem of movement, while the resultant traffic congestion/chaos and accidents are also on the increase. If such is the case at present when hardly less than 17% of the country's population are in the urban centres, one can well visualise what would be the scenario around the turning of the century though the problem has been rightly seized of by the Planning Commission. The provision of Rs. 50 crores in the Fifth Plan is too meagre and scanty for strengthening

the urban transportation system. As in the West individual mode of transportation cannot solve but only accentuate the problems of mobility and ultimate solution lies in the development of rapid mass transport systems. The consideration of massive investments on the limited available space with its fast diminishing utility and returns also tilts the scales heavily in favour of rapid mass transport system. The average travel speed of about 8-12 kms. in the urban centres also questions the economic viability and operational efficiency of only other mode/other than rapid mass transport. The Metropolitan Transportation Project Organisation constituted for the four metropolitan cities by the Ministry of Railways with skeleton staff drawn from railways is too inadequate to meet the posing challenges of future and again it alone cannot treat all the urban problems such as congestion, accidents parking etc., in toto. Considering the visualised futuristic demand scenario of about four thousand million passenger kms. which requires an investment outlay of 4000 crores, it is high time to visualize a centralised urban transport agency pooling the resources of rail, air and road technologies to carry out systematic and scientific research and planning to meet the challenging problems ahead.

#### **6. Inland water Transport & Coastal Shipping**

The country has got 5000 kms. of coastal shipping and another 5000-6000 kms. of navigable inland waterways, with an additional scope for about 3000 kms. with the launching of the ambitiously contemplated Ganga-Cauvery Project, which can yield two-fold advantages, namely, relief to the pressure of rail and road transport systems and savings to the consumers by way of cheaper transport cost. The chief advantages of the inland water transport system are (i) economy in the use of energy, (ii) inherent low cost, (iii) capacity for expansion and (iv) capability to increase service without encountering physical constraints. A glance at the major advantages of the domestic waterways can not help but to grab the futurologists' foresight to increasingly exploit this system to the advantage of the third millenium populace.

Unfortunately, scanty attention has been accorded to this form of transport during the last quarter of a century and despite the negligible importance, the inland waterways are carrying about ten million tons of goods. During the last quinium roughly about one third of export Cargo's domestic transportation has been carried by inland waterways. The performance is rated to be  $2\frac{1}{2}$  times higher than the road transport and about  $\frac{2}{3}$  of railway transport system. Though transport of ores is the major cargo utilising this mode of transport, this mode has got vast potential for many other commodities, given the desired design and type of boats and steamers. Now the regular services are in vogue in certain parts of West Bengal, Bihar, Uttar Pradesh, Kerala and Konkan coast.

Added to the existing service on the Konkan coast, Calcutta to Narayan Ganj and Gauhati, Calcutta to Karim Ganj, and a few other backwater services in Kerala, Madras and Gujarat, immediate exploratory measures are to be taken to study the feasibility and introduction of services on the rivers Ganges, Brahmaputra, Sutlej etc., firstly to start with linking up of short distances such as Allahabad and Rajmahal, Chapra and Dohrighat, Colgang and Karagola etc., and then secondly linking up of longer distance. Transport potential and cost benefit analysis on the much contemplated Ganga Cauvery link projects may also be rightly taken up now during its embryo stage. Regular hydrographic surveys of the navigable channels, regular dredging and conservancy measures periodically would help to intensify the operational efficiency of this transport. A comprehensive feasibility study of the navigable rivers and channels, rationalised fare structure and the choice of different types of vessels adaptable to the type of commodity and the character of the waterways should also be carried out. A healthier development of this mode would require an investment outlay of about 2000 crores besides separating this from the Ministry of Transport and Shipping and placing it under the control of an independent minister, since this form of transport has to be developed from the scratch and needs constant and special medicare.

#### **7. Pipelines**

Pipelines though of recent origin is still a vital mode of transport both for solid and liquid materials. Considering the lowest transportation cost, the investment on this mode should not be a barrier and wherever possible for whatever commodities transportable this mode should be given top priority. What little bit of pipelines for the transportation of petroleum products is, is totally inadequate in the context of highly promising off-shore and on-shore petroleum products in the country. Considerable thinking and imaginative planning are highly in demand to assign the proper role for pipelines both as principal carrier and its substitutability of other forms of transport.

#### **8. Air Transport**

Post industrial and technological developments and advancements have created a must climate for the air transport in the transportation sector, with the increased conscience for time and the added value for the time thus gained. In India the air transport is managed by Indian Airlines Corporation for domestic services and Air India for international services. This systematic segregated functioning will be highly beneficial in organising, and maintaining the fleet and the services provided that both the Corporations view the problems of staffing, additions and replacements, improvement in innovative technologies and other allied problems after both of them shedding down their spirit of establishing individual identity. The futurologists can not but think that air transport is one and only one subsector of

transport and as such the visualised futuristic scenario is to be beautifully painted and coloured with one hand for better display.

The task of prognosis has resulted in visualising an air travel by about 50 million passengers and about 2.5 million tonnes of cargo in the year 2000 A.D. If the proposed vision of uniclass train services is materialised, a shift of another 1.5 million passengers to this mode can be easily anticipated. The task of gearing up the machinery to accelerate the supply to the demand level will be a real challenge to the air transport. Immediate and elaborate action warranted in this regard is the airport terminals—the base infrastructure development which is unfortunately at present under the control of very many agencies such as Civil Aviation Department, Ministry of Defence, international airports authority etc., that hampers an efficient, co-ordinated and integrated planning and development of the fleet size, type and nature of the service etc. In this regard the Tata Committee's recommendations are comprehensive. Since the gestation period is too long and the investment is massive, the planning of aircrafts of different types, speeds and capacities after establishing the traffic potentials in the different routes including the possible changes in the airmap, has to be undertaken right now well in time.

### 9. Inter-Modal Split

An exercise into the intermodal traffic flow split is prime and vital as an intermediate technology for the global forecast technology, and without which the financial analyst's and investment appraiser's job will be incomplete, rather misleading, in assessing resource requirements and in the allocation of the same to different modal development projects. Mainly there are two types of inter-modal split analysis, namely, (i) market research type to establish the importance of various factors in the choice of a particular mode and (ii) the analysis as a part of forecasting exercise to predict future flows of traffic for planning purposes. Both the types are fundamentally different in so far as in the former the determinants of demand are required *per se* whereas in the later the factors influencing modal split are only required as an intermediate stage in the overall forecasting process.

Modal split can not be separated from traffic generation, attraction and distribution since all react upon each other, for example traffic flow upon a particular node is likely to develop a particular type of transport and similarly the development of a particular type of transport mode such as pipelines may affect the entire traffic flow pattern.

“By its nature, a model of freight transport demand offers a greater scope for analytical depth than does a study of passenger demand. The choice of mode by a passenger is, ultimately a psychic matter of consumer desires in which the economist is able to say only that travellers prefer whatever they happen to prefer. Since no pleasure



is derived from the means chosen for freight transportation, the selection of carriers is likely to be based exclusively on economic considerations”.\*

However the problem of studying intermodal split is highly complex and vexacious since the interdependence of the traffic, mode and the infrastructure and *vice versa* besides, the determinants of influence also reacting among themselves. The problem is also to be tackled with the help of iso-cost curves taking into account the fastness and the transportation cost instead of the conventional and classical cost minimisation angles. Different types of intermodal split studies such as the market research approach, the total traffic flow approach, the consignment approach and the multi-regional approach are to be undertaken to establish a perfect or fairly accurate behavioural patterns of the different modes so that an advance information tank can be built to guide and channelise the investible resources.

#### 10. The Nation and Transportation Scenario

Country is spread over an area of 3.27 million sq. kms. and is the seventh largest country in the world. The population has been registering 2.23% annual compound rate and inspite of the optimism for containing the population growth the population is likely to touch 960 million mark in the turning of the century. The concentration and density of population concentration would continue to vary in their dispersal and the current pattern depending on the topographical division namely Himalayan and Sub Himalayan mountain ranges, the northern plain, the peninsular plateaus and mountains, plains and hills on the east and west coast. During the last quarter of the century industry, mining, metallurgy, manufacture and agriculture have all registered a phenomenal and impressive growth, thanks to the foresightedness of our leaders in planning and initiation of the 5 year plans. The national net product has more than doubled during this period and the climate provided by the emergency for sustained and accelerated economic growth would likely to move at an average rate of 8 per cent.

Inland transportation, on the lines of the other sectors, has also expanded much faster than the growth of the economy. Road and rail, particularly the former, have grown up at a fantastic rate. Besides the conventional forms of transportation, the new means like pipelines, ropeways and supersonic jets are also taking a new shape and a place in the overall transportation. In spite of the innovative advancement of technology, the oldest form of transport, the bullock cart is also finding its new place in the visualised scenario. The national transportation scenario thus visualised for the year 2000 A.D. is given in Table 2.

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\*W. J. Banmol, “Studies on the demand for freight transportation”.

TABLE 2

*National Transportation Scenario in 2000 A.D.*

Type of mode	Anticipated traffic	Resource requirement (in crore Rs.)
1 Roads and road transport		
(a) Passenger traffic (in billion pass km) .	700	12,000
(b) Freight traffic (in billion tonne km) .	600	
2 Railways		
(a) Passenger traffic (in billion pass km) .	300	
(b) Freight traffic (in billion tonne m)	400	20,000
3 Metropolitan Transport (in billion pass km)	4	4,000
4 Inland waterways and coastal shipping .	5% of total transportation demand by all modes	2,000
5 Air transport . . . . .	—Do.—	
6 Pipelines . . . . .	2-3% of total demand	1,500

The quarter of a century passed since independence have witnessed the lack of National Transportation Policy in the country, except a little bit piece-meal and haphazard guidelines provided by CTPC, Motor Vehicles Taxation Enquiry Committee, Intermediate and Major Ports Committee/Commissions, etc. Time is running fast to provide the nation with a white paper on National Transportation Policy clearly spelling out the aims, objectives and goals of different modes of transport and the roles expected of each and the likely shares of private and public sectors so as to provide a clear cut policy frame for the technologists, researchers and investors so that a health integrated and coordinated transportation development without distractions and distortions can shape the futuristic scenario.

The absence of National Transportation Board or a single agency at the apex level, to coordinate and integrate the planning development and investment over various modes of transport, keeping in line with the national objectives, has resulted in the piece-meal and lop-sided investments on one or other transportation modes leading to avoidable duplication, wastage and competition. Hence the creation of National Transportation Board and the formation of National Transportation Policy should be taken upon priority basis.

### 11. Conclusions

As far as it can be visualised, there will be problems galore by the year 2000 A.D. both as regards the number as well as the size.

We are already passing through a crisis and if things are allowed to drift it will deepen to such an extent as to become unmanageable, crippling all economy and social life. What can also be foreseen today is that the problems will be so intermingled and inter-acting with each other that our old method of singling out a problem, project it on the basis of past trends and then think out a solution to meet it will not work. A very broad spectrum of thinking and planning will have to be adopted wherein the inter-action of each problem with the others will have to be determined and then it will have to be planned to see whether each of the different wheels of the planning process is moving in unison, with a uniform pace or some of the wheels are pulling back while the others are trying to go ahead. The problem of transportation will also have to be tackled in the same manner, i.e. along with and in relation to the others and thereafter the various modes which have to be evolved or retained will have to be determined. May be in the process we have to make adjustments or compromises but one thing appears to be certain and that is that progress has to be visualised as one single identity with different facets or organs and all the organs have to be taken care of simultaneously and uniformly. On the basis of the overall scenario in the year 2000 A.D. the transportation policy for the country has to be formulated right from now and efforts have to be started immediately to implement the same in a progressive manner so that the country is able to face the problem squarely as and when the time arises. A National Transportation Committee set up with these clear objectives in view will be of immense help in this direction.

## APPENDIX I

*List of members of futurology panel on transportation*

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12. Mr. S. C. Misra,  
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Planning Commission,  
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13. Mr. R. N. Seth/  
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## IV. COMMUNICATIONS

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## IV. COMMUNICATIONS

### 1. Introduction

This paper draws on the numerous reports and papers of other technical sub-groups as well as on the notes by members of this sub-group. A preliminary preferred-future sub-system design describing a district-wise Rural Radio Service facility based on low power FM transmitters was circulated earlier. It appears in "Special Notes for Discussion Volume III" of the Panel on Futurology, and indicates the sub-groups concern for issues of technology policy which have high leverage on our alternative futures. Also appearing in the "Special Notes Volume III" are Notes by Mr. B. G. Verghese on the role of traditional media in the future, and a paper by Dr. Narsing Deo on the impact of microcomputer electronics.

A 'Systems approach' to all kinds of communication activities and media is necessary in order to see how they will combine to affect the human and social environment of India-2000 A.D. The simplest scheme that will serve to classify communication is 'one-to-one' (in person, telephone, telex, post), 'many-to-one' (post), 'many-to-many' (group meetings, theatre, newspapers, small magazines), and 'one-to-many' (broadcast media such as TV, radio and news agencies). The balance between these facilities as actually experienced by different elements in a society will determine the type of society that results from the social infrastructure of communication systems.

In Section 2 of this paper we present the 'Most Likely future scenario' obtained by an extrapolation of current trends. Certain basic issues of social and technology policy which can be seen to be crucial are then isolated in Section 3. In Section 4, a 'Preferred Future' is outlined in terms of its Communication systems. It is aligned with the preferred Future of the other Sub-Groups in that it expresses a social preference for a participative, socialistic and egalitarian society. Section 4 is divided into sub-sections which take up each of the policy issues raised in Section 3. In each case specific Positive Policy options have been identified for debate, which, it is hoped, will contribute towards achieving the preferred Future.

### 2. Emerging Scenario—The most likely future

- Knowledge-based bureaucratic society; Agro-surplus regions, Urban complexes dominate; limited access to one-to-one and many-to-many media; "Bombay-film" swamps other mass communication metaphors; One-way mass communication results in Pavlovian responses.

In this section we draw upon the other Interim Reports and upon technological trends to extrapolate to the end of the century, where we see India evolving into a bureaucratic society, but one which is knowledge-based. That is, access to power and to relative degrees of freedom of personal choice is based upon prior access to education and knowhow.

The growing cost of paper and of energy has resulted in limiting availability of books and educational material (at high prices) to the super-metropolitan areas and in the rich agro-surplus regions which have broken away altogether from the bottom half of the population to approximate "1970's Italian" standard of living. Educational and Scientific standards among this class continue to be in the forefront of the world and advanced scientific breakthroughs are frequent in physics, agriculture, space science, etc. Technological progress in industry is also respectable. Semi-literacy and non-participative obedience to governmental directives is the lot of the 'backward' masses in other regions now totalling 500 million. Migration between rural and urban areas is restricted in most states.

Telephone and telex service has spread in urban and rich rural areas and is widely used in government and commerce. Fast, efficient intercity and international service is provided. However, this has resulted in clearly bifurcating the population between the elite one-tenth who is so linked and the vast majority who are not used to communicating rapidly, and whose rate of learning and absorption of new ideas is much slower.

The mass media—newspapers, the radio, TV serve the urban and rich rural areas reasonably well, and in other regions people can watch community TV sets. Films have remained universally popular and have wiped out the last vestiges of drama and traditional arts. 'Classical' music and dance is dying for lack of an audience and dedicated new entrants since filmi-pop music is so much more popular and easier to do. TV programs balance the dominance of the Bombay-film with didactic instructional programs on national themes and educational topics. Since black and white (i.e. gray) TV is ineffective in teaching chemistry, the life sciences or agriculture, educational programs concentrate on mathematics and the alphabet for young children.

The mass media are effective in mobilising public opinion behind national programs wherever needed, and to explain and inform about government objectives. However, it is noticed that to a greater and greater extent the people wait for and depend on the government to take the initiative. Voluntary groups or community action are rare even among the educated.

### 3. Critical Issues raised by Emerging Scenario

- Will geographic distribution of access to communications be concentrated or spread widely?



- Will the availability and price structure of media systems support a small spectrum of users or many types of users and uses? Interchangeability of messages and movement.
- What is the meaning of difference between 'hard' and 'soft' technologies and what choices should therefore be policy-derived?

These three questions are really the practical aspects of the issue, "Do we want a bureaucratic society or a participative one?" In a bureaucratic society such as India had under the Moghuls or the British or such as the Austrian empire, the country, as represented by its elites, prospers while the rest of the people support the "national" strength by their contribution of hard work and sacrifice. There is little or no choice for the masses, and the process of decision-making is torturous since it is based always on prior decisions by higher authority. Individual initiative, discovery, voluntary organisations and community activity are not characteristics of bureaucratic societies where the government leads and the people follow.

Since 1935 under the influence of the Freedom struggle, India moved a long way towards becoming a participative society, but the compulsions of rigid technologies (such as TV), the rising costs of energy and capital goods and paper, and the effect of the existing bureaucratic choices has been to put this movement in doubt. The goal of becoming a participative society, which is the stated goal of the government and of the Congress party as well as of most of the Opposition, is steadily receding under the compulsions of fragmented thinking about Communications investments and policies, especially in the mass media and telecommunications fields.

We suggest below a consistent set of policy recommendations which may reverse the trends and point India towards becoming a more participative, more creative and self reliant people, so that the scenario for the year 2000 will be one which we can accept with pride rather than foreboding.

#### **4. Preferred Scenario—What Policy Decisions are needed ?**

In the preferred scenario for Management, the Sub-group has visualised less hierarchical, more participative, team work organisations in government and Industry. In the preferred scenario for Rural Development, the Sub-group has projected a more equal participation by all sectors in both economic and social life. Rural areas will be innovative, adaptive, productive both in economic and in human terms. In the preferred scenario for Energy, the Sub-group has projected a better distribution of energy-use in the population especially in rural areas which today uses mostly animal energy sources. Other Sub-groups doubtless project similar values.

All these have in common the theme—indeed the value or ethic—of greater participation and more equal sharing particularly by rural

people. This can only come about if information/knowhow/problem-solving ability are widely disseminated and shared. We share this basic value and what follows supports it in specific ways.

Another part of the preferred Future of special interest to the Sub-group on Communications is the greater use of "relevant" technology. This means modular technology rather than monolithic technology, people-scale technology rather than technology accessible only to large corporations or governments :

We see wide availability of telephone service with personalised "beepers" linking up to shared channels. We see a public telex-telegam service providing an alternative to trunk telephone channels. We see mass production and use in rural areas of FM receivers for local development-and-community-service radio stations.

We see mass production of cassette tape recorders for personal and institutional use. We see mass production of Super-8 film projectors for educational and training purposes. We see use of color TV videotape and cassette as teaching devices.

We see the proliferation of substantial community owned and operated offset printing plants in rural areas, and of similar competing privately owned units in urban areas providing the base for a wide spectrum of special-interest pamphlets, booklets, magazines and local newspapers. We see the greater metropolitan newspapers functioning, in competition, with differing styles as daily magazines, with much more broad-based community participation in the pages of the paper and service to special interest groups, different professions, and differing points of view.

We see an 'ethnic boom', a resurgence of interest in man-made art and music. We see dance and drama thrive at the community level in villages and urban neighbourhoods, encouraged by community-owned multi-purpose "Communication Centres", and the difference between the warmth and immediacy of a staged drama or event is well appreciated over the slick and smooth (but cool and distant) filmed version.

We see life-long learning as the pattern, supported by the aforementioned Communications Centres and libraries.

4.1 *Issue of Geographic spread of availability and access to communication media to spread Information/Knowhow/Problem-solving ability.*

4.1.1 *Compensatory effort to vitalise rural areas using a balanced mix of communication devices—low power local radio transmitters, more local print media, public telephones, etc.*

A creative people is one which has its own problem-solving capability at the local level. This knowhow can be nurtured by creating a Communications matrix centred in each rural region (Say, revenue

district) so that it has its own resources of printing facilities, a district-wise local radio transmitter (FM, 3KW) and a rudimentary (public) telephone service. On this technological base, locally relevant informational instructional materials can be developed and distributed to raise local productivity. On it local initiative can grow and flourish.

That this can be done with a very small fraction of the budgets presently allocated to "rural development" is demonstrated in detail in the paper "*Regional Radio Service*" prepared for the NCST Panel on Futurology. This paper spells out the economic advantage of using (locally assembled and) mass-produced FM receivers which can be used at home or carried everywhere to receive a local district-wise FM station.

The paper also identifies the advantages for implementing agencies concerned with area development if they can address specific target groups through the Regional Radio Service, refer to local events and places, tie broadcasts to local training and demonstrations, etc. All this can be done for much less money than is proposed to be spent upon the relatively small number of TV sets under the Satellite TV program for mass-media coverage of village India. (See below).

It should be pointed out here that a decision on the use of FM as a broadcast medium is due anyway since the AM broadcast band channels have become overcrowded in India. The conventional approach would be to introduce FM first in the metropolitan cities of Delhi, Bombay, etc. as a profit-making venture for AIR to broadcast film music and commercials. On the other hand, integrated thinking about priorities, will demonstrate that this technology should be used as part of the *System of rural development* which is now receiving administrative attention and *which requires media support* in rural areas in a way they have not received hitherto. When this imbalance has been corrected it would be appropriate to considering the use of the FM technology also for 'community-building' purposes in urbanised areas where separate channels can be created for different purposes such as adult education, on-the-job training courses, daytime programs for women at home, industrial background music, etc.

Below is a brief economic comparison of a balanced mix of rural communication services compared with the present plan to invest in a satellite TV broadcast system.

Typical District—Population—2,000,000

Present Plan —	Balanced Rural Communication Plan which includes the following elements :	
2000 TV sets@Rs 5,000 each:	(i) 20,000 radio sets @ Rs 200	4,000,000
Capital investment :Rs. 10,000,000	(ii) District Cooperative Offset Print Plant etc	5,000,000
	(iii) 2000 additional village telephones @Rs. 50	1,000,000
	Total (i)+ (ii) +(iii)	10,000,000

What are the advantages of the alternative Plan?

- (a) *Local employment* : Hundreds of jobs will be created at skill levels feasible in rural areas, including in electronics, the small-unit technology of the future.
- (b) *Local problem-solving and Solution-dissemination network* : The grid of telephones enable development problems to be known quickly at the relevant nerve centres. The local radio service enables as immediate and locally relevant response to be made, while an adequate local printing plant permits relevant pictorial and written materials to be quickly generated and distributed on the same subject.
- (c) *Infrastructure for literacy* : Successful literacy programs require locally produced literature which is responsive to the developing needs and consciousness of the neo-literates. Without this, adults as well as children lapse back into illiteracy.
- (d) *Growth in Knowledge* : Local production by photo-offset technology of pamphlets, booklets and posters as well as periodicals will result in greater penetration of knowhow into the community. Commercial and agro-business news-sheets circulating among the local merchants and farmers will raise alertness and productivity. Regional weekly or monthly 'farm' and cultural magazines will provide vehicles for sharing of experiences, and competition in growth and utilisation of knowledge.

#### 4.1.2 *Community building through multi-media Communication Centres for technical learning, etc.*

A 'growth' centres' strategy has been identified by all state governments as best for rural areas; the importance of a demographic drift away from metro regions is now widely accepted. How is this to be achieved? Clearly it needs factors that increase the absolute amount of information in rural areas and encourage dynamic information flow and exchange *within* the rural area so as to draw out existing know-how and make it more broadly utilised. Dr. V. M. Dandekar and Dr. B. S. Minhas have independently suggested a rural development model that includes local demonstration/teaching centres supported at taluka and district-level by technical expertise.

We recommend that, at district level, and related on the one hand to the District Cooperative offset Printing Plant and on the other to the Rural Radio Service studios should be a multi-media communication resources Centre. This centre would acquire or make, store, repair and rent out to schools and local organisations.

- (a) Cassette tape recordings of cultural and educational interest
- (b) Super-8 movies of cultural and educational interest
- (c) Videotape cartridges (as the technology develops)

- (d) Theatrical costumes and equipment
- (e) Musical instruments

The Centre would not only service high schools and training centres in the district but also village and Block Theatrical groups. It may maintain its own resident company of actors and musicians. There is evidence from the I & B Ministry's own Dance and Drama Division of the cost-effectiveness of live drama in creating change. Other countries' experience (of UNESCO reports) strongly support this. Rural artists do not require a *subsidy*, they require *exposure*, which means more events, and a stage. (This latter can be arranged by having a platform built for every group of villages of 8-10,000 population). If the villages can rent the necessary costumery, etc. they can be relied upon to support the system.

Whereas Cinema is Passive/Cool/Addictive, and very expensive, Theatre is Active/Warm/Adaptive and non-addictive. As a community focus it has many advantages over a cinema hall or TV set.

The modular technology of tape cassettes, super-8 film, and possibly videotape, is preferable for educational purposes to the monolithic technology of broadcasts over radio or TV. This is because of the opportunities for greater versatility in timing; repeatability, variety of pace, student participation, etc. etc. Inter-institutional activities, however, such as debates, contests, dramatics, etc. are better suited to broadcast media, e.g. the RRS transmitter. A telephone hook-up from one or two classrooms to the studio provides effective on-line feedback and "audience participation" in the case of a visiting lecturer giving a broadcast to schools.

There is today a strong inbuilt trend that favours the spread of commercial 'Bombay-film' cinema metaphor as the base of all entertainment and cultural communication. This can only happen at the cost of India's rich cultural tradition and of many values we take for granted today. One way to prevent this takeover is to revitalise the roots of art, music and drama in rural areas through the facilities provided by Communication Centres. A detailed plan for such Centres would be based on a staff of about 50 and a recurring budget of Rs. 5 lakhs annually.

#### 4.2 *Issue of Availability and Price Structure of media systems to support a wide spectrum of users and uses.*

Fundamental to a participative society is *variety*, especially in the character of the information flows. Cyberneticists like Ashby, Beer, von Bertalanffy and others make much of the "Law of Requisite Variety" which says in effect that a system will survive and cope (and not be overcome or run down) only if it has more intrinsic variety than its environment has surprises. This is easy to appreciate in principle, but its practical application requires hard thinking and serious

choices. *A bureaucratic society by definition does not have sufficient variety because communications are mostly one-way.* However it does cope by the simple expedient of suppressing the surprises in the environment by various administrative steps, resulting in a relatively brittle status-quo balance which can be typified sociologically as “1960’s East European”.

For India, whose entire Freedom struggle is saturated in the values of the participative society—especially the writings and actions of the principal founding father and political thinker, Jawaharlal Nehru—what does this require by way of policy decisions?

#### 4.2.1 *Lower Paper and Postage Prices for Literature*

Rising prices, especially of printing paper have driven out of business dozens of serious periodicals in the last few years. Strangely there has simultaneously been a population explosion of film magazines. An extrapolation of this trend to the year 2000 is alarming, to say the least. Does government newspaper licensing and postage rates favour film magazines which serve no useful social purpose? At present yes, because the other publications cannot afford what they can. “Bad Currency drives out Good” is an immutable law of mankind.

It is therefore essential that (1) the scheme of concessional prices for white printing paper be extended from school text-books to technical, educational and cultural publications of all kinds other than ‘film and fashion’ periodicals. (2) *Concessional postage rates* should be made applicable to all technical, educational and cultural publications (even if they are not monthlies), and to the carriage of other educational or informative materials such as books. (3) Research institutions should be able to post their reports and publications of a non-periodical nature at concessional rates.

#### 4.2.2 *Encouraging use of Postal and Telephone facilities rather than energy-intensive transport*

##### 1976 Prices of Communications Service

(local currency units)

	Bus Fare	Letter	Telephone Call	Taxi Fare
India . . . . .	.25	.25	.60	1.50
Switzerland . . . . .	1.00	.20	.20	3.00
U.S.A. . . . .	0.50	.10	.10	1.25

The table above shows that whereas abroad a letter is one-fifth as expensive as an urban bus ride, in India it costs the same. Abroad a telephone call is less than a tenth the price of a minimum urban

taxi fare; in India it is just half the price. This clearly shows that telephone and postage costs have already risen unreasonably high and are causing uneconomical use of energy in alternate ways of placing people in one-to-one contact. They should be brought down. This is true of urban areas. How much more so in rural areas? Here special 'intra-rural' postage and telephone rates are justified at one-half the present urban rates, for all communications within the taluk or district.

The importance of radically expanding services and of lowering telecommunication prices within metropolitan cities is emphasised by the crowding of streets and the need to expedite business decisions. Setting up of satellite cities such as 'New Bombay' can be done only by providing these centres with very extensive telecommunication facilities at much lower prices.

#### 4.2.3 TV vs Print media, Colour TV and Other Print media Issues

We have identified in the Emerging Scenario one likely harmful trend towards polarizing mass media around three nodes hard news, didactic or instructional messages and Bombay-film type 'entertainment'. Since none of these requires thinking on the part of the recipient, it can result in atrophying initiative and self reliance.

Extensive studies of TV in relation to Radio, newspapers and magazines where all are in use suggest the TV gives its audience a greater feeling of psychological closeness to the communication. (However, surveys also show that more than half who watch the news on TV do not remember a single item of it when questioned minutes later.) The printed word provides a better medium for conveying objective knowledge about objects and events.

	Newspapers	Magazines	Radio	Television
	(Percent of persons gaining knowledge from this medium)			
General Knowledge	94	36	66	25
Specific Knowledge	78	83	5	8
Knowledge of Newsworthy events	76	11	43	60

The above table is quoted by Emery et al in "*A Choice of Futures—to Enlighten or Inform*" (a study done for the Australian PTT by the Australian National University) to demonstrate the relative power and cost efficiency of print media over radio and radio over TV in knowledge transmission of various kinds.

This is too complex an issue to go into here in its full research depth. However we wish to stress that only print media (and to some extent a very local radio station) have the character of being able to carry not only hard news and instructional material, but also

cultural material of varying depth and entertainment features of varying 'heaviness'. The similarity between TV and film make it inevitable that the dominant film metaphors will also dominate TV. For a fraction of the cost of TV, radio and print media can 'do the job'.

If, nevertheless it is asked how TV could be strengthened as a medium to make it more adaptable to educational and cultural purposes, we would recommend an early switch-over to colour TV from gray-scale TV. The cost of TV sets is so high in any case that it is necessarily an institutional investment—schools, dormitories, community centres, apartment block meeting rooms, etc.—rather than a private purchase. Therefore, if metropolitan TV transmissions were in colour, it would at least be possible to broadcast educational features that depend on colour and texture—topics such as Chemistry, Biology, Zoology, Agriculture, Geography, Ecology, urban living, food habits, hygiene, etc. really cannot be dealt with on gray TV.

#### 4.2.4 *Traditional Media vs. Film*

The preferred future has in it a resurgence of traditional forms of communication of ideas, including the printed word and theatre. This will require certain technological support. For instance, the mechanisms for simply duplicating a written message today is very limited :

- (a) Typewriters in Indian languages are lacking.
- (b) Spirit duplicators (which can reproduce upto 100 copies in multicolor) are yet unknown.
- (c) Small offset machines and their paper-plate technology are still undeveloped.

The only technique available for short runs are messy stencil duplicators and for medium length runs, letter-press. The latter is feasible only because of the depressed wages in this industry.

Subsidised R & D and manufacture of the three devices above and of 'xerox' type duplicators should be part of national policy if each person and organisation is to play its part in the national resurgence.

Theatre—dance and drama—too have a role in building the all important sense of self-in-history which is so essential in holding a civilisation together. Our preferred future includes subsidised rural Communications Centres, Taluka-wise, which support village-level drama activities by making and renting stage equipment, costumes, instruments, etc.

Similarly each urban housing community would have Communication Resource Centres which would

- (a) Buy, make, repair and stockpile Theatrical equipment, and instruct in their use through formal and informal classes.



- (b) Maintain a Resident Company of actors and musicians
- (c) Rent out stage space and/or properties to amateur groups
- (d) Provide training in all aspects of practical theatre productions
- (e) Also provide a lending-library service in all kinds of educational audio-visual and library material.

This emphasis on theatre is based on the following propositions :

- (a) Theatre is a better carrier of Cultural values whereas Cinema garbles and bastardises culture.
- (b) Theatre is responsive to its audience and under control of the audience, whereas Cinema feedback is only through the box office, which is generally a poor indicator of quality, relevance or truth.
- (c) Theatre is Modular, malleable, low technology, people-intensive and people-oriented. Cinema is capital intensive, people-devouring, high, 'hard' technology, prepared remotely from its audience.
- (d) Theatre has situational adaptivity, language adaptivity, Cinema is rigid.

#### 4.3 *Choosing 'soft' over 'hard' technology*

Here we illustrate with a number of examples the need to develop technological tools which have the character of being *malleable* rather than rigid. It is necessary that communications technology support

- (a) Geographic dispersion of access to communication services, and
- (b) Broad-based and multi-purpose use of communication channels.

But technology is not "neutral". Certain technologies are more supportive of the social purposes and national goals identified earlier.

##### 4.3.1 *Microcomputers and Communications Services*

One of the Sub-group's Background papers stresses the importance of microcomputer technology for modularizing various technologies. Large Scale Integration makes it possible to place considerable logic and memory on a single chip. Thus "intelligent lathes", "intelligent sewing machines", etc. are possible.

We recommend that this technology be intensively used in communications, such as by creating portable (wireless) telephones for use within a building or cooperative colony. Thus individual wired connections will not be needed, nor a manned switchboard, to provide every family with access to the telephone network. Outgoing calls may be possible only from certain fixed stations while incoming calls could be taken anywhere within a small area.

This may lower the device cost to that of a portable radio and make telephone access in urban areas well-nigh universal. Such a result is desirable to prevent the development of a chasm in society

between those used to quick links, and those who never think of rapid information movement and who are therefore slow to adapt to new opportunities.

In rural areas, it would seem more useful to develop unmanned (intelligent) telex stations at village and hamlet post offices. Numerous other possibilities including far cheaper electronic exchanges should be developed. Microcomputers are well suited to storing and forwarding telex messages over a rural grid.

#### 4.3.2 *Inter-urban and Intra-urban links*

The bulk of business transactions will continue to be urban, though the dispersal of industry to rural areas requires that such units be given proper communication links to. This is best done by a very rapid expansion of Telex, teletype, and newswire services using 'message-switching' technology, rather than point-to-point switched links.

All trunk services (voice as well as digital data) on the main inter-city routes between the 25 main urban centres should be Digital, using data compression techniques for voice channels. This will result in *enormous savings* in capital investments on the extremely long (1000 mile) main trunk lines of the Indian network. An improvement in channel availability of upto 5 can be expected on voice channels alone. A further improvement will result from using 'packet switching' rather than point-to-point links for digital data, by providing for intermediate nodal storage of messages.

Telecommunications services must be planned in the light of digital data traffic generated by computerised business and administrative systems. When agencies like the Banks, Life Insurance and government finally switch over to computers, a quantum jump in digital traffic will take place. It is therefore wise at this stage to plan for an all-digital network and to digitise voice traffic as well. This can be done using microcomputer devices.

#### 4.3.3 *Encouragement to Communication-based Enterprises*

If the main trunk lines provide digital service, a wide variety of new enterprises providing information services on a subscription basis can come into being to accelerate economic growth and development. Some of these are :

- (1) Economic data services giving forecasts to subscribers over their telex on a daily/weekly basis and, for the first time, usefully up-to-date.
- (2) Statistical data services giving summaries to subscribers of government-generated data such as crop arrivals, rail loadings, steel shipments, air and sea dispatches, crop estimates, etc. Again these can, within a day or two, aggregate city and state data and computer-analyse to provide up-to-date national data.

- (3) Price trend data from all centres for crop arrivals, wholesale and retail prices, etc. Again, index numbers can be computed from the network data and the results put on-line in 24 hours or less. This is likely to lead to much better management of commodity inventories.
- (4) General economic/Commercial 'news' wire services of a regionally or commodity-specific nature. Thus a Coffee news wire, a Tea news wire, a Cotton news wire, a Wheat news wire, a Steel news wire, a Shipping news wire, etc.
- (5) Dial-in information retrieval services of all kinds in science and technology, trade and manufacturing, medicine and R & D.

The above are illustrative. The aim is to enable the *Market-in-Information* to be created. This is the classic function of the metropolis, and is clearly seen in the dominant activity in places like New York which enjoys primacy because of its information-exchange function in its society. We want to link all our business enterprises with a telecommunications network which serves the same purpose.

#### 4.3.4 *Communications Satellite ?*

Satellites to supplement terrestrial telecom links is part of the likely scenario. However, because of the technology involved, this involves greater dependancy upon foreign countries than on expansion of the capacity of our land links through digitising the voice channels, which can be accomplished with indigenous skills and with modular computer hardware rather than with a single-piece satellite. On the other hand, a Comsatellite can be purchased and put in place quickly and is likely to work for 5 years at least. A mixed strategy is recommended.

#### 4.3.5 *Television by Satellite or not?*

Nationwide TV broadcasts, whether black and white or in colour are, in our classification, "hard" technology, because they are monolithic and rigid and cannot be adapted to regional needs. Only messages of a "hard news" type, or entertainment of a "Bombay-film" character or a continued and impersonally packaged "instructional" documentary or filmed programme can be shown over such a technology. All the scientific research available shows that such software has a very poor social cost-benefit factor, let alone the loss on hardware investment.

Compared with radio, little or nothing is gained for many times as much money, time, manpower, and energy sunk in TV. There are no scientific trends or breakthroughs visible which would lower the cost of a TV picture tube, which makes a set cost 10 to 20 times the price of a portable radio. Therefore 'economies of scale' need not be looked for in TV and consequently TV must fall low on economic priorities.

Metropolitan television stations broadcasting in colour can possibly have an educative and community-development effect provided that :

- (a) the sets are made available primarily to educational or community institutions/societies/clubs.
- (b) Audience feedback is built in for each programme by telephone if not live.

This is because the target audiences are regionally specified and hence the programme content and formats can be both timely and geographically relevant.

The “immediacy” of TV, while novel and striking at first, has been shown by scientific research to be deceptive because the message cannot be retained. The “immediacy”, the *medium* becomes the *message*, and soon the *message*. Worldwide scientific research supports the view that TV is a high cost, low benefit medium, which in the long run conveys a little more than the fact it is ‘on’. It results in a passive, cool, uninvolved audience which comes to take “seeing” for “doing”. This can be a very costly result for a country requiring hard work and strict discipline. In short our preferred future has very little TV, and that in colour (see Section 4.2) restricted to specific metropolitan areas.

#### 4.3.6 *Technologies deserving of attention*

In para 4.3.1 we have identified “*microcomputers*” as a technology of great significance for the future and relevant to communications planning. In 4.3.2 we have identified *all-digital trunk circuits* as another technological breakthrough of relevance in India. What are some others?

*Devices for the Handicapped* : Because of the heritage of the past, India has a disproportionate number of physically handicapped persons—the blind, the deaf, paraplegics, etc. They represent potential brain-power which can be used provided they are enabled to communicate easily, both verbally and in writing. This is a fruitful area for R & D and includes low cost ‘talking books’, (Microcomputer-based?) writing machines, etc.

*Educational devices* : In the future more and more emphasis will be laid on learning, on skills and understanding. Therefore teaching aids, which are communication tools, will be increasingly important. The use of Holography and 3-D imaging is one technology to be developed. Another is that of mass production of “Relief Maps” and similar embossed and printed materials.

*Man-machine communication* : Last, but by no means least, is the interface between human beings and computers and similar machinery. Ever larger amounts of data—and even information—are being collected and processed by computers; the ability of persons to control and direct these information processes—to make effective use of computer power and of computerised information—must increase. This requires the development of many devices whereby people can put data and com-

mands *into* the computer and get information *out of* the computer. Much progress has already been made abroad in creating flexible man-machine communication systems, in both hardware and software. Though better than punched cards, there is a long way to go before people can deal with computer-stored information as easily as they do with paper.

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## APPENDIX A

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**V. URBANOLOGY**

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## V. URBANOLOGY

### 1. Introduction

Urbanology may be defined as the "Science of Human Settlements" related to the present and future development of existing as well as new cities. Urban population in India has grown considerably in the recent decades. It increased from 110 million in 1971 to 120 million in 1974 and is expected to reach about 300 million by the year 2001. According to the 1971 Census, the proportion of urban population to the total population in India was 19.87%, which may be considered low as compared to certain advanced countries (Australia 85.5%, Israel 82.1%, U.K. 78.3%, U.S.A. 73.5% etc.) Urbanisation is considered to bring about two major changes—it helps economic development, and it changes the life style of people by engaging them in activities other than agriculture. Therefore, the process of urbanisation is likely to accelerate in India too, because with the increased population more and more people are likely to seek employment in non-agricultural and urban activities, both production and the attendant services.

Also, there is a view that it might be desirable to increase the rate of urbanisation consciously, for it is believed that urbanisation provides the necessary economic and social infrastructure for trade, commerce, and manufacturing activity. It also provides better and higher levels of living in terms of educational facilities, health care, recreation and intellectual pursuits. Urban areas also offer employment potential to the rural unemployed. Increased urbanisation may thus be used to lessen the burden of sustaining rural population on agriculture only. Based on this reasoning, TCPO study has indicated that an urbanisation level of about 40%, by the end of the century, would be desirable.

An important feature of population growth in India has been that the increase in urban population is greater than that in the rural population. Between the years 1961 and 1971, the rate of growth of urban population was 3.8% as against the rural growth rate of 2.2% per annum. Metropolitan cities have experienced a phenomenal growth at the rate of 58.72% between 1961 and 1971.

It can safely be surmised that urban population in different regions and among different size of towns and cities has been growing at differential rates. Should such an imbalance be permitted? The conditions in our cities today clearly indicate that measures must be taken to stop or reduce such an imbalance. Our cities today are

characterized by inadequacy of public utilities and services like drainage, sewerage, drinking water, and electricity etc. The transportation and communications networks are users' nightmare. Housing shortage is so acute that the mushrooming slums, squatter colonies, basties and other unauthorised temporary constructions provide shelter to a large number of people. Even in planned new towns and housing estates, the number of people who have been provided decent housing and plots is less than the number of people who have settled in slums, squatter colonies, or simply on the payments. Still, we know for sure that urbanisation is bound to grow, probably at an accelerated rate. The best we can do, therefore, is to devise means and find ways to channelise urbanisation along the right lines.

## 2. Problems of Urban Centres

Our cities today are characterized by inadequacy of public utilities and services like drainage, sewerage, drinking water, and electricity etc. The severity of the problem of urban poverty and unemployment, inadequacy of housing and urban infrastructure reflects primarily the almost exponential population growth coupled with the acute shortage of resources to provide for the services.

2.1 The problems of Urbanisation may be grouped under the following heads :

(a) *Socio-economic & technical* : Under this can be listed:—

- crime and violence;
- unemployment;
- congestion & overcrowding leading to pollution;
- scarcity of amenities and facilities (services) sewerage treatment, water, roads, health care etc.;
- traffic;
- Proliferation of slums and squatter settlements.

(b) *Management & Organisational* :

- multiplicity of organisations;
- political intervention and patronage;
- disproportionate investments.

2.2. *Housing* : Acute shortages in housing today are likely to become critical in the next 25 years when we may have to provide shelter to almost one billion human beings. The estimated housing shortage in 1974 was of the order of 15.6 million dwelling units (11.8 million in rural areas and 3.8 million in urban areas). This estimates itself is based on a very minimum standard of "Shelter".

*Water* : It may seem to be available in abundance, but acute water shortage is certainly not unknown to our city dwellers even today.

How much water should be provided per head ? How to ensure sufficient supply of properly treated potable water to all residents is becoming a major problem in all big cities.

*Health* : Overcrowding in the cities, unemployment, scarcity of food, polluted environment, etc. are all likely to fell upon the health of the coming generations. Are we likely to become a nation of 'sick people', without redress from a multitude of maladies ? Understaffed, over crowded hospitals are crying for a radical solution to meet the pressing needs of the society.

*Transport* : Our urban transport systems today are inadequate and badly managed. Disturbing questions arise—Can we afford to transport the teeming millions of tomorrow at subsidised rates ? Should the private ownership of automobiles be abolished to ease traffic congestion and to conserve energy wasted in transporting a single individual ? What justification is there to subsidies the transport of urban poor at the expense of Rural Poor ? etc.

*Energy* : Faced with the Oil Crisis we are well aware of the energy squeeze. Can we meet our future requirements from the hydro-electricity and coal reserves only ? To what extent would the Solar and Atomic energies come to our rescue ?.

*Food* : Notwithstanding the Green Revolution, we still are short of food grains. With growth of urbanisation, lesser number of people would be engaged in agricultural pursuits. Intensive agriculture may also not succeed in bridging the gap, thereby forcing more rural workers into the cities in search of employment and survival.

*Education & Employment* : With the stress on education, we are likely to have more 'educated unemployed'. With the strengthening of the economic base of the rural areas, the employment opportunities there would be increased. Still, the secondary and tertiary sectors of the economy will have to absorb a greater proportion of the additional labour force, which would require accelerated industrialisation and the growth of trade and commercial activities. Obviously, the existing urban centres are not in a position to meet these extra needs. Therefore, new agricultural and industrial centres would have to be carefully planned and developed to prevent choking of the existing urban centres.

*Environmental Pollution* : The deadly combination of object poverty and environmental pollution will, very likely, be the price we

shall have to pay for accelerated urbanisation. Technology may come to our rescue, but we must remember that indiscriminate use of technology, as shown by experience of western countries, can lead to environmental degradation.

From the above it is clear that our survival may, very well, depend upon how carefully we are able to control the trends; so that realistic plans well within the resource constraints, could be devised to provide for a viable future.

### 3. Scenario I

#### *Emerging Future based on Current Trends*

It has already been noted that our urban scene is pervaded by SCARCITY of all conceivable commodities and facilities. This is a bleak picture indeed which is likely to be further aggravated if the current trends continue unabated. Exploding population is the most serious factor to be considered. All estimates indicate that a "Second India" will be added, in the sense that the population of India with reference to the base year population of 548 million in 1971 will double itself, by the turn of the century. A summary of these estimates would be in order here :

TABLE I  
*Population Estimates*  
Base year 1971 (million) — 548

	Low	Medium	High
1 Ford Foundation Study Ambannavar's Estimate 2000 A.D.	926	999	1035
2 World Bank's Population Planning working paper 2000 A.D.	..	948	...
3 Registrar General's Estimate 2000 AD	846	945	1032

*Note* —Low, Medium and High projections are based on the assumptions regarding gross Fertility Rates and Mortality rates etc.

Today, our population already is more than 600 million and is distributed over almost 3121 towns and cities and 575721 villages. The urbanisation pattern in the country is depicted graphically in the accompanying map.

The population distribution ratio of 20 : 80 between urban and rural sectors today is likely to become 30 : 70 by the year 2000 A. D. likely population distribution in rural and urban sectors of various States of the nation is given in Table II.

TABLE II

*Percentage Distribution of Rural-Urban Population by States 1971-2001*

States and Union Territories	1971		2001	
	Urban	Rural	Urban	Rural
<b>All India</b>	19.91	80.09	29.44	70.55
1 Andhra Pradesh	19.32	80.68	28.57	71.43
2 Assam	8.82	91.18	13.04	86.94
3 Bihar	10.00	90.00	14.39	85.21
4 Gujarat	28.08	71.92	41.53	58.47
5 Haryana	17.66	82.44	26.11	73.89
6 Himachal Pradesh	6.99	93.01	10.34	89.66
7 Jammu & Kashmir	18.59	81.41	27.48	72.52
8 Kerala	16.24	83.76	24.01	75.90
9 Madhya Pradesh	16.20	83.80	24.09	75.91
10 Maharashtra	31.17	68.83	46.09	53.91
11 Manipur	13.19	86.81	19.50	80.50
12 Meghalaya	14.56	85.45	21.50	88.50
13 Karnataka	24.31	75.62	35.94	64.06
14 Nagaland	9.95	90.05	14.71	85.29
15 Orissa	8.41	91.69	12.44	87.56
16 Punjab	23.73	76.27	35.09	64.91
17 Rajasthan	17.63	82.37	26.07	73.93
18 Tamilnadu	30.26	69.74	44.75	55.25
19 Tripura	10.43	89.57	15.43	84.57
20 Uttar Pradesh	14.02	85.98	20.73	79.27
21 West Bengal	24.52	75.48	36.25	63.74
<b>Union territories</b>				
1 Andaman & Nicobar Islands	22.77	77.23	23.67	66.33
2 Arunachal Pradesh	3.70	96.30	5.46	94.54
3 Chandigarh	90.55	9.45	96.00	4.00
4 Delhi	89.70	10.30	96.00	4.00
5 Mizoram	11.36	88.64	16.80	83.20
6 Pondicherry	42.04	57.96	62.17	37.83

Estimates based on the Statistics contained in "The Population of India—1974 World population Year, CICRED series".

### 3.1 The broad implications of these projections are:—

1. The rate of growth of urbanization will continue at least at the present rate except in the last decade when it might be increased of the century there will be approximately 300 million people in urban centers.
2. The magnetic pull of the present metropolitan areas will continue to grow, leading consequently to selected megalopolitan areas having concentration of enormous mass of people in ugly agglomerates. We envision five major megalopolitan areas with the projected population as follows :

TABLE III

Megalopolitan areas	Population in the (Year 2000 (in millions)
1 Bombay, Ahmedabad, Poona . . . . .	38.60
2 Calcutta . . . . .	23.00
3 Madras, Bangalore . . . . .	19.70
4 Delhi . . . . .	19.00
5 Lucknow, Kanpur . . . . .	10.00

3. In addition, there will be about 20 cities with a population of about one million each and at least 600 cities with a population of between 50,000 and 500,000. Smaller towns will decline in number.
4. According to various trade and industrial policies at least 100 major new towns will emerge in various parts of India.

#### 4. Scenario II

##### *Preferred Future & Strategy*

The shortages faced by urban centres today in areas like housing, water supply, sewage disposal, transportation and communication, energy, health and environmental pollution, education & employment point a bleak picture of our urban scene. The Future would be even bleaker if we permit "Fate" to determine the outcome. It is imperative therefore that we intervene through judicious planning with the objective of our optimising the use of our limited resources so that balanced growth of the regions can be ensured.

The preferred future city must ensure that adequate services & facilities are made available to all its inhabitants. As such the growth of a city must be limited to a manageable size. Smaller cities can thus have a chance for growth the big cities the opportunity to consolidate their position and improve the services. The socio-economic parametres influencing the outcome of our preferred future deserve special

attention so that the future can be shaped according to our plans. These are as follows:—

TABLE IV

*Urban Settlements by Population Size 1971-2001*

Year	Size-Range of Towns and cities						All size Range of Towns & Cities	Number & Population (in million)
	Over 100000	50000 to 99999	20000 to 49999	10000 to 19999	5000 to 9999	Below 5000		
1971	150 (53)	221 (15)	652 (20)	588 (14)	822 (6)	287 (1.0)	3121 (109)	Number of towns Population.
1981	204 (78)	309 (21)	1021 (27)	1042 (16)	556 (7)	370 (1)	3702 (150)	Number of towns Population
1991	67 (111)	435 (30)	1034 (38)	1109 (16)	1107 (8)	450 (20)	4402 (205)	Number of towns Population
2001	339 (15.7)	606 (42)	1303 (51)	1181 (18)	1215 (8)	657 (2)	5301 (278)	Number of towns Population

Source :1— The figures for 1978 are actuals, as of census.

2—Total Urban Population for the years 1971-2001 has been taken from The Population of India' 1974 World Population Year—CICRED series, Registrar General of India.

3—The number of towns projected has been taken from urbanisation trends and projections in India 1981—2001, Town and Country Planning Organisation, New Delhi (Undated).

#### 4.1 *Population Policy*

(a) A beginning has been made by announcing the National Population Policy aimed at checking the population growth. It aims at reducing the growth rate from the existing level of 2.5 per cent per annum to 1.37 per cent per annum by 1986. However, nothing short of zero population growth is likely to be meaningful.

##### (b) *Population Disposal*

An important aspect persistently being neglected is population dispersal. Population distribution amongst the regions is wide and varied leading to uneven pressure on resources. Lack of opportunities in the countryside drives thousands of villagers to the cities every year. These waves of migrants undergo untold misery in the cities where they come in quest of fulfilling their cherished dreams.

Population disposal may be achieved through:

- (1) Registration-cum-Reception Centres in cities that would work in close liaison with Employment Exchanges and permit migrants to live in a city only if a job is available.
- (2) Investments in metropolises and big cities to be regulated and gradually brought down to zero so that smaller cities can grow and new settlements can come up.
- (3) Licensing policy modified to prohibit new industrial location within 50 miles of metropolitan cities. Location of industries and new industrial towns should aim at achieving balanced regional growth as far as possible so that population also gets equally distributed.
- (4) National subsidies for urban facilities like transport, communication, health care etc. to be stopped. (No rationale for subsidising a minority Urban poor against the majority rural poor).
- (5) An integrated system should be developed to plough back the rural resources into the rural sector itself.
- (6) Benefits available in Urban centres like education facilities, entertainment, health care etc. should be provided in the rural areas also.
- (7) Creation of Market towns and Growth Centres for integrated rural and regional development.

#### 4.2 *National Land use Policy*

The proposed Land use commission must make a thorough survey of land. All land-use in the country so that could be divided in to the categories:—

- (i) land for agriculture,
- (ii) land for construction—residential and industrial.



Price of agricultural land should be low and permitted to fluctuate within a very narrow limits only, whereas the prices of land for construction can follow market trends.

The objective of earmarking agricultural land is to release all fertile land for agricultural use only for all time to come this will particularly save good land from being gobbled up by sprawling cities on their outskirts. In fact, it is very strongly suggested that all metropolitan cities must be frozen at their present size to prevent them from becoming more unmanageable.

4.3 (1) A majority of the urban centres in India are either mis-managed or grossly under-managed. Available technological, administrative and political practices are inadequate for proper management of the cities. Multiplicity of implementing organisations coupled with lack of political will to act constructively have resulted in the implementation of only a fraction of the development plans formulated during the last two decade. Professional city-managers, with knowledge of modern management techniques should replace the present civic administration appointees, whose sole claim to the office is political patronage.

(2) In all residential developments adequate provision must be made to house those engaged in Informal Sector activities like house cleaning, Fruit & Vegetable vending, ironing of clothes, cleaning of utensils etc. It is these workers who create instant slums by pitching tents, shaks, huts etc. in a clearing near to their work place. Providing 10-15 houses per 1000 population in a colony would be much more effective removing the slums than giving them Free Plots 25-30 miles away from their working places.

(3) To prevent urban sprawl, 5 storeyed, walk-up, row housing should be adhered to as far as possible.

#### 4.4 *New Settlements & Expansion of existing cities*

It is found that the rate of natural increase in the large cities is lower than that in small towns, which means that the population explosion in large metropolitan cities is due mainly to migration. The in-flow of migrants who are largely poor, semi-skilled or unskilled, with traditional rural values poses economic, social, cultural and political problems in the cities. Outlets must be devised to relieve the already choked cities by their planned expansion, or by creating altogether new settlements. The policy of creating and locating new settlements should aim at balanced regional growth, rather than creating glittering show-pieces which remain surrounded by filthy slums.

Location of industries and new industrial towns also should aim at, as far as possible, achieving balanced regional growth. Industrial licensing policies need to be reviewed in this light.

#### 4.5 *National Urbanisation Policy*

As urbanisation is taking place at a faster rate than population growth we need to develop a strategy to channelise urbanisation.

Adoption of a National urbanisation policy, covering both rural and urban settlements as a continuum, should aim at the following objectives:

- (a) Evolving a spatial pattern of economic development based on regional planning and location of a hierarchy of human settlements consistent with the exploitation of the natural resources in the region, and ensuring functional linkages inter-se ;
- (b) Securing the distribution of population between rural and urban settlements within each region on both the long term and the short term perspectives and also between towns of various sizes;
- (c) Securing the distribution of economic activities in small and medium sized towns and in new growth centres in order to induce the desired population distribution and achieve maximum economic growth for the future;
- (d) Controlling and, where necessary, arresting the further growth of metropolitan cities by dispersal of economic activities, enactment of legislative measures and establishment of new counter-magnets in the region to reduce social and economic costs and to improve the levels of living ;
- (e) Providing minimum level of services for improving the quality of life in rural and urban areas and gradually reducing the differences between rural and urban life.

The suggestions listed here to contain and channelise Urbanisation, with the objective of improving the chaotic conditions in our cities and to achieve balanced regional growth, are by no means being put forth for the first time. Expert groups have been voicing their alarm and making recommendations from time to time. But, as is the usual fate of almost all studies & reports, these recommendations have invariably been collecting dust in the filing cabinets. It is urged, therefore, that implementation of the recommendations should be very sincerely attempted.

### **Recommendations**

The major recommendations of the Urbanology Group are listed as under :

#### 1. *Population Growth & Dispersal*

- (a) We must aim at achieving zero population growth as early as possible.
- (b) To achieve population distribution, investments in metropolises and other big cities should be gradually stopped so that smaller cities can grow.
- (c) All metropolises should be frozen at their present size so that they remain within manageable limits.

- (d) Licensing policy to be modified to prohibit new industries being located within 50 miles of metropolitan cities. In fact, industrial location to be aimed at achieving balanced regional growth.
- (e) System must be evolved to plough back rural resources into the rural sector itself.
- (f) Movement to big cities to be controlled subject to availability of jobs there.

## 2. *Land Use Policy*

Space is a scarce resource and has to meet the demands of providing Food as well as shelter. Land Use Commission, therefore, must distinctly allocate land for Agricultural Use, and land for construction of residential, commercial and industrial buildings. If a through job is done by the experts now in properly earmarking land use, the pattern for future urbanisation would be decided for all time to come. The task is colossal, but must be undertaken without delay.

## 3. *National Urbanisation Policy*

Evolving and a Speedy implementation of National Urbanisation Policy is imperative. (See page 81).

## 4. *Squatter/Slum Clearance*

Prevention is always better than a cure. We should therefore try to remove the root cause of squatter/slum colonies. Numerous studies have indicated that a majority of squatters are engaged in Informal Sector activities. Any open space, near to their work place, is thus ideal for them to erect their huts, tents, shacks etc. out of the materials easily available near the site. Removing them to the periphery of the city only aggravates their problem because it increases their commuting charges and reduces their working time by 2 to 3 hours daily. A better solution therefore would be to provide adequate housing for them whenever a new residential development takes place. In fact, they can be charged rents at par with government employees.

## 5. *City Management*

To ensure performance, appointment to city-managerial jobs should be strictly based on professional competence rather than political patronage. Non-professionals already in position should be eased out of their jobs within a maximum period of 3 years.

## APPENDIX I

*Members of Urbanology Technical Sub-Group*

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|--|---|
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| 6. Thiru T. K. A. Dewan<br>Mohammed,   |   |

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## VI. RURAL DEVELOPMENT

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## VI. RURAL DEVELOPMENT

[*Note on Methodology*: The basic methodology adopted for this note follows from my initial presentation at the Bangalore meeting of the Panel on Futurology, "A Note on Theory and Methodology in the Study of the Future". I do not believe that the future can be predicted. Nor am I convinced of the utility of prognostics which informs much of futurology. As I look at it, the only meaningful approach to the future is to try and design one, to evolve a preferred model for the future and strategies for moving from the expected future if human agencies do not intervene in the historical process to the preferred future if they do—as indeed they should, for the alternative is nothing short of disaster.]

### 1. Introduction

There has been a great deal of talk lately in our country on rural development. Many of the formulations of the problem, and the phrases and clichés used are reminiscent of the fifties when discussions on planning and the Community Development movement laid a great deal of stress on rural development. (This was before the philosophy and model underlying the Second and Third Plans seeped through and took command of our thinking on economic development.) There is one significant difference, though. Whereas the emphasis of the Community Development period was mainly on establishing an administrative network going down to the villages and providing for extension agencies and paid personnel without thinking too much of social structural aspects and class configurations prevailing in the rural areas, the accent now is on the problem of massive poverty, on the 'rural poor', and on reforms needed to raise their levels.

On the other hand, it needs to be said of the earlier period that despite all the defects of the Community Development movement and its largely bureaucratic character, there did indeed take place considerable development of the countryside, at least in terms of laying out a vast infrastructure of welfare services, cooperatives and voluntary organizations. What is more, that period was also characterized by a significant transfer of resources from urban to rural areas which to no small extent contributed to a steady relationship between the two sectors (the rural areas continuing for over 20 years to maintain 80 per cent of the total population). This was also the period when political power shifted to the rural areas, thanks largely to the electoral process and the permeation of competitive politics, and gave rise to substantial

articulation of rural needs and interests even though this still left out the very poor and the underprivileged.

Today, on the other hand, while there is great deal of talk of rural development and the problems of the rural poor, the fact of the matter is that the condition of rural areas is deteriorating and within the rural social structure the position of the lower strata is worsening. Politically too the last few years have seen both an increase in the power of the urban based educated elite and the alliance of this elite structure with the upper and middle castes in the rural areas. On the whole 'rural development' is more rhetoric than reality and, on present indications (with concentration of economic power and a continuous narrowing of the base of the political system), there seems little chance of matters improving.

## 2. Emerging Scenario

In fact, if all one could do was to extrapolate from present and expected trends, the future appears rather dark. Though estimates vary, the population of rural India is expected to be somewhere between 600 and 700 million by the end of the century. Land under cultivation is likely to remain about the same as today. If private property in land and present inheritance rules continue, the already highly fragmented nature of the land system will become much more fragmented with continuous splitting and further splitting. This will make agricultural holdings uneconomical (even by the standards of small farm technology) and productivity from land will decline. Meanwhile, even if the distribution of village size (which at present puts 30 to 40 per cent of villages beyond reach of the administration, welfare services and improved technology) improves by merger of contiguous settlements, the average village size will continue to be small and thus inaccessible to any technological breakthrough.

While these structural characteristics will inform rural India, the actual magnitudes appear to be frightening. It is estimated (even taking the Medium-2 projection of the Registrar-General) that in order to ensure minimum desirable nutritional standards for all (a calorie intake of between 2400 and 3100) the country will need to produce 210 million tonnes of foodgrains, i.e., an increase of 100 million tonnes in 25 years. Given the structural characteristics mentioned above and the inevitable resource constraints, this seems impossible to achieve. This means one of two things. We shall need to import large quantities of food and surrender our aim of self-sufficiency in food which we consider to be crucial to our independence as a nation. But our ability to import food in any sizeable quantity will depend on the one hand on adequate export earnings through industrial output at competitive prices which is likely to become increasingly difficult and on the other hand on ample availability of food round the world which



also seems unlikely given the shortages in various parts of the world. Alternatively, we shall have to give up the requisite nutritional standard that we have set before ourselves, and indeed even to reduce the per capita intake of food which may, for large numbers of people, mean a step towards starvation.

Also, there are serious limits to the population that agriculture alone can sustain. Given the fact that there is little evidence of any significant progress on providing non-agricultural employment in rural areas, this means two things: a further growth in rural unemployment and still more sharpening underemployment (which is already lower than 100 man days per year for the vast majority of the people), and a big boost to outward migration to urban and mostly to metropolitan areas. Given the slow pace of industrialization and the relative paucity of investible resources, the urban areas are unlikely to be able to provide employment to the growing volume of in-migrants and what we will get is the phenomenon of rural poverty and unemployment producing still greater poverty and unemployment in the urban areas. Simultaneously with this—and given the dominant life-style of the high consumption elite and the middle class strata who also set the norms for the rest of the population—the degree of inequality and social injustice will grow in both rural and urban areas but perhaps more conspicuously in the urban areas.

Meanwhile, standards of health are likely to decline further as the needed expansion in health services will be beyond our reach and as in any case both the large majority of village settlements and the areas where the poor are huddled together in the cities will be both inaccessible to public health services and subject to a breakdown of sanitation and a spread of the diseases that normally go with overcrowded pockets of poverty. Similarly, disparities in educational standards will grow, the absolute numbers of illiterates will increase, and the skills and capabilities needed for fruitful employment will be restricted to the upper strata of the population.

Such a convergence of poverty and unemployment, disease and illiteracy that denies life chances to the vast periphery of the underprivileged—and the fact that a growing incidence of this convergence will occur in urban and metropolitan settings—can only produce a climate of extreme tension, a growing incidence of crime and not a little public violence that can be held down only by growing repression by the police and the para-military arms of government. This is a scenario of not only extreme misery and inequity and injustice but also one of breakdown of authority and indeed of the social fabric itself. Such a scenario may be inconceivable at the present moment but it is quite likely, indeed unavoidable on present indications. What is involved in this scenario is nothing short of the demise of the Indian nation (not to speak of the democratic polity which will die much earlier) and the end of Indian civilization itself.

### 3. The Main Issues

If such a scenario is to be avoided it is necessary to re-consider the whole model of development that we have adopted which has produced and will continue to produce mass poverty and inequity co-existing with high affluence and waste. It is necessary to provide an *alternative path of development* which produces minimum conditions for the rural masses, stops (or at least keeps within limits) the influx into urban areas, and gives rise to an integral approach to both rural and urban development, each sector supporting the other (instead of the present parasitic relationship) and both becoming part of a common continuum of human settlements and productive relationships that have one single focus: the well-being and dignity of all individuals irrespective of location or class.

Central to this shift from a negative to a positive scenario are three major aspects of development strategy and an optimal interrelationship between them. These are:

1. *Life Styles*: While retaining a good deal of diversity of a cultural and individual kind, there is need to have a consensus on such matters as desirable and undesirable consumption standards, use and distribution of resources for the gratification of needs, and norms of minima and maxima in incomes and wealth.

2. *Organization of Space*: There is need to move away from considering 'rural' and 'urban' as separate sets of entities and to think of them as a continuing structure of city, town and countryside, of agriculture and industry, of hinterland and metropolis. India has a unique opportunity of developing a social continuum in which while the romantic utopian dream of village self-sufficiency may be left behind (there should be no regret about this as such a system had very many negative features), we may also be able to avoid the scenario of huge metropolises draining the resources of the countryside in a parasitic manner. The scenario best suited to us—and to civilized life—is one in which the country is studied by a few thousand localities (regions), each clustering around a medium-size town, sharing in its amenities and its economy in a relatively egalitarian manner, in which all strata of society gain from the benefits of modernity but avoid the ills of post-modern consumer societies that are prisoners of highly concentrated production complexes.

3. *Production System and Technology*: Such a structuring of space will need to be supported by a corresponding continuum of productive orientations and technology relevant to each of them. The strategy that we shall have to evolve will need to be integral to the development of the country as a whole—where both production and administration are decentralized to medium-sized towns and their rural hinterlands, where city growth rates are arrested from becoming grotesque, where employment opportunities in agriculture (which have some natural

limits) are supplemented by employment in small and widely diffused industries, where educational institutions are located close to where the jobs are and restructured from the present emphasis on university degrees to an emphasis on widely scattered training institutions based on short duration courses for middle range technicians in various walks of life, where health facilities are not limited to the privileged, and where the economy derives its strength from the purchasing power of the great numbers of the people and not from expansion of middle class consumer industries and their 'export orientation'. Implied in such a restructuring of rural-urban and agricultural-industrial relations is a new technoeconomic model for our society which will enable us to reach the goals set out by us in the Directive Principles of the Constitution and often elaborated since. Rural development must be conceived as part and parcel of this model as a whole, a model in which we talk less of rural development in our usual segmental fashion and more of development of individuals and communities—all of them irrespective of distinctions of local or class. It is only in this overall context that 'rural development' will make sense.

#### 4. Scenario for the Future

It is from an optimal interrelationship of the above three parameters that our design for the future emerges. It has to be a comprehensive design of which rural development becomes an integral and a crucial part. We give below the essential components of such a design:

1. *Principle Focus*: The prime concern of economic policy for a just social order ought to be to generate employment that is able to absorb at least the new additions to the adult population, and where there is a substantial backlog of unemployment and underemployment, to absorb that as well. The major source of injustice today it to be found not so much in a condition of general scarcity as in the fact of diminishing marginal utility of man as such, in the fact that millions of people find themselves idle and useless, often in their very prime of youth.

2. *Agricultural Transformation*: The major impetus for such employment will have to come from a transformation of the agricultural sector, converting it from an area of stagnation to a catalyst of growth. This can be achieved, first and primarily, by introducing and rapidly implementing the new agricultural technology on a wide enough basis. The new technology does seem to us to have provided a major breakthrough in our aim of achieving self-sufficiency as well as for raising the status of agriculture in national priorities. However, there is need to adopt these practices with conscious care and try to adapt them to fulfil social goals. They must substantially raise employment and the incomes of the poor, not just aggregate output. Beyond availing of the new inputs there is need to attend to other practices: crop differentiation that can increase the amount of labour needed per

acre of land and raise the income of labourers, development of water resources that are suited to the need of small farmers and tenants, encouragement of farm practices that are labour-intensive, discouragement of mechanization that is labour-replacing and the provision of relevant credit and infrastructural inputs for the small cultivators. This, in turn, calls for the other package of measures known as land reforms, so that the benefits of the so-called green revolution are widely dispersed instead of being preempted by the well-to-do farmers as has occurred in so many countries, so that the rural social and economic structure becomes more egalitarian, and so that the available land is able to provide employment and a minimum income to millions of more families than is presently the case.

3. *Rural Industrialization* : In large parts of the world it is safe to predict that the sum total of reforms involved in the new agricultural technology and redistributive legislation will not be enough to sustain a growing population on land. Studies on manpower absorption by different sectors of the economy show conclusively that, except in the few places with very low density and large surpluses of land, there comes a stage when agriculture begins to absorb a diminishing proportion of the rising population. This critical stage will be reached in our country between 1980 and 1985. It does not follow from this, however, that those not engaged in agriculture should take to the cities for jobs in modern industries, for the fact is that the latter are not as great employers of men as they are of machines; and, in any case, the investment needed to generate the needed employment through modern industry is of a scale that few among the poorer countries can afford—except by large-scale import of foreign capital, which is neither feasible nor desirable.

If we consider various other trends in resource use, congestion, breakdown of city life, and growth of crime and violence, it is necessary to restrain large-scale migration to the cities. There is need, therefore, to provide nonfarm employment in the rural and semirural areas. This can be done, first through massive public works programmes for constructing durable community assets (building roads, canals, wells, and various other infrastructural facilities for rural development) for which there is great scope in our millions of villages and tribal settlements. Employment in these public works can take on a role quite different from short-term relief operations; they can become a basis for long-term investment and reduction of costs in such spheres as water use, land consolidation, and marketing of farm output, in turn generating more productivity, employment, and incomes. A large part of these activities can be supported from increased food output, thus also restraining inflationary tendencies. Improvements in agriculture can also be used as a stimulus to a whole line of processing and refining industries in the rural areas.

Second, such a combination of increased farm output and increased employment on land and public works should provide the basis, through its stimulation of demand for consumer necessities, for the growth of small towns close to the rural areas where medium-and small-scale industries can be located. The usual haphazard growth of towns and cities that takes place in the absence of conscious policy renders them into essentially parasitic spots where middlemen bring the flashy output of industries from large cities (and imports from foreign lands which, of course, continue to tantalize men and women in our country) and tempt villagers into buying them at exorbitant prices. This should give place to a conscious policy of decentralized industrial development and location so that urban growth becomes complementary to rural development and contributes further to the growth of employment and incomes of the poorer strata. The chief casualty of the colonial period was a whole range of rural and semi-rural industries and a number of non-agricultural occupations that gave livelihood to large sections of the people—and which in fact made for a society that was far less unequal and unjust than is the case now. It may not be possible to revive the whole spectrum of these occupations, but it is possible and necessary to provide a new basis for fulfilling the same economic functions, namely, making available work other than farming. The encouragement of self-employed artisans, the cultivation of the finer arts and crafts in line with our rich and complex traditions, and the growth of new and small-scale industries for the manufacture of goods needed by the local people can provide the basis for this regeneration.

4. *Social Continuum* : The crux of such a combination of policies designed to raise employment and alleviate mass poverty is to put agricultural and rural development at the core of public policy. But there is a counterpart of this approach in the area of urban development and industrial policy as well. Apart from heavy industries that require large capital inputs and centralized organization, industrial development should be employment-oriented as much as possible, should produce goods that are needed by large strata of the population rather than by a small middle class, and should be widely dispersed in the country so that the employment that it generates benefits all areas rather than is concentrated in a few cities or regions as is the case today. Regional disparities constitute a crucial dimension of social injustice and its visibility. Most of the favoured regions are those with large urban centres.

Socially, this means that the present duality of city and countryside must give place to a continuum in which the agricultural revolution (and its necessary concomitants in livestock and horticultural development) regenerates the villages, small-scale and medium industries are located in the towns, and large-scale industries that necessitate heavy

inputs of capital and high technical efficiency are located in the cities. As such a fusion between industry and agriculture will take place, further intermediate links in this continuum—rural social structures in towns, urban amenities in villages—will develop, thus combining the best-features of both rural and urban life and producing a composite and integrated culture.

Our preferred world should be not one made of millions of self-contained villages but, rather, one of thousands of small nucleating towns towards which the rural landscape gravitates, thus doing away with both the present duality of metropolitan and rural cultures, limiting the large size and concentrated location to just the industries that cannot do without them, while at the same time enlarging the size and horizon of rural communities, and providing them with the necessary infra-structure of welfare and communication facilities. Such a spatial structure—supported by a decentralized structure of community decision-making as argued below—would provide the necessary framework for the techno-economic alternative to the present dualist model of city versus countryside.

5. *Policy on Education*: It is not simply by altering the economic basis of rural-urban relationships that a more just social order will be created. We also need to alter the cultural under-pinnings of the present patterns of dominance and disparity. An important aspect of the sharp duality of life styles and living standards found in most poor countries is the nature of the educational system whose aim continues to be to produce colonial-type gentlemen, disoriented from the large society and constituting a class apart.

In most ex-colonial countries, formal education was initially meant to produce an *elite*, mainly to fill the ranks of the bureaucracy, the law-and-order establishment, and the technical positions in public administration and private enterprise. This orientation still persists in spite of the achievement of independence and in spite of the political elite's commitment to democratic and socialistic ideals. Education, far more than property or income, is the basis of privilege in our society.

Meanwhile, a majority of the population continues to be illiterate and unskilled while the ranks of the highly educated in the urban areas keep swelling. Studies in this area suggest that whereas expansion of literacy and primary education produces very rich and rapid dividends, after a point higher education turns out to be a huge waste. Acquisition of a minimum educational level greatly raises a person's skills and his capacity to enter the employment market; it also raises his sense of potency and his ability to relate himself to the outside world, his sense of political efficacy, and his general self-confidence and sense of dignity. In contrast, an indiscriminating expansion of higher education beyond the absorptive capacity of the economy produces an alienated class that is unable to relate meaningfully to the rest of society,<sup>1</sup> rapidly inhabits

various levels of the bureaucracy making it increasingly inefficient and insensitive to the needs of the people, and, with growing unemployment in its ranks, loses self-respect and becomes aggressive.

This polarization between a large mass of illiterate and totally unskilled and *hence* unemployed people on the one hand and a class of people who are over educated and *hence also* unemployed on the other is a natural culmination of the hiatus between the elite and the people—and between parasitic cities and a depressed countryside—discussed earlier. We must alter this condition by a major allocation of resources to mass literacy, primary education, and adult education programmes, by giving special attention to the economically weak and socially handicapped strata whose major avenue of mobility seems to be education,<sup>2</sup> and by a reorientation of the job market so that employment to a large spectrum of non-technical jobs is available to those without college degrees, thus deflating the importance of higher education and the disparities that result from insistence on degrees.

It is necessary to strongly emphasize the importance of dire spread literacy in generating massive social and economic transformation. Poverty, more than anything else, is a cultural condition and if poverty breeds poverty and perpetuates itself, it is because it is located in a cultural milieu—a milieu of ignorance, distance, segregation, and a very very low self-image of the poorer classes who suffer exploitation without protest and indeed consider exploitation to be the natural state of affairs. This situation cannot be changed except by a basic cultural attack. And the primary precondition for this is literacy and minimum education. This point cannot be overemphasized and needs to be expressed continuously and loudly.

Finally, higher education itself needs to be reoriented, by restricting university education to what its logical role is, namely, to provide basic grounding in main sources of theoretical knowledge, and to develop a vast network of functional education located in the vicinity of institutions and enterprises where knowledge is to be used. Except for a few advanced courses for specialists, these should impart intermediate skills through short-duration programmes, for use in the rural and semi-urban areas where the real work is. Only thus can the present spectacle of the highly educated queueing up for jobs in the cities while the villages are starved of technical manpower be brought to an end. Several commentators appear to dismiss higher education (and institutionalized education generally) as largely unnecessary. We do not share this view. There is urgent need for a very large number of doctors, engineers, geologists, architects, designers, managers, even economists and sociologists. What is at fault is not their availability but their placement, their location. Most of them are unwilling to go where the real jobs are, the institutions where they learn are unwilling to

train them for use in local conditions, and the leadership is unwilling to tell them candidly about their duties and their responsibilities. There is need to look upon education as a political process, upon the attainment of a degree or diploma as a social good that must be capable of being socially used, and upon the relationship between educational output and available work as part of a conscious plan of development. Higher education, instead of becoming an instrument of class privilege and exploitation and a source of disparities, must be made an integrator of human resources and human needs.

There is also need to undertake a major review of the whole institutional approach that has accompanied the modern view of education—classroom-based, bookish, graded, and located in large campuses in large cities. This approach needs to be replaced by a closer relationship between education and work—including intellectual work where education is sought for scientific and literacy pursuits—and by bridging the gap that divides the location of one from the location of the other. City-based education must be largely for city folk. For others, schools and other institutions must go where the people are, not the other way around. Unless these various aspects of the educational scene are approached with some perspective on the changing social reality, it is difficult to see how the deep cultural barriers that divide different classes and accentuate economic disparities can be overcome. Education can be made to bridge these gaps or to accentuate them. The need is to move from the latter orientation to the former.<sup>3</sup>

There is need to give special attention to the education of women. In our country, as in most parts of the developing world, women are less educated than men and within the depressed social strata and ethnic minorities the gap is even more pronounced. Meanwhile, daughters of the rich are flocking to the universities and some of them are leading women's lib movements (aping their counterparts in affluent countries), which in our country means the liberation of the privileged. These gaps in education among women and between them and men are an important source of the persisting duality of cultures, economic levels, and consumption standards, the latter more often than not being a direct function of the perennial shopping to which the educated women are so addicted. These differences also account for the wide divergences in the way children of the rich and the poor are brought up, thus perpetuating sharp disparities for generations to come.

Lack of education of women is an important cause of the exploitation of women which is a marked characteristic of our society (though in a way that is quite different from the case in Western countries). The main basis of this exploitation is economic and it is found at its worst in the lower classes and among the scheduled castes—wives and daughters working outdoors from dawn to dusk while their menfolk



are found to indulge themselves in drinking, gambling and wife-beating. The only way of breaking out of this 'culture of poverty' is education for all—but most of all for women. As a matter of social policy there is need to pay special attention to raising the educational levels of women and mothers from poor, underprivileged, and conservative<sup>4</sup> strata of society in order to spin off a major process of social reconstruction.

6. *Ethic of Consumption*: Even more fundamental than the gaps in the literary culture are the gaps in the material culture that divide the urbanized upper and middle classes from the people. Perhaps the most important and glaring contrast of today is caused by the extraordinary consumption levels and material possessions of the richer and high-status groups, following almost *in toto* the standards set by the high-consumption societies. The lust for things and for more and more things has become so myopic that it has given rise to all kinds of unethical practices, chief among these being a large incidence of corruption among public officials and a thriving black money economy that is sustained by the availability of a large array of consumer goods.

Apart from the vulgarity of such ostentatious living in a society characterized by massive poverty and malnutrition and apart from the creeping corruption to which it gives rise, such standards of consumption also undermine the whole fabric of economic policy. If a massive programme of employment and social welfare is to be generated, a high rate of savings and capital accumulation will be necessary. This implies a high rate of savings among those with large incomes as well as implies a restraint on salary and wage increases among the employed classes, including the working class, so that resources can be transferred to employing the unemployed (in a poor country to be employed is itself a privilege) and raising income levels of the poorly employed and the underemployed<sup>5</sup>. There is also need to encourage voluntary savings among the working class, the farmers, and the lower-middle classes who have already reached an income level that provides for basic consumption needs. At the same time the consumption of the really poor sections must be raised substantially both for increasing productive efficiency and for equity.

All of this calls for an *ethic of consumption* that discourages ostentatious living, cuts down the production and consumption of non-essential items, and shifts production priorities toward fulfilling the needs of the poor. It is, of course, necessary to encourage saving among the peasantry, the lower-middle classes and even the labouring classes as mentioned above. But this will be an impossible task unless the pace-setters of society themselves adopt a consumption ethic that encourage austerity and reduces the gap in material culture between the different classes. Gandhi put his finger on the most crucial dimension of moving toward a just social order when he called for *a limitation of wants* and warned his countrymen against falling prey to an industrial machine that not only reduces a majority of men into

labouring slaves but also dictates what and how men should eat, wear, dress, sing, and dance. Today his insights are even more relevant than when he lived. If there is to be an end to exploitation and inequity in our society, the present norm of a high-consumption ethic must give place to one that on the one hand meets the minimum needs of all men and on the other hand limits the needless expansion of wants that have no relationship with the basic requirements of body and mind.

7. *Nature of Production*: Built into such an ethic of consumption is also an ethic of production that is critical to the achievement of justice in society. The current notions of social justice derive from a concept of economic equality that is essentially distributive. It is not surprising, therefore, that both theoretical understanding and empirical evidence have underlined the need for first expanding the cake and then distributing it. Part of the problem is that both production and distribution are thought of in terms in which the mass of the people are reduced to a position of subjects and onlookers. An economic ethic that seeks to meet the consumption needs of all while limiting the flow of inessential commodities involves a simultaneous increase in the incomes of the poor and the output of goods that they will need to buy with those incomes. This means that instead of conceiving production and consumption as two separate activities, one aims at an economic system that (to repeat Gandhi) not only produces for the mass of the people but one in which the mass of the people are also the producers.

As all visions, perhaps this, too, is an ideal type. All that one can hope to initiate is a movement toward such a stage. In practical terms this calls for a location policy that, while permitting large-scale organization where it is unavoidable, will encourage the growth of small-scale, labour intensive, decentralized pattern of industrial development. Similarly, the market economist's retrogressive concept of effective demand (that only the needs that are backed by the existing distribution of purchasing power are worth producing for) will have to give place to a concept of *need effectiveness* so that the real needs of the people as a whole determines what goes into the package of production. A combination of such a production system and the consumption ethic outlined above will lead to a climate in which progress toward dispersal and decentralization of economic power becomes possible. As this happens, the orientation to social justice will become less technocratic and become more political and thus capable of initiatives from below.

8. *Social Minima*: A major casualty of the present structure of consumption and production is the fact that large numbers of people living in poor—as well as in some rich—countries suffer from acute malnutrition and resulting physical and mental deficiencies. Their numbers are likely to increase in the next few decades. While demographers and bureaucrats are busy propagating birth-control measures to

ward off an 'explosion' sometime in the next century, the problem of enabling those who are already born and will be born in the next twenty five years—only after which population planning is likely to have an impact—to live a normal life and put in sustained work for their livelihood is receiving inadequate attention<sup>6</sup>. The picture of the culture of poverty that emerges from various studies is highly depressing: it is a picture of large families exhibiting physical and psychic abnormality, incapacity for sustained work even for a few hours, a pronounced inferiority complex, a tendency to deal with patterns of exploitation and coercion by directing them inward and against their own dependents, and a vicious cycle of parents inducting children into these characteristics of deprivation and degradation, turning them into the same kind of adults when they grow up, and thus almost *ad infinitum*. We must give top priority to a programme of providing basic health care (with more accent on preventive health services) and an adequate supply of protein and other nutrients to the poor and especially to their children. One of the more important elements reinforcing rural poverty in our country is that those most needing medical attention are precisely those who are too poor to take advantage of available facilities. The same is the case with nutrition.

Here it is essential to stress a special advantage that developing countries like ours have in charting a distinctive course of development in which the human cost that had accompanied economic growth in other societies can be avoided. Given our advantage of low costs of trained manpower it is possible to spread the basic essentials of education and health over the whole country, to all classes of people, and in a short time through concentrated and devoted effort. This will lay a surer basis for all-round and continuous development than all the investment made in high technology, urbanization, mass media development and the other appendages of 'modernity'. Health and education are the essential prerequisites of social and economic mobilization for sustained development, for the so-called 'take-off'. Once such a basis is laid, nothing can prevent a society from moving forward. What is more, it will be a process of development that will produce much less disparities and inequity than is the case when the sole emphasis is on economic growth in aggregate GNP terms without regard to the cultural framework in which it takes place.

9. *Minima and Maxima*: The above analysis provides the elements of an alternative model. The objective of development, according to us, should be to achieve minimum conditions of material welfare for all the people, the *minima* to be defined according to local conditions and norms, but all of them providing at the least a package of minimum items of human necessity such as food, clothing, shelter, nutritional needs and children and mothers, and socially approved minima of health, education, drinking water, and public transportation for all. The extent to which these minima should be translated into personal

or family incomes or be combined with social welfare and social security programmes of the government will depend on local conditions and the nature of the future political system. But it should not be difficult for any system to work out a minimum-income policy as a basic component of development planning.

A policy of minima entails a policy of *maxima*. Indeed, without the latter the former is, in practice, impossible to realize in reasonable time. Also, beyond a certain point, income ought not to be allowed to grow nor human wants allowed to be artificially stimulated by the aggressive salesmanship of modern industry or the demonstration effects from the rich capitalist countries. There are two reasons for this limitation, one of which is relative and the other absolute. No one has a right to amass more and more income and riches when large sections of the population live below subsistence standards. Also, it is morally undesirable to go beyond a certain level of fulfilment of human needs. For an unlimited gratification of wants leads to individual decay and social disharmony, an unnecessary destruction of natural resources, a fouling of the human environment, and hence a bartering away of the health and happiness of future generations for the present pleasure and lust of a few. Hence, our emphasis on 'limitation of wants' as a necessary principle of our preferred world.

There should be a reasonable *scale* connecting the minima and maxima, that is to say, an admissible ratio between the two, thus limiting disparities and enabling society to implement the principles of natural justice. Entailed in the norms of such a scale is the further norm of *transfer* of surplus incomes and wealth above the maximum to those who have not yet reached the minimum.

10. *Issue of Participation*: Implicit in our preferred model for social and economic justice are also a number of other issues. The norms of minima and maxima are not mere economic formulations; they are part of a certain conception of a good and desirable life. Not only should an individual be entitled to a minimum level of living; he should also be able to participate actively (though he ought not to be forced to do so) in the way things are produced and decisions are made. It is not just a minimum wage that one thinks of here in some kinds of contractual relationship, alienated from the work process and the total scheme of ownership, production, and distribution of the means of livelihood. Rather, one thinks of an apparatus that man himself controls, finds meaningful, and derives a sense of personal power and significance from. Furthermore, to the extent that economic activity is managed and mediated by political and administrative agencies, the whole problem of effective participation in decision-making, at the desirable *level* and in optimum *units*, becomes real. Without such participation the economic aims may indeed be difficult to achieve.

There is also the question of not permitting the economic process, and what is now tellingly called the 'industrial-bureaucratic complex' of modern society, to take on an automation of its own and destroy every other value in its inexorable march. In other words, as the values of a participatory democracy and of nonviolence in man's relations to man and to the environment are joined with the values of individual autonomy and social justice, it may well be that we should ask ourselves equally basic questions about the kind of institutional superstructure that we want to build. Three major dimensions of this issue are (1) the rural-urban structure of the economy, (2) the territorial structure of the state, and (3) the participatory structure of the polity. As we pose these questions, it will become clear that the available model of modernization is not conducive to our goals; that the norm of a necessary shift from a predominantly rural to a predominantly urban structure based on large-scale industrialization may not be the best thing that human intelligence has devised; and that urban metropolitan life, far from being a 'civilizing' instrument, may turn into a structure of manipulation, exploitation, and destruction of the very properties of man's natural environment that are essential to human survival.

Similarly, we may also question the norms of centralized government, large-sized states, and big bureaucracies as necessary instruments of national integration and political accountability; and as we question these, we may begin to answer with greater clarity the problems raised about local autonomy, about decentralization of functions, powers, resources, and talents, and about optimum size for genuine participation of the people. Perhaps there is something to be gained in the very short run from large-scale enterprises, modern communication media, and centralization of planned initiative, although the real issue here is less of scale than of control. But it is also necessary not to close all options for the generations to come concerning the quality of life they would like to have. As the prospects of the future are vitally affected by what is done in the present—it is no longer possible to think in terms of just a few months or even a few years ahead—it is a matter of considerable responsibility that these various consequences of present actions are borne in mind.

It is necessary to consider here a widespread belief that rapid development cannot be carried out in a participatory framework, that only a determined and authoritarian elite can bring it about, that this indeed is the lesson of contemporary history. Our answer to such a position is that it mistakes appearance for reality, that the issue is not one of choice between liberal democracy dominated by machine politics and state socialism in which a small bureaucratic elite seeks to perpetuate itself, that both these systems are authoritarian as far as the large numbers of the people are concerned (there is far greater similarity between the two than appears at first sight), and that the real issue

relates to the classic predicament of political life, namely, the relationship between those in power and those out of power, between the government and the people. Seen in this light it is not surprising that the demand for authoritarianism has normally come from members of the privileged classes (the businessmen, the bureaucrats, and the technocrats), often reinforced by the analyses and prescriptions of foreigners.

Our model of a participatory system is not conceived in terms of simple political reforms. Rather, it is expressed in a number of sectors—concerning economic organization and its governance, that nature of education, location work and enterprise, choice of technology, size of units (economic, political, demographic, communications), and the nature of work. Participation is not some process of involving everyone and reducing all to a common denominator. Rather, it consists in evolving institutional structures from which diverse individuals get a sense of dignity and self-respect, as beings that are able to determine their own destinies. (Poverty and inequality are themselves reflections not just of prevailing relations of production but rather of structures and values that deny dignity to the human being.)

Nor is our thinking on participation conceived in terms of establishing idyllic and isolated small communities. Our conception (outlined above) of a social and spatial continuum goes against such a utopia. We are also convinced that given the numbers of human beings we have to deal with, such a utopia is no longer feasible. Our concern, rather, is to imbibe into structures at various levels and of various sizes the *value* of participation as integral to our model of a just society and our conception of autonomy and dignity of all human beings. It is only through such an integrated view of the various components of our model that an alternative political perspective can emerge and policy issues can be discussed in a meaningful manner.

It would be folly, however, to look upon such a perspective as in any way smooth sailing on some neat path. Nothing is more difficult to realize than changes in the social framework of politics—except for the worse. Every step on such a path needs to be fought for, by organizing for it and building sustained pressures from below in the form of social and intellectual movements. And it is, of course, clear that these will need to be conceived and carried out in not one but many spheres, at not one but many levels. But we are firmly convinced that it is only on the basis of a clear acceptance of a decentralized and highly participant democratic structure that social justice can be realized.

These, then, are the issues that arise when specific problems of economic strategy, political structure, educational policy and the reconstruction of the human space are considered from the integrated perspective provided by a set of values and the criteria that follow from it. Involved in such an approach is what may be called a design for living in which reason, compassion, and a regard for the equal worth of all men are joined in the cultivation of a truly civilized life.

And as we do this, the distinctions between economic and political issues disappear and we begin to see the real linkages that underlies any effort to produce a better world. Our conception of alternative strategies entails such a comprehensive perspective on the future.

#### Footnotes

1. We do not share the diagnosis that the main fault in higher education in the developing countries is that universities are far too oriented to liberal arts and general science training and do not give adequate attention to technical education: In our view, the universities (perhaps everywhere) have gone too far in accommodating this view and have in the process lost their character. It is the function of a university to train the minds of its members and provide basic analytical skills for facing concrete problems in life. Rather, the fault lies in the fact that universities are turning out engineers and technicians, economists, and social scientists who are basically illiterate and who are taught from obsolete texts dumped by multinational publishers into the colonial markets. Graduates come out of these mass factories wholly unprepared for dealing with the problems they are likely to encounter in their work.
2. One of the unfortunate consequences of the recent attack on schools and education in some developing countries is that upper-class elites who have already cornered educational resources and occupy bureaucratic and professional positions (and have sent their own children abroad for studies) have been busy pruning down educational programmes—just at a time when such programmes were beginning to spread to backward regions and lower classes. Though the motivation of its authors is clearly different, the ‘de-schooling’ thesis poses the same danger as the ‘limits to growth’ thesis.
3. There are practices outside the educational sphere that contribute to the inequitous role of education. One is the wage and salary structure that obtains in a society—the enormous gap between the top and the bottom of salary scales, the wide disparity between payments in private and public sectors (the former being very high), and similar gaps between urban and rural jobs, even of the same type (the rural being underpaid). These differences provide a powerful rationale for prescribing higher (and foreign) degree for the better-paying jobs, something that the poor and the weak can never afford.
4. Apart from the poor and the underprivileged, there are specific ethnic groups in which women are assigned a subsidiary status, and this condition is perpetuated by wide gaps between men and women in their access to cultural institutions, economic opportunities, and political movements. Educational deprivation

contributes substantially to this condition. Thus, both the general standing of the Muslim masses (as distinct, of course, from the small urbanized and educated elite) and the status of women among the Muslims have suffered from the low educational standards of the women.

5. Underemployment is even more of a curse than unemployment. After all, the choice to remain unemployed is not available to the really poor who must take whatever comes, however, little, intermittent or degrading. For a fuller discussion, see my "Political Economy of Employment", *Social Change* (New Delhi), 3(3), September 1973.
6. This is not to underrate the importance of reducing population growth. For in a already highly populated country the burden of dependency on the income-earners becomes much too heavy and the *sense* of dependency among the young brings in feelings of rejection and humiliation.



## APPENDIX 'A'

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## VII. FOOD

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### Scope

The most important source of raising human food is land which has traditionally tended to be considered as an inherited means of subsistence. Increasing population and severe limitations in extending the agricultural area for food production has brought on the need for harnessing land as a business venture and aimed at producing agricultural surpluses (especially food) so as to bring in food security and ensure continuous supply to the people.

The investment approach for maximum land productivity will have to consider a variety of socio-economic factors that would operate in future years. A major cause of concern is the fast pace of urbanisation in recent years and the migration into cities of rural populations seeking means of livelihood. If centres for the processing of food and other consumer items could be organised in rural areas, the disproportionate pressure of population on cities is likely to be minimised.

Future policies and plans for agricultural development should, therefore, clearly aim at maximum production of food, its protection against wastage, appropriate processing industry at or near the agricultural production centres and the organisation for an efficient distribution system.

Since production of animal-based foods is far more expensive, food crops should merit high priorities in our future policies. A set of alternatives would, however, be useful in planning viable approaches to solving the problems of food and nutrition towards the turn of the century.

This document, therefore, deals with the following features needed in planning for 2000 A.D.: (a) population growth and urbanisation; (b) food consumption model designs and their nutritional spectrum; (c) production targets based on these models; (d) strategies for production, storage and processing of foods; and (e) outlines of a distribution system.

### Population growth and urbanisation

A study of several estimates shows that population in India in 2000 A.D. may reach 836-1083 millions. For the present study however a population of 969 millions (at av. decennial growth rate of 2.466%) in 2000 A.D. (table 1) has been taken into account. Consistent with population growth, urbanisation is also accelerating and according to

National Commission on Agriculture, urban population will reach a figure of about 281 millions (29% of the total population as against 21% in 1971) in 2000 A.D. A study by Urban Systems Centre, Bombay has estimated that urban population is likely to reach 350-400 millions in 2000 A.D.; besides, it has identified five megalopolitan areas and populations :

Megalopolitan area	Population in 2000 A.D. (millions)
1. Bombay, Ahmedabad and poona	38.60
2. Calcutta	23.00
3. Madras, Bangalore	19.70
4. Delhi	19.00
5. Lucknow and Kanpur	10.00

Further, about 20 cities with a population of 1 million each, and at least 600 cities with a population of 50,000-500,000 are also anticipated to emerge. Thus, the challenge of matching social amenities and medical care to increased needs will be alarming unless suitable planning is initiated and measures taken to minimise indiscriminate migration of rural folk to urban centres in search of livelihood. Migration of labour into cities can be slackened only by generating food surpluses and creating rural employment through agro-based industries, besides organising appropriate facilities for education, medical care and entertainment.

In order, therefore, to help in planning for adequate food supplies and safety factors, a few food consumption models have been used in computing food targets for 2000 A.D.

#### **Design of food consumption models**

The designs of food consumption models are based on the intake of food materials to provide 2400 calories and 46 g of proteins per day as recommended by Indian Council of Medical Research and of 2124 calories and 46 g of proteins stipulated by the Task Force on Nutrition (tables 2 & 5). The dietary pattern suggested by these organisations include animal based foods but the models designed in this study, consist exclusively of cereals, pulses, tubers and oilseeds which are less expensive. While working out these models, it is recognised that vitamins and minerals have to be provided through fruits, and vegetables whose annual production is approximately 30 million tonnes.

The percentage of calories obtainable from cereals, pulses, tubers and oilseeds, in different models has been determined on the ratio of average production of 5 years. The gram equivalents of calories from each food material have been used in computing food requirements and production targets for 2000 A.D.

TABLE 3

*Designs of food consumption models for 2000 A.D.*

Model	Calories (%) from		Other food materials
	Food grains	Oilseeds and tulyers materials	
Model I . . . . .	80	20	..
Model II . . . . .	90	10	..
Model III . . . . .	80	10	10
Model IV . . . . .	70	30	..

**Food consumption as per models**

All the models at calorie intake of 2400 provide for higher consumption of cereals (438 to 564 g./day) than recommended levels (412 g.). Consumption of pulses is similar to recommended levels (60 g.) except in Model II where it is 67 g./day. Models I and IV show far greater consumption of tubers (231 g. and 347 g. respectively) than recommended level (87 g.). Oil consumption is 14 g./day in Model I, 6.9 g./day in Models II and III and 20.7 g. in Model IV (tables 2 and 4).

Model III designed for a calorie intake of 2400, is characterised by moderate consumption levels of all food materials including tubers as compared to others, and also allows for consumption of other foods. Even with consumption of cereals, pulses, tubers and oil, this model can provide 2160 calories which is higher than that recommended (table 5) by NCST Task Force on Nutrition.

Model I is similar to III, except for higher consumption of tubers. Model II is characterized by higher levels of food grain consumption than other models but comparable levels of tubers and oilseeds.

Model IV is characterised by lower consumption levels of food grains than other models but involves the highest consumption of tubers, i.e., 347 g./day. This model, could therefore represent a scenario dominated by tubers (table 4).

**Nutritional spectrum of models**

The nutrient composition of four models designed at 2400 calorie/day level, indicates that all of them provide higher levels of proteins, thiamine, and nicotinic acid than recommended allowances but comparable levels of iron (table 5). The invisible fat contents of the models range from 15.4 to 28.65%. The models, however, show deficiencies of calcium, beta-carotene, riboflavin, and vitamin C, which have to be made up from other foods which invariably form part of dietaries.

### **Food production targets**

Food production targets based on each model have been computed with addition of 15% and 20% to account for seed, feed and wastage. Under these extra levels considered, 9% is for seed and feed and the rest for avoidable wastages of 6 to 10% as estimated by the Food Losses Committee of Govt. of India. Since it is safer to aim at higher production targets, data obtained with 20% addition to human requirements which provide for 10% of wastages have been taken into account (table 6).

The targets of food grain (cereals + pulses) production is 208 million tonnes according to model IV, 238 million tonnes according to models I and III and 268 million tonnes according to model II (tables 7 and 8).

### **Prospects of achieving targets for 2000 A.D.**

At current per hectare yields of food crops, production of cereals alone would require 203 to 263 million hectares which is not practical since the entire land area is 328 million hectares only. If yields are doubled, food targets of models I, II, III and IV could be met from a cultivated area of 155, 158, 145 and 147 million hectares respectively. This would mean that cultivated area has to be expanded by 21, 24, 11 and 13 million over that of 134 million hectares in 1974-75 (tables 7 and 8). Hence, from the point of view of minimum expansion of cultivated area, food production targets of models III and IV appear to be more practical.

### **Multiple cropping**

Sequential cultivation of crops also called multiple cropping, has been found to yield more than 12 tonnes of food grains per hectare in irrigated areas. For example, multiple cropping of maize-potato-maize has yielded about 12.6 tonnes of maize and 28.9 tonnes of potato per hectare. Another multiple cropping sequence (maize-potato-wheat-mung) in Rajasthan has shown per hectare yields of 8.99 tonnes of food grains, and 18.875 tonnes of potato.

If, however, doubling of per hectare yields becomes difficult on a national scale, multiple cropping could be planned by bringing some additional area under irrigation to supplement the current food production. In addition to about 120 million tonnes of food grains produced from 134 million hectares in 1974-75, an extra 120 million tonnes of food grains could be produced by bringing an additional 10 million hectares under irrigation. Thus, the entire cultivated area would not exceed 145 million hectares while yielding a total of 240 million tonnes of food grains and a minimum of 100 million tonnes of tubers.

### **Storage requirements**

About 70% of the foodgrains is retained in 567000 villages and the rest enters the urban marketing channels. Food grains in villages



are stored in underground pits and overground traditional structures. Since the urban population is estimated to reach 281 millions by 2000 A.D., storage requirement is bound to increase for accommodating the extra food procurement. Similarly, rural population will reach a level of 688 millions requiring much larger storage facilities at village level.

Models I and III which show identical food grain production target which is also higher than that of Model IV have been considered for convenience in assessing the storage requirements. Model II has not been considered since it presents a picture of the highest food grain production targets and will require 153.26 million hectares of land in spite of doubling yields as compared to about 136 million hectares according to Models I and III (tables 7 and 8).

The production target in 2000 A.D. is 98 million tonnes of rice (147 million tonnes of paddy), 57.4 million tonnes of wheat, 15 million tonnes of maize, 20 million tonnes of jowar, 13 million tonnes of Bajra, 5.3 million tonnes of Ragi, 4.2 million tonnes of small millets and 25 million tonnes of pulses totalling to about 238 million tonnes (tables 6A and 12).

If 70% of food grains continues to remain in villages, the rest amounting to 71.4 million tonnes will require storage space in urban areas. Since the present urban storage capacity has been estimated at 29 million tonnes only, an additional capacity of 42.4 million tonnes costing about 636 million rupees (at Rs. 15/tonne) will become necessary. The cost of phased construction at the rate of 1.7 million tonnes/year (for 25 years) will be about 25.5 million rupees (table 9). Likewise, storages for more than 84 million tonnes of food grains have to be organised in villages. Since this would involve enormous investments and organisation, a separate autonomous agency should be created and entrusted with the task of storage and infestation control of food materials.

#### **Fumigant and insecticide requirements**

Fumigants like MB/EDB and aluminium phosphide have been used for the disinfection of food materials in the country. Pesticidal formulations based on Lindane and DDT are also sprayed on the surface of jute bags (1.44 g/bag) for preventing cross infestation during storage. Hence, adequate supplies of these inputs are necessary for protecting the food stocks from spoilage.

Out of the production target of 238 million tonnes of food grains in 2000 A.D., paddy (147 million tonnes) and Ragi (5.3 million tonnes) undergo little damage if adequate precautions are taken to prevent the seepage of moisture and rodent activity. Hence, the remaining 134.7 million tonnes consisting of other foodgrains need protection on priority.

Assuming that 50% of 134.7 million tonnes will be fumigated by aluminium phosphide and the rest by MB/EDB, requirements of these two classes of chemicals can be estimated at 269.4 and 3367.5 tonnes valued at 22.899 and 16.84 million rupees respectively. Likewise, 40.4 million tonnes (30% of 134.7 million tonnes) stored in urban areas will need about 404 million jute bags. Treatment of these bags with Lindane and DDT (used in equal proportion in the pesticidal emulsion) will require 291 tonnes of each of these pesticides costing 29.1 and 1.46 million rupees respectively (table 10).

The current installed capacities of BHC (used for the manufacture of Lindane) and of DDT are adequate but production has to be raised by 2910 and 291 tonnes respectively. In the case of aluminium phosphide and BM/EDB, installed capacity and production have to be raised by 19.4 and 2759.4 tonnes respectively (table 11).

#### **Storage and disinfestation service**

Food protection in rural sector is more difficult than in urban areas because of complex socio-economic factors and lack of facilities. Further, agencies connected with agriculture, food, community development and warehousing render advisory service only, and cannot therefore, percolate into rural sector. A separate storage and disinfestation agency particularly for rural areas may be considered in view of the extra food grain production anticipated in 2000 A.D.

#### **Processing of food grains**

Most food grains are covered by husk and bran which should be removed before human consumption. It is, therefore, necessary to examine the current processing facilities to plan for future needs.

*Paddy*: The paddy is milled in 70,000 hullers and 14,000 shellers (table 12). Conventional shellers and hullers can generally mill 1 and 0.875 tonnes (0.25-1.5 tonnes/hour) of paddy per hour respectively; on this basis, milling capacity in the country, by continuous 8 hour shifts, amounts to 33.6 million tonnes from shellers and 147 million tonnes from hullers. This appears adequate to mill all the paddy in 2000 A.D. Hullers, however, give lower milling yields than shellers and most of them have become obsolete. In contrast, shellers are capital intensive, and not within the reach of small operators in rural/urban areas. Future strategies may, therefore, aim at setting-up mini rice mills designed and tested at CFTRI such units are being commercially fabricated in the country.

*Wheat*: About 95% of what produced in the country is milled in stone mills (*Chakki*) for *Atta* and the rest in roller flour mills. The present annual roller flour milling capacity is about 6 million tonnes but the total quantity of wheat milled so far has not exceeded 2.9 million tonnes per year. Thus, the existing roller flour mills are sufficient even if roller milling of wheat is increased to 6 million

tonnes. Marginal expansion of roller mill capacity can be undertaken according to needs but the primary emphasis should be for improvement of *Chakḱis* to yield a variety of products so that small units located at rural and semi-urban centres could largely replace the capital intensive, sophisticated roller mills.

*Maize* : Maize is primarily ground into flour in *Chakḱi* for human consumption, and about 2% of production used for starch and its derivatives. Three dry milling units with a total annual capacity of 80,000 tonnes have been set up based on foreign know-how in some urban areas to produce semolina, and flour. An imported maize mill of 50 tonnes/day capacity costs about 85 lakh rupees or about 1.6 lakh rupees per tonne of milling capacity of 8 hours shift per day. Such a mill is, therefore, not suitable for rural and semi-urban areas. Hence, a small maize mill has been designed and tested at CFTRI. A 400 kg/hour unit costs about 1.2 lakh rupees or about 8,000 rupees per tonne of milling capacity of an 8 hour shift per day. It is an adaptation of a rice huller incorporating suitable components for conditioning, grinding, sifting and separation of germ. Even the existing old hullers could be converted into maize mills by slight modification and addition of some components at a cost of about Rs. 10,000/-.

*Jowar, Bajra, Ragi and small millets* : Flours of jowar, bajra and Ragi milled in *Chakḱi* are used for *Roti* and other preparations. If they have to be popularised for consumption by larger population groups, suitable adaptation of *Chakḱi* is necessary to obtain bran-free flours which can cook soft, and are amenable for use with wheat, rice and in convenience foods (*Idli, Dosa, crispies*). It may be mentioned that technologies for obtaining refined flours from jowar, Bajra and Ragi are already available in the country.

#### **Storage and processing of tubers**

The production targets for potato and tapioca in 2000 A.D. are 23.2 and 28.01 million tonnes respectively (table 1).

Although more than 80% (1.4 million tonnes) of the available cold storage capacity (1.764 million tonnes) is being used for potatoes, the major portion of production is marketed for direct human consumption thereby posing problems of crashing prices during gluts besides heavy spoilage.

Raw tapioca tubers are also extremely perishable and cannot be stored for more than 6 days.

The major approach which merits serious consideration for minimising spoilage during handling and storage is to reduce the cost of

transportation, is the drying of tubers at producing centres themselves. Since mechanically dried products are expensive, sun-drying techniques have to be improved and popularised to produce hygienic items with extended shelf-life, thereby facilitating easy transportation to consuming centres.

#### **Public distribution system**

An informal public distribution system has been functioning in the country except in Calcutta, Asansol and Durgapur group of towns in West Bengal and the metropolitan city of Bombay where statutory rationing is in operation. The distribution is channelised through fair-price shops and cooperative organisations totalling 2,24,805 in February, 1976.

The public distribution system handled only about 2.3 million tonnes of food grains in 1956, 14.1 million tonnes in 1966, 10.61 million tonnes in 1974 and 11.12 million tonnes in 1975. The procurement during these respective years amounted to 0.04, 4.01, 5.68 and 9.48 million tonnes (table 13). Besides, the inconvenience caused by irregular distribution, lack of quality control and problems of underweight in retail outlets have been driving the consumers to open markets thereby resulting in price fluctuations, particularly in urban areas.

Although ideal distribution system should cover the entire population, its organisation and functions cannot be easily upgraded to meet national needs, because of limitations imposed by the existing market structure. Hence, a statutory public food distribution system for urban areas may be kept in view so that the availability of food grains can be improved in rural areas. This approach will help in the rationalisation of consumption patterns among the populations of various income groups in urban areas and also enable the government to increase the quantum of procurement for building adequate buffer stocks to meet shortages arising out of drought conditions.

According to the National Commission on Agriculture and Rashmi May the urban population in 2000 A.D. will be 281 and 400 millions at growth rates of 3.783% and 5% respectively.

Hence, quantum of food grains required for distribution to these two levels of population estimates and storage facilities have been presented (table 13) on the basis of a convenient model considered in the earliest of this study. Additional quantities of 58.2 and 66 million tonnes will have to be procured and handled in the public distribution system over that handled in 1975. Storage facilities of 49.2 and 77 million tonnes costing 633 and 1163 million rupees will also become necessary.

TABLE 1  
*Projections of population in 2000 A.D.*

Author	Basis of calculation	Population (millions)
Sukhatme <sup>a</sup>	{ At 1.7% compound per year . . . . .	836
	{ At 2.1% compound per year . . . . .	1000
Rashmi Mayurb	Through various analysis and projections (not specified).	850-1000
Ranganekar <sup>c</sup>	{ At tapering rate of growth from 2.25% in 1971 to 2.7% by the end of century.	1032.1
	{ At constant rate of growth 2.25% throughout till the end of century.	1083.11
	{ At the rate of 2.25% at present to 1.6% by 2000 A.D.	945.4
National Commission on Agriculture†	Total . . . . .	935.0
Present Study . . . . .	{ Averag rate of growth of 2.466% (as recorded between 1961-71**)	969.0
	{ †Urban (29%) . . . . .	281.0
	{ †Rural (71%) . . . . .	688.0

\*\* Census of India, 1971, Paper 1 of 1971 — Supplement, Govt of India, 1971, pp. 4, 69.

+ National Commission of Agriculture, Growth Strategy and Progress Report II.

(a) Sukhatme P. V., *Feeding India's Growing Millions*, Asia Publishing House, 1965, pp. 6, 132.

(b) Rashmi Mayur, *Urbanisation in India in 2000 A.D.*, Urban Systems Centre, NITIE, Bombay, 1964.

(c) Ranganekar.

TABLE 2  
*Balanced diets and food consumption patterns*

Food material	Recommended g/day		Consumption pattern (g/day)
	I C M R <sup>a</sup>	Nutr. Task Force <sup>b</sup>	
Cereals . . . . .	412	376	434
Pulses . . . . .	60	64	34
Green leafy vegetables . . . . .	125	116	21
Other vegetables . . . . .	50	61	71
Roots and tubers . . . . .	87	69	N.D.
Fruits . . . . .	30	40	10
Milk . . . . .	100	189	69
Fats/Oils . . . . .	40	39	12
Meat and fish . . . . .	30 } . . . . .	23	14 <sup>d</sup>
Eggs . . . . .	30 } . . . . .	15	
Sugar and jaggery . . . . .	35	38	19

(a) Average of allowances recommended for men and women engaged in moderate work; C. Gopalan & B. S. Narasinga Rao, *Dietary Allowances for Indians*, Nat. Inst. Nutr., Hyderabad, 1971, p. 87-88.

(b) *Task Force on Nutrition*, NCST, Oct. 1972.

(c) C. Gopalan, *et al*, *Diet Atlas of India*, Nat. Inst. Nutr., Hyderabad, 1971, p. 29.

(d) Meat, fish and egg.

TABLE 3

*Food consumption models, calories and their equivalent as food material*

Model	Proportion of Food materials	At 2400 Kcals/day		At 2100 Kcals /day	
		Calorie obtainable	Food material <sup>a</sup> equivalents(g)	Calorie obtainable	Food material equivalents(g)
<i>Model I</i>					
Cereals . . . .	72.00	1728.0	501.0	1512.0	438.00
Pulses . . . .	8.00	192.0	59.0	168.0	52.00
Tubers . . . .	12.30	295.2	231.0	258.3	202.00
Oilseeds . . . .	7.70	184.3	34.0	161.7	30.00
			(14.0) <sup>b</sup>		(12.20) <sup>b</sup>
<i>Model II</i>					
Cereals . . . .	81.00	1944.0	564.0	1701.0	493.00
Pulses . . . .	9.00	216.0	67.0	189.0	58.50
Tubers . . . .	6.15	147.6	115.3	129.0	101.00
Oilseeds . . . .	3.85	92.4	17.0	81.0	15.00
			(16.9) <sup>b</sup>		(6.0) <sup>b</sup>
<i>Model III</i>					
Cereals . . . .	72.00	1728.0	501.0	1512.0	438.00
Pulses . . . .	8.00	192.0	59.0	168.0	52.00
Tubers . . . .	6.15	147.6	115.3	129.0	101.00
Oilseeds . . . .	3.85	92.4	17.0	81.0	15.00
			(6.9) <sup>b</sup>		(6.1) <sup>b</sup>
Other foods. . . .	10.00	240.0	..	..	..
<i>Model IV</i>					
Cereals . . . .	63.00	1512.0	438.0	1323.0	383.5
Pulses . . . .	7.00	168.0	52.0	147.0	45.5
Tubers . . . .	18.50	444.0	347.0	388.5	303.5
Oilseeds . . . .	11.50	276.0	51.0	241.5	45.0
			(20.7) <sup>b</sup>		

Calories and respective food material equivalents based on ratio of average production of 5 years;

(a) Calculated on the following basis: 3.45 calories/1 g of cereal; 3.23 calories/1 g. of pulses; 1.28 calories/g of tubers; and 5.42 calories/1 g. of oilseeds.

(b) Oil equivalent at 40.5% oil content.

TABLE 4

*Recommended allowances and nutritional spectrum of models*

Nutrient	Nutritional content of models at 2400 Kcals/day				
	Recom- mended levels <sup>a</sup>	Model I	Model II	Model III	Model IV
Calories (Kcal)	2124	2400	2400	2400	2400
Proteins (g)	46.0	59.90	66.1	58.6	54.1
Fat (g) <sup>b</sup>	..	22.700	16.6	15.4	28.65
Calcium (g)	0.6	0.322	0.314	0.283	0.331
Iron (mg)	26.0	26.490	28.7	25.56	24.36
Ratinol (mcg)	632.0	N.C.	N.C.	N.C.	N.C.
Beta-carotene (mcg)	750.2	275.710	296.41	263.96	254.34
Thiamine (mg)	1.1	1.660	1.77	1.58	1.570
Riboflavin (mg)	1.2	0.826	0.851	0.76	0.804
Nicotinic acid (mg)	15.1	17.450	18.630	16.63	16.290
Vitamin C (mg)	51.1	57.800	26.120	26.00	76.310
Folic acid (mcg)	107.5	..	..	..	..
Vitamin 12 <sub>1</sub> (mcg)	1.0	..	..	..	..

(<sup>a</sup>) *Task Force on Nutrition*, NCST, Oct. 1972; N.C. — Not calculated.

(<sup>b</sup>) No firm recommendation on fat.

TABLE 5

*Food production targets for 1969 millions in 2000 A.D.  
(at 2400 Kcal/day)*

Food Item	Actual consumption requirement	15% added <sup>b</sup>	20% added <sup>c</sup>
<i>Model I</i>			
Cereals . . . . .	177.1	204.0	213.0
Pulses . . . . .	20.9	24.0	25.0
<b>Total Foodgrains . . . . .</b>	<b>198.0</b>	<b>228.0</b>	<b>238.0</b>
Tubers . . . . .	81.7	102.2 <sup>a</sup>	102.2 <sup>a</sup>
Oilseeds . . . . .	12.0	13.8	14.3
<i>Model II</i>			
Cereals . . . . .	200.0	230.0	240.0
Pulses . . . . .	23.8	27.4	28.6
<b>Total Foodgrains . . . . .</b>	<b>223.8</b>	<b>257.4</b>	<b>268.6</b>
Tubers . . . . .	41.0	51.2 <sup>a</sup>	51.2 <sup>a</sup>
Oilseeds . . . . .	6.0	6.9	7.2
<i>Model III</i>			
Cereals . . . . .	177.1	204.0	213.0
Pulses . . . . .	20.9	24.0	25.0
<b>Total Foodgrains . . . . .</b>	<b>198.0</b>	<b>228.0</b>	<b>238.0</b>
Tubers . . . . .	41.0	51.2 <sup>a</sup>	51.2 <sup>a</sup>
Oilseeds . . . . .	6.0	6.9	7.2
<i>Model IV</i>			
Cereals . . . . .	154.9	178.2	186.0
Pulses . . . . .	18.4	21.2	22.0
<b>Total Foodgrains . . . . .</b>	<b>173.3</b>	<b>199.4</b>	<b>208.50</b>
Tuders . . . . .	122.6	153.3 <sup>a</sup>	153.3 <sup>a</sup>
Oilseeds . . . . .	18.0	20.7	21.7

(<sup>a</sup>) At 25% addition to account for post-harvest losses.

(<sup>b</sup>) 15% — 6% feed + 3% seed + 6% post harvest losses.

(<sup>c</sup>) 20% — 6% feed + 3% + 10% post harvest losses (rounded off to 20%).



TABLE 6

*Food production targets\* for 969 millions in 2000 A.D. (at 2400 Kcal/day) as per Model III*

Food material	Production target (million tonnes)
Rice . . . . .	98.00 (147.00)**
Wheat . . . . .	57.40
Maize . . . . .	15.00
Jowar . . . . .	20.00
Bajra . . . . .	13.00
Ragi . . . . .	5.3
Small millets . . . . .	4.2
Pulses . . . . .	25.00
Tubers . . . . .	51.20†

\* Human requirements + 20% addition;  
tapioca 28.0 million tonnes

\*\* As paddy

† potato 23.2;

**TABLE 7**  
*Production targets for 2000 A.D. and area requirement*

Particulars	Model I				Model II			
	Cereals	Pulses	Tubers	Oilseeds	Cereals	Pules	Tubers	Oilseeds
Production target in 2000 A.D. (million tonnes) <sup>a</sup>	213.00	25.00	102.00	14.00	240.00	28.6	51.2	7.2
Production in 1974-75 (million tonnes)	87.50	10.40	12.50	7.94	87.50	10.4	12.5	7.94
Area required in 2000 A.D. (million hectares)								
At average yield <sup>b</sup>	233.02	38.40	8.22	29.78	262.65	43.93	4.10	14.89
At av. yield doubled	116.51	19.20	4.11	14.89	131.30	21.96	2.05	2.44
At attainable yield recorded <sup>c</sup>	65.97	16.67	4.12	..	74.48	19.06	2.46	..
Area in 1974-75 (million hectares)	96.11	22.58	0.97	14.61	..	..	..	..

(a) At 2400 K cal/day + 20% addition (9% feed + seed + 11% wastages)

(b) Average yield of 1971-72 to 1974-75

(c) Yield recorded in coordinated project and demonstration trials.

Model I — Calories from : cereals, 72%; pulses, 8%; tubers, 12.3%; and oilseeds, 7.7%.

Model II — Calories from : cereals, 81%; pulses, 9%; tubers, 6.15%; oilseeds, 3.85%.

**TABLE 8**  
*Production targets for 2000 A.D. and area requirement*

Particulars	Model III				Model IV			
	Cereals	Pulses	Tubers	Oilseeds	Cereals	Pulses	Tubers	Oilseeds
Production target in 2000 A.D. (million tonnes) <sup>a</sup>	213.00	25.00	51.20	7.20	186.00	22.00	153.30	21.70
Production in 1974-75 (million tonnes)	87.52	10.40	12.50	7.94	87.52	10.40	12.50	7.94
Area required in 2000 A.D. (million) hectares)								
At average yield <sup>b</sup>	233.02	38.40	4.11	14.89	203.20	33.80	12.31	44.90
At average yield doubled	116.51	19.20	2.06	7.44	101.60	16.90	6.16	22.45
At attainable yield recorded <sup>c</sup>	65.97	16.67	2.46	..	57.46	14.67	7.35	..
Area in 1974-75 (million hectares)	96.11	22.58	0.97	14.61	96.11	22.58	0.97	14.61

(a) At 2400 calories per capita/day + 20% addition (9% feed + seed and 11% wastage).

(b) Average yield of 1971-72 to 1974-75.

(c) Yield recorded in All India Coordinated project and demonstration trials.

Model III — Calories from : cereals, 72%; pulses, 8%; tubers, 6.15%; and oilseeds, 3.85% (oil equivalents). The remaining 10% of calories has to be provided by animal based foods, fruits and vegetables.

Model IV — Calories from; cereals, 63%; pulses, 7%; tubers, 18.5%; and oil seeds 11.5% (oil equivalents).

TABLE 9

*Storage requirements in 2000 A.D.*

Particulars	Million tonnes
(A) Food grain production in 2000 A. D. <sup>a</sup>	238.00
(B) Currently stored in villages <sup>b</sup>	81.20
(C) Likely to be stored in villages in 2000 A. D. <sup>b</sup>	166.60
(D) Additional village storage capacity required (C—B)	85.40
(E) Current urban storage capacity	29.00
(F) Likely to be stored in urban areas in 2000 A. D.	71.40
(G) Additional urban storage capacity required (F-E)	42.40
(H) Cost per year of phased construction of additional storage (1.7 million tonnes/year) till 2000 A. D. at Rs 15/tonne)	25.500 (million rupees)

(a) — As per model III;

(b) — 70% of total production.

TABLE 10

*Fumigant and insecticide requirements for protecting foodgrains in 2000 A.D. according to Model — III*

1. Total food grain production . . . . .	238 million tonnes
2. Total wheat, maize, bajra, small millets and pulses which required fumigation . . . . .	134.7 million tonnes*
3. Quantity of EDB/MB needed for protecting 67.35 tonnes at 1 kg/20 tonnes or (5 g/100 kg) . . . . .	3367.5 tonnes
4. Cost of EDB/MB at Rs 5000/tonnes . . . . .	16.84 million rupees
5. Quantity of phosphide needed for protecting 67.35 million tonnes at 4 g/tonne . . . . .	269.4 tonnes
6. Cost of phosphide at Rs. 85,000/tonnes . . . . .	22.899 million rupees
7. Approximate bag storage for 30% of food grains likely to be in urban area . . . . .	40.41 million tonnes
8. Approximate number of bags needed (100 kg capacity)	404.1 millions
9. Approximate quantity of pesticide chemicals needed for post proofing of 404.1 million bags at 1.44 g/bag	582 tonnes
10. Lindane (50%) . . . . .	291 tonnes
D.D.T. (50%) . . . . .	291 tonnes
11. Cost of Lindane at Rs 100/kg . . . . .	29.1 million rupees
12. Cost of DDT at Rs 5/jg . . . . .	1.455 million rupees
Total cost of fumigants + Lindane + DDT . . . . .	70.294 million rupees

\* Paddy and Ragi are omitted since they suffer little loss during storage provided they are protected from moisture and rodents.

TABLE 11

*Present plant capacity for pesticidal chemicals, production and requirements in 2000 A.D.*

Pesticide	1972			Requirements in 2000 A.D. <sup>b</sup>	Gap to be bridged (tonnes) (B—D)
	Licensed capacity (tonnes)	Installed capacity <sup>a</sup> (tonnes)	Production <sup>a</sup> (tonnes)		
	A	B	C		
BHC . . . . .	29,900	25,900	15,429	2910 <sup>c</sup>	Nil
DDT . . . . .	4,200	4,200	4,116	291	—
Al Phosphide . . . . .	450	250	178	269.4*	19.4
MB/EDB . . . . .	968	608	72	3367.4	2759.4

a—Task force on pesticides, Pesticides, 1973, 7(8), p 23, 24—25; b—For a total of 134. million tonnes food grains consisting of wheat, maize bajra, small millets and pulses according to model III; —Estimated on the basis of 10% yield of Lindane

TABLE 12

Processing requirements for food materials in 2000 A.D. as per Model III

Food Material	Production target in 2000 A.D. (Million tonnes)	Current processing methods and facilities	Guidelines for action
<i>Cereals and millets</i>			
Paddy . . . . .	147.00 (98.00)*	(a) Milled in 14000 shellers (1 tonne/hour and 76,000 hullers (0.875 tonnes/hour).  (b) Mini rice mills (0.5 tonnes/hour) being commercially fabricated.	(a) Existing milling capacity of 33.6 million tonnes from shellers and 147 million tonnes from hullers (300 days of 8 hours shift) sufficient to mill the entire production in 2000 A.D.  (b) Progressive replacement of hullers by mini rice mills.
Wheat . . . . .	57.40	(a) About 95% milled in <i>Chakki</i>  (b) Less than 5% milled in roller flour mills (annual capacity 6 million tonnes)	(a) Improvement of <i>Chakki</i> to produce diverse products in rural sector.  (b) Roller flour mill expansion may receive lower priority.
Maize . . . . .	15.00	(a) Same quantities used for starch (total annual production 87,546 tonnes).  (b) Dry milling capacity in 3 units 80,000 tonnes/year. Mini maize mills for dry milling being fabricated.	(a) Increase of wet grinding capacity for starch according to requirements.  (b) Introduction of mini maize mills in rural sector for diverse products.
Jowar . . . . .	20.00	} <i>Chakki</i> milling	(a) Introduction of improved dhal mills for higher milling yields.
Bajara . . . . .	13.51		
Ragi . . . . .	5.30		
Small millets . . . . .	4.20		
Pulses . . . . .	25.00		
<i>Tubers :</i>			
State . . . . .	23.20	(a) Over 80% (1.4 million tonnes) of cold storage capacity (1.76 million tonnes) used for potatoes.  (b) Processing negligible	(a) Testing of storage in pits in cold areas.  (b) Popularisation of hygienic sundrying of tubers at farm level for storage/transport cost reduction.
Tapioca . . . . .	28.01	(a) Eaten fresh or sun dried; some quantity used for starch and sago.	..

\*Rice

TABLE 13

*Recruitments of food grains and storage facilities for statutory urban distribution system in 2000 A.D. as per Model III*

Particulars	281 millions (29% of total popula- tion) <sup>a</sup> at 3.783% growth rate	400 millions (41% of total popula- tion) at 5% growth rate <sup>b</sup>
<i>Food requirements</i>		
Cereals and millets . . . . .	63.20	87.33
Pulses . . . . .	6.00	10.25
Tubers . . . . .	11.82	20.99
Food grains handled by public distribution system in 1975 (million tonnes).	11.12	11.12
Additional foodgrains to be handled (million tonnes) .	58.02	86.46
Storage capacity with procurement agencies (million tonnes) .	20.00	20.00
Additional storage capacity needed (million tonnes) . .	49.20	77.58
Cost of additional storage capacity (Rs. 15/tonne) (million rupees).	738.00	1163.70
Bags required for storing additional food grains (millions) .	580.20	864.60

a NCST;

b Rashmi Mayur.

## APPENDIX A

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## VIII. MANAGEMENT

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## VIII. MANAGEMENT

### Introduction

The concern for future is the concern to build a new society. Management is the key to this developmental task. The shifting scene of managerial practices both in the Government, in the private sector and in the public sector suggest that we are moving in the right direction. If we look at the 50's and then at the 70's, we can see that the emerging scenario of the year 2000 is one of hope as well as that of ample fulfilment. This is not to say that we do not face any crisis points. Management of India's resources, the management of man and material and the development of science and technological inputs hold the secret to our future prosperity. We are today 608 million people. We may be around 960 million in the year 2000 A.D. This vast humanity can be our asset. The capacity to organise ourselves and to manage our affairs well can guarantee and provide the right strategies for survival and to ensure a certain quality of life. Our Technical Sub-Group examined various management parameters as can be seen in terms of the organisation and work style of our personnel and as it concerns itself with the decision making process and and to us, future of management appears full of hopes.

Organisational structures, personnel policies, programme content, use of new technologies and tools of management were critically looked at by us in order to search the required reforms. In building up the scenarios for the year 2000 one cannot escape the temptation to say that Indian managerial force has the necessary vigour, capability, and expertise to prepare for a secure future which guarantee a state of affairs where the right man is working at the right job with the right technics to ensure conditions in the country where food is available for everyone; and our people possess appropriate skills; can get employment as they are and where they are; can generate wealth in its numerous forms; and with the discrete use of known technologies both indigenous and those which characterise a post-industrial society, are able to instal right management systems to deliver the goods in time.

When we look at the emerging management profile of India three things become clear. Firstly, the new managers, the manager of today and tomorrow, would have to be one who is intellectually well-informed not only in the national context but is also familiar with the international data in the area in which he specialises be it the field of exports, marketing, production or resource planning. Such a knowledge on his part would be needed in addition to his general

knowledge and creative ability. At the minimum he shall have to possess the ability and means to acquire international data and information. Secondly, the responsibility of the Indian management is primarily one of managing "a large human system" be it in the field of education, transportation, health or whatever else one may think of. The Indian need element as it gets accentuated and aggravated by ever increasing population would make tremendous demands on our management capability, accountability and timely delivery of the services in numerous areas. Thirdly, in the context of these emerging responsibilities and the qualitative demands that they put on the management — any management, public or private — the paramount need of tomorrow and for that matter even today is that of resource management. No matter how much we advance there could always be a live crisis that our resources could fall short of what we need to enable them to offer to the people a bare minimum standard of life not without a certain touch of quality about it. This would then be an additional task, a heightened challenge and indeed the paramount duty of each manager to think of these innovative social systems whereby even with minimum level of resource we may be able to ensure 'maximum happiness to the maximum people'. All this would demand a management system which is less alienated from the Indian social milieu — a management system and a managerial style where concern for others and the concern to deliver goods should take precedence over traditional norms of procedures, rules and regulations and the formality of the process prescribed for due accountability. This could be the case with every management function be it prevention of disaster or be it pre or post disaster servicing.

The emergence of a mature self-governing, self-sustaining, self-relevant society calls for a new management style. The ability to analyse facts formulate alternatives, take a decision, implement it to its minutest details, the essence of modern management which is information based and at the same time is indicative of a creative endeavour.

The paucity of resources, trained personnel and insufficient community participation are three obvious crisis points that characterize futuristic scenarios. We need to take every conceivable step to overcome the same.

Community participation with the management and an Indian version of 'social self-management' in the form of citizen participation with administration, in the form of industrial democracy, in the form of participative decision making process, whatever be the form in which the community action could be organised, would, one is compelled to consider, holds the key to new organisational forms and decision making process for the future management system.

Feudalistic structures thus have to yield to a participative management culture. And an intense state of active competition shall prevail, hereafter, not only to get hold of and employ a well-informed manager, but organizations will have to struggle hard to retain his or her services.

In order to produce a good manager — a creative and bold decision maker and executive — we shall have to begin his training earlier than is the case today. We have to make management an educational discipline to which our children have to be exposed from the very beginning of their learning experience, right from the school age. This is a great educational responsibility.

Human resource development is the most important task for a nation as vast and great as India is. Management is one important input in this entire process. Management for 2000 A.D. clearly indicates the immediate tasks of today which can turn our population into a 'resource'.

The scenarios presented here are based on a methodology which has included use of discussion, brain storming sessions, questionnaire, verbal Delphi and intensive face to face interviews with top management executives and administrators in this country. A study of the secondary source material, one need not add, preceded the testing of the futuristic formulations of the trend and the preferred scenario for Indian Management 2000 A.D.

The management for and towards future will be one which is less alienated and is non-elitist in character. The need for modern management is not of large organisations alone. The small industry and the small farming operations equally need the advantages that can accrue from sophistication. In fact they still are a neglected sector. We have tried here to spell out concrete areas in which massive work should commence be it organisational development or the emergence of non-hierarchical, data based innovative and task force oriented administrative action. Mere advancement in technology would not make the society more modern until and unless the man who handles the new technologies are well trained and are basically result-oriented managers. Without a participative management culture which permits freedom for initiative and innovation to all functionaries, big or small, we would not be able to go very far. The management culture needs to be freed from the 'feudalistic' — cum — 'clerical' negativism.

The management of the future clearly indicates the need for the emergence of such a participative culture which is creative at the same time has that innate strength which turns the seeming catastrophe into a great opportunity of immense fulfilment and generates that unique 'euphoria', which one gets when a job is done well. Indian Management, one fervently hopes, will swiftly move in this direction.

Finally, I thank all those who have cooperated with me in offering their views and reactions towards the preparation of this 'interim report'. It is with great humility that I submit the same for further discussion, debate and hopefully for an early implementation of some of the important recommendations made. We should accept the fact that after all "Future is today".

### 1. Management Defined

Management is basically an exercise in doing things better. It is a continuous decision making process. Its key objective is to serve people and to fulfil their numerous needs. The need element more than anything else determines the kind of management practices that should be followed. The key factors to be taken into account would include population, financial and material resource, personnel, technology, social purpose and quality of life.

### 2. What constitutes concern for Future

The concern for future is the concern to look at a long-range perspective in terms of people's need and in terms of the numerous ways of fulfilling of those needs. As such, a futuristic view-point *inter-alia* involves the following few considerations :—

- (a) Study of resource and demand : Today and in the future (25 years hence or 50 years hence);
- (b) Study of numerous alternates (social, economic, technological and even political); and
- (c) Determining the future goals. This is a normative exercise. Here one indicates a certain preference (What kind of society we wish India to be like in the year 2000 AD?).

### 3. The Key Task of Management

The key task of management, in the Indian context, would be to fulfil six basic human needs : (1) Food and Water; (2) Shelter; (3) Clothing; (4) Health; (5) Education; and (6) Work (Employment). The sophistication of management and the tools that it can use would guarantee or indicate failure or success of people's capacity to help themselves. This would also indicate the prevailing management style: (Feudal, paternal, professional, participative, etc.).

### 4. Proliferation of Management Responsibility

In the Indian management scene of the last thirty years one finds numerous developments which characterize the public administration process, the public sector management process, and the private sector management. In all of them there are three dominant elements : (a) Hierarchical structures; (b) Concern for accountability; and (c) Profit as a yardstick of good or bad performance. (Not in Public Administration).

The proliferation of State's functions and the S&T sophistication of industrial activities have given rise to numerous management pat-

terns, organisational forms and managerial style. The impact of Western administrative and managerial systems, however, continues to dominate the thinking and practice both in the private and the public sector. The role of multi-nationals is equally visible in influencing management culture at least of the larger companies. Even management education has been so far highly Western oriented and, by and large, it has been elitist in character. Equally important development has been the growing emphasis on training and administrative and managerial reform. As a contrast this must, however, be admitted that the impact of modernisation has not been experienced or accepted or implemented by all the institutions within the public or the private organised sector small industry being a case in point. The local administration too still displays a management style more typical of the 19th Century.

#### **5. Leading Questions Concerning The Management of "A Large Human System"**

The task of management in India is the task of managing a "large human system". Some of the questions that we have to ask ourselves are as follows :—

- (1) Is our management system suited to the task of managing a large human system? (608 million people in 1976 — 960 million people in 2000 A.D.).
- (2) Is our management system, in the fourth decade of the 20th Century, tuned to cope with the challenges of the 21st Century ?
- (3) What are the inherent strength of the system? What are its inherent weaknesses?
- (4) What should constitute the dynamics of management change?
- (5) Thus, to prepare ourselves for the tasks of the future, what current decisions are inescapable?

#### **6. Futuristic Scenario**

In an attempt to look at the future one can offer numerous scenarios which could be one or the other of the following :

- (i) Scenario based on a model of 'business as usual';
- (ii) Scenario for several expected futures; and
- (iii) Scenario for a preferred future.

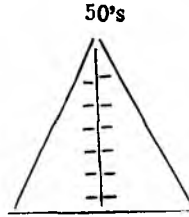
These scenarios have to be seen in terms of human needs on the one hand and the national capabilities on the other.

The management for the future or the management towards the future can be glimpsed in two illustrative scenarios which are as follows :

**A : The Trend Scenario : (Management : 2000 A.D.)**  
**MANAGEMENT IN GOVERNMENT**

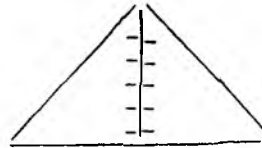
Parameters examined

1. Nature of Bureaucracy



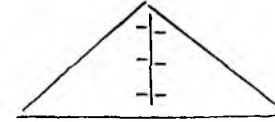
50's

Too hierarchical  
Monolithic



70's

Increased specialisation  
More participation.



2000 A.D.

Participative  
Team work  
Less hierarchical

Broad-based

2. Work Methodology.

3. Organisational Structures.

1. Characteristic Weberian typology (W.T.); establishes rational legal bureaucratic order.

1. Weberian typology gets enfeebled (W.T.) as State functions multiply.

1. Gradual crumbling of administrative pyramid leading to shrinking of policy levels and concomitant programme executing organisations.

4. Personnel Management

2. Administration still top heavy; limited extension of delegation of powers.

2. The character of decision making alters with the increased delegation of authority and due to in work-style.

5. Training Function.

2. *Impact of British Administrative System.*

3. Decision making process hierarchical and still precedent oriented. Consultative aspect dominates.

3. New administrative ethos lays emphasis on targets; time bound programmes; greater facility in implementation policies.

6. Reforms Function

(1) Executive part and parcel of legislature.

4. Proliferation of Governmental responsibility gives birth to new formations.

4. Flow of personnel from industry to Government and vice-versa.

7. Decision making process

(2) Doctrine of Ministerial responsibility.

5. Influx of specialised personnel.

5. Increased lateral entry.

3. *Limited Functions*

(1) Law and order.

(2) Limited development functions.



- (3) Slow moving work style.
- (4) Highly pyramidal structures: monolithic top heavy.
- (5) Personnel selection : traditions prevails : competitive examinations continue.
4. *Training Function.*  
Limited in character.
- (6) Selection process non-related to candidate's specification.
5. *Reforms Function*  
Beginning of O & M exercise. Early emphasis on statistical study of work-load.
6. *Decision making process*  
Heirarchical : limited delegation of authority; over-whelming concern for precedents; decision making highly consultative and therefore time consuming; highly backward looking too : Historical orientation dominates.
7. Commencement of planning.
6. Training function increase as well as reform function gains momentum.
7. Work study, operation research, new technics begin to receive attention.
8. The continuation of planning process alters the decision making process in various organisations.
9. Project management and role of consultancy increases.
10. Heirarchical attitudes & approach continue to dominate the secretarial work.
11. Growth of S & T organisation & emergence of short range & long range S & T Planning.
6. Likely crisis in personnel management due to proliferation and diversity in the conditions of service of different types of personnel.
7. Likely emergence of parity in personnel policy as amongst different functionaries/services, etc.
8. Emergence of S & T institutions leading to new approaches to programme fulfilment.
9. Emphasis on task forces/groups/teams as against vertical heirarchical decision makers.
10. Strengthening of management and cooperative sector.
11. Emergence of new styles of rural development & District administration.
12. Emergence of new administrative culture accompanied with attitudinal change.

## BUSINESS MANAGEMENT

Parameters examined

1. Organizational style.

50's



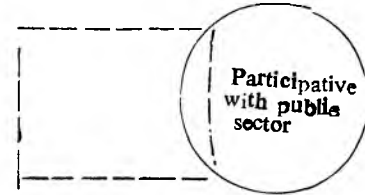
closed  
sector

70's



More Open &  
Exposed to pro-  
fessionalism.

2000 A.D.



Participative  
with public  
sector

2. Personnel policy,

3. Programmes.

1. Family owned concern.

2. Pole of managing agencies.

3. Foreign collaboration and emergence of multinationals.

4. Lack of management training.

5. Personnel management highly personal and subjective.

6. Lack of social purpose.

1. Emergence of professionally qualified people.

2. Managing agencies abolished.

3. Strengthened emergence of multi-nationals.

4. Increase in professionally qualified personnel.

5. Claim of social purpose made.

6. Increased management education and training effort.

7. Diversification of industrial activities

8. In-house R & D, O & M, Operations research and adoption of new management techniques.

9. Emergence of joint endeavours with public sectors

10. Better industrial relations.

11. Emergence of professionals in sales, marketing, public relations, etc. & allied managerial tasks.

12. Increased delegations of authority and decision making ability to lower functionaries.

1. Increased participation in management.

2. Better industry Government relation.

3. Increased role of multi-nationals;

4. Increased emergence of the joint sector.

5. Increased R & D effort

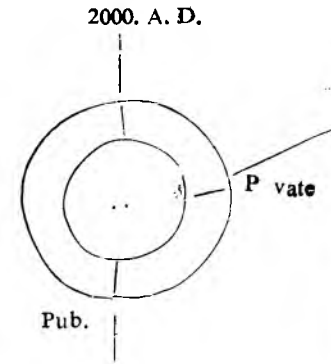
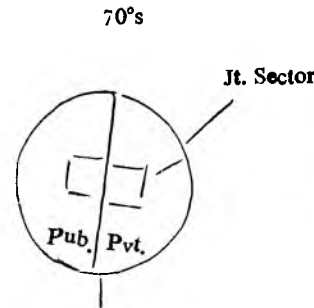
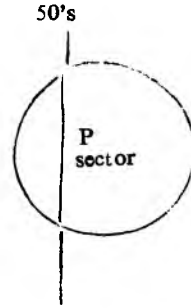
6. Increased meritocracy.

7. Crisis situations arise from resource scarcity.

# PUBLIC-SECTOR VIS-A-VIS PRIVATE-SECTOR

Parameters examined

1. Management Style



Increased commonality upto 60%

- 2. Personnel Policy.
- 3. Training functions.

4. Decision making style.

5. Impact of engineering and allied S & T discipline.

1. Narrow public sector base.

2. Rigid demarcations between private and public sectors

3. Emergence of new definitions concerning the role of public sector.

4. Third Plan decides public sector should make profit.

5. Implementation of Industrial Policy resolutions leading to increase in the public sector activities.

6 Work style still hierarchical.

7 Slow impact of professionalism in the field of project management marketing of R & D etc.

1. Increased proliferation of public sector undertakings.

2. Phase of revaluation of work strategies personnel policies, industrial relations in public sector.

3. Emergence of joint sector.

4. Greater intercourse between private and public sector both professional and commercial.

5. Project management evaluation technics strengthened.

6. Increased emphasis on R & D.

1. Public sector and private sector cooperation increases to 60% greater collaboration, exchange of personnel and joint activities.

2. Training and management sophistication increase

3. Time-bound programme take upper hand.

4. Great increase in research, development and design activities—with the emergence of several in-house R & D units.

5. Free flow of ideas and trained managers from one sector to another.

### *B. The Preferred Future Scenario : Management 2000 A.D.*

The concept of a preferred future in any field tends to be subjective. The national needs, however, does help to focus attention on certain values, programmes and institutional arrangements which deserve attention and eventual acceptance. In terms of national policy, therefore, one can outline an "accelerated" implementation scenario. The preferred future for Indian Management would be one which amongst other things would try to embrace the following few goals :

1. Availability of increased management know-how to all management structures (tiny units, medium scale enterprises; large organisations);
2. Information system to include both national and international data base for decision making process;
3. Increased resource to long-range planning. (Commodity profile, sales profile, marketing profile, technology assessment, etc.);
4. Emergence of non-hierarchical forms (different power structures);
5. Emergence of participative management (accountability to workers);
6. New managerial life style and attitudinal changes on the part of Managers and administrators. (Less alienation to environment, people, users of services);
7. Rural orientation (increased decentralisation);
8. Innovative administration (De-routinization).

### **7. The Future Tasks indicating Current Decision to Strengthen Indian Management Scene**

In terms of the concern for future even though it is usually targeted to a distant date (2000 A.D. or 2040 A.D.) our conclusions (several alternates) must lead to current decisions. The priority area of management concern for 2000 A.D. is essentially one where current decisions for management change should commence immediately both to eliminate crisis situations (known and not so known such as : (a) Scarce resource management, (b) Just Personnel Policy (right man for right job and equal growth opportunities, etc.) and to augment our efforts in favour of our preferences and points of fulfilment. Some of these priority areas are as follows :

1. Increased delegations;
2. Emphasis on initiative;
3. Programme orientation;
4. Sound Personnel Policies;

5. Resource management : Increased managerial inputs introduction in the field of water, agriculture and energy management;
6. Modernisation of management in neglected areas, such as, the small farms, the village, the agricultural farmers;
7. Enlargement of information base;
8. Increased professionalism;
9. Role of management in service sector; increased emphasis in fields like Transportation, Communication, Hospital;
10. Emergence of S&T Institutions; problems of management of running laboratories and R&D management in general;
11. New approaches in university administration; non-hierarchical;
12. Emphasis on "ad-hoc-cracy versus bureaucracy";
13. Emergence of non-hierarchical organisational structures;
14. Free mobility of personnel from Government to Education, from Education to Industry, from Industry to Government and so on;
15. Overhauling of defence management;
16. Adoption of post-industrial technology leading to diversified management styles.
17. Emergence of new management systems relevant to Indian conditions involving community participation.
18. Introduction of management education in school curriculum.
19. New Trends in Managerial Life Style.

## 8. Conclusion

To sum up in the Indian context Futurology (Futures Research) is basically a study of the new technologies and relevant social goals. We need to make a scientific assessment of Indian physical and human resources and of the way they should be managed and utilised so that we can assure a reasonable success for the Indian people and the Indian society which has indeed a great future. In this process we cannot overlook the familiar "crisis points" in different walks of life. Our concern is not merely for newer ideas but we have also to look at such methods whereby we can eliminate wastages in all walks of life. We should make judicious use of our resources. As managers and administrators we are vitally concerned with the impact of management technology on life; and with the right choice of managerial tools and style of work relevant to our needs, our people and our society. For all this we should take into account a long-range view-point based on which the current decisions should be taken.

## APPENDIX A

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## IX. EDUCATION

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## IX. EDUCATION

### Introduction

The Indian educational system has been put to periodic scrutiny several times during the last 100 years since the beginnings of what can be called the modern education. A number of commissions were appointed by the Government from time to time to survey Indian education notable being the Indian Education Commission, 1882, the Commission of 1902, the Sadler Commission of 1917, the Radhakrishnan Commission of 1948, the Lakshmanswami Mudaliar Commission of 1952 and the Kothari Education Commission of 1964. To this one could add, for sheer historical considerations, numerous Despatches starting with Wood's Despatch of 1854, a series of Committees such as, the Hartog Committee of 1929, the Sapru Committee of 1934 and numerous reports such as, the Abbot-Wood Report of 1936-37, the Sargent Report of 1944 right up to J.P. Nayak's 'Charter' of 1975. The periodic deliberations of Central Advisory Board of Education offer yet another current review of the educational system in our own times.

Curiously enough, in all these surveys three common characteristics are visible :—

- ✓(1) They have all expressed dissatisfaction with the prevailing educational system;
- (2) They have all pleaded for speedy educational reforms; and
- (3) They have all shown concern for future.

The First Commission of the Independent India which was specifically asked to go into the changes necessary in the University education, observed, "The marked deterioration of standards in teaching and examinations and increasing dissatisfaction with the conduct of university administration and elections to university authorities are matters of great concern. The universities as the makers of the future cannot persist in the old patterns however valid they may have been in their own day. With the increasing complexity of society and its shifting pattern, universities have to change their objectives and methods, if they are to function effectively in our national life. A policy of drift in the vague hope that, if the universities are granted full autonomy and are permitted to pursue their own ends with intelligence and imagination, higher education will take care of itself, will be dangerous. *Automatic and spontaneous adjustment will not take us to the future we want.* We must develop a comprehensive positive

policy within the limits of which there should be ample scope for pioneering and experimentation”.

Dr. A. Lakshmanswami Mudaliar's Commission which specifically went into the reform of secondary education in India felt that the educational system should continuously adopt itself to the circumstances and conditions of life of a nation. The Commission in its report observed, “India's needs today are different from what they were in the past. India is now free and independent. The educational needs of a free country are different and ought to be different from what they were under the foreign domination”. It added, *“In a changing world the problems of education are also likely to be changed.*

Likewise in the Kothari Commission report while referring to the changing times, the science-based world, the commitment to development, welfare progress and security its Chairman Dr. Kothari, observed, “It is characteristic of a world permeated by science that *in some essential ways the future shape of things is unpredictable. This emphasizes all the more the need for an educational policy which contains a built-in flexibility so that it can adjust to changing circumstances. It underscores the importance of experimentation and innovation. If I may say so, the single most important thing needed now is to get out of the rigidity of the present system. In the rapidly changing world of today, one thing is certain : yesterday's educational system will not meet today's, and even less so, the need of tomorrow*”. He further added, our report, only offers, “the first step towards bringing about what may be called *an educational revolution* in the country”.

When the Constitution makers of India, amongst other things, gave their vision of a preferred future, they specifically gave a ‘directive’ for a state of affairs where free and compulsory education is available for children upto the age of 14. At that time there were less than 50 million children in this age-group. Today, there are over 70 million children in this age-group and we have not yet been able to realise this dream of the Constitution makers. There will be around 120 million children in this age-group by the year 2000 A.D. Are we ready to meet their educational needs?

The dilemma of India is the dilemma of managing a ‘large human system’ be it for education or for any other human need. Will the conventional means offer a solution to our problems? A rough estimate indicates that following conventional methods we need to open a school every tenth minute for 250 pupil in order to meet the current needs of the children within the age-group 6 to 14. It would also require mobilisation of 1 per cent of India's current population as primary school teachers. Do we then have the resource and the management capability to attain this goal? As things stand today, we don't seem to have enough resource to fulfil even the minimum goal of attaining 100 per cent literacy.

It is more than clear that we have to take recourse to non-conventional methods. The entire exercise of human resource development (608 million today and 960 million, plus or minus persons by the year 2000 A.D.) is some responsibility. The advantages available because of science and technology and of other modern sophistications that India can today muster, coupled with a certain degree of human dedication, can certainly help us a lot to usher India into a "learning" society which is the hall-mark of the post-industrial society. Is the nation prepared for such a dynamic leap? These and others are some of the basic questions to which the Technical Sub-Group on Education had applied its mind. In addition, it has looked at the basic educational needs of the children, the youth, the special Group like the women, etc., looking for such practical and meaningful solutions whereby on the one hand our educational system may shoulder the task of human resource development and promote nationality and creativity on the other.

This Interim Report recaptures a variety of the familiar and new points presented by members of the Technical Sub-Group in the two rounds of sessions that this Group had during the year 1975-76. Some of these ideas were subsequently test-checked by me at the seminars specifically organised at SNDT Women's University, Bombay, IIT Bombay, IIT Madras, University of Madurai and several person to person discussions with all those who happen to be the leading figures concerned with educational change and reform in India — too many to be named here.

This report presents two scenarios — the trend scenario which, if modified, does envisage a state of affair where "appropriate education" shall constitute massive introduction of non-formal education. It should take precedent over the existing formal system. No one denies the fact that educational processes should primarily be committed to attain 'excellence'. But a formal system has embedded in it "time" element and a "cost" element. If such a system creates conditions that fruits of education should be out of reach of the 85 per cent of India's population, one may gently ask for whose benefit and pleasure all this 'formality-for-excellence' — really is?

The preferred scenario presented here gives a 21 Point Programme of an "accelerated implementation scenario" on which action should commence today. If we are committed to a socialistic society, we are perhaps obliged to have a judicious mix of setting up Centres of Excellence and higher knowledge along with a host of creative, unstructured and innovative experiments to educate millions of Indian citizens. This interim report does not so much offer solutions as it tries to ask: What should then constitute such a creative, experimental, innovative and futuristic system of Indian education? Sooner we find our answers better would it be in the national interest. Inspired with some such

commitment for the future and with a humility that the enormity of our problems devolves on all of us I submit this Interim Report for further consideration, discussion, debate and, if possible, for quick and speedy implementation today of some of the recommendations made here.

### **Aspects of Futuristic Projections**

Any attempt towards futuristic projections in the field of education can take its cue from the developmental needs of the nation.

The basic question to be asked are : Is education for knowledge and skills ? Or, is it for employment ? Or is it for societal transformation ?

The population profile of India also gives a direction what this scenario would look like. We are today 600 million people. Present status of literacy is only 29% of the total population. There were 1.8 million educated job seekers in the year 1970; they rose to 2.3 million in 1971; and about 3.3 million in 1972 signifying a percentage rise to 26 to 43 respectively. The cost of generating employment for educated people is equally staggering. For instance, the schemes for educated unemployed initiated in 1971-72 and continued through 1972-73 expected to create an additional employment opportunity only for 65,000 people. In addition the scheme to generate self-employment opportunities for 500,000 people which was introduced by the Planning Commission and got implemented between April 1973 and March 1974 was to cost around Rs. 1000 million. The special programmes launched in the States and Union Territories during 1972-73, at a total cost Rs. 270 million were expected to generate employment for about 3.7 million people of whom 11,000 were to be engineers. The key question is how and what cost do we generate employment for the mounting population of India and what constitutes "Appropriate Education" to undertake the vast exercise of Human resource development — between 1975 & 2000 A.D. ?

### **The Key Educational Issues**

If by the year 2000 A.D. India's population is likely to be around 960 million people even on a conservative estimate one can say that at least 500 million people would constitute a group of such able bodied citizens who can be gainfully employed. Such an employment prospect necessitate availability of a varying degree of educational experience. We have thus to ask ourselves what this education would cost us? And; will the current educational system meet the needs of the Future? Here we can also ask the following few additional questions :—

1. What should be the educational system to meet the needs of the future? The present educational systems does not produce man-power which society can readily absorb. Nor does it help

turn existing population into active man-power as a national resource. How should we make education an instrument of turning India's population into a resource?

2. Today, our emphasis is on formal training, learning by rote and production of theoretical papers. Is not today's educational system unrelated to life and society? Even scientists only work to see their names in Western journals. Is not the current Indian educational system, as seen, in terms of its syllabus, programme content, evaluation and graduating yardsticks such that needs be altered? Should we not have instead a programme content which includes part study-part work? (Chinese have tried it with success).
3. Should our evaluation or the graduation yardstick be merely one that judges the memorising skill? Should we not give due recognition to those who contribute to the production process in the country — be it at the cottage industry or be it in the field of sophisticated industries? Also, therefore, don't our teaching techniques need to be changed? If so, in what direction?
4. Does not the paramount need to make optimal use of the existing set-up *inter-alia* poses the question if the higher education should be frozen for the next five years? Is it not a debatable matter if — considering the global disenchantment with higher education — there should be no expansion in the existing infrastructure in this field?
5. Is not there a need to undertake a cost benefit analysis, how much it costs the nation to turnout a graduate of different types : medical, engineering, general and so on : and what the nation in turn benefits from them?
6. There is also a need to re-evaluate the existing norms and value systems which have given birth to certain false values and equally inappropriate life styles unsuitable to a country where, less than one-third of our population lives in urban areas and the majority lives in the rural area. If it is true that our educational system upholds the urban life-style and caters preponderantly to the needs of urban-elite alone, should it not then be altered? Do we need to act in reverse? Should we develop an educational system which make working in rural areas more attractive. Should not education help solve the twin problems of India — mass unemployment and mass migration of rural population to the cities?
7. Finally, can it be suggested that there should be a total ban on school buildings and expansion thereof? Should we not instead make optimal use of the existing buildings? Can't we

educate young people upto 11 p.m. in the night in a shift system. Besides, is not the class-room technique expensive? Should we not combine it with the satellite communication educational programmes at appropriate levels of education? Given an ideal combination of hard-ware (satellite) and the soft-ware (Educational films etc.), in the long run would it not be less expensive a way of coping with the demand of educating an expanding population (600 million today — 960 million in 2000 A.D.)?

8. Also, do we not need to tag all units of production with one educational institution or the other e.g. Cottage industry with functional literacy centres — industry with technological institutions?
9. Finally, 'the goals of future education', is it not right to assume, should have a great deal in common with the 'National developmental goals.' Today, is there not a contradiction visible between the educational goals and the developmental goals?

### **Two Scenarios**

#### **A. *The trend Scenario : Outline of Appropriate Education***

If the educational developments in India continue as they are then by the year 2000 A.D. this system, which is elitist in character, if corrected, will perhaps lean towards short duration vocational courses and non-formal education. These are clear cut trends which indicate how educational system can be made appropriate to the needs of a 'large human system'. The case for these changes can be discussed as follows :—

#### ***Short-Duration Courses***

The definition of appropriate education would lie in the cumulative and comprehensive answers to the above questions. If we are to educate our masses, make them literate, impart them a variety of skills — and if we need a body of trained workers be they teachers, nurses, doctors, apprentices, engineers or scientists — considering that education, hereafter, need to give emphasis on specialised skills then, clearly, we need to take recourse to short courses. The future duration of various courses — which constitute a variety of programmes of formal education — would, one can safely say, consist of not more than two years at the college level education. Of course, we can easily foresee that the people exposed to such short duration courses would be returning for a second or third shot of education later — from their work place, occupation or creative endeavour in which they are engaged. We should indeed abandon the idea that short-term courses will dilute the knowledge level. The true measure of knowledge lies in its "appropriateness."

### *Mode & Content of Education*

As time passes one can easily forecast the emergence of non-formal education in a big way besides the existence of the facility for persons who wish to get educated to enter any curricula at any stage or at any age group. The non-formal system would include 'Performance-oriented-courses', the Open University System as is being practised today in the U.K.; the non-school type field education as is prevalent in the U.S.A., the Chinese extension education programme that goes around the clock, and around the year; the educational facilities of the world open university now being operated from the Rapid city, South Dakota USA for correspondence type courses; and several others programmes using Radio and Television relevant to the indigenous need. Some of these programmes may be relevant for rural technology and agriculture or to assist small scale industry or to upgrade individual skills; many such courses will either totally replace the formal education or shall supplement them through extra-curricular science education in schools, colleges and universities. Many of these programmes shall provide opportunities of education to persons who had earlier failed to avail of formal instruction of today.

### *New Technology of Education*

In this respect one can foresee increased use of Audio-visual techniques, of our national T.V. and radio hook up cheporoned by a ground force to cater to the needs of the children, the primary education, the education of the special groups, such as the specialised training of teachers or of managers or of education relevant to the needs of special social groups such as the handicapped persons or the housewives or the neglected groups such as the hill and tribal folks, the women, and even the nomadic groups.

### *Societal Values and Evaluation*

One of the most important debate related to our system of education, which has not yet begun on a national plane, lies in the realm of societal value system be it social, economic or pedagogic. Today the place of a person is judged in the society not only on the level of education that he or she has acquired but also on the market economy the price that the employment market offers in terms of the emolument rating. This needs an overall change. A futuristic view suggests that once we reduce our emphasis on formal degrees, which would be the case in the future, we shall not grudge offering adequate place in society, and appropriate employment too, to those who had gone through short duration of courses. It is only through such courses and appropriate socio-economic valuation that we would be able to raise, in millions, trained personnel, to participate in the developmental activities of the country.

### *New Pedagogic Norms*

The futuristic view also suggests that in order to achieve what is stipulated above we shall have to evolve different norms of evaluation of our pedagogic standards. The present day craze of our scientists and educationists for recognition by the Western peers would get replaced by an overwhelming respect towards indigenous appraisal. In addition the yardstick of scholarship attainment would probably lie in not so much be based on theoretical or conceptual writings but would be equally measured in terms of the contribution that an individual's work shall make towards fulfilling the societal needs.

### *Appropriate education needs 10% of G.N.P.*

The goals of appropriate education are far too many to be easily enumerated. The challenge of human resource development in India is not merely a wishful dream. It is a must. Indian society faces a severe crisis point in its current inability to train and gainfully employ its teeming millions. A futuristic vision of things to come warrants that much before 2000 A.D. India would be spending not 3% of G.N.P. as is the case of today but 10% of its G.N.P. towards 'appropriate education'. The test of our realism lies in taking action now and here.

### *B. Education : Accelerated Implementation Scenario of a Preferred Future :*

Arising out of the trend scenario of an appropriate educational system we can also here indicate our preferences.

The concept of a preferred future in any field tends to be subjective. The national need, however, does help to focus attention on certain values, programmes and institutional arrangements which deserve attention and eventual acceptance.

In terms of the national policy, therefore, one can outline an "accelerated" implementation scenario.

Education for the future and education towards the year 2000 A.D., in the Indian context, should aim at certain futuristic targets. The adoption of such targets as an integral part of the Six Five Year Plans that separate the year 1976 from the year 2000 A.D. would influence the course of current decision in educational planning.

By the year 2000 we shall be around 960 million people. If education is conceived as a life long exercise, then, we would have to aim at establishing an infrastructure for education which could meet the varying types of educational needs of this vast and diverse population. In India today we have created institutions which, to some extent correspond to best in other part of the world. We have our Harvard,



our Oxford and our Eton. But the experience gained from the functioning of such centres of 'learning' patterned on alien models have introduced gross distortions in our educational system which is reflected in the injustices and inequalities of our present day society. Among the criticisms levelled against the present system are :

- (a) It caters largely to the needs of elitist groups in our society.
- (b) Because of the formal nature of the system, the time element (10+2+3), the cost and the highly selective nature of the preparation required for entry into these institutions renders them beyond the reach of 85 per cent of India's population.
- (c) It suffers from acute 'knowledge obsolescence' which is visible both in the calibre of the majority of the community of teachers and professors as well as in the design of curricula. There is no system by which knowledge updating and knowledge renewal can be ensured.
- (d) It is not geared to suit the real needs of our society. For instance professionals such as, nurses, doctors, engineers, etc., undergo stereotyped learning for four and five year periods at high cost to society and high personal cost in time and money. They are then made to forcibly fit into job situations that do not require such elaborate training. What is being neglected by our present system is the training of middle level professionals who would be available more quickly to society (through short courses, etc.) and who could, if need be, so back to their institutions for further training and acquisition of more sophisticated skills.

#### **Twentyone Points**

If the above premise be correct, then the preferred future for Indian educational system would be one which, amongst other things, should embrace the following few goals :

- (1) Achievement of 100 per cent literacy (We will not at this time go into the polemics surrounding the definition of 'Literacy').
- (2) Education to be free upto secondary level; for higher levels and professional education gradual reduction of costs over the years.
- (3) 'Cafeteria' system of education where one has a greater freedom in choosing areas of ones interest and time schedules that do not require rigid sequential stages of school and college attendance with fixed hours in the day time for 'acquiring' knowledge.
- (4) Flexible syllabus and course content to ensure greater creativity and less curricula burden on the pupils.

- (5) Assessment to be made in terms of performance credits and not necessarily written examinations.
- (6) Degrees to be valid over a limited time-frame. To overcome knowledge obsolescence degrees shall have to be 'renewed'.
- (7) Mode of education : "Study-work-study" in all fields with increased emphasis on 'creativity' at all levels.
- (8) Educational content to have relevance to life, society, ethics, socio-economic imperatives and culture.
- (9) Compulsory teaching of history of science, history of civilisation, world geography, international institutions and comparative religion.
- (10) Compulsory work experience in rural development and military training.
- (11) An increasing larger portion of the total outlay for education to be devoted to building the infra-structure and the soft-ware needed for non-formal education.
- (12) Conventional higher educational opportunities to be provided only for highly meritorious students in the normal run; and, specialised training in narrow specialities to be open to one and all.
- (13) Technical education to have a much larger 'practical' component.
- (14) Industry to be called upon to bear a share of the cost of technical education since they are the biggest beneficiaries of the products of technical education.
- (15) Delinking of degree requirements from jobs and linking jobs to work experience and work credits.
- (16) Increased use of new educational technologies : Audio-Visual aids, SITE, correspondence courses and open universities.
- (17) Vocational stream to commence from Class VIII onwards.
- (18) Special emphasis on education of interest groups such as : women, handicapped persons, tribal and hill people and nomads, etc.,
- (19) New educational structures : Greater autonomy for academic institutions.
- (20) Increased student participation in determining course content and running of educational administration.
- (21) Gradual emergence of common school system.

### **Conclusion**

In conclusion, an additional emphasis needs to be laid on the fact that all that is necessary to be done should be done to promote egalitarianism, rationalism and creativity through our 'educational system. We cannot ignore the fact that education does remain that potential instrument which alongwith other factors promotes inequality in society. It should be our hope that over the years this would not be the case.

## APPENDIX A

Note : We reproduce here the following four tables. These are :—

1.1 Literacy and Illiteracy; 1901—1971.

1.2 Education : Number of Schools and Enrolment : 1950-51 to 1974-75.

1.3 Expenditure on Education : 1960-61 to 1974-75.

1.4 Outturn of Science Graduates and Post-Graduates : 1963-64 to 1968-69.

These have been taken from the publication entitled "Basic Statistics relating to the Indian Economy, Vol. I: All India" published by Economic Monitoring Service of the Economic Research Bureau (ERB), Bombay. The notes below the tables are supplied by the ERB and edited by Dr. Narotam Shah, then Bureau Chief, Commerce, Member, NCST Futurology Panel's Technical Sub-Group on Energy. Dr. Shah is presently Director of Centre for Monitoring Indian Economy, Bombay.

TABLE 1.1

*Literacy and Illiteracy : 1901 — 1971*

	Number of literate	Number of illiterate	Literacy (per cent)		
	(In crores)		Total	Male	Female
1901 (a)	1.3	22.5	5.4	9.8	0.7
1911 (a)	1.5	23.7	5.9	10.6	1.1
1921 (a)	1.8	23.3	7.2	12.2	1.8
1931 (a)	2.6	25.3	9.5	15.6	2.9
1941 .	..	..	..	..	..
1951 (b)	6.0	30.1	16.7	25.0	7.9
1961 .	10.5	33.4	24.0	34.4	13.0
1971 .	16.1	38.7	29.5	39.5	18.7

Notes : (a) Relates to undivided India (b) Excludes Jammu and Kashmir.

Source : Registrar General and Census Commissioner, Census of India 1971 India, Pocket Book of Population Statistics.

### Highlights

1. It is shocking but true that since independence, the number of illiterates in India has increased by about 10 crores, even as the number of literates has also risen by about 11 crores.
2. Strange as it may seem, the drive for adult education, which was one of the popular activities of the political and youth organisations during pre-independence years, has almost disappeared as a non-official voluntary activity.
3. If the earlier enthusiasm had continued and expanded, illiteracy could have been almost completely wiped out within the quarter century of independence. That it has not been done, reflects very sadly on the sense of social responsibility of the educated elite of this country.
4. Many developing countries have achieved literacy rates much higher than that of India. In particular, illiteracy has been almost completely eradicated through popular voluntary efforts in China.

TABLE 1.2

*Education : Number of Schools and Enrolment : 1950-51 to 1974-75*

	Class I to V			Classes VI to VIII			Classes IX to XI		
	Number of educational institutions ('000)	Students in age group 6 to 11		Number of educational institutions	Students in age group 11 to 14		Number of educational institutions	Students in age group 14 to 17	
		Lakhs	Percentage to total population in this age group		Lakhs	Percentage to total population in this age group		Lakhs	Percentage to total population in this age group
1950-51 . . .	210	192	42.6	13,596	31	12.7	7,288	12	5.3
1951-52 . . .	215	193	43.3	14,576	34	13.5	8,063	14	6.0
1952-53 . . .	222	203	44.4	15,340	36	14.6	8,719	15	6.4
1953-54 . . .	239	217	46.7	16,252	38	15.1	9,515	16	6.7
1954-55 . . .	264	232	49.4	17,318	40	15.8	10,200	17	7.0
1955-56 . . .	278	252	52.8	21,730	43	16.5	10,833	19	7.4
1956-67 . . .	287	267	54.5	24,486	46	17.3	11,805	20	9.1
1957-58 . . .	298	282	56.7	27,015	49	19.3	12,639	22	9.2
1958-59 . . .	302	308	57.3	39,597	54	20.7	14,326	24	9.7
1959-60 . . .	319	326	61.5	41,921	61	20.7	15,703	25	9.3
1960-61 . . .	330	350	62.4	49,663	67	22.5	17,257	29	10.6
1961-62 . . .	352	389	67.4	55,915	76	26.8	19,806	33	12.9
1962-63 . . .	366	419	70.9	61,377	82	29.0	21,440	36	13.7
1963-64 . . .	377	445	72.0	65,588	90	27.9	22,996	40	13.5
1964-65 . . .	385	482	75.5	72,153	98	29.4	25,252	46	15.0
1965-66 . . .	391	505	76.7	75,798	105	30.8	27,477	50	16.2

1966-67	.	.	.	396	529	78.1	79,493	115	32.4	29,900	55	17.1
1967-68	.	.	.	..	551	..	..	124	..	..	60	..
1968-69	.	.	.	399	555	77.3	83,943	123	32.3	32,433	66	19.3
1969-70	.	.	.	..	577	..	..	131	..	..	71	..
1970-71	.	.	.	404	593	80.3	88,587	134	34.1	35,773	72	20.4
1973-74	.	.	.	..	638	83.9	..	150	35.6	..	85	22.0
1974-75	.	.	.	..	669	86.7	..	162	37.5	..	90	22.8
<b>(Target)</b>												

*Source* : 1. Planning Commission, Basic Statistics Relating to the Indian Economy, 1950-51 to 1965-66 & 1950-51 to 1969-70, Annual Plan, 1967-68 and 1968-69, Fourth Five Year Plan, 1969-74, The Fourth Plan Mid-Term Appraisal, Volume II, Draft Fifth Five Year-Plan 1974-79, Volume II, and Annual Plan 1974-75.

2. Publications Division, Ministry of Information and Broadcasting, India 1971-72 and 1973.

*Highlight* 1. It is platitudinously true that the primary schools constitute the very foundation of the entire education edifice in the country. Yet, tragically enough, this layer is accorded unacceptably to priority in the government policy and practice. The school buildings, teaching aids as also salaries, status and quality of teachers— all these are terribly shabby at the primary level.

TABLE 1.3

*Expenditure on Education : 1960-61 to 1974-75*

(Rs. crores)

Year	Central government	State governments	Total (1) & (2)	Col. (3) as per cent of GNP
1960-61 . . . . .	44	195	239	1.6
1961-62 . . . . .	26	235	261	1.6
1962-63 . . . . .	28	251	279	1.6
1963-64 . . . . .	31	279	310	1.6
1964-65 . . . . .	42	319	361	1.6
1965-66 . . . . .	49	373	422	1.8
1966-67 . . . . .	96	420	516	1.9
1967-68 . . . . .	112	356	468	1.4
1968-69 . . . . .	123	402	525	1.6
1969-70 . . . . .	137	680	817	2.3
1970-71 . . . . .	159	793	952	2.5
1971-72 . . . . .	178	887	1,065	2.5
1972-73 . . . . .	195	1,034(RE)	1,248	2.5
1973-74 . . . . .	210(RE)	1,152(BE)	1,363	2.4
1974-75 . . . . .	290(BE)	..	..	..

*Note :* From 1966-67 onwards, the data include expenditure on scientific services and research in respect of Central Government.

*Source :* 1. Reserve Bank of India Bulletin, various issues.

2. Government of India, Explanatory Memorandum on the Budget of the Central Government, various issues.

*Highlights*

1. A significant part of the finances for education comes from the fees paid by the students and private charity. But still about three-fourths of the total expenditure on education is financed by the Central, State and local governments.
2. A disproportionately large part of the expenditure is devoted to high school and college education, the benefits of which accrue only to about top 5 per cent of the Indian population. As such, the present educational system tends only to buttress the dominant position of the upper income groups in the Indian society.
3. There is an urgent need for a radical restructuring of the educational system along the following lines :
  - (a) A massive campaign for adult education to completely wipe out illiteracy.
  - (b) A crusade to improve the quality of education at all levels and particularly at primary and high school levels by improved teachers' training, raising the teacher/student ratio, increasing the salaries of teachers and providing them better educational aids and better buildings.
  - (c) A bold programme of recasting the curriculum and teaching methods to make all the courses (from economics to technology) less bookish and more operationally significant.
  - (d) Giving a strong vocational bias to all courses to ensure that those who come out of educational institutes do not remain unemployed, simply because — as is the situation today — they are unemployable.

TABLE 1.4

*Outturn of Science Graduates and Post-graduates: 1963-64 to 1968-69*

Faculty/Degree	Number of recipients of degrees						Percentage increase between 1963-64 and 1968-69
	1963-64	1964-65	1965-66	1966-67	1967-68	1968-69	
1	2	3	4	5	6	7	8
<i>Faculty of Science</i>	<b>41,128</b>	<b>46,040</b>	<b>51,129</b>	<b>59,424</b>	<b>79,489</b>	<b>86,984</b>	<b>111</b>
B.Sc.	34,046	38,230	42,437	49,767	59,045	74,242	118
M.Sc.	6,571	7,290	8,009	8,892	10,454	11,722	78
Doctorate	511	520	683	765	990	1,020	100
<i>Faculty of Agriculture</i>	<b>5,458</b>	<b>6,836</b>	<b>6,005</b>	<b>7,117</b>	<b>6,788</b>	<b>8,516</b>	<b>56</b>
B.Sc. (Agri.)	4,718	5,569	4,902	6,129	5,476	6,976	48
M.Sc. (Agri.)	698	1,140	1,011	892	1,223	1,417	103
Doctorate	52	127	92	96	89	123	137
<i>Faculty of Veterinary Science</i>	<b>1,108</b>	<b>1,184</b>	<b>962</b>	<b>1,303</b>	<b>1,153</b>	<b>1,397</b>	<b>26</b>
B.V.Sc.	999	1,030	855	1,120	996	1,206	21
M.V.Sc.	109	151	104	174	136	173	95
Doctorate	..	3	3	9	21	18	
<i>Faculty of Medicine</i>	<b>4,577</b>	<b>5,596</b>	<b>6,604</b>	<b>7,437</b>	<b>8,033</b>	<b>9,413</b>	<b>106</b>
M.B.B.S.	3,789	4,635	5,516	6,317	6,892	8,197	116
M.D./M.S.	771	940	1,049	1,115	1,121	1,190	54
Doctorate	17	21	39	5	20	26	53

TABLE 1.4—*contd.*

1	2	3	4	5	6	7	
<i>Faculty of Engineering Technology . . .</i>	<b>10,007</b>	<b>10,347</b>	<b>13,269</b>	<b>14,622</b>	<b>16,108</b>	<b>15,808</b>	<b>58</b>
B.V./B.Sc. (Engg.), B.Sc. (Tech.) etc.	9,466	9,739	12,710	14,001	15,422	15, 25	61
M.D./M.Sc. (Eng.), M.Sc. (Tech.) etc.	515	576	520	628	620	508	—1
Doctorate . . . . .	26	32	39	33	66	75	188
Total . . . . .	62,288	70,003	77,969	89 943	1,02,571	1, 2 118	96

*Source* : University Grants Commission, *Annual Report*, 1971-72 and previous issues.

*Highlights*

1. While the later data are not yet published, the current figure of the total outturn of science graduates and post-graduates may be in the neighbourhood of 2,00,000. At least in absolute terms, this figure compares favourably with the corresponding figure for most of the European countries. But in relation to the population of India, the present outturn of science graduates and post-graduates should be regarded as too small.
2. However, the matter that should cause us the utmost concern is the poor quality of these graduates and post-graduates.
3. Out of about 1,22,000 science graduates and post-graduates turned out in 1968-69, as many as about 87,000 or about seventy per cent came from the general faculty of science and only about 35,000 from other faculties with a pronounced applied bias. There is an urgent need to execute a big shift from the general faculty of science to other applied faculties to ensure that these graduates and post-graduates prove useful to the economy.
4. The relative neglect of the agriculture sciences in an agrarian country like India should be regarded as most deplorable.



## APPENDIX B

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**X. DRAFT ON INTEGRATION DOCUMENT—  
A DISCUSSION PAPER**

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## X. DRAFT ON INTEGRATION DOCUMENT— A DISCUSSION PAPER

### Introduction

A faithful record of the deliberations and conclusions by the Futurology Panel and its Technical Sub-Groups are presented in the following pages. It is an attempt to delineate the futuristic imperatives and provide a set of policy recommendations for current day decision making. This monograph purports to be the "Integration Document" encompassing intellectual endeavours over four years—both exhaustive and qualitative in some select areas. This first draft of the integration document is now submitted to the members of the Panel and the Technical Sub-Groups for further evaluation.

The thrust of the futuristic thinking is oriented to the compulsions of the galloping Indian population and the consequent accentuation and doubling up of the 'need' element that future shall devolve on the deliverance of goods and services to the citizens. Thus the first pointer for consideration lies with the policy makers whether they could, today, in all their programmes, take into account the emerging need element of a population which, by the turn of century, would have doubled up. Whatever else lies in the area of improbability the governance of a 'large human system' which is the stark Indian condition, experience, and reality, is a certainty of an order which needs to be fully reckoned with. From this acceptance flow other considerations. Could we retain the institutional heritage and cope with the future with the existing administrative apparatus or do we need to innovate and make a radical break from the past in some selected areas? These are some of the several debatable questions that futuristic thinking have surfaced in a pointed manner. Perhaps, futurism in the Indian context is, after all, not that much of an exotic or fanciful exercise. Future, after all, consists of two kinds of events; events that we would like to see happen; events that we would like to see *not* happen. We would like to see 100% literacy, 100% employment, food for all, enough energy for our diverse needs, a responsive and a responsible management system and the fulfilment of the bare minimum needs of the people of this country. This could be our preferred future. At the same time we would not like to see reoccurrence of breach of peace, instability, war, fire, flood, famine, acute shortages or crisis laden management failures. Such points of crisis we would like to avert.

An inventory and indepth study of the Indian resource picture, its distribution and consumption pattern and the increased demand that the future shall make on it is indicative not merely of the challenge that the policy makers need to recognise and respond, today, itself, but it also requires from us a more creative and innovative management of national resources—both physical and human. Herein lies the futuristic compulsion to assess the social reality—its strength and, distortions—to make critical examination of the poverty question as well as the parameters of the quality of life for all; and muster sufficient strength to be able to discard that segment of our past, embeded in the present, which, rationally thinking, need not be bequethed to the future.

While presenting a catalogue of sectoral recommendations to the policy makers the above considerations have weighed foremost with the members of the Futurology Panel and its Technical Sub-Groups. These numerous sets of alternatives and suggestions for attaining a desirable future do not exhaust themselves. Futurologists neither look for convergence of ideas nor are apprehensive of divergence. Their concern is in the search of alternatives and several different possibilities. It may also be added that some of the recommendations carry or reiterate known remedial step of socio-economic and administrative reform but they too have futuristic relevance. If such recommendations have been restated, they are only indicative of the yawning gap that still exists between our constructive thinking and tardy implementation. However, the basic objective here is to stimulate more critical and creative assessment of the Indian strength and weaknesses so that we face the future with a certain degree of knowledge and preparedness. Futurology in that sense is not an escape exercise.

I am grateful to all the members of the Panel and the members of the Technical Sub-Groups who have during the last four and a half years, notwithstanding their other preoccupations, given their unstinted support and have made useful contributions in arriving at the sets of ideas which may impart a touch of quality to our current day decision making process. They may hold the clue for the emergence of a future reflecting a deliberate desire to improve upon the present. In particular, I am grateful to the members of the Working Group set to formulate the Integration Document, namely, Dr. Rashmi Mayur, Dr. T. K. Majumdar, Dr. Malathi Bolar and Dr. N. S. Srinivasan. This is only the first draft and certainly this monograph needs a second look. It shall require several alterations, modifications and even at places some amplification. Suggestions to this effect are cordially invited.

### **Section I : Futurology Panel's Mandate & Methodology**

The formation of the National Committee on Science and Technology (NCST) Panel on Futurology in the middle of the year 1973 has been the starting point of futuristic studies in India particularly those

undertaken under the auspices of the Department of Science & Technology. The Panel identified nine areas, namely, (i) Energy Generation and Needs; (ii) Housing; (iii) Transportation; (iv) Communication; (v) Urbanology and Slum Problems; (vi) Rural Development; (vii) Food; Management; and (ix) Education, for intensive study with a view to prepare scenarios for the year 2000 A.D. presenting likely future perspective and available options in these fields. The Panel also envisaged to undertake exercises in technology assessment in order to uncover three types of consequences—"desirable, undesirable and uncertain". It is hoped that such studies will enable the decision makers with a list of alternatives and new courses of action. Another objective of the Futurology Panel is to prepare several monographs and technical reports in the field of future studies. Several such studies have since been carried out. It also aims to encourage and stimulate future conspicuousness and future research in the advanced centres of learning in India. To achieve this, sensitising, awareness and thematic workshops are being held—almost a workshop a month—since October 1976.

2. *Methodologies* : The Panel had accepted two methodologies. One of these is termed "crisis analysis". The main approach here is that in the various areas identified by the Panel, wherever it is possible to do so, certain known crisis points that have been part of the Indian experience in these areas, such as Food, Energy, etc. be identified with a view to take a deep look at them. Such a case-study, this methodology suggests, might give us an empirical model for the future and even suggest several alternative courses of action. The main idea is to go from known to unknown. This will make our study of future more practical and utilitarian instead of utopian. The second methodology accepted by the Panel pleaded for a deliberate built-up in our work on the future, 'a normative component—not an expected future but a preferred future; not just adapting to the inevitable but designing something along our image of a desired future'. It was stipulated that the concept of a preferred future would help us evolve alternatives that shall provide us with a paradigm of both theory and action and thus inform both our scientific and our socio-political strivings and determine strategies for moving from the expected to the preferred future.

3. The preliminary study of the Indian resource— demand, socio-economic, science and technological data and the available view-points presented by some of the Indian intellectuals inclined towards futures indicated both the enormity and the complexity of the Indian situation. Of the various factors social, technological, economic, political and other, the "population" factor was deemed to be a critical factor. A country which can add twelve to fourteen million of people in a year does present a demand curve which can be disturbing in nature, more so, if, one finds that the resource projections are not likely to keep pace with the demand which in the years to come is going to

be made on its resources. Secondly, the urban-rural segmentation and contrast in life-patterns presents additional complexity of its own; wherein the mass migration of rural population to the urban areas constitutes the major upsetting factor. The third significant factor is the prevailing state of mass unemployment in the country. Apparently, all these factors seem to considerably circumscribe and delimit the value of available developmental options.

4. The Penal found that even if our efforts in the field of family planning are a major success India will have an approximate population of 960 million people (plus or minus) in the year 2000 A.D. Moreover, when 44.2 per cent of today's population is below fifteen years of age, and considering the fact, that the average life span of an Indian has since considerably improved, we could easily expect 65 per cent of today's population to be alive to see the dawn of twenty-first century. In less than twenty-five years from now, thus, we would have added a "Second" India. Thus the question arose how do we go about building a secure and happy future for this population? Apparently, the consensus of the Panel was that a judicious balancing of the S&T inputs and social goals and concomittant acceptance of right options by the policy makers can determine the national course for the future. Once the policy makers accept one set of option or a combination of options, choices and alternatives, to fulfil social and community needs then, it was stipulated that to ensure a secure and fulfilling future for the nation, action on them should commence now. It is in this context that one can safely say that the panel's attempt towards futures studies has not been merely utopian in character.

5. *The Base Document*: Pursuing this approach a Base Document on Futurology was prepared. The objective of the Base Document was to present in a consolidated form not only the prevailing Indian view-point on future but also to build a plausible scenario for the year 2000A.D. which could spell out a positive and forward looking strategy whereby "it should be possible to ensure conditions in the country where food is available for everyone, appropriate skills could be imparted to the needy; energy in whatever form we need would become available and we may be able to install right management systems to deliver the goods in time". To conceive of such a strategy the Base Document suggested that we should not treat our ever expanding population as a problem instead look at it as a "resource". If we take necessary steps, it was argued, that out of the 960 million people which are likely to be there in the year 2000 A.D. we can turn at least turn 500 million able-bodied people into a resource by imparting them appropriate skill and creating for them work on "as they are and where they are" basis. Thus we could, perhaps, establish "a most probable Indian future" and ensure some degree of happiness for all its citizens. The strategy to achieve this was that notwithstanding the



Five-Year Plan programmes which essentially constitute. A short-range planning exercise, there is an urgent need to give extra-higher-priority in; atleast, four crucial areas even, if it involves sacrifice of some other programmes. These four areas are : Food for physical power; Communication for skills and intellectual power; Nuclear and *other* energy sources for mechanical power and management for organising power. In these four areas, the Base Document concluded, that we should leap-frog in terms of technological growth and take recourse to the modern most or the so called *post-industrial technology*. An over-concentration of Indian effort in these four key area, it was argued could, though imaginative harnessing of the post-industrial technology, help train people and create employment locally and can even turn our population into a "resource". This briefly was an optimistic scenario presented in the Base Document.

6. *The Role of Technical Sub-Groups* : The next stage of work in the field of futures studies commenced in January, 1975 with the setting up of the Technical Sub-Groups in the nine areas with which the Futurology Panel is chiefly concerned. Technical Sub-Groups were expected to play the role of a think-tank. It was expected that they would take an integrated as against narrow sectoral view and adopt a systems approach, in their thinking. The Technical Sub-Groups, giving them a varied representation, were composed of academic experts, specialists, consultants and agency representatives both from the Government, the public and the private sector.

#### A. *First Round of Meeting (Jan.—May, 1975)*

7. The highlights of the deliberations of the first round of discussions held by these nine Technical Sub-Groups *inter-alia* brought into fore the following major points :

- (1) All the Technical Sub-Groups felt that a study of the progress made in India in the areas with which they were concerned indicates both 'development' as well as 'gaps' between Indian expectations and actual achievement.
- (2) The Technical Sub-Groups accepted the two methodologies referred to above relevant to build up future scenarios. In addition, they also found it necessary to build appropriate models identifying our crisis situations as well as the most desirable futures.
- (3) All the Sub-Groups agreed in full measure with the approach presented in the Base Document. They too were of the view that any search for alternatives for the future should commence with a basic assumption that every conceivable attempt and effort needs to be made to turn India's increasing population

into a resource notwithstanding such measures that can be taken to reduce its rate of growth.

- (4) There was also a general consensus that in a country like India the technological advancement would have to be on a dual track. We have to develop indigenous technology and apply technology appropriate to a given situation. Also, we need to break new grounds and take recourse to highly sophisticated technology in selective areas. It was argued, India having missed the Industrial revolution cannot afford to miss the Technological revolution.
- (5) The Sub-Groups also agreed that notwithstanding the application of science and technology, in order to step up Indian production machine at all levels, a permanent need exists to bring about radical change in our life style and value system in order to ensure that the benefits of our advancement reach every member of the Indian society. There was a strong feeling that 'community', the 'group' should be the basic recipient unit and not so much the individual which should determine our choices and options to deliver services to satisfy basic human needs.
- (6) The Groups also agreed that something needs to be done very quickly in order to diminish mass unemployment and mass migration of Indian population from the rural to the urban sector.
- (7) The Groups also felt that since their areas of study overlap, there is need to take an integrated and total view and this necessitates mutual interaction between the various Technical Sub-Groups prior to the finalization of their respective scenarios. Moreover, the Groups also began to identify areas of intensive research where adequate data is not available.
- (8) The Groups categorically demanded that even though the search of various options and alternatives are targeted for the year 2000 A.D., the policy and administrative action on them needs to commence *now*.
- (9) The Groups unanimously felt that until and unless a drastic change is brought about in the Indian educational system, any amount of technological inputs and administrative refinements would not help the society to steer clear of the dangers and the crisis that awaits it in the coming decades.
- (10) The Technical Groups also held the view that continued thinking in the field of Futurology needs to be supplemented by a policy commitment on the part of major Governmental agen-

cies to accommodate programmes of perspective planning in the areas with which they were concerned.

- (11) Notwithstanding, their cataloguing of shortfalls and gaps between promise and performance all the Groups reaffirmed their immense faith in the inherent strength of the Indian genius to overcome whatever obstacles our great society may face. They were confident that a bright future lies ahead.

8. During the course of the second session of each of the nine Technical Sub-Groups new characteristics emerged which lent an additional touch of quality to their deliberations. The second round of discussions brought into light the following additional points :

- (1) A futuristic view of Indian problems requires a major break in selective areas, to be judged by each sectoral technical sub-group with some of the past policies and practices. The country's progress, if it has to take full care of the galloping millions that will get added to our population, requires on one hand serious attempts to arrest the population growth and on the other to introduce a new management commitment at all levels for the timely fulfilment of our plans and targets.
- (2) The Futurology Panel constitutes a Group distinct and different from any other forum in the country. It is neither a planning forum nor is it formulating yet any long-range perspective plans, though its deliberations and scenarios would be the basis of any attempt by any other forum to undertake long-range planning. Futuristic exercises do offer a better long term perspective view of the fundamentals of a society which departmental plans do not provide.
- (3) In terms of methodology or projections, three views emerged relevant to the modelling, exercise of the technical sub-groups. These are :
  - (i) Business as usual model which requires trend extrapolation;
  - (ii) Scenario for the expected future; and
  - (iii) Scenario for the preferred future.
- (4) The paucity of data whether it is to be seen in terms of the profile of the Indian poverty or it has to be looked in terms of the future possibilities that research and development and technology can offer is indeed acute. This is a gap that ought to be filled. Futuristic projections cannot be confined to the limited data that Census Report or other official publications today offer. It calls for intensive and sustained research and

social survey. In turn, it would demand considerable funding which needs to be taken up with a certain degree of urgency.

- (5) The Groups also felt that a national debate, in terms of life style, would be an equally inescapable exercise. This could be the search for matching of peoples' aspirations (sociologists findings) and the opinion leaders views (the planners' indication of what people can get within limited resources). It could also provide the normatives in our preferred future. Indian life, it was agreed, calls for a certain degree of rationalisation and the boundaries of this new rationality needs to be determined.
- (6) The Groups also felt that since the work of the Futurology Panel is unique in character, it can afford to have a framework of thought in which we are not only concerned with the points of fulfilment that country can achieve. The potentialities of growth in India are limitless even though the present day capabilities to achieve them be debatable. These groups, would thus be well within the scientific obligations that its methodologies impose to incorporate in their studies by a sense of realism that Indian conditions dictate, and at the same time, allow its thinking to accept novel ideas and even unknown possibilities.
- (7) The key paramount problems for the future, in terms, of Indian's socio-economic development would, however, lie in how best we can take care of our food, water and energy problems. These are the crucial areas. Whether we like it or not they do indicate, at the same time, overwhelming future crisis and, curiously enough, overwhelming possibilities of ample fulfilment in terms of the nation's needs. Sound technology and sound management holds the key to our success here as elsewhere.
- (8) Rural, urban development and housing, communications and transportation are indeed features of a societal growth where every effort needs to be taken to let income level rise. These are areas where scope for new experimentations in terms of establishing the egalitarian norms to dictate current choices for future development are indeed immense and even desirable.
- (9) The two areas education (developing people) and management (making things happen, if possibly quickly) which deal with human resource development and judicious organisation of our man and woman power need a reaffirmation of the key-note of the Futurology Panel's base paper in that in our

population lies our real resource and assist. Imparting of appropriate skills to gainful occupation and task-completion is at once India's inherent strength even it be still an unrealised dream.

- (10) The Groups reaffirmed that every institution in the country should begin and be required, as a matter of policy, to take a long-term view of their programmes and activities.

## **Section II : The Indian Imperative : Societal Analysis & Key Indicators**

9. Essentially, the Futurology Panel and its Technical Sub-Groups have posed to themselves the key question : What kind of social alternative can we seek for India keeping in view its culture, history and social conditions? It is apparent that the foremost effort here is to seek and determine national strength and weaknesses inherent in the system and then to look at the organisational and institutional apparatus which could ensure emergence of a better society. It was all the time kept in mind that any organised system catering to the human needs should bring a measure of national minimum to all its people. The key argument runs as follows :—

10. India is a large human system. Its present population is around 620 million people. With the current population rate growth we are adding 14 million people each year. Even if we manage a population policy which is earnest and is all embracing, considering that there are 104 million couples in the fertility zone and that 44 per cent of India's population today is below 15 years of age and that our longevity has gone up, it will take 30 to 35 years time to attain fertility equilibrium (as many couples passing out of the fertility zone as shall enter it) and it will take additional 30 to 35 years to obtain zero population growth (as many couples die as shall get born). As such any impact of controlling our population growth in real terms would take effect somewhere in the second half of the 21st century. Consequently, India today should prepare itself to manage from today onwards the human needs of 1,000 million people with which figure we shall enter the 21st century. This is an enormous challenge. Short-term plans and short-term decisions yield short-term results. Resources once committed lead to irreversible decision. No wonder, therefore, that concern for future is a legitimate concern for India. A futuristic approach to manage India is thus not an escape exercise. It is an exercise in preparedness.

11. The reality of India is indeed baffling in character. A large country with numerous ethnic groups having a variety of customs and traditions; uneven socio-economic growth and suffering from mass unemployment is something to be reckoned with. Curiously enough,

even though we are in the 20th century, in India, we dwell simultaneously in several centuries. In each household there are persons whose life style would correspond not to 20th century but to different centuries. The grand-mother lives in one century, the father in the second, the children in another century and so on. Likewise there is a strange co-existence and admixture of different technologies. We are simultaneously in the bullock-cart age, in the steam engine age, in the motor car age, in the jet age, and so on. According to official figures, we have 73% of the population in the rural sector and 50% of the population in the urban sector living below the poverty line, which means that each person has the capacity to spend only Re. 1 per day to meet all his needs : food needs, housing needs, education needs, health needs and transportation needs, etc. This indeed presents a shocking situation.

12. Perhaps, the social stability that the Indian society has maintained has come from two major sources : religion and social cohesion. It is strange and yet the ultimate truth that religion or the faith in the divine powers that may be, as manifested in a variety of ways, have verily kept the people of India contented with their lot. Their sense of religion, their beliefs, their customs, have given them a strange strength to rationalise their suffering, their poverty, their endless misery. Supplement to this is the social cohesion through tradition and hierarchical divisions on functional ethics. This has provided the resilience for the society to adopt technology and innovative management while keeping the societal functional divisions in a maze of adoptive techniques and systems. This has resulted in the present confounding situation of having a third largest skilled force in the world and simultaneously having more than 40 per cent of the population below the poverty line.

13. In our quest to resolve the dilemma of managing India we can not escape answering such questions : Is the solution to India's problem a matter of political choice? Or, does the answer to its problems lie in imaginative application of science and technology? Or, is it a matter of social mobilisation? A satisfactory answer or search of solutions, choices and remedial measure arising therefrom does call for national debate and discussion. We are not yet clear in our minds towards that, while moving towards the 21st century, in which direction we really propose to take India from now onwards.

14. Social distortions that characterise the Indian society : social inequality, economic impoverishment, educational bankruptcy, massive worklessness are all positive indicators of the malady not necessarily offering a clearcut choice or a bunch of decisions that shall help us to manage our resources well in order to meet and cope with a variety of human needs that people demand of its decision makers.

15. The tragedy lies in the pursuit of a languid managerial system which is making the social chasm widen each day. People's aspirations on the one hand and the planners capability to deliver the goods on the other has not quite struck a balance. The fruits of growth are getting siphoned off without reaching the masses. Apparently, the institutional arrangements that generate and distribute the fruits of welfare have much to answer for this state of irrationality. Take the example of our educational system. We have hundred odd universities, thousands of colleges and schools and yet we can accommodate in the system barely 30 per cent of our population. The formality of our educational system and the cost element that goes with it does not make it possible for 70 per cent of our population to participate in it. The question, therefore, arises should we continue with this system or should we go into the reforms where the very concept of an educational system characterized by 'degree' oriented exposure to learning and knowledge is changed. Numerous similar dilemmas face us in other spheres. Should the country go for Coca Cola or for clean drinking water? Should the country go for a public transportation system or for the private car? And so on. Whereas both alternatives would have a place in the society yet the questions of life style that these values establish create a climate where notwithstanding all our efforts to ameliorate the conditions of our people through planned socio-economic development, the social differences get accentuated. Do we have hynthesis for a national average for a life style which even if it were not the life style of one and all at least, was that normative goal which was one that every citizen of this country could compete and was approachable. Today the difference in income level would be around 1 : 30 if not more.

16. The substance of various approaches to Indian development and to the task of managing the human needs of our countrymen lies in taking some bold decisions. These decisions ought to be those which take into account the needs not merely of the present population but that of the population which we shall have to serve until the second half of the 21st century. It is in this light that we need to make a resource inventory. It is in this light also that we have to take decisions and choose those options and alternates which need not serve only the elite or a few but instead be of service to the totality of the human society, to serve whom we are pledged.

17. It is indeed a great pity that we have not yet unleashed creativity in our organised institutional framework. The result is that we are either adapting ourselves to the standards and goals of other countries or keeping ourselves busy in blaming God for everything that goes wrong in this country. Neither approach is correct. If we unleash experimentation, creativity, non-formal approach to sort out our problems we shall find that amazingly new options become available

to us which can certainly help in sorting out the dilemma of managing Indian system. Our value framework thus does require a total overhaul, be it applicable to the social institutions which govern families such as marriage, customs, etc., or, be it the question of redesign of our administration and production sets-up.

18. People's participation is an inevitable overall governing factor which should determine the new institutional arrangement. Bureaucratic, hierarchical and power oriented institutional apparatus would not help manage such a large human system. It has already proved its inadequacy, and if persisted with it shall be the supreme cause of our failure to serve the nation well. People's involvement with planning, socio-economic developmental programmes, agricultural production, industrial sector is now an inescapable necessity.

19. Where does one start solving India's problem? It is almost like asking how does one eat an elephant. We may bite it anywhere and yet we can merely scratch it here and there. A total reorganisation, if not a revolution, lies in releasing human energy involving it in the regional and local developmental programmes which in itself is a great management task.

20. Let us face it : India has vast potentialities. Our population can be our human resource and an asset. In order to mobilise this great human potential we cannot ignore the logic of technological advancement : it is an additional tool at our disposal. The growth of human civilization is indicative and the fact that each age has lead man to use to its advantage newer and newer technologies which have served humanity well in a given time. The search for still better technologies is a quest of an eternal value. It is an on going process. India did miss the industrial revolution. India cannot afford to miss the technological revolution.

21. A legitimate step we need to take is to leap-frog and accept *the best technology*, whatever be its price, if it is socially relevant to the Indian conditions. Thus social mobilisation on a massive scale on the one hand and post-industrial technology, in selective areas, on the other, does constitute a package, which, one should expect, will help us solve the dilemma of managing a large human system, well. Again, on a note of caution, we should exercise social control over technologies (which we introduce) as otherwise we perpetuate the adaptive and absorptive capabilities of the Indian society which ultimately will result in the dichotomy of having the two extreme! The managerial skills, innovative management techniques and controls are required to deliver the fruits of growth to all the members of the society from the poorest and the richest.



22. A massive national debate on the subject, the Panel has felt needs to be undertaken, irrespective of political, ideological and other considerations.

23. Panel's work is thus based on the qualitative exhaustion of ideas by planners, economists, sociologists, administrators and the academia associated with the Panel and its nine Technical Sub-Groups. In terms of the search for societal alternatives the basic governing indicators that Panel examined were as follows :—

1. "Demographic profile" (numbers? range).
2. "State of the Economy—Poverty,  
— Employment opportunities".
3. "Food, Shelter, Clothing, Health"
4. "Energy".
5. "Education and Culture".
6. "Transportation and Communication".
7. "Land, Water and other Natural Resources".
8. "Organisation and Management".
9. "Social mobilisation".
10. "Ecology".
11. "Science and Technology".
12. Regional Co-operation and External Factors".

24. In terms of identifying the basic common assumptions, the Likely Future Scenario (L.F.S.) and taking account of other futuristic considerations, (all targetted to 2000 AD), the final position statement was drawn up by the Panel which is briefly given below. (Here the Panel also identified areas which indicated inconclusive research and paucity of data).

*Demographic Profile Population* : Will be 960<sup>M</sup> [Likely Future Scenario (L.F.S.)] (desire population 800 million).

- Rural-Urban break-up : Present 80-20 percent (l.f.s. 70% rural—30% urban).
- *State of Economy* : (Poverty, employment opportunities).
- Growth rate 3% (Present); l.f.s. 5% by 2000 AD; desired 6%.
- Average growth rate between now and 2000 A.D. 7%.
- *Poverty Line* : (Rs. 40 per capita per month consumption).
- (50% in urban areas and 73% in rural areas). (Present).
- Preferred future scenario : Zero poverty line (or overall poverty line may be reduced upto 10%).

The Group identified that this indicator requires further research in order to identify the relevant inputs needed to achieve the zero poverty

preferred scenario. It was felt that an economist may be commissioned to write report on this topic. Also, it was felt that each Technical Sub-Group too should describe what inputs are needed to produce zero poverty line.

Employment opportunities : Dependence on Agriculture and agriculture related industries (inconclusive discussion) .

- Issues raised were : (1) Agriculture will continue to provide major employment.

vs.

(2) It need not, and we have to explore other avenues.

- Employment opportunities to be generated in the region where the people are.
- Smaller communities should be encouraged 10<sup>5</sup> population.
- Inter-dependent regional growth centres preferred.
- Discussion on food was postponed since the Technical Sub-Group report was not available. (desired target for 2000 AD 210 million).
- *Transportation* : Research recommended on intermodel split (Train transport vis-a-vis roads, air transport, inland water transport (emphasised). Public transportation preferred.
- *PFS* All human habitations must be connected by motorable roads within 5 miles (motorable points could be connected by bullockcart/cyclable roads).
- *Education and Culture* : Non-formal education to receive greater outlays than formal education. (Further research suggested).

The Group accepted the study-work-study pattern as relevant even for formal structures of education.

- *Culture* : Research recommended.
- *Communication* : Every village (500 population) to have at least one two-way communication system with the outside world (in every post office).
- (Inconclusive discussion : Research recommended).
- It was decided that matters pertaining to land, water, natural resources, organisational management, social mobilisation, ecology and science and technology require further discussion and research.
- *Food, Shelter, Clothing, Health* :
- **Minimum nutritional requirements to be ensured (2500-3000 calory per day per adult).**

- *Shelter* : Housing : Present 5.7 person per household.
- l.f.s. 4.5 person per household.
- 5 sq. ft. in urban area and 8 sq. ft. in rural areas (Living space).
- (Research recommended on management of rural inhabitat).
- *Clothing* : More research needed with specific reference to the type of cloth needed for the year 2000 AD.
- *Health* : It was recommended that a Technical Sub-Group be set up in this area. (A new Technical Sub-Group has been set up).
- *Energy* : Domestic consumption 0.4 MTCR (PFS) per capita.
- 3000 MTCR by 2000 AD (Commercial/industrial fuel).
- Regional Co-operation and External Factor. (In depth studies recommended).
- *Water* : (A new Technical Sub-Group has been set up).

25. As will be seen from the Interim Reports submitted by the Tech. Sub-Groups, the above assumptions and the alternatives suggested for a likely future scenario are amply reflected in the recommendations made by the Sub-Groups to the planners and the policy makers for current day decision making. The key message of Futurology Panel is that since the population explosion in India will accentuate human needs by a factor of two, it is desirable that the current day resource commitment, financial outlay and choices with respect to numerous interventions, such as, education, technology management, etc. should today itself accommodate the needs of the future generation and on that basis policy alternates and choices be made. We now turn to examine the sectoral recommendations.

### **Section III : Alternative Models & Choices : Key sectoral recommendations**

26. In terms of alternatives three models have in one way or the other emerged before the Technical Sub-Groups :

*Model I* : Indian society would continue to have social inequalities but with reduced intensity. This is proposed to be achieved by high rate growth of GDP (10-12% per annum) so that the surpluses generated get transferred to the underprivileged groups through trickle down effects. According to this view this is possible through the application of high technology in production and wide spread development of infra-structure and services largely through labour intensive techniques. However, even in these areas a selective application of capital intensive technology is advocated particularly in spheres where such an application has multiplier effects, for example human resource development or even the service sector. In this model removal of disparities in the levels of living is the consequence of growth and not a condition for it.

*Model II* : India is characterised by gross inequalities between the various social groups with regard to income, life styles, accessibility to resources and services, skills, information and task relevant knowledge. This structural condition leads to parasitism and multiforum exploitation of one section of society by another. This in turn causes wasteful, inefficient and socially unproductive mobilisation of material resources and underutilisation of human potential for development. In view of the structural conditions mentioned, the second alternative posed is that an egalitarian socio-economic framework is of pivotal significance for removal of poverty and to provide opportunities to all sections of society for development. Development is conditioned by redistributive and poverty focused strategies which ensure homogeneity in the satisfaction of basic human needs—food, shelter, clothing, health, education, employment. This view advocates social ownership of productive resources and social control of both production and consumption. The nature of technology application is more or less the same as proposed in the first model. Additionally, it entails a radical transformation of national values and the institutional structure.

*Model III* : The third model envisages a concept of 'frugal society' wherein the production is based on social needs, the determination of which emerges through a participatory structure of organisation, decision making and sharing of political power at all levels of organisation, local, state and national. In view of the social reality in India, its basic concern is with the satisfaction of basic human needs and homogeneity in the quality of life. Development according to this model is decentralised and essentially based on the mobilisation of local resources and skills through the application of appropriate technology and upgrading the traditional skills. This would entail the evolution of self-reliant and self-managed communities organised around, productive resources sufficient to provide basic needs of the community as well as viable services. This model supports participative culture in its manifest aspects.

27. The logic and rationale of Indian human needs as described earlier and the choices for current decisions as outlined in the interim reports of Futurology Panel's technical sub-groups felt that the Model III described above could offer the most constructive, creative, adaptive and socially acceptable model of socio-economic development of the country. The sectoral recommendations, choices, options as stated in the interim reports are as follows :

## Rural Development

1. The model development hitherto followed needs to be altered to an alternative part of development which generates employment and purchasing power to the rural masses so as to ensure the satisfaction of basic needs in regard to nutrition, clothing, health, education and housing. The principal focus for such a development strategy is to usher in a just social order.

2. Generation of employment on a massive scale in the rural areas would depend upon the transformation of agricultural sector. This would depend on a wide transfer and defusion of the new agricultural technology. With a choice being conditioned by multiplier effect of the technique in creating employment. Employment can, however, be increased through adopting differentiated cropping practices, proper management and development of water resources, labour intensive farm practices, and increasing the intensity of labour absorption per acre of land. It may be pertinent here to point out that in India only 83 persons are employed per hundred hectares of arable land as against 250 in Japan and 167 in U.A.R. This needs to be supported by providing credit and agricultural inputs to small farmers and land reforms.

3. A massive programme for the development of rural infra-structures should also be undertaken. And establishment of agro-industries mainly producing goods to raise employment and provide purchasing powers to millions of people who would be absorbed in agricultural and allied activities.

4. The present duality between city and the countryside clustered around small and medium towns functioning as nucleating points for the inclusion of agriculture and industry as well as the rural and the urban.

5. A major allocation of resources should be provided for mass literacy primary education, adult education and dissemination of skills particularly geared to weak and socially handicapped strata. In addition the present institutional approach should be replaced by a closer relationship between education and work. As a matter of social policy, there is need to pay special attention to raising the education levels of women and mothers from poor, underprivileged, and conservative strata of society in order to spin off a major process of social reconstruction.

6. The present form of high consumption ethic must give place to one that on the one hand meets the minimum needs of all men and on the other hand limits the needless expansion of wants.

7. Production should be organised in a manner which promotes small scale labour intensive decentralised pattern of industrial development but at the same time permitting large scale organisations where this is unavoidable. The production of goods and services should be oriented to social needs rather than on effective demand.

8. Satisfaction of minimum basic needs particularly that of nutrition, health and education should be ensured to all classes of people and this should constitute the main basis for future development programmes.

9. A minimum income policy to provide a package of minimum items of human necessities needs to be laid down along with a maximum for the material welfare of our people. It also involves a mechanism for transfer of surplus incomes to those who have not reached the minimum. Development should be carried out in a participatory framework involving evolution of institutions production systems and special structures which can mainly control and develop by a community participation of people in decision making.

### **Urban System**

#### **1. *Population Growth & Dispersal***

- (a) We must aim at achieving zero population growth as early as possible.
- (b) To achieve population distribution, investment in metropolises and other big cities should be gradually stopped so that smaller cities can grow.
- (c) All metropolises should be frozen at their present size so that they remain within manageable limits.
- (d) Licensing policy to be modified to prohibit new industries being located within 50 miles of metropolitan cities. In fact, industrial location to be aimed at achieving balanced regional growth.
- (e) System must be evolved to plough back rural resources into the rural sector itself.
- (f) Movement to big cities to be controlled subject to availability of jobs there.

#### **2. *Land Use Policy***

Space is a scarce resource and has to meet the demands of providing food as well as shelter. Land Use Commission, therefore, must distinctly allocate land for Agricultural Use, and land for construction of residential, commercial and industrial buildings. If a thorough job is done by the experts now in properly earmarking land use, the pattern for future urbanisation would be decided for all time to come. The task is colossal, but must be undertaken without delay.

#### **3. *National Urbanisation Policy***

Evolving and a speedy implementation of National Urbanisation Policy is imperative.

#### 4. *Squatter Slum Clearance*

Prevention is always better than a cure. We should, therefore, try to remove the root cause of squatter/slum colonies. Numerous studies have indicated that a majority of squatters are engaged in Informal Sector activities. Any open space, near to their work place, is thus ideal for them to erect their huts, tents, shacks etc. out of the materials easily available near the site. Removing them to the periphery of the city only aggravates their problem because it increases their commuting charges and reduces their working time by 2 to 3 hours daily. A better solution, therefore, would be to provide adequate housing for them whenever a new residential development takes place. In fact, they can be charged rents at par with government employees.

#### 5. *City Management*

To ensure performance, appointment to city-managerial jobs should be strictly based on professional competence rather than political patronage. Non-professionals already in position should be eased out of their jobs within a maximum period of 3 years.

### **Housing**

#### 1. *National Housing Policy*

It is imperative to evolve a National Housing Policy so that efforts can be directed towards a speedy solution of the housing problem.

Housing policy must not be viewed simply as an instrument to provide shelter but rather as an instrument of social policy to achieve growth with social justice. To achieve these objectives, it must clearly define :

- the "Settlement Pattern" for the overall development of townships;
- a proper land-use policy;
- ways and means for dispersal of population and to curb the influx of migrants into metropolitan cities;
- means for slum squatter settlements clearance;
- evolve uniform need-based standards by rationalising the scales of accommodation;
- provide for the use of new substitute building materials; and
- make adequate financial provisions as investments in housing thus far have been meagre.

#### 2. *Investments*

In order to achieve the U.N. recommended decennial rate of dwelling additions of 100 dwellings per thousand population more funds must be made available for housing construction.

Establishment of Rural Housing Development Corporation on the lines of HUDCO should be expedited so that funds may be made available for rural housing as well.

### 3. *Slum Clearance*

- (i) All new residential colonies must make adequate provision for the housing of those prospective workers who will find employment in the Informal Sector activities in that neighbourhood;
- (ii) Provision of adequate housing to the construction workers should be made the responsibility of the concerned contractors;
- (iii) Squatters and slum dwellers who must be displaced and are provided with serviced-sites should also be provided with subsidised transport to and from their work places at least during the transition period of 3 months when they may be able to seek jobs nearer to their new abodes.

### 4. *Housing Designs & Norms*

- (i) Work should be initiated to evolve house designs that would utilise solar energy for heating and cooling purposes.
- (ii) Space norms and density standards are outmoded and need to be revised for rural/urban houses.
- (iii) It is essential to evolve uniform need-based standards by rationalising the scales of government accommodation. This will do away with the paradox of an aged couple, with children at the university or well settled in life, occupying a palatial 5-7 roomed villa while a junior executive with three kids finds himself crowded in a one bedroom apartment.

### 5. *Miscellaneous*

- (i) Single storeyed residential construction should not be permitted by public agencies at least.
- (ii) Five storeyed, walk up, new housing should be encouraged;
- (iii) The present trend of providing accommodation near the city centre to senior officers should be reversed so that lower and middle management level employees who cannot afford their own transport are accommodated nearer to their work places. This is of particular relevance in case of Delhi

### **Education**

*We should aim at :*

1. Achievement of 100 per cent literacy (we will not at this time go into the polemics surrounding the definition of 'Literacy').
2. Education to be free upto secondary level; for higher levels and professional education gradual reduction of costs over the years.
3. 'Cafeteria' system of education where one has a greater freedom in choosing areas of ones interest and time schedule that do



not require rigid sequential stages of school and college attendance with fixed hours in the day time for 'acquiring' knowledge.

4. Flexible syllabus and course content to ensure greater creativity and less curricula burden on the pupils.
5. Assessment to be made in terms of performance credits and not necessarily written examinations.
6. Degrees to be valid over a limited time-frame. To overcome knowledge obsolescence degrees shall have to be 'renewed'.
7. Mode of education : "Study-work-study" in all fields with increased emphasis on 'creativity' at all levels.
8. Educational content to have relevance to life, society, ethics, socio-economic imperatives and culture.
9. Compulsory teaching of history of science, history of civilisation, world geography, international institutions and comparative religion.
10. Compulsory work experience in rural development and military training.
11. An increasing larger portion of the total outlay for education to be devoted to building the infra-structure and the soft-ware needed for non-formal education.
12. Conventional higher educational opportunities to be provided only for highly meritorious students in the normal run; and, specialised training in narrow specialities to be open to one and all.
13. Technical education to have a much larger 'practical' component.
14. Industry to be called upon to bear a share of the cost of technical education since they are the biggest beneficiaries of the products of technical education.
15. Delinking of degree requirements from jobs and linking jobs to work experience and work credits.
16. Increased use of new educational technologies : Audio-Visual aids, SITE, correspondence courses and open universities.
17. Vocational stream to commence from Class VIII onwards.
18. Special emphasis on education of interest groups such as : women handicapped persons, tribal and hill people and nomads, etc.
19. New educational structures : Greater autonomy for academic institutions.
20. Increased student participation in determining course content and running of educational administration.

## 21. Gradual emergence of common school system.

**Management**

Some of the priority areas are as follows :—

1. Increased delegations;
2. Emphasis on initiative;
3. Programme orientation;
4. Sound Personnel Policies;
5. Resource management : Increased managerial inputs introduction in the field of water, agriculture and energy management;
6. Modernisation of management in neglected areas; such as, the small farms, the village, the agricultural farmers;
7. Enlargement of information base;
8. Increased professionalism;
9. Role of management in service sectors increased emphasis in fields like Transportation, communication, hospital;
10. Emergence of S&T institutions; problems of management of running laboratories and R&D management in general;
11. New approaches in university administration non-hierarchical;
12. Emergence of non-hierarchical organisation structures;
13. Emphasis on “ad-hoc-cracy versus bureaucracy”;
14. Free mobility of personnel from Government to Education, from Education to Industry, from Industry to Government and so on;
15. Overhauling of defence management;
16. Adoption of post-industrial technology leading to diversified management styles;
17. Emergence of new management systems relevant to Indian conditions involving community participation;
18. Introduction of management education in school curriculum.
19. New Trends in Managerial Life Style.

**Energy**

1. A time to time survey be conducted by the various concerned Ministries, to keep abreast with the latest knowledge on reserves of conventional energy resources such as coal, oil, gas and hydro-electricity.
2. The R&D to tap New Energy Sources such as solar, wind, tidal and geothermal should be encouraged by various academic institutes such as IITs, etc. and concerned public and private sector organisations. Separate funds should be allocated by

Ministries, DST, CSIR, etc. for R&D work on these energy resources. The break-through of which would result in an infinite source of non-pollutant energy.

3. Emphasis should be laid to develop non-conventional energy sources for rural electrification. This will result into considerable saving in power losses occurring in rural transmission and distribution system.
4. Efforts to install larger units of 500-1000 MW unit capacity at Pit heads, should be emphasised.
5. To improve upon utilisation of installed generating capacity of Thermal Power Stations, typical measures such as training of station O&M personnel, pooling and disseminating of operational experience, etc. should be taken up.
6. To obtain better utilisation factor, integrated operations of neighbouring grid systems for different States should be adopted.
7. For long-term programmes R&D efforts should be initiated in the new and efficient generation techniques such as dual cycles, MHD, fluidised bed etc.
8. The increased power generation would need the development of HV AC/DC transmission lines on national basis. A project-cum-feasibility report by CEA, BHEL and other concerned organisations should be prepared.
9. The use of Bio-Gas plants should be popularised particularly for rural areas, as this will solve the rural problem of fuel and manure both.
10. Transportation of fuel is going to pose a serious problem, alternative mode of transportation other than rail transport, such as coastal shipping, slurry pipe line, inland waters, rope ways etc. should be developed.
11. A Survey/study for the future life style (2000-01 AD) the available resources, the consumption, the demand pattern for different sectors should be done by the concerned Ministries in association with academic institutes and the consultants.
12. A stress to study the environmental aspect should be initiated, keeping in view the industrial, domestic and agricultural sectors using the conventional energy resources.
13. Energy for Transportation—keeping in view the bulk amount of energy used by Transport sector, it should be emphasised to encourage mass transportation system rather than utilising the individual transport facilities.
14. An emphasis should be laid upon to develop Fast Breeder Technology for nuclear energy, which with thermal reactor

mix could prove a more attractive source of power than the conventional energy resources.

15. Along with the development of energy sources, efforts are to be made to ensure conservation of energy in all sectors of economy.
16. Total energy concept should be introduced wherever practicable.

## **Food**

### *A. Overall Approach*

1. Land is our most important resource. It transforms solar energy into foods of choice. These should not merely provide adequate sustenance and nutrition to the people, but must generate surplus money for investment. This means nurturing and conserving the land in every possible manner to maximise returns while maintaining a continuous high level of productivity.

2. Food is more than merely production, harvesting and distribution. It is a total system which has many inter-related socio-economic facets at national and at individual levels. Each of these affects the other.

3. Broadly speaking, the following areas of interaction emerge :

- (a) Agricultural inputs and optimum productivity;
- (b) Technological considerations for harvesting, processing and distribution, and
- (c) Peoples' needs, both individual and collective.

4. These three major sub-systems have further been discussed under relevant sub-heads.

### *B. Agricultural Inputs*

1. *Crop patterns* : Various population scenarios have been developed (Table 1), as well as Models in which calorie needs (Table 2) are met from different sources. All these point to the need for greatly increasing calorie outputs, with attention also to protein sources and fat output, besides sources of vitamins and minerals (Table 3). The highest calorie yields per unit area derive from roots and tubers such as cassava, potato, sweet potato and yam, and wider cultivation of these should be planned (Table 4) and the people prepared for consequent food changes through suitable educational inputs.

2. Whatever the Model employed, or the nutritional calorie level targetted, the quantities of foodgrains and pulses will practically need to be doubled. Calories in India essentially mean cereals and tubers and proteins essentially mean dhals, cultivable land area being limited, productivity must increase (Table 5). Heavy inputs into breeding and cultivation strategies are called for, with the themes of high yields,

short crop duration, multiple cropping, crop rotation and irrigation. Crop mixes even for each area which give annual cereal/pulse yields in the ratio 3 : 1 should be aimed at.

3. Oil consumption may seem satisfactory on an average, but this hides very large disparities. Perhaps a third of all Indians eat no free fat at all. Higher yields per unit area are imperative, whether from new oilseeds (sunflower, oil palm) or from existing ones (groundnut, safflower). Interconvertibility of major edible vegetable oils, and technologies to upgrade most oils to edible products, imply that the particular crop that is raised is not of great importance. Location will determine the crop, e.g. while the oil palm can only be grown in limited localities, the sunflower and groundnut are far more general.

4. Yields per unit area of fruits and vegetables are extraordinarily high, 8-10 times that of cereals, and these should become major dietary components, to supply not only vitamins and minerals, but even calories and proteins.

#### *Animal food production*

1. The low efficiency of all forms of animal food, milk, meat and eggs, is recognised, as is the very high true cost in energy terms of raising the yields of animal food products. All considerations point to the utmost caution in developing such foods on national scales. Animal feeding should be limited to waste materials not utilised as human foods. Use of animal food should be channelised to the nutritionally vulnerable groups; milk and eggs mainly for children, pregnant and nursing women, and milk products to nutritional needs rather than economic buying power.

2. People need to be educated to the facts regarding animal food, and its likely consequence to the economy. Adults can do without milk (they have done so far centuries in China and in prewar Japan) but for children milk is hard to substitute as a total food.

3. In this context, agricultural waste materials should be thought of either as raw materials for animal food production, or for industrial products. Caution is necessary when the latter threatened the former.

#### *Seeds, fertiliser and plant protection*

1. The need for and value of these inputs are now well established and require no emphasis. Estimates of requirements on the Model III basis are shown in Table 6.

2. However, in future thinking, the finiteness of non-renewable resources such as fertilisers needs emphasis. There is great need for eco-systems which require minimum fertiliser inputs, make use of symbiotic nitrogen-fixing organisms and utilise a minimum of phosphorus and potash, or derive them from organic sources which can be mulched into the soil. How to achieve this requires innovative thinking even from now before we get set in energy-wasteful practices.

3. Natural protectants derived from plant sources will repay long-range study. A wealth of empirical traditional knowledge is there to sift and build upon. Neem fruit, mahua oilcake, pyrethrum are random examples.

#### *Water*

1. India's major agricultural constraint is water. There are many projects in progress or planned to relieve or mitigate this limitation. Too much monsoon-reliance is precarious.

2. However a bold leap in thinking in so vital an area is justified. The two river-linking schemes that have been proposed, the Ganga-Cauvery link, and the Dastur Garlands system, need to be thoroughly evaluated. On the success of water supply will depend a quantitative, permanent change in food availability in our country.

#### *Management*

Agricultural complexes in which varied crops are grown and processed, in part or wholly, to the finished food should provide economies of scale and reduce multiple profit sharing. The production ideal in these complexes should be foodstuffs which balance climatic suitability, storage ability and processing ease, while actual crop rotations, within the choices available, should balance nutrition with other factors.

#### *Educational inputs*

Extension workers to carry research innovation to the farmer, and are themselves practically oriented, are now the weakest link in the chain. By educating and assisting the farmer, they make increased production a reality.

### *C. Technological Considerations*

#### *Post-harvest technology*

1. Waste in many forms is widespread and insidious. There are field losses through insects and rodents, and waste in handling, transport and storage. Very often nutritional value is also depleted because insects attack the more nutritious parts of the grain, e.g. the proteins.

2. Projections can be made of the costs of storage capacities and plant protection chemicals required at the turn of the century based on existing knowledge (Table 7). A lot of this storage should be in rural areas near the points of production, and a rural disinfection corporation to oversee such a gigantic operation may be itself a highly productive management investment.

3. Losses in foodgrain milling through traditional technologies are exceptionally heavy. New capital-intensive and labour-reducing technologies that are available are not the answer. Appropriate technology is particularly relevant here. Where capacity already exists even for future needs, as for paddy milling (Table 7), modernising

existing traditional mills would be the best immediate approach in terms of benefit realised for expenditure. New units should be of the improved types, as for wheat *chakkis*.

4. Storage capacity is a major factor controlling price, availability and quality, and data based on one of the Models adopted are shown in Table 8. Distribution of such storage structures is lopsided at present, and needs to be shelved in favour of rural areas.

5. The future distribution network will obviously be influenced by future storage and marketing patterns. A year-round supply of foodstuffs with a minimum of handling and transport needs to be worked out depending on population distribution using computer techniques.

#### D. *People's needs and Social Patterns*

1. There is need to consider the consumer as the centre of all food plans, rather than the farmer or the processor. All interactive policies should proceed from that standpoint, geared to ensuring maximum retention of nutritive value, cooking quality and organolaptic values; minimising the labour of obtaining foodgrains and of using them; provision of ancillaries which synergise food intake, such as water, power, fuel, health care and prophylaxis.

2. Public education through mass media (and this should include entertainment education to preserve the otherwise drab quality of life) and a feedback regulation through assessment of public demands is important. Food being so basic a need, now taking up 75 per cent of individual expenditure, education clearly deserves a high priority.

3. Urbanisation is fast becoming parasitic in nature. Urban areas are swallowing up basic scarce goods like foodgrains, milk, and even inputs which are needed for agriculture. Land, often of high agricultural quality, is being appropriated for expanding metropolises, to the detriment to agriculture. Water is being diverted to meet urban needs, and agriculture is thus deprived. The trend to urbanisation needs to be forcibly checked. Statutory rationing in all urban and semi-urban areas for quite a range of consumer goods may be one way of containing urban greed.

4. Rural living on the other hand should be consciously fostered. Moving large industry to backward areas and to the villages is one way, but can have only a limited overall impact. Developing labour-intensive rural activity, whether developmental or productive; would be more effective in reversing the trend. This needs to be supported by such attractions as provision of electricity, potable water, mass entertainment and good communications.

5. Changes in life patterns are developing in urban areas, and these are beginning to affect even rural families, Joint families are

dwindling, and with it the activities of womenfolk in preparing a whole host of traditional foodstuffs like papads, pickles, sweetmeats, special forms of foodgrains, preserved vegetables and fruits and so on. In its place, standard market products are being purchased, leading to greater market demands on the one hand, and the need for more purchasing power on the other. Yet today barely 20 per cent of all food production reaches the consumer market, while 80 per cent is retained for rural use. Pressure on both rural and urban consumption will need to be provided for. Semi-processing of perishables to increase their useful life as foodstuffs is one approach to the problem. Fully-processed food is another with special attention to cost-reducing technologies of production and distribution in order to broaden the demand base.

6. Overall growth with social justice is the key to balanced food consumption by all our people. Clearly this has many facets which go far beyond just the provision of food.

### TABULAR PROJECTIONS FOR 2000 A.D.

TABLE 1  
*2000 A.D. Population Estimates*

	Millions
Sukhatme . . . . .	836—1000
Rashmi Mayor . . . . .	850—1000
Rangnekar . . . . .	945
National Commission on Agriculture . . . . .	935
Present estimate . . . . .	969 total
Based on 1961—71 average . . . . .	688 rural
growth rate of 2.466% . . . . .	281 urban

TABLE 2  
*Models in which Sources of Calories are varied*

Model	Percent calories derived from		
	Foodgrains	Tubers and oilseeds	Animal foods, fruits and vegetables
I . . . . .	90	10	..
II . . . . .	80	20	..
III . . . . .	80	10	10
IV . . . . .	70	30	..



TABLE 3

**NUTRIENTS FROM MODELS COMPARED WITH ICMR  
BALANCED DIETS**

- (a) Requirements of major nutrients like calories, proteins and fats and of some micro-nutrients like B-carotene, thiamine, nicotinic acid and ascorbic acid are met by ALL FOUR MODELS.
- (b) Micro-nutrients that are supplied mainly by protective foodstuffs (other than foodgrains, tubers and oilseeds) such as calcium, iron, retinol, riboflavin, folic acid and vitamin B<sub>12</sub>, are MARGINAL OR DEFICIENT IN ALL FOUR DIETARY MODELS.

TABLE 4

**REQUIREMENTS OF MAJOR FOODSTUFFS DERIVED FROM  
MODELS—20% excess added: Seed 6% + Feed 3% + Losses 11%**

	1976-77 production million tonnes	At 2400 Cals/head Model				At 2100 Cals/head Model			
		I	II	III	IV	I	II	III	IV
		million tonnes				million tonnes			
Cereals . . . .	116	240	213	213	186	209	186	186	162
Pulses . . . . .	9.5	29	25	25	22	25	22	22	19
Tubers . . . . .	12.5	51	102	51	153	45	87	45	134
Oilseeds . . . .	13.5	7.2	14.3	7.2	21.7	6.4	15.2	6.4	19.2
Others . . . . .	..	..	..	(10%)	..	..	..	(10%)	..

TABLE 5

**LAND REQUIREMENTS**

(In million hectares)

Area in 1976-77		MODEL III*			MODEL IV*		
		At av. yield	At twice av. yield	At opti- mum yield	At av. yield	At twice av. yield	At opti- mum yield
<b>mha</b>			<b>mha</b>			<b>mha</b>	
96.1	Cereals	233.0	116.5	66.0	230.2	101.6	57.5
22.6	Pulses	38.4	19.2	16.7	33.8	16.9	14.7
1.0	Tubers	4.1	2.0	2.5	12.3	6.2	7.4
14.6	Oilseeds	14.9	7.5	..	44.9	22.4	..
<b>134.3</b>	<b>TOTALS</b>	<b>230.4</b>	<b>145.2</b>	<b>85.2</b>	<b>294.2</b>	<b>147.1</b>	<b>79.60</b>

\*—At 2400 Cals./head.

TABLE 6

*Projections for Foodgrain Protection*

Total foodgrains: 238 million tonnes Foodgrains (paddy and rabi omitted since they require no protection) :135 mill. tonnes

	Rate g/t	Quantity t	Price Rs./t	Value Rs. m
Ethylene dibromide/methyl bromide (half the grains).	50	3,367 <sup>a</sup>	5,040	16.8
Al-phosphide (other half)	4	269	85,000	22.9
Urban storage :		30% of foodgrains or 40.4 mil. t. needing 404 mill. t. bags requiring pestproofing.		
Lindane (half)	1.44g	291	100,000	29.1
DDT (other half)	per bag	291	5,000	1.5
			Total	70.3

<sup>a</sup>—present capacity 968 t; other protectants are indigenously available.

TABLE 7

*Processing Requirements*

Paddy	. 140,000 shellers and 70,000 hullers; capacity adequate even in 2000 A.D.; replace with improved mini rice mills.
Wheat	. 95% milled in chakkis, which need improvement; 5% in roller flour mills (6 mt/a). capacity adequate.
Maize	. Total quantity small; either dry milled or wet-processed for starch; capacity increases marginal.
Pulses	. 75% milled at home, rest in 700 mechanised units needing improvements.
Potatoes	. 80% of present cold storage capacity used by potatoes; other kinds of storage need studies.
Tapioca	. Home processed.

TABLE 8

*Storage Projections Based on Model III*

Storage of	Current capacity	Capacity required in	Additional capacity	Cost of additional capacity
		2006 A.D.		
		million tonnes	million Rs.	
Rural (70%)	81	166	85	1280
Urban (30%)	29	72	43	640
		238		1920

## Transportation

Transport programmes involve huge capital investments which act

### I. General

as inputs for the future economic and social activities and also to determine their course, besides being the torch bearer of the advancement of economic civilization and hence a study in futurology of transportation is an essential pre-requisite for long-range planning.

The futuristic national scenario of transport for a visualised 960 million people in the year 2000 A.D. suggests that the passenger and goods traffic are likely to reach in 2000 A.D. the staggering figures of 1000 billion passenger kilometres and 1000 billion tonne kilometres respectively, that is roughly about three times of the existing passenger traffic and four times of the freight traffic.

### II. Research on Transportation Futurology

More attention has to be paid to human factors particularly to the needs and requirements of the present and potential users. The provision of Transport is a service to the community and adequacy of the service should be judged not merely by its engineering efficiency and profitability but also by its impact upon the country and by the extent to which the service meets the level of expectations of the people in terms of comfort, convenience, accessibility, opportunities, frequency and reliability. Given below are the lines on which intensive research on the futurology of transportation is required to meet the aspirations broadly :

- (a) Analysis of the existing material and research results designed to provide needed information to assess and understand the nature of transportation process, to define relevant transportation service requirements and to establish a proper set of realistic goals, objectives, standards and performance criteria for transportation systems today and in future;
- (b) Motivated research for widening the range of alternative choices of transportation requirements to satisfy the consumers;
- (c) Research on models and methodologies aimed at improving the techniques available to appraise the consequences of alternative choices so as to take correct decisions with full knowledge of costs and benefits;
- (d) Development of engineering ability to design and demonstrate the transportation systems and their performance characteristics so as to effect economy in operation and energy to the nation;
- (e) Emphasis on the development of scientific research aimed at controlling of pollution and better standards of environmental quality;

- (f) Provision of meaningful alternatives in the form of better public transportation as compared to private transportation systems; and
- (g) High degree of emphasis on the provision of better education and training facilities on the transportation systems which would help to bring out sound transportation specialists for the future.

It is suggested that to ascertain reasons for the gap between anticipation and materialisation in the targets of different modes and the deficiencies in the anticipative technology, a postmortem of the Five Year Plans should be undertaken to identify the defects and deficiencies in the forecast technology.

### III. *Rail Transport*

In view of futuristic dominance of railways on the freight transport system of the country, it is essential for the railways to reorganise its statistical data information service so as to make it possible to take the right type of management decisions to plan, expand and co-ordinate, and also for the broadening up of the informational data base to monitor in advance the spatial and industrial growth patterns and their anticipated input-output movement requirements by mode.

A well co-ordinated and integrated National Transport Plan or at least a White Paper on it would help to assign precisely the nature and type of service requirements of railways so as to tailor its services to synchronise with the changing environments by converting the function oriented railways into systems oriented.

Suggested are a series of internal overhauling and scientific re-organisation of the railways based on need oriented research and development on the problems like conversion of metre gauge into broad gauge, introduction of personalised door to door service and the containerisation of freight traffic followed by utilisation and freight forwarder schemes, automatic handling of goods and speedy turn around of the wagons. Increase in the speed and the introduction of sophisticated telecommunication means to strengthen the system as well to minimise the investment finance, introduction of uniclass passenger trains and a flexible concept of "long distance" keeping in view the road transport's operational potentials are suggested to consolidate the position of the railways. A direct shift from steam to electric traction instead of via diesel power and streamlining of its organisational machinery into system oriented instead of its continuing as function oriented organisation are also suggested. Disaggregation of micro-planning into micro-regional planning, cost oriented fare structure and systems oriented functioning to increase its productivity and efficiency in economic viability are also warranted. The needs are more for conso-

lidation and strengthening of the system than for expansion and the approach should be directed towards developing a co-ordinated and integrated national transport plan for the country.

#### IV. *Roads and Road Transport*

Road transport is visualised to carry an anticipated 600 billion tonne kilometres and 700 billion passenger kilometres of goods and passenger traffic. Absence of forecast inputs such as time series statistical data, inter-model travel habits, income and price elasticity of demand for travel, etc., make the prognosis difficult. Problems of identifying the core areas, the technology hubs around which the technical advancement should revolve to resolve the formidabilities facing ahead, the judicious management of limited resources, the needed research orientation both managerial and technical to achieve an integrated optimisation, advance action to initiate on the advancement of immediate, intermediate and ultimate technology, and the acquisition of adequate resources both men and materials, collection of scientific data on traffic flow patterns, systematic analysis of the infrastructure and super-structure inventory, their adequacy and utilisation performance characteristics, travel habits, behavioural patterns, production and requirement areas of products and their spatial distributional pattern, resource mobilisation and its optimal utilisation, development of rural and inter-rural infrastructure and also the kuchcha roads and bullock carts are vitally essential inputs and are to be studied in depth individually and conjunction with other factors.

#### V. *Urban and Metropolitan Transport*

The futuristic vision expects about 260 million people (27 percent) will be urbane in character around the turn of the century. Discouraging the individual mode of transport in favour of mass transport system is of utmost importance. The diminishing utility of the road space and the increase in the travel speed besides discouraging the growth of urban centres and encouraging the dispersal of urban activity are some of the important aspects to be considered. Also visualised is a centralised urban transport agency pooling the resources of rail, air and road technology to carry out scientific research and planning to meet the challenging problems facing ahead and also to co-ordinate and integrate the different modes of transport.

#### VI. *Inland Water Transport and Coastal Shipping*

The country has got 5000 kilometres of coastal shipping and another 5000 to 6000 kilometres of navigable inland waterway with an additional scope for about 3000 kilometres which can relieve the pressure on rail and road transport system and also result in substantial savings to the consumers due to its cheaper transport cost. Regular hydrographic survey of the navigable channels, dredging and conservancy measures

periodically, rationalised fare structure and choice of different types of vessels adaptable to the type of commodity and the character of waterways, besides a comprehensive feasibility study of the navigable rivers and channels are essential to increase the scope and to intensify the operational efficiency of this transport. This mode requires an investment of Rs. 2,000 crores and needs to be separated from the administrative control of the Ministry of Transport and Shipping and placed independently in charge of an independent Minister to develop this form of transport from the scratch where it is now.

#### VII. *Pipe Line*

This form of transport needs considerable thinking and imaginative planning for specified commodities to transport between specific points to make this form of transport as a principle carrier and also its substitutability of other forms of transport in view of a very low transportation cost involved in the long run as compared to the massive investment requirements.

#### VIII. *Air Transport*

50 million passengers and 2.5 million tonnes of cargo traffic are visualised for the year 2000 A.D. The proposal of introducing uniclass train which has been accepted in broad terms will shift another 1.5 million passengers to this mode of transport. In view of this huge magnitude of traffic demand, it is felt that the gearing up of both the Indian Airlines and Air India Corporations to meet the futuristic needs, development of terminals under unified agencies after shedding down their individual identity, modernisation of crafts adaptable to the traffic demand, cutting down the overhead costs and reduction in the fare with the increasing utilisation are essential.

#### IX. *Inter-Modal Split*

An exercise into the inter-modal traffic flow split is prime and vital as an intermediate technology for the global forecast technology, and without which the financial analyst's and investment appraiser's job will be incomplete and misleading in assessing resource requirement and in the allocation of the same to different modal development projects. The problem is highly complex and vexacious since the interdependence of the traffic mode and the infrastructure, and *vice versa* besides the determinants of influence about reacting among themselves. Inter-modal traffic flow split analysis is essential to build an advance information tank to guide and channelise the investible resources.

#### X. *The Nation and the Transportation Scenario*

Keeping in view the vastness of the country, the differences in the terrain conditions, the growth of population and the acceleration of the economic activity, and the consequent transportation needs which would encompass the conventional national transportation systems like

road and rail, and the new means like pipelines, ropeways and super-sonic jets, besides the out-dated bullock carts, are visualised. The emerged national transportation scenario for the year 2000 A.D. is given below.

*National Transportation Scenario in 2000 A.D.*

Type of mode	Anticipated traffic
1. Roads and road transport	
(a) Passenger traffic (in billion pass. km.) . . . . .	700
(b) Freight traffic (in billion tonne km.) . . . . .	600
2. Railways	
(a) Passenger traffic (in billion pass. km.) . . . . .	300
(b) Freight traffic (in billion tonne km.) . . . . .	400
3. Urban passenger transport (in million passenger trips per day)	325
4. Inland Waterways and coastal shipping . . . . .	5% of total transportation demand by all modes
5. Air transport . . . . .	Do
6. Pipelines . . . . .	2-3% of total demand

## XI. Conclusion

There is an immediate need to bring out a white paper on national transportation policy to integrate and co-ordinate the transportation development to identify the needed research and technology development and to give guidelines for investment, all of which would help to avoid duplication, wastage and competition due to the piece-meal and lopsided transportation development taking place hitherto. The successful translation of the white paper into action lies in the creation of a National Transportation Board at the apex level, to coordinate and integrate the planning and development of various modes of transport keeping in line with the national objectives.

## Communications

*Emerging Scenario*—The most likely future :

Knowledge-based bureaucratic society; Agro-surplus regions; Urban Complexes dominate; Limited access to one-to-one and many-to-many media; “Bombay-film” swamps other mass communication metaphors; One-way character of mass media creates Pavlovian Syndrome and passivity in the people.

*Critical issues* raised by the emerging scenario :

- Will geographic distribution of access to communications be concentrated or spread widely?
- Will the availability and price structure of media systems support a small spectrum of users or many types of users and uses? Interchangeability of messages and movement.

- What is the meaning of difference between 'hard' and 'soft' technologies and what choices should therefore be policy-derived?

*Preferred Scenario*—What policy decisions are needed?

- Issue of Geographic spread of availability of Communication media to spread information/knowhow/problem-solving ability
  - Compensatory effort to vitalise rural areas using broad spectrum of communication devices—low power local radio transmitters, more local print media, public telephones, etc.
  - Community building in urban and rural areas through multi-media Communication Centres or technical learning etc.
  - Pricing policies to favour broad-based use of postal and telecommunications over transport wherever possible.
  - Support for role of Traditional media and art forms—Music/Drama/Dance.
- Issue of availability and price structure of media systems to support variety
  - Role of wide variety of special-interest print publications—postal rate, paper-pricing and legal aspects.
  - Role of local daily and weekly newspapers.
  - Positive role of metropolitan newspapers and newspaper chains.
- Issues of Technology Policy
  - Preferred broadband telecom strategy: All trunk communications services on main intercity routes between the 25 main urban centres to be digital, including digitised voice channels; to support packet-switching.
  - The Budget for Television services to be severely curtailed and telecommunication channels, funds and talent transferred to Radio, especially rural radio.
  - Radio Broadcasting to be decentralised with regional FM transmitters as the vehicle for rural and urban community-building and development services. Appropriate structure of quasi-judicial Communications Commission and publicly owned operating agency, National Broadcasting Authority.
  - Incompatibility of Television with a need-based mass communications policy. Cost of TV too high relative to benefits for next decade.
  - Modular technology wherever possible — use of micro-computer chips to provide versatility to user devices, e.g. party-line telephones and rural telex service.



- Expansion of telex and message-switching services and multiple newswire services in different languages. Use of minicomputer-based interfaces between (national) English newswire and local statewide vernacular newswires for Indian language newspapers.
- Communications satellite to supplement coaxial and VHF links.
- Encouragement to Communications-based enterprises which create a market in Information—such as subscription service over Telex for Economic and Commercial Statistics, and computer-based information-retrieval services for technical, medical, trade and commercial data.



## APPENDIX A

*Note:* The sectoral recommendations incorporated in this document are based on the Interim Reports submitted by the Convenors of the nine Technical Sub-Groups of the Futurology Panel who are as follows:—

*Tech. Sub-Group on:*

- |                      |                          |
|----------------------|--------------------------|
| 1. Energy            | ... Mr. K. S. Chatterjee |
| 2. Food              | ... Dr. B. L. Amla       |
| 3. Housing           | ... Dr. S. Maudgal       |
| 4. Urbanology        | ... Dr. S. Maudgal       |
| 5. Transportation    | ... Dr. N. S. Srinivasan |
| 6. Rural Development | ... Dr. Rajni Kothari    |
| 7. Communication     | ... Dr. J. G. Krishnayya |
| 8. Management        | ... Dr. S. C. Seth       |
| 9. Education         | ... Dr. S. C. Seth       |

National Systems Unit,  
National Institute of Educational

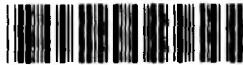
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Date.....

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