

DEPARTMENT OF SCIENCE & TECHNOLOGY

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

INTERIM REPORT

on

COMMUNICATIONS

by

Prof. J. G. Krishnayya

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NCST PANEL ON FUTUROLOGY

The formation of the National Committee on Science and 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 simulate future consciousness and research in few advanced centres of study.

Nine technical sub-groups of Futurology Panel have been constituted to prepare monographs on the above topics. The report here, by Prof. J.G. Krishnayya, Director of the Systems Research Institute, and Convenor of the Futurology Panel's Technical Sub-group on Communications, is an interim report from his group. This constitutes an objective study. Statements made in this Report, however, do not yet constitute any policy position. It is hoped that this study 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 choose the future course of action. The Futurology Panel will welcome comments and suggestions.

New Delhi,
the 11th October, 1976.

(S.C. Seth)
Member-Secretary
NCST Panel on Futurology

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- Modular technology wherever possible - use of microcomputer 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.

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 whenever 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 tortuous 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-telegram 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 video-tape 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

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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-wide 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-wide 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

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 knowhow 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 Services (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/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 audiences 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.

	<u>Newspapers</u>	<u>Magazines</u>	<u>Radio</u>	<u>Television</u>
	(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 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 intercity 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 upto 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 upto 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 dependency 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 program 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 program by telephone if not live.

This is because the target audiences are regionally specified and hence the program 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 massage. World-wide 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 brainpower 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 commands 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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