NETWORK NEW ZEALAND
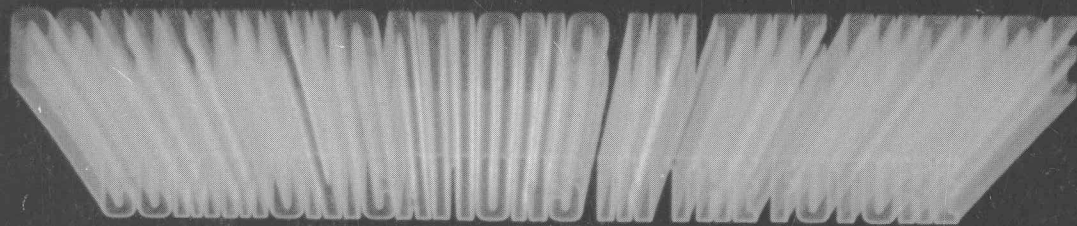
COMMUNICATIONS IN THE FUTURE

NETWORK NEW ZEALAND

A summary report by the CFF Communications Policy Research Group:
Gerald Moriarty (co-ordinator), P. W. Harpham, Marie Keir,
John P. Moriarty, George Van Valkenburg.

PREFACE

This report on communications in New Zealand's future is intended to provide the public with information to promote the discussion and debate which must precede future Government policy-making in this vital area.

Prepared by a Policy Research Group set up late last year by the Commission For the Future, the report is based on nine working papers listed in the appendix and available separately from the Government Printer.

The members of the group were chosen from diverse backgrounds relevant to the future of communications. The co-ordinator, Gerald Moriarty, was seconded from Radio New Zealand to the CFF secretariat for 3 months at the beginning of the project. Most other work was accomplished through the generosity of the individuals concerned and their employing organisations: respectively, Marie Keir (Department of Scientific and Industrial Research), P. W. Harpham (Progeni), John Moriarty (Hewlett-Packard) and George Van Valkenburg, a communications consultant.

The CFF thanks the group members for their work and expresses its appreciation also of the contributions of Michael Conway, who edited Network New Zealand; Catherine McCarthy, who typed the manuscript; Jock Lee, who drew the cartoons; and David Allen, who devised the diagrams on pages 47 and 51.

The views expressed in the report are those of the individuals concerned and do not necessarily represent the views of their employing organisations or of the Commission For the Future.

CONTENTS

NETWORK NEW ZEALAND, 2010 AD: VISION 1

The Japanese tourist clinging to the ice face on Mt. Cook has his hands full. There's a storm moving in and his board of directors in Osaka are in a crucial meeting. He doesn't speak a word of English and his Kiwi guide 3 metres above him speaks no Japanese. Network New Zealand has answers to most of his problems.

The 75 mm-wide bracelet on his wrist "beeps" just above his head. He speaks in Japanese to the displayphone, and the voice of his guide comes back, also in Japanese. The words travelled from the New Zealander 36 000 kilometres into space, where they were automatically translated into understandable Japanese and returned to the wrist terminal. They discuss their next move on the ice face, taking time out to call up a display of the next hour's weather forecast and satellite image of the South Island on the liquid crystal screen.

The bracelet beeps again and the tourist is requested to help make a decision in Osaka. Within seconds he is linked into the teleconference in Japan, and his display quickly shows him the budget figures under discussion.

He casts his vote, just as the ice above breaks away, dropping him into a 300-metre crevasse. The network can't save his life, but his bracelet's navigation chip pinpoints the location of his body to within 1 metre for later recovery.

Imaginative though it is, this scene from the future looks entirely possible. All the technology is already in sight from satellite relays and computer translation through portable receivers and transmitters to flat display screens and location beacons. Further miniaturisation and cost reductions are required but astonishing progress is being made in both areas.

1. SUMMARY

This report accepts survey findings that New Zealanders prefer a balance between economic growth and quality of life in environmental terms.

It envisages a Network New Zealand that would include:

A. A public broadband (probably optical fibre) digital network similar to the telephone system of today but able to provide vision as well and able to handle far more data transmission.

B. Optimum use of space satellites for direct broadcasting of national and South Pacific regional radio and television services, as well as point-to-point links as appropriate.

C. Mobile communications terminals for any car, boat, aircraft or individual, using the radio spectrum. The medium might be via space satellite or low power cellular radio systems.

D. Essential and/or socially desirable baseline services equitably available on subsidised or averaged cost basis.

E. Other services available from public or private enterprise on a user pays or sponsored basis.

F. Relaxed regulation of terminals and services that can be used on the public network, subject to technical compatibility.

G. A new funding base for the total communications infrastructure, possibly along the lines of highway funding of the past.

H. Opportunity for New Zealand-owned private enterprise to provide parts of the communications infrastructure.

I. Comprehensive legislation regarding rights of privacy, copyright, trans-border data flow, and other issues arising from the use of new technology.

If Network New Zealand is desired, then it is approachable during the next 20 to 30 years if certain policies are selected early enough.

The report discusses the need for new organisational structures and concludes that a statutory planning and policy research authority should be established.

It raises possible early steps including relaxed regulation of terminals and services permitted by the Post Office and the Broadcasting Tribunal, early integration of Broadcasting and Post Office advance planning, and the establishment of "demonstration communities" to try out concepts.

2. INTRODUCTION

Because of New Zealand's shape and terrain, its division into two major islands, and its isolation from the rest of the world, the nation's social and economic development have always depended heavily on transport and communications facilities.

The present communications system has served New Zealand well—most homes have a telephone, radio and television set—but if major advances in communications technology are to be adopted then more sophisticated transmission facilities will be required in the future.

One of these could be the use of orbiting satellites to provide an enhanced two-way link with the rest of New Zealand for outlying farms and homes—and even, as sketched in our opening vision, for individuals on the move.

The ways in which the new services are provided will have far-reaching effects on the lives of all New Zealanders. This applies not only to the choice of technology but also to its ownership, control, accessibility and cost to the user.

For videophones to replace telephones, the telephone cables would have to be replaced by a broadband transmission facility, such as optical fibre cable. This would enable national and international organisations to conduct many of their meetings by videoconferencing and would save time and expense—and energy consumption—entailed in hundreds of kilometres of travel.

An optical fibre network could handle far more telephone traffic than the present cables. It would enable many individuals to do much of their work at home using computer terminals which could receive and transmit detailed drawings and pictures as well as messages.

The network could provide a wide range of television and radio programmes, and the home television set need not be just a passive receiver: it could be used also to request and obtain information at will, to respond to opinion polls and even to vote in referenda.

A two-way interactive network of this kind, accessible at a cost that all can afford, could lead to a democratic utopia.

But a network nation is a two-edged sword. Information flow and control are inextricably tied with our political future. If they are one-way, from the top down, they can be an effective mechanism for totalitarian control of the most minute aspects of our lives.

3. METHODOLOGY

14

In studying the future of communications and information in New Zealand over the next 30 years, the Communications Policy Research Group has attempted to follow the logical track of:

— studying communications *needs*

— considering New Zealanders' *values*

— suggesting some New Zealand communications *goals*

— surveying the predictable *technologies*

— and identifying policy *alternatives*
that can fit the technologies to the goals and values of New Zealanders.

The function of the group has been to attempt to identify the strategic issues for discussion. It has been concerned with indicating and considering trends for the purpose of policy-making rather than becoming involved in planning details such as the cost and timing of possible steps.

4. COMMUNICATION NEEDS

THE IMPORTANCE OF COMMUNICATIONS AND INFORMATION

Everything humans do involves communication and information. Communication can be defined as all procedures by which one mind may affect another. Information is the substance of communication.

Communication is an essential process for humans to act socially—for people to co-operate and survive in societies.

The functions of communication are to inform, educate, persuade and entertain people, to co-ordinate information and activities, to provide human interaction and dialogue and to facilitate creativity.

These functions are achieved through a diverse range of communication systems which can be expected to expand greatly over the next 30 years. Many present and anticipated services are shown in table 1. (Page 19.)

The channels of communication, particularly those of the mass media, disseminate all kinds of information and are sources of social influence. They are means of changing community attitudes or reinforcing social values.

Communication systems are powerful agents in the development of communities and countries. They are a tool of those in power and should also provide individuals with access to decision makers.

COMMUNICATION NEEDS AND WANTS

It is therefore critically important that these essential processes are managed and developed to the best advantage of society.

Demand for communications is made up of personal and group "needs" and "wants". A farmer "needs" to know the price of lamb in London. He "wants" to know the rugby score from Sydney.

Every individual needs communications to survive, to relate to others, to learn, and to express creativity. Every family group, business, church and nation needs different levels of communications to exist and function.

For individuals, the channels of communication are their five senses. Many of their needs are met by personal contact with family and workmates. These personal needs and channels will change very little in the future.

When we use printed images and symbols, audio-visual media, or alternatives such as braille, we extend our senses across time and space. We can read ancient writings. We can see and hear a wedding in England.

One of the many difficulties in establishing national communication needs is the fact that the combination of all individual needs does not necessarily result in a collective need. Moreover, a collective need does not necessarily imply satisfaction of an individual's need.

18

For example, many people would agree that New Zealand's cultural identity should be preserved and protected, but would also admit that they would like to have more imported television programmes available for their individual consumption. Thus the individual demands great diversity and choice. The collective need favours the protection of cultural identity by balancing foreign content (and hence providing some diversity).

Policy makers and planners must balance the conflicting demands of groups and individuals in society. They do this by attempting to identify the overall values of the community, from which they can best decide what is in the "public interest".

Overall community values should determine the broad direction of development and indicate what is most likely to represent the "public interest". Predominant social values also determine to a large extent the means by which identified demands are met.

TABLE 1: COMMUNICATION SYSTEMS—FUNCTIONS AND USAGE*

Communication Functions	Point-to-Point	Mass	Interpersonal
	• Telephones and telegraphy • Postal • Radio and satellite • Data links	• Press • Radio (Terrestrial and satellite) • TV • Data networks • Film • Magazines • Print	• One-to-one • Groups
INFORM	– Telephone call – Videophone call – Letter – Electronic mail – Telegram and telex – Computer and computer-subsystem linking – Mobile radio	– Newspaper story – Classified advertising – Radio announcement – TV news – News film – Magazine story – Posters – Multi-access data bases	– Simple spoken statement
EDUCATE	– Instruction by telephone – Correspondence course – Computer-aided instruction – Audio and video recordings	– Radio/TV education – Textbooks – Newspaper courses – Computer-aided instruction – Libraries	– Classroom instruction – Group-based informal education – Extension services training
PERSUADE	– Telephone advertising – Electronic mail advertising	– Newspaper editorials and feature stories – Radio/TV speeches – Dramas – Advertising (all media) – Videotex advertising	– Political discussion groups – Extension services – Public speeches
CO-ORDINATE	– Orders and directives through all media – Communication within organisations	– Emergency announcements – Announcements of deadlines (e.g.) for payments of tax	– Staff meetings – Supervisory relationships
DIALOGUE	– Telephone conversation – Exchange of telegraphs – Exchange of data via computer links – Teleconferencing (audio, video, data)	– Interactive videotex – Radio and TV teaching with organised feedback – Letters to editor	– Meetings – Animation groups
ENTERTAIN	– Computer games	– Broadcast drama and music – Newspaper comics – Cinemas – Various print with entertainment purposes – Libraries	– Live entertainment
CREATE	– Graphics – Audio visual recordings – Computer-aided instruction	– Film – Broadcast programmes – Publications: Art, Poetry, etc.	– Live artistic performance: Art, Drama, Dance, Music, Poetry, etc., Oral tradition

THE INFORMATION SOCIETY

New Zealand can already be regarded as a network nation of sorts. We have social networks that support families, individuals and business. We already have a good communication and transport network.

However, the convergence of telecommunications and computer technologies into what are now widely known as information technologies is carrying the developed world into a social revolution, likely to have an even greater impact than the industrial revolution.

The new society resulting from the widespread use of these new information technologies is being described as an Information Society.

It is characterised by a majority of workers being involved with information rather than with goods, and/or the major part of economic production arising from information activities.

An information society is richly abundant in information sources, services, communication pathways and man-machine interfaces or terminals. The use of computers attached to and within networks will provide the means of efficiently handling information in the future, just as the transport system has provided the means of handling the movement of goods in the industrial society.

While the information society could add to personal communication and information opportunities, there is another side to it. The increased avenues for gathering information and being entertained at home could reduce the need for face-to-face contact and indeed the time available for it. There have already been isolated examples of people becoming so emotionally attached to their personal computers and multiple television channels that they have had difficulty relating to other people and have rejected normal human contact.

The predictable technology will be able to fulfil the communications demand of any New Zealand society. The policies by which technology is introduced and developed will to a large extent shape that society. It is therefore essential to concentrate not only on the technical aspects of the future but also—and particularly—on the social options and impacts that will accompany the use of future technologies.

NETWORK NEW ZEALAND, 2010 AD: VISION 2

The blue-sheep farmer outside Dunedin spends most of his time improving his genetically engineered flock. His wool is used to make school jerseys that do not need dyeing. Unfortunately the renaissance of pride in ethnic origins has led the local school board to designate tartan jerseys for next year.

His hoffice* terminal takes care of much of the management of the farm by itself. Overnight it calls up the market quotations from London and Bahrain, analyses the weather forecasts, computes the value of his stock, and prints out a suggested list of management options and schedules. It takes the farmer about 10 minutes to make the day's decisions.

His wrist terminal has a special high-resolution screen so that he can see the All Blacks in Europe in living colour. He also keeps track of his TAB telebets on the Monte Carlo and Las Vegas circuits from wherever he may be.

His children like their telestudy choices. His daughter is graduating from the Open University in Britain and his son is practicing Zen meditation with a Chinese master. Neither has ever left the South Island.

*Home-office.
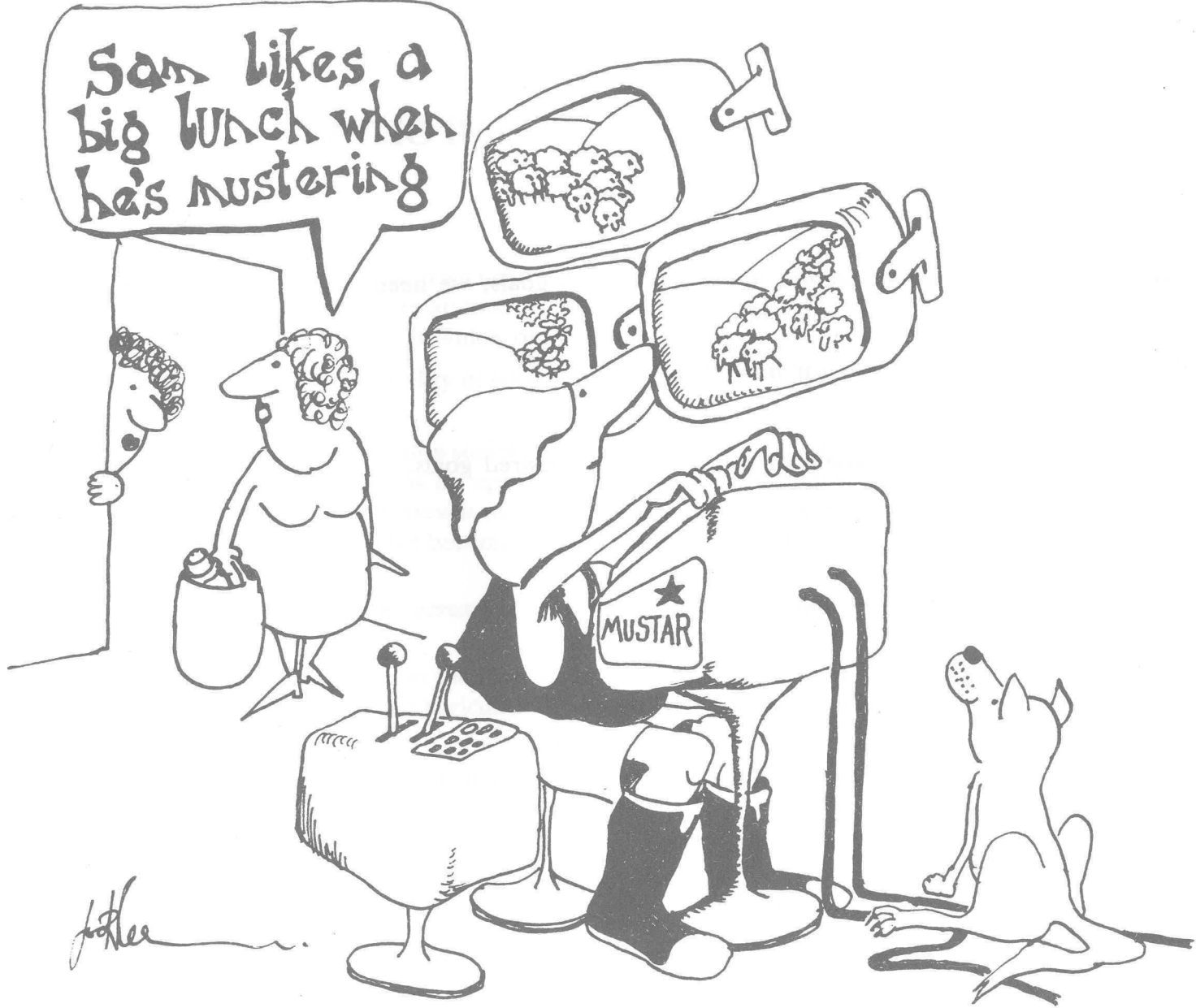
WHY COMMUNICATION POLICY IS IMPORTANT

In order to follow a chosen direction towards identified goals, we need guidelines.

Policies provide these guidelines for making decisions.

Policy helps focus the development of society towards desired goals.

TYPE OF POLICY NEEDED

To guide society in a desired direction we need to anticipate advantages and disadvantages which may occur. Simply supporting the present structure and values of society causes inflexibility and reduces the opportunity to benefit by change. Reacting to events which occur is a defensive rather than constructive strategy.

Anticipatory policy increases the ability of society and individuals to be in control of the future. This is what we should aim for in making policy.

Many of the theories of the information society are being developed in the United States and Europe. On the one hand in the United States there is an optimism that information industries will proliferate and provide growing employment. The European view is more cautious and predicts widespread unemployment, at least in the mid-term, as the information sector becomes largely automated and the impact of information technologies is felt.

The following diagram shows the increasing importance of employment in the information sector of the economy.

The diagram shows that the trends in the New Zealand workforce are similar to those in the United States. However we are still predominantly an agriculturally-based economy and can be expected to continue to be so in the foreseeable future.

It is often argued that the impact of information technologies will limit the future growth of employment in the information sector.

This is why anticipatory policy making is so important. It will help to avoid some of the worst effects and allow us to take advantage of the benefits of the technologies.

DEVELOPMENT OF INFORMATION SOCIETY

Four-Sector Separations of Work Forces

☐ Information   ▨ Services   ▨ Industry   ■ Agriculture

United States — 1950, 1970

New Zealand — 1956, 1976

50 40 30 20 10 0 10 20 30 40 50 60 70 80 90 100

Percentages of Work Force
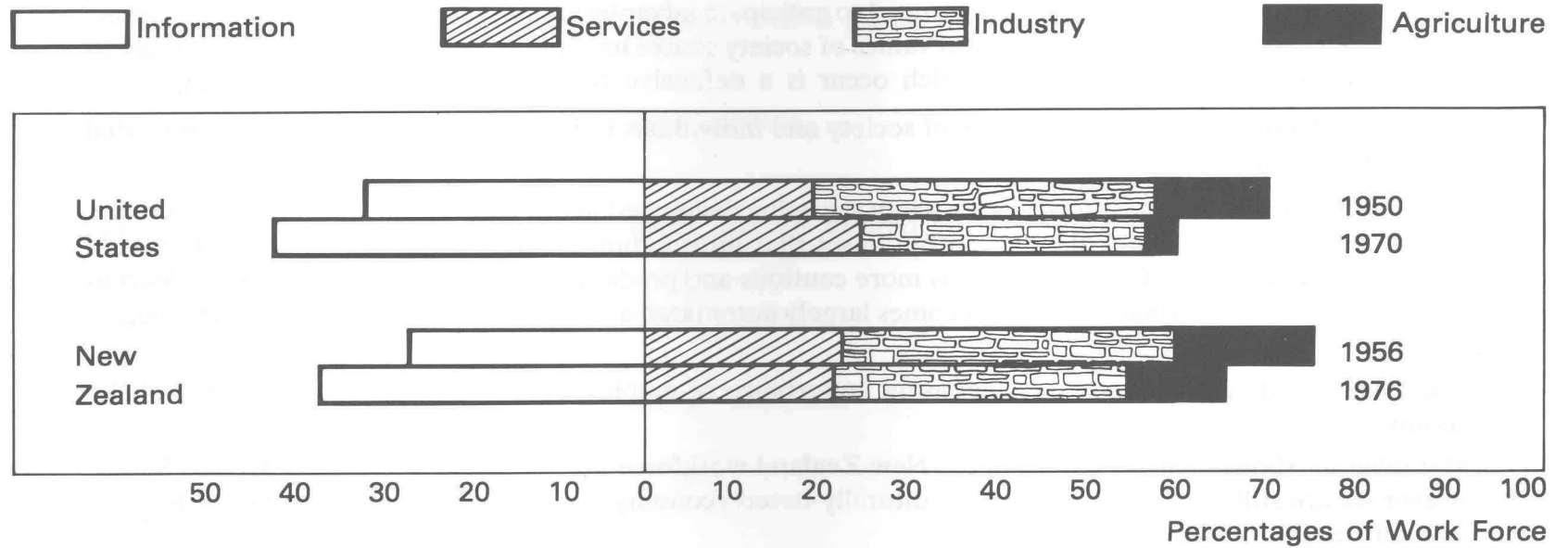
Sources: United States figures from OECD paper DSTI/ICCP/80.10. New Zealand figures from Network
New Zealand working paper on information occupations

KIWIS ARE DIFFERENT

The problems faced by New Zealanders in designing a desirable communications future are different from any other national group on earth.

In most basic terms, no other multi-million population has such geographic buffers or physical isolation from the rest of the world.

There is also physical isolation within New Zealand. This has led to a good communications system already—roads, railways, air services, telephones, radio and television, mail, libraries, the press and a high use of cars for personal mobility.

This communications network could effectively be extended by additional technology, but the tradeoffs must be considered. For example, better telecommunications networks within New Zealand could lead to less desire for personal mobility and to increased physical isolation in some cases.

Additionally, New Zealanders are geographically mobile and have a special need for effective communications systems to maintain family contacts.

Whereas physical isolation and low population density have historically been handicaps, they can be viewed as positive advantages for New Zealand in the era of satellite communications and total electronic global systems.

In comparison with New Zealand—

North America has areas of extreme population congestion. It has several predominant languages. It relies on a regulated, free enterprise system that evolves through infighting, non-standardisation and exploration of each technological niche along the way.

Europe has extreme population congestion and diversity of languages and cultures. Many national boundaries are crossed by communication lines and fall within each satellite footprint (the area covered by satellite beans).

Australia has vast areas of land spread across several times zones. It has a number of government and private groups contesting such policy issues as control of domestic satellite systems.

In the case of New Zealand, competition for electromagnetic spectrum (which includes radio waves and satellite orbital slots in comparatively light. Lying within a single time zone and being coverable by a single satellite footprint is an advantage. A predominant national language is a further advantage. However, an abundance of available channels in the future can ensure that minority languages are heard.

This implies that New Zealand, if it so chooses, can make a national commitment to becoming an enhanced network nation, and can achieve that goal far more quickly and more easily than other nations.

5. NEW ZEALANDERS' VALUES

PRESCRIPTION FOR A NEW ZEALAND LIFE-STYLE

A baseline accepted for this study has been the survey of New Zealand living standard attitudes conducted for the Commission For the Future in late 1980. The results of that survey were reinforced in Televote 1981 in which New Zealanders gave their views on alternative development philosophies.

Both surveys indicated that New Zealanders, on average, place as much emphasis on improving social and environmental living standards (quality of life) as they do on economic growth.

This could be interpreted as the normal desire to have one's cake and eat it too. But expressed more positively, it is a prescription for a unique brand of South Pacific life-style which is not a stereotype of other industrialised nations.

In order of importance, the 1980 survey concluded that New Zealanders favour:

- Indefinitely sustainable use of natural resources.

- Redeployment of unemployed economic-production workers in social-production activities.

- Economic growth from more import-substitution orientation, less export orientation.

- Mixed-scale industries.

- A wide variety of work and creative use of increased leisure time, within the scope of a wide variety of life-styles.

- A more co-operative and less competitive society.

- A mixture of advanced and simple technology in use, with specialised production of computer technology goods and services.

- Economic and social equality throughout society.

- Less central government, more regional and community government.

- Stronger links with Pacific Nations than with other countries.

Properly structured, a Network New Zealand could lead the nation in the direction of most, if not all, of these valued attitudes.

CONSERVATION OF RESOURCES

Energy conservation: Several overseas studies suggest there is a tradeoff between energy use and communication. The paperless electronic office, automation, and telecommunicating instead of travelling, add up to such savings that information technology may prove to be the cheapest path to energy conservation. Also, vast amounts of pulp wood may be released for other applications.

Spectrum conservation: Another resource to be safeguarded is the frequency spectrum. This can only be achieved by proper planning and management. Direct broadcasting from space satellites can release spectrum for other purposes.

People conservation: Employment may both suffer and benefit from the application of future information technology. Jobs will be lost, other jobs will be created. Social patterns of work throughout a lifetime will change. Information technologies are catalysts which are forcing us to consider seriously job creation and the redefinition of work.

One of the most significant trends is toward continuing education and periodic redirection of careers. Educational resources and services could be delivered to the home or community centre as cassettes or discs, or as computer-aided services, or as broadcast television. The home of the future could regain its former (pre-compulsory schooling) role in education—the late 20th and early 21st century version of our present correspondence school.

Another possibility is the growth of small community education/communication centres—education may become a cottage industry. These centres along with universities could become learning exchange centres (extensions of existing networks) where there are learning facilitators who no longer teach, but guide students to other people or to educational media or packages, whichever is most appropriate to their needs.

ECONOMIC GROWTH AND INDUSTRY

Import substitution: New Zealand could develop new industries such as the manufacture and export of optical fibre cable, personal communicating devices and home terminals. These could serve domestic and regional markets while making minimum use of imported content.

New Zealanders have already shown a high level of proficiency in the development of computer/communications systems. These will provide key occupations in the future and will underpin attractive export opportunities for countries that anticipate the growing market for information goods and services.

Manufacturing for the computer/communications industry is clean and non-polluting. It is low in energy use and requires a wide range of skilled and professional workers.

Mixed-scale industries: Information technology can reduce the traditional advantages of size presently enjoyed by some industries. Small businesses may have more chance of success if electronic mail services become widely available. Currently, independent companies cannot exchange electronic mail because no public service exists and Post Office regulations prohibit private services with external links, but if those same companies merge they can then use electronic mail within their new corporate structure.

New computerised machinery can easily be programmed for short runs and flexible outputs, again assisting smaller firms to compete.

CREATIVITY AND CO-OPERATION

Variety of work and creative leisure: Telecommunications abundance can make it possible for many New Zealanders to work from the location of their choice.

The computer programmer can work from his home terminal at the edge of a lake. Clerical workers can go to neighbourhood centres instead of downtown.

The vast menu of active and passive recreational and entertainment services available will make both creative and consumer leisure a matter of individual choice. As demand for these services increases, new industries and new jobs will be created either in New Zealand or overseas. New Zealanders will need to decide whether to foster new industries and develop new skills or rely instead on imported services.

More co-operative society: This can be facilitated by greatly improved communications. Often mistrust is a product of incomplete information.

Computer conferencing and video conferencing can bring together common-interest groups spread over wide areas to discuss and act on common problems.

We can reasonably expect continued conflicts of interest between groups. These may be eased by providing more effective mechanisms for negotiation and bargaining through new communication services. Like equitable income distribution, the equitable access to information and to communication facilities may help people to feel more tolerant and co-operative.

This will not, however, necessarily result in co-operation. In a complex, turbulent society—that is, a society subject to rapid, uneven change—effective communication networks are necessary for both participation and co-operation but may not be sufficient to secure either. Achieving them may depend on the willingness of those in power to share decision-making and ensure equitable distribution of society's resources, particularly income and information.

Economic and social equality: A vital step towards this is to structure pricing policies and baseline communications and information services so that all New Zealanders have equitable access to these essential systems.

NETWORK NEW ZEALAND, 2010 AD: VISION 3

The Minister of Finance represents Westland. From her hoffice in Hokitika, she logs into the day's parliamentary videoconference. She can see and hear her colleagues around the country more clearly than in Parliament chambers. (She is 83.)

As the debate drones on, the computer in her terminal constantly updates her notes and information as her staff around the country feed in facts and interpretations.

When it is her turn to speak, the eloquence of old returns to her face and voice. She knows that any of her constituents, as well as any voter in New Zealand, might be watching and voting in the electronic referendum to come in a few moments.

She will be facing the local electorate officials personally this afternoon in the next room, so she chooses her words with care.

The slim fibre-optic cable that carries her voice and image now links into the main grid covering the whole country. There is now an optical cable under Cook Strait and a master cable to Sydney.

The Minister will be going to the Beehive personally for the ceremonial Parliamentary Session on Queen's Birthday. Except for this yearly pilgrimage, she can transact all of her duties from wherever in the world she may be, via the teleconferencing network.

... and Mr Speaker, on this matter I feel compelled to cross the floor...

NETWORK PARLIAMENT

Taking Government back to the people: One possibility is a teleconferenced Parliament thus allowing Members to remain longer in their electorates while assembling in Wellington briefly from time to time.

Government is basically an information industry. Its output is paper. Decentralisation becomes easier with computer-linked paperless offices.

Electronic referenda and possibly direct electronic voting will be feasible and may prove desirable at times.

On the other hand, a government could assume absolute power simply by taking control of communication channels and information flows.

Stronger links with Pacific Nations: Improved international and regional communications would support this. Direct broadcasting of radio and television services between New Zealand and the South Pacific via satellite could become a powerful tool for increased co-operation and understanding.

6. COMMUNICATIONS GOALS

The future will produce many changes and the social environment of the future is envisaged as turbulent.

For societies to retain their coherence in turbulent environments they must concentrate not on material objectives which can be swamped by events, but on ideals or goals which can be commonly held.

Even though they cannot always be fully attained, goals are guides to decision-makers. They serve as focal points and bench marks for the measurement of day-to-day progress.

COMMUNICATIONS GOALS FOR NEW ZEALANDERS

Goals should be based on the values and attitudes held by the majority of the population. The Policy Research Group believes the following national communication goals reflect the important social values of New Zealanders previously identified:

Communication/information systems should be recognised as essential national resources and services fundamental to the healthy development of New Zealand society.

They should supply the communications necessary for individual self-fulfillment in a caring community by providing:

- Future communication/information services designed to strengthen democracy.

- Equitable distribution of communications services.

- Equitable access to all such services, domestically and globally.

- Equitable access to employment opportunities and education; recreational, entertainment and information services; and sources which enhance a sense of community.

- Indigenous content and the opportunity to communicate in any preferred language.

- Protection of individual and group rights of privacy, thus enhancing the dignity, freedom and independence of all New Zealand residents.

7. PREDICTABLE TECHNOLOGIES

PREDICTABLE AND UNPREDICTABLE

The kinds of communications services and terminals available in the future appear to be highly *unpredictable*.

The number of potential services, both public and private, is virtually unlimited. It may be compared with the number of different purposes for which motor vehicles use our road system of today.

New types of terminals with novel and improved capabilities will come on the market more rapidly than new automobile models. Voice in/voice out systems will lead to even more advanced man/machine interfaces.

The amount of cheap computing power in terminals and appliances will be staggering. Today's micromainframe will be obsolete tomorrow.

High definition pictures, 3-D displays, stereo sound and many more developments are on the way.

The Policy Research Group is of the opinion that tomorrow's communications pathways and/or networking systems will fall primarily into three *predictable* categories (excluding physically transported storage media such as audio and video cassettes, discs and other memory devices):

(a) Optical fibre digital network.

(b) Space satellite services for both point-to-point and broadcast use.

(c) Mobile terminals and services for both point-to-point and broadcast use.

COMMON DENOMINATOR

All electronic communications have one common denominator—their reliance on the frequency spectrum.

This is the physicist's term for the continuous band of wavelengths extending from the familiar kilocycles (or kilohertz) on the radio dial, up through the spectrum of visible light and on beyond the shortest x-rays.

Both broadcast systems and reticulated systems are simply ways of providing bandwidth where it is needed.

As supplied by nature, there is only one frequency spectrum for radiated signals. In this respect it is a natural resource like others, that may be used wisely or squandered.

Worldwide, there is a tendency for radio, television and mobile communications bands to be saturated by users.

The South Pacific, because of its low population density, has much less congestion than highly populated continental areas. Nevertheless, some bands are already crowded in New Zealand.

Modern science is rapidly developing improved ways of using the spectrum, of carrying more information per channel, and of allocating channels to users only at the time of their need.

New technologies are making it possible to use higher and higher frequencies, even into the optical portion of the spectrum—literally, the rainbow.

Harnessing lasers for communication purposes means that hundreds or thousands of times as many signals can be carried at optical frequencies as can be transmitted on currently-used radio bands.

In highly simplified terms, it is as though you could transmit different Morse code signals coloured every hue of the rainbow at the same time, and as though your eye could distinguish between thousands of these hues to read the signals.

RAINBOW IN A BOTTLE

Modern technology has captured the colour spectrum or "rainbow" in a bottle—or rather, in another glass container, the hair-thin optical fibre. Bundles of these glass fibres can be packaged in a cable no larger than the ordinary telephone cord.

Whereas nature gives us only one electro-magnetic spectrum, which must be husbanded with care, the optical fibre cable can give us a virtually unlimited number of packaged rainbows wherever we choose to direct them. And just one of these rainbows could carry the complete radio, television, and telephone/telegraph traffic of all of New Zealand.

PRESENT LIMITATIONS

Many new communications projects in the headlines around the world today are attempts to work around the limitations of the current copper-based systems of telephone lines and coaxial cables.

Overseas videotex systems such as Prestel, Telidon and Antiope are attempts to make a telephone system do something beyond its original design capability.

The explosion of private cable television companies and private satellite services in the United States has resulted from an inadequacy in the publicly provided or sanctioned services, either in capacity or in pricing.

Even such an advanced system as the Qube two-way co-axial cable television service in the United States is restricted in its growth potential by a limit on present bandwidth.

Most of the regulatory issues of today could disappear with bandwidth abundance instead of shortage.

A public, digital, broadband network in New Zealand could leapfrog all of these problems and lay the foundation for a highly-developed network nation.

AN OPTICAL FIBRE DIGITAL NETWORK

Today, we take for granted telephones in every office and most homes, linked by copper wire and microwave to virtually every other telephone in the world.

People on the International Subscriber Dialling (ISD) network (who include most New Zealanders) can dial a dozen or so digits and within seconds have two-way communication with any one of millions of others around the globe. It is an amazing system that too often is taken for granted.

Tomorrow, an optical fibre cable system might replace the complete telephone network. This bundle of hair-thin glass fibres can carry the equivalent of hundreds of channels of television and radio or thousands of voice channels.

It promises to be cheaper than copper (which we could later recover from telephone poles), and more reliable, and could well be manufactured in New Zealand, possibly from New Zealand raw materials.

The designing, manufacturing and installation of such an optical network could be one of the most pervasive employment programmes ever undertaken in New Zealand.

The availability of such a network would make every New Zealander "information and communications wealthy" beyond most of the world's dreams.

It may be deemed desirable that, while the agency which provides the public network would provide a baseline terminal—the future equivalent of the basic telephone—there would be minimum regulation of other types of terminals and services which could use the network. The main requirements would be the use of approved interfaces and standards of a technical nature for protection of the network.

RANGE OF INFORMATION/ENTERTAINMENT SERVICES

Television, Radio

Telephone, Telegram, Telex

Electronic Mail

Emergency Services: Police, Fire, Ambulance

Utility Services (water, electric, gas) meter reading

Broadcasts from Parliament

Stock Exchange: Market Information

Banks: Accounts, Information

Transport: Airline, Bus, Ship, Railway timetables, tickets, reservations

Supermarkets, Department Stores: catalogues, purchasing

Hospital: Diagnosis, Prescriptions

Race-course, TAB

Education

Library: video books, reference source

Newspaper

Farms

optical fibre cable

Factories

Earth Station International Satellite Connection

Subscriber's home

Camera

TV Set

Terminal Controller

Keyboard

Microphone

Cable Distribution Organisation

optical fibre cable

sub-centre

sub-centre

sub-centre

Fire, burglar alarms

Printer

Telephone

optical fibre cable

Schools

47
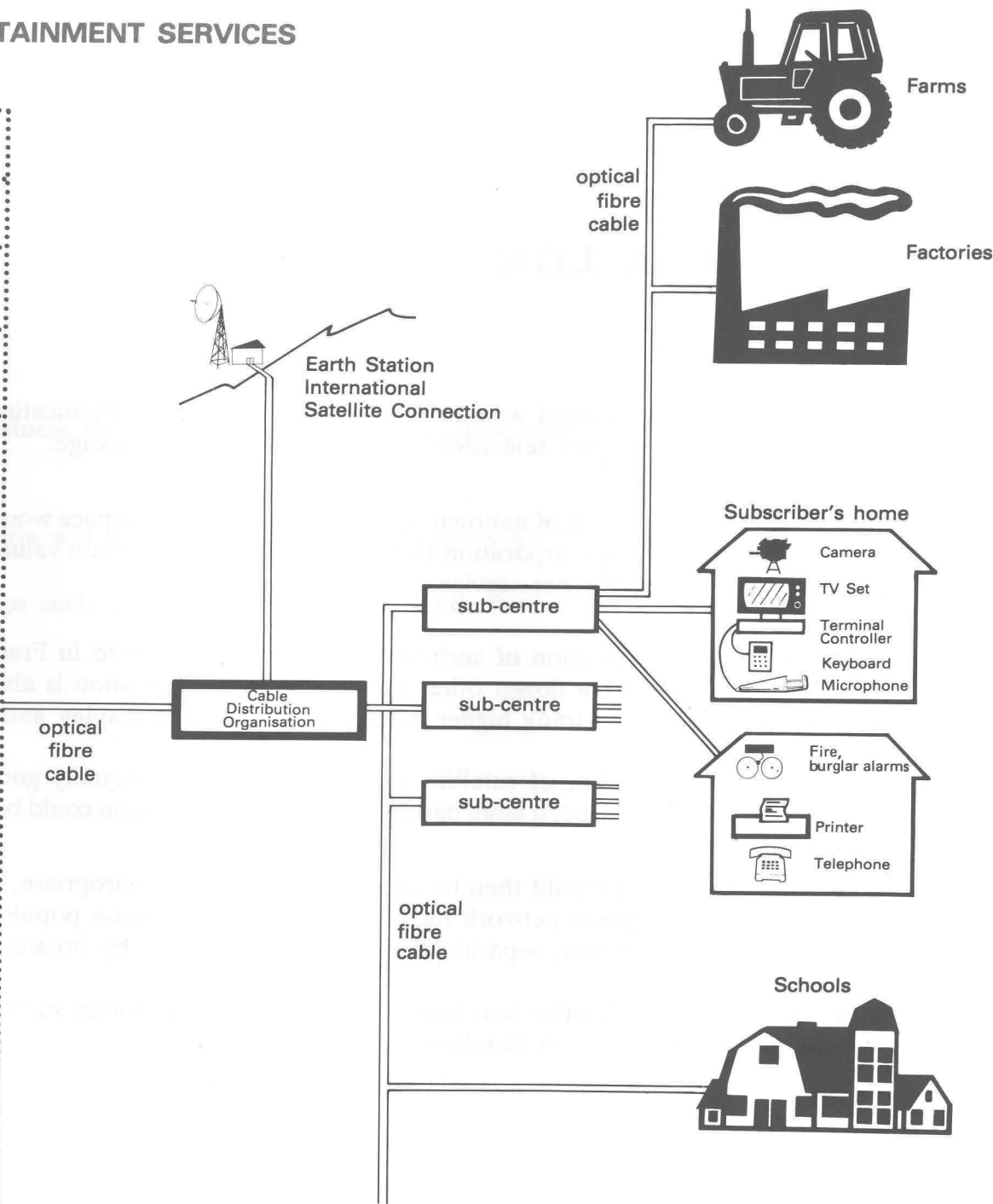
SPACE SATELLITE SERVICES

A Network New Zealand would make optimum use of communications satellite services, both for direct broadcasting of radio and television and for point-to-point linkage.

The direct broadcasting of national or regional services from space would be a revolutionary step. Instead of some 400 Broadcasting Corporation transmitters and translators on valuable frequencies, there would be just one satellite transmitter per service.

Plans for the introduction of such services are well advanced in France, Germany, Canada, the United States, Japan and half a dozen other countries and consideration is also being given to introducing a new television standard providing higher resolution, widescreen display and stereo sound.

Line-of-sight reception of satellite broadcasts should be equally good all over New Zealand, including offshore islands. If desired, a large part of the South Pacific region could be included in the satellite's footprint.

Point-to-point links would then be available and used as appropriate, both by private and public agencies. For example, the optical network might begin growing in dense population centres and evolve out into the provinces. In the interim, separate centres could be linked by broadband satellite channels.

It may prove cost effective to retain satellite links to high country stations or sparsely populated districts and islands as an alternative to installing optical cables.

New Zealand-owned private business data systems could find specialised niches and thrive alongside a national public network.

Economic and other policy criteria will decide whether satellite services are:

- Provided by international groups such as Intelsat or by future South Pacific co-operatives.

- Hired from private suppliers.

- New Zealand-owned.

MOBILE TERMINALS

50   Tomorrow, every individual who can afford it could have a portable terminal so that he is never out of touch with the world. The pocket telephone or wristwatch video screen are technically feasible in a world of micro-electronics.

     The networking of car, boat, aircraft, and pocket terminals must of necessity be over the airwaves. The maximum number of appropriate frequencies should be made available for these mobile users.

     Mobile services would interconnect with the main electronic highway, providing access to all appropriate services.

     The actual networking might be done in several ways. Links direct to space satellites may be feasible, and the problems of addressing three to six million New Zealanders would not be major.

     Alternative systems might use the concept of "cellular radio" in which a nationwide grid of low power transmitters creates an environment in which a mobile terminal is never out of touch with usable channels.

     A side benefit of the personal terminal could be a reduction in search and rescue costs and the immediate response of emergency services to the ill and the threatened.
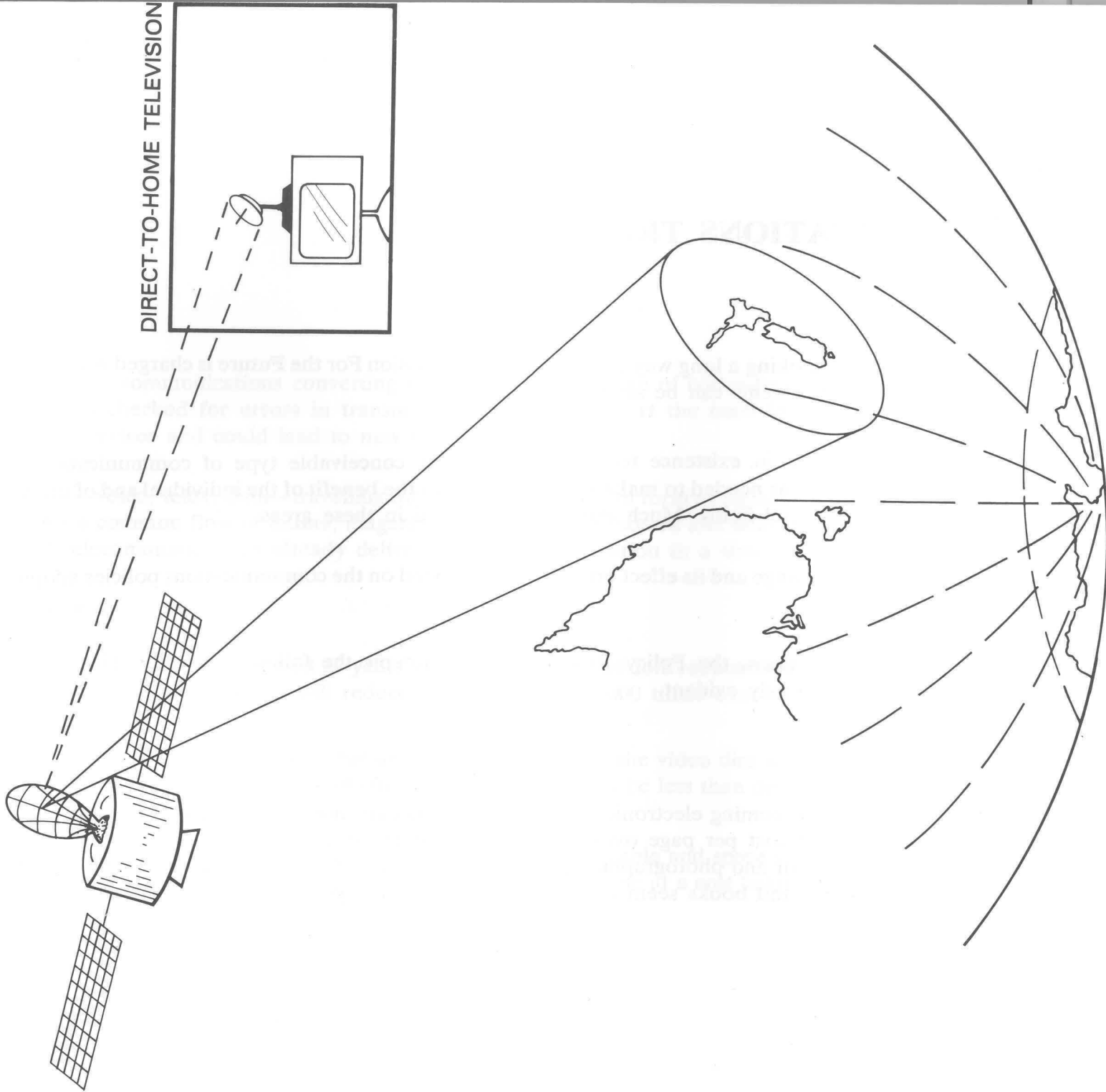
DIRECT-TO-HOME TELEVISION

COMMUNICATIONS TRENDS

One advantage of looking a long way ahead, as the Commission For the Future is charged with doing, is that many intermediate problems can be set to one side.

The technologies are in existence to enable almost any conceivable type of communication required. However, the innovations needed to make sure this works to the benefit of the individual and of the nation are in the political and social fields. Much thinking is essential in these areas.

The actual rate of change and its effect on society will depend on the communications policies adopted by the Government.

With these qualifications, the Policy Research Group accepts the following as probable developments, mostly from trends already evident.

- All media rapidly becoming electronic. While print media currently have advantages in image resolution, "browsability" and cost per page over such early electronic systems as Prestel, these will probably be overcome. Newsprint and photographic film can be expected to follow parchment and illuminated vellum into museums. Printed books seem certain to become very expensive.

- All electronic communications converting to digital—the language of computers. It can be encoded for security and checked for errors in transmission. This could avert the need for separate networks for individual services and could lead to new flexibility.

- All signals—voice, telex, data—travelling intermixed in a common form as packets of data. Ordinary mail represents a common flow of letters, magazines and bills that is sorted and delivered by address. Packet-switched telecommunications already deliver electronic information in a similar manner.

- More for less!

  -*Computing power:* Over the past 30 years, there has been a 2000-fold reduction in cost and it is predicted that the cost per calculation will reduce a further 100 to 1000 times over the coming 30 years.

  -*Memory:* One authority predicts that new techniques such as the video disc will reduce digital storage costs to one ten-thousandth that of current systems. This will be less than one-thousandth the cost of current paper storage.

  -*Communications:* New technologies such as the optical fibre cable and space satellite promise to bring the equivalent of hundreds of television channels into the home at a cost below that of today's copper conductor and terrestrial transmission.

- More freedom of choice. There will be an increased availability of information of all kinds. Stored information such as video cassettes and video discs will compete with an expanded menu of one-way and two-way media for what still remains a single pair of human eyes and ears.

- Restructuring and convergence of communications and information organisations. Content specialists or information providers may serve many types of media. Technology agencies will develop and maintain the networks and terminals for groups of media.

- More global interaction and interdependence. As modern networks lower the cost of communication, information will flow as freely across the ocean as across town. Homogenisation of culture, language and tradition is already happening.

- More two-way communications services. Traditional publishing, radio and television represent one-way flows of information from source to recipient. Correspondence, telephone calls and interactive computer networks represent two-way flows. It is generally accepted that two-way flows are more near the ideal, and that the technological trend to more two-way flows is highly desirable in social terms.

- More turbulence in society as change occurs, such as increased competition between groups.

- Access to information becoming more important for satisfactory conflict resolution.

CONVERGENCE

One of the most significant trends is the merging and blurring of historical roles throughout the communications/information sector.

On the technical level, this means that information flows can come to the user interchangeably via cable or broadcast systems. Television and radio type services can reach the home or office by cable as well as by airwaves. Two-way voice, video and data flows can travel by satellite link or low-power transmitter system as easily as by cable.

On the institutional level, it means that organisations can be expected to become "horizontal". Information providers—writers, editors, archivists—may service publishing, radio, television, cinema and data services interchangeably. The trend is already evident as newspaper groups compete to enter the electronic media.

It is possible and may be desirable that technical channels of communication also move in the direction of "horizontal" organisations.

A common, switched digital data flow would mean ideally that there would be no distinction between voice, video and computer information, and that flow could travel by cable or airwave systems.

CONVERGENCE OF COMMUNICATIONS

Communication by—

TELEGRAPH

TELEPHONE

NEWSPAPER

RADIO

TELEVISION

TELEX

COMPUTER DATA FLOW

BROADCAST VIDEOTEX (e.g. Oracle)

ON-LINE VIDEOTEX (e.g. Prestel)

ELECTRONIC MAIL

VIDEOPHONE

C   B   C

TWO-WAY
OFFICE OR HOME
VIDEO SET

C: Computers for digital coding
    and switching

B: One or more broadband networks
    (cable or airwave)

8. POLICY ALTERNATIVES

THE ELECTRONIC HIGHWAY

"Communications policy in an information society is akin to transportation policy in an industrial society."

Dr M. Porat*

Consider the model of New Zealand's roading system. Roads, streets and motorways are publicly owned, publicly maintained and have been subsidised over the years by public funds. They provide access to every home and business in the nation.

They are freely accessible to private and public vehicles of many kinds. Horse and wagon, pedestrian, bicyclist, car and truck traffic—in general, all are free to share the system.

Most vehicles must be licensed and proven fit for travel. There are speed and road limits, traffic rules and regulations, but the purpose of the law-abiding road user is not questioned!

New models of vehicles can be added to the system freely. More efficient vehicles can be imported. High value and low value vehicles, public and private, share the same roadway.

---

*Author of *The Information Economy* (Nine volumes), U.S. Department of Commerce, 1977.

In short, it is a lightly-regulated, well-functioning public service. It may be a good model for the desirable electronic communications structure of the future.

A broad-band electronic highway in New Zealand will become inevitable if information activities come to dominate the world economy as is predicted. Without such a network New Zealand industry could not remain internationally competitive; New Zealand people could become information poor. An early start to building a broad-band electronic highway should perhaps receive something of the priority given in the past to constructing roads, bridges and railway lines.

A precedent for the degree of commitment which may be required was established a century ago, when much of the foundation for New Zealand's social and economic development was laid.

In 1870 there were only 80 kilometres of railway track in New Zealand, and that was in three different guages. By 1876, 1156 km of track had been opened and another 687 km were under construction. More than 3200 km of roading, bridges and tunnels were built in those 6 years, and telegraph lines lengthened from 2700 km to 5100 km.

RELAXATION OF REGULATIONS

60

The Broadcasting Corporation does not own the radio and television receivers and does not control all programming services in New Zealand.

The Electricity Department does not own every appliance or license the purpose of each lamp in New Zealand.

We are free to purchase private vehicles and to drive them on public highways for any purpose of our choosing.

Why, then, should we be required to have standard telephone terminals and tight regulation of the public resource which is the telephone network?

Technical compatibility with, and protection of this network are obviously necessary, but they are also neatly definable in technical specifications. They can be ensured through type-approval, which should not be withheld unreasonably.

The trend in the United States, Great Britain and elswhere is for so-called "foreign" equipment to be permitted on the telephone network via appropriate connections (interfaces).

If New Zealand followed this trend and the resulting demand for capacity overwhelmed the network, it would be a clear indication that this national resource needed to be strengthened and expanded to meet new communication needs.

If there were substantial loss of revenue to the Post Office, it would indicate that a new funding base was required.

If competition from satellite delivered services were more cost effective, it would help define the "mix" in an optimum future New Zealand system.

While proceeding with an intensified use of the existing copper network, the Post Office would have time to plan and begin construction of a comprehensive national wideband network that eventually would replace the existing system.

This should not be construed as an attack on past or present policy. It is simply a prediction that in the future, a Post Office-type network will be the single most important communications facility in New Zealand, but its function will be substantially different from today.

DEMONSTRATION COMMUNITY

Clearly the Policy Research Group cannot predict all the social and economic consequences of these moves. Often benefits may appear obvious, but disadvantages turn up later when a new system has been operating for a while. The effects that the distribution of additional communication resources will have on households and employment, to give just two examples, would take some time to assess.

Therefore, it may be advisable to consider implementing these changes first in a controlled demonstration community, so that their impact can be studied. Demonstration communities have already been established in Canada and Japan.

NETWORK NEW ZEALAND, 2010 AD: VISION 4

The Auckland pensioner was born in Rarotonga. Most of his family still lives there, although he has a sister and three sons scattered around New Zealand.

His communications service costs the equivalent of $1 per day. For this he gets basic telephone and videophone service, television, radio, electronic mail and access to information services.

The basic charge lets him make at least one call per day to each of his relatives in New Zealand, as well as call his local medical centre. Beyond this he pays the equivalent of 10 cents per call to any terminal in New Zealand.

A videophone call to Rarotonga is extra, but the cost is still less than that of a voice call of 30 years earlier.

He enjoys television to fill the hours, and the basic screen on his terminal brings in public radio and television free of extra charge. But he prefers to spend some of his pension on the overseas services, and now has a choice of 200 channels on his small terminal.

His sons have promised to buy him a satellite receiver next year so that he can watch video in flawless colour on a wall display 1 metre high by 2 metres wide.

He rarely has to leave his house and garden except by choice for exercise. A health monitoring device links him to the clinic for daily checkups, and the medic-alert medallion he wears around his neck will summon an ambulance or police if he has a problem.

He can transact all his banking and correspondence through the terminal and order groceries and sundries for delivery to his door.

This afternoon he will join his Auckland Technical Institute French history teleclass for a videotour of the Loire castles.

BASELINE SERVICES

It is in keeping with New Zealand tradition that a communications goal includes the right of everyone to equitable and affordable basic services.

What are these services, and how should they be provided?

The answer will be a matter for public debate and modification as technologies and attitudes change. But it is possible to envisage a system whereby the future equivalent of today's basic telephone is issued at a subsidised or averaged cost to every communications user.

This might consist of a video/telephone terminal with keyboard for computer type entry. Via this basic terminal, the subscriber could receive subsidised communications and information services, such as:

- A basic number of telephone or videophone calls nationwide per month, with no inland toll charges. This would enable the geographically remote, the elderly, the poor and the handicapped to maintain contact.

- A number of quality national and community television services.

- A number of quality national and community radio services.

- Videotex-type access to such information and data banks as have historically been freely available, such as the free public library system, local and national government information and statistics.

- Interaction with the process of government, such as voting in local and national referenda; direct voting; and audio-visual access to parliamentary and local body debate, whether the debate is from a central location, or teleconferenced. (In essence, it will be possible for Parliament to meet via videoconference while the Members remain in their electorates.)

- A range of essential educational services.

- Other New Zealand or global services as may from time to time be judged basic.

Beyond these baseline services would rise a vast pyramid of information, educational and entertainment services that would be available to the subscriber on a user-pays or sponsored basis.

FUNDING

There are three ways of funding communication/information services:

User pays directly, such as telephone toll charges.

User pays indirectly, such as advertising sponsorships.

User pays collectively, such as TV licences or tax subsidies.

The funding of future growth in communications will be an item of major policy discussion. It is to be hoped that innovative solutions may arise, peculiar to the New Zealand situation.

For example, an annual communications fee could be charged to all terminal/receiver users to support the establishment and development of technical networks and to cover the cost of basic services. The fee should be reviewed regularly and could be graded to cover different ranges of services.

There could be an additional fixed charge for telephone/videophone calls anywhere in New Zealand with a baseline number of calls per month (and emergency and medical calls) included in the communications fee.

The new technology of packet-switching brings with it the possibility of billing per number of packets of information transmitted, instead of by the duration of connection. The social and economic impacts of such a policy should be investigated.

The early New Zealand roads, bridges and tunnels were financed by massive public investment as a necessary step in national development. If the same philosophy were applied to communications, a responsive and superior system might be developed quickly. Communications facilities are inherently less costly than road systems, so the multiplier effect of the public dollar would be far greater.

The role of advertising in the future is a major issue with a high level of uncertainty.

It may be assumed there will be increasing competition for "the advertising dollar".

Most persuasive advertising—for example, introducing and promoting new and re-vamped products—seems likely to remain within the province of mass media.

Nevertheless, major changes in the advertising industry are probable, possibly including the fundamental change of charging on-line videotex users for viewing some types of advertising.

In some classified advertising areas, such as the selling and buying of cars, videotex could provide a more flexible and comprehensive service and may find consumers willing to pay for it.

ORGANISATIONAL STRUCTURES

There is general agreement in the Policy Research Group that new structures are necessary to make the best use of new communications technologies.

What kinds of organisations would serve us best in the future?

A Ministry of Communications? Should the telecommunications functions of Broadcasting and of the Post Office and possibly other Government departments be combined at the highest level? Or is it preferable to continue existing organisations with new strong policy guidelines reflected in changes to the appropriate Acts and regulations?

A Spectrum Management Agency? Should responsibility for the radio frequency spectrum be in the hands of an independent body charged with *managing* this national resource for the public good?

Today the New Zealand Post Office acts as the "administrator" of the spectrum. It co-ordinates and licenses users, but does not manage the spectrum in the sense of evaluating and encouraging the optimal national use of the total resource.

A National Transmission Authority? With the convergence of cable and broadcast pathways of communication, would it make sense to create an institutional body such as a public corporation to provide both the telephone-type cable network and the broadcast transmission facilities?

This would offer rationalisation of policies and facilities such as microwave networks, and permit the optimum mix of cable and broadcast pathways, or hybrid systems. It would carry the danger of monopolistic control and susceptibility to single-cause disruption.

Strengthened Communications Advisory Council and/or Broadcasting Tribunal? Should an existing agency be strengthened and funded to allow it both to adopt the spectrum management role and to give a lead in other communications policy issues?

CAUTIONS

- The greater the reliance on a single system or electronic highway, the more vulnerable it is to attack or disruption.

  On the other hand, a network designed for survivability can provide built-in redundant (duplicate) paths, self-correcting features, and automated control. Single-point linkages such as satellites can be backed up to a certain extent by undersea cables and short wave radio.

- The costing of terminals and of information can either increase or decrease the information gap between rich and poor. Strict user-pays systems may reinforce the power of large companies, the affluent and the educated.

  However, widely available baseline services can spread the benefits of the information society to any remote location and to the handicapped and the less affluent. They can also support activity in the information sector of the economy, stimulating employment and reducing costs.

- Computers and information networks have the power to "never forget". An authoritarian society could assemble personal dossiers on each individual. The information might or might not be completely true.

  New Zealand might choose to place limits on the information compiling powers of financial and governmental agencies, and also provide mechanisms whereby individuals could review their own files for accuracy and completeness.

- Information overload may become a greater problem. With a virtually unlimited number of media clamouring for eyes and ears, there is a tendency to "turn off" which means that sometimes vital information might not be received or recognised.

- Literacy, graceful language and creative manual arts are at risk so long as electronic displays are limited in their number of words on screen and by the fidelity of their pictorial material.

- The unrestricted flow of information across national borders may have hidden hazards. That which is legal in one country may be illegal in another. Subversion and computer crime can flourish worldwide, and be difficult to detect.

- There will be a tendency towards homogenisation of cultures and language. It is evident today through American television programming. The potential will be increased as more media become global.

- Any modification in traditional employment patterns should be approached in co-operation with employees and unions. The tools of communication can be used for increasing public understanding of employment problems and solutions, as well as opportunities for retraining and relocation of workers.

- Foreign majority ownership of key elements such as space satellites or foreign acquisition of communications companies or information providers may be undesirable. Existing laws may need to be modified to cope with the changing technology.

The world's foremost expert on biocybernetics lives and works at the edge of Lake Tarawera. Her hoffice is crammed with more telecommunicating and computing power than used to be found in a complete university, and its fibre optic link has the highest data flow in New Zealand. The costs are borne by her clients in Europe and North America.

Most of her experimental work is performed in a research establishment in Berne, Switzerland. Usually it is carried out by others to her specifications but occasionally she conducts it herself by remote control.

She does not own a vehicle, and much prefers conversations with her computer and videoconferencing with her international super-chess group to physical travel. She is considered a bit odd.
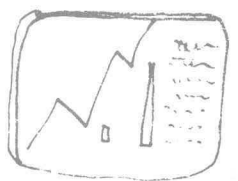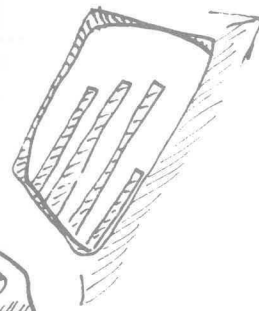
9. RECOMMENDATIONS

RESEARCH AND PLANNING AUTHORITY

If communications and information policies are to help shape New Zealand's future, then public debate on the issues and possibilities raised in this report must continue.

The members of the Policy Research Group recommend as a first step the establishment of a statutory authority to undertake anticipatory communications policy research and broad national integrated planning.

This authority should have much greater powers and resources than the present Communications Advisory Council, which it should replace.

GOALS AND OBJECTIVES

The new authority should seek a high level of public participation and set national communications goals and objectives. It should:

(a) Conduct an early review and revision of all relevant legislation such as the Post Office Act and the Broadcasting Act, as well as regulations and practices derived from these Acts. Some aims should be to:

- Facilitate adoption of appropriate new services and technologies in a timely manner.

- Encourage consolidation of technical functions and planning among Government agencies.

- Identify baseline socially-desirable services.

- Consider relaxation of regulation of terminals and services in line with major overseas trends.

- Rationalise the funding base for a comprehensive communications infrastructure.

(b) Advise the Government on revised organisational structures as outlined earlier.

(c) Define and enunciate public policy regarding copyright, rights of privacy, trans-border data flow, communications rights and goals and other issues of social importance raised in this report.

(d) Organise the establishment of a demonstration community which would serve as a testing ground for new communications policies, technologies and services under New Zealand conditions before their widespread adoption.

(e) Develop communications policies that would foster New Zealand industry and encourage competition in both the public and private sectors.

10. APPENDIX

NETWORK NEW ZEALAND WORKING PAPERS

1. *Towards a Communications and Information Policy for New Zealand.* A discussion paper by Myra Harpham.

2. *Information Occupations: The New Dominant in the New Zealand Work Force.* An analysis by Michael Conway.

3. *Communication Needs and Rights; Communications in Four New Zealand Contexts.* A working paper by P. W. Harpham, Marie Keir, Gerald E. Moriarty, and George Van Valkenburg.

4. *Communications to the Year 2010: Some Social, Political and Economic Issues.* Marie Keir.

5. *Computer Communications and Information Services.* Notes by P. W. Harpham.

6. *The Future of Broadcasting and Frequency Spectrum Usage in New Zealand.* A working paper by Gerald E. Moriarty.

7. *The New Zealand Daily Newspaper: An Endangered Species.* A working paper by Michael Conway.

8. *Point-to-Point Communication in New Zealand Over the Next 20 Years.* A working paper by John P. Moriarty.

9. *Space Satellite Distribution.* An input paper by George Van Valkenburg.

SELECTED REFERENCES

The Wired Society and *Communications Satellite Systems,* both by James Martin, Prentice-Hall.

The Network Nation: Human Communication via Computer, Starr Roxanne Hiltz and Murray Turroff, Addison Wesley.

The Information Society: The Issues and The Choices, Kimon Valaskakis, University of Montreal, 1979.

Many Voices, One World: Communication and Society, Today and Tomorrow, Sean McBride et. al., UNESCO, 1980.

The Computerisation of Society: A Report to the President of France, Simon Nora and Alain Minc, MIT Press, 1980.

The Future with Micro-electronics: Forecasting the Effects of Information Technology, Iann Barron, Ray Curnow, Frances, Pinter Ltd., 1979.

Goodbye Gutenberg, Anthony Smith, OUP, 1980.