

SOCIAL AND ECONOMIC EFFECTS OF INFORMATION-ORIENTED INVESTMENT

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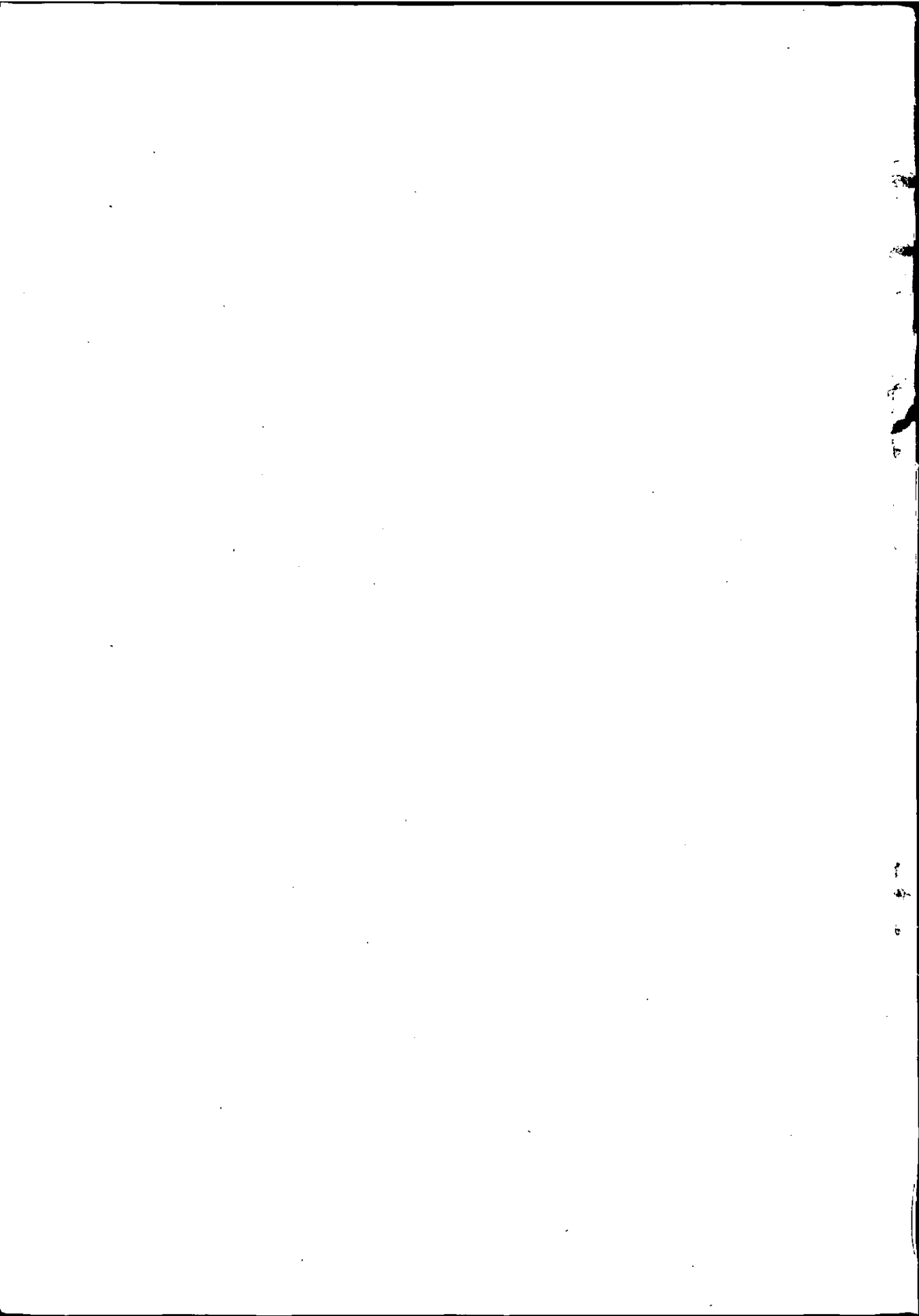
JAPAN COMPUTER USAGE DEVELOPMENT INSTITUTE

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3-2-5 Kasumigaseki, Chiyoda-ku, Tokyo, Japan.
Telephone 581-6401

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SOCIAL AND ECONOMIC EFFECTS
OF
INFORMATION-ORIENTED INVESTMENT



FORWARD

The present study was made to objectively evaluate the effects that information-oriented government investments may produce on the economy and society of this country.

The formation of fixed capital by the Government has played a major role in the economic and social development of this country. However, a limit to capital spending mainly for the development of heavy and chemical industries particularly by private enterprises has been in sight in the past several years, because of increased pollution, shortages of energy and resources, and a major change taking place in people's attitudes to values. Under these circumstances, greater importance has come to be attached to public investments by the Government for increased people's welfare.

As for future government investments, the following three directions are considered possible, that is, public facilities-oriented investments such as those for the construction of roads and housing, leisure pursuit-oriented investments such as for recreation and leisure centers and information-oriented investments such as those for the development of CATV-equipped cities, traffic information systems, etc.

However, hardly any studies have yet been made to evaluate the social and economic effects of these three types of government investments and clarify their mutual relationships

and also to ascertain the trade-off relations between the conventional industrialization-oriented investments and the two other types of investments.

The present study leaves much to be desired particularly with respect to the methods employed and the accuracy of data and results obtained, as it had to be completed in time for presentation as discussion material to the International Symposium on Information scheduled for 1973 in Tokyo under the sponsorship of the Japan Computer Usage Development Institute. The efforts of the researchers engaged in this study will be more than sufficiently rewarded if it proves useful as a starting point for further studies on this problem and provide any suggestions to the Government in working out its policy on information-oriented investments.

This study was undertaken by this institute with the cooperation of the below-mentioned Information-Oriented Investment Research Group.

The institute hereby expresses its heartfelt gratitude to the members of the research group for their cooperation.

Information-Oriented Investment Research Group

Project Director Yoneji Masuda, Director Japan Computer Usage
Development Institute

Seiichiro Yahagi, managing director,
Nippon Time-Share Co., Ltd.

Shiro Shimaya, member of the editorial
board, Nihon Keizai Shimbun

Yoichi Yonemura, senior researcher,
Nomura Research Institute

Ryozo Hosoe, managing director,
Software Management Co., Ltd.

Development of software undertaken by
SMC group

March 1974

Hidezo Inaba, President
Yoneji Masuda, Project director
Japan Computer Usage
Development Institute

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SOCIAL AND ECONOMIC EFFECTS OF INFORMATION-ORIENTED INVESTMENT

I Summary of Study Results

The results of the present study on "Social and Economic Effects of Information-oriented Investment" may be summed up as follows:

- 1) If we continue to follow the conventional pattern of economic development emphasizing industrialization-oriented investments, we are likely to witness increasingly unfavorable effects caused on society by such negative factors as inflation, pollution, and crowdedness, with a widening gap between economic growth and public interests.
- 2) If we switch to an economic development pattern emphasizing information-oriented investments, there will be less unfavorable effects due to inflation, pollution, crowdedness, and such other negative factors, and favorable effects on society such as improved medical care, and education will be generally raised.
- 3) It is estimated that information-oriented investments will be generally about 3.5 times as effective as industrialization-oriented investments in contributing to the good of society -- specifically, 10 times in improving education,

2.5 times in minimizing crowdedness and pollution, and 1.5 times in improving medical care and curbing price hikes (See Fig. 1).

- 4) With respect to the possible economic effects of industrialization-oriented and information-oriented types of investments, the former will soon cause the economic growth rate to decline whereas information-oriented investments will allow it to remain at a much higher level.
- 5) Conceivable reasons for this tendency include the following effects expected from industrialization-oriented investment: (a) increasing shortages of energy and underground resources at home and abroad, (b) growing opposition of local communities to new industrial installations by reason of pollution, and (c) a continuing exodus of raw material industries to newly-developing countries.

From information-oriented investments, on the other hand, the following favorable effects can be expected:

- (a) There will be less resistance from local communities since pollution will be reduced; (b) less material resources will be required; and (c) more and more investments will be induced in a chain reaction.
- 6) It is estimated that the industrialization-oriented investment pattern is likely to keep the economy growing at a real

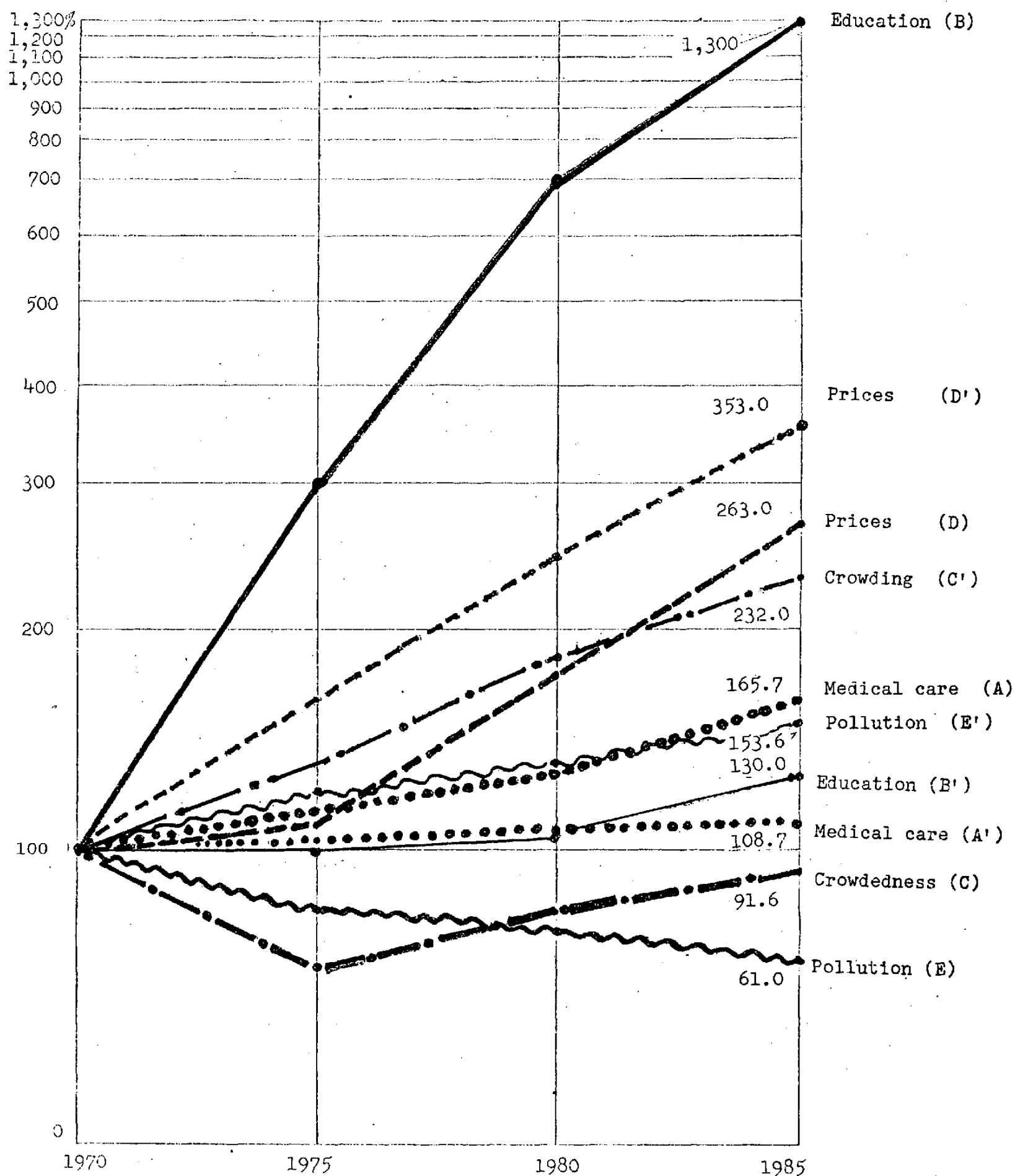
rate of 3 percent, or at a nominal rate of 8 percent, both much lower than the present levels, whereas the information-oriented investment pattern will permit a real economic growth rate of 5 percent and a nominal growth rate of about 10 percent.

- 7) With respect to the future composition of Japanese industry, it is expected that, with the industrialization-oriented investment pattern maintained, the contribution of raw material industries (such as steel, oil refining, paper, and lumber) will be reduced by half, and living-related industries (textile, furniture) and functional industries (construction, civil engineering, communications, electric power, financing insurance) also will decline in relative importance. On the other hand, service industries will be increasingly important, and are likely to become the leader of Japanese industry in the future.
- 8) If we switch over to the information-oriented investment pattern, raw material industries will similarly decline sharply in relative importance, and so will living-related and functional industries, though less conspicuously. On the other hand, processing industries (computer, electric equipment, common machinery) and knowledge industries (publishing, broadcasting, information service, computer, software) will be increasingly important, and are likely to become the leaders of Japanese industry in the future (See Fig. 2).

9) From the above analysis, the following main conclusions can be drawn:

- i) The Japanese economy in the future should undergo as soon as possible a change-over from the industrialization-oriented pattern of development to an information-oriented pattern.
- ii) Information-oriented investments should be emphasized in the immediate future to help reduce unfavorable effects such as pollution, crowdedness and inflation. Such investments will contribute greatly to the good of society, and have much more favorable effects on the economy.
- iii) Effective long-range planning is desired for information-oriented investments in education since education will play a vital role in creating markets for information and knowledge industries in the future.
- iv) Such information-oriented investment contributive to the good of society will require huge amounts of money and may not be made easily on a strictly commercial basis. Such funds should be provided by the Government.

Fig. 1 - Social Benefits Expected From Industry-oriented and Information-oriented Investment Patterns



REMARKS

1. "Education" level represents ratio of educated population (those with computer-oriented education) to total population.
2. "Medical care" level is based on number of doctors per 100,000 of population and ratio of health-controlled population (those regularly undergoing health checks) to total population.
3. "Crowdedness" level is based on car tie-up hours and degree of congestion during commuting hours.
4. "Prices" level represents ratio of prices of perishable foods.
5. "Pollution" level is based on NOx and BOD values.

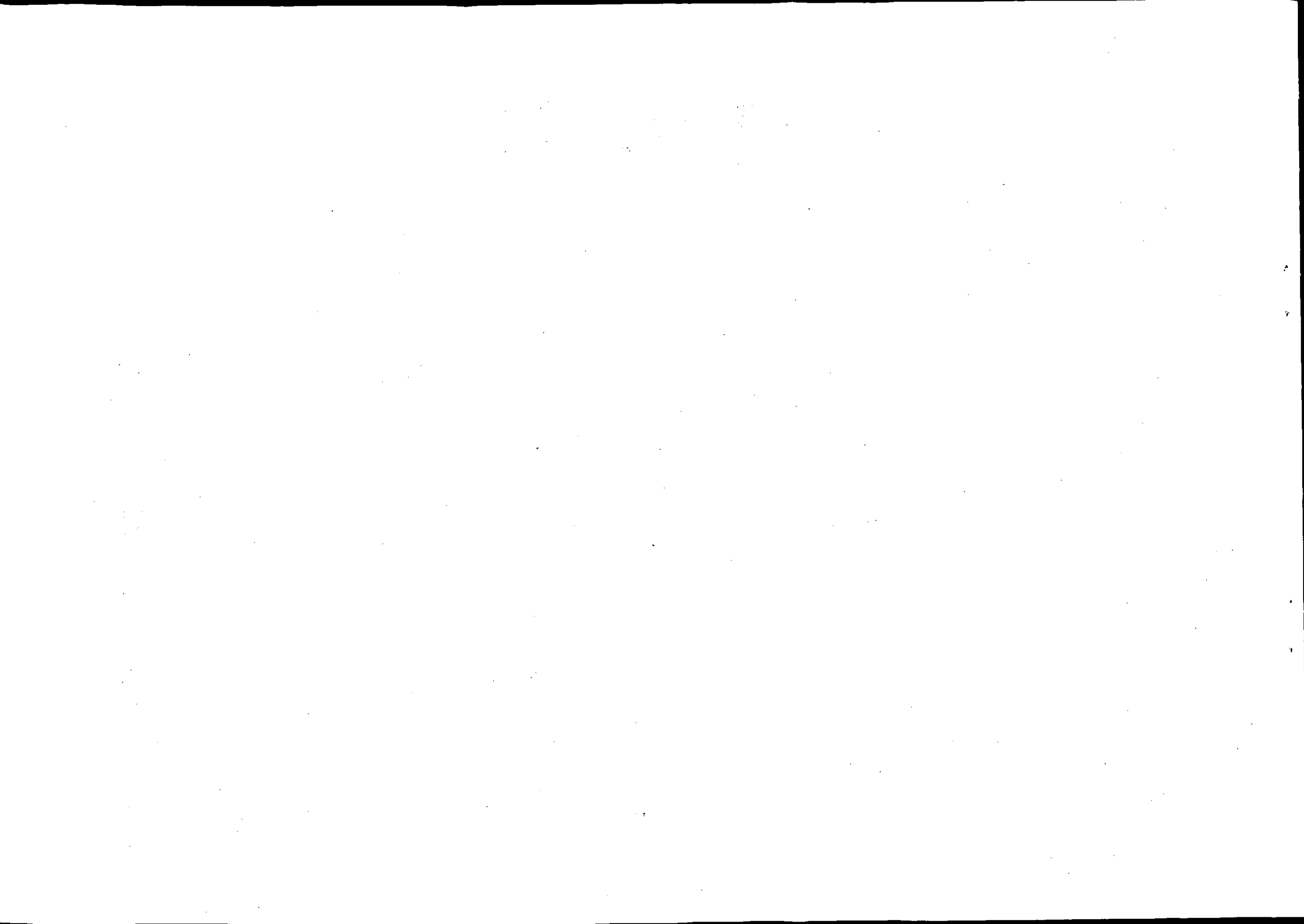
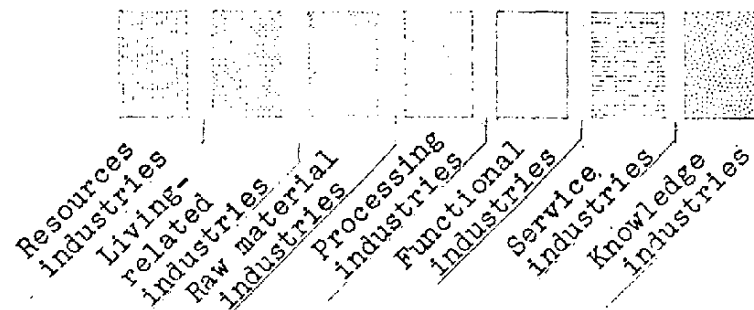


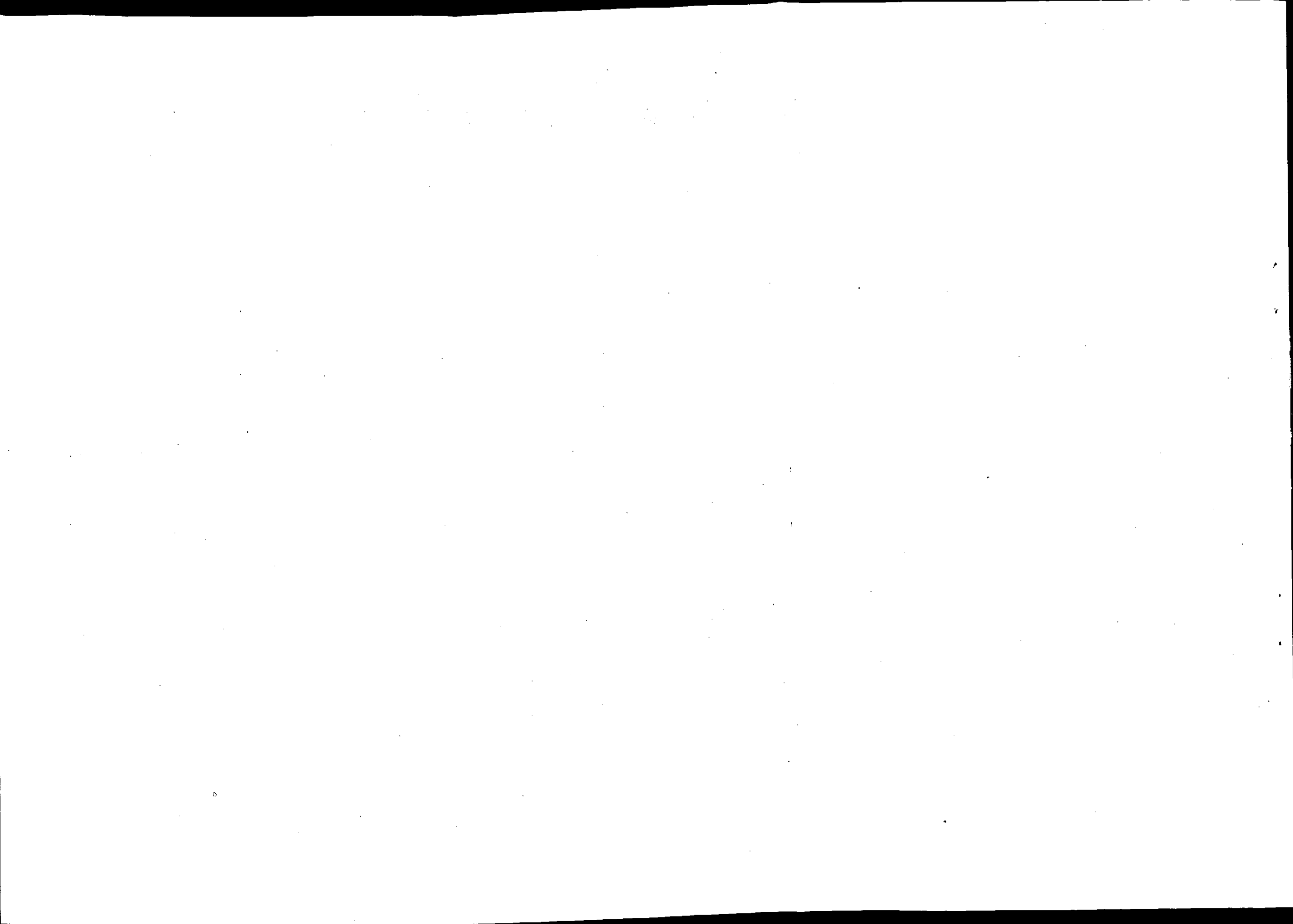
Fig. 2 - Economic Effects Expected From Industrialization-oriented and Information-oriented Investment Patterns

Industrialization-oriented	'70	52 (15)	11.2 (20)	14.7 (24)	10.3 (14)	17.7 (24)	9.6 (13)	52 (7)	Gross national product (nominal) \$245.7 billion (100%)			
	'75	65 (5)	16.9 (13)	23.4 (18)	20.8 (16)	31.2 (24)	13.2 (14)	12.7 (10)	130.3 (100)		Industrialization-oriented (1985)	
	'80	104 (6)	17.2 (11)	27.9 (16)	29.6 (17)	41.8 (24)	26.2 (15)	17.4 (10)	172.5 (100)		Gross national product: \$779.3 billion	
	'85	18.7 (8)	23.4 (10)	25.7 (11)	42.1 (18)	46.8 (20)	51.4 (22)	25.7 (11)	233.6 (100)		Growth rate, nominal: 8% Growth rate, real: 3%	
Information-oriented	'70	52 (15)	11.0 (20)	11.7 (24)	10.3 (14)	17.7 (24)	9.6 (13)	52 (7)	Gross national product (nominal Prices) \$245.7 billion (100%)		Information-oriented	
	'75	68 (5)	16.3 (12)	21.7 (16)	24.4 (18)	31.2 (23)	13.9 (14)	17.2 (13)	135.8 (100)		Gross national product: \$1,033.5 billion	
	'80	10.5 (5)	20.9 (10)	27.2 (13)	41.9 (20)	43.9 (21)	29.3 (14)	33.6 (16)	208.3 (100)		Growth rate, nominal: 10% Growth rate, real: 5%	
	'85	16.3 (5)	36.2 (12)	27.6 (9)	67.5 (22)	53.7 (18)	52.2 (17)	56.0 (18)	310.0 (100)			



REMARKS

1. Resources industries: Agriculture, forestry, fishing, coalmining, nonferrous metal ore, natural gas, and other underground resources industries.
2. Living-related industries: Industries manufacturing food products, textile products, wood products, furniture, leather, and such other goods.
3. Raw material industries: Pulp, paper, rubber, chemical, oil, ceramic, iron and steel, nonferrous metal, and metal product industries.
4. Processing industries: Common machinery, electric equipment, computer and related equipment, transportation equipment, and precision machinery industries.
5. Functional industries: Construction, civil engineering, electric power, city gas, service water, financing, insurance, real estate, transportation, and communications industries.
6. Service industries: Commerce, motion picture, entertainment, hotel, and other common service industries.
7. Knowledge industries: Graphic arts, publishing, information service, software, public service, legal and other professional service industries.



II Economic Growth, Social Welfare and Informationalization

1. Economic growth divorced from social welfare.

Recently, public attention is focused on the relationship between economic growth and social welfare, because of remarkable tendencies toward increased incompatibility of economic growth with social welfare. The reasons are as follows. Firstly, sustained economic growth has come to give rise to social demerits such as increased pollution, overcrowdedness and depletion of natural resources. Secondly, social overhead costs for the removal and prevention of pollution and overcrowdedness have come to apply pressure against enterprise profits.

This tendency toward disparation between economic growth and social welfare indicates a radical change taking place in the basic mechanism of economic and social development, if we recall the fact that in the past economic growth used to lead directly to social welfare, without causing any factors contradictory to it.

2. Social welfare-oriented economic policy line

Under these circumstances, efforts are being made to seek an economic policy line with emphasis on social welfare, which is to take the place of the hitherto followed industrialization policy line with priority to production. There are, roughly speaking, the following directions in

these efforts, that is, (1) public facilities-oriented, (2) leisure pursuit-oriented, and (3) information-oriented.

The public facilities-oriented direction is represented by the efforts to increase public facilities, which furnish a basis for a "civil minimum", such as public housing estates, parks, schools and hospitals, while the leisure pursuit-oriented direction is aimed at increasing recreation centers, facilities for bicycle riders, overseas trips and leisure hours. The last named information-oriented direction is aimed at developing automation, information service and knowledge creation.

3. Three economic lines and their effects on social welfare.

The above-mentioned three economic lines have a common feature in that all these are aimed at social welfare, and they are mutually inter-related. However, the effects of each of these economic lines on social welfare differ in nature and content from those of the other lines.

Table 1 shows the comparison of the four patterns of economic development, that is, the industrialization-oriented, public facilities-oriented, leisure pursuit-oriented and information-oriented patterns, with respect to social welfare in its general meaning (education, medical care, leisure pursuits, social security, conservancy of natural environment) and welfare in its more positive meaning for human life (self-actualization, participation, freedom) and also with respect to counter-welfare as demerits of these patterns (inflation, overcrowdedness, pollution).

Table 1 - Effects of 4 Different Patterns of Economic Development on Society

Economic growth pattern		Industriali- zation- oriented (emphasiz- ing con- sumer good)	Public utilities- oriented (emphasiz- ing "civil minimum")	Leisure pursuit- oriented (emphasiz- ing recrea- tion)	Information- oriented (emphasizing knowledge)
Effect on society					
Personal benefits	Self-actualization	△ 1	□ 0	○ 2	⊙ 5
	Participation in creative	△ 1	○ 2	□ 0	○ 2
	Freedom of choice	X -1	△ 1	○ 2	X -2
Social benefits	Education	△ 1	○ 2	△ 1	⊙ 5
	Medical care	△ 1	○ 2	○ 2	⊙ 5
	Leisure pursuits	○ 2	□ 0	⊙ 5	○ 2
	Social security	△ 1	⊙ 5	□ 0	□ 0
	Natural environment	X -5	○ 2	X -2	△ 1
Negative effects	Inflation	X -5	X -5	○ 2	△ 1
	Crowdedness	X -5	○ 2	X -5	⊙ 5
	Pollution	X -5	○ 2	○ 2	X -2
Net effect		-14	13	9	22

LEGEND ⊙ Much better

○ A little better

△ Fair

X Much worse

X A little worse

□ Not much affected

The salient points that emerge from the above table may be summed as follows.

1. If the industrialization pattern is continued, counter-welfare such as inflation, overcrowdedness and environmental disruption, will assume more and more serious proportions, and damage to natural environment will be increased.

On the other hand, very little progress will be made in education, medical care and welfare, with only leisure pursuits expected to be expanded to a certain extent.

2. The public facilities-oriented pattern is expected to improve welfare in terms of social security (measures for aged people, physically handicapped persons, poor people, pension systems). But this pattern suffers from a defect that inflation is stimulated by investments in public works such as construction works. At the same time, no positive effect is expected to be achieved in the increasing welfare in human terms, or in making people feel their life worth living, although some progress may be made in participation (participation in community activities and in policy-making).

3. The leisure pursuit-oriented pattern is effective to a considerable degree in expanding positive welfare in human terms, for instance, in increasing leisure hours and freedom, but at the same time, it has its own demerits in that it gives a spur to environmental damage and overcrowdedness.

4. In contrast to the above, the information-oriented pattern is effective not only in increasing welfare

in human terms such as self-actualization and participation and in expanding social welfare such as education and medical care, but also in easing or resolving overcrowdedness and pollution. However, on the other hand, there is danger that it may bring about limitations on freedom (strengthened automation and administration) and public damage due to information (invasions of privacy).

The overall evaluation of the effects of the four above-mentioned economic lines on social welfare is as follows. In contrast to the fact that the industrialization-oriented pattern (-12) has negative effects on social welfare, the other patterns rank as follows with respect to their favorable effects on social welfare in the following order: the information-oriented pattern (22), public facilities-oriented pattern (13), and the leisure pursuit-oriented pattern (9). The above figures show that the information-oriented pattern ranks higher in this respect than the two other patterns.

But, at the same time, the above shows that whatever economic line may be followed in the future, sufficient measures against possible demerits must be taken into consideration.

4. Social welfare-oriented economic lines, economic growth and industrial structures

In case any of the above-mentioned social-welfare oriented economic lines is adopted in the future, it goes

without saying that it will have a major effect on economic growth and industrial structures.

In the first place, a change in the nature of investments, which necessarily accompanies a changed economic line, cannot but produce a substantial change in the economic situation. Secondly, a different effect on social welfare may produce an even more important economic growth and industrial structures.

The following may be anticipated as characteristic tendencies in such changes. (See Table 2)

(1) In case the present industrialization-oriented pattern is continuously maintained, the growth rates of resources industries (iron and steel, oil refining, chemical industries) will substantially slow down owing to energy and materials shortages, and the slow-down of these industries will be followed by that of functional industries (construction, electric power, transportation, communication industries) and the living-related industries (foodstuff processing, textile, furniture manufacturing industries). Only service industries (commerce, motion picture, amusement and entertainment industries) will grow. As a result, the economic growth rate (in real terms) will remarkably decline.

(2) In case the public facilities-oriented pattern is adopted as an economic line, functional industries will be maintained on a high level thanks to increased construction of

housing and roads, and resources industries will also grow accordingly. On the other hand, the relative importance of processing industries (machinery, electric machinery, transportation and handling machinery industries) and daily necessities industries will decline. As a whole, it would be unavoidable that the economic growth rate will be considerably slowed down because of restrictions on the supply of resources and energy.

(3) In case the leisure pursuit-oriented economic line is pursued, service industries will grow remarkably, and living-related industries will also develop, notably the production of de luxe goods. But, on the other hand, the production of resources and processing industries will go down. As for the economic growth rate, it will decline to a considerable extent temporarily as the entire economy will be switched to the resources-saving type, but will recover later somewhat as a result of the development of leisure pursuit and health industries.

(4) In case the information-oriented pattern is adopted as an economic policy line, knowledge industries (publishing, broadcasting, software, information services, education) and processing industries (particularly computer-related industries) will grow rapidly, while the decrease in the output of resources and functional industries will be moderated to some extent because of the switchover of these industries to the resources-saving type. As a result, from a long-range outlook the economic rate may be maintained.

Table 2 - Effect of Social Good-oriented Patterns of Development on Economic Growth and Composition of Industry

	Industri- alization- oriented (emphasi- zing good of con- sumers)	Public utilities- oriented (emphasi- zing "civil minimum")	Leisure pursuit- oriented (empha- sizing leisure pursuits)	Informa- tion- oriented (emphasiz- ing knowledge)
Economic growth rate	X	X	△	□
Composition of Japanese industry				
Resources industries	□ ±0	▲ -1	□ ±0	□ ±0
Living- related industries	X -3	X -3	○ +3	▲ -1
Raw materials industries	X -5	○ +3	X -3	X -5
Processing industries	△ +1	X -3	X -3	⊙ +5
Functional industries	▲ -1	⊙ +5	△ +1	▲ -1
Service industries	○ +3	△ +1	⊙ +5	○ +3
Knowledge industries	△ +1	△ +1	△ +1	⊙ +5
Net effect	-4	+3	+4	+6

LEGEND X Greatly reduced. X Considerably reduced.
 ▲ A little reduced. □ Not much affected.
 △ A little increased. ○ Considerably increased.
 ⊙ Greatly increased.

5. Social and economic effect of information-oriented investments and its significance

The above projections are made on the basis of the following suppositions.

(1) The worldwide shortages of energy and natural resources will assume more and more serious proportions in the future, and even if there is active demand for the products of resources industries and even if sufficient investments are made, these industries are not expected to be able to increase their supply capacity.

(2) Because of mounting citizens' movements, pollution and restrictions on overcrowdedness, it will become more and more difficult for the conventional key industries of this country such as power generation, iron and steel, chemical and auto industries, to construct new factories, and either these industries will be unable to fully meet the demand for their products, or demand for their products will slow down.

(3) These restrictions on the production of resources and pollution-causing industries will have a negative effect also on the processing and living-related industries.

(4) Therefore the future economic growth, which is governed by the law of demand and supply, will be strongly determined by (a) natural conditions (shortages of resources and damage to natural environment) and (b) social conditions (citizens' movements, pollution increase, etc.)

(5) Conversely speaking, these facts show that a switchover to an industrial structure, which will meet the three conditions of (a) resources-saving, (b) freedom from pollution and (c) high social welfare will become the key to economic development in the future.

The foregoing analysis was made on the basis of these suppositions. The final conclusion derived will be as follows.

(1) It will be most effective to select the information-oriented pattern as a future economic line in order to achieve economic growth and social welfare simultaneously in the future.

(2) From a short-range outlook for information-oriented investments, it would be possible to meet social needs by laying emphasis on the solution of the problems of prices, pollution and overcrowdedness and by concentrating on areas (medical care, education, welfare) from which greater effects may be obtained in social welfare.

(3) However, since large sums of investments are required before actual results can be achieved in the construction of information-oriented society and since such investments can hardly be made on a commercial basis, the Government is required to make large sums of information-oriented investments.

(4) Viewed from a long-range standpoint, it is necessary to make information-oriented investments particularly

in the area of compulsory education, so that information may be utilized by individuals and that a system of values may be constructed in which information will be economic goods for the masses.

III Measurement of Social and Economic Effects of Industrialization-Oriented and Information-Oriented Investments

The above discussions are mainly theoretical, and do not help us grasp the economic and social effects of various types of investments quantitatively. Therefore, it is necessary to quantitatively measure the social and economic effects of the information-oriented economic line.

Here we estimated these effects with respect to the industrialization-oriented and the information-oriented economic line for the purpose of comparison.

A. Measurement of social and economic effects of industrialization-oriented economic line

1. Social welfare effects for the industrialization-oriented economic line

Here we estimated the social effects of the industrialization-oriented economic line on the supposition that the past investment policy centered on those for the development of heavy and chemical industries, are continued. Table 3 shows the results of estimation.

Table 3 - Social Welfare Effects of Industrialization-Oriented Investments

	Education level	Overall Medical Care Levels			Overall Overcrowdedness Level			Price Level	Pollution level
		Overall level	Medical care level	Health level	Overall level	Auto over-crowdedness level	Commuter over-crowdedness level		
1970	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1975	100.0	102.4	102.4	107.9	139.0	169.0	109.0	166.0	124.0
1980	105.0	105.9	104.8	203.6	185.0	254.0	116.0	245.0	138.0
1985	130.0	108.7	105.2	321.2	232.0	339.0	125.0	353.0	153.0

- Notes: 1. "Education level" denotes the percentage of persons who have received computer-oriented education, to the total population.
2. "Medical care level" denotes "the number of doctors per 100,000 of the population" and "health level", the percentage of persons who receive medical examinations, to the total population.
3. "Auto overcrowdedness level" denotes the hours of delay in motor driving due to congestion, and the "commuter overcrowdedness level", the overcrowdedness of commuters in trains during commuting hours.
4. "Price level" denotes the price level of perishable foods.
5. "Pollution level" denotes NOX and BOD values.

Here the five indices of (1) medical care, (2) education, (3) overcrowdedness, (4) prices and (5) pollution were selected as social welfare indices to represent other indices of social welfare.

Further, in measuring the social welfare effects of industrialization-oriented investments, their estimated values in 1975, 1980 and 1985 were obtained by extending their past trends.

The estimated values show the following trends.

(1) The indices of social welfare such as education and medical treatment are improved to a certain extent, but their growth rates are low at 130 for education and 108.7 for medical care in 1985.

(2) On the other hand, the indices of negative effects on social welfare such as overcrowdedness, prices and pollution, are raised all along the line. This increase in the indices of negative effects on social welfare indicates a corresponding deterioration of the social welfare level. The index in 1985 is 353 for prices, 232 for overcrowdedness and 153 for pollution.

These figures show that if the industrialization-oriented economic line is maintained in the future, the level of social welfare will lower further in the future.

2. Economic effects of the industrialization-oriented economic line

The economic effects of the industrialization-oriented economic line are estimated in Table 5. As this

table shows, the economic growth tends to decline sharply, the relative importance of resources industries in the industrial structure goes down substantially, and they are gradually switched to service industries, together with the decline of social welfare indices. (See Table 4)

Table 4 - Economic Effects of the Industrialization-Oriented Economic Line (Nominal Terms)

Industry	(\$ Billion)							
	1970		1975		1980		1985	
Resources	17.7	(7)%	21.7	(4)	34.7	(6)	62.3	(8)
Living-related	36.7	(15)	56.3	(13)	64	(11)	78	(10)
Materials	49	(20)	78	(18)	93	(16)	85.7	(11)
Processing	34.3	(14)	69.3	(16)	98.7	(17)	140.3	(18)
Functional	59	(24)	104	(24)	139.3	(24)	156	(20)
Service	32	(13)	60.7	(14)	87.3	(15)	171.3	(22)
Knowledge	17.3	(7)	42.3	(10)	58	(10)	85.7	(11)
Gross National Product	245.7	(100)	436	(100)	575	(100)	779.3	(100)
Estimates by the Japan Economic Research Center	245.7		510.3		103.4		204.5	

- Note: 1. "Gross national product" from "National Income Statistics" for 1970, compiled by the Economic Planning Agency.
2. Industries are classified according to the January 1, 1973 issue of the Nihon Keizai Shimbun.
3. Estimates by the Japan Economic Research Center from "The Japanese Economy in 1985".

The conclusions that may be derived from the above estimates may be summed up as follows.

(1) The gross national product will grow at an annual rate of 8 per cent in nominal terms, rising from \$245.7 billion (calculated at ¥300 for the dollar) in 1970 to \$779.3 billion in 1985. However, as an annual price increase rate of 5 per cent is envisaged, the growth rate in real terms is only 3 per cent.

(2) The Japan Economic Research Center estimates Japan's gross national product in 1985 at \$204.5 billion envisaging a nominal economic growth rate of 15 per cent and an annual growth rate of 10 per cent in real terms. The above mentioned estimated economic growth rate represents less than one-third of the growth rate estimated by the center.

(3) This remarkable slowdown of the estimated growth rate is due to a substantially reduced production of the resources industries, such as oil-refining, iron and steel and chemicals, and to the import of this production slowdown on other industries. The production decline of the resources industries is explained by (a) shortages of energy and oil resources at home and abroad, (b) difficulties in the construction of new factories due to citizens' movements and (c) exodus of resources industries to developing countries.

(4) As a result, the relative importance of the resources industries to the entire industrial structure will be roughly halved and decline from 20 to 11 per cent, and the living-related and the functional industries will also reduce their relative importance by about 5 percentage points.

(5) In contrast, the service industries will increase their relative importance from 13 per cent to 22 per cent, and will exceed the functional industries and rank first in production value. This is because leisure pursuit industries and health industries are expected to grow sharply in the 1980s.

(6) Of the resources industries, the power generation industry will lower its relative importance, but the relative importance of these industries as a whole will not be reduced so much, as Government investments in construction and civil engineering projects are expected to be stepped up.

B. Measurement of Social and Economic Effects of Information-Oriented Economic Line

1. Social welfare effects of information-oriented economic line

(1) Pre-conditions for information-oriented economic line.

The social and economic effects of the information-oriented economic line were estimated on the supposition that the following conditions are provided.

1) The government makes information-oriented investments amounting to \$66.7 billion according to the Plan for Information Society, worked out by this institute.

2) The other conditions are to be the same as in the case of the industrialization-oriented economic line.

The effects of information-oriented investments will cover very broad areas, including installation of CATV facilities, medical care, education, transportation and goods distribution. However, information-oriented investments will be able to produce far reaching social and effects basically through formation of nationwide data communication or information new networks, based on the large capacity computers connected to data communication line networks, and also through the combination of the information networks with the existing and new social systems. Thus, the social welfare effects of information-oriented investments will be tremendously great.

However, all information-oriented investments for the formation of social information networks require large sums of leading investments, which will be too large in most cases to be provided on an enterprise basis.

Therefore, information-oriented investments for the formation of social information networks are required to be made to a large extent by the Government.

a. Government's information-oriented investments
and their financial backing

The Government is to make information-oriented investments amounting to \$66.7 billion by 1985 according to this institute's Plan for Information Society. Funds for this purpose are to be provided on the basis of the following presuppositions:

- (1) Japan's nominal GNP is to be increased at an annual growth rate of about 10 per cent on a sustained basis.
- (2) Government investments are to carry more weight than private investments in the future, and
- (3) Information-oriented investments by the Government are to grow at a fairly high pace in future.

b. Contents of The Plan for Information Society

The project-by-project distribution of the \$66.7 billion investments for the creation of information-oriented society is to be as follows:

(a) Formation of a nationwide information network	\$3.6 billion
(b) Rationalization of administration	\$2.2 "
(c) Development of highly sophisticated MISs	\$5.8 "
(d) Computer-oriented education	\$36.9 "
(e) Modernized medical care	\$8.0 "
(f) Pollution prevention systems	\$1.6 "
(g) Modernization of distribution systems	\$2.7 "
(h) Systems-oriented traffic systems	\$2.6 "
(i) Spread of home terminals	\$1.1 "
(j) International cooperation in informationalization	\$3.4 "
(k) Measures against demerits of computerization	\$0.18 "
Total	\$68.2 billion

(2) Social welfare effects of Government's
information-oriented investments

Table 5 shows the estimated social welfare effects that may be produced in case the Government makes information-oriented investments totalling \$66.7 billion by 1985 according to the above-mentioned preliminary conditions.

Table 5 - Social Welfare Effects of
Information-Oriented Investments

Educa- tion level	Overall Medical Care Level			Overall Overcrowd- ness Level			Price level	Pollu- tion level
	Over- all level	Medi- cal care level	Health level	Over- all level	Auto over crowd- edness level	Commuter overcrowd- edness level		
1970	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1975	300.0	118.8	113.2	343.2	58.0	57.0	58.0	111.0 79.0
1980	700.0	137.3	116.7	635.8	74.0	86.0	62.0	175.0 70.0
1985	1,300.0	165.7	122.3	937.4	91.0	116.0	66.0	263.0 61.0

Notes: Standards for the estimation of social welfare indices are the same as in Table 3.

The estimated results shown in the table reveal the following characteristic points:

- 1) Speaking about the social welfare indices of education and medical care, that for education will be 13 times higher in 1985 at 1,300, while that for medical care will be less than double at 165.7.
- 2) This is due to the fact that a sum of \$36.7 billion, or

55 per cent of the total information-oriented investments of \$66.7 billion, is earmarked for education. Further, this is due to the fact that since medical care is a special kind of work concerned with human lives, there is naturally a limit to the improvement of productivity in medical care due to computerization.

- 3) As for the two negative effects on social welfare, that is, overcrowdedness and pollution, the pollution level will be reduced to about half, or 61.0 in 1985, but the overcrowdedness level will tend to rise after being reduced to 58.0 by 1975, and will reach 91.0 by 1985.
- 4) The reason for this is as follows. Factors against pollution such as (a) strengthened anti-pollution measures, (b) development of technologies for pollution prevention, and (c) exodus of pollution-causing industries overseas, will operate continuously, while there is a limit to the effect of computerization in easing overcrowdedness, if motor cars and the number of commuters are to increase at the present pace, unless the following radical steps are taken -- (a) overall introduction of far-reaching traffic systems, and (b) strengthened restrictions on the entry of motor cars into congested areas.
- 5) Unlike the two above-mentioned indices, the price level will rise about 2.6-fold to 263.0 by 1985. This is also

due to a limit to the effect of computerization on the reduction of distribution costs, and the solution of this problem depends largely to the following factors -- (a) a substantial increase in the productivity of agriculture, (b) development of substitute foods such as artificial foods, and (c) curb on population increase.

However, all these indices show fairly high improvements, though in varying degrees, over those for industrialization-oriented investments, and it can be clearly observed that the social welfare effects of information-oriented investments will be generally higher than those of industrialization-oriented investments. Table 6 compares the social welfare effects of information-oriented investments with those of industrialization-oriented investments in 1985.

This table shows that the difference in social welfare effects between the two types of investments is the highest in education, with the education level for information-oriented investments being 10 times higher than that for industrialization-oriented investments. The social welfare effects of information-oriented investments is the highest in education, being 10 times higher than those of industrialization-oriented investments, followed by the social welfare effects of the former investments in overcrowdedness and pollution (about 2.5 times), medical care (15 times) and prices (1.3 times).

The simple average of these differences in social welfare effects between the two types of investments is about 3.58 times in favor of information-oriented investments. It goes without saying that the 10-fold difference in education has a lot to do with this high level for information-oriented investments.

The following table compares the social welfare effects of information-oriented investments with those of industrialization-oriented investments.

Table 6 Expected Effects of Industrialization-Oriented and Information-Oriented Investment Patterns on Society in 1985

	Overall Medical Care Level			Overall Crowdedness Level			Price level	Pollution level	
	Educa- tion level	Over- all level	Medi- cal care level	Health level	Over- all level	Auto over- crowd- edness level			Commuter over- crowded- ness level
Informa- tion- oriented (A)	1,300.0	165.7	122.3	937.4	91.0	116.0	66.0	263.0	61.0
Industri- alization- oriented (B)	130.0	108.7	105.2	321.2	232.0	339.0	125.0	353.0	153.0
Degree of improve- ment *	10.0	1.52	1.16	2.92	2.56	2.94	1.92	1.33	2.50

* Represents A/B for education, medical care and health, and $100 + A/B$ for crowdedness, prices and pollution.

A. Education Level

According to The Plan for Information Society, a total sum of \$36.7 billion is to be spent for the purpose of enforcing computer-oriented education at kindergartens, primary schools, lower and higher secondary schools (numbering 51,000) by 1985 and also for the purpose of providing computer-oriented education to government officials, top leaders and medium standing staff members of enterprises at national and private computer-oriented training centers also by that year.

Here we regarded a population with a certain level of basic computer-oriented education as the "standard education population", and figured out the number of housewives and other people utilizing ordinary terminals of computers by using a certain coefficient, and added the number to the standard computer-oriented education population. Thus, the education level was obtained by dividing the standard computer-oriented education population by the total population.

According to our calculation, the standard computer-oriented education population will be 3.27 million persons in 1975, 8.12 million in 1980, and 15.11 million in 1985. These figures will be expressed in indices by 300 in 1975, 700 in 1980, and 1,300 in 1985, with 100 for 1972-1975 as the base. In this way, the standard computer-oriented education population will increase 13-fold in 12 years, and 13,000 persons per

100,000 of the population, or 13 per cent of the total population, will have received computer-oriented education by 1985.

Further, in case the plan for information-oriented education is carried out, the cumulative standard computer-oriented education population in 1985 will be broken down as follows.

a.	Administration	419,000 persons
b.	Medical care	450,000
c.	Schools	14,605,000
d.	Pollution prevention	15,600
e.	Enterprises	13,500
f.	Homes	312,000
g.	Middle-aged and old people	25,000
	Total	15,418,000

B. Medical Care Level

The plan for information-oriented society envisages a total sum of ¥240,000 million to be spent on the project of modernizing medical care, which is subdivided into (1) first aid medical treatment, (2) medical care in remote islands and areas, (3) community health care, and (4) introduction of hospital automation. Here the medical care level and the health care level is defined as the number of doctors per

100,000 of the population, and the health level as the number of persons who will receive a certain level of medical examination twice a year.

According to this method, the overall medical care level will rise about 65 per cent in 1985 to 165.7, with 100 for 1970 as the base. As for the medical level and the health level, the former will go up to 122.7 and the latter sharply to 937.4. This relatively low improvement in the medical care level is due to the fact that, as mentioned before, there is a limit to the productivity of medical care and to the number of new doctors that can be secured, even if various information systems are introduced.

However, we incorporate the following bold measures in this project for the purpose of substantially raising the medical care level.

- a. To newly establish medical technical schools where the students will complete their medical education courses in a shorter period of time than in medical colleges.
- b. To revise the Medical Practice Law so that nurses and public health nurses with more than five years of service may be enabled to engage in medical treatment within certain limits, and
- c. To fully introduce new information techniques into the fields of medical examination and treatment, such as medical care systems for people in remote

areas, utilization of TV for diagnosing, semi-automatic diagnosing systems, individual-basis medical care files.

If the above-mentioned measures are taken, it is expected that the medical care level, or the number of doctors per 100,000 of the population will be stepped up by about 20 per cent, as explained above.

The sharp advance of the health level is explained by the fact that a complete community health control system will be established through the establishment of 1,500 health care centers throughout the country, in addition to the existing national health care system, centered on health examination and hospitalization for the purpose of health examination, under the national health insurance system.

C. Overcrowdedness Level

Further, according to the Plan for Information Society, a sum of \$2.6 billion will be invested for developing systems-oriented traffic systems by 1985 and introducing CVSs (computer-controlled vehicle systems) and area traffic information systems. Automobile overcrowdedness and commuters' overcrowdedness are selected here as the indices of overcrowdedness.

Tokyo Metropolis is made to represent the entire country. In case the plan is enforced, the overall index will

be 91 in 1985, with the automobile overcrowdedness level at 116, and the commuter overcrowdedness level at 66. It should be noted here that the overall overcrowdedness level, which will lower to 66 in 1975, will go up to 91 in 1985. This indicates that overcrowdedness in urban traffic cannot be solved unless radical measures such as dispersal of population are adopted.

a. Automobile overcrowdedness level

We suggest the following measures to ease the overcrowdedness of streets with automobiles.

- i) Prohibition of individually-owned passenger cars from entering Tokyo Metropolis.
- ii) Introduction of CVSs into the areas around Kasumigaseki and Marunouchi, in Tokyo.
- iii) Introduction of an integrated traffic control system to cover the entire areas of Tokyo Metropolis.

The waiting time of automobiles at main intersections inside Tokyo Metropolis during rush hours was made the index of automobile overcrowdedness.

In case the above-mentioned measures are taken, the contribution of each measure to the easement of automobile overcrowdedness will be as follows.

- | | |
|--|--------|
| 1) Prohibition of automobiles from entering Tokyo Metropolis | 0.087% |
|--|--------|

ii)	Introduction of CVSs	0.032%
iii)	Introduction of overall traffic control system	0.30%
	Total	0.419%

As these figures show, the most effective measure is the introduction of a computer-oriented, overall traffic control system. The prohibition of automobiles from entering Tokyo Metropolis is less effective than expected. The effect of this measure will be more psychological than real. The CVS is not so effective, as the introduction of CVSs is confined to the central business centers with a medium level of overcrowdedness.

b. Commuter overcrowdedness level

The crowdedness of National railway and private railway trains in Tokyo Metropolis and in the suburban areas was taken as the index of commuter overcrowdedness. More concretely, when the number of commuters in a train coach during rush hours exceeds a certain level (120-140 persons), the train coach is considered "overcrowded."

The following measures are contemplated for the purpose of easing commuter overcrowdedness.

- 1) To stagger school hours for commuting students, and to adopt flexi-hours for office workers so that 20 per cent of the commuters may be shifted

before and another 20 per cent after rush hours.

- ii) To adopt a system by which managers, administrators, specialists, sales personnel and others may work at home or with homes as their operating centers, and for this purpose, to install home terminals and establish a self-regulatory system.

These measures will reduce commuter overcrowdedness as follows.

- i) Introduction of flexi-hours 40%
- ii) Enforcement of a system of work at home 15%

D. Price Level

The Plan for Information Society envisages as a project for modernizing distribution systems the opening of large-scale unmanned superstores in the cities with a population of more than 1 million, at a rate of 1 such superstore per 5,000 households for the direct sale of perishable foods from producers to consumers. This project requires a total investment of \$2,709 million.

For the sake of convenience, the retail price index in Tokyo Metropolis was selected as the index of social welfare. According to this method, the overall welfare index will rise about 2.6-fold to 263 in 1985, with 1970 as 100. However, if it is supposed that the retail price index is to

rise at the present rate, the overall welfare index would rise about 3.5-fold to 353. Compared with this level, the index will be reduced by about 26 per cent if the measures are taken. The rise in the prices of perishable foods will be curbed as follows.

a.	Saving of distribution costs through direct connection of producers to consumers	10%
b.	Saving of personnel costs through operation of unmanned superstores	4%
c.	Lowering of retail profit margin through mass sale of low-priced goods	15%
d.	Stabilized prices of meats through storage of imported meats	undefinable
	Total	31%

It must be noted that 31 per cent is a maximum estimate, and it would be safer to estimate the total effect at 20-25 per cent.

According to our estimate, if nothing is done to prevent a rise in the price of beef, it will be raised from \$46 per kilo in 1970 to \$17.7 in 1985 in terms of dollars. The price of cabbages will rise from \$0.24 per kilo in 1970 to \$22 in 1985. In view of this, it is expected that the need to establish large-scale superstores and connect producers directly to consumers will be greater in the future.

E. Pollution Index

The Plan for Information Society envisage the spending of \$333 million government funds for the introduction of anti-pollution systems by the end of 1985 into the main designated polluted areas and for the establishment of pollution information centers throughout the country.

Adopted here as pollution indices were NO₂ content in the atmosphere of Tokyo, Kawasaki, Osaka and other principal cities and BOD values in the water of the River Tama and the River Yodo. The simple averages of these indexes were obtained. In case the anti-pollution measures are carried out, the pollution index will be lowered to 65 by the end of 1985 from 100 for 1970, but the lowered value is not yet sufficient to satisfy the standard value set by the government as a target.

Further, standard data used here for the measurement of the effect of the anti-pollution measures show the rates of "akashio" (excessive growth of plankton in the sea due to the pollution of sea water) occurrences in the Seto Inland Sea, and it is problematical to measure the estimated values of the effect of the measures for the prevention and removal of pollution.

However, we were compelled to use these data, fully aware of these insufficiencies, in view of the time assigned for the research work and the availability of other data concerned.

Originally, success in the prevention and removal of pollution depends mainly on the following factors:

(1) Development of technologies for the prevention and removal of pollution, (2) local people's movements against pollution, (3) behavioral consciousness of enterprises, and (4) Government regulations against pollution.

All these factors involve a number of unknown elements so that it is very difficult to obtain any objectively reliable data at the present stage.

(3) Combined Social Effects of Information-Oriented Investments

In the above, the social effects of information-oriented investments according to The Plan for Information Society are quantified.

In the following we will sum up the interrelationships among the indices shown in the table.

(1) The education and medical care indices are in inverse proportion to the price, overcrowdedness and pollution indices, and thus, if the former indices are in the positive, these indices have a negative effect on the latter indices.

(2) The mutual relationships between the indices in each one of these two groups of indices are in direct proportion to each other, and not only when one index becomes

positive, it has a positive effect on the other index or indices, but also these indices exert combined positive effects.

(3) The most important of these five indices is that of education, which functions as the leading factor as against the other four factors.

2. Economic effects of information-oriented investments

Table 7 shows the estimated economic effects of information-oriented government investments. This table shows that the economic growth rates will be higher for information-oriented investments than for industrialization-oriented investments. Further, as for industrial structure, the proportion of the knowledge-intensive industries and processing industries will be increased remarkably in the entire industrial structure.

These estimates show the following main features and tendencies.

(1) GNP in nominal terms will grow at an annual growth rate of 10 per cent from \$245.7 billion in 1970 to \$1,033.7 billion in 1985. In real terms, the annual growth rate will be 6 per cent. These figures represent fairly lower levels than 15 per cent in nominal terms and 10 per cent in real terms, estimated by the Japan Economic Research Center. However, the growth rate in real terms shows a nearly double advance from 3 per cent to 5 per cent as compared with that (3 per cent) for industrialization-oriented investments.

(2) This substantial increase of the growth rate in real terms for information-oriented investments over that for industrialization-oriented investments may be explained by the following.

- a. A measurable improvement is seen in the counter-welfare indices (overcrowdedness, price, and pollution) as compared with industrialization-oriented investments.
- b. A substantial improvement will be made in the education and medical care levels (particularly the education level) as compared with industrialization-oriented investments.
- c. As materials-saving industries will be developed as a result of the increase in information-oriented investments, pressure against the requirement of materials will be eased.
- d. Information-oriented investments are sure to induce private enterprises to make increased investments.
- e. Computer-oriented education investments is expected to work as a factor for inducing individuals to make increased information-oriented spending.

(3) "The Plan for Information Society" envisages a Government spending of a total of \$66.7 billion by the end of

1985. If we estimate the induced effect of this spending on private investments at 0.5, the amount of private investments induced will be \$33.4 billion. If we estimate the product coefficient of the total combined information-oriented investments at 1, the cumulative product effect of the investments up to the end of 1985 will be \$200 billion. Further, if we estimate that 2 per cent of personal spending is earmarked for information-oriented spending as a circuitous induced effect of these investments on personal spending, 2 per cent of the estimated cumulative personal spending of \$2,080 billion or \$40 billion will be earmarked for information-oriented spending. All told, the direct and indirect economic effect of the Government's information-oriented investments will total \$240 billion. If this value is added to the gross national product of \$779.3 billion which is expected to be attained in case the line of industrialization-oriented investments is followed, the total will reach \$1,017.7 billion. This is very close to the gross national product of \$1,033.7 billion, which is expected to be attained if the line of information-oriented investments is followed. This shows that the above-mentioned estimates are fairly reliable.

As for changes in the industrial structure, the processing industries will increase their relative importance from 14 in 1970 to 22 in 1985, the knowledge intensive industries from 7 to 18. This is because the computer-related industries in the processing industries will develop, and the

information and information service industries in the knowledge-intensive industries will also make process, and further because these groups of industries will be the leading industries of economic growth.

(5) As against these, the materials industries will reduce their relative importance most from 20 in 1970 to 9 in 1985. Further, the resources, living-related and functional industries will reduce their relative importance, but not so much.

(6) Meanwhile, the service industries will increase their relative importance from 13 to 17 in the meantime. This is because it is expected that in case the line of information-oriented investments is followed, investments in materials-saving industries and leisure industries will be increased more than in case the line of industrialization-oriented investments is followed.

(7) As a result of remarkable changes in the growth rates of different industries, the industrial structure as a whole will change largely toward an information-oriented structure, with the combined processing and knowledge-intensive industries stepping up their relative importance to 40 per cent. If this tendency is continued, the proportion of the information-oriented industries as a whole will exceed the 50 per cent mark in 1990.

Reference Data

Model of Information-Oriented Investments

(1) Basic concepts of model of information-oriented investments

An original model was developed for the purpose of estimating the social and economic effects of information-oriented investments on the basis of the following three basic concepts.

1. It should be a socio-economic model combining social and economic blocks (segments).
2. The model should be developed with information-oriented investments as a means of policy.
3. The model should be designed so that it may permit analysis of both industrialization-oriented investments and information-oriented investments.

(2) Structure of simulation model

1. The model consisted of the four blocks of investments, economy, society and industry.
2. A means of interference was provided between blocks so as to adjust mutual influence between blocks.
3. The investment amount as a policy variable plays the role of initialization of simulation, and the effect of investment affects many other

variables in the economic block and the society block.

4. Next, the chain-reaction effects of the blocks of economy and society on the block of industry were measured.
5. Then mutual effects on the component elements inside each of the blocks of economy, industry and society, were measured.
6. Two alternative courses -- the industrialization and information-oriented course -- were envisioned for Japan's future. First, the socio-economic effects of industrialization-oriented investments were estimated, and second the social effects of information-oriented investments were estimated, and then the economic effects of this social effects were measured on the basis of the economic scale and industrial structure estimated in the course of industrialization-oriented investment.

(3) Staged order of simulation in the model

1. Economic projections were made on the basis of the assumption that the present trends are maintained.
2. The economic estimates and estimated industrial structure calculated on the basis of the assumption that the present trends are maintained, were revised according to social indices obtained

on the basis of the assumption that the present trends are maintained.

3. The economic estimates and estimated industrial structure revised in this way, were revised again according to the social indices which are expected to be improved in case information-oriented investments, totaling ¥20,000,000 million, which are made according to the "plan for information society."
4. The internal composition of gross national product was changed on the basis of the economic figures revised again.

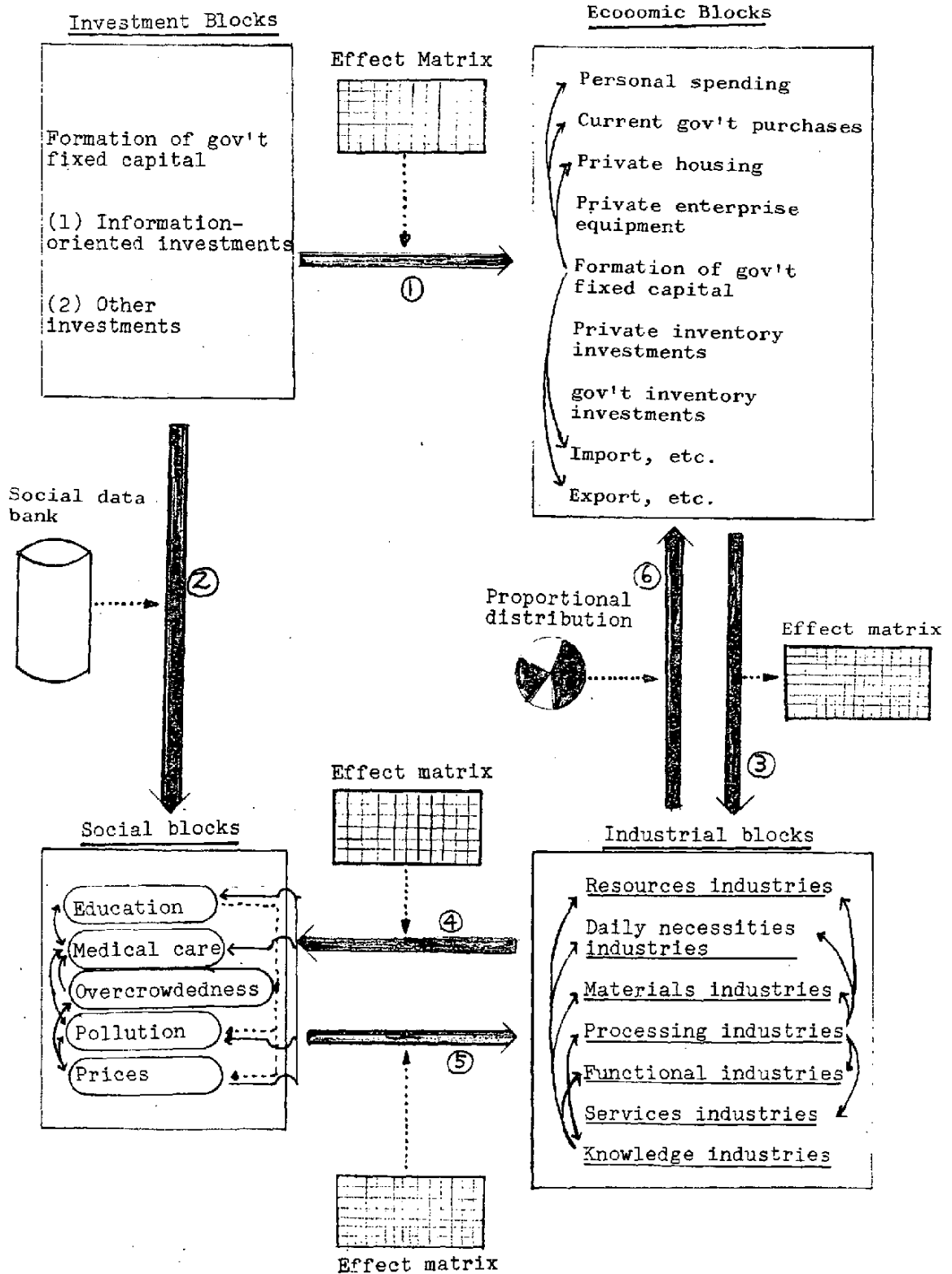
(4) Problems and methods of future improvement

1. The matrix of mutual effect between blocks was prepared on the basis of one of the following methods -- (1) model case, (2) substitution, and (3) Delphi method, because no reliable economic and social data related to information-oriented investments were available. Because of this, some subjective elements are contained in the "effect matrixes." Therefore, it is necessary to develop them into more objective ones in the future.
2. Industries were classified according to a new method adopted by Nihon Keizai Shimbun. However, this represents itself only as a rearrangement

of the conventional classification of industries, and is inadequate for accurately estimating the effect of information-oriented investments in new industries such as computer-related industries, information service, software and data communication industries. It is necessary to classify industries in a new way, taking this fully into consideration.

3. The selection of indices of social welfare was arbitrary, and was not sufficiently studied. Further, no concrete data on these indices were available, and no social data bank was in operation. At the same time, objective data for the preparation of parameters were lacking. These defects should be removed in the future.
4. As for proportional distribution to the economic blocks from the industrial blocks, further investigation and improvement are needed, in view of the lack of highly reliable coefficients which will be applicable to new economic and industrial structures.
5. The external variables, which may have a strong influence on economic growth rates and industrial structures, such as social indices, domestic and international politics, resources, and ecology, are completely ignored. It is necessary to incorporate these into the model as external variables.

Composition of Model of Information-Oriented Investments



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