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ABSTRACT

In behalf of the Kettering Foundation, a nine-month study by the Delphi technique was undertaken to identify projects or action programs in the public interest which might be supported at a total funding level of 1/2 to 5 million dollars. To elicit and process ideas and information three successive questionnaires were sent to 43 persons in various fields of specialization. The 10 most wanted studies, the 10 next most wanted studies, and 42 other proposals resulting from this procedure are listed and summarized, and each proposal is evaluated in terms of probability of success, probable societal impact, annual and total cost, number of years required, and cost effectiveness. Projects rejected as too small, too costly, or inconclusively evaluated also are described. A possible method of program selection is included, and a list of participants is given. (SK)

FUTURE OPPORTUNITIES FOR FOUNDATION SUPPORT

Olaf Helmer and Helen Helmer

Report on a Study
Sponsored by the
Charles F. Kettering Foundation

R-11

Institute for the Future
Middletown Connecticut 06457

June 1970

FUTURE OPPORTUNITIES FOR FOUNDATION SUPPORT

1. Preface

The following report presents the results of a nine-month study by the Institute for the Future that had been commissioned by the Charles F Kettering Foundation.

The authors wish to acknowledge the cooperation on the part of staff members of the Kettering Foundation and of the Institute, and especially the assistance provided by Winston Franklin, who monitored the study on behalf of the Foundation.

The substantive results of the study are due in large part to the imagination and efforts of a panel of respondents in a Delphi inquiry. The names of these participants are as follows:

Saul Alinsky	Alfred Gellhorn	Samuel Proctor
Richard de Bold	Bertrand Goldberg	Nicholas Rescher
Philip Bondy	William Golden	Henry Reuss
James Bonner	Pat Gunkel	Walter O. Roberts*
Kenneth Boulding	Theodore Hesburgh	Olin Robison
Harrison Brown*	Marvin Hoffenberg	Rudy Ruggles
John Burlew	Frederick Hooven*	Leonard J. Savage
Ramsey Clark	Peter Hooven	Joseph Slater
James Comer	Charles Kettering*	Stewart Udall
Norman Cousins*	John Kincaid	Peter Van Vorhees
Charles Day	Willard Libby	Phyllis Wallace
Richard Farson	Richard Lombard*	Christopher Wright
Joseph Fisher	George Mandanis	Paul Ylvisaker
Andre Fontaine	David Mathews	
George Gallup*	Andrew Morgan	

Asterisks identify the names of Trustees of the Kettering Foundation.

2. Introduction

This is a report of a study conducted by the Institute for the Future on behalf of the Kettering Foundation for the primary purpose of identifying, by means of the Delphi technique, research projects or action programs in the public interest suitable for support at a total funding level, over a number of years, of between 1/2 and 5 million dollars. The secondary objective of the investigation was methodological in that it provided an opportunity for testing the utility of the Delphi technique in the context of program selection.

The assignment required that the study address itself to two tasks: the nomination of candidate proposals, and the selection of a program of projects from among the candidate proposals. The present report, indeed, identifies a large number of potential areas of support; and while it does not presume to select from them a specific program to be supported by the Kettering Foundation, it does accompany each proposal with an evaluation in terms of

- its probability of success if adequately supported,
- its probable societal impact if successful,
- its estimated annual and total support requirements, and
- its cost-effectiveness.

Thus, incidentally, the study not only used a method the application of which led to the formulation of numerous proposals for new ventures – a method that could, with variations, be employed by other foundations in search of diversification - but it also laid the groundwork for the actual selection process by providing an evaluation of each proposal in terms of specific parameters.

Moreover, in Section 11, a decision method is outlined by which a group of planners, such as the trustees of a foundation, might effectively carry out the actual program selection process.

3. The procedure

The central device used in this study for obtaining proposals for new ventures and for their evaluation in terms of the parameters stated above was a survey of expert opinions by the Delphi technique. This method has previously been used on many occasions and in many different contexts, though primarily for the scientific forecasting of technological and societal developments. It employs a series of successive questionnaires, in the present case three, in order to elicit and process ideas and information that a panel of carefully selected specialists may have at their disposal. The opinions of the participants are handled anonymously throughout and, although the second and third questionnaires require the respondents to react to information fed back to them on the outcome of the preceding rounds, the procedure does not require any direct communication among the panelists. The mechanism of an anonymous debate among the participating experts has been found to avoid some of the negative psychological aspects of face-to-face discussion and, by and large, to lead to more reliable results.*

In the present study, the panel of participants consisted of the 43 persons named in the preface. This group was augmented, in the first round only, by 10 staff members of the Kettering Foundation and by 10 staff members of the Institute for the Future. (The reason for their exclusion from later rounds was that, while Round 1 merely asked for ideas, Rounds 2 and 3 were concerned with the evaluation of ideas resulting from Round 1, and the participation of the Foundation or Institute staff members might conceivably have introduced some bias into these evaluations.)

The basic panel of 43 represented the following fields of specialization. The numbers indicate the number of representatives in each category; because of multiple skills, they add up to more than 43:

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* See: Olaf Helmer and Nicholas Rescher, "On the Epistemology of the Inexact Sciences", Management Science, 6 (1959), 48.

Agriculture	1	Mechanical engineering	1
Architecture	1	Medicine	4
Banking	2	Operations research	1
Biology	1	Philosophy and values	2
Chemistry	2	Political science	2
Ecology	1	Psychiatry	1
Economics	2	Psychology	3
Education	3	Public opinion surveys	1
Foundation management	2	Research administration	3
Government	3	Sociology	3
Journalism	3	Statistics	1
Law	3	University administration	8
Literature	1	Visual arts	3
Mathematics	1	World food resources	2

In preparation for the first questionnaire round a taxonomy was composed, consisting of 64 areas of potential interest, grouped loosely under 6 major category headings (Table 1). Taxonomies such as this are never quite satisfactory, and the present one surely is no exception. This list was presented in Questionnaire 1 merely to illustrate the range of possible areas for new ventures and, incidentally, to determine the areas of greatest concern to the respondents.

The instructions which went out with the first questionnaire read in part:

1. Without regard to the taxonomy, write brief (one paragraph) descriptions of three or more specific problems or projects which you think are presently receiving insufficient attention and which the Kettering Foundation might fruitfully undertake.

2. Please imagine yourself to be a trustee of the Kettering Foundation and examine the taxonomy from that viewpoint. If you find that a particular area of concern to you has not been included, please add it at the end as Item 65, etc. In which of the areas listed would you like to see some new ventures proposed? Please indicate your interest in this respect by distributing 20 points over some of the areas, allocating 1, 2 or 3 points to each area selected.

   "1" would indicate "some interest",
   "2" would indicate "medium interest",
   "3" would indicate "major interest".

The result of this round was not only a collection of 189 proposals but

TABLE 1: Taxonomy of Areas of Potential Interest

SOCIETY

1 Education [all aspects of education, including non-institutional, from pre-kindergarten through adult retraining; reform of curricula; administrative organization, and teaching methods]

2 The family [its changing structure and role in society]

3 Racial conflict [the prospects for the alleviation of the causes of racial conflict; equality of opportunity].

4 Youth problems [the youth movement and its future; problems of alienation from the processes of government]

5 Interpersonal relations [friendship; interpersonal alienation; the sexual revolution]

6 Poverty [war on poverty; the poverty gap; the welfare system]

7 Law and order [war on crime; law enforcement; the judicial establishment]

8 Urbanization [a catch-all for urban problems not elsewhere mentioned in this list, including in particular urban renewal and the planning of new cities]

9 Arts and crafts [literature, music, dance, art, dramatic arts; architecture; culinary art, folk art, etc.]

10 Social theory [sociology, social indicators]

11 Economic theory [basic economic theory, econometrics, input-output models, monetary and fiscal theory]

SYSTEMS AND INSTITUTIONS

12 Government [government structure and government efficiency; redistribution of government functions among fedreal, state and municipal agencies]

13 Political institutions [the political parties; elections; pressure groups; the changing structure of power elites]

14 Corporate structures [corporate organization; the changing role of the corporation in our society; corporate planning]

15 The public/private interface [conflict and cooperation between the private and public sectors; combined approaches to public problems, such as pollution, transportation, control of crime, etc.]

16 Societal interactions [interaction between social groups through grievance, arbitration and cooperation mechanisms]

17 Health care systems [the health care delivery system; public health standards; hospital reforms; the effect of automation]

18 Transportation systems [intra- and inter-city ground transportation; traffic congestion; air transportation]

19 Communication systems [all forms of communications media; the growth of communication networks; new communication technologies, computer networks]

20 Utilities [water resources, new sources of power; regulatory problems]

21 Institutional innovations [new societal systems, institutions and organizations of all kinds]

22 Basic theory [systems theory, organization theory, information theory]

TABLE 1 - continued

ENVIRONMENT

23 Pollution [water pollution, air pollution, solid waste pollution, noise pollution, thermal pollution, radioactive pollution]

24 Wildlife and open spaces [protection of wildlife, national parks, preservation of natural beauty]

25 Beautification [beautification of highways, cities and towns; cleanup of industrial litter]

26 Privacy [safeguarding of personal information in central data banks; protection from communication inundation]

27 Entertainment [all forms of entertainment, including spectator sports]

28 Recreation [active sports, outdoor activities, games]

29 Leisure [new leisure activities, hobbies, adult education, post-retirement activities; problems of the leisure economy]

30 The drug culture [proliferation of non-therapeutic drugs; regulatory measures; effect on youth, family life, economic productivity, creativity]

31 Ecology [interactions among environmental trends and between environmental and societal trends]

INTERNATIONAL AFFAIRS

32 Arms control [arms control and disarmament; forecasts of threats of future weapons]

33 Prevention of international conflict [reduction of international tension; prevention of accidental war, safeguards against unintended preemptive war; deescalation]

34 World government [United Nations; partial abandonment of national sovereignty; regional supra-national structures; world constitution]

35 Cultural rapprochement [cultural exchange, scientific and technological cooperation; automated language translation]

36 Population control [birth control, mass-administered contraceptive agents]

37 World food problem [prevention of famine and malnutrition; increasing agricultural production; new sources of food (oceans, artifical protein)]

38 Disease control [prevention and control of epidemics; immunization against bacterial and viral diseases; eradication of cancer]

39 World resources development and management [inventory, discovery, and distribution of world resources; exploitation of extraterrestrial sources]

40 Development of pre-industrialized countries [socio-economic development of less developed countries; problems of technological transfer]

41 International trade and investment [trade barriers and customs unions; foreign investment; monetary stability]

42 Disaster warning [warning of hurricanes, earthquakes, epidemics, locusts, tidal waves, radioactivity]

43 Disaster relief [emergency medical, food, and economic relief; post-war recovery]

TABLE 1 - continued

VALUES AND MORES

44 Individual goals and values [value structure, motivation, patterns of change in values, individual decision-making]

45 National goals and values [national goals and subgoals; effect of technological and environmental change on values]

46 World goals and values [common international goals and values; structure of human values regardless of nationality; extraterrestrial goals]

47 Religion [the social role of religion and religious institutions; relation between religion and values, the future of the Church]

48 Quality of life [components of the "quality of life", problems of their aggregation and measurement; effects of technological and environmental change on the quality of life]

49 Ethics and value theory [basic theory of values, hierarchical structure of values, problems of value measurement]

SCIENCE AND TECHNOLOGY

50 Physical sciences and astronomy [physics, chemistry, meteorology, astronomy; subdivisions and related areas such as cryogenics, nuclear physics, cosmology]

51 Bio-medical sciences [biology, medicine, bio-medical research, pharmacology, exobiology, physiology]

52 Behavioral sciences [psychology, psychiatry, interpersonal relations]

53 History and humanities [history, languages, study of literature, theology]

54 Social sciences [sociology, anthropology, political science]

55 Mathematics and philosophy [pure and applied mathematics, logic, scientific methodology, metaphysics]

56 Operations research [operations analysis, systems analysis, analysis of the future]

57 Social technology [application of operations research to the solution of social problems; societal planning, especially urban planning]

58 Information management [data banks, role of the computer, data processing, automated libraries, human information processing (including Delphi)]

59 Agricultural and food technology [agricultural methods, food processing, derivation of food from the oceans, artificial protein, food additives]

60 Building technology [new materials, automation of the construction industry, building codes]

61 Mining technology [land mining, safety measures, ocean mining]

62 Space technology [vehicle technology, lunar exploration, planetary exploration]

63 Other physical technologies [a catch-all for technologies not elsewhere mentioned]

64 Science and technology policy [policy-making with regard to scientific and technological development in the private and public sectors]

also an indication of the relative weight of attention that, in the opinion of the respondents, should be given to each of the areas in the taxonomy.

Ranking these areas by the sum of the weights assigned to them, the following occupied the 10 top positions:

Area	Sum of weights
Education	67
Ecology	64
Pollution	63
Racial conflict	46
Population control	44
Quality of life	42
Youth problems	38
Prevention of international conflict	38
Institutional innovations	37
Health care systems	34

(It should be noted here that ecology and pollution are closely related; taken together, their combined weight places Ecology + Pollution far ahead of all other items.)

The 5 areas ranking next highest were: Poverty, The public/private interface, Arms control, World resources development and management, and Law and order.

It is also interesting to note that the following areas received no weight assignment by any of the respondents: Disease control, International trade and investment, Mining technology, and Space technology. This, of course, may shed more light on the panel's bias as a group than on the unworthiness of support of the omitted areas.

As for the 189 proposals that were produced by Round 1, these were processed as follows. Some, which evidently were of identical or closely related intent, were combined. A few were omitted, because in the experimenters' judgment they either were too obscurely worded to permit reasonably unambiguous interpretation or were not responsive to the instructions

of Questionnaire 1. Finally, the majority of proposals were reformulated slightly in an effort to enhance clarity and to achieve a modicum of uniformity of presentation (lest differences in format might introduce a bias into the subsequent evaluations).

The result of this process were 165 proposals, which formed the input into Round 2. This material was far more voluminous than had been anticipated at the outset of the study. Therefore, in order not to burden the respondents with an unmanageable evaluation task, it was decided to divide the panel into five subpanels and to submit to each of these approximately one fifth, or about 33, of the total set of proposed items for evaluation. An attempt was made, as far as possible, to construct the subpanels and the partitioning of the proposals into subsets in such a manner that respondents were asked to evaluate primarily proposals in areas in which they had expressed an interest, indicated either by weight assignment or by proposal contribution.

In Round 2, then, each respondent received a list of about 33 proposals, an evaluation sheet, and a set of instructions, which in part read as follows:

> An evaluation is requested in the following regards:
>
> (a) The formulation of the proposal: If you wish to suggest an amendment to the formulation, please do so on the back of the evaluation sheet, being sure to label your statement clearly with the appropriate item number. If you have made an amendment, it will be assumed that your subsequent evaluation refers to the statement as amended by you.
>
> (b) The probability that the proposed project, if adequately funded, will successfully accomplish its stated goal.
>
> (c) The importance of the results of the proposed effort, if indeed it should be successful, in terms of their societal impact. Here, if you should judge the impact to be strong, it would be helpful if you could indicate in a word or two what type of impact you are envisaging.

(c) degree to which support of the proposal would fill a gap, in the sense that support from other sources, to your knowledge, is non-existent or insufficient. If you know of adequate other support, you are asked to state its source.

(e) The required level of funding: To support a given project below a certain minimum level would clearly be wasteful. On the other hand, support above a certain level would generally yield sharply diminishing marginal returns. Hence you are being asked to advise the Foundation, if it were to support the project at all, what you would consider reasonable minimum and maximum levels of funding.

In particular, on the evaluation sheet the panelist was invited to respond to (b) by checking one of six boxes, labeled as follows:

Virtually no chance (<5%)
Little chance (20%)
Less than even chance (40%)
Better than even chance (60%)
Good chance (80%)
Virtually certain (>95%)

As for (c), the choice was between four alternatives:

Virtually no impact
Slight impact only
Moderate impact
Strong impact

In the case of (e), the respondent was to indicate both the annual amount and the number of years, for minimal as well as for maximal support.

Upon examining the returns from Round 2, it appeared that, while in particular the evaluations in response to Parts (b) and (c) were reasonably complete, a response to Part (e) on funding levels had been omitted in many cases, possibly reflecting a feeling of some of the respondents that they were not especially competent to supply such an estimate. In those cases where the number of responses to Part (e) was singularly deficient, a group of three staff members of the Institute with some experience in project cost estimates was asked to provide additional inputs to augment

the panel's estimates.

The responses to Parts (b), (c) and (e) of Questionnaire 2 were collated, their medians were computed, and these medians were taken as numerical indicators of the panel's opinions as a group. Based on these assessments, more than half the proposals under consideration were eliminated from the final round on one of three grounds:

- too low a probability of success,
- too small a societal impact even if successful,
- outside the cost-range (for reasonable minimal support) between $ 250,000 and $ 5,000,000.

(The lower bound, stated earlier as $ 500,000, was brought down to $ 250,000, since we were now talking in terms of minimal support.)

The remaining 80 proposals formed the input into the final, third, round. The wording of a few was slightly revised, based on suggestions received from the respondents. Again it was thought that even this reduced number was too large to require that each respondent examine each proposal. Consequently the list was divided into two sublists of 40 and each was submitted to one half of the respondents. The sublists were obtained by allocating every other proposal to one of them; the panel of respondents was split randomly.

In the third round, then, each respondent received a list of the 40 proposals assigned to him for reevaluation and one of the two evaluation sheets reproduced on the next two pages. Each panelist was asked to review the median figures derived from Round 2 for those 10 (out of the 40) entries with regard to which he thought himself relatively most knowledgeable. In addition, he was to rank from 1 to 10 those 10 proposals among the 40 which he considered to be most appropriate for Kettering Foundation support.

A few of the Round 2 medians were revised in Round 3. Again, few respon-

KETTERING QUESTIONNAIRE 3
EVALUATION SHEET

#	ITEM DESCRIPTION	Relative knowledgeability	PROBABILITY OF SUCCESS if adequately supported		SOCIETAL IMPORTANCE if successful		MINIMUM SUPPORT LEVEL				Your Ranking 1 to 10
			Median probability	Your estimate	Median impact*	Your estimate*	Median annual level	Your estimate	Median no. of years	Your estimate	
1.01	Alternative secondary Education		50%		6		750 T		5		
1.08	Right to higher education		60		6		250 T		3		
1.12	Adult responsibilities		60		6		600 T		3		
1.14	Reading disability		80		6		350 T		3		
1.19	Equal educational opportunity		60		5		1.1 M		3		
1.21	Institute for black development		60		5		625 T		4		
1.27	Transition schools		70		4		1.1 M		4		
2.07	Crime and criminal justice		60		5		500 T		2		
2.09	Crowding		80		6		200 T		2		
2.14	Urban environmental esthetics		50		5		300 T		2		
2.17	Relocation of slum families		60		5		500 T		2		
2.19	Cities within cities		60		5		1.0 M		3		
2.25	Social observatory		60		5		500 T		3		
2.27	Qualitative economic growth		60		5		250 T		2		
2.30	Leadership regeneration		60		7		150 T		2		
3.02	New forms of government		40		7		400 T		2		
3.10	The future of the corporation		60		7		175 T		2		
3.13	Use of R+D in the public sector		60		5		300 T		2		
3.16	Experiment in health care		70		5		370 T		3		
3.22	Mass communication media		60		5		300 T		2		
3.25	Center for visual communication		60		5		400 T		4		
3.27	Urban communications		70		7		250 T		2		
3.30	Monitoring science and technology		60		7		750 T		4		
4.01	Effects of air pollution		80		5		500 T		5		
4.03	Water and air pollution		60		6		550 T		3		
4.09	Community leisure centers		50		5		500 T		2		
4.12	Interdisciplinary drug research		80		5		1.0 M		5		
4.16	Environmental preservation		60		5		320 T		1		
4.18	Ecological considerations		60		5		500 T		1		
4.21	Dynamics of value change		60		5		300 T		2		
4.31	Human intelligence		70		7		150 T		3		
4.33	Cooperation versus aggression		60		5		100 T		3		
5.07	International co-operative ventures		60		5		750 T		5		
5.10	Reduction of chauvinism		80		3		600 T		5		
5.12	Economics of a stable population		80		5		250 T		3		
5.16	Agricultural and food technology		60		5		550 T		4		
5.20	Analysis of future society		50		5		620 T		3		
5.28	Information policy		60		5		600 T		2		
5.32	Building codes		60		5		220 T		2		
5.34	Environmental science		70		5		450 T		4		

1. In the column headed "Relative knowledgeability", check those 10 items out of the 40 which concern areas in which you are relatively most knowledgeable.

2. For the 10 items which you have thus checked, examine the four quantities printed (they are the medians of the responses to the second questionnaire), and insert your own estimates in the corresponding adjacent columns.

3. In the last column, rank from 1 to 10 those 10 proposals among the 40 which you consider to be most appropriate for Kettering Foundation support.

* Using a scale from 1 to 7, as follows:
1 = virtually no impact, 3 = slight impact only, 5 = moderate impact, 7 = strong impact
(with 2, 4, 6 representing intermediate values).

KETTERING QUESTIONNAIRE 3
EVALUATION SHEET

#	ITEM DESCRIPTION	Relative knowledgability	PROBABILITY OF SUCCESS if adequately supported		SOCIETAL IMPORTANCE if successful		MINIMUM SUPPORT LEVEL				Your Ranking 1 to 10
			Median probability	Your estimate	Median impact*	Your estimate*	Median annual level	Your estimate	Median no. of years	Your estimate	
1.07	Training for public service		80%		5		300 T		3		
1.10	Conservation education		60		6		200 T		3		
1.13	University reform		60		9		175 T		4		
1.15	New goal for medical education		60		5		200 T		3		
1.20	Integrated urban housing		50		6		250 T		1		
1.23	Black leadership education		80		5		500 T		5		
2.02	Anti-poverty experiment		50		5		600 T		5		
2.08	Analysis of criminal justice		60		5		500 T		2		
2.10	Prison reform		70		5		575 T		2		
2.15	New towns		60		5		650 T		2		
2.18	The police of the future		70		5		1.0 M		2		
2.24	Nonmetropolitan settlement		60		5		500 T		3		
2.26	Social indicators		60		4		250 T		2		
2.28	Training for citizen action		50		6		1.0 M		2		
3.01	State and local reform		60		5		150 T		3		
3.05	Medical-care systems analysis		60		7		300 T		1		
3.11	Public/private interface		50		5		500 T		2		
3.15	Community health care delivery		80		6		650 T		4		
3.18	Metropol: transportation		80		5		150 T		2		
3.24	Transportation and communication		60		7		130 T		2		
3.26	Mass media in decision-making		50		6		500 T		1		
3.28	Intellectual institutions		40		7		220 T		3		
3.31	Participation in democracy		60		6		250 T		4		
4.02	Pollution control pilot study		60		4		70 T		4		
4.07	Lake eutrophication studies		80		5		625 T		3		
4.11	Heroin addiction cure		40		7		750 T		5		
4.13	Social aspects of drug abuse		60		5		250 T		1		
4.17	Institute of Ecology		60		5		1.0 M		5		
4.19	Regional environmental council		60		5		300 T		5		
4.28	Physical sciences		80		7		500 T		1		
4.32	Instinct toward violence		60		7		350 T		2		
5.06	Strengthening world order		60		5		400 T		5		
5.09	U.S. population and environment		80		5		220 T		3		
5.11	Understanding among diplomats		60		4		350 T		5		
5.13	Acceptance of population control		60		7		400 T		5		
5.19	Socio-economic development		50		5		750 T		4		
5.21	Methodology of futures analysis		60		5		250 T		2		
5.30	Computer-aided problem solving		60		5		625 T		3		
5.33	Herman Kahn		70		4		75 T		5		
5.35	Science policy processes		50		5		250 T		4		

INSTRUCTIONS:

1. In the column headed "Relative knowledgability", check those 10 items out of the 40 which concern areas in which you are relatively most knowledgable.

2. For the 10 items which you have thus checked, examine the four quantities printed (they are the medians of the responses to the second questionnaire), and insert your own estimates in the corresponding adjacent columns.

3. In the last column, rank from 1 to 10 those 10 proposals among the 40 which you consider to be most appropriate for Kettering Foundation support.

*Using a scale from 1 to 7, as follows:
1 = virtually no impact, 3 = slight impact only, 5 = moderate impact, 7 = strong impact
(with 2, 4, 6 representing intermediate values).

dents seemed to have strong opinions on funding levels, so that most of the revisions occurred with regard to Probability and Impact.

Since the subset of panelists evaluating a particular proposal in Round 3 was, in general quite different from the subset that had evaluated it in Round 2, and since there was no opportunity for further feedback and reconsideration, there was a problem of how best to combine the judgments received in Rounds 2 and 3. The rule which the experimenters adopted in computing revised medians on the basis of Round 3 returns was to assume that each Round 2 median represented the judgment of three respondents additionally to those who expressed an opinion in Round 3. Thus new medians were obtained by augmenting the Round 3 responses with three fictitious responses equal to the Round 2 median. This rule clearly appears to be arbitrary; yet it may be justified by observing that it yields values that, intuitively, give a reasonably valid indication of the panel's position, while any other equally reasonable (and equally arbitrary) rule would have yielded virtually identical values.

Since, in the last round, a respondent was asked to evaluate only 10 of the 40 proposals submitted to him, it had to be expected that some proposals would be judged by relatively few persons. In fact, 18 of the 80 proposals were "underevaluated" in this sense; these are listed in Section 7.

For the remaining 62 proposals, the median responses, as revised by the procedure described above, were accepted as the group's "consensus" with respect to Probability, Impact, and Minimum Support Level.

In order to be able to present the results of this evaluation in some orderly fashion, it was thought desirable to combine the Probability and Impact ratings into a single Effectiveness index. There are many ways in which this can be done, and the experimenters selected one which seemed intuitively acceptable. (Again it may be pointed out that this apparent

arbitrariness should not be objected to, since the result does not seem particularly sensitive to the precise formula that is applied.)

We assumed, in fact, that among the Impact rating of I = 1, 3, 5, 7 each corresponds to an effect, e, worth twice as much as the preceding one, leading to the geometric series 1, 2, 4, 8 or, for the entire scale from 1 to 7:

I:	1	2	3	4	5	6	7
e:	1	$\sqrt{2}$	2	$2\sqrt{2}$	4	$4\sqrt{2}$	8

We now define the expected effectiveness, E, of a proposal whose probability was assessed as p as

$$E = p \times e$$

Thus, a proposal with probability .60 and impact 5 has the effectiveness

$$E = .60 \times 4 = 2.40$$

Using this effectiveness index, E, for each proposal, and the estimated minimal support level as its "cost", C (in million dollars), we can represent the 62 items resulting from this exercise on a cost-effectiveness scatter diagram (Figure 1).

Clearly, a proposal is most attractive if its effectiveness is high and its cost is low. Thus the "best" proposals are to be found in the upper left-hand corner of this diagram, and the quality deteriorates as we move down and to the right (in the direction of the arrow). Needless to say, the exact ordering obtained in this manner should not be taken too seriously in view of the many uncertainties involved, both in the respondents' minds (with all due respect to them) and in the experimenters' interpretation of their judgments. This uncertainty is perhaps especially noteworthy in respect to cost estimates. Yet this ordering gives at least some rough indication of relative desirability, and it has been used to establish the numerical order from 1 to 62 among the proposals listed in what follows.

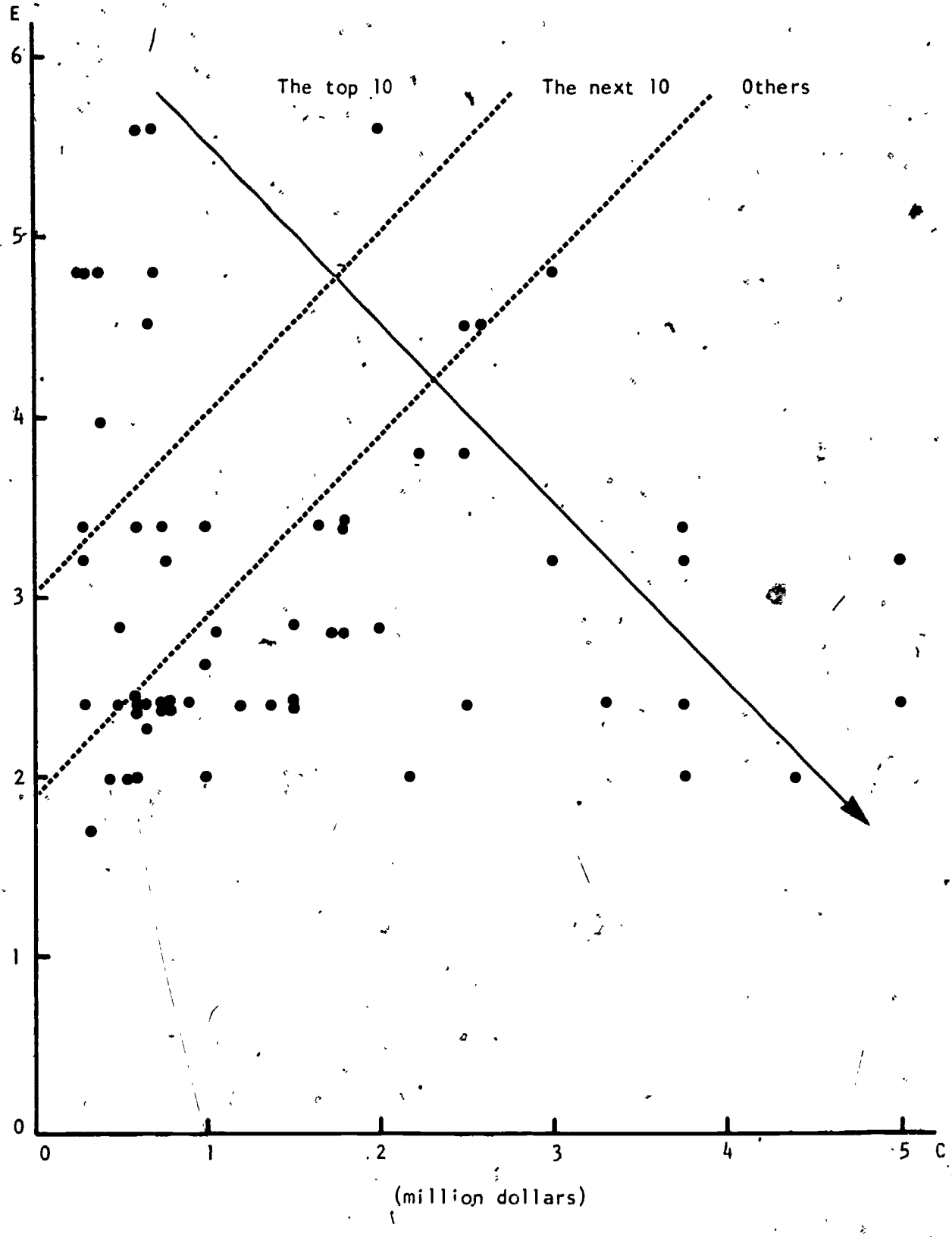

Figure 1

EFFECTIVENESS VS. COST

For each proposal, as will be seen, we have also recorded its so-called cost-effectiveness; this is the quantity E/C, where C is the total indicated cost and E is the expected effectiveness as defined above. (The alternative of ordering the proposals simply according to descending cost-effectiveness was dismissed because it would have placed even greater emphasis on the cost estimates which, as pointed out before, can not be considered highly reliable.)

4. The ten most wanted studies

We begin our listing with the ten proposals which, under the scoring system explained above, rank highest among those 62 entries in the third round which were adequately evaluated. Their titles are as follows; also given, for comparison, are the ranks they would have received among all 62 had they been ranked according to cost-effectiveness:

		Rank by E/C
1	Human intelligence	6
2	Urban communications	7
3	Transportation and communication	1
4	Leadership regeneration	2
5	The future of the corporation	3
6	Instinct toward violence	10
7	U.S. population and environment	11
8	Acceptance of population control	34
9	Crowding	5
10	Medical-care systems analysis	14 1/2

We note that 7 of these are also among the top 10 with regard to cost-effectiveness. Two others are close, and only one item, #8, has a relatively poor cost-effectiveness rating; this is due to its estimated cost of $ 2 million.

More detailed descriptions of these 10 entries are given on the following pages.

1. HUMAN INTELLIGENCE

Societal Impact:	7	Cost effectiveness:	9.3	Annual Cost:	$ 200,000
Probability:	.70	Number of years:	3	Total Cost:	$ 600,000

The classical notion of an intelligence quotient has been recognized by many researchers as having outworn its utility; yet its naive application is still wide-spread. What is needed is a new, comprehensive, up-to-date study of human intelligence, with its results published in a form that is useful and comprehensible to educators at all levels and does not lend itself to the traditional bureaucratic abuse to which the IQ concept has been subjected. Such a study should include a redefinition of "intelligence", it should examine the merits and limitations of existing testing procedures and possibly devise new ones, and it should ascertain the dependence (or independence) of intelligence on cultural differences and on genetic factors. The study should further include experimental research concerned with methods of enhancing intelligence, e.g. through very early education and/or sensory stimulation, the development of intelligence drugs, methods of improving the prenatal environment, and nutritional supplements.

2. URBAN COMMUNICATIONS

Societal Impact:	7	Cost effectiveness:	8.1	Annual Cost:	$ 275,000
Probability:	.70	Number of years:	2 1/2	Total Cost:	$ 688,000

Intra-urban communications ("the local loop") is in a state of emerging crisis. This is largely due to (i) unreliable and short-term-oriented demand forecasts and (ii) long amortization horizons for (obsolescing) common-carrier facilities. An integrative study program should forecast demands for communications services within and among highly urbanized areas in the United States over the next two decades. Sectors of demand to receive special attention could be: industry, banking, municipal governments, publications, communications media, and educational institutions. Through cost-effectiveness, and contingency analyses, such a study would determine the technological alternatives that best satisfy projected demand. The study would investigate, in particular, the joint impact of communications satellites, broadband coaxial cables, and advanced techniques for modulation and signal processing.

3. TRANSPORTATION AND COMMUNICATION

Societal Impact:	7	Cost effectiveness:	17.1	Annual Cost:	$ 140,000
Probability:	.60	Number of years:	2	Total Cost:	$ 280,000

How much of the displacement of people could be removed by sufficiently effective means of verbal and pictorial communication? Conferences and lectures could relatively easily be arranged by telecommunication with little radical equipment (in particular, without the luxury of television). Sufficiently advanced communication would permit very effective shopping by televisor at great savings in transportation and to the advantage of buyer and seller. With such communication techniques the present pressure to concentrate offices and stores in big cities and to have clerical workers and administrators always physically present in the offices where they work could be largely obviated. While the communication industry presumably sees the advantage of expanding in the direction suggested, the question might be raised under foundation auspices whether the interests of the communication industry as now organized really are parallel with those of the public in this respect. A broad examination should be planned of the extent to which transportation of people will be replaced by communication.

4. LEADERSHIP REGENERATION

Societal Impact:	7	Cost effectiveness:	16.0	Annual Cost:	$ 150,000
Probability:	.60	Number of years:	2	Total Cost:	$ 300,000

A study of institutions experiencing problems of leadership and of the means of regenerating the concept of leadership should be conducted in different areas of contemporary life: education, government, business, social agencies. Complications of modern society and technology tend to concentrate more and more decision-making in the hands of a few. Profound problems of communication and identity have developed everywhere in our society, from the General Motors plant to the ghetto to the college campus. Leadership is obviously a social necessity. However, no experimentation is being developed to give our traditional concepts of leadership a new form. These new forms should be characterized by delegation of responsibility and a more meaningful involvement on the part of the constituents. Modern communication technology has not been utilized to strengthen participation and a sense of identity. The democratic dialogue has, in fact, broken down in the city and on the campus. There are many obvious reasons for this. It seems, however, that we have not examined the impact of centralization of authority in an age that has phenomenal potential to disseminate information and to expedite dialogue. One of the most concrete problems in contemporary society is the breakdown in our traditional concepts of leadership. The credibility gap in almost every institution provides ample evidence that we are applying twentieth century forms to eighteenth century leadership traditions.

5. THE FUTURE OF THE CORPORATION

Societal Impact:	7	Cost effectiveness:	12.8	Annual Cost:	$ 188,000
Probability:	.60	Number of years:	2	Total Cost:	$ 375,000

A study of the changing forms and functions of the corporation in the late and post-industrial era. It should include consideration of the following items:

(a) responsibilities and relationships to stockholders, employees, and society as a whole,
(b) the future of the profit motive,
(c) the means for creating incentives to move corporations toward socially desirable goals (e.g. avoidance of pollution, production of low-cost housing) when profits do not provide sufficient motivation,
(d) availability and cost of cash,
(e) the characteristics and nature of the labor force and of the consumer,
(f) the impact of new technology on production, management, and distribution,
(g) the nature of the new service industries,
(h) new media for advertising,
(i) land ownership and control.

6. CHANGING THE INSTINCT TOWARD VIOLENCE

Societal Impact:	7	Cost effectiveness:	6.9	Annual Cost:	$ 350,000
Probability:	.60	Number of years:	2	Total Cost:	$ 700,000

A comprehensive study in the psychology and sociology of the national trait toward violence and the development of educational methods toward reconditioning the human instinct in this regard. While Stanford and other universities have done some relevant research, more adequate financing is needed for a full-scale treatment of the problem.

7. U.S. POPULATION AND THE ENVIRONMENT

Societal Impact:	6	Cost effectiveness:	6.8	Annual Cost:	$ 220,000
Probability:	.80	Number of years:	3	Total Cost:	$ 660,000

A study of the maximal size to which the U.S. population can be expected to grow should address itself to the question as to the point at which the U.S. population growth is likely to overwhelm our environment, irrespective of what we do to depollute air, water, and land, and to nudge the population into the least harmful areas. The surface was scratched in the September 1969 hearings of the House Conservation and Natural Resources Subcommittee.

8. ACCEPTANCE OF POPULATION CONTROL

Societal Impact:	7	Cost effectiveness:	2.8	Annual Cost:	$ 400,000
Probability:	.70	Number of years:	5	Total Cost:	$ 2,000,000

The continuing population explosion is the greatest problem of our times, even more threatening to the quality of our lives than thermonuclear war. The causes are well documented, but no effective solution has been proposed. Therefore, intervention by society at large will have to be imposed, either by governmental control or (especially in the U.S.) by massive use of advertising and public-relations agents. The question is how this can be accomplished without unacceptable coercion. This calls for an international project to study and test various theories of gaining acceptance of methods of population control that give due consideration to psychological and social impediments.

9. CROWDING

Societal Impact:	6	Cost effectiveness:	9.9	Annual Cost:	$ 200,000
Probability:	.70	Number of years:	2	Total Cost:	$ 400,000

A study of the psychological effects of human crowding is recommended because trends in this country, as in every industrialized country, point toward increasing crowding of people into urban areas. It is known from careful experiments what devastating effects crowding has on rats. Similar effects are beginning to be observed in people in large urban centers. Very little attention has been given to this; yet it will be one of the most important problems of the future.

10. SYSTEMS ANALYSIS OF MEDICAL CARE

Societal Impact:	6	Cost effectiveness:	11.3	Annual Cost:	$ 300,000
Probability:	.60	Number of years:	1	Total Cost:	$ 300,000

This is a proposal for an operations-analytical systems analysis of current medical care in this country which would identify major inefficiencies and inequities in the present health care delivery system and investigate the desirability and means of their removal.

For emphasis, we state once more that the order in which the proposals are presented in this report, while it is not arbitrary, should not be given undue significance. Thus Proposal 1 is not "the best" (in some absolute sense) that emerged from this study, nor is each of the ten proposals listed in this section necessarily "better" than those listed in the following section. All that can be said is that, by and large, proposals listed earlier have been evaluated by the participating experts in a manner that tends to make them appear, from the point of view of their probable societal impact, as representing more promising investments than those listed later.

5. The ten next most wanted studies

Next in our ranking, occupying Positions 11 through 20, are the ten proposals listed below.

11. INTRA-METROPOLITAN TRANSPORTATION

Societal Impact:	5	Cost effectiveness:	10.7	Annual Cost:	$ 150,000
Probability:	.80	Number of years:	2	Total Cost:	$ 300,000

An adequate public transportation system is said to be the key to solving many of our urban problems - delivery of medical services, accessibility to jobs, decent housing, etc. Little has been done in developing better transportation systems because of their prohibitive cost. No one has studied the cost of not providing such a system. The magnitude of the price we pay for not allowing a large segment of our population accessibility to jobs, health care, decent housing, etc., would probably be amazing. For instance, large portions of maternity cases lack prenatal care because of inadequate transportation to obtain such service. The result could be some form of brain damage. It costs the state approximately $ 250,000 to institutionalize a child for life. A subsidized bus line from the ghetto to the city's major medical facilities might be cheaper. An analysis of the comparative cost of providing adequate intra-metropolitan transportation vs the cost of not providing it, is indicated.

12. CONSERVATION EDUCATION

Societal Impact:	6	Cost effectiveness:	5.6	Annual Cost:	$ 200,000
Probability:	.60	Number of years:	3	Total Cost:	$ 600,000

A program is recommended to sponsor the inclusion in the public-school curriculum of grades 1-12 of an introduction to ecology with emphasis on the human impact on nature. The program would involve extensive use of visual material and field trips. At higher levels, it could also deal with social problems of recreation and leisure and the questions of the values of natural beauty. The program would be a pilot project involving one or several school districts.

13. THE RIGHT TO HIGHER EDUCATION

Societal Impact:	6	Cost effectiveness:	4.5	Annual Cost:	$ 250,000
Probability:	.60	Number of years:	3	Total Cost:	$ 750,000

Formal schooling beyond the 12th grade is now, for all practical purposes, a right and not a privilege and an investigation is proposed to ascertain the implications of this situation in terms of the current college and university system in the U.S. The study should include consideration of what changes in the system may be needed, what institutional forms may be required, what the resource implications are, and what alternative types of financing are desirable.

14. THE ECONOMICS OF A STABLE U.S. POPULATION

Societal Impact:	5	Cost effectiveness:	4.3	Annual Cost:	$ 250,000
Probability:	.80	Number of years:	3	Total Cost:	$ 750,000

The general need to control population growth is now widely accepted in this country. Ultimately this may imply a stabilized population. Population stability could impose severe strains on the U.S. economy, which has been stimulated by burgeoning production activities to serve its growing population. A careful study of the structure of the U.S. economy, and the likely impacts of different rates of population growth (lower than current rates, and including a zero growth rate) on both supply and demand of consumer goods would yield important insights into the adjustments needed to accommodate a future decline of the population growth with minimum economic disruption. It would also indicate the substitution of services (such as health, education, and amenities) for consumer goods needed to sustain various levels of the GNP.

15. PARTICIPATION IN THE DEMOCRATIC PROCESSES

Societal Impact:	6	Cost effectiveness:	3.4	Annual Cost:	$ 250,000
Probability:	.60	Number of years:	4	Total Cost:	$ 1,000,000

Creation of a new institution is proposed that would be designed to encourage greater participation in the democratic processes that shape the future of our society. Such an institution might employ a group of scholars, working interdisciplinarily, who would periodically assess and describe the social state of the nation and outline major options that appear to emerge with regard to its future course. Such a report should be given wide circulation, especially among the colleges and universities and through the news media. A possibility to which some thought might be given is that of sponsoring forum discussions across the nation of the issues presented in such a report ("surmising forums" in Bertrand de Jouvenel's phrase).

16. INTEGRATED URBAN HOUSING

Societal Impact:	6	Cost effectiveness:	5.7	Annual Cost:	$ 250,000
Probability:	.50	Number of years:	2	Total Cost:	$ 500,000

If we fail to reverse the present trend, a majority of the citizens in each of the fifteen largest cities in the United States will be of a racial minority by 1985. Clearly, mere law enforcement is inadequate to the need. A comprehensive study in the total range of local procedures, architectural features, and socio-economic and other techniques for fully integrating urban housing is required. The results of the suggested study might offer some guidance as to the most effective ways of dealing with the problem.

17. COOPERATION VERSUS AGGRESSION

Societal Impact:	5	Cost effectiveness:	8.0	Annual Cost:	$ 100,000
Probability:	.60	Number of years:	3	Total Cost:	$ 300,000

The basis of aggressive behavior is beginning to receive serious attention from psychologists. The mere reduction of aggression, however, may have a negative effect. What is needed for the long-term betterment of mankind (especially if population control is delayed) is the replacement of aggression by cooperation. Therefore the current research

17. COOPERATION VERSUS AGGRESSION (continued)

on agression should be supplemented by corresponding investigations of the psychological and physiological basis of an attitude of cooperation. A knowledge of the underlying difference between these two behavior states may suggest a ready means for converting the one into the other. If the change is made in favor of cooperation, it could mean the end of war as well as of individual assault. An investigation aimed at the identification of methods of converting aggressive into cooperative attitudes is advocated.

18. HIGHER EDUCATION TOWARD IMPROVED BLACK LEADERSHIP

Societal Impact:	6	Cost effectiveness:	1.8	Annual Cost:	$ 500,000
Probability:	.80	Number of years:	5	Total Cost:	$ 2,500,000

Support of a network of small colleges each willing to increase their student bodies by twenty additional Negroes is recommended. Each participating institution would thus produce forty more black college graduates at the end of eight years. The small colleges could handle these numbers without great alteration in their structures if each were given $ 50,000 a year, of which 4/5 could be for financial aid to the students. One fifth would support an additional member of the counseling staff.

19. EXPERIMENT IN A COMMUNITY HEALTH CARE DELIVERY SYSTEM

Societal Impact:	6	Cost effectiveness:	1.7	Annual Cost:	$ 650,000
Probability:	.80	Number of years:	4	Total Cost:	$ 2,600,000

The design for a hierarchical system of health care should be created, taking advantage of currently available information processing and medical electronics. Such a system should encompass the range of care from routine physical check-ups to surgical intensive care to nursing homes. It should be implemented experimentally in a sample community, its components being tailored to the level of utilization which that community would need.

20. QUALITATIVE (RATHER THAN QUANTITATIVE) ECONOMIC GROWTH

Societal Impact:	5	Cost effectiveness:	4.8	Annual Cost:	$ 250,000
Probability:	.60	Number of years:	2	Total Cost:	$ 500,000

Research is recommended in economic theory, aimed at the establishment of an economic model in which qualitative rather than quantitative growth is emphasized. A group of economists would be entrusted with the task of modeling an economy where the expense of cleanup is paid in the present rather than in the future, an economy based on zero population growth in which the social objectives are the enhancement of the standard of living of people presently poor. The model would be of an economy where growth in GNP would be based not on consumption but on conservation of resources and wastes.

6. Forty-two other proposals

The following list presents the remaining ones of the 62 proposals which together constitute the main outcome of this study.

21. MONITORING SCIENCE AND TECHNOLOGY FOR SOCIAL IMPLICATIONS

Societal Impact:	7	Cost effectiveness:	1.6	Annual Cost:	$ 750,000
Probability:	.60	Number of years:	4	Total Cost:	$ 3,000,000

This is a recommendation for the creation of an organization to monitor scientific advances and major technological developments and to interpret their implications for society. The purpose of such an organization should be to alert society in general and governmental and private planning agencies in particular of its findings. This would be a direct follow-up on the NAS recommendation to this effect, and might take a form akin to that of the Council for Economic Development, for the areas of scientific and technological development. Unless we begin to audit, interpret, plan for and disseminate information on the possible impact on society of new scientific discoveries and an exploding technology, humanity could be in for some nasty surprises. Moreover, as the time span between a major new technical breakthrough and its impingement on people grows ever shorter, so too does the time to understand and adapt to the consequences diminish. As life in a technological society becomes more interrelated, more complex and seemingly less under an individual's control, it becomes tremendously important to foresee possible new perturbations to society. Change, particularly in response to or because of scientific developments, should be planned. The alternative will be a frantic response to dramatic new technical breakthroughs which may or may not be adequate. There may well be future developments that will require years of man's best effort to prepare to handle properly. The difference in this approach from the IBM-sponsored Harvard effort would be in a less theoretical approach and in greater emphasis on operational policy implications for legislatures and for planning agencies in the private sector.

22. MASS COMMUNICATION MEDIA

Societal Impact:	5	Cost effectiveness:	4.0	Annual Cost:	$ 300,000
Probability:	.60	Number of years:	2	Total Cost:	$ 600,000

This is a proposal concerning research on the quality of the content of our mass media and on their effect both domestically and internationally. More intellectual and financial resources are required to upgrade the quality of the content of our burgeoning communications media. Technology is, as always, way ahead of content at the moment. This subject is critical both in national and international terms, for the media represent perhaps the largest source of informative education which most people receive and certainly are responsible for many of their attitudes and perceptions of the world around them. This study should include an examination of the amount and kind of action generated by the media, the credibility of the media, the extent to which they have replaced the courts in convicting people, the effect on political campaigns, the impediments to upgrading the quality of television and radio programming and of the new inexpensive video-tape cassettes, and the role, quality and influence of computerized information retrieval bank systems.

23. USE OF R+D IN THE PUBLIC SECTOR ANALAGOUS TO THAT IN THE PRIVATE SECTOR

Societal Impact:	5	Cost effectiveness:	4.0	Annual Cost:	$ 300,000
Probability:	.60	Number of years:	2	Total Cost:	$ 600,000

A study is proposed of the similarities and differences between private and public producers of goods and services and of the consequent roles of R+D in both sectors. Until recently it was believed that the concepts of the profit motive and of the public service motive were irreconcilable and necessarily required different structures and techniques. Consideration should be given to: the recent blurring of the distinctions between institutions in the public sector and those in the private sector; the increasing emphasis upon social responsibility and public service to be found in enlightened industrial concerns; the new interest in certain public agencies toward employing some of the techniques of business and industry for economy of operation, quality control, and management efficiency; the function of R+D in industry, which has not yet found a counterpart in government and education. The purpose of R+D as funded and structured internally by industry may be assumed to be one of self-renewal, by exploring the possibilities of offering new or improved goods or services. This concept of R+D may be introduced into a given public agency. Having identified a new or improved service to society, we may construct a model program for implementing such a service, specifying purposes to be fulfilled, means for accomplishment, and data collection for evaluation. "Risk capital" might then be set aside for a specified period of R+D in which the program would be exempt from the type of annual budgeting justification required of established programs, using a post-audit evaluation in terms of degree of fulfillment of declared purposes. The output may then be absorbed into the regular program of such a public agency, or not, depending on the evaluation.

24. A NEW GOAL FOR MEDICAL EDUCATION

Societal Impact:	5	Cost effectiveness:	4.0	Annual Cost:	$ 200,000
Probability:	.60	Number of years:	3	Total Cost:	$ 600,000

A redefinition of health as physical, mental and social well-being should lead to the expansion of education in medicine so as to include social science as well as the development of collaborative research between the health and the social sciences. A program to encourage such collaboration is proposed.

25. ENVIRONMENTAL PRESERVATION

Societal Impact:	5	Cost effectiveness:	3.8	Annual Cost:	$ 320,000
Probability:	.60	Number of years:	2	Total Cost:	$ 640,000

A rapidly proliferating technology has enabled us to substitute basic resources in plentiful supply for those which are more scarce. This has reduced the dependency of the national economy on certain extractive industries. Simultaneously, our population is exerting increasing demands for undisturbed natural environment. The policies and other criteria under which we regulate environmental use and invest public and private funds for extractive development tend to reflect the social values and technical capacity of our society in past years. A study is needed which would investigate both the extent to which American society is placing increasing value on environmental amenities as well as the implications that our evolving technology might have for decisions to use the environment as a source of extractive commodities at the sacrifice of amenity value. The study could provide a basis for policies that would lead to rational programs for environmental preservation.

26. IMPROVED TRAINING FOR PUBLIC SERVICE

Societal Impact:	5	Cost effectiveness:	2.7	Annual Cost:	$ 300,000
Probability:	.70	Number of years:	3 1/2	Total Cost:	$ 1,050,000

This is a proposal to survey and identify methods for reforming the curricula of schools of public administration, with the object of providing improved training for public service. The quality of curricula for the public service is, at best, equal to that of business administration curricula twenty years ago. Reforms in public-administration training should view the objective as the management of large, complex, stochastic systems instead of as merely methods of personnel selection and budget preparation. One possible interdepartmental approach - practiced at UCLA - is to choose a triadic course structure, consisting of (a) quantitative methods, mathematics, and computer usage, (b) a substantive area (e.g. public health), and (c) the socio-economic environment for the public subsystem covered under (b).

27. COST-BENEFIT STUDY ON WATER AND AIR POLLUTION

Societal Impact:	6	Cost effectiveness:	2.1	Annual Cost:	$ 550,000
Probability:	.60	Number of years:	3	Total Cost:	$ 1,650,000

Except for some preliminary work done in the State of New York, there is little information available on the cost of not eliminating pollution. If a comparative analysis of the cost of cleaning up the nation's air and water and of the cost of not doing so should confirm the New York findings, then it should be followed up by research on how to get the message across to the public most effectively, so that anti-pollution measures will be implemented.

28. ECOLOGICAL CONSIDERATIONS IN POLICY DECISIONS

Societal Impact:	5	Cost effectiveness:	3.2	Annual Cost:	$ 500,000
Probability:	.60	Number of years:	1 1/2	Total Cost:	$ 750,000

This study would examine the means both of formulating sound policy decisions in terms of ecological considerations and of implementing them politically. In many instances, traditional economic criteria may have to be replaced by ecological evaluations. An effort should be made to establish economic measures and "social indicators" of ecological imbalance.

29. UNIVERSITY REFORM

Societal Impact:	5	Cost effectiveness:	3.2	Annual Cost:	$ 188,000
Probability:	.60	Number of years:	4	Total Cost:	$ 750,000

A study, including a survey of innovative ideas, regarding reforms in the field of higher education is advocated. Such a study should concern itself with the changing role of the university in modern society and should examine questions of administrative reorganization, personnel policies, curricula, and teaching methods (including computer-assisted instruction).

30. THE SOCIAL ASPECTS OF DRUG ABUSE

Societal Impact:	5	Cost effectiveness:	3.2	Annual Cost:	$ 250,000
Probability:	.60	Number of years:	3	Total Cost:	$ 750,000

A research project is recommended to develop a program of drug education and of appropriate social reforms to deal with the underlying causes of drug abuse. This study should include an examination of the social strata and motivation of those who participate and those who abstain, as well as in-depth investigation of the attitudes and social perceptions of matched groups of drug-dependent persons, occasional drug users, and drug abstainers. The study should focus on the relationship of usage of drugs to social estrangement, to rejection of society in whatever form, and to the ability of the users to formulate clearly their attitudes about the society in which they find themselves. Drug abuse should be viewed as a form of covert social protest. "The drug epidemic may prove to be a powerful lever in the struggle to regain American social idealism and self-respect."

31. METHODOLOGY OF FUTURES ANALYSIS

Societal Impact:	5	Cost effectiveness:	3.2	Annual Cost:	$ 250,000
Probability:	.60	Number of years:	3	Total Cost:	$ 750,000

The state of the art of forecasting and preparing for the future is at a point where existing and promising methodological developments need to be fully summarized and reviewed, and where there should be a program to design and describe a more complete spectrum of methods for analyzing future possibilities and synthesizing possible futures. This project should examine the different forecasting needs, or even the different meanings associated with forecasts, pertaining to such different areas as science and technology, society, the arts, and values.

32. PUBLIC/PRIVATE INTERFACE

Societal Impact:	5 1/2	Cost effectiveness:	2.6	Annual Cost:	$ 500,000
Probability:	.55	Number of years:	2	Total Cost:	$ 1,000,000

This proposal supports creation of sponsorship for new corporations (possibly not for profit) in areas of enterprise that require public and private cooperation. Such organizations may be needed either in areas of future public needs, e.g.

(a) public transportation
(b) new cities
(c) regeneration of old cities
(d) low or moderate cost housing
(e) earth-orbital and lunar development

or in areas where certain bureaucratic functions might be returned to the private sector, e.g.

(f) post office
(g) public parks and recreational areas
(h) welfare programs
(i) weather forecasting
(j) corps-of-engineers functions
(k) consumer protection

33. HERMAN KAHN

Societal Impact:	4	Cost effectiveness:	5.6	Annual Cost:	$ 75,000
Probability:	.70	Number of years:	5	Total Cost:	$ 375,000

This proposal recommends the support of Herman Kahn in creative and unconventional thinking on national problems. Kahn has a unique intellect and personality. His ideas are constructive disturbers of complacency, goads to the inert, and testers of the established order. He should be removed from the apparatus of the Hudson Institute (perhaps by facilitating its merger into some other organization) with its financial and organizational distractions; he should be awarded, say, a five-year grant for himself, an assistant, a secretary, and funds for an occasional consultant. Thus he can work on problems that interest him, without constraints of saleability and customer preference. [Note: This suggestion has not been discussed with Mr. Kahn.]

34. INTELLECTUAL INSTITUTIONS

Societal Impact:	6	Cost effectiveness:	3.4	Annual Cost:	$ 220,000
Probability:	.40	Number of years:	3	Total Cost:	$ 660,000

A project is proposed for the identification, analysis, and underwriting of carefully selected innovations among intellectual institutions. This project would not necessarily involve the creation of perpetually innovative institutions. It would involve deliberate stimulation of the growth of intellectual institutions which would constitute a model for the next step in the evolution of advanced universities and other institutions that accept the responsibility for training and continuing the education of persons for constructive intellectual and social leadership. The project would reveal how relatively modest funding for this purpose can have (and has had) major impact and leverage. Much good can follow from the conscious creation of viable new intellectual institutions, little can follow without it, or from uncritical trial-and-error institutional evolution.

35. ADULT RESPONSIBILITIES FOR UNIVERSITY STUDENTS

Societal Impact:	6	Cost effectiveness:	1.9	Annual Cost:	$ 600,000
Probability:	.60	Number of years:	3	Total Cost:	$ 1,800,000

The widening gap between intellectual awareness and emotional maturity is caused, in part, by the ever-increasing postponement of adult responsibilities. What is needed is a response to alienation of older adolescents and young adults with the constructive opportunities for making use of their talents and idealism. Provision of support is recommended to those institutions of higher learning which incorporate into the traditional four-year liberal arts program adult experiences involving substantial responsibility for other human lives whether in teaching, prisons, drug rehabilitation, youth work or other critical areas of social need. Philosophically the concept may be linked to a kind of national service for the increasing numbers of young people who will not be called to military service.

36. CENTER FOR VISUAL COMMUNICATION

Societal Impact:	6	Cost effectiveness:	1.9	Annual Cost:	$ 450,000
Probability:	.60	Number of years:	4	Total Cost:	$ 1,800,000

This is a proposal for the establishment of a center for the study of visual communication. Visual communication is a new phenomenon which has had the greatest possible impact on the younger generation, but almost nothing is known about visual intelligence or about content aspects of electronic technology. Thus the President of the United States tends to choose a visual medium to communicate to the people of his country, by presenting "filmed radio" talks, without any use or implication of the visual medium other than his appearance. We have the ability to concentrate enormous amounts of data through visual means. Yet, for instance, U.S. Senators continue to communicate with their constituencies as though we were still in the days of the Continental Congress. Ph.D.s lecturing in the United States still write books and refer to their graduate school notes as though it were the middle ages. The visually talented are either excluded or underfed by the educational establishment. Everything from motion film to environmental sculpture is being developed in the climate of a cave. If one could identify a single tool with multiple implications in everything from recreation to politics that could revolutionize the problem-solving process it would be a sophisticated and coherent implementation of visual communication.

37. PHYSICAL SCIENCES

Societal Impact:	5 1/2	Cost effectiveness:	1.7	Annual Cost:	$ 500,000
Probability:	.80	Number of years:	4 1/2	Total Cost:	$ 2,250,000

This proposal concerns the granting of selective support for university and other basic research programs in the physical sciences that promise to be of great human benefit. This project would first have to identify basic research areas in the physical sciences in which resources have been meager and evaluate the degree to which the results of such research might contribute to an improvement in the human condition. Actual financial support should be given to those ranking highest in this regard. Candidate areas might include climate research, research on chronic diseases from air quality degradation, ocean food production, factory food methods, etc.

38. STATE AND LOCAL REFORM

Societal Impact:	5	Cost effectiveness:	4.4	Annual Cost:	$ 150,000
Probability:	.50	Number of years:	3	Total Cost:	$ 450,000

This is a recommendation for the funding of a project to evolve a political strategy for accomplishing the fiscal and organizational modernization of state and local government. Such reforms have been set forth in the studies of the Douglas Commission on Urban Problems and the Advisory Commission on Intergovernmental Relations. Possibly a professional exposé might be conducted of one or more state governments, with the objective of stimulating public pressure for state government reform.

39. DYNAMICS OF VALUE CHANGE

Societal Impact:	5	Cost-effectiveness:	2.7	Annual Cost:	$ 300,000
Probability:	.60	Number of years:	3	Total Cost:	$ 900,000

A study is proposed of the dynamics of value change in our society from the psychological, behavioral, and social viewpoints. This study would include laboratory simulation and field interviews and would center on such subjects as:

the future of the work ethic,
aspirations of various socio-economic groups,
leisure,
the super-culture and its diffusion (Boulding),
the growth of anti-rationalism and mysticism,
public reactions to welfare (the anticipated response to guaranteed income),
alienation in the city,
sex mores,
the role of the family,
business ethics,
attitudes toward crime and punishment,
attitudes toward government,
nationalism.

40. URBAN ENVIRONMENTAL ESTHETICS

Societal Impact:	5	Cost effectiveness:	3.3	Annual Cost:	$ 300,000
Probability:	.50	Number of years:	2	Total Cost:	$ 600,000

A study of the esthetics of the urban environment is intended to concern itself with the effect upon the individual in urban areas of bad design, dirt, ugliness, and the various types of pollution which are attendant upon all of our cities. The object would be to arrive at programs of improvement which would go beyond "beautification", which is usually merely an attempt to put a good face on what is basically a poorly designed environment.

41. PILOT STUDY OF POLLUTION CONTROL

Societal Impact:	4	Cost effectiveness:	5.0	Annual Cost:	$ 85,000
Probability:	.60	Number of years:	4	Total Cost:	$ 340,000

A university should be selected where significant research on pollution problems is under way and nearby communities identified as being willing to cooperate. Under the guidance of a joint faculty-citizen committee, several alternative anti-pollution measures might be implemented in the communities, and the effects observed, analyzed and reported on by the faculty monitors. The results would be published and thus made available to other communities.

42. SOCIAL OBSERVATORY

Societal Impact:	5 1/2	Cost effectiveness:	1.9	Annual Cost:	$ 500,000
Probability:	.60	Number of years:	3	Total Cost:	$ 1,500,000

The proposal recommends the establishment of an agency of social accounts which would coordinate the fragmented efforts currently conducted in many places to define our national goals and to select objective social indicators as well as subjective indicators of social satisfaction as measures of the quality of life in our society. It would develop methods for monitoring these indicators, either through direct polls or via expert consensus; and it would monitor and report on their actual course as well as forecast the expected effects of alternative policies on their future course.

43. EFFECTS OF AIR POLLUTION ON HUMAN PHYSIOLOGY

Societal Impact:	5 1/2	Cost effectiveness:	1.5	Annual Cost:	$ 500,000
Probability:	.80	Number of years:	5	Total Cost:	$ 2,500,000

A study is proposed to be conducted for the purpose of determining the chronic and acute effects of a variety of air pollutants on the human physiological system. Particular emphasis is to be placed on effects of pollutants at low concentrations for long exposure times. The goal of this study is to increase the level of medical knowledge sufficiently so that pollution control legislation will be intelligently formulated and well founded.

44. INFORMATION POLICY

Societal Impact:	5	Cost effectiveness:	2.0	Annual Cost:	$ 600,000
Probability:	.60	Number of years:	2	Total Cost:	$ 1,200,000

The high-speed computer, a dynamic communications technology, and the increased sophistication of decision-making organizations have jointly increased the amount of basic social information used by our society. Not only is it cheaper to produce this information than was previously the case, but it may be rapidly transmitted and readily presented in either aggregate or primary form. All of this has led to a myriad of data collection exercises which are frequently uncoordinated, often inefficiently preserved, and have given rise to a concern over a potential invasion of personal privacy. These problems are particularly acute in the governmental sector. A careful study of the information needs of public agencies in the United States, cast against the technological capability of providing such information, could lead toward recommendations and criteria useful in the establishment of a national information policy, which would seek to collect relevant social and economic information in an organized fashion, preserve it in readily usable fields, and at the same time protect the private interests involved.

45. PRISON REFORM

Societal Impact:	5	Cost effectiveness:	1.6	Annual Cost:	$ 575,000
Probability:	.70	Number of years:	3	Total Cost:	$ 1,725,000

A thorough study is advocated of the needs and potentialities of prison reform. This study should be concerned with current practices in America's penal institutions, the philosophies behind them, and the attitudes of those engaged in the administration and operation of these institutions. It should include the physical and emotional impact

45. PRISON REFORM (continued)

of imprisonment upon inmates in order to elucidate some of the causes of recidivism. Suggestions for reforms in the system should be examined which would direct it away from a purely punitive function toward a rehabilitative one. The study should seek to develop recommended policies and programs and outline mechanisms for establishing model programs in some prisons that might later be emulated and adopted in others.

46. SCIENCE POLICY PROCESSES AND INSTITUTIONS

Societal Impact:	5	Cost effectiveness:	2.0	Annual Cost:	$ 250,000
Probability:	.50	Number of years:	4	Total Cost:	$ 1,000,000

For historic reasons, present procedures and institutions dealing with science policy are heavily influenced by traditional characteristics of the science enterprise and the science community. They are also affected by assumptions about the feasibility and permissibility of unlimited proliferation of new knowledge, since scientists were part of a closed academic system and the knowledge itself tended not to be subject to the constraints of a closed system of interdependencies. These traditions and assumptions unnecessarily constrict the range of choice on science policy matters and affect adversely the application (or non-application) of science, scientific methods, and various types of futures research to the solution of social problems. It is now possible to conduct thorough impartial studies, with a view to the development of institutional capabilities for policy planning studies, that will yield more appropriate and effective approaches to the future government of science. The first task, and the main purpose of this project, would be to determine the most appropriate settings for such studies and for the development of persons with the optimum attributes for performing such studies and implementing their consequences.

47. ENVIRONMENTAL SCIENCE

Societal Impact:	5	Cost effectiveness:	1.6	Annual Cost:	$ 450,000
Probability:	.70	Number of years:	4	Total Cost:	$ 1,800,000

This is a proposal for the creation of a new research institution or aid in the reshaping of an existing one to bring into systematic, sustained and close intellectual interaction a group of physical scientists and representatives of other disciplines who will not only do research on environmental problems but will spend part of their time working on the formulation of environmental policy. The other disciplines represented should include law, sociology, economics, ecology, and medicine. Policies to be formulated and examined should be concerned with national programs to be recommended for private and governmental priority for improving the understanding and reconstruction of a natural environment of high quality (urban as well as rural).

48. COMPUTER-AIDED GROUP PROBLEM-SOLVING

Societal Impact:	5	Cost effectiveness:	1.7	Annual Cost:	$ 462,000
Probability:	.60	Number of years:	3	Total Cost:	$ 1,385,000

Experimentation with the application of new communications technology to group problem-solving situations is proposed because the increasing pace of change in society and the increasing complexity of societal problems require more and more often the fast and

48. COMPUTER-AIDED GROUP PROBLEM-SOLVING (continued)

effective collaboration of groups of specialists in order to arrive at adequate and timely decisions. Yet the current modes for exchange of data and informed opinion in group problem-solving situations are inadequate, regardless of whether they involve transportation of persons to a common meeting place or the transportation of information or ideas to individuals by mail, telephone, or telegraph. Assuming that the new communications technology will win the race with transportation technology, there will be a need to aid institutional group problem-solving by providing instantaneous exchange of data and opinion and by gathering a consensus from a variety of locations without moving individuals from one place to another. This suggests conducting a pilot experimental program in which, under controlled conditions, all the known and usable communications technologies are brought to bear on a given group and problem. These could include multi-screen telecasts of agenda, central data displays, live manipulations of data and displays, voices and images of participants, and live broadcasts or pre-recorded tapes of images, data or opinion from remote locations, plus supplementary and parallel communications of written or pictorial materials by facsimile transmission.

49. SETTLEMENT PATTERNS IN NONMETROPOLITAN AREAS

Societal Impact:	5	Cost effectiveness:	1.6	Annual Cost:	$ 500,000
Probability:	.60	Number of years:	3	Total Cost:	$ 1,500,000

Recent demographic and social trends have transformed the way in which we occupy our natural environment, and accordingly the structure and pattern of our demands for environmental services. Research is needed which focuses on nonmetropolitan areas in the United States, and the transformation that has occurred within its resident population. While the phenomenon of urbanization is well known, we are poorly informed about the demographic and other social changes in the nonmetropolitan areas - such as the age and occupational structure of rural people, their pattern of residence and employment. These factors are powerful determinants of the type of environmental services these communities will demand in the decades ahead. Deeper understanding of the social trends occurring in nonmetropolitan America would provide a basis for examining the adequacy of different patterns of community settlement and would suggest procedures under which such services as water supply, transportation, waste disposal, etc., can be provided effectively, without long-run detrimental effects on the environment.

50. REGIONAL COUNCIL OF ENVIRONMENTAL QUALITY

Societal Impact:	5	Cost effectiveness:	1.6	Annual Cost:	$ 300,000
Probability:	.60	Number of years:	5	Total Cost:	$ 1,500,000

Funding is recommended for the staff, over five years, of a regional or state council of environmental quality which would sponsor basic research, set standards of environmental quality, devise methods for monitoring the latter, and determine effective political means for achieving enforcement of standards. Funding would be provided because of present reluctance on the part of state governments to provide money for such a purpose and with a view towards showing other governments an effective operating and investigatory body.

51. TRAINING INSTITUTE FOR CITIZEN ACTION

Societal Impact:	6	Cost effectiveness:	1.4	Annual Cost:	$ 1,000,000
Probability:	.50	Number of years:	2	Total Cost:	$ 2,000,000

Citizen actions pertaining to any current program related to poverty, law and order, racial conflict, health, or other social, economic or political issues all demand organization. Lacking organization there can be no power for action and no mechanism producing the kind of bona fide representatives essential to the give and take, the wheeling and dealing and compromising between different sectors of our population in the intercourse of a free and open society. Organizers are not born as such but must be trained. This calls for a training institute for organizers which has a record of achievement and not one for rhetoric.

52. REDUCTION OF CHAUVINISM

Societal Impact:	5	Cost effectiveness:	1.1	Annual Cost:	$ 600,000
Probability:	.80	Number of years:	5	Total Cost:	$ 3,000,000

A program of massive exposure of American local leaders (most of whom believe the United States is divinely guided in its actions and never wrong) to other types of thinking and acting is advocated. Mayors and Councilmen from small towns across the country would be transported to Europe and other continents to observe how other countries deal with their problems. Programs would be intelligently and creatively planned to put the visitors in dialogue with their opposite numbers; factories and farms would be inspected, in addition to visits to art galleries and concerts. An attempt would be made to sift out in advance any closed minds whose prejudices would only be intensified. Attitude surveys should be conducted at the beginning and end of such programs to determine the extent of opinion changes.

53. INSTITUTE FOR BLACK DEVELOPMENT

Societal Impact:	5	Cost effectiveness:	1.0	Annual Cost:	$ 625,000
Probability:	.60	Number of years:	4	Total Cost:	$ 2,500,000

Creation of an institute is proposed which would employ a group of black scholars working interdisciplinarily, to assess and describe periodically the social state of the black community in the U.S. and to propose directions and programs for corrective action. This institute should utilize expertise, black or white, from every arena of American endeavor: business, industry, government, education, etc. It might also develop some leadership programs for black youth. A working relationship with black and white Congressmen and policy makers would make it possible for reports from the institute to receive wide circulation in colleges, universities, news media, and so on. Such an institute would be most appropriately located at a black college and could strengthen the scholastic tone and atmosphere of that institution.

54. ANALYSIS OF THE FUTURE OF SOCIETY

Societal Impact:	5	Cost effectiveness:	0.9	Annual Cost:	$ 620,000
Probability:	.50	Number of years:	3 1/2	Total Cost:	$ 2,170,000

There has been a change in attitude about the future. The fatalistic view that it is unforeseeable and inevitable in being abandoned. It is being recognized that there are a multitude of possible futures and that appropriate intervention can make a difference in their probabilities. This raises the exploration of the future, and the search for ways to influence its direction, to activities of great social responsibility. New, interdisciplinary approaches to such an exploration, while still in their infancy, are promising. With proper support they may help revive a constructive interest on the part of society at large in shaping its own future and thus diminish the alienation of today's youth from the democratic processes of government.

55. ALTERNATIVES TO CONVENTIONAL SECONDARY EDUCATION

Societal Impact:	6	Cost effectiveness:	0.9	Annual Cost:	$ 750,000
Probability:	.60	Number of years:	5	Total Cost:	$ 3,750,000

This is a proposal for an experimental program to design and test alternative methods of secondary education. This study would seek out approaches that would build especially on work experience and would be sensitive to the biological and emotional needs of youth. A pilot program, set up in competition (or in conjunction) with conventional schooling, should test such a concept and, in particular, examine the possibility of thus shortening the educational process for those students that gain significantly from such an approach.

56. HEROIN ADDICTION CURE

Societal Impact:	7	Cost effectiveness:	0.9	Annual Cost:	$ 750,000
Probability:	.40	Number of years:	5	Total Cost:	$ 3,750,000

An intensive program of laboratory research is advocated to discover a chemical cure for physical addiction to heroin and other opiate derivatives. It may definitely be expected that heroin addiction can be cured, not by methadone but by a chemical formula that will relieve physical dependency. This cure - which should be achievable at a cost substantially less than that of a polaris sub - would relieve a city like New York of major portions of all crime.

57. EQUAL EDUCATIONAL OPPORTUNITY

Societal Impact:	5	Cost effectiveness:	0.7	Annual Cost:	$ 1,100,000
Probability:	.60	Number of years:	3	Total Cost:	$ 3,300,000

This proposal concerns the funding of some long-range efforts in support of one society characterized by equal educational opportunities for all, as a counter to the enormous pressures for racial separatism. Within communities of "middle America" (towns of 10,000 to 30,000 outside the feasible bussing radius of metropolitan ghettos) that volunteer to cooperate, dormitory residences might be provided for some promising minority-group students to enable them to attend the local high school for several years in preparation for college attendance or other post-secondary school opportunity. Grants might be made with

57. EQUAL EDUCATIONAL OPPORTUNITY (continued)

the understanding that communities would waive school tuitions and that locally constituted Boards of Directors would assume responsibility for obtaining partial funding during the first few years and full financial responsibility thereafter.

58. INTERNATIONAL COOPERATIVE VENTURES

Societal Impact:	5	Cost effectiveness:	0.6	Annual Cost:	$ 750,000
Probability:	.60	Number of years:	5	Total Cost:	$ 3,750,000

This is a recommendation for the establishment of a group that would select promising areas for international cooperation and award grants to appropriate existing or newly created institutions for action programs aimed at implementing such cooperative approaches. Specific, vital operational assignments which can be given to U.N. agencies and other international organizations (in such areas as education and science, the uses of the oceans, environmental control, prevention of famine and disease, space exploration, etc.) could help build a fabric of world cooperation.

59. SOCIO-ECONOMIC DEVELOPMENT OF LESS DEVELOPED COUNTRIES

Societal Impact:	5	Cost effectiveness:	0.5	Annual Cost:	$ 750,000
Probability:	.50	Number of years:	5	Total Cost:	$ 3,750,000

This is a proposal for the establishment of an international institute for the promotion of socio-economic development of the less developed countries. The study of national development requires an interdisciplinary approach, involving a joint examination of economic and socio-political issues as well as of technological aspects of the problem. An institute as proposed might undertake such a study through the medium of a simulation laboratory. Among the functions of such a laboratory would be the following: designing strategies, on behalf of aid-giving countries, of optimal support to less developed countries; designing development strategies for self-help by such countries; representing a clearing-house, focus, and catalyst for the many, fragmented efforts in the socio-economic development area that go on throughout the world; assembling data banks on developing countries and designing methods for their processing and retrieval; promoting the transfer of technology from advanced countries to emerging countries, encouraging systems-analytical approaches to development problems; providing a centralized institutional setting for conferences and working seminars and for the collation of expert judgment in all areas relevant to the development of the emerging nations.

60. INTERDISCIPLINARY DRUG RESEARCH

Societal Impact:	5	Cost effectiveness:	0.6	Annual Cost:	$ 1,000,000
Probability:	.80	Number of years:	5	Total Cost:	$ 5,000,000

A thorough, non-emotional investigation is recommended of the total spectrum of drugs, including alcohol, barbiturates, amphetamines, mind-expanding and habit-forming drugs. The medical and social effects of these drugs as well as their interrelationships need to be studied. Equally important are the medical and social reasons for using them. Attention should be given to the consequences of the dehumanizing and depersonalizing effects of society which are believed to induce the use of these drugs.

61. TRANSITION SCHOOLS

Societal Impact:	4	Cost effectiveness:	0.5	Annual Cost:	$ 1,100,000
Probability:	.70	Number of years:	4	Total Cost:	$ 4,400,000

Two or three small junior colleges in the South or the Appalachian region should be selected to develop programs that would identify talented students from deprived areas at the rising junior year of high school and give them two full years of training to prepare them for first-rate college training. The pilot programs developed in such schools could be modified for replication in public schools. Training might be limited to three or four areas on an interdisciplinary basis, attempting new curriculum designs and teaching techniques. This project rests on the assumption that bright, poor students are being destroyed in weak secondary schools and that some models need to be invented to facilitate academic "leaps" for the bright poor. Subsidies should be granted to the participating junior colleges.

62. INSTITUTE OF ECOLOGY

Societal Impact:	5	Cost effectiveness:	0.5	Annual Cost:	$ 1,000,000
Probability:	.60	Number of years:	5	Total Cost:	$ 5,000,000

This proposal concerns the establishment of a National Institute of Ecology, to undertake urgent research on pollution, contamination, and other factors that imperil the ecological balance of the earth. Such an institute should carry out the comprehensive systems research needed to arrive at a master plan for redeveloping the environment and to free the atmosphere, the land and the water from contamination. The master plan would form the basis for coordination of the efforts of all public and private agencies which are concerned with man's environment and ecology, and it would serve to establish guidelines to be used by future generations as the basis for consideration of the effects of large-scale environmental changes.

7. Inconclusively evaluated proposals

Of the 80 entries in Round 3 of the Delphi study, 18 (as mentioned earlier) were elected for assessment by so few respondents that they cannot be considered to have been properly evaluated. It should be remembered, however, that in their preliminary evaluation in Round 2, they scored sufficiently well to be carried over to the final round. They are listed in the following table.

63. READING DISABILITY AMONG AMERICAN CHILDREN

Societal Impact:	6	Cost effectiveness:	4.3	Annual Cost:	$ 350,000
Probability:	.80	Number of years:	3	Total Cost:	$ 1,050,000

A study is proposed to determine the level and causes of reading disability among the children of America. Such a study should include sampling from various income groupings, racial groupings, regional groupings, mobile and stable families, etc. An attempt should be made to determine the exact nature of these problems; therefore, neo-natal birth problems, neurological and developmental problems, quality of teaching, stability of schools and other related factors should be taken into consideration. A survey of qualified personnel and facilities available to serve children with specific reading problems should be conducted. A review of the teacher training programs as they relate to reading is also indicated. Finally, an attempt should be made to determine the degree to which emotional and behavioral difficulties in children are related to reading disabilities.

64. INVENTION OF NEW FORMS OF GOVERNMENT

Societal Impact:	7	Cost effectiveness:	4.0	Annual Cost:	$ 400,000
Probability:	.40	Number of years:	2	Total Cost:	$ 800,000

This proposal recommends a systematic study of different forms of government, and the invention of new forms, especially for the developing countries. Much world tension stems from the hang-up with two words: "communism" and "democracy". Actually there are about fifty different types of democracy and probably as many different varieties of communism. Classifying governments, as we are inclined to do, into these two categories is about as sensible as dividing all the people of the world into two groups: "good" and "bad". Scholars both here and abroad could do much to lessen world tensions and built-in animosities by devising a new and more accurate description of each type of government and making a systematic study of the type of government best suited to the needs of a given nation, including the invention of new government forms. For more than a hundred years the nations of South America have floundered on the rock of so-called "democracy". They borrowed our forms and tried to use them with populations unready and unsuited for democracy of the English-American type. Presently, a good example of the desperate need for a new kind of governmental structure is South Vietnam. If we insist on the kind of democracy we know, democracy will fail there as it has in every similar situation during the last 150 years. A new kind of government must be devised - probably something with some of the controls utilized in communist-type governments, but if possible avoiding many of the excesses found in them.

65. RELOCATION OF SLUM FAMILIES

Societal Impact:	6	Cost effectiveness:	3.4	Annual Cost:	$ 500,000
Probability:	.60	Number of years:	2	Total Cost:	$ 1,000,000

It is recommended that a study be conducted of the problem of relocating the residents of slums which are being cleared. Along with urban renewal there will be an enormous redistribution of the American population. While model cities will help, the big problem is likely to be that of emptying the slums and relocating families in communities of the United States where they have the best opportunity for jobs, decent housing, better schooling, and a better social environment.

66. USE OF MASS MEDIA IN DECISION-MAKING

Societal Impact:	6	Cost effectiveness:	5.7	Annual Cost:	$ 500,000
Probability:	.50	Number of years:	1	Total Cost:	$ 500,000

This is a recommendation for studies in the use of mass media as a multi-media planning and decision-making apparatus to deal with the significant problems, from personal to national. Broadcasting is now used almost entirely for entertainment and information and has never been used as a planning medium. We are now at the stage where we must involve mass participation on an almost immediate basis for most of the problems that confront us. The possibilities of demonstrations are manifold; for example, an all-day simulated smog disaster in which 200,000 Los Angelencs would play dead and the rest would try through various uses of the mass media, games, telephone response, etc., to cope with these problems. The possibilities for network involvement in the setting of national goals in this manner are quite real. There are many possibilities for the use of mass media in other dimensions which have not yet been explored fully, for example their therapeutic benefits.

67. BUILDING CODES

Societal Impact:	5	Cost effectiveness:	5.5	Annual Cost:	$ 220,000
Probability:	.60	Number of years:	2	Total Cost:	$ 440,000

There are many vested interests in the building industry that are standing in the way of more rational, progressive, and uniform building codes. A neutral study of this subject that offers a consistent set of reasonable recommendations might be very helpful by acting as a catalyst in bringing about some overdue reforms in building codes. The study should include the formulation of guidelines for more rational building codes as well as the identification of change agents in this field and it should arrive at recommendations as to appropriate methods by which these can be influenced toward accepting proposed code reforms.

68. EXPERIMENT IN HEALTH CARE BY A UNIVERSITY MEDICAL CENTER

Societal Impact:	5	Cost effectiveness:	2.5	Annual Cost:	$ 370,000
Probability:	.70	Number of years:	3	Total Cost:	$ 1,110,000

If evolutionary and experimental development of health delivery systems is to occur rather than arbitrary imposition of a health care plan, the university medical centers must be encouraged and subsidized to conduct the research. A prepaid, comprehensive health insurance program conducted by a group of clinical faculty in a university teaching hospital

68. EXPERIMENT IN HEALTH CARE BY A UNIVERSITY MEDICAL CENTER (continued)

could explore the feasibility of providing high-quality service while also fulfilling teaching and research responsibilities. By objective parameters the university talent could assess the impact of the system on health. The medical and other students could identify their future roles, which now is impossible, and the current emphasis on crisis medicine could be changed to preventive health care.

69. SYSTEMS ANALYSIS OF CRIMINAL JUSTICE

Societal Impact:	5	Cost effectiveness:	2.4	Annual Cost:	$ 500,000
Probability:	.60	Number of years:	2	Total Cost:	$ 1,000,000

A systems analysis of all aspects of the administration of criminal justice in the United States should be conducted. This effort should include a survey of the best current thinking and innovative practices in the areas of pre-trial commitment, bail, sentencing, prison conditions, parole, rehabilitation, and recidivism. Based on this survey, a systems approach should be taken toward formulating a comprehensive reform program, which should then be disseminated for review to governmental units, citizen groups, and universities.

70. CRIME AND ATTITUDES TOWARD CRIMINAL JUSTICE

Societal Impact:	5	Cost effectiveness:	2.4	Annual Cost:	$ 500,000
Probability:	.60	Number of years:	2	Total Cost:	$ 1,000,000

A comprehensive study of attitudes toward crime and how to deal with it is proposed because crime has become one of our great national problems. Many people, both black and white, do not feel safe on the streets at night, in contrast to the situation even a few years ago. Further studies of the entire problem area are needed - the attitudes toward the police, the functioning of our courts, the social aspects of the problem, etc. The seriousness of the problem was recently illustrated by the suggestion of "preventive detention" prior to trial, a concept totally at variance with our basic concepts of justice.

71. LAKE EUTROPHICATION STUDIES

Societal Impact:	5	Cost effectiveness:	1.7	Annual Cost:	$ 625,000
Probability:	.80	Number of years:	3	Total Cost:	$ 1,875,000

This is a recommendation for a fundamental study to integrate existing knowledge pertinent to the understanding of the ecological processes that maintain proper nutrient and oxygen levels in lakes. These processes include biological, chemical, and physical phenomena such as nutrient supply, algal growth kinetics, lake stratification, sedimentation and transport, etc. In comprehensively and quantitatively describing the eutrophication processes this study will serve both as a prediction tool and as a guide for future data collection programs. The ultimate aim is to give proper direction to programs for the preservation and enhancement of our lakes, considering their value as a supply of water, as recreational resource, as a source of food, and as a contributor to the esthetics of a region.

72. SOCIAL INDICATORS

Societal Impact:	4	Cost effectiveness:	3.4	Annual Cost:	$ 250,000
Probability:	.60	Number of years:	2	Total Cost:	$ 500,000

Funding of existing groups or establishment of new groups to study, define, and develop social indicators is proposed. Such indicators should eventually be capable of giving a quantitative indication of the extent to which our society is "improving" and should be useable as a measure of the extent to which proposed programs could be expected to be "beneficial to society". A nonnegligible amount of the effort should be devoted to investigating the potential dangers associated with the use of such indicators in general and especially the premature use of early versions of such indicators.

73. NEW TOWNS

Societal Impact:	5	Cost effectiveness:	1.7	Annual Cost:	$ 650,000
Probability:	.60	Number of years:	2	Total Cost:	$ 1,300,000

The urgent need for the development of new towns is almost unquestioned. Yet there are sizeable impediments to their realization. This proposal recommends a comprehensive study of the possibilities for implementing the development of new towns. Among the difficulties that must be overcome, and which the proposed study is intended to examine are the following:

(a) There is the legalistic problem that most states do not have enough usable, unincorporated land suitable for building a town for 100,000 people. Land need is controlled by multi-jurisdictions, and some knotty problems have to be solved to overcome this difficulty.

(b) New approaches have to be found to the mass production of high-quality housing. Packaged large-scale housing and community development schemes are required.

(c) The third point concerns financing. Because of the enormous amounts of capital required for large-scale packaged developments, and in view of the jurisdictional land use problems mentioned under (a), some co-operative effort between the public and private sectors may be needed, which in turn may require an institutional innovation of considerable impact.

74. COMMUNITY LEISURE CENTERS

Societal Impact:	5	Cost effectiveness:	2.0	Annual Cost:	$ 500,000
Probability:	.50	Number of years:	2	Total Cost:	$ 1,000,000

This proposal recommends the creation of a number of model community centers for the use of leisure time. Such centers should be multi-purpose, and they should serve youngsters as well as oldsters. They should provide relaxation and relief from social isolation, by offering opportunities for pursuing hobbies, playing games, engaging in charitable work, encouraging discussion and study groups for mutual and self-education, providing educational films, and arranging art shows and other exhibits. Once a few well-designed centers of this kind have been successful, this may turn out to be a social invention comparable in importance to that of the free public library, and the concept may well proliferate through wide-spread emulation.

75. THE POLICE OF THE FUTURE

Societal Impact:	5	Cost effectiveness:	1.4	Annual Cost:	$ 1,000,000
Probability:	.70	Number of years:	2	Total Cost:	$ 2,000,000

A study is proposed which would be aimed at forecasting, and carrying out a cross-impact analysis of, expected changes in law enforcement procedures. The police force of the future and the system of law enforcement procedures within which it will have to operate are subject to considerable change. It is proposed that a systematic effort be made (i) to forecast the relevant aspects of the environment within which these changes will take place, (ii) to make a survey of potential reforms in law enforcement procedures, (iii) to develop methods of evaluation for proposed reform programs, and (iv) to obtain forecasts of the size and structure of future police forces and of law enforcement procedures that are both desirable and attainable. Such a study could be carried out at one of three levels:

Level A: Compilation of innovative law enforcement measures (including solicitation of novel ideas in this regard) and preliminary gross cost-effectiveness evaluation of each proposed measure.

Level B: Same as A, plus an analysis of cross-impacts among proposed measures and a consequent effectiveness analysis in terms of selected urban indicators.

Level C: Same as B, plus a simulated-planning conference aimed at selecting, within given budgetary constraints, a program of measures from the list of candidate measures resulting from B, and an evaluation of the expected benefits of such a program in terms of urban indicators.

76. STRENGTHENING WORLD ORDER BY STRENGTHENING THE UNITED NATIONS

Societal Impact:	5	Cost effectiveness:	1.2	Annual Cost:	$ 400,000
Probability:	.60	Number of years:	5	Total Cost:	$ 2,000,000

This proposal recommends the establishment of a ten-year program to support the United Nations by finding what department of that body (or one of its specialized agencies) needs and deserves the most help in implementing a creative program. Various parts of the U.N. organization such as the Office of the U.N. High Commissioner for Refugees have in the past used private funds (Ford Foundation, Nobel Peace Prize) to great advantage. The challenge would be to determine annually what division of the U.N. was performing the most imaginative job leading to the establishment of world order. The award of a grant for further work in this field would call attention to such outstanding performance.

77. AGRICULTURAL AND FOOD TECHNOLOGY

Societal Impact:	5	Cost effectiveness:	1.1	Annual Cost:	$ 550,000
Probability:	.60	Number of years:	4	Total Cost:	$ 2,200,000

The purpose of this study would be to obtain a reasonably accurate idea of the gravity of the future world food situation. It would involve forecasts of population growth, of agricultural productivity, of new sources of food, of advances in food technology, and it would address itself to the economic problem of world-wide food distribution.

78. INTERNATIONAL UNDERSTANDING AMONG YOUNG DIPLOMATS

Societal Impact:	4	Cost effectiveness:	1.0	Annual Cost:	$ 350,000
Probability:	.60	Number of years:	5	Total Cost:	$ 1,750,000

A series of informal weekend and week-long conferences for diplomats of the younger and middle levels, with the object of getting them acquainted with one another as persons, and appreciative of each other's cultural background. Consultants would be engaged to start discussion on a variety of world issues. At present diplomats are one of the few groups who lack a professional organization (even politicians have their interparliamentary union) to carry out any such conference program. The goal is to have them know each other as people before they face each other as adversaries and/or spokesmen for a sovereign nation.

79. CITIES WITHIN CITIES

Societal Impact:	5	Cost effectiveness:	0.8	Annual Cost:	$ 1,000,000
Probability:	.60	Number of years:	3	Total Cost:	$ 3,000,000

In this proposal it is suggested that a plan be developed for a high-density urban center of more than 100,000 persons to be constructed within an existing northern industrial city. This plan must provide a total environment for living, education, recreation, employment, culture, and perhaps retirement. The study should include land use, architectural types, cost, and economic feasibility. Such a study would reveal critical guidelines which may lead to massive solutions of existing urban problems. The outcome may well suggest the desirability of continuing the form of the high-density city; the solution of traffic problems through the intimate combination of total living requirements; the renaissance of a democratic environment through the availability of urban resources. While numerous planning efforts are being made now to halt the trend toward greater density, the trend nevertheless persists. The proposed study, which would provide an imaginative technological environment for the expansion which is inevitably occurring, may reveal positive benefits to be derived from this trend. The study may indicate that an effort should be made to increase our urban population with a protective technology, rather than try to break up our cities and move toward a program of developing new towns with old problems.

80. ANTI-POVERTY EXPERIMENT

Societal Impact:	5	Cost effectiveness:	0.7	Annual Cost:	$ 600,000
Probability:	.50	Number of years:	5	Total Cost:	$ 3,000,000

This is a proposal for an experimental study of alternative methods for dealing with the problem of poverty. The study is intended to provide valuable information to government agencies that have a responsibility for alleviating poverty in this country. The plan would be to select, say, 100 poor families, divide them into 5 groups of 20, and allot $ 5000 to each family, using a different mode of allotment for each the 5 groups:

Group 1 receives the amount in cash.
Group 2 receives the amount in food and medical care.
Group 3 receives the amount in education for their children.
Group 4 receives the amount in adult retraining.
Group 5 receives the amount in durable goods (automobile, applicances, clothes).

Statistical information could be collected over five subsequent years on how well each family is doing.

8. Proposals rejected as being too small to qualify as new ventures

The following 15 proposals, although considered of sufficient merit in terms of expected effectiveness, were not carried beyond Round 2 because, in the judgment of the respondents, they could be adequately funded at a level below $ 250,000 and therefore would not qualify as new ventures as stipulated for the purposes of the current survey. They clearly may be candidates for support under different auspices.

81. DIABETIC RETINOPATHY

Societal Impact:	7	Cost effectiveness:	128.0	Annual Cost:	$ 50,000
Probability:	.80	Number of years:	1	Total Cost:	$ 50,000

Diabetic retinopathy appears to be the leading cause of blindness but is perhaps the least understood and controlled. An extensive research program on diabetic retinopathy is advocated.

82. BARRIERS TO SOCIAL CHANGE

Societal Impact:	7	Cost effectiveness:	16.0	Annual Cost:	$ 100,000
Probability:	.40	Number of years:	2	Total Cost:	$ 200,000

The barriers to social and technical change must be understood and reduced. It is difficult to move forward until we can understand what is holding us back. To a great extent, these inhibitions are functional. For example, we all know many ways in which education could be improved for the benefit of the student, but the educational enterprise does not exist for the benefit of the student. It is imbedded in a social context which makes it almost impossible to employ the newer techniques. We must spend time and money trying to understand such inhibiting factors as the inability of any profession to change itself. Almost all change comes from invasion or rebellion, not from planning from within. A study of the agents of social and technological change and, especially, of the barriers to such change and of the means for their removal.

83. WILD LIFE AND OPEN SPACES

Societal Impact:	5	Cost effectiveness:	16.0	Annual Cost:	$ 100,000
Probability:	.80	Number of years:	2	Total Cost:	$ 200,000

Aside from supporting wild life and open spaces directly, a foundation could do a great deal by funding basic psychological investigations which will measure the import of wild life and open spaces for man and the contributions of these assets to the quality of life. In order to fight the detractors of these values, it may be necessary to cost-benefit-analyze them out of business.

84. ADULT EDUCATION

Societal Impact:	5	Cost effectiveness:	16.0	Annual Cost:	$ 200,000
Probability:	.80	Number of years:	1	Total Cost:	$ 200,000

Increased leisure, early retirement provisions in labor contracts, technological unemployment, and increased longevity are making many hours of lifetime available for elective pursuits. A study to develop curricula and a physical environment for continuing education of the adult population is recommended. This study would designate the desired fields of education, the methods for making it available, and the most effective environment for its development. The relationship of such education to the function of urban centers should be included as a part of the study.

85. JOURNALIST SPECIALISTS

Societal Impact:	5	Cost effectiveness:	14.5	Annual Cost:	$ 110,000
Probability:	.80	Number of years:	2	Total Cost:	$ 220,000

The increasing complexities of modern life demand deeper and more thorough knowledge from journalists. The answer lies in specialization. Support is recommended for a series of programs in universities which will train both beginning and mid-career journalists in a variety of specialties such as social science, urban affairs, physical science, government, criminology and penology, consumer protection, education, religion, etc.

86. ELECTION AND POLITICAL-PARTY REFORM

Societal Impact:	6	Cost effectiveness:	37.7	Annual Cost:	$ 75,000
Probability:	.50	Number of years:	1	Total Cost:	$ 75,000

A project is proposed to study the existing political party organization and the nominating and election processes in this country and to develop recommendations for their reform. Both the tight control exercised by senior party politicians over the nominating processes for most political offices and the burdensome campaign costs generally required of candidates for major public offices greatly limit the number of capable men who seek public elective offices. The control exercised indirectly by both key party figures and large campaign contributors over public officials after they are elected should be explored. These problems should be studied, carefully documented and exposed for public scrutiny. Viable alternatives should be developed and presented to the public. In addition, pressure group activities should be reviewed to determine what sectors of the population have not been adequately represented in the past and whether these groups that are now involved in acts of civil disobedience are under-represented by pressure groups. If so, the viable alternatives to civil disobedience for such groups should be identified.

87. TRANSPORTATION AND THE QUALITY OF LIFE

Societal Impact:	5	Cost effectiveness:	26.7	Annual Cost:	$ 90,000
Probability:	.60	Number of years:	1	Total Cost:	$ 90,000

Transportation is an essential element of our modern life and becomes an important ingredient in the planning of cities and communities. Many of the ugly aspects of community life become necessary under our present transportation system. Something should be possible to be done to reap the benefits of rapid transportation and still allow for a more

87. TRANSPORTATION AND THE QUALITY OF LIFE (continued)

peaceful and cultural life in the cities. An intensive investigation should be supported of transportation systems and the role they play in affecting the quality of life.

88. LEISURE TIME ACTIVITIES

Societal Impact:	5	Cost effectiveness:	20.0	Annual Cost:	$ 120,000
Probability:	.60	Number of years:	1	Total Cost:	$ 120,000

The availability of additional leisure time could become a major social problem in this country, rather than a desirable environmental condition. It is now very apparent from a variety of research that alternatives and even specific programs must be made available to individuals providing them with ideas, recommendations and new activities that could be undertaken to fulfill the use of leisure time in a positive fashion. A survey of the uses of leisure time would furnish a comprehensive menu of such possibilities.

89. REGULATORY AGENCIES

Societal Impact:	5	Cost effectiveness:	13.3	Annual Cost:	$ 90,000
Probability:	.60	Number of years:	2	Total Cost:	$ 180,000

An attempt should be made to determine whether the regulatory agencies address themselves to the needs of a wide range of Americans, the needs of groups peculiar by race or region, and to low-income groups. An attempt should also be made to determine whether the people who serve on these agencies are themselves representative of a wide range of Americans. The method of selection of persons to regulatory agencies should be studied to determine whether the process precludes agency interests in the needs of a variety of groups. The Federal Communications Commission, the Federal Trade Commission, and the regulatory aspects of the Departments of Agriculture, Commerce and Labor in particular should be studied.

90. REFORM OF INSTITUTIONS FOR THE MENTALLY ILL

Societal Impact:	5	Cost effectiveness:	12.0	Annual Cost:	$ 100,000
Probability:	.60	Number of years:	2	Total Cost:	$ 200,000

An effort at reforming the policies and programs of institutions for the care and treatment of the mentally ill should be supported. Such a project should examine current practices and research activities; it should develop policy and program recommendations, create models, and subsequently provide help to institutional personnel to adopt these models.

91. SYSTEMS ANALYSIS OF BEAUTIFICATION

Societal Impact:	5	Cost effectiveness:	12.0	Annual Cost:	$ 100,000
Probability:	.60	Number of years:	2	Total Cost:	$ 200,000

One reason why there is so much talk and so little action regarding beautification is that too little is known about how to set up an effective and efficient program for dealing with the problem. What is needed is a systematic survey of methods of cleanup and beautification, including solicitation of innovative ideas. This should be followed

91. SYSTEMS ANALYSIS OF BEAUTIFICATION (continued)

by a comprehensive systems analysis of potential measures, aimed at designing specific programs of urban, rural, and highway beautification for several levels of assumed public expenditure.

92. WELFARE CLIENTS

Societal Impact:	5	Cost effectiveness:	20.0	Annual Cost:	$ 100,000
Probability:	.50	Number of years:	1	Total Cost:	$ 100,000

A study is proposed to ascertain the attitudes of the one million people living on welfare in New York City, in order to understand their objectives, resentments, and ambitions. Welfare "clients" are one-eighth of the population of New York City. Apart from the economic burden to others and the implicit human misery and degradation, what threat does this mass of people constitute to the relative tranquility of the city? What can be done to improve their prospects?

93. THE FUTURE OF LABOR UNIONS

Societal Impact:	5	Cost effectiveness:	11.1	Annual Cost:	$ 90,000
Probability:	.50	Number of years:	2	Total Cost:	$ 180,000

A comprehensive study should be undertaken which is designed both to forecast the future of the labor movement in the U.S. and to provide a rational basis for long-range planning within the labor unions. Such a study would have to concern itself, among other things, with

(a) the unions' responsibilities to their members,
(b) future relations to employers,
(c) future fringe benefits,
(d) prospects of unionization of white-collar workers,
(e) responsibilities to society as a whole,
(f) problems of mid-career retraining,
(g) new modes of protecting the worker against new technology that do not retard technological progress.

94. NEIGHBORHOOD DEMOCRACY

Societal Impact:	5	Cost effectiveness:	10.0	Annual Cost:	$ 200,000
Probability:	.50	Number of years:	1	Total Cost:	$ 200,000

A study is proposed which would be aimed at producing effective recommendations on the implementation of workable forms of Jefferson's "local republics". The study should examine, in particular, questions of control over schools, refuse collection, public safety, and anti-poverty measures. Its recommendations may well take the form of the design of pilot efforts in some of these areas.

95. PRESS COUNCILS

Societal Impacts:	4	Cost effectiveness:	24.3	Annual Cost:	$ 70,000
Probability:	.60	Number of years:	1	Total Cost:	$ 70,000

This proposal concerns the promotion, on a pilot basis, of press councils in several different-size cities. Evaluation of the performance of these pilot press councils may provide guidelines for the establishment of a national institute to check on the performance of the press, as suggested by the Kerner Commission.

9. Proposals rejected as being too costly to qualify for support by a medium-sized foundation

Finally, the following 7 proposals, although like those of the preceding section considered to be potentially effective, were not entered into the final round because they had been judged to require funding at a level above the stipulated 5 million dollar limit.

96. MDs OF ENVIRONMENTAL SCIENCE AND ENGINEERING

Societal Impact:	5	Cost effectiveness:	0.6	Annual Cost:	$ 1,100,000
Probability:	.80	Number of years:	5	Total Cost:	$ 5,500,000

This is a proposal for the development of a new profession by supporting suitable universities (such as UCLA) in establishing a new four- or five-year graduate curriculum to train and accredit doctors of environmental science and engineering to work with the established authorities and professions (public health, medicare, zoning and traffic commissions and authorities, and industry). This new curriculum probably would consist of two or three years of interdisciplinary course work at the graduate level and another two years of supervised field training leading to a state license. The Foundation could help financially to set up the necessary chairs. In the case of UCLA, the Institute of Geophysics and the School of Engineering, which are leading such an effort at present, could house and nurture such a program at least in the beginning.

97. EXPERIMENT IN PROFESSIONAL TRAINING FOR THE UNDERPRIVILEGED

Societal Impact:	5	Cost effectiveness:	0.4	Annual Cost:	$ 1,000,000
Probability:	.60	Number of years:	6	Total Cost:	$ 6,000,000

This nation needs personnel in social welfare administration and criminal rehabilitation who are well acquainted with the poverty syndrome and the sub-culture that pervades the city centers. A number of institutions might be subsidized to experiment with the professional training of promising adults from that environment who have had no previous higher education. This program could test the hypothesis that many mature adults who have not been privileged to attain college training and who have grown up and spent most of their lives in the culture of poverty can succeed in graduate professional training in social work, education and law.

98. EXPERIMENTATION IN TEACHER EDUCATION

Societal Impact:	5	Cost effectiveness:	0.4	Annual Cost:	$ 1,600,000
Probability:	.60	Number of years:	4	Total Cost:	$ 6,400,000

This is a recommendation for the establishment at a major university of a center for experimentation in undergraduate teacher education where emphasis would be placed on actual school experience in connection with theoretical work and on different structural arrangements for academic work. Experiments should include early involvement as school tutors and aides by undergraduates in teacher education. Academic credit could be earned

98. EXPERIMENTATION IN TEACHER EDUCATION (continued)

on the basis of such work done under faculty supervision, thereby eliminating the need for some of the conventional course work.

99. BIRTH CONTROL METHODS

Societal Impact:	7	Cost effectiveness:	0.3	Annual Cost:	$ 2,600,000
Probability:	.60	Number of years:	6	Total Cost:	$ 15,600,000

Promising new bio-medical research programs should be supported that may lead to simplified new methods of birth control.

100. SPACESHIP EARTH

Societal Impact:	5	Cost effectiveness:	0.15	Annual Cost:	$ 1,600,000
Probability:	.60	Number of years:	10	Total Cost:	$ 16,000,000

A study is recommended of the characteristics of a "Spaceship Earth", that is, an earth in which man finds a reasonably comfortable place in an essentially circular material process, and in which all processes of production and transformation are looped so that garbage and effluent are our only raw materials. This long-range ecological study, which would link a large number of subordinate projects together, should be carried out under different assumptions about energy input, the most pessimistic of course being reliance on energy from the sun. The nature of the technology which would be involved and the population which such systems could support are the crucial questions. Problems of the transition to the acceptance of the spaceship-earth concept are also very significant. This would involve studies of the human learning process, of conflict resolution, and of the determinants of fundamental human values, as well as studies of material technology.

101. CRIME DETERRENCE

Societal Impact:	5	Cost effectiveness:	0.14	Annual Cost:	$ 5.700,000
Probability:	.60	Number of years:	3	Total Cost:	$ 17,100,000

A pilot program is recommended, in several cities of over 250,000, to increase the number of patrolmen on the streets of high crime areas without reducing the number of patrolmen in other areas of the city. The purpose of the program is to act as a deterrent. It would be of several years' duration. The first year would be devoted to recruitment, with emphasis on recruiting veterans. Recruitment is probably necessary since most police forces in large cities are under their authorized strength. Recruiting veterans would increase the racial heterogeneity of the force and perhaps ease other tensions. Subsequent years would be operational and also analytical. The analytical portion would be concerned with analyzing the rate and nature of crimes in the subject area, as compared with the previous years', and then performing the same analysis for the neighboring areas.

102. FORECASTS OF ENVIRONMENTAL POLLUTION

Societal Impact:	7	Cost effectiveness:	0.24	Annual Cost:	$ 2,000,000
Probability:	.60	Number of years:	10	Total Cost:	$ 20,000,000

This proposal recommends the establishment of an institute that would assess technology for its future effects on the environment and would monitor present and forecast future pollution. It would acquaint the public with meaningful alternative measures for dealing with pollution and with their relative monetary and social costs.

10. Examination of the completeness of coverage

Although some care was taken in the selection of respondents to provide broad coverage of potential topics of interest, it was, of course, too much to expect that all areas of the taxonomy presented earlier would be given uniform attention or even that each would be represented by at least one proposed project.

We examined each of the 102 proposals listed above from these points of view and identified both the primary area to which it belongs within the taxonomy and one or more secondary areas to which it is relevant. The results of this examination are displayed in Table 2.

This tabulation serves two purposes. Firstly, it can be used as an index for locating proposals within the list of 102 that have some bearing on a particular entry in the taxonomy. Secondly, it draws attention to areas that have been largely or even totally neglected in terms of proposals addressed to them. While some areas may, of course, have been deliberately disregarded because the respondents felt that they did not warrant any particular attention, others may not have been dealt with because they fell outside the fields of interest or special competence of the participants. We note the following deficiencies in coverage:

(i) Areas with no primarily or secondarily relevant proposals:

22 Basic theory (of systems and institutions)
27 Entertainment
32 Arms control
38 Disease control (internationally)
39 World resources development and management
42 Disaster warning
43 Disaster relief
46 World goals and values
47 Religion
53 History and humanities
55 Mathematics and philosophy
61 Mining technology
62 Space technology
63 Other physical technologies

TABLE 2: Coverage of taxonomy areas by proposed projects

Area	Proposals in this area	Proposals relevant to this area
SOCIETY		
1 Education	12 13 24 26 29 35 55 57 61 63 84 96 97 98	1 18 22 34 51
2 The family		39
3 Racial conflict	16 18 53	57
4 Youth problems		35
5 Interpersonal relations	6 9	17
6 Poverty	80 92	20 61 65 84 97
7 Law and order	45 69 70 75	39 92 97
8 Urbanization	40 49 65 73 79	9 11 16 39
9 Arts and crafts		
10 Social theory	42 72	
11 Economic theory	20	14 59
SYSTEMS AND INSTITUTIONS		
12 Government	38 64 89	26 39
13 Political institutions	4 15 86	
14 Corporate structures	5	4
15 The public/private interface	32	23 73
16 Societal interactions	51 93 94	
17 Health care systems	10 19 68 90	24
18 Transportation systems	11 87	3 49
19 Communication systems	2 3 22 36 48 66 85 95	44
20 Utilities		49
21 Institutional innovations	15 23 33 34	32 64 73 74
22 Basic theory		
ENVIRONMENT		
23 Pollution	27 41 43 71 102	62
24 Wildlife and open spaces	83	25 71
25 Beautification	91	40
26 Privacy		44
27 Entertainment		
28 Recreation		74
29 Leisure	74 88	39 84
30 The drug culture	30 56 60	
31 Ecology	25 28 47 50 62	7 12 71 96 100 102
INTERNATIONAL AFFAIRS		
32 Arms control		
33 Prevention of international conflict	58	76
34 World government	76	
35 Cultural rapprochement	52 78	
36 Population control	7 8 14	100
37 World food problem		77
38 Disease control		
39 World resources development and management		
40 Development of preindustrialized countries	59	
41 International trade and investment		59
42 Disaster warning		
43 Disaster relief		

TABLE 2 (continued):

Area	Proposals in this area	Proposals relevant to this area
VALUES AND MORES		
44 Individual goals and values		39
45 National goals and values		39 66
46 World goals and values		
47 Religion		
48 Quality of life	87	20 40 42 65 74 87
49 Ethics and value theory	39	
SCIENCE AND TECHNOLOGY		
50 Physical sciences and astronomy	37	
51 Bio-medical sciences	81 99	8 10 24 30 43 56
52 Behavioral sciences	1 6 17	8 9 30 39 40 45 60 63 70
53 History and humanities		
54 Social sciences (see also 10)		
55 Mathematics and philosophy		
56 Operations research	31 54	102
57 Social technology	21 82	15 28 31 54 59
58 Information management	44 48	19 22 48
59 Agricultural and food technology	77	
60 Building technology	67 73	16
61 Mining technology		
62 Space technology		
63 Other physical technologies		
64 Science and technology policy	46 100	

(ii) Areas with no primarily (but some secondarily) relevant proposals:

2 The family
4 Youth problems
20 Utilities
26 Privacy
28 Recreation
37 World food problem
41 International trade and investment
44 Individual goals and values
45 National goals and values

In order to shed some light on the question of whether areas of the taxonomy were neglected deliberately or by default, it may be well to examine the respondents' interest as expressed by them in the third round in terms of the ten proposals they had been asked to select and to rank from 1 to 10. Using the sum of these ranks assigned to items by the respondents as an indication of the panel's combined interest, the 80 proposals which formed the subject matter of Questionnaire 3 appear in the order shown in Table 3, arranged in descending magnitude of respondents' combined interest.

Even a cursory examination of this table makes it apparent that the correlation between the preferences reflected by this tabulation and the ordering of the proposals as presented in this report is not overwhelming. Undoubtedly, therefore, the panel exhibits a certain amount of bias. A specific example of evidence to this effect is the appearance of such items as University Reform and Science Policy Processes in first and fourth places, which may be accounted for by the fact that many of the respondents belong to the academic and scientific community.

By and large, therefore, we cannot be sure that the gaps in coverage that were observed are not simply reflections of the limitations in the disciplinary coverage represented by our panel of experts, - a deficiency that could have been avoided only by an increase in the size of the panel. Consequently, in applying the results of this study to the determination of specific funding programs, it would be well to pay special attention to the gaps in coverage listed above and to give separate consideration to the support worthiness of areas enumerated there..

TABLE 3: Proposals 1-80, ranked by the sum of the panelists' preference rankings

Rank	Item No.	Item
1	29	University reform
2	39	Dynamics of value change
3	7	U.S. population and environment
4	46	Science policy processes
5	22	Mass communication media
6	25	Environmental preservation
7	42	Social observatory
8	10	Medical-care systems analysis
9	18	Black leadership education
10	51	Training for citizen action
11	20	Qualitative economic growth
12	4	Leadership regeneration
13	5	The future of the corporation
14	55	Alternative secondary education
15	11	Metropolitan transportation
16	2	Urban communications
17	16	Integrated urban housing
18	40	Urban environmental esthetics
19	19	Community health care delivery
20	54	Analysis of future society
21	3	Transportation and communication
22	26	Training for public service
23	38	State and local reform
24	12	Conservation education
25	45	Prison reform
26	8	Acceptance of population control
27	59	Socio-economic development
28	27	Water and air pollution
29	72	Social indicators
30	56	Heroin addiction cure
31	14	Economics of a stable population
32	53	Institute for black development
33	57	Equal educational opportunity
34	21	Monitoring science and technology
35	34	Intellectual institutions
36	13	Right to higher education
37	35	Adult responsibilities
38	37	Physical sciences
39	30	Social aspects of drug abuse
40	24	New goal for medical education
41	33	Herman Kahn
42	62	Institute for Ecology
43	60	Interdisciplinary drug research
44	6	Instinct toward violence
45	17	Cooperation versus aggression
46	28	Ecological considerations
47	76	Strengthening world order
48	52	Reduction of chauvinism
49	49	Nonmetropolitan settlement
50	69	Analysis of criminal justice
51	1	Human intelligence
52	41	Pollution control pilot study
53	58	International cooperative ventures
54	32	Public/private interface
55	36	Center for visual communication
56	15	Participation in democracy
57	80	Anti-poverty experiment
58	64	New forms of government
59	50	Regional environmental council
60	44	Information policy
61	23	Use of R+D in the public sector
62	43	Effects of air pollution
63	9	Crowding
64	67	Building codes
65	63	Reading disability
66	79	Cities within cities
67	66	Mass media in decision-making
68	68	Experiment in health care
69	77	Agricultural and food technology
70	61	Transition schools
71	65	Relocation of slum families
72	71	Lake eutrophication studies
73	78	Understanding among diplomats
74	31	Methodology of futures analysis
75	75	The police of the future
76	47	Environmental science
77	73	New towns
78	48	Computer-aided problem solving
79	56	Heroin addiction cure
80	70	Crime and criminal justice

11. A possible method of program selection

This section is concerned with the problem of selecting a program of projects that can be funded within prescribed budgetary constraints, given a set of proposed projects that have been evaluated with respect to their probable cost and effectiveness.

If the cost and effectiveness estimates are thought to be highly reliable, and if the projects are independent with regard to cost and effectiveness (in the sense that the joint cost and the joint effectiveness can be obtained by adding the costs or the effectiveness measures of the individual projects), then an optimal program can be determined analytically by successively maximizing marginal utilities.

In practice, these conditions are rarely satisfied, and they certainly are not in the case at hand, where a program selection must be made in the face of considerable uncertainties. Not only are the effectiveness and, particularly, the cost estimates of the proposals listed in Sections 4 through 9 obviously deficient in reliability, but in many instances the formulation of the proposal is sufficiently vague to permit of several interpretations as to the precise nature and the intensity of the effort envisaged by the proposer.

Assuming that the responsibility for selecting a program of projects from a given list of proposed projects and within a given budget rests with a group of judges, how might they proceed systematically and efficiently in order to arrive at a mutually acceptable selection? The procedure outlined below represents one way of accomplishing this; while it could obviously be varied in detail, it is believed that its general type of approach is well suited to the task.

Step 1: Assuming that the cost of supporting the entire set of proposals far exceeds the budget, a preliminary elimination is required, resulting in a residual listing of candidate proposals for further consideration. For this purpose, let each judge indepen-

dently rate each proposal either 0 or 1 or 2 ("not interested", "mildly interested", "strongly interested"). Score each proposal by adding its ratings. Accept as candidates those with highest scores, choosing a cut-off point so that the total cost of the candidate proposals is of the order of two or three times the given budget.

Step 2: If a project is to be funded at all, it would be wasteful to support it at too low a level. Let each judge, guided perhaps by the estimated funding requirements accompanying the proposals, independently state what he would consider the minimal reasonable funding level for each project, if it were to be funded. In cases of wide disagreement among the responses, have a brief discussion followed by independent re-votes. Accept the median figures as the minimal cost estimates.

Step 3: Have each judge independently allocate the given budget over the list of candidate proposals, using the rule that an allocation to a proposal must be either zero or no less than the previously accepted minimal cost. List the responses in matrix form, as follows, where the entries in each row are arranged in ascending order of magnitude:

	Proposed allocations						
	Lowest	Next to lowest	...	i^{th} lowest	...	Next to highest	Highest
Proposal 1	A_{11}	A_{12}	...	A_{1i}	...	$A_{1,n-1}$	A_{1n}
Proposal 2	A_{21}	A_{22}	...	A_{2i}	...	$A_{2,n-1}$	A_{2n}
⋮	⋮	⋮		⋮		⋮	⋮
Proposal m	A_{m1}	A_{m2}	...	A_{mi}	...	$A_{m,n-1}$	A_{mn}
Total cost	C_1	C_2	...	C_i	...	C_{n-1}	C_n

Select that column, say Column i, such that the total for that column, C_i, does not exceed the given budget, B, while C_{i+1} does, and accept $A_{1i}, A_{2i}, \ldots, A_{mi}$ as the preliminary allocations. If C_i is less than B, the residual budget, $B-C_i$, will be disposed of in Step 4.

To illustrate, consider a case of 7 proposals and 8 judges, a budget of 100, minimal costs as shown, and responses as follows:

	Minimum	J_1	J_2	J_3	J_4	J_5	J_6	J_7	J_8
Proposal 1	40	40	0	50	40	0	60	0	40
Proposal 2	10	0	20	0	10	10	20	20	0
Proposal 3	30	30	30	0	0	40	0	0	0
Proposal 4	30	30	0	0	0	30	0	0	30
Proposal 5	50	0	50	50	0	0	0	60	0
Proposal 6	20	0	0	0	20	20	20	20	0
Proposal 7	30	0	0	0	30	0	0	0	30
		100	100	100	100	100	100	100	100

Now rearrange the responses in each row in ascending order:

	Lowest	Second lowest	Third lowest	Fourth lowest	Fifth lowest	Sixth lowest	Sev'th lowest	Highest
Proposal 1	0	0	0	40	40	40	50	60
Proposal 2	0	0	0	10	10	20	20	20
Proposal 3	0	0	0	0	0	30	30	40
Proposal 4	0	0	0	0	0	30	30	30
Proposal 5	0	0	0	0	0	50	50	60
Proposal 6	0	0	0	0	20	20	20	20
Proposal 7	0	0	0	0	0	0	30	30
	0	0	0	50	70	190	230	260

Here, the fifth column is the last one for which the total does not exceed the given budget of 100. Hence we have the preliminary allocations:

Proposal 1: 40
Proposal 2: 10
Proposal 6: 20

leaving a residue of 30 yet to be allocated.

Step 4: It remains to allocate the residual amount of $B-C_i$ (in the illustration: 30). This should be done by raising the preliminary allocations made in Step 3, which were the i^{th} lowest,

to amounts somewhere between the i^{th} lowest and the $(i+1)^{th}$ lowest (observing the constraint, however, that any allocation which is not zero must not be less than the minimal amount stipulated previously). In the illustrative case, the options would be as follows:

raising Proposal 2 from 10 to at most 20,
raising Proposal 3 from 0 to 30 (or not at all),
raising Proposal 4 from 0 to 30 (or not at all).

(Note that Proposal 5 is not eligible, since it takes 50 units to initiate it, which is more than is still available.)

To carry out the residual allocation among the remaining options, the same procedure is followed as in Step 3. If as a result there is a further sizeable residual, Step 4 may have to be reiterated; if the residual is small, it may be simplest to resolve its disposal by informal discussion.

In reviewing the merits of the above procedure, it should be noted that the resultant amount allocated to each project is such as to equal or exceed the amount that i or more of the judges had recommended, where i typically is large enough to represent a majority.

12. Comments on methodology

We live in a time where societal emergencies are crowding in upon us with increasing urgency and where, consequently, the wise expenditure of philanthropic largesse has assumed greater importance than ever. Indeed, public clamor and specific legislation add weight to the foundations' own desire to act as true guardians of the public interest. It is not inappropriate, therefore, for foundations to look for new and more systematic approaches to determining the most worthwhile public causes to which they might give their attention and support.

The present study may be regarded as a first pilot effort in this direction, and it is hoped that, aside from its substantive content, its methodological approach might provide a modest contribution to the emerging debate on a possible reorientation of philanthropic programming methods.

The practice - not without exceptions admittedly - has been for foundations to be approached with funding requests by individual proponents of ideas for supposedly worthwhile projects, and for foundation officials to award grants to some extent on the basis of their intuitive preferences and of the persuasiveness with which project proposals had been stated.

The approach used in the present study, while leaving the ultimate decision-making responsibility of foundation officials unimpaired, has been different in two major respects. It has appealed to a set of specialists in a broad variety of fields to formulate proposals for projects that might serve the public interest, and it has asked these same experts, not just to appraise these proposals individually, but to evaluate them comparatively in the spirit of what amounts to a rudimentary systems-analytical approach.

The device used for this purpose has been a simplified version of the Delphi method, which typically addresses a series of inquiries to a panel of respondents, providing feedback between rounds on the responses received in the preceding round.

The merits of this approach, particularly when applied in an all-out effort rather than a mere pilot one, may be characterized as follows:

(i) Proposals are solicited on a systematic basis rather than received haphazardly.

(ii) Participants, by being asked to propose several projects in the public interest, are stimulated to think innovatively and not just to promote a single, favorite project.

(iii) Project proposals, by being edited into a format that is reasonably uniform, have a better chance of being judged on their comparative merits than on the basis of possibly speciously persuasive formulation.

(iv) Proposals are evaluated in the spirit of a systems-analytical approach, in the sense that

  (a) assessments are required of their cost, probability of success, and effectiveness (in terms of societal impact),

  (b) each respondent is encouraged to simulate the eventual program selection process by stating which particular subset, out of the total set of proposals, he would most wish to advocate.

(v) Over-specification of the mode of execution of a proposed project is avoided, which on balance is advantageous (provided the formulation leaves no doubt as to the overall purpose of the project) because it facilitates the decision-making process and gives appropriate discretion to those who will eventually be charged with the execution of the project.

There is no doubt that the endeavor reported on here cannot lay full claim to the potential merits of the approach that are outlined above. A future, more thorough effort might well attempt to seek improvements over the

present one in several respects:

- The number of respondents should be larger (possibly twice as large), both to achieve more complete coverage of potential areas of interest and to ease the evaluation burden per person.
- A special panel may have to be appointed to deal with the problems of cost estimates.
- Information should be gathered and transmitted to the evaluators on the current status and level of support from other sources of ongoing projects equal or similar to proposed projects.
- At least one more evaluation round should be added to the Delphi inquiry in order to do justice to the need for the assessment of expected effectiveness of proposed projects. Indeed, the inherent vagueness of any measure of "societal impact" requires some mechanism for inter-subjective communication in order to establish a common basis for consensus. Here, the standard Delphi feedback procedure, which in this case would require a fourth round, would be helpful. Respondents would then be asked in the third round to justify those among their responses which deviate relatively strongly from the responses of the majority and in the fourth round to reassess their opinions in light of of the arguments presented by the other panelists. This give-and-take would provide some of that mechanism for offsetting the conceptual vagueness of the effectiveness assessment and thereby facilitate the establishment of an intuitive consensus.