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9. ABSTRACT
 (Library and Information R&D)
 Presents the results of an AID-sponsored study which assesses the operations of and recommends means to strengthen the activities of Volunteers for International Technical Assistance (VITA), a private organization which answers technical inquiries from individuals in developing countries. VITA also fosters development of local foreign organizations to mobilize local skills and data for solution of local problems. The assessment included evaluations of the quantity of inquiries received in 1970, their distribution by sectors and subject matter, the quality of the inquiries in terms of adequacy of explanation of the problem, the complexity of the problems described, the adequacy of the responses by assigned VITA volunteer specialists, and the adequacy of feedback from the inquirers. This consultant-directed study concludes that VITA is productive and has achieved a distinctive international role with relatively limited resources. VITA volunteers have a wide range of talents and provide useful answers to inquiries. Information provided by VITA to the agricultural and business sectors in 1970, the year for which cases were evaluated, resulted in increased production on 150-200 farms and in 40-50 manufacturing enterprises. The study recommends that the VITA central staff and clearinghouse operations be strengthened to make the information-retrieval and volunteer-selection functions more efficient. VITA staff are now engaged in upgrading their information retrieval systems.

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RESPONDING TO TECHNICAL INFORMATION NEEDS
OF DEVELOPING COUNTRIES

An Evaluative Review
of the

Volunteers for International Technical Assistance
INTERNATIONAL INQUIRY SERVICE

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Agency for International Development
Washington, D.C.

March, 1972

The Office for Private Overseas Programs sponsored this consultant's study to gain better insight into present and potential achievements and problems of the VITA voluntary approach in responding to technical information needs. The study was directed by Richard Morse, and its findings and recommendations are his. It is hoped the study will serve as a useful tool to VITA in their continuing program development efforts.

It is being printed for those interested in the challenging task of adapting and transferring technical knowledge effectively; and in VITA as a privately managed program through which individuals can contribute to overseas development.

PREFACE

Volunteers for International Technical Assistance, VITA, was started in 1959 as a person-to-person effort to answer, by correspondence, technical inquiries from individuals in developing countries. VITA's founders believed a private volunteer effort of this kind would complement government aid programs for making the wealth of technical information in the United States more accessible. It would enable engineers, agriculturalists, businessmen - experienced persons active here at home in many fields - to contribute their knowledge directly and in a practical way, by personal response to those who ask for help with specific problems.

Although its activities have grown and diversified, VITA has maintained its personal, humanistic approach, and the original assumption about the need for such a private volunteer program has been confirmed by the numbers of people who call upon its services.

VITA's by-mail inquiry service continues to operate out of the headquarters office in Schenectady, New York. There, a small professional staff assisted by local volunteers receives inquiries from nationals of developing countries and from intermediaries such as Peace Corps Volunteers, personnel of the United Nations and the Agency for International Development, missionaries, and private companies and development groups. Each request is logged in and given a preliminary review to determine the type of assistance needed. Typically, it is then assigned to one or several volunteer consultants who have registered their skills with VITA and whose resumes indicate an appropriate background for adequate response to the problem. These volunteers work in hundreds of American businesses and companies, universities, agencies, and the professions. (VITA's roster now also includes nationals of other countries as well.) Some inquiries, however, are answered from VITA's own library, VITA publication series, or are referred to private companies, or to one of the 150 private and public organizations with which VITA has informal cooperative relationships.

Once the response or responses to the inquiry have been received, they are reviewed and forwarded to the requester. In many cases follow-up and additional information are required, and often a continuing correspondence is established between the volunteer and requester.

While the inquiry service remains the heart of VITA's international program, the experience with it has led to other activities for making technical information and expertise available in practical ways. Under

a "counterpart" concept, VITA endeavors to foster a local organizational presence to mobilize local skills and data in the solution of local problems. For these local counterpart efforts, VITA's volunteer consultants serve as a backup resource. Under local leadership, a VITA counterpart was formed in the Philippines in 1969; in the Dominican Republic in 1971; and additional ones in Latin America are planned during the coming year.

The local counterpart concept is now being applied also here in the U.S. through establishment of VITA-USA, in 1969, as a domestic effort of technical assistance to private and public anti-poverty programs. VITA-USA was begun with a grant from the Office of Economic Opportunity, but private monies also support the program. It includes five urban offices - Boston, Washington, Houston, San Francisco, and Pittsburgh - plus a national consulting service operating out of Schenectady. Each urban office has its own local roster of volunteer consultants who are linked with the central roster in Schenectady. Most consulting in the domestic programs is done on-site on a face-to-face basis, not by mail, and this experience is relevant to VITA's interest in providing on-site consultants in the international program.

VITA's status as a voluntary, private agency assisted by public funds sets the framework for this evaluation. For several years VITA has been concerned with the development of methods to assess the effectiveness of its services. In the case of the inquiry service, as a regular step, Appraisal Forms are sent to all inquirers after a suitable interval. To contribute to VITA's efforts in evaluation, the present study was suggested by the Agency for International Development, which in recent years has provided grant support meeting approximately 25 per cent of VITA's international budget. At the request of AID, a preliminary statement of evaluation objectives, scope, and method was prepared by the Consultant for review with VITA. Discussions among VITA, AID, and the Consultant led to agreement on the evaluation objective: "to strengthen VITA's ability to assess the effectiveness of current activities and to identify and justify needed program improvements in response to changing international needs".

While the evaluation report is prepared for and on behalf of AID, the basic objective of contributing to VITA's own ability at self-assessment and development was pursued throughout the appraisal and will be evident in this report. Active VITA participation in the evaluation was essential to attainment of this objective. An evaluation team was therefore constituted, as follows: the Consultant, who directed the evaluation; Mrs. Pat Holland, VITA Research and Evaluation Officer, counterpart to the Consultant; Mrs. Ethel Carlson, Manager, International Inquiry Service; Mrs. Karen Hamm, Mrs. Pamela Shiffler, and Miss Barbara Stants, staff inquiry coordinators; and Dr. Albert Titus and Mr. Raymond Veeder, volunteer inquiry coordinators. The

team jointly formulated the Evaluation Measures presented in the report and developed a consensus on standards and procedures for rating inquiries and responses. Case appraisals by individual evaluators were reviewed and analyzed by the Consultant and Mrs. Holland in close consultation.

The Consultant assumes full responsibility for objectivity, evaluation design, methods, conclusions, and recommendations of the appraisal. Pursuant to the evaluation design, credit for the study of technology transfer in adhesives and its presentation is that of Mrs. Holland. Strong secretarial support, particularly on the part of Mrs. Virginia Ohmart, was continuously provided by VITA.

The Consultant wishes to thank Dr. Beno Sternlicht, Chairman of VITA's Board of Directors, Mr. Lloyd Hughlett, President at the time the appraisal was commissioned, Mr. Benjamin P. Coe, Vice President, Mr. Edward S. Dennison, Assistant to the President, and Mr. William Daley, Director for International Consulting Services, for their active cooperation. Mr. Daley, having direct responsibility for the international inquiry service, contributed significantly in ideas, practical knowledge, and constructive criticism. The critique and suggestions of other VITA board members and staff are also acknowledged with thanks. Appreciation is expressed also to AID staff members whose comments were helpful in reviewing the evaluation design.

Richard Morse

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PURPOSES AND DESIGN OF THE APPRAISAL

In 1972, Volunteers for International Technical Assistance enters its fourteenth year as a bridge between users and providers of technical information. Founded by seven Mohawk Valley scientists and engineers, VITA now numbers some 5,000 active volunteers in the United States and over 500 in 90 other nations. The present appraisal has been commissioned by the Agency for International Development as a means of enabling VITA to reexamine its international goals and operating performance, as a basis for future program development.

The objective of the evaluative review is to strengthen VITA's ability to assess the effectiveness of current activities and to identify and justify needed program improvements in response to changing international needs. To gain this objective, the agreed scope and methods of the evaluation include: (1) defining standards of performance relevant to voluntary, private agencies in the field of international information transfer; (2) establishing ratings and quantitative indicators to test current progress against the defined standards; (3) engaging VITA staff in applying the devised ratings in an evaluation of recent performance; and (4) presenting the findings in a form suited to review by VITA management and to subsequent use in program execution. The appraisal is limited to VITA's international program, and specifically to the international inquiry service.

As a starting point, an effort was required to define standards of performance by which to measure the effectiveness of technical information services. To arrive at usable standards which accurately reflect VITA objectives - and as a step in clarifying these objectives - a working statement of VITA goals was first developed through discussion with VITA board members, officers, and staff. With these working objectives as a frame, rating scales were established as a basis for assessing VITA inquiries and responses.

Applying these standards, the structure of the evaluation was built on two procedures. First, VITA's effectiveness in responding to individual inquiries was assessed by examining a representative cross-section of recent case histories. In assessing each case, the established rating scales as well as the inquirer's own appraisal and report on use of VITA information were applied. Case abstracts presented in Chapter II

summarize the factual record of implemented inquiries, among those evaluated. Second, VITA's role in technology transfer, adaptation, and development was assessed by studying the cumulative record of all VITA cases in two fields: adhesives and irrigation. These longitudinal studies are reported in Chapter III. Development effects of the inquiry service as seen in both cross-sectional and longitudinal appraisals are examined in Chapter IV.

But priorities and trade-offs among VITA objectives are themselves a central concern of the appraisal. By conducting the evaluation in the context of the working objectives arrived at in early discussions, it becomes possible in the concluding chapters to suggest future relative emphases on each objective, if VITA should so choose. A review of the working objectives therefore serves as a suitable introduction to the report.

VITA's working objectives are, as formulated at the outset of the evaluation:

1. Meet human needs, improve living standards, contribute educationally to communities' and individuals' ability to meet their own needs.
2. Unique response to individual inquiries.
 - a. Relevant to expressed or felt need
 - b. Perceptive in seeing underlying or unspoken need
 - c. Educative in enlarging inquirer's understanding of the problem
 - d. Two-way communication with inquirer, avoiding technological superiority or "we know best" syndrome.
3. Quantitative development effects.
4. Pathbreaking contribution to cross-cultural transfer, adaptation and development of technology.
5. Cumulative effect on "state of technology" in selected fields. Excellence in selected fields, threshold competence in many.
6. Lively involvement of VITA volunteers in generating new activities.

Objectives 2, 4, and 6 belong to the realm of knowing, of personal communication, of understanding. Objectives 3 and 5 are economic and technological in nature. Objective 1 is purposefully phrased to embrace both realms: the perceptual and the material. VITA, in its brief record, is thus concerned with fundamental questions of cognition, technology, and culture.

Objective 2 speaks to VITA's special forte: direct person-to-

person exchange of query and reply. The inquirer states his problem to the best of his understanding, naming those variables which he perceives to be significant. The VITA volunteer in responding at times asks elucidation of these and other variables. More frequently he integrates the information sent by the inquirer with his own knowledge of the field and forms a direct reply. The unity of the person at each end of the exchange is the intrinsic potential strength of the process. "The processes of unity take place in the mind."* Two minds, in extraordinarily different cognitive and physical settings, intersect in grappling with the problem at hand.

There is presumption, of course, on the part of the volunteer respondent in believing that his information, built in a particular matrix of ecological, economic, and social forces, can be helpful to an inquirer who operates in quite a different setting. Naivete as well. Naivete and presumption are perhaps reversed in proportion on the part of the inquirer. But one senses in reading the two-way letters that each party is normally aware of the gulf. Willingness to face contrasts is a starting place for reducing or harmonizing contrasts. "Internationalizing" of VITA volunteers was voiced as a basic objective by a director at a recent board meeting. "Participating as a vicarious traveler" is the experience of a jack-of-all-trades and master-of-many volunteer, as he describes the wide variety of queries he has tackled.

Personal traits of curiosity, the appeal of discovery, and standards of inquisitiveness, thoroughness, and mental integrity are intrinsic in the VITA process. These qualities set an implicit standard by which to test the performance of the process as a whole. Internal professional standards are made explicit in Evaluation Measure 3, the rating scale established to weigh "Factors in Success or Failure - on VITA's part."

An impulse to do something new in one's land, to produce, make a business advance, meet a pressing need: these initiatives are at the root of the types of inquiry VITA receives. To the entrepreneur or community agent, practicality of the information provided is the test of VITA's performance. Translation of facts and counsel into action is in turn the touchstone by which many volunteers measure effectiveness. Numbers of people aided, quantities of goods or services delivered, monetary benefits, are tangible measures of results. Against Objective 3, a rating scale on Developmental Effects was applied in an effort to gain quantitative indicators of implementation.

The departure point of Objective 4 is recognition that VITA's history is a cross-section of the currents of technology sought by

*Geroid Tanquary Robinson

modernizing countries and transferred or adapted by technologically compelling societies in the past decade. As an information process, VITA cases range along a broad but broken spectrum. Some inquiries are unique, in a peculiar matrix of socio-techno factors. Occasionally a valid answer will be delivered "from some previous order in time and space into a new order with not so much as a ligature clinging to it of the old place where it was organic."* Numerous modes of repeated or similar problems, however, are also contained on the spectrum. VITA files in this view constitute a window on technical diffusion across cultures.

But similar problems often do not receive the same treatment. Persons at VITA headquarters who are responsible for "coordinating" inquiries, matching queries to volunteers, change with the years and differ in their perception of how to find the "best" source for a certain type of inquiry. Sub-modes of replies can thus be discerned. The sum of many problems small in individual content may or may not add up to a technological core. VITA's catholicity in probing, comparing, and retaining, in its memory, the alternative solutions to similar dilemmas is another dimension on which the organism's health must be assayed.

Objective 5 encompasses another dimension of exchange. By contributing to the flow of technological information in selected fields, VITA is moving on a line congruent to the 25-year goal recommended by President Nixon's Commission on International Trade and Investment Policy: the long-term "elimination of all barriers to international trade and capital movements." Mobility and free transfer of information is in formal economic terms essential to the validity of the free trade model. Greatly quickened assimilation and evaluation of technological information by industrializing countries is indispensable to their conquest of poverty.

Varying emphases among VITA's values and objectives contend, it would seem, in the appraisal process. The conflict is more apparent than real, however. Basically in question is the field of action itself: the complex process by which the relevancy of information is perceived, tested, and applied. How far can a mail-order inquiry service contribute to such a process? What can be learned from a decade's results toward strengthening the flow of relevant information and uncovering deeper comprehension of needs? How do these lessons set the stage for VITA's program for encouraging development of overseas affiliates and counterparts, and how can such overseas initiatives expand communication of meaningful perceptions and experience? To these questions the appraisal is directed.

*Robert Frost

VITA'S CENTRAL ACTIVITY: RESPONSE
TO INDIVIDUAL INQUIRIES

Pride in being uniquely responsive to each person who writes to VITA is expressed by many volunteers and staff members. Personalized, relevant, and practical answers are seen as one of the organization's earliest hallmarks. A major objective of the evaluation, accordingly, is to test achievement of this standard.

The inquirer's own appraisal of VITA information and his experience in putting VITA counsel to use are, it is evident, the first points to be examined. Appraisal forms or letters sent in by inquirers are therefore a starting point for the evaluative study. A Pre-Evaluation study conducted by VITA revealed, however, that only about two out of five requesters send VITA an assessment of the service received. Many of their assessments are too sparse to yield meaningful evidence. This experience of limited feedback, it should be noted at the outset, is shared by most mail inquiry services. Inadequate feedback is indeed a feature of mail information services which has often called their utility into question. To supplement inquirers' appraisals, other direct and indirect evaluation instruments are required.

Evaluation Measures: Quality and Complexity of Inquiry

The cornerstone of effective information transfer is good problem definition. Some queries are too incomplete or unframed to provide the basis for a sensible answer. Sometimes the inquirer is engaged in an activity but does not have a clear view of its ramifications and so is not able to organize relevant questions. Other requesters are on "fishing expeditions", having glimpsed an opportunity but having too little grasp of its parameters to raise good questions.

When VITA receives an inquiry, in the great majority of instances the only evidence for judging the capacity of the inquirer to carry out his project is in the organization, details, and clarity of the inquiry letter. This is much less a matter of language and articulation than of substance and relevancy. Both as a point of departure for evaluating VITA's recent performance and to meet the related purpose of equipping VITA for future assessment and management of the inquiry program, a

measure of the intrinsic quality of each inquiry letter is required.

The rating scale on "Quality of Requests", presented as Evaluation Measure 1 on the next page, was devised by the evaluation team to meet this need. A five-point scale was adopted for this and other ratings to be simple and practical in application, symmetric around the mid-point 3, yet providing enough detailed attributes to facilitate development of a consensus of scoring among the eight members of the evaluation team. Recognizing the substantial subjectivity in applying such a qualitative scale, consistency was sought by pairing evaluators in initial sets of test evaluations on the same case. Divergent scores were threshed out in meetings of the full team, prior to launching the full program of case assessments.

Quality of problem definition determines the degree of reality with which VITA can come to grip with an inquiry. Given this perception of the need, a second dimension which governs VITA's effectiveness is problem complexity. Problem complexity determines the number and mix of volunteer skills that must be drawn upon to supply a sound answer. The intrinsic difficulty of the problem, its compounding of varied elements, and its demands on originality or creativity in reply: these attributes set the level of "inputs" which VITA must supply. They also go far to determine whether a response from a distance, without direct personal exposure to the scene of the problem, has a chance of meeting the level of reality transmitted even in the best quality request.

If quality sets the demand or "user" value of the inquiry, complexity represents the resources that must be marshalled on the supply side. Complexity of each inquiry is therefore a second point of departure for measuring VITA's performance, and provides a grasp on the package of inputs which VITA inquiry service personnel must bring to bear. Evaluation Measure 2, "Rating Scale on Complexity of Problem", is designed to capture this dimension of the inquiry process.

It will be seen that the elements in each rating on the Complexity scale constitute, to a large degree, a content analysis of each level of problem. The content of problems ascends in complexity from a single-focus solution of a technical hitch in a production operation (Complexity 1), to coping with several technical aspects or with combined technical and managerial factors (Complexity 3), and finally to the originality and/or team effort required for a new design or an R & D approach (Complexity 5).

Problem definition examples

To illustrate the contribution of sharp problem definition and also the application of the Quality and Complexity scales, three inquiries are quoted here in their entirety. If the reader will examine these in the context of the rating scales, he will detect the specific elements responsible for the assigned scores. The reader may also

Evaluation Measure 1

RATING SCALE ON
QUALITY OF REQUESTS

- (5) Full details, comprehensive, logical.
All pertinent quantitative information.
Explicit goals and expected results.
Sees problem realistically.
Fully explains economic, social and
cultural factors bearing on the project.
Documents past progress.
- (4) Key details, clear statement.
Much quantitative information.
General statement of expected results.
Some discussion of anticipated problems.
Notes relevant economic, social and cultural
factors.
- (3) Workable statement of project, some missing
elements.
Some quantitative information.
Existing enterprise, in line related to inquiry.
Indicates hoped-for results.
Refers to possible problems and/or environ-
mental factors.
- (2) Incomplete statement of problem.
Few numbers.
Limited discussion of pre-conditions.
- (1) Vague, indefinite, general.
Few or no details.

Evaluation Measure 2

RATING SCALE ON
COMPLEXITY OF PROBLEM

- (5) Invention or innovation.
New design.
Systems approach indicated.
Management strategy or issue.
Original Research & Development.
- (4) Design adaptation or modification.
Research to make known process not
commercially publicized.
Feasibility or project report to be
prepared by VITA
*Joint venture.
- (3) Techno-managerial or techno-economic problem,
including economic scale of process or plant.
Many-faceted technical problem.
Identify source of design or process.
Locate feasibility report.
*Licensing/technical assistance.
- (2) Several technical elements.
Single-focus management problem.
Technical problem with price-cost element.
Identify use for specified raw material, waste,
by-product.
- (1) Single-focus technical problem.
De-bug a process.
Specify raw material source, grade, type.
Retrieve public information on process.
Send existing design or plan.
Refer to source of machinery or equipment.
Existing literature or bibliography.

*Unless handled as a referral, which is current (1971) VITA policy

quarrel with one or more scores. He will thereby appreciate both the difficulty and the intent of establishing a consensus among the evaluators for consistent application of these measures.

Quality 4, Complexity 4. "We have a 3/4 laying-up machine for laying-up of sector conductors of a power cable. According to the present arrangement, the main carriage can carry either 3 or 4 cradles (for carrying the bobbins). Since it takes considerable time to change the bobbins from 3 to 4 or vice versa, we plan to add one floating cradle in front of the main carriage. Thus the 4th core will pass to the central shaft of the main carriage and has to join the lay plate where the other three conductors from the cradles on the carriage are joining. We wonder if you can recommend at what place the 4th core should leave the central shaft of the carriage and join the lay plate. The bobbin size of the supplying bobbins is 56" flange dia. x 30" traverse. P.S. Enclosed sketch indicates the suggested arrangement."

Quality 1, Complexity 3. "Kindly let us have technical information on comprehensive plant requirements for the manufacture of zinc chloride from zinc scrap or its sulphide and oxide with chlorine or hydrochloride acid and possibly a list of firms who can supply such a plant."

Quality 1, Complexity 1. "We are manufacturing Coated Papers, particularly Gummed Papers and Transfer Decal Papers (Simplex).

1. We have the problem of drying gummed papers since they get curled after drying and create difficulties in slitting and rewinding.
2. After the first coat is given it is difficult to give the second coat over the first one while manufacturing transfer papers. Could you please suggest suitable remedies and oblige."

These examples are problems in manufacturing technology, currently the largest field of VITA inquiries. To gain a representative base for selecting a sample of individual inquiries for evaluation, and as a first step in analyzing trends in VITA problem topics, the sectoral distribution of inquiries was examined.

Sectoral Distribution of Inquiries

The sectoral breakdown of inquiries over the past four years, based on VITA's classification system, is presented in Table 1. Business inquiries, of which the bulk are in the manufacturing sector, have risen from 24 percent of the total in 1968 to 44 percent in the first nine months of 1971. Business-Technical cases, 36 percent of the

total in 1971, are predominant.

Changes in "Business" sub-categories in the period covered in Table 1 prevent a complete analysis of their separate trends, but the increase in the share of Business-Management cases from 4 percent in 1969 to 9 percent in 1970 and 8 percent in 1971 is noteworthy. This rise in the incidence of management questions, on such topics as marketing, export-import, feasibility analysis, and costs, is documented in greater detail in later chapters.

Agriculture, at 13 percent of 1971 inquiries, has dropped both in number of cases and relative percentage during the past two years but is still the second largest category.

The volume, geographic dispersion, and subject variety of Business-Technical, Agriculture, and Business-Management cases were the basis for selecting these categories as an appropriate cross-section for evaluating individual inquiries and replies. Food Processing, at 11 percent of current inquiries, was also a strong candidate. Since Food Processing problems typically combine many elements of both Agricultural and Business issues, it was decided that factors influencing successful performance in Food Processing would be adequately taken into account if an appropriate sample of cases was evaluated for the Agriculture, Business-Management, and Business-Technical sectors.

Evaluation sample

As the test year for individual inquiries, 1970 was selected to reflect the most recent possible pattern of operations and yet allow a long enough elapsed time period to assure reasonable feedback of appraisals from inquirers. Little being known on the statistical distribution of inquiry characteristics believed important to effective VITA replies, it was decided to evaluate a large sample of cases in each of the three major sectors. An overall target of 50 percent of the feedback cases was set for evaluation. Size of sample in each sector was set to assure larger sample representation for those sectors with fewer feedback cases. Cases for evaluation within each sector were chosen at random.

Sectoral variations in feedback rates and in sample size and percentage are shown in Table 2. The case sample finally evaluated equals 48 percent of the feedback cases, distributed by sector to assure a fully representative cross-section of cases in each major field.

Rating of Inquiries

Ratings on the Quality, Complexity, and Anticipated Developmental Effect of each inquiry were assigned by the evaluator upon scrutinizing

Table 1

SECTOR DISTRIBUTION OF VITA INTERNATIONAL INQUIRIES

	Number of Inquiries				Percentage			
	<u>1968</u>	<u>1969*</u>	<u>1970</u>	<u>1971</u> (9 months)	<u>1968</u>	<u>1969*</u>	<u>1970</u>	<u>1971</u> (9 months)
Agriculture	334	405	343	226	16	18	15	13
Business	482	816	895	779	24	35	39	44
Small	(482)	(398)	@	@	(24)	(17)	@	@
Technical	@	(325)	(696)	(644)	@	(14)	(30)	(36)
Management	@	(93)	(199)	(135)	@	(4)	(9)	(8)
Crafts	85	79	60	35	4	3	3	2
Education & Communication °	165	146	109	74	8	6	5	4
Food Processing	276	129	187	193	14	6	8	11
Housing & Construction +	322	260	213	128	16	11	9	7
Medicine & Health	90	55	36	36	4	2	2	2
Power	109	103	73	93	5	5	3	5
Transportation	@	@	25	19	@	@	1	1
Water & Sanitation	@	@	178	109	@	@	8	6
Home Improvement	77	62	@	@	4	3	@	@
Other	96	230	164	81	5	10	7	5
Total	2,036	2,285	2,283	1,773	100	100	100	100

*Includes 192 U.S.A. inquiries

() Sub-totals for Business categories

@ Not separately classified

°1968-69: Education

+1968-69: Construction

Table 2

FEEDBACK AND SAMPLING RATES

<u>Sector</u>	<u>In- quiries 1970 (No.)</u>	<u>Inquirers' Ap- praisals (No.)</u>	<u>Feed- back Rate* (%)</u>	<u>Evaluated Cases (No.)</u>	<u>Sam- pling Rate@ (%)</u>
Agriculture	343	129	37.6	60	47
Business-Management	199	62	31.2	44	71
Business-Technical	<u>696</u>	<u>234</u>	<u>33.6</u>	<u>100</u>	<u>43</u>
Total, three sectors	1,238	425	34.3	204	48

*Percentage of Inquirers' Appraisals to Inquiries

@ Percentage of Evaluated Cases to Inquirers' Appraisals

the original inquiry letter.* If later letters displayed more than marginal changes in these attributes, ratings were accordingly modified. Such modification of initial ratings was required, however, in only a relatively small proportion of the evaluated cases. Ratings presented in this report are the final scores.

The assigned ratings are summarized in matrix form for each sector and for all evaluated inquiries in Table 3, showing their cross-classification by Quality and Complexity. In percentage form, these ratings are separately summarized for each sector and for all cases in Table 4.

It will be seen in Table 4 that only 15 percent of the evaluated inquiries were assigned high Quality scores of 5 or 4. Just over a quarter were of Quality 3. The low and lowest brackets, Quality 2 and 1, total 57 percent of the evaluated cases. This volume of indifferent or poor inquiries presents one of the most intractable problems in VITA's operation of the inquiry service. Recommendations pointed to this underlying constraint on VITA program improvement must be a principal concern of the evaluation.

Sectoral contrasts in Quality of inquiry are also evident in Table 4. Twenty percent of the Agricultural queries are of the top two Quality grades, compared to 14 percent for Management and 12 percent for Technical inquiries. Thirty percent of the Agricultural group are of Quality 3, making 50 percent of average or better Quality, compared to only 39 percent for both the Management and Technical categories. These contrasts, and differences among the sectors in relative Quality/Complexity ratings, may be summarized as follows:

<u>Sector</u>	<u>Percent of cases with scores 3 or above</u>	
	<u>Quality</u>	<u>Complexity</u>
Agriculture	50%	32%
Management	39	32
Technical	39	23

The relative ratings of inquiries on these two attributes are a challenge to VITA in that the Quality of requests substantially exceeds their Complexity. On the whole, clarity of problem definition exceeds the intrinsic difficulty of the problems in question. This is clearly brought out in the matrix array of Table 3, on which the diagonal sloping downward from top left to bottom right contains the cells for which Quality equals Complexity. The degree to which Quality exceeds

*"Effect" ratings are defined in Evaluation Measure 4, page 93.

Table 3

DISTRIBUTION OF EVALUATED INQUIRIES
BY QUALITY AND COMPLEXITY

<u>Quality</u>	<u>Complexity</u>											
	<u>5</u>	<u>4</u>	<u>3</u>	<u>2</u>	<u>1</u>	<u>Total</u>	<u>5</u>	<u>4</u>	<u>3</u>	<u>2</u>	<u>1</u>	<u>Total</u>
	<u>Agriculture</u>						<u>Business - Management</u>					
5	0	1	1	0	0	2	0	1	2	0	0	3
4	1	0	4	3	2	10	0	1	1	1	0	3
3	0	0	6	4	8	18	1	0	1	4	5	11
2	0	0	3	4	6	13	0	0	4	2	3	9
1	0	1	2	2	12	17	0	0	3	2	13	18
Total	1	2	16	13	28	60	1	2	11	9	21	44

<u>Quality</u>	<u>Complexity</u>											
	<u>5</u>	<u>4</u>	<u>3</u>	<u>2</u>	<u>1</u>	<u>Total</u>	<u>5</u>	<u>4</u>	<u>3</u>	<u>2</u>	<u>1</u>	<u>Total</u>
	<u>Business - Technical</u>						<u>All Evaluated Inquiries</u>					
5	0	2	1	4	0	7	0	4	4	4	0	12
4	0	1	0	2	2	5	1	2	5	6	4	18
3	0	0	5	10	12	27	1	0	12	18	25	56
2	0	0	6	8	24	38	0	0	13	14	33	60
1	0	2	6	3	12	23	0	3	11	7	37	58
Total	0	5	18	27	50	100	2	9	45	49	99	204

Table 4

SECTORAL VARIATION IN QUALITY AND COMPLEXITY
OF EVALUATED INQUIRIES

Percentage of Evaluated Inquiries

<u>Rating</u>	<u>Agriculture</u>	<u>Business- Management</u>	<u>Business- Technical</u>	<u>Three Sectors</u>
<u>Quality</u>				
5	3	7	7	6
4	17	7	5	9
3	30	25	27	27
2	22	20	38	29
1	28	41	23	28
	100	100	100	100
<u>Complexity</u>				
5	2	2	0	1
4	3	5	5	4
3	27	25	18	22
2	22	20	27	24
1	47	47	50	49
	100	100	100	100

Complexity in each sector can be seen by an inspection of cells above this diagonal, and vice versa.

Contrasts between Quality and Complexity of inquiries are further summarized in Table 5. The two ratings are equal on 32 percent of all evaluated cases. Quality exceeds Complexity in 50 percent, while Complexity exceeds Quality in 18 percent of the evaluated problems.

The Quality and Complexity scales are not, of course, fully commensurable. The above challenge to VITA's performance should therefore not be pushed too far. But elements of commensurability are present. The main common element is that these scores are two ways of looking at the same thing: the idea in the mind of the inquirer. When rated on independent but symmetric scales, it appears that the average ability of inquirers to define problems is at least on a par with the nature of the problems they perceive, or somewhat higher.

Appraisal and Use of VITA Information by Inquirers

After an appropriate interval, VITA follows up its replies to requesters by providing an Appraisal Form which seeks factual details on how the information was used, as well as comments by the inquirer on prescribed questions. Inquirers' assessments and uses of VITA information as reported on the Appraisal Form or in letters sent on the inquirer's own initiative are analyzed in the present section.

Adequacy of feedback

In the three major sectors evaluated, just over one-third (34.3 percent) of all inquirers in 1970 returned some form of appraisal to VITA. No real yardstick is available for judging the adequacy of this feedback rate. By what is known of the experience of other international inquiry agencies, a 34 percent feedback rate seems reasonable, or even good. But by the standard of VITA's own objective of achieving an effective person-to-person exchange, such a rate of reply is not good enough. If only about one third of the persons who originally have the enthusiasm and interest which it takes to write a distant agency find it worthwhile to return the Appraisal Form, there is much room for improvement. A more satisfactory goal in terms of VITA's aspirations would be a feedback rate of better than half.

Analysis to determine how VITA might achieve a higher rate of feedback was not a specific objective of this evaluation, nor has such an analysis been carried out in the past. The evaluation does equip VITA with certain instruments with which to analyze the question, and provides a working hypothesis to be further tested. As seen in Tables 2 and 4, the sector with highest Quality inquiries, Agriculture, also has the highest feedback rate. Feedback rates by sector in 1970 were:

Table 5

RELATIVE QUALITY AND COMPLEXITY RATINGS
OF EVALUATED INQUIRIES, BY SECTOR

	<u>Number of Inquiries</u>			
	<u>Agriculture</u>	<u>Business- Management</u>	<u>Business- Technical</u>	<u>Three Sectors</u>
Quality exceeds Complexity	29	17	57	103
Quality equals Complexity	22	17	26	65
Complexity exceeds Quality	9	10	17	36
	60	44	100	204
	<u>Percentage</u>			
Quality exceeds Complexity	48	39	57	50
Quality equals Complexity	37	39	26	32
Complexity exceeds Quality	15	23	17	18
	100	100	100	100

Agriculture, 37.6 percent; Business-Technical, 33.6 percent; and Business-Management, 31.2 percent. The proposition can be advanced on the basis of these figures that the rate of feedback is related to the Quality exhibited in the inquirer's request.

VITA information and its use

Facts and guidance supplied by VITA have been utilized in improving an existing activity or implementing a new project in 74 of the 204 evaluated cases, or 36 percent. The sectoral breakdown of implementation rates and of other inquirer uses and appraisals is given in Table 6. Agricultural cases show the highest implementation rate, 43 percent. Implementation of Business-Management cases at 39 percent is above average, and of Business-Technical cases below average, at 30 percent.

In ten of the implemented Business inquiries, four Management and six Technical, VITA services were used to equip an extension agency, library, or research center with information needed for the development of local industry. Percentages representing these ten cases of indirect or intermediary use are shown in brackets on Table 6. If these percentages are deducted in order to give the sector-wise implementation rate by direct users, Agriculture's sectoral performance is further highlighted:

<u>Sector</u>	<u>Percentage Implementation by Direct Users</u>
Agriculture	43 %
Business-Management	30
Business-Technical	25

In 56 cases, or 27 percent of the total, VITA information was used in planning, developing, or evaluating a project whose implementation was still pending at the time of the inquirer's appraisal. In 15 instances, data sent by VITA was used in reaching a decision that conditions were not suitable or timely for the project under consideration.

In 14 cases, seven percent of those evaluated, VITA information was not useful, too late, or less useful than information obtained from other sources. In nine percent of the cases studied, the project was abandoned for reasons unconnected with the VITA inquiry. In 27 cases, 13 percent of the total, the feedback letter was too vague or unspecific to determine the action actually taken.

The informational content of each implemented case is summarized, by sector, in the following pages. The nature of pending action and of negative decisions is also examined. In subsequent sections, factors contributing to the rejection of information and relationships between inquirer use and Quality or Complexity of inquiry will be studied.

Table 6

INQUIRERS' USE OF VITA INFORMATION IN EVALUATED CASES,
BY SECTOR

	<u>Used in Project</u>	<u>Action Pending</u>	<u>Used in Deciding Against Project</u>	<u>Infor- mation Not Useful</u>	<u>Project Dropped</u>	<u>Un- known</u>	<u>TOTAL</u>
	<u>Number of Cases</u>						
Agriculture	26	18	5	4	2	5	60
Business- Management	17 (4)	9	3	2	3	10	44
Business- Technical	31 (6)	29	7	8	13	12	100
All Evaluated Cases	74 (10)	56	15	14	18	27	204
	<u>Percentage</u>						
Agriculture	43	30	8	7	3	8	100
Business- Management	39 (9)	20	7	5	7	23	100
Business- Technical	31 (6)	29	7	8	13	12	100
All Evaluated Cases	36 (5)	27	7	7	9	13	100

NOTE: Brackets show numbers and percentage of cases in which information is being used by library, research center, or extension service.

Agricultural uses. For the Agricultural cases, ratings and key elements of each implemented inquiry are set forth in Evaluation Abstracts 1. Evaluation abstracts are listed in successive order of Quality, Effect, and Complexity as rated by the evaluation team. Critique and observations by the evaluator on VITA's performance are presented in the column headed "Evaluator's Comment".

Implemented agricultural inquiries differ substantially in content and in geographic location, but show quite tight focus and definition of the variables involved. Of the five high Quality, high Complexity cases first listed, four are experimental or concerned with the initiation of new projects: R & D on process and equipment requirements for corn drying in Guatemala; design and control of fertilizer trials in Tonga; basic reference sources on starfish development, also for Tonga; and avoidance of root disease in introducing tomato cultivation in tropical Sierra Leone. Quality 3, Complexity 3 or 2 inquiries on the growing of plants in nutrient solutions (hydroponics) in Taiwan and on initiation of field research on laterite soils in Niger are similarly addressed to new, developmental projects. It is of note that five of the six queries just cited originated with Peace Corps Volunteers, evidently in favorable positions to launch long-term projects, yet see action started prior to the end of their tour of duty.

The initiator of the tropical tomato inquiry was a Peace Corps Agricultural Specialist. He reported successful pilot tomato culture, but onset of root disease when grown in field conditions, due in his judgment to ineffective soil sterilization. Nutrient and fertilizer requirements were asked. Two volunteers sent exhaustive replies, one seeking more details on tomato varieties grown, soil chemistry, and disease characteristics, the second sending much instructive data on these and related variables and on practical steps for fertilizer adaptation. The Peace Corps adviser sifted this advice and selected cultivation methods and nutrients which were in field trial by a farmer and a school student when he sent in his appraisal of VITA services.

Problems of existing farm production or inputs, generally rated lower in Complexity than the above developmental projects, are the subjects of other implemented inquiries: abnormalities in cattle reproduction in Algeria; inexpensive tests of rice polish nutrient quality in India; basic cultural requirements for expanding soybean production in Argentina, and for substituting drought-resistant sorghums for corn in northeast Brazil; control of pineapple diseases in Bolivia; and assessment of insecticide hazards in India.

On projects of longer gestation such as the tomato trials, or the bullock harness design cited in the Evaluation Abstract for Tanzania and the moldboard plow for Sierra Leone, the evaluation made it clear that feedbacks at recurrent intervals should be obtained to learn end

Evaluation
Abstracts 1

RATINGS AND KEY ELEMENTS OF IMPLEMENTED INQUIRIES

Agriculture

<u>SOURCE</u>	<u>COUNTRY</u>	<u>SUBSTANCE OF INFORMATION</u>	<u>INQUIRER'S ACTION AND APPRAISAL</u>	<u>EVALUATOR'S COMMENTS</u>
<u>Quality 5, Effect 3, Complexity 4</u>				
PCV* for Guatemala Inst. of Agrarian Reform		Advice on existing plan for development of corn drying methods and equipment. Burner and fan problems.	Information useful in plan review, but some a little too primitive	Coordinator needed technical support in followup letter. Research lead missed.
<u>Quality 4, Effect 3, Complexity 5</u>				
PCV for Tonga Dept. of Agriculture		Design, controls, and interpretation of fertilizer experiments. Soil sample sent; volunteers send simple trial designs and ask many questions; contact set up with New Mexico State University lab.	Fertilizer trials in process. In frequent correspondence with volunteers and has come in with several more inquiries.	Except for slow start this is a shining example of what can be done by mail.
<u>Quality 4, Effect 3, Complexity 3</u>				
Artificial in-semination technician	Algeria	Causes of high repeats and abnormalities in cattle reproduction. Diet supplements, effect of heat, care, and water requirements.	Reports confirmed basic understanding of problem.	Replies well focused on geographic area and conditions.
PCV for Tonga Dept. Ag.		Literature on starfish and addresses of reference sources.	Wrote sources. Ag. Dept. asked followup when PCV left post.	VITA should have tapped more volunteers for missing sources. Still following up.

*American Peace Corps Volunteer

<u>SOURCE</u>	<u>COUNTRY</u>	<u>SUBSTANCE OF INFORMATION</u>	<u>INQUIRER'S ACTION AND APPRAISAL</u>	<u>EVALUATOR'S COMMENTS</u>
PC Agr. Special-ist	Sierra Leone	Nutrient requirements, fertilizers, soil sterilization to avoid root disease in tropical tomatoes.	One farmer, one secondary school student trying out under field conditions.	Practical, detailed volunteer replies on interacting variables.
<u>Quality 4, Effect 2, Complexity 2</u>				
PCV	India	Quick, low cost tests of rice polish quality for poultry feed. Bulk, microscopic, crude fiber.	10 PCVs and intensive poultry staff briefed. Saved 400 tons feed by rejecting adulterated polish.	Requester's thorough inquiry brought very informative answers.
PCV	Haute Volta	Plans for chick incubators using local materials.	Built incubator, worked, plan make more. 10 farms affected.	Library plans useful, but volunteer replies wide of the mark.
<u>Quality 4, Effect 2, Complexity 1</u>				
Private	Argentina	Soybean cultivation, soils, seed, fertilizer	Translated and distributed to 1,800 farmers. More details would be welcome.	More information should have been sent, especially in light of feedback.
<u>Quality 3, Effect 4, Complexity 3</u>				
Ministry of Econ. Affairs	Taiwan	Economics of hydroponics and steps to start production. Also on vermiculite production.	Excellent replies, used for exploratory and planning studies.	All out job, probably because inquirer is known to VITA and is very knowledgeable.
<u>Quality 3, Effect 3, Complexity 3</u>				
IESC*	Singapore	Banana growing on large plantation scale.	Extremely useful.	Would have been instructive if inquirer had said just how information used.

*International Executive Service Corps

<u>SOURCE</u>	<u>COUNTRY</u>	<u>SUBSTANCE OF INFORMATION</u>	<u>INQUIRER'S ACTION AND APPRAISAL</u>	<u>EVALUATOR'S COMMENTS</u>
		<u>Quality 3, Effect 3, Complexity 2</u>		
PCV	Brazil	Substituting sorghum for corn in animal diets. Cultivation, storage, grinding, recipes.	VITA improved on local information. 60 farmers using on demonstration plots.	Value of sending to several volunteers demonstrated. Needs new feedback.
		<u>Quality 3, Effect 2, Complexity 2</u>		
Miss-ionary	Madagascar	Planting, care, fertilizing, uses of coconut trees.	Translated into Malagasy. 100 families will plant.	Requester improving local cash crops, well organized.
PCV	Niger	Background material for research on laterite soils.	"Accrued broad background from which I can start."	Clear, excellent information. On-going exchange.
		<u>Quality 3, Effect 2, Complexity 1</u>		
PCV	India	How to control monkeys from damaging crops.	Compiled suggestions and distributed in district.	Lack of feedback on former problems limits value.
		<u>Quality 2, Effect 4, Complexity 2</u>		
Miss-ionary	Tanzania	Design for simple bullock harness.	Harness made by carpenter with German-Tanzanian agricultural team. Tests will take three years.	Feedback should be requested each year without fail.
		<u>Quality 2, Effect 3, Complexity 1</u>		
Miss-ionary	Kenya	Beekeeping. Drawings of smoker and extractor.	Built to plans. Work "beautifully". Cites best source and describes hive found easy to construct.	Requester tests, pursues, recommends. Very useful feedback.

<u>SOURCE</u>	<u>COUNTRY</u>	<u>SUBSTANCE OF INFORMATION</u>	<u>INQUIRER'S ACTION AND APPRAISAL</u>	<u>EVALUATOR'S COMMENTS</u>
PC Agr. Spec	Sierra Leone	Sketch and plans for moldboard plow.	Local steel fabricator made two prototypes, now being tested. Plan should show more dimensional detail.	Need another feedback on how plow worked.
PCV	Costa Rica	Citrus crops	Information used, no details.	
<u>Quality 2, Effect 2, Complexity 3</u>				
Private	India	Evaluate relative dangers of three insecticides.	Comparative information used in deciding to continue use of one type for now.	No final answer known but balanced "state of opinion" provided.
PCV	Tonga	Strawberry cultivation.	Used, but limited value.	More volunteer inputs needed. VITA scores negative.
<u>Quality 2, Effect 1, Complexity 2</u>				
Miss-ionary	Bolivia	Control of pineapple plant diseases.	After trying 11 earlier sources, VITA answer gave lead to motorized sprayer.	Good volunteer answers and referrals exposed many angles of problem.
<u>Quality 1, Effect 3, Complexity 1</u>				
Techno-serve	Dominican Republic	Basic information on poultry farming. Sent Peace Corps Poultry Manual from library.	"Our cooperative field worker will find invaluable."	

<u>SOURCE</u>	<u>COUNTRY</u>	<u>SUBSTANCE OF INFORMATION</u>	<u>INQUIRER'S ACTION AND APPRAISAL</u>	<u>EVALUATOR'S COMMENTS</u>
<u>Quality 1, Effect 2, Complexity 1</u>				
Univer- sity Ext. Service	Philip- pines	Water pump plan	Used in teaching. "Extremely useful"	Basic plan useful in teaching application.
<u>Quality 1, Effect 1, Complexity 1</u>				
Private	India	Sources of old poultry journals, list of poultry magazines, USDA publications. Poultry articles.	"I am now in proper touch."	
Private	India	Packing and transporting eggs. Economic egg production.	Decided on flats. Established correspondence with volunteer in New Delhi.	Substantial replies from volunteers and American Poultry Institute.
Private	Ethiopia	Poultry raising, library materials.	Built brooder based on plan sent by VITA. Very successful.	Basic plan geared to individual farmer's requirements.

results. Need for later feedback is even more pronounced on many projects in the "Pending" category. The range of such pending action is indicated by this partial list: hot weather potato storage using local materials, Haute Volta; breeds of beef cattle suited to Malaysia's climate; plans for a simple corn sheller, Ivory Coast, and rice huller, India; success with pelletized onion seed and sweet corn obtained through VITA advice, Panama.

In Agriculture, inquiries in which VITA information was used in arriving at a decision not to proceed mainly involve ideas for introducing crops not commercially grown in the region: grapes for Korea, mushrooms for Ghana, tea for the Congo, and turmeric for Bolivia. These were Quality 3 and 2 inquiries, mostly of Complexity 1. The inquirer considered information sent by VITA sufficient to show that the new crop entailed higher costs or greater difficulties than he was prepared to meet. Waste of effort and resources was thus averted.

Diversity of Business-Management inquiries. By contrast with the focused, physical substance of most agricultural cases, implemented Business-Management inquiries cover an even wider variety of topics and are characteristically diffuse in content. Evaluation Abstracts 2, which summarizes these inquiries, includes three market research cases, two in industrial project analysis, two on financial management, two on common market preconditions and effects, two on new product uses (which might better be classified as Technical, though they have economic aspects), one on management of new technology, and several on scattered topics.

Since the content of implemented cases is set forth in the Abstracts, we may further illustrate the range of Management requests by citing pending cases and those on which negative decisions were reached. Examples of pending action:

1. The Director of the Association of Banks in Israel asked through OECD for information on the effects of a selective employment tax imposed in various countries; how far, and to what extent it affected prices and the deployment of labor. His appraisal: "We intend to go through the material and arrive, if possible, at some conclusions. It is not clear at present whether such a tax will be imposed or not. Nevertheless, we want to know as far as possible what are likely to be the economic implications if such a tax is imposed."
2. A requester in Indonesia was interested in helping to revive a long-established, but declining credit union, and asked for suggestions. His letter commenting on the information sent indicates that he is continuing to correspond with one of the VITA volunteers on the matter.

Evaluation
Abstracts 2

RATINGS AND KEY ELEMENTS OF IMPLEMENTED INQUIRIES

Business - Management

<u>SOURCE</u>	<u>COUNTRY</u>	<u>SUBSTANCE OF INFORMATION</u>	<u>INQUIRER'S ACTION AND APPRAISAL</u>	<u>EVALUATOR'S COMMENTS</u>
		<u>Quality 5, Effect 4, Complexity 4</u>		
PROMEXPORT Industry Dept.	Brazil	Marketing advice on exports of manufactured goods, processed foods, crafts from Brazil. Names of importers, distributors.	Very useful to craftsmen of Pernambuco. Published information on export contacts in regional newspaper.	Volunteers knowledgeable on product opportunities and importers. Knew key people to contact.
		<u>Quality 4, Effect 4, Complexity 2</u>		
27 PROMEXPORT Industry Dept.	Brazil	Information on legislation and regulations affecting import to U.S. of Brazilian products.	A great help to handicraft exporters.	Advised on legislation and referred to U.S.Consul.
		<u>Quality 3, Effect 5, Complexity 5</u>		
Dept. Nat'l Planning (via OECD)	Colombia	Economies of scale in different industries for 5-nation customs union. Variables to be analyzed.	Extremely useful in analyzing which industries to allocate to each country.	Reply extensive but not pointed. VITA should have called on volunteers in business schools or economics departments.
		<u>Quality 3, Effect 4, Complexity 2</u>		
Instituto de Fomento Industrial	El Salvador	Data on U.S. imports of vegetable waxes provided by U.S. Tariff Commission	Used in market analysis.	VITA went to authoritative source and obtained exact data needed.

RATINGS AND KEY ELEMENTS OF IMPLEMENTED INQUIRIES

Business - Management

<u>SOURCE</u>	<u>COUNTRY</u>	<u>SUBSTANCE OF INFORMATION</u>	<u>INQUIRER'S ACTION AND APPRAISAL</u>	<u>EVALUATOR'S COMMENTS</u>
		<u>Quality 3, Effect 3, Complexity 3</u>		
Instituto Di Tella (via OECD, AID)	Argentina	Approaches to management of technology, for use by Argentine firms and in training managers.	"Your help was crucial" in showing that very little has yet been done on this subject; therefore will have to do the research themselves.	VITA should have followed up. Volunteers could give substantive assistance in the research.
		<u>Quality 3, Effect 3, Complexity 1</u>		
P.C.V.	Brazil	List of U.S. firms which import 4 specified fruits, or their concentrates.	Exactly what was wanted. Wrote to named companies.	Right on the nose.
Cooperative of 5 tung oil factories	Argentina	Research on new uses for tung oil. Group is member of Pan American tung organization. Specifically ask about Battelle's work in this field.	Requested and obtained from Battelle a proposal for research.	Battelle also thanked VITA for its "intermediary" role. Coordinator very tactful in handling.
		<u>Quality 3, Effect 2, Complexity 2</u>		
Private Company	Colombia	Systems to evaluate used equipment. Rating systems provided and book cited.	Used. Explains that purpose is to appraise loan collateral.	Reply was less specific than it might have been because of lack of knowledge of requester's purposes.
		<u>Quality 3, Effect 1, Complexity 2</u>		
Engineering Company	India	Record systems for man-hours and inventory.	Modified to suit his requirements and used to provide cost estimates to customers.	Very complete answer provided.

RATINGS AND KEY ELEMENTS OF IMPLEMENTED INQUIRIES

Business - Management

<u>SOURCE</u>	<u>COUNTRY</u>	<u>SUBSTANCE OF INFORMATION</u>	<u>INQUIRER'S ACTION AND APPRAISAL</u>	<u>EVALUATOR'S COMMENTS</u>
<u>Quality 2, Effect 3, Complexity 2</u>				
Dept. of Finance (via OECD, AID)	Cayman Islands, W.I.	Deficit financing of capital programs in underdeveloped countries.	Government economist used the information.	Problem not clearly defined, brought in-exact response; not clarified by coordinator.
<u>Quality 2, Effect 2, Complexity 1</u>				
Private Individual	Ethiopia	Utilizing Arabic gum for cottage industries; fully covered in Tropical Products Institute Report.	Useful. Would like updated version mentioned by T.P.I.	T.P.I. will send as soon as ready.
FAO (via OECD)	Italy	Bibliography on European Common Market effects.	Of great interest. Has considerable value and is much appreciated.	Specialized literature search of type normally performed by research agency.
<u>Quality 1, Effect 4, Complexity 3</u>				
Developm't Bank (via UNIDO)	Jordan	Requirements and layout for setting up a battery factory. Through Dept. of Commerce contact made with 2 firms which provide "package" plants. Literature also sent.	Books suggested are being ordered.	A good deal more information on battery production could have been searched from VITA files. Time consuming.

RATINGS AND KEY ELEMENTS OF IMPLEMENTED INQUIRIES

Business - Management

<u>SOURCE</u>	<u>COUNTRY</u>	<u>SUBSTANCE OF INFORMATION</u>	<u>INQUIRER'S ACTION AND APPRAISAL</u>	<u>EVALUATOR'S COMMENTS</u>
<u>Quality 1, Effect 3, Complexity 3</u>				
Arab Economic Developm't Fund (via OECD)	Kuwait	Bibliographies and documents on techniques of rock salt production and international salt markets.	Very valuable. Has been of much assistance in compiling data.	Nice work. Notable persistence on part of VITA staff in getting responses.
<u>Quality 1, Effect 3, Complexity 1</u>				
Ministry of Economic Planning (via OECD, AID)	Tanzania	Preparation of feasibility and PERT studies. Product costs and feasibility guide.	Several government economists used the information.	University of North Carolina material good; simple, but not very substantial.
<u>Quality 1, Effect 1, Complexity 1</u>				
Contact Lens Company	Brazil	Promotional material on contact lenses.	Conflicting feedbacks. One says information used, other, not used.	Much correspondence over a trivial request.
Missionary	Nigeria	Names of foam plastic manufacturers and bibliographies on mold making	Useful.	Spare time interest of a pilot who never explained his purposes.

3. The Chamber of Commerce in Trinidad reported that their member, who had requested information on the production of masking tape, sandpaper, and sanding discs on a small scale, was studying the comparative literature prior to making a decision.

Some requesters studied the information provided, and then decided against what they had had in mind. Such a decision can result in a saving of time, labor, and/or capital. Examples:

1. A missionary in a Nigerian leprosarium helps patients to devise and construct improved farm implements as part of a rehabilitation program. Sometimes the ideas are appropriated by larger firms, who then produce the same implements on a large scale. The missionary was thinking of getting the devices patented to prevent this. Upon learning that the patent process in Nigeria is costly and involved with that of the U.K. patent office, he wrote: "I think it may be more trouble than it is worth." Instead he reported the situation to the Intermediate Technology Development Group in England, leaving any action to be taken to them.

2. A representative of the Malta Development Corporation had asked through OECD for industry profiles on glass bottles. After receiving the information, he wrote: "The literature sent to us has proved very useful, unfortunately in a negative way. The promoter concerned has come to the conclusion that the lack of raw materials will not justify the setting up of a glass bottle industry in Malta, particularly since the local demand is limited to a population of 300,000."

As seen in Table 6, Business-Management cases include the largest share, 23 percent, on which action by the inquirer cannot be established even though an appraisal was received. Inspection shows that eight of the ten Management inquiries for which action is "Unknown" were received through intermediary agencies, principally OECD and AID. Seven of the eight were Quality 1 inquiries, and of these two were Complexity 2 and five Complexity 1. Content ranged from "management of government-owned corporations", to "advice on machine leasing", and "information on stock exchanges and money markets". The wide-open nature of such inquiries obviously makes it difficult to pinpoint any action that may result.

Business-Technical inquiries. Implemented Technical inquiries, summarized in Evaluation Abstracts 3, are notable for specificity of detail and sharp problem definition. Most Technical cases in which VITA information has been applied are those of existing companies

Evaluation
Abstracts 3

RATINGS AND KEY ELEMENTS OF IMPLEMENTED INQUIRIES

Business - Technical

<u>SOURCE</u>	<u>COUNTRY</u>	<u>SUBSTANCE OF INFORMATION</u>	<u>INQUIRER'S ACTION AND APPRAISAL</u>	<u>EVALUATOR'S COMMENTS</u>
<u>Quality 5, Effect 2, Complexity 4</u>				
Mission Training School	Congo (Lulua-bourg)	Fabrication of press and making or purchase of dies to stamp metal braces for volume production of folding wooden cots.	Implemented suggestions, starting industry employing 50 trainees who will work in community programs.	Volunteer answered request in detailed, thorough manner, aided by design sketch provided by inquirer.
<u>Quality 5, Effect 2, Complexity 3</u>				
PCV	Mali	Equipment and process for essential oil extraction from citrus fruit.	Project started. Direct correspondence with equipment supplier established.	Need another feedback to determine ultimate results.
<u>Quality 4, Effect 4, Complexity 1</u>				
Missionary	Congo	Salt block manufacture for cattle: composition, mineral traces, binders, water volume, granulation, pressure.	Experimenting with small press and new binder. Encouraging results, could affect cattle throughout region.	Need a later feedback.
<u>Quality 4, Effect 2, Complexity 4</u>				
Private Consulting Firm	India	Production technology for power cables. Modification of machine for laying-up sector cables, to remove bottleneck. Sketch sent.	After exchanges with two volunteers who had sent alternative solutions, results satisfactory.	Encouragement to consulting profession and productivity gain warrants substantial detail provided by VITA.

<u>SOURCE</u>	<u>COUNTRY</u>	<u>SUBSTANCE OF INFORMATION</u>	<u>INQUIRER'S ACTION AND APPRAISAL</u>	<u>EVALUATOR'S COMMENTS</u>
<u>Quality 4, Effect 2, Complexity 2</u>				
Private Manufacturer	India	Machining methods and material specifications for internal gears and shaft seals for industrial rotary pumps.	Acknowledges specific and complete details. Putting to trial in production.	Vegetable oil refineries and other pump users benefit indirectly as well as this manufacturer.
<u>Quality 3, Effect 4, Complexity 2</u>				
Ag. Department	Zambia	Availability, specifications, price small oil expressor; also for hand-operated can sealer and simple processing retort.	Used by 10 extension agents in Western Province to demonstrate home and community food preservation.	Exceptional VITA library coverage this subject made reference to volunteers unnecessary.
<u>Quality 3, Effect 3, Complexity 3</u>				
Private Manufacturer	India	Manufacturing methods for synchronous motor for oscillograph. Asked for design; volunteer not a designer but suggests design features to look for in duplicating existing motors.	Producing drive mechanism and progressively taking up motor elements, buying at first. Advice "extremely useful". Asks VITA help on quantity discount from U.S. supplier.	Very sound technical collaboration at arms length because manufacturer and volunteer speak the same language. VITA keeps out of commercial disagreement.
<u>Quality 3, Effect 2, Complexity 2</u>				
Private Engineer in Mfr'g Company	India	Pressing, hardening, tempering harrow discs; edge grinding.	Heat treatment process and other suggestions result in good quality product.	First replies incomplete. VITA followup with U.K. company succeeded.
Private	Botswana	Diagram for mixing basin for cattle to mix clay for bricks	Some information helpful, other too primitive for size of operation.	Failure to refer to volunteers, reliance on library, missed specifics of the operation.

<u>SOURCE</u>	<u>COUNTRY</u>	<u>SUBSTANCE OF INFORMATION</u>	<u>INQUIRER'S ACTION AND APPRAISAL</u>	<u>EVALUATOR'S COMMENTS</u>
<u>Quality 3, Effect 2, Complexity 1</u>				
Univer- sity Ext. Ctr. UNIDO)	Rwanda (via UNIDO)	Glass manufacturing methods and factors in feasibility of cottage scale production	Used by 20 Extension staff to evaluate projects for promotion	Assistance in building a basic industrial advisory capability in Rwanda.
<u>Quality 3, Effect 1, Complexity 3</u>				
Private manufac- turer	Israel	Formula for chromium coating and "sputtering" methods in razor blade manufacture	Appreciates information and is following up with suppliers of equipment	VITA should have asked that cited booklet be sent to inquirer.
<u>Quality 3, Effect 1, Complexity 1</u>				
Private manufac- turer	Mexico	Material to clean and purify bronze castings from scrap: lithium sticks, capsules, alloy.	Has given "the results I desire, notably bettering the quality of material which we make".	Volunteer zeroed right in on what was needed, and also brought supplier into picture usefully.
Miss- ionary	Japan	Offset printing glaze removal. Three solutions sent, each different.	Alternative solutions evaluated, one applied successfully.	Coordinator sent solutions without comment but request-er able to weigh.
<u>Quality 2, Effect 4, Complexity 1</u>				
Indus- trial Dev. Ctr. for Arab States	U.A.R. (via OECD and AID)	Current and basic bibliography on paper industry	Supports industrial docu-mentation and information function serving eight Arab countries	Thorough answer sent, but only after fruitless leads. Improved access to specialized biblio-graphies needed.

<u>SOURCE</u>	<u>COUNTRY</u>	<u>SUBSTANCE OF INFORMATION</u>	<u>INQUIRER'S ACTION AND APPRAISAL</u>	<u>EVALUATOR'S COMMENTS</u>
<u>Quality 2, Effect 3, Complexity 2</u>				
Univ- ersity Ext. Ctr.	Rwanda (via UNIDO, OECD)	Potential manufacture of roof tiles from fibrous matter mixed with cement. Volunteer doubts feasibility due weight, poor bond.	Evaluating for industrial extension service	Since reply negative but effect potentially wide, more than one volunteer should have been consulted.
<u>Quality 2, Effect 2, Complexity 3</u>				
Univ- ersity Ext. Ctr.	Turkey	Requirements for simple pump manufacture; also other rural products	Used to educate selves on approach to program development for rural industry	Needs another feedback, also contact with industrial advisory specialists.
Private manu- facturer	India	Source of machinery for manufacture of thermostatic bellows. Proprietary suppliers named. Rebuilding of general purpose machinery briefly explained.	Helpful information received from companies named. Scheme under development.	Peace Corps Volunteer working with company suggested VITA approach. Project may be beyond firm's present scope.
<u>Quality 2, Effect 2, Complexity 2</u>				
Univ- ersity Ext. Ctr.	Rwanda (via UNIDO, OECD)	Use of volcanic rock as building material. University of Hawaii bibliography on building applications.	Evaluating for local application. "It is necessary to have interesting information in the beginning".	Replies realistic in pointing out limits as well as feasible uses of lava rock.
Univ- ersity Ext. Ctr.	Rwanda (via UNIDO, OECD)	Rope and string manufacture from sisal, bamboo, papyrus. Pertinent information and questions raised by volunteers.	Rope project looks favorable; hope start next year.	VITA has given a sense of reality to extension service which is just starting and must build confidence.

<u>SOURCE</u>	<u>COUNTRY</u>	<u>SUBSTANCE OF INFORMATION</u>	<u>INQUIRER'S ACTION AND APPRAISAL</u>	<u>EVALUATOR'S COMMENTS</u>
<u>Quality 2, Effect 2, Complexity 1</u>				
Private corporation	Taiwan	Method of heat transfer, exchanger selection, in refrigerator manufacturer.	Useful and applied in modifying product.	Inquiry not sufficiently specific, slowed effective reply.
PCV	India	Sunflower cultivation, oil extraction. Factors in profitability vs. competitive oilseeds.	Applied in farm extension program.	Reference to former cases revealed various aspects influencing feasibility.
<u>Quality 2, Effect 1, Complexity 1</u>				
Private	Malaysia	Methods of marking wood rulers, manufacturing plastic rulers. Three-way letters with two volunteers being exchanged.	Successfully made wood rulers but faced plastic cost advantage. Working on plastic ruler production; results not yet in. Needs another feedback.	Technical problem shifted to cost problem. Both volunteers outstanding examples of effective and satisfying person-to-person transfer of technology.
Private (via Instituto de Fomento)	El Salvador	Extraction of diosgenin from barbasco roots; method, flow diagram, equipment	Information used by three producers	
Private	Papua New Guinea	Addreses of shipping companies, electronics product suppliers	Contacted. May widen trade contacts from U.K. only to U.S.	Volunteer with knowledge of the trade named relevant firms.
University	Trinidad	VITA booklets on small canning facilities	Used in industry extension service.	Supplied by VITA library. No volunteer reference necessary.

<u>SOURCE</u>	<u>COUNTRY</u>	<u>SUBSTANCE OF INFORMATION</u>	<u>INQUIRER'S ACTION AND APPRAISAL</u>	<u>EVALUATOR'S COMMENTS</u>
Private	India	Formula, methods, and home-made equipment for manufacturing tooth powder. Improved saponification process, materials.	On home industry basis, made two pilot batches and is continuing to experiment. Appreciative.	Good back and forth exchange on problems and methods of solving.
Private	Brazil	Circuit diagrams for metal detection apparatus	Sent three feedback letters saying problem met by diagrams received.	All diagrams provided by manufacturers; no volunteers contacted.
<u>Quality 1, Effect 1, Complexity 1</u>				
Private	India	Jute weaving as home industry	Information used as instructional material in training program	Library material only.
Private manufac- urer	India	Colored candle making. Method of mixing salts with wax to ensure continuous flame.	Materials very useful. Also receiving help from Indian Institute of Petroleum.	Candle packet in VITA library satisfied request.
Private	India	Cosmetic formulas	Information used to make hair spray satisfactorily.	Requester experimenting, evidently not yet in the market.
Private manufac- urer	India	Problems in coated paper manufacture. Drying defects, curling of gummed papers. Second coating over first in transfer decal papers. Three volunteer replies, each with different, specific answer.	Very many thanks, defects solved. "The indications of all the three scientist-volunteers have been incorporated in our equipment and process."	Remarkable that three different responses each focused sharply on need, with good results.

already engaged in the line of production to which their problems relate. Manufacturing methods for a wide variety of products are covered, demanding volunteer contributions from many specialized fields of production technology. A review of the Abstracts will reveal the sharpness of detail which characterizes these implemented projects.

Sectorwise implementation and information content

With perspective enlarged at this point to cover all three major categories, the immense variety of techno-economic problems and conditions encountered in successful inquiries is strikingly evident. It has been possible to see that implemented Management inquiries are more diffuse in individual content than Agricultural or Technical inquiries. But this after all is what is implied in Management. And since the rate of implementation of Management cases falls between that of the other two sectors, no conclusion as to the effects of diffuseness vs. focus on implementation can be drawn.

It is necessary to turn to other inquiry attributes and to factors in VITA's response, if sectorwise differences in implementation are to be understood.

Influence of Quality and Complexity on Implementation

For each sector, a cross-classification of implemented inquiries by Quality and Complexity is displayed in Table 7. The prominence of implemented inquiries in above-diagonal cells where Quality exceeds Complexity is even more pronounced than for all evaluated inquiries (Table 3). This is true for all three sectors. The strong incidence of implemented cases among those for which Quality exceeds Complexity can be summed up most succinctly by comparing the relative ratings of implemented inquiries to those of all evaluated inquiries:

<u>Relative Ratings</u>	<u>Number of Inquiries</u>		<u>Percent</u>
	<u>Total</u>	<u>Implemented</u>	<u>Implemented</u>
			<u>to Total</u>
			%
Quality exceeds Complexity	103	42	41
Quality equals Complexity	65	24	37
Complexity exceeds Quality	36	8	22

Sectoral consistency in this pattern can be seen in the percentages of implemented inquiries lined up with percentages of all evaluated inquiries, by sector, in each relative rating class:

Table 7

NUMBER OF IMPLEMENTED INQUIRIES
BY QUALITY AND COMPLEXITY

<u>Quality</u>	<u>Complexity</u>						<u>Complexity</u>					
	<u>5</u>	<u>4</u>	<u>3</u>	<u>2</u>	<u>1</u>	<u>Total</u>	<u>5</u>	<u>4</u>	<u>3</u>	<u>2</u>	<u>1</u>	<u>Total</u>
	<u>Agriculture</u>						<u>Business - Management</u>					
5	0	1	0	0	0	1	0	1	0	0	0	1
4	1	0	3	2	1	7	0	0	0	1	0	1
3	0	0	2	3	1	6	1	0	1	3	2	7
2	0	0	2	2	3	7	0	0	0	1	2	3
1	0	0	0	0	5	5	0	0	2	0	3	5
Total	1	1	7	7	10	26	1	1	3	5	7	17
	<u>Business - Technical</u>						<u>All Evaluated Inquiries</u>					
5	0	1	1	0	0	2	0	3	1	0	0	4
4	0	1	0	1	1	3	1	1	3	4	2	11
3	0	0	2	3	3	8	1	0	5	9	6	21
2	0	0	2	3	9	14	0	0	4	6	14	24
1	0	0	0	0	4	4	0	0	2	0	12	14
Total	0	2	5	7	17	31	2	4	15	19	34	74

Relative Ratings	Sector and Percentages							
	Agriculture		Management		Technical		All	
	All Cases	Imple-mented	All Cases	Imple-mented	All Cases	Imple-mented	All Cases	Imple-mented
	%	%	%	%	%	%	%	%
Q exceeds C	48	54	39	53	57	61	50	57
Q equals C	37	35	39	29	26	32	32	32
C exceeds Q	15	11	23	17	17	7	18	11
	100	100	100	100	100	100	100	100

In each sector, the percentage of implemented inquiries is higher than the percentage of all evaluated inquiries in the "Quality exceeds Complexity" class, and below that of all evaluated inquiries in the "Complexity exceeds Quality" class.

Separate influences of Quality and Complexity on implementation can be seen in Table 8, which classifies the inquirer's use of VITA information for cases in each Quality and Complexity grade. These relationships can be seen more clearly when the small number of grade 5 and 4 cases are combined, and when percentages representing research or extension use are excluded. Percentages in the Table 8 column headed "Used in Project" then stand as follows:

Rating	Used in Project	
	Rated by Quality	Rated by Complexity
	%	%
5 and 4	50	55
3	38	33
2	32	29
1	25	29
All Cases	31%	

The decrease in the rate of inquiry implementation with decrease in inquiry Quality is both sizeable and steady. We conclude that the Quality of inquiry has a significant influence on implementation.

Except for Complexity 5 and 4 grades, on the other hand, there seems to be little relationship between implementation and Complexity. Implementation of 55 percent of Complexity 5 and 4 inquiries, compared to overall implementation of 31 percent (when indirect use cases are excluded), may provisionally be taken as evidence of more than average attention to such problems on the part of VITA. We return to this evidence in discussing factors in VITA performance later in this chapter.

Implementation is an undefined resultant of the originator's motivation and command of his project, on the one hand, and of VITA's performance in filling gaps in his information and judgment. From the

Table 8

INQUIRERS' USE OF VITA INFORMATION IN EVALUATED CASES,
BY QUALITY AND COMPLEXITY

<u>Quality and Complexity Ratings</u>	<u>Used in Project</u>	<u>Action Pending</u>	<u>Used in Deciding Against Project</u>	<u>Information Not Useful</u>	<u>Project Dropped</u>	<u>Unknown</u>	<u>TOTAL</u>
	<u>Percentage of Cases</u>						
<u>Quality</u>							
5	33	42	0	0	17	8	100
4	61	33	0	0	6	0	100
3	38	34	11	11	5	2	100
2	40 (8)	22	8	7	12	12	100
1	24 (9)	22	7	7	9	31	100
<u>Complexity</u>							
5	100	0	0	0	0	0	100
4	44	22	0	11	11	11	100
3	33	29	13	9	7	9	100
2	39 (10)	31	6	6	10	8	100
1	34 (5)	26	6	6	9	18	100
<u>All Evaluated Cases</u>	36 (5)	27	7	7	9	13	100

NOTE: Brackets show percentage representing information being used by library, research center, or extension service.

implementation pattern seen above, it is reasonable to conclude that Quality of inquiry as rated by the evaluators is a meaningful measure of the inquirer's thoroughness and competence to carry through a project.

From inquirers' reports on the number of cases in which VITA information has contributed to project implementation, taken against the pattern of relative Quality/Complexity ratings, it is evident that VITA has fully measured up to the challenge posed earlier by the excess of Quality over Complexity in problems submitted by inquirers.

Factors in VITA Performance

We turn to an internal perspective on effectiveness: to the performance of volunteers, and the process of selecting volunteers and other information sources for each inquiry.

Two approaches to assessing VITA's "search and match" process were adopted. Steps involved in selecting volunteers and information were first identified and translated into performance factors on which subjective ratings could be assigned. Then objective measures of volunteer involvement, utilization, and response were developed. In conclusion, the two lines of evaluation are joined.

Evaluating performance factors

Qualities essential to effective information exchange on the part of VITA and the requester are set forth in Evaluation Measure 3, "Factors in Success or Failure". The four factors first defined - "Skills", "Fit", "Match", and "Feelings" - bear particularly on the responses sent by VITA volunteers. Staff and volunteer "coordinators" at VITA headquarters who have the chief responsibility for selecting respondents and materials for each inquiry are also concerned with these four factors, but have even larger concern with "Critique", "Finish", and "Timing". Although the manager of the inquiry service sees each inquiry on its arrival and is able to observe the progress and adequacy of response on a continuing sample of cases, the volume of inquiries handled - averaging 190 per month in recent years - require that inquiry coordinators assume primary responsibility for the quality of VITA's performance on individual inquiries.

The evaluation team arrived at its rating of each performance factor on each case by examining all materials in the case file and assigning a single overall score. A simple three-point scale was applied: 0 for Ordinary or Average, + for a Positive or extra measure of quality, and - for Negative or clearly inferior response.

The chief factors in the requester's effectiveness were also identified and rated. Evaluation Measure 3 lists these qualities - "Maturity"

Evaluation Measure 3

FACTORS IN SUCCESS OR FAILURE

On VITA's part

Skills	Do the number and skills of Volunteers and organizations who responded match the complexity of the problem?
Fit	Do the answers fit the detailed request?
Match	Do the answers match the resources, size of operation, and other circumstances revealed in the request?
Feelings	Is there an element of insensitivity, "We know best" in material sent to the inquirer? Or, conversely, an attitude that would encourage the requester to pursue?
Critique	Did the coordinator adequately review, criticize, comment on, and select from the material supplied?
Finish	Should more complete information have been asked of the requester, Volunteers, or other sources? Or was it, and did it help in giving satisfactory answers?
Timing	Was the response sent without undue delay and on time to be effective?
Other	Specify.

On part of requester

Maturity	Were the pre-conditions and timing right for beginning project?
Management/ Technical	Did the requester have adequate management and technical ability to carry out the project?
Market	Was there a market for product?
Capital	Was funding available for project?
Motivation	Was the requester's commitment to the project too low, or did he show a genuine interest in proceeding?
Other	Plus or minus factor which evaluator noted.

<u>Rating Code:</u>	Positive	+	Unknown	U
	Negative	-	Not applicable	NA
	Ordinary	0		

or pre-conditions, "Management/Technical ability", "Market", "Capital", and "Motivation" - and their interpretation as used by the evaluators. Grounds for rating requester qualities were of course much thinner than for VITA performance, usually consisting only of the inquiry letter and feedback, except in the minority of cases in which several exchanges of letters are on file. Nevertheless, by being forced to decide on a rating for each factor unless evidence was completely lacking, the evaluator stretched his appreciation of the inquirer's setting in each case, contributing to his overall grasp of the inquiry.

Because our concern here is with VITA's role in the inquiry process and our basis stronger for evaluating VITA performance factors, we focus in this section on the assessment of factors involving VITA volunteers and coordinators. Adjusted scores on VITA performance factors are presented in Table 9, in order of rank.*

Factors earning the highest scores - Fit 77, Timing 74, and Skills 73 - constitute the minimum requisite qualities of an inquiry service. Fit implies an answer directly responsive to the explicit points of the inquiry. Timing requires special handling if the request is urgent or has a deadline, but implies promptness (normally a substantive reply within one month to six weeks) even in the absence of a deadline. Skills constitute the basic resource of the volunteer roster. The fact that the case review results in low negative percentages of 8 or 9 and high positive percentages of 62 to 54 on these critical inquiry service faculties confirms the basic strength of VITA as a technical information agency.

The lower score for Skills as compared to Fit is directed more at the number of volunteers engaged in particular inquiries than at deficiency in the ability of those engaged. In numerous instances, as discussed below, the evaluator found that the multiple facets of an inquiry deserved attention by more volunteers than were approached by VITA, to bring varied skills and viewpoints to bear.

Two factors bracketed near the middle of the scoring range, Match and Feelings, reflect somewhat different scoring considerations. The concept of Match, over and above Fit, was introduced by the evaluation team to uncover underlying aspects of the request apart from those explicitly stated: the level of resources evidently at the disposal of the requester, the scale of activity likely to be supported by the

*Since the possible range of plus and minus scores is from +100 to -100, the net percentage (plus less minus) is adjusted from the possible range of 200 to the familiar range of 100, setting -100 as zero. Tables 9, 13, and 14 present adjusted scores.

Table 9

EVALUATION OF VITA PERFORMANCE FACTORS

<u>Performance Factor</u>	<u>Percentage of Cases Rated</u>		<u>Adjusted Score*</u>
	<u>Plus</u>	<u>Minus</u>	
	%	%	
Fit	62	8	77
Timing	56	8	74
Skills	54	9	73
Match	52	15	69
Feelings	38	2	68
Finish	42	21	61
Critique	38	28	55

*Net Score on scale of 100. See footnote, page 44.

market or production area concerned, types of technology likely to be suited to the situation, and other aspects on which the judgment of an experienced volunteer might be expected to go somewhat beyond the facts articulated in the inquiry letter. The negative mark of 15 on this factor registers the evaluators' judgment that in this percentage of inquiries VITA could have done more in tailoring the reply to the apparent circumstances of the inquirer.

The net score on Feelings amounts to a somewhat indifferent evaluator reaction to VITA performance in this regard. The low negative mark of 2 shows that the team found no cases to speak of where an offensive or insulting nuance was transmitted to the originator. The low positive mark of 38 indicates that evaluators regarded the majority of replies as average or ordinary in this respect. The reply was in normally courteous, businesslike terms or, if the evaluator sensed a latent attitude of technological superiority, this was not explicit. Plus marks were reserved for instances of special involvement and sensitivity on the part of volunteers and coordinators.

Finish and Critique, with adjusted scores of only 61 and 55, are not only at the bottom of the scale but also draw most frequent evaluator comments on inadequate VITA performance. Cases which the evaluator considered "unfinished" typically contain unanswered points, angles advanced by a volunteer but not followed through by the coordinator, leads to other volunteers or organizations which the coordinator did not pick up, or a need to continue the search for one or more additional volunteers to match the full content of the request. The very low rating on Critique is most serious in pinpointing coordinators' frequent need for specialized professional help in assessing and reviewing volunteers' answers. Low marks on Critique are also associated with cases in which coordinators reply to inquiries themselves, with no one's review. Objective, independent Critique is obviously lacking in this practice.

Poor Finish and Critique are observed in a large proportion of the cases in which VITA did not call upon an adequate number of volunteers, in the evaluator's judgment. As will be seen below, many of these are cases in Quality 3, Complexity 3 brackets. They entail elements of judgment or difficulty that call for analysis of alternatives, or for greater depth in VITA answers. High negative scores on Finish, and especially on Critique, show the need to bring wider experience to bear in the coordinator's function at key junctures in processing above-average inquiries.

Utilization of volunteers

On the average, only 1.3 volunteer replies or referrals regarded by coordinators as "satisfactory" were received on each evaluated inquiry. A surprising number of problems are not sent to any volunteer, contributing to this low average. Such queries are answered directly

from VITA's Information Resource Center or are referred to organizations, either public information sources or private companies. Uneven and unpredictable levels of volunteer response to particular inquiries further contribute to the low average figure.

Sector wise contrasts in the average number of volunteers and organizations approached for each case, and the number of satisfactory replies or referrals, are set forth in Table 10. Agriculture once more stands ahead of the other sectors, both in average number of satisfactory volunteer replies (1.5) and in percentages of satisfactory volunteer and organization answers. VITA's sustained past work on Agricultural problems no doubt goes far to explain this sector's stronger involvement of volunteers and higher rates of effective response.

The lowest percentage rates of satisfactory response from both volunteers and organizations are exhibited by Management inquiries. Apparently the recent rapid growth in demands on VITA for Management assistance is yet to be matched by adequate build-up of a well-rounded volunteer roster and sophisticated search techniques in the basic fields of Management information.

Details of volunteer utilization are elaborated in Table 11. Parallel data on utilization of organizations appear in Table 12. Average utilization, by sector, is shown for each Quality and Complexity grade.

Volunteer involvement tends to decline with Quality and with Complexity. Sharply lower use of volunteers is experienced in Quality 2 and 1 and in Complexity 1 inquiries. The break in Agriculture, it should be noted, occurs lower, between grades 2 and 1 in both Quality and Complexity. Sustained high use of volunteers in Agricultural cases of Complexity 2, and to slightly lesser extent of Quality 2, is a distinctive feature in this picture of volunteer involvement.

Much lower involvement of volunteers in comparison with the general trends of Table 11 is experienced in Technical cases of Quality 3, and in both Technical and Management cases of Complexity 3. The need for greater engagement of volunteers in Business inquiries of grade 3 is suggested by this below-par utilization. This need will be tested, and confirmed, in the analysis of performance scores which follows.

In the Business field, but not in Agriculture, greater reliance on organizations is shown for inquiries below grade 4 on both Quality and Complexity scales. On Business inquiries in the grade 3 and grade 2 border zones of difficulty and judgment, coordinators frequently call upon companies and other organizations instead of volunteers.

Table 10

SECTOR VARIATION IN RESPONSE OF VOLUNTEERS AND ORGANIZATIONS

<u>Sector</u>	<u>Average Number of Volunteers</u>			<u>Average Number of Organizations</u>		
	<u>Contacted</u>	<u>Satisfactory Replies or Referrals</u>	<u>%</u>	<u>Contacted</u>	<u>Satisfactory Replies or Referrals</u>	<u>%</u>
Agriculture	2.1	1.5	72	1.0	0.6	60
Business- Management	2.5	1.2	50	1.5	0.7	47
Business- Technical	1.9	1.1	59	1.7	0.8	49
Three Sectors	2.1	1.3	62	1.5	0.7	47

Table 11

UTILIZATION OF VOLUNTEERS
BY SECTOR, QUALITY, AND COMPLEXITY OF INQUIRY

Inquiry Rating	Average Number of Volunteers Contacted				Average Number of Satisfactory Replies or Referrals			
	Agriculture	Business- Management	Business- Technical	Three Sectors	Agriculture	Business- Management	Business Technical	Three Sectors
<u>Quality</u>								
5	4.0	2.7	2.8	3.0	2.5	1.7	1.6	1.5
4	1.8	4.0	3.0	1.8	.7	3.0	2.2	1.5
3	3.1	3.4	2.0	2.2	2.4	2.0	1.0	1.6
2	2.5	2.0	1.6	1.8	1.8	.9	1.0	1.1
1	.8	1.8	1.7	1.5	.7	.5	1.1	.8
<u>Complexity</u>								
5	5.0	6.0	NA	5.5	2.0	1.0	NA	1.5
4	2.0	4.0	3.4	3.2	1.0	3.5	2.0	2.1
3	3.0	2.8	1.7	2.4	2.1	1.1	1.3	1.2
2	2.9	4.0	1.9	2.6	2.2	1.8	1.2	1.6
1	1.1	1.3	1.8	1.5	.9	1.3	1.1	1.0
<u>Average All Cases</u>	2.1	2.5	1.9	2.1	1.5	1.2	1.1	1.3

Table 12

UTILIZATION OF ORGANIZATIONS
BY SECTOR, QUALITY & COMPLEXITY OF INQUIRY

Inquiry Rating	<u>Average Number of Organizations Contacted</u>				<u>Average Number of Organizations Responding</u>			
	<u>Agriculture</u>	<u>Business- Management</u>	<u>Business- Technical</u>	<u>Three Sectors</u>	<u>Agriculture</u>	<u>Business- Management</u>	<u>Business- Technical</u>	<u>Three Sectors</u>
<u>Quality</u>								
5	1.5	.7	.6	.8	1.5	0	.3	.5
4	.8	0	.4	.5	.3	0	0	.2
3	1.3	1.4	1.8	1.5	.7	.7	1.0	.8
2	1.0	2.0	2.3	1.7	.6	1.2	1.1	.9
1	.8	1.7	1.3	1.3	.6	.7	.6	.6
<u>Complexity</u>								
5	1.0	0	NA	.5	1.0	0	NA	.5
4	1.5	0	1.4	1.1	1.5	0	.4	.5
3	1.4	1.9	2.0	1.8	.8	1.0	.6	.7
2	1.9	.8	1.8	1.3	.3	.7	1.1	.8
1	.9	1.8	1.5	1.4	.5	.7	.8	.7
<u>Average, All Cases</u>	1.0	1.5	1.7	1.5	.6	.7	.8	.7

Analysis of performance scores

Combined scores on the seven VITA performance factors discussed above are presented in Table 13. The table permits an analysis of adjusted net scores by sector, for each Quality and Complexity grade.

The close relation between VITA performance and Quality of inquiry is clearly indicated in Table 13. Performance scores fall sharply with Quality of inquiry. The only important exceptions to this pattern tell their own story. Quality 4 Agricultural inquiries and Quality 3 Technical cases receive performance scores distinctly below the trend; we examine these categories in the next section.

In relation to Complexity, performance scores display a more or less even tendency, except for a pronounced dip on Complexity 3 cases. Underlying the low net score for Complexity 3 inquiries are high negative performance elements in all three sectors. Negative elements fall sharply, as might be expected, on problems of lower Complexity, accounting for the rise in net scores for Complexity 2 and 1 cases as compared to Complexity 3.

Performance scores on the part of VITA and on the part of requesters are presented, by sector, in Table 14. A remarkable correspondence between the level of VITA and requester scores in each sector is revealed. The high and low scores of Agriculture and Business-Technical, respectively, are virtually of the same magnitude. Business-Management inquiries rate higher in VITA performance than in requester effectiveness, but in both respects are intermediate. A broad line of relationship between the effectiveness of originators of requests and the accomplishment of VITA in response can be persuasively argued from the scores displayed in this summary table.

Inquiries Requiring Greater VITA Inputs

Inquiry categories which call for greater VITA attention can be identified by inspecting performance scores cross-classified by Quality and Complexity. Inadequate or poor performance are indicated by low positive and high negative scores, unadjusted, for these sub-categories in each sector:

<u>Sector and Sub-category</u>	<u>Unadjusted Score</u>		<u>Average Number of Volunteers Responding</u>
	<u>+</u>	<u>-</u>	
<u>Agriculture</u>			
Quality 4, Complexity 3	16	8	1.0
" 4, " 2	2	3	.7
" 3 " 3	25	8	2.0

Table 13

EVALUATION OF VITA PERFORMANCE
 BY SECTOR, QUALITY, AND
 COMPLEXITY OF INQUIRY

<u>Adjusted Net Scores</u>				
<u>Rating</u>	<u>Agriculture</u>	<u>Business- Management</u>	<u>Business- Technical</u>	<u>Three Sectors</u>
<u>Quality</u>				
5	68	90	83	82
4	64	90	76	70
3	87	83	60	74
2	78	77	64	69
1	73	63	53	60
<u>Complexity</u>				
5	93	36	n.a.	74
4	40	100	70	69
3	71	68	55	63
2	77	79	63	69
1	77	72	65	70
All Evaluated Cases	75	74	63	68

n.a. Not applicable

Table 14

SECTOR VARIATION IN VITA AND REQUESTER PERFORMANCE FACTORS

<u>Sector</u>	VITA			REQUESTER		
	<u>Cases Rated</u>		<u>Adjusted Score</u>	<u>Cases Rated</u>		<u>Adjusted Score</u>
	<u>Plus</u>	<u>Minus</u>		<u>Plus</u>	<u>Minus</u>	
	<u>%</u>	<u>%</u>		<u>%</u>	<u>%</u>	
Agriculture	60	11	75	52	5	74
Business- Management	58	11	74	45	7	69
Business- Technical	39	14	63	36	11	63
Three Sectors	49	13	68	43	8	68

<u>Sector and Sub-category</u>	<u>Unadjusted Score</u>		<u>Average Number of Volunteers Responding</u>
	<u>+</u>	<u>-</u>	
<u>Business-Management</u>			
Quality 1, Complexity 3	10	8	.3
" 2 " 3	17	6	1.3
<u>Business-Technical</u>			
Quality 3, Complexity 2	23	20	.4
" 2 " 3	14	15	.8
" 1 " 3	3	14	.8

The kinds of additional effort required of VITA are suggested by an examination of individual cases accounting for negative scores in these sub-categories.

Agriculture

Assistance in evaluating a new crop, in research on fish cultivation, and on several types of agricultural equipment was requested in agricultural cases on which VITA's replies were less than adequate.

Quality 4, Complexity 3. A Peace Corps Volunteer in Bolivia providing substantial information on local climate and cultivation factors, asked for guidance on how to assess the feasibility of olive cultivation, on methods of olive growing, and on the processing of olives and olive oil. VITA sent an excellent FAO study and a reply on an earlier case, which the Peace Corps worker said were helpful in his evaluations of this possible new crop. The FAO reference, however, was for 1961 and, in the Western Hemisphere, made only brief mention of experimentation with olives in Argentina, noting promise in other American countries. In light of the need for updated information and for later results in this hemisphere to do justice to the requester's thorough approach, the evaluator considered that the judgment of volunteers should have been obtained. None were consulted.

The request for basic materials on starfish cultivation, though implemented as noted in Evaluation Abstracts 1, was not fully met. The coordinator did not complete the search for specific sources cited in the request letter. More volunteers familiar with technical literature retrieval should have been called on. When the Peace Corps worker who originated the inquiry left Tonga, the Department of Agriculture wrote stating that they still needed specific information. No action was taken, until

the evaluator reopened the case.

Quality 3, Complexity 3. Increased paddy output in Tanzania brought a request from a missionary for a design for a rice thresher, possibly powered by a portable diesel or petrol engine. The coordinator sent two VITA plans from the Village Technology Center. The requester termed these "too much of a gadget", requiring too much local skill to make and maintain. "We have gone back to a simple slot thresher (IRRI design) and ahead to a commercially produced, powered thresher." Failure to refer this inquiry to volunteers caused VITA to miss the nature of local conditions. Volunteers should normally be brought into the picture on requests of such Quality and Complexity to ensure that VITA's Information Resource Center and VITA plans are not outdated, but a living resource.

Low cost plans for silos for milch cattle fodder were sought by a Peace Corps Volunteer in India, with a detailed description of local conditions. Two volunteers replied, both suggesting trench silos covered with plastic. The Peace Corpsman replied that ground moisture was too great for trench silos and plastic sheet not yet cheap in India. In the evaluator's judgment these factors should have been noted in the coordinator's critique, with resort to additional volunteers and to other silo inquiries earlier processed by VITA. A follow up on the rejected technical solution should also be made, by consulting other volunteers with experience in monsoon regions.

Mechanical innovations or adaptations suited to small farms, modest output, animal power, and difficult ecological conditions typically involve great complexity, sustained field trials and modification to suit locally varied conditions. VITA cannot be expected to mount large innovative efforts, which for such requirements must be undertaken close to the scene. Numerous VITA volunteers, however, have the interest and capability to make significant design and judgment contributions on farm machinery. On requests of this kind, several volunteers should be actively engaged to keep VITA up-to-date with the world's rapidly but sporadically changing small farm technology.

Business-Management. In the Management sub-categories exhibiting poor VITA scores, Complexity of request exceeded Quality and the burden of performance shifts to the inquirer.

Complexity 3, Quality 1 and 2. In one instance, the requester sought marketing guidance for an exotic food, but showed little knowledge of the steps entailed. Guidance in setting up a battery factory was sought in a second case.

Detailed assistance in formulating a business school curriculum was a third request. Greater probing by VITA or by a volunteer to cause the inquirer to examine his plans more thoroughly is probably the best service that can be given in such cases.

Business-Technical. Problems of substantial Complexity on by-product utilization, price-cost comparisons, and design or selection of equipment and machinery are representative of grade 3 and grade 2 cases on which better VITA inputs should be expected.

Quality 3, Complexity 2. In ten cases in this sub-category an average of only 0.4 volunteer replies were received. VITA's limited response cannot be explained by evidence of probable requester ineffectiveness, since combined requester factor scores total 31 pluses and zero minuses. Five of the 10 inquiries were sent to no volunteer. Negative VITA scores are concentrated in three of the five. A Turkish exporter sought advice on alternative uses for 20,000 tons/year of valonea nut shells, husks, and other remnants. The volunteer coordinator offered several ideas, but no details on probable process requirements, costs, or methods. For a Brazilian producer of auto battery cases, an IESC consultant requested market information on cost comparisons between specified plastic materials and rubber, based on U.S. production experience. Cost assessments received from two companies differed, but were not reconciled. The third case called for design of a clay-mix pit, for clay to be mixed by animals for brick-making. Textbook material was sent, and was rejected as "too primitive" by the requester.

Each of these inquiries is on the borderline of a 3 rating in Complexity. Among the cases not only technical judgment and ingenuity are called for, but also objectivity and ability on aspects of production volume, balancing of production operations, scale economies and other cost elements, and competitive marketing. The need for involving knowledgeable volunteers is evident.

A further weakness in VITA's handling of these inquiries is that each was the responsibility of a volunteer coordinator. No review of the VITA answer was therefore provided. If a second judgment had been applied, the failure of VITA to match the Quality and Complexity of the requests would probably have been realized, followed by reference to a specialized volunteer.

Quality 2, Complexity 3. Five requesters in this sub-category sought production equipment and processes for specified products. A Thai company manufacturing carpets asked for details of carpet-weaving looms. VITA wrote to

weaving firms, probably potential competitors of the overseas firm, but not to manufacturers of carpet-making machinery. The requester's appraisal: some information was "too simplistic", the rest on "enormous machines". Other machinery sought in these cases: for dyeing and finishing of hand toweling; for production of mini-size pharmaceutical containers from low-grade paper pulp; and special-purpose machinery for the manufacture of thermostatic bellows. A very substantial response was made on the last item by two volunteers, but little accomplished for the other requesters.

Machinery requests often extend to proprietary information. In some instances this leads to correspondence with a machinery supplier who is prepared to pursue the inquiry toward a purchase or licensing arrangement. In other cases, like those just cited, the inquiry is not met. In two of these cases, no volunteers were approached. Volunteers having extensive knowledge of production machinery, including experience with earlier designs and with rebuilt equipment, are frequently able to provide much relevant information without infringing proprietary designs. VITA's roster lists over 65 volunteers with "Machinery" skills and nearly 150 volunteers with qualifications in "Machine Design". Much more extensive involvement of volunteers with these skills is required to meet Business-Technical inquiries characterized by this degree of difficulty

Conclusion: Organizing the Response to Individual Inquiries

The origin and substance of the VITA inquiries reviewed above make it clear that a strong grass-roots constituency in cities, small towns, and villages of many countries have become aware of VITA, and send solid, timely questions. A large proportion of the originators of inquiries are persons actually engaged in the activity which they seek to improve. Widespread recognition of VITA's effective record by entrepreneurs and practical development agents is a vital foundation on which the organization can securely build.

Our analytical review of individual inquiries leads to the following conclusions and recommendations.

1. Quality and Complexity of inquiry are two principal guides to the kinds of action required on VITA's part in developing an effective reply. These attributes can be appropriately assessed by VITA staff, using the ratings described above. It is recommended that each incoming inquiry be rated on these two measures as a guide in organizing the response, and as a benchmark for use in subsequent program appraisals.
2. VITA implicitly assigns a low grade or status to Quality.1

and 2 inquiries, and those of Complexity 1, in engaging fewer volunteers on such inquiries (Table 11). This is understandable in view of the basic source material available in VITA's Information Resource Center on many problems, and also with a view to conserving volunteer and coordinator time on problems that are likely to prove infructuous. VITA's very low performance score (Table 13) on Quality 1 cases, however, is ground for the belief that this practice has gone too far. A pronounced increase in the use of volunteers is recommended, through procedures that will give greater but still selective attention to Quality 1 and 2 requests.

3. Problems rated 5 or 4 in Quality and/or Complexity by the evaluation team are apparently intuitively identified by VITA as difficult assignments, more volunteers being called upon in such cases. Problems rated 3 in Complexity, which may entail less adaptive or innovative solutions, but which nevertheless do involve managerial or business judgment, require greater attention than is now typically assigned.
4. As a minimum overall target, it is proposed that the number of volunteers contacted be increased by 50 percent, from 2.1 per inquiry to an average of over 3 volunteers per inquiry. This would increase the average number replying satisfactorily from 1.3 to 2 volunteers, assuming maintenance of the present 62 percent rate of satisfactory replies. The target is not so much in point as is a determination to assure that several judgments are brought to bear. The percentage rate of satisfactory replies is less important than the number and range of viewpoints represented in volunteers who do reply.
5. On many Quality 1 and 2 inquiries, VITA should arrange to seek clarification of the inquirer's setting and questions at the outset. It is suggested that volunteers assume more active responsibility in eliciting added facts and clarification. When a Quality 1 or 2 inquiry is assigned initially to a volunteer, he should be equipped with the checklist of questions which VITA has developed to send to inquirers whose query is incomplete or unclear. The volunteer, after structuring the problem, would ask the inquirer pertinent questions on the missing variables. To strengthen the procedure, these further steps are proposed:
 - A. Volunteers who are asked to assume this responsibility on Quality 1 and 2 inquiries should have wide general competence in the subject field concerned, as contrasted to specialized skills, and be able to bring a rounded judgment to bear in raising variables for clarification by the originator. If possible, these volunteers should have experience in the geographic area concerned. To identify

generalists on volunteer skill cards, resumes in each subject field must be subjected to careful review. Accomplishment of this distinction between generalists and specialists in the adhesives field is reported in the next chapter, indicating the feasibility of this approach.

- B. If the inquirer does not reply to the volunteer's questions and checklist, it will be assumed that the questioning process has served to help clarify his situation. No Appraisal Form would then be sent.
6. A good many Quality 1, Complexity 1 inquiries ask for specialized bibliographies. Surprisingly large numbers of organizations and volunteers must often be contacted by VITA to obtain suitable reference lists. It is recommended that a roster of volunteers with particular skills in bibliography be established. Skill cards for documentation and bibliography should be critically reviewed, and consideration given to a VITA Newsletter notice requesting volunteers who are equipped to provide bibliographical replies to join the roster.
 7. To bring stronger VITA answers on Quality 3 and Complexity 3 inquiries, these measures are recommended:
 - A. Request coordinators should assume greater responsibility and devote more of their available time to these requests. At the first stage, they should engage the judgment of generalist volunteers in structuring the overall approach to the problem, including possible team effort. Ways of enrolling subject-matter generalists in the review of replies from specialist volunteers should be explored.
 - B. Volunteers should be selected with the aim of gaining participation by at least three persons; one with general technical competence in the field; one or more specializing in the specific issues involved; and one with related managerial or business experience.
 - C. A joint ad hoc approach in cooperation with an appropriate specialized agency located in the country or region of the request should be weighed.
 8. Manufacturing inquiries, even when sharply defined, frequently involve new business ideas or questions of market and product development that offer many imponderables to respondents remote from the scene. To strengthen the involvement of VITA volunteers in such cases, these steps are suggested:
 - A. Volunteers who are themselves entrepreneurs or proprietors, particularly of small companies, should be identified by a new skill descriptor and engaged in the first stages of organizing a reply.

- B. The roster of management skills should be reviewed with an eye to limitations noted on page 47, to improve selection of volunteers and to enroll new volunteers with business or managerial skills now inadequately represented.
 - C. Volunteers skilled in Machinery and Machine Design should be more frequently consulted on inquiries related to choice of production methods, machinery, and scale of operation.
9. Appointment of a person with wide overseas project experience to the VITA inquiry service middle management staff is recommended, with the principal responsibility of supporting, strengthening, and reviewing the judgment of request coordinators on inquiries rated 3 and above in Quality or Complexity.
 10. Appraisal Forms or letters asking the inquirer to give his assessment of VITA information should be phrased, where applicable, in the context of subject-matter advancement. For example: "We are revising and updating our technical materials on paddy threshers. Your advice and factual experience in using or assessing the information we sent you on threshing equipment would be valuable to us in improving future replies. Please include full details on each factor in your setting which contributed to, or prevented, the result you aimed for."

Many inquirers will welcome this invitation to an active role in building VITA's capability, enhancing the value of feedback reports as contributors to technical development. On inquiries of high Quality or Complexity, it is recommended that VITA follow up by requesting feedback reports at successive stages of implementation.

III

VITA'S ROLE IN TRANSFER AND DEVELOPMENT OF TECHNOLOGY

The present chapter evaluates VITA's performance as a clearinghouse and examines its multiplier effects, asking questions such as:

Is VITA engaged simply in retrieval and transfer of information - in a passive clearinghouse role - or does it have a significant component which is adaptive, innovative?

Does VITA develop an awareness of needs, priorities, and positive or negative solutions? If so, does VITA catalyze attention to these issues by volunteers and by other institutions? If not, why not? Is awareness developed, but programs not formulated or resources lacking to carry issues forward?

Does VITA perform a signaling function by alerting other institutions to current problems and solutions? In its relations with other organizations, is a communications network being developed that can serve as a growing resource in information exchange?

What cultural contrasts and trends are discernible in reviewing VITA's record on selected problems?

Beneath these broad considerations, we are concerned with the daily process and system by which VITA matches volunteers to inquiries. How effective are volunteer resumes and skill cards in enabling coordinators to identify respondents with the right ability? Does the classification system of Problem Subjects employ useful cross-references, providing adequate links to volunteer skills? How accessible is the information in past VITA cases?

Our attack on these issues is through longitudinal study of two subjects in which VITA has had substantial experience. A study of technical transfer in adhesives forms the core of the chapter, followed by comparative lessons from the irrigation record. The context is first established through an overview of technological realms in which VITA operates.

VITA's Window on Technological Change

Problem Subjects on which VITA has processed inquiries run literally from abaca and absorption to zippers and zoological gardens. Such juxtapositions as gardening, gold, and grain storage, polyvinyl chloride, ponds, and pork, barkcloth, barrels, and batik are found on the frequency distribution of Problem Subjects presented as Appendix I. Nearly 2,000 subjects have been treated in the 13,548 inquiries processed by VITA through September, 1971.* The policy of open-ended acceptance of inquiries on virtually any topic has given VITA an immense exposure to the kinds of technical development that are on people's minds in many parts of the world.

On two-thirds of the problems in this vast array, ten or less queries have been received. In only 39 Problem Subjects have more than 100 inquiries been processed. On 92 subjects, 51 to 100 inquiries have come in. The number of Problem Subjects by frequency of inquiry is summarized in Table 15, which sets the structure for the listing of subjects in Appendix I.

A certain redundancy is obvious in Appendix I, due to overlaps in classification. A broad category like water subsumes several finer categories, such as water distillation, water dowsing, and even desalination. The frequency of occurrence declines as subject descriptions become narrower. In analyzing the frequency distribution of Appendix 1, such connectives and overlaps must be sought.

Relative consistency in classification has been maintained during the past two years, with continuity in the staff member who assigns inquiries the descriptors. Yet variation is inevitable, with differing emphases in problem content, and the memory of no one person, let alone successive staff members, capable of maintaining constancy in distinctions. These problems of nomenclature and indexing are examined in the review of adhesives and irrigation cases.

Since over 5,700 volunteers are active in VITA's roster, there is no inherent lack of expertise to cope with the most infrequent or unusual problem. But to trace all possible crossing-points of competence between volunteers and inquiries it would almost be necessary, in Paul Samuelson's term, "to specify the entire universe." Trees of relationship must be constructed.

*These statistics refer to inquiries handled directly by VITA, excluding the 7,418 inquiries processed by DATA International prior to its merger with VITA in 1967.

Table 15

NUMBER OF PROBLEM SUBJECTS
BY FREQUENCY OF INQUIRY

<u>Frequency of Inquiry</u>	<u>Number of Problem Subjects</u>
Over 200	13
101 - 200	26
51 - 100	92
26 - 50	166
11 - 25	346
1 - 10	1,355
	<hr/>
	1,355

The 1,355 Problem Subjects on which ten or less cases are on record constitute the extensive margin of VITA's field. Little cultivation of these topics is called for, except as they form roots or sub-disciplines of more active topics. Keeping an eye out for hybrids or promising mutations that may arise in these outcrops, VITA's principal realm of program concern is in those Problem Subjects with high frequency of inquiries.

Time trends in Problem Subjects on which more than 50 inquiries have been handled are presented in Table 16. Perhaps the most striking overall characteristic of the table is the predominance of topics on rural life and agriculture. VITA's past work in Village Technology is fully reflected here. Though several of these topics - water pumps, agricultural machinery, preservation of food, and milk - have receded from their highest period of activity, in absolute numbers rural topics are still very significant. Rising or sustained recent trends are seen in vegetable oils, water wells, seeds, animal feed, cattle, fertilizers, soybeans, swine, and citrus fruit.

Toward future program development, Problem Subject trends are further analyzed in Table 23, Chapter VI.

Criteria for the Study of Technical Transfer

As a basis for selecting problems for study, the following criteria were established:

1. Problem with strong current trend or otherwise known to have wide continuing incidence and technological interest.
2. Many volunteers listed on the skill card in this field and, as far as could be determined, involved in work on inquiries.
3. One topic of significance in rural communities, spanning great cultural distance, and one of "modern," probably urban, technological content.
4. Sharp problem definition in VITA records. Convergent rather than diffuse in content.
5. Alternative technologies of interest.
6. Sectoral distribution: one topic Agriculture-related, and one of Manufacturing interest.

Of the high frequency subjects in Table 16, adhesives and irrigation were selected as offering the best balance among these criteria.

Technical Transfer Study: Adhesives

This analysis of VITA adhesives cases includes 68 of 71 cases

Table 16

TIME TRENDS IN PROBLEM SUBJECTS

Problem Subject (1)	<u>Years and Number of Cases</u>					Problem Subject	<u>Years and Number of Cases</u>				
	'61- '65	'66- '67	'68- '69	'70- '71 (2)	TOTAL		'61 '65	'66 '67	'68- '69	'70- '71	TOTAL
	<u>Over 200 (3)</u>						<u>101 - 200 (3)</u>				
Mfg. methods	50	230	151	35	466	Water	9	114	41	15	179
Designs	37	203	96	33	369	Agr. machinery	6	34	100	37	177
Machinery	38	68	90	54	250	Utilization	11	86	47	33	177
Marketing	9	32	81	103	225	Commerce	16	75	49	25	165
Water pumps	42	82	44	38	206	Plastic	14	53	45	38	150
						Poultry	18	51	45	31	145
						Rice	27	35	44	29	135
						Irrigation	9	54	39	31	133
						Generators	24	54	38	13	129
						Solar	42	62	23	0	127
						Preservation	17	81	16	12	126
						Cooperatives	8	16	31	70	125
						Oils	15	47	33	26	121
						Wood	22	55	15	25	117
						Preserv. foods	19	39	41	18	117
						Documentation	13	99	2	1	115
						Pest control	14	50	41	9	114
						Controls	20	64	28	2	114
						Cement	14	34	48	17	113
						Training	7	26	35	30	108
						Photog. proj.	30	49	23	5	107
						Fruits	7	50	29	16	102

(1) Excluding major categories and the following overlapping categories:
 Food
 Production
 Electricity
 Industries
 Processing
 Concrete
 Management

(2) 1971: 9 months

(3) Number of inquiries in VITA history. This table shows frequency distribution and trends only for those problem subjects on which more than 50 inquiries have been processed.

TIME TRENDS IN PROBLEM SUBJECTS

Problem Subject	<u>Years and Number of Cases</u>					TOTAL	Problem Subject	<u>Years and Number of Cases</u>					TOTAL
	'61- '65	'66- '67	'68- '69	'70- '71				'61- '65	'66- '67	'68- '69	'70- '71		
	<u>51 - 100</u> (3)							<u>51 - 100</u> (3)					
Comm.developm't	8	51	24	16	99	Weaving	9	24	25	9	67		
Fibers	14	41	30	11	96	Ind.plants	22	18	16	1	67		
Storage	10	33	25	28	96	Wastes	18	38	9	1	66		
Textiles	7	33	23	32	95	Coatings	0	17	31	17	65		
Water supply	14	15	38	28	95	Driers (apparatus	8	27	18	12	65		
Water treatment	22	44	19	9	94	Refrigerators	10	31	14	10	65		
Feasibility	4	28	25	37	94	Extraction	6	23	15	20	64		
Kilns	20	27	20	24	91	Tractors	12	27	14	11	64		
Sanitary eng.	15	42	28	6	91	Dyes	7	28	16	12	63		
Drying	13	39	25	13	90	Fish culture	6	25	19	13	63		
Seeds	7	22	35	25	89	Recreation	2	26	7	28	63		
Vegetables	6	31	28	20	85	Vegetable oils	4	17	16	26	63		
Animal feed	0	6	47	31 ^x	84	Bridges	14	22	18	9	63		
CINVA-Ram	9	32	38	4 ^x	83	Nuts, edible	7	22	15	18	62		
Pipes	18	31	25	9	83	Drilling,drills	16	29	5	11	61		
Rabbits	7	18	35	23	83	Systems	13	33	13	2	61		
Pottery	15	27	23	17	82	Corn oil proc.	2	30	27	1	60		
Bamboo	6	20	20	13	81	Fish	7	8	25	20	60		
Coconuts	14	27	21	19	81	Water storage	5	14	27	14	60		
Soaps	9	20	32	20	81	Woodworking	7	25	23	5	60		
Steel	3	31	27	20	81	Bananas	6	20	20	13	59		
Teaching aids	9	28	32	11	80	Books	6	18	29	6	59		
Bricks	18	29	19	13	79	Costs	1	12	30	16	59		
Cattle	4	28	23	24	79	Swine	6	9	24	20	59		
Structures	7	23	22	26	78	Water wells	0	11	20	28	59		
Fertilizer	4	24	21	28	77	Wind	22	29	7	0	58		
Leather	3	27	25	22	77	Ceramics	5	18	26	7	56		
Horticulture	8	40	26	2	76	Furniture	5	22	14	15	56		
Power	21	34	16	5	76	Photog.equip.	2	21	21	12	56		
Wells	20	36	18	2	76	Tanning	12	6	29	9	56		
Packaging	3	24	31	16	74	Materials	4	40	9	3	56		
Chemicals	0	42	9	22	73	Citrus fruit	3	17	18	17	55		
Paper	16	25	12	20	73	Concrete blocks	9	31	10	5	55		
Pumps	0	12	47	14	73	Poultry equip.	4	12	32	7	55		
Soybeans	1	16	27	29	73	Cans	17	28	5	4	54		
Peanuts	9	20	17	26	72	Clothing	5	21	11	17	54		
Adhesives	7	22	19	23	71	Windmills	0	9	34	11	54		
Milk	11	30	24	6	71	Export-Import	2	3	18	30	53		
Paints	4	27	30	10	71	Roofs	8	22	11	12	53		
Batteries and components	9	29	24	8	70	Meat	10	13	18	11	52		
Cottage ind.	2	12	33	22	69	Printing	5	20	15	12	52		
Ovens	14	21	18	15	68	Soils	7	24	16	5	52		
Boats	1	14	26	21	62	Looms	6	18	21	6	51		
						Waterwheels	7	17	20	12	56		

^xNow a publication

(3) Number of inquiries in VITA history. This table shows frequency distribution and trends only for those problem subjects on which more than 50 inquiries have been processed.

classified as such from 1963 to the present. At the outset, two facts become clear: that the field did not build steadily, and that the term "adhesives" can be applied to a variety of products which are, on the face of it, quite unrelated.

From 1963 to 1966 a total of only seven adhesives requests were received. In 1967 alone, 13 were received. Then they dropped again, to 8 in 1968, and 11 each for the next two years. However, for the first 8 months of 1971, 12 were received. Apparently interest is on the upswing again.

With the inquiries being sporadic in the earlier years, there was little impetus for a sense of awareness and continuity to promote VITA capability in adhesives.

Coupled with the erratic quantitative course of adhesives history is the diversity of the requests. Following are some of the questions included in this field:

1. How can rosin furniture glue be made stronger?
2. What is required to manufacture surgical tape?
3. What binder should be used to make vermiculite wallboard?
4. What is the proper binder for making hard coke dust into briquettes?
5. What is the procedure for making flypaper?

A third factor also has some bearing on development of VITA's capability: the continuity of the request handlers, the coordinators. The coordinators were all volunteers for several years. (Even today, many problems are handled by volunteer coordinators.) In the past year and a half, 10 different coordinators have handled adhesives requests. Thus, even individual awareness was not fostered as to what had gone before, what progress had been made, what trends, if any, existed, what volunteers had contributed, or what literature had been used.

To some extent, all of these factors contributed to the lack of systematic use and evaluation of VITA's prime resources: volunteers and existing information. Fewer than half of the volunteers listed as adhesives experts have been queried on adhesives problems, while at the same time a large number of volunteers not so listed have been called upon. The reasons, and some possible avenues VITA might consider to develop a knowledgeable grasp on this amorphous field, emerge from a close look at the adhesives cases.

Has VITA's role been that of an innovator, or of a clearing-house? The following avenues were pursued in an effort to establish any patterns that might exist:

1. The footwear cases were grouped and studied.

2. The coke briquetting cases were similarly grouped.
3. Cases where requesters reported that the information had been implemented were examined for clues.
4. Cases which aborted at the outset when requesters failed to clarify the project and need were checked.
5. Cases where product improvement was the goal were examined.
6. Special cases of particular importance were considered. These included one where the opportunity for replication was documented, and three concerning new products.

The footwear cases

1. Date: April, 1963
Country: Philippines
Request: Assistance in developing five adhesive products:
 1. Tin can sealer.
 2. Gasket and rim cement.
 3. Clear shoe sole cement.
 4. Filter tip adhesive.
 5. Insulating varnish.
Quality of request: 1
Complexity: 3
VITA action: Unable to provide any useful information. (Volunteers queried: 4)

2. Date: August, 1967
Country: India
Request: Formulas to make leather and rubber sole adhesives.
Quality of request: 3
Complexity: 2
VITA action: One volunteer sent information from the Handbook of Adhesives; recommended this source to VITA for its complete coverage of adhesives and its understandibility.
Second volunteer saw request in VITA Newsletter. A resident of Mexico, he recommended glue used there.
Third volunteer provided two formulas, gave source for all chemicals cited as Imperial Chemicals Industries of India.
Fourth volunteer cites best glue, gives source for it.

3. Date: September, 1967
Country: Pakistan
Request: Formula for glue firm is presently using to bond leather to rubber. Sample follows.

Quality of request: 3 (Upgraded)
Complexity: 2
VITA action: Information from previous problem sent.

4. Date: November, 1968
Country: India
Request: Techniques of dry rubber adhesive manufacture.
Later clarified: requester wants to bond insoles to foam rubber.
Quality of request: 1
Complexity: 2
VITA action: First volunteer sends pressure sensitive formula first; upon clarification, sends contact adhesive formula.
Second volunteer provides general description of process and name of American company which manufactures ingredients and will provide details.
5. Date: August, 1970
Country: India
Request: Self-curing adhesive for bonding leather to leather, rubber to rubber, leather to rubber in making shoes.
Quality of request: 1
Complexity: 2
VITA action: Coordinator, an adhesives volunteer, sends several formulas.
6. Date: June, 1971
Country: Pakistan
Request: Adhesive to attach soles to uppers, eliminate stitching.
Quality of request: 1
Complexity: 2
VITA action: Same coordinator as above writes to requester explaining type of cement and method. Letter is quite technical.
7. Date: August, 1971
Country: India
Request: Information on rubber cements for shoes.
Quality of request: 1
Complexity: 2
VITA action: Same coordinator sends relevant information from Vanderbilt Handbook, five patent write-ups and Chapter VIII of How Modern Shoes Are Made.

Summary of footwear cases. The first footwear request, in 1963, did not result in significant help. Response to the second, in 1967, was excellent. The two volunteers who made this contribution had not been in the roster in 1963. Over and above their answers, they greatly increased VITA's capability. One critiqued a source work and

recommended that VITA acquire it; the other specified the company in India that could provide the chemicals called for in the variety of formulas he sent. So, from a very limited capability in 1963, VITA had in 1967:

identified two useful volunteers,
identified an outstanding source work,
identified the Imperial Chemical Industries of India
as a source for needed chemicals.

Results of this added knowledge:

1. The two volunteers were never again queried on shoe adhesives.
2. The Handbook of Adhesives was not used in answering any further shoe adhesives problems.
3. The valuable reference to an Indian company was buried in the file folder.

In fact, by 1970, no volunteers at all were being asked to respond to shoe requests, or to any other adhesives requests, when they are coordinated by the volunteer whose field this is. The Handbook surfaces again later in answer to a non-shoe problem, and a number of other references are used by the in-field coordinator, but have apparently not been systematically acquired by the organization itself.

Three of the later requesters were Indians, and might have found the chemicals source in their own country useful. (Some requesters have commented that the chemicals required are unavailable.) Going through sixty or so cases in search of potentially useful information is a discouraging task. Had the "adhesives for footwear" category had its own card, a coordinator would have only six problems to search in responding to the latest request on shoe adhesives.

Innovation was apparently not called for in filling these requests, but rather the making available of existing information.

The coke briquettes cases

Refining a subject category with modifiers, as suggested above, would make retrieval less an obstacle within that category, and would also aid in retrieving relevant information from entirely different categories. This is indicated by study of the three coke briquette cases on the adhesives card.

These cases are few enough to present them in a continuing narrative, as befits the detective story they constitute. All three requests were received within a nine months period, from September,

1969 to May, 1970, were handled by the same coordinator, and came from India.

The first merely asked what binder could be used to make coke dust into briquettes. VITA volunteer Alfred Powell responded with the process and types of binders, but commented that in his 50 years of experience, he had never heard of the coke dust, or breeze, being used for fuel because it has other, more valuable uses.

When the second request was received a month later along the same lines, the Powell letter was sent, and a volunteer from the fuels field was contacted. He recalled a case he had worked on some years before, but could not find the information he had collected for it, and contacted another volunteer who had worked with him on the case. The latter provided the old case number to VITA and suggested that all information in that case be sent. The old folder proved to be a gold mine, very useful to the requester. But, the new find was not also sent to the requester of only a month earlier.

The request that came in the following May asked what binders the Japanese had been developing for coke briquettes. Was it economical? Available?

Again the Powell letter was sent to the requester, but in addition, the coordinator also recontacted Powell for any further information he might have. Powell responded with an important contribution -- a copy of a report on experiments carried out at the Regional Research Labs in Hyderabad. The U.S. Department of the Interior also contributed, explaining that what the Japanese were experimenting with was binderless coke, and sending three reports on research and testing of a number of binders.

There are both positives and negatives apparent in these cases.

Positive: 1) VITA is building substantial knowledge.

2) VITA went back to the volunteer for comment, instead of just sending his original report, and struck paydirt by so doing.

Negative: 1) VITA was not led by its own procedures back to the old case, but by chance, through contacting the right volunteer.

2) VITA did not retrace its steps, sharing with not much earlier requesters, the new information. Both might have been quite interested in the Hyderabad tests, and the first would have wanted the information in the old case folder as well.

In these instances, VITA did not very efficiently serve even as a clearinghouse.

Implemented cases

Six requesters reported that they had used the information provided by VITA in carrying out their various projects. A higher than average ratio of Quality to Complexity exists in these cases; Quality exceeds Complexity in four of them. A general description of the requests and VITA action on them follows:

1. Information on the best formula and procedure for manufacturing flypaper. One volunteer provided a commercial source in the United States for the adhesive, saying that the query was out of his line of experience. A second provided a general formula taken from expired patents. A third provided formulas from the Chemical Formulary, explained the makeup and sources for several of the ingredients, described the technique, and suggested alternate approaches manufactured commercially in the United States, which would give the requester an idea of current trends. A fourth individual also replied (evaluator unable to ascertain his relationship) with a discussion of various types of flypaper and an article describing a recent development. The requester apparently continued in contact with this latter man, trying various approaches.
2. Formula to make leather and rubber sole adhesives. Several formulas, descriptions of techniques, book sections, and articles were sent, plus a source in India for the chemicals. (This is the previously described shoe sole adhesive request.)
3. Requester first asked for the method of making dry powered casein glue for bonding wood to wood. Later he asked for a wet glue formula. A volunteer gave detailed response on both types, comparing their qualities.
4. Glue to prevent staples from breaking apart. Volunteer with a staple manufacturing company says his firm does not use, but others use a specified glue from Du Pont. Requester obtained and reported it was exactly what he wanted.
5. One of the later footwear requests regarding bonding soles to uppers, this query was answered by the volunteer coordinator with several formulas.
6. A formula for simple hideglue for use in the cardboard

container industry. A consulting firm and two volunteers provided the answer, with the consulting firm also including information on simple machinery for container manufacture.

Viewed from this new angle, i.e., what sort of a role has VITA played in implemented cases, a more positive picture emerges. There is, in the first request, that intimation of an on-going relationship and continuing experimentation that are necessary if innovation or adaptation is to come about. And there is something beyond the "clearinghouse" concept, a quality of a stronger contribution than a simple transfer of requested information in more than one of these cases. Respondents in the second and sixth cases were thinking beyond the question that had been asked to the one that had not.

Requester failed to clarify

That communication is a vital concomitant to innovation or adaptation is nowhere clearer than in those queries grouped together as Requester Failed to Clarify. These were requests that could not be assigned until a clearer picture of what was in the requester's mind, and what his current status on the project was, could be elicited by the coordinator. The potential for breakthroughs in some can be readily seen from a listing of them:

1. Production of bamboo tiles, all aspects, including adhesives.
2. Binding plastic seats to chairs.
3. Production of wood and paper glue using local materials.
4. Revise an oil process to improve the quality of wood glue.
5. Manufacture of "black colored" adhesive tape.
6. Manufacture of synthetic glue.
7. Simple construction techniques for prefab doors and windows, using hand tools and low cost glues.
8. Adhesives for clear, thin PVC film and tapes.

Granted that some of the above would have resulted, if clarified, in the supplying of existing information, the majority have an intriguing aura of innovation and creativity. In the case of the bamboo floor tiles, a volunteer was queried, gave some starting points and was looking forward to becoming fully involved with the project once he had more information.

Product improvement

Certainly to be looked into in this quest for VITA's role in

adhesives are those instances where help is asked in improving an existing product. Unfortunately, however, the outcome of the issue is unknown in six of these nine cases, and the project was dropped in the other three.

1. Improving the strength of rosin glue for furniture. Forest Products Laboratory (Madison, Wisconsin) provided bulletins on animal glue, water resistant glue, durable glue from blood, etc.
Outcome: Unknown.
2. Treatment for animal glue to prevent softening through moisture absorption. Forest Products again provided its animal glue bulletin offered suggestions. Requester given a contact which would analyze the glue.
Outcome: Unknown.
3. Devise an oil removing process to improve the quality of wood glue. Requester failed to clarify.
4. Assistance in reducing the cost of a white, non-casein glue requester manufactures. Formulas for experimentation provided by two volunteers. Requester replied that the main ingredient, polyvinyl acetate, is too expensive, asks for formula for that. Coordinator queries the two volunteers again. One is not available, the other says he has already covered this ground. (Folder information is incomplete.)
Outcome: Unknown.
5. Cactus juice additive darkens and loses adhesiveness after a short time. Two volunteers provided different methods, one based on slowing oxidation by processing without oxygen, and the other by adding formaldehyde. Requester dropped project before experimenting.
6. Same requester wanted to know what to add to prickly pear mucilage for use as an insect spray. Requester dropped this project also, went out of business.
7. Requester hopes to achieve better bond between rubber and metal. Volunteer coordinator replies that a special cement is needed and that it is proprietary. Cites sources for purchase and provides articles.

Lack of continuing contact with requesters, business problems of requesters, proprietary information -- all combine to prevent conclusions being drawn as to VITA's role, or potential role.

Special cases

There were two cases where the requester was interested in producing what was apparently a new product; vermiculite wallboard in one instance, and rice husk floor tiles in another. Possibly the bamboo tiles was a third. An Indian manufacturer asked for the process and appropriate adhesive for making insulation board from vermiculite. A volunteer replied that the manufacture of vermiculite board seemed impractical to him, but nevertheless suggested two binders for experimentation. An American company sent a brochure on its products, which did not include board. The Vermiculite Institute passed the request to Mandovel Ltd. of England, which supplies vermiculite to European customers. Mandovel supplied the names of these contact to the requester. Outcome: Unknown.

A requester in the Philippines asked for a clear, weatherproof glue, preferably plastic, to bind rice husks into floor tiles. A representative of Enjay Fibers and Laminates responded, describing two possible combinations, and was interested in continuing assistance. The requester, however, was forced to drop the project by other factors.

No innovation occurred. Possibly the first case is an example of a missed opportunity, but in view of the fact that the requester did not return a feedback form, the chances are that the necessary communication would most likely not have been set up. It appears that often when VITA finds volunteer respondents who are willing to explore innovation, the channel to the requester dries up.

The last of these special cases involves not only VITA's role as innovator or clearinghouse, but also amounts to one of the few times in adhesives history that the potential for a network effect was clearly discernible. On both counts, the results were negative.

The very first adhesive request sent to VITA in 1963 was from a rural development agent in Zanzibar. He requested a source for a glue, hot water and soap resistant, to replace the hard and slow task of stapling bristles into push-brooms. The project was part of the development of small industries on Zanzibar and a neighboring island, and according to the requester, any successful results would almost certainly be copied in Kenya, Tanganyika and Uganda. A short while later, a letter was received from the National Development Inquiry Service of Ceylon. The Zanzibar request had come to their attention in the Newsletter. They asked that all information received on it be duplicated and sent to them. The only response VITA was able to obtain at this early stage in its development, was a letter from the Forest Products Lab, citing the problems involved and regretting that they had no solution to offer.

Another opportunity for VITA to be a contributor to a network

was more successful in 1969. Sudarshan Ltd. of Ceylon communicated several times with VITA concerning the small scale manufacture of glue for envelopes, tapes and general office use, and the equipment needed for manufacture. The formulas were provided by a volunteer coordinator. Later he sent a number of names of equipment manufacturers, together with comments on the requirements. An extra effort was made at VITA to follow up on this case, but no feedback was received. Continuing contact would have been of great interest to VITA because Sudarshan, like VITA, provides free technical assistance to development projects.

In summary, then, VITA has played no discernible role as an innovator or adaptor in the adhesives field, and has had little opportunity to foster a network effect. It has, however, developed steadily a capability as something more than a clearinghouse.

It has also developed, or perhaps it is more accurate to say that, like Topsy, it grew, a number of informational resources on adhesives.

Growth of the literature and its use

The attached chart is not necessarily complete as to the use the literature has received; in many cases the abstract lists titles of articles that may well have come from one of these sources.

The Industry Requirements bulletins have been most consistently used since VITA acquired them. The Inquiry Service finds them especially useful in answering general requests of low quality.

The interesting fact that is not brought out by the chart is that VITA now relies entirely on in-house materials when a certain volunteer coordinator handles the problems, on a combination of volunteers and in-house information when a second volunteer coordinator handles them, and on the single problem in this period handled by a new staff coordinator, used no in-house information; in the early days VITA relied entirely on volunteers. Forest Products Laboratory provided 8 bulletins in 1/66 to answer #454. VITA evidently acquired these, yet did not search them for an answer on problem #1600. Instead, Forest Products again supplied one of the bulletins. It is possible this happened because the coordinator was different. The key to the use of literature is the individual coordinator throughout the eight year period. For example, note that two volunteers urged use of the Handbook of Adhesives in 1966 and February, 1968. Yet, this work was apparently not acquired by VITA, or at least not used until March, 1969. VITA had received by this time 28 adhesives requests. Note that when this work is finally used, it is used by just one coordinator, although 14 coordinators handled adhesives problems from March 1969 to the present.

ADHESIVES
GROWTH OF THE LITERATURE AND ITS USE

<u>Date</u>	<u>Forest Products</u>	<u>Skeist Handbook of Adhesives</u>	<u>Technology of Adhesives</u>	<u>Industry, Plant Requirements Bulletins</u>	<u>Chemistry & Technology of Gelatins and Glues</u>	<u>Chemical Formulary</u>
8/63	Animal Glue 492 Water Resistant Glue 40 Durable Blood Glue 280-1-2 Properties Synthetic Resin Glue 256-7-8					
1/66	Water Resistant, #40 (F.P.L. sent again)					
12/66		VV Galley cites, recommends				
8/67		VV Dwyer sends info from; recommends				
9/67				Sent 2		
2/68		VV Galley sends Table of Cont.				
			VITA uses, regards as best source	Sent 5		
3/69			VITA sends info from (Webber)			
5/69			VITA sent sections	Sent	VITA set sections (Carlson)	
7/69				Sent		VV Lipscomb uses
11/69				Sent 4	2 Chapters (Carlson)	
12/69						Ch. II sent

<u>Date</u>	<u>Forest Products</u>	<u>Skeist Handbook of Adhesives</u>	<u>Technology of Adhesives</u>	<u>Industry, Plant Requirements Bulletins</u>	<u>Chemistry & Technology of Gelatins and Glues</u>	<u>Chemical Formulary</u>
1/70				Sent		
11/70		Section sent (Webber)				
6/71		Section sent (Webber)				
7/71				1 sent		
8/71						

Others: Neville Chem Co. book - 20269 (Titus)

(2) Modern Plastics Ency. - 20638 (VV Shortridge)

Adhesive Age (periodical)- 20825 (Webber) and 21257

Industry Profile Rubber Cement - 20830

(2) United Shoe Co. How Modern Shoes Are Made, Ch. VIII - 20857 and 21256 (Webber)

Rubber Handbook - 21257 (Webber)

Vanderbilt Handbook - 21256 (Webber)

Patents (Webber)

Volunteer usage on adhesive requests

VITA has 97 volunteers listed on the Adhesives skill card. Of these, seven have at this point been cancelled, but three of those cancelled previously worked on adhesives cases. Thus we can conclude that the potential number of adhesives volunteers available for these 68 requests was 93. Of these, only 41 were sent one or more adhesives requests. Thirty volunteers from other skill areas responded to at least one adhesives request.

Most of the volunteers on the adhesives card (94%) were not on the volunteer roster before 1966.

The fact that 56% of the adhesives volunteers have never worked on adhesives requests is not by any means to say that they have not been used. One has worked on 18 other problems, another on 16, and there are several instances of adhesives volunteers having worked on only one adhesives problem, but more than 20 other requests each. To ascertain, if possible, why so many had not been queried on adhesives problems, skill resumes of the 49 volunteers in this category were studied. Three had clearly been listed on the adhesives card by mistake. One who has proficiency in adhesives does not accept problems connected with private businesses. Most adhesives problems fall into this category. In these four cases, then, it was clear why coordinators, after inspecting the resumes, would not send them adhesives problems.

In the remaining 45 resumes, some connection with adhesives was indicated. Sometimes it was a prime connection where it appeared that the volunteers should definitely be called upon to answer adhesives requests. For example, one volunteer (on the roster since May, 1967) states prominently that he is "capable of original research in adhesives." Others list a specific category of adhesives as a major field of capability. Among those categories are: wood adhesives, metal adhesives, laminating adhesives, epoxy adhesives, plastic adhesives, and silicone adhesives. Having previously studied a problem in which the requester asked for the formula for "a two-solution epoxy resin adhesive like Araldite made by CIBA of Switzerland," the evaluator was surprised to note that the query had not been sent to a volunteer listed on the roster for several years whose resume listed experience with "two part epoxy resin adhesives."

It is not always easy to discern the level of competence from the resumes and skill categories that were in use until a few months ago. The volunteer's normal areas of expertise often seemed unconnected with adhesives, yet that category had been circled on the skills list.

The new skills list now in use allows for one of three degrees of ability to be checked: amateur, competent, expert. This is helpful but would be more so if the qualifying terms that seem to pepper the

adhesives field were also listed. As it stands, VITA will still receive a "not in field" response when it sends a bone glue request to a volunteer who is indeed an "expert", but in the plastics adhesives field. One volunteer's comment when he returned a problem unanswered gives an idea of how complicated the adhesives field is:

"My experience in the field of glue would be limited to pressure sensitive adhesives which are of the temporary variety rather than forming permanent bonds. I expect the requester wishes to manufacture glues of the latter types for wood, metal, etc. which would be expected to perform at a higher bonding power than can be obtained from p.s. adhesives. If clarification indicates an interest in p.s. adhesives, please contact me again for information."

With all these limitations in mind, the following conclusions have been drawn regarding the 45 volunteers available to answer adhesives problems:

There are 9 volunteers who appear to be well versed in the field in general.

There are 24 additional volunteers who list capability in a particular kind of adhesives and whose resumes indicated educational background and work experience related to the adhesive they specify.

The remainder do not appear to have a primary connection with the field.

It might be well if coordinators systematically check out the nine generalists and 24 specialists as future adhesives problems are received. They may then wish to review the other resumes and where they feel it is warranted, check out some of these volunteers on problems. This should permit some weeding of the adhesives skill cards leading to more effective selection and use of the volunteer.

Irrigation: Phases of Integrative Development

The overall impression gained from a review of 106 irrigation cases is that this field is if anything more diffuse than adhesives. Many gaps exist in the continuity of VITA's work in the field in spite of the larger body of experience. Significant integrative phases of work occurred, however. We concentrate on salient lessons from the record.

Comparative caliber of inquiries

Tables 17 and 18 compare the Quality and Complexity of adhesives and irrigation inquiries. Irrigation is substantially stronger in Quality, slightly so in Complexity. A remarkable number of requesters in irrigation, notably Peace Corps Volunteers and some missionaries, document local water, soil, slope, distance, temperature, use and other variables with care in sending problems.

Build-up of capability

Classification history plays a trick when VITA's record of irrigation work is to be traced. Only nine problems are so classified for the entire 1961-65 period. The number apparently jumps to 38 in 1966, and levels off at about 15 per year thereafter. A closer look shows that in 1961-65 period 110 cases in the sub-categories water pumps, water supply, wells, water storage, wind, and water wheels were processed. All are treated as irrigation subjects in 1966, but obviously only partly cross-classified in the earlier years.

Village Technology Handbook

The concentration of work by VITA on these aspects of irrigation was indeed so great in 1963 and 1964 that several independent reports were prepared, forming the basis for inclusion in the Village Technology Handbook in 1964 of materials on well drilling, rotary lift pump, lift pump capability, sealed dug well, earth borer, handle mechanism for hand pump, and inertia hand pump. Later, "Standard Answers" were prepared on small dams, hydraulic rams, inertia pump, pumps of 25' to 50' head, well drilling, and windmill pumps and generators. The 1970 revised edition of the Village Technology Handbook maintained strong emphasis on water supply and distribution facilities.

Field basis for coordinator competence

Over much of the period from 1966 to 1970, VITA coordinators with previous field experience in Asia handled a large proportion of irrigation problems. One had done original design work on bicycle-powered pumps and field work with inertia hand pumps in Afghanistan, contributing to an ability to guide inquirers on practical aspects of their use and experimental development. Another coordinator picked up problems of plastic piping for a mission farm manager in Botswana in an exhaustive, original letter. These coordinators called on volunteers in numerous instances, at other times relying on standard VITA irrigation materials.

Self-satisfaction

Completion of the Village Technology Handbook, in the earlier period, left an element of complacency at times. "That should solve all your problems," a coordinator asserted to a Peace Corps Volunteer in sending extracts from the Handbook. The Peace Corps rejoined by

Table 17

DISTRIBUTION OF ADHESIVES INQUIRIES
BY QUALITY AND COMPLEXITY

<u>Quality</u>	<u>5</u>	<u>4</u>	<u>3</u>	<u>2</u>	<u>1</u>	<u>TOTAL</u>	<u>Percent</u>
5	0	1	0	0	0	1	1
4	0	1	0	1	1	3	4
3	1	1	2	6	4	14	21
2	0	0	5	7	11	23	34
1	0	2	6	8	11	27	40
TOTAL	1	5	13	22	27	68	
Percent	1	7	19	32	40		100

Table 18

DISTRIBUTION OF IRRIGATION INQUIRIES
BY QUALITY AND COMPLEXITY

<u>QUALITY</u>	<u>C O M P L E X I T Y</u>					<u>Total</u>	<u>%</u>
	<u>5</u>	<u>4</u>	<u>3</u>	<u>2</u>	<u>1</u>		
5	1	3	2	2	2	10	9
4		4	3	5	4	16	15
3		1	7	9	11	28	27
2	1	4	2	5	6	18	17
1		1	3	4	26	34	32
Total	2	13	17	25	49	106	
%	2	12	16	24	46		100

asking for supplemental details. None were sent. A later coordinator dismissed the possibility of using a hand pump for an 800' lift, 2,000-yard distance community irrigation lift system for El Salvador. In the same month, he sent two VITA plans for hand pumps to the Philippines commenting, "There is really little other choice in the way of simple hand pumps."

The unvoiced word

That the last word had not been said was demonstrated for the El Salvador requester, a Maryknoll mission worker, by a volunteer whose letters are models of explanation of technical functions to a layman. The volunteer's first letter stated the relevant variables and formulas, concluding that centrifugal pumps in two stages would be required, though each of only 1 HP, and asking seven factual questions. The requester answered the questions, and then asked how high a hand pump could lift water in a smaller diameter pipe. He asked also about animal power, with the side remark that money is short. Though the inquirer did not baldly stress lack of resources for a motor-driven pump, the volunteer got the word. He adapted to the hand pump constraint. He proposed a three-stage lift, with storage tanks, and sketched the design of a force pump with a long lever handle. The volunteer noted that an adaptation of an oil well pump "walking beam" would produce the needed leverage, and sent details of materials and manufacturing methods.

Surprisingly, in view of the requester's strong initiative, no feedback is on file. Nor has this volunteer been engaged on other water lift problems.

Requester contributions

Feedback letters from Peace Corps workers in Honduras and Senegal in 1965-66 alerted VITA to circumstances in which local farmers, in one case through a cooperative, had invested funds in motor pumps, a distinct jump in technology and investment over types of lifts proposed by VITA for these localities. In Senegal, water was to be raised through tubing for an overhead sprinkler system. It is possible that this information from the field triggered VITA's attention to sprinklers, on which ability has since steadily advanced.

A later (1969) Mexican request for information on Israel's drip irrigation system was answered, on referral by VITA, by the University of California. The material has since been sent to several inquirers whose statement of problem was analogous.

How not to reinvent the wheel is also on record, through a requester's initiative. As a Peace Corps worker in India in 1967, he obtained designs from VITA on various human-powered and animal-powered pumps.

He enabled a local manufacturer to modify and implement the design for a bullock-driven pump. In field trial, it proved uneconomical, given the actual power local bullocks could produce. He sent VITA the full engineering report of the negative result, an instructive case in design and field testing.

Advance in sprinkler capability

The earliest request for a low-cost sprinkler design, in mid-1967, was answered by a volunteer with two published bulletins and certain U.S. cost data. One year later, a requester from Mexico was put in touch by VITA with a volunteer who saw and took the challenge of designing a full field system. By mid-1969, when the executive head of the Freedom From Hunger Foundation in Ceylon requested plans for the design of a crawler-type sprinkler system, three excellent volunteer replies were provided. One asked for pertinent data, offering to send a detailed design. Two went ahead on the basis of stated assumptions and produced designs. Regrettably, no feedback is available to test their suitability in the field.

Network role: positive and negative

Two VITA volunteers working on windmill specifications in 1966 took pivotal positions in reviving 40-year old U.S. designs. One, after handling VITA requests on windmills for village irrigation, prepared a resume of the state of the art, and was in turn able to answer queries from Iowa State University and the Michigan University School of Public Health. The work of these volunteers was continued in cooperation with the specialized resources of Brace Research Institute, Montreal.

Informal cooperation with the American Society of Agricultural Engineers in 1967 led to outstanding volunteer involvement in the El Salvador three-stage lift, and to other professional support. The ASAE connection evidently did not mature. An opportunity for cooperation with one of Asia's most down-to-earth field research stations, the Planning Research and Action Institute of Lucknow, was missed in 1967. The PRAI director had proposed joint work in advancing development of a cheap, portable lift for paddy irrigation, already well started in field experimentation. VITA did not respond.

More recently, VITA is apparently in effective communication with the Israel Institute of Technology, Haifa, and has referred inquirers directly to that institution for current reports on drip irrigation.

Conclusion: Defining and Enhancing VITA's Role

Our topic studies leave no doubt of VITA's active role as a clearinghouse. VITA's services, as seen in irrigation and adhesives, go beyond information transfer to technological adaptation and, at times, innovation.

VITA's formal equipment as a clearinghouse is provided by its consistent use of the core classification system established by the Federal Council of Scientific and Technical Information (COSATI) as the basis for classifying and indexing Problem Subjects and volunteer skills. The VITA thesaurus built up from the basic COSATI system is now roughly in its fourth generation of use.

In VITA's performance as a clearinghouse, however, many instances of inefficiency have been observed in the adhesives and irrigation record. The great diversity of problems received, their semi-random sequence, long intervals, and personnel changes cause loss of system memory. Problems with high frequency of occurrence receive more thorough and sustained attention, increasing opportunities for adaptive and innovative advances as seen in irrigation, but such accumulation of experience in turn builds its own difficulties in subsequent tracing and selection of past materials.

These difficulties are well recognized by VITA staff, who have launched steps to improve the efficiency of the clearinghouse function. Steps are underway to provide for a new cycle of up-dating and harmonization of thesaurus, skill bank, and library. Detailed thesaurus entries would be "renegotiated" along macro- and micro- lines, consistent with possible eventual installation of a computerized retrieval system.

Our review of adhesives and irrigation cases confirms the high priority to be assigned to information system improvements. Action on these lines is recommended:

1. Sharper problem descriptors and modifiers are needed, focused on end-use and functional categories as exemplified by "adhesives for footwear". During the evaluation it became possible to develop a "tree of Problem Subjects" for working use in irrigation. Branches representing 34 Problem Subjects, arranged in functional sequence from water source to lift, transport, storage, use, and chemical additives, connect the 106 individual cases to the main irrigation trunk. It is recommended that the frequency distribution and lists of Problem Subjects presented in Appendix I be used to build such "trees" of subject relationships as a guide to coordinators and other staff.

2. In reorganizing the Information Resources Center, or library, systematic steps are required to introduce cataloguing and shelving

categories that are fully consistent with those being evolved for problems and skills. Secondary referencing as necessary for inter-library exchanges must also be maintained. The magnitude of effort required to bring the library classification and organization to full effectiveness in support of the daily inquiry service should not be underestimated. Full time assignment of a qualified staff member is recommended.

3. Refinement of skill cards and volunteer resumes should be steadily advanced, to identify volunteers with broad general experience, by field, and to assign descriptors pinpointing the most relevant specialized skills of each volunteer. Distinctions made by volunteers in listing their specialized fields on resumes - pressure sensitive adhesives, metal adhesives, wood adhesives - should be explicitly recorded on new skill cards. Identification of competent subject-matter generalists requires early attention, for which these suggestions are offered:

A. The review of adhesives volunteers reported above should be taken one step further, to see what patterns of descriptors or resume attributes tend to identify subject-matter generalists.

B. Such patterns of volunteer attributes may also be discernible in a systematic review of the informal file boxes used by inquiry coordinators to locate volunteers with proven records that indicate broad competence.

C. Skill cards that represent connecting echelons in trees of Problem Subjects should be thoroughly reviewed, especially to identify volunteers with suitable combinations of managerial and technical experience.

D. Building selection criteria or patterns of descriptors through the above steps, a roster of subject-matter generalists should be developed by computer cataloguing, either through KWIC-type indexing using the unit terms on existing volunteer master cards, or by inverting the arrays of volunteer numbers listed on existing skill cards. (Numerical coding of skills would be a preliminary step in the latter procedure.)

E. Letters gauging the readiness of selected volunteers to handle more inquiries, of either low or high Quality and Complexity, should be exchanged prior to assigning increased responsibility on the lines suggested in Chapter II.

4. Procedures to make past cases a living resource should be revived. Individual case files are an underutilized resource, containing scattered but often pragmatic replies to locally specific needs. Longitudinal evaluations confirm the difficulty coordinators experience, under pressure of time, in recovering such material from the files and

assessing its transfer value. As the eventual goal, useful case materials and abstracts on each Problem Subject should be available to coordinators in one folder. This would permit the coordinator of a current inquiry to review a broader range of past replies and to exercise more qualified judgment, with the objective of putting all relevant materials into the hands of those volunteers who are asked to work on the current problem.

5. The magnitude of effort required to mobilize past VITA case material for relevant current use is not to be underrated. An earlier effort to glean such valuable documents from the files was abortive. A two-prong approach is proposed:

A. On Problem Subjects included in integrative VITA programs, as outlined in Chapter VI, selected volunteers should be engaged in abstracting past cases.

B. On other Problem Subjects meeting agreed criteria, coordinators handling current problems should uniformly review all past cases and have key materials transferred to folders in the Information Resource Center. An initial criterion would be to institute this practice for Problem Subjects covered in all inquiries rated 3 or higher on Quality or Complexity. When appointment of more coordinators becomes possible, criteria and timetables for covering all Problem Subjects should be adopted.

C. Both the above procedures should include uniform flagging of those Problem Subject cards for which user folders have been created, and the placing of standard transfer forms in the original file cross-referenced to the new user folder. Incremental clerical and duplicating costs will be entailed in both procedures.

6. The thrust of the proposed changes is to reduce sheer physical routines that now take much coordinator time, permitting progressively greater application of judgment by coordinators in selecting volunteers and materials. VITA inquiry coordinators bring substantial qualities of personal commitment, practical judgment, and professional discernment to their task, not as subject-matter specialists - far too many disciplines are involved - but with knowledge of how to structure problems and combine volunteers from different skill classifications in building answers. Professional upgrading of the positions of request coordinators is implied in this series of measures to strengthen the inquiry service.

The process in which VITA is engaged, which starts with problem definition by a person in one environment and causes inquiry coordinators and volunteers in another environment to organize a reply, is almost always adaptive, in being guided basically by the constraints of the originating environment. Attributes of change and novelty

arise from the constraints felt by the originator and his and the respondents' search for a new combination of elements to overcome these constraints.

In high Quality inquiries, exchanges among volunteer, coordinator, and inquirer at times exhibit sequences of ideas, field tests, modifications, and success: key steps in innovative discovery. The volunteer alone, it is clear, does not accomplish the innovation.

In active problem fields such as irrigation, bunching of inquiries has offered opportunity for integrating various sets of factors in problem solution. It is recommended that such integrative steps be made an explicit aspect of VI'A's self-development, to increase its adaptive and innovative role as well as strengthening its clearing-house function. Core subject fields should periodically be selected for integrative attention. Concrete recommendations for such creative program development are offered in Chapter VI.

IV

DEVELOPMENT EFFECTS OF THE INFORMATION SERVICE

The measurement of effects is a central aspect of the entire process of technology adaptation, and is one of the tough challenges to any inquiry service. This chapter summarizes the results of projects reported in Chapter II in factual terms and discusses their probable effects as measured on the instrument devised in the evaluation. Cumulative developmental effects as seen in the technology transfer studies of Chapter III are then considered.

Results in Current Production and in Project Development

In the implemented cases examined in Chapter II, information provided by VITA has contributed both to current production and to projects of longer gestation, many involving development of human and physical capital.

Cases of direct use by producing units involve 14 Agricultural projects and 21 Business-Technical projects. Eighty farm families have introduced new crops or production inputs as a result of these 14 Agricultural inquiries. They include 60 farmers raising sorghum on demonstration plots in Brazil; ten introducing chick incubators in Haute Volta, one introducing poultry brooders in Ethiopia, and one egg flats in India; one farmer undertaking field-scale tomato trials in Sierra Leone; two using moldboard plows adapted from VITA plans in Sierra Leone; several using motorized plant sprayers to control pineapple disease in Bolivia; one or more engaged in trials with an improved bullock harness in Tanzania; and several in beekeeping in Kenya. Up to 100 additional families were expected to introduce coconut trees in Malagasy at the time of the appraisal. Quality control in selection of ingredients for a poultry feed mill in India has been improved, preventing adulteration and thereby saving 400 tons of feed in the first phase of operation.

New or improved manufacturing technology has been adopted by one large company producing refrigerators in Taiwan, and through assistance by a private consulting firm in correspondence with VITA, by one large firm producing power cables in India. Sixteen small or medium private companies report utilization of VITA information. Expanded production or improved cost or quality performance have been accomplished by companies manufacturing industrial pumps, synchronous motors,

harrow discs, coated papers, and colored candles in India; circuit detection equipment in Brazil; bronze castings in Mexico; razor blades in Israel; bricks in Botswana; and wood and plastic rulers in Malaysia. Three small firms in El Salvador have started production of diosgenin. Small Indian firms have utilized VITA information toward new production of thermostatic bellows, cosmetics and tooth powder. Mission-supported schools and producing units in the Congo have introduced manufacture of metal braces for cots and improved salt blocks for cattle. Community and home canning and oil expresser units have been introduced in Zambia, and essential oil extraction in Mali.

The above applications, it will be recalled, are by producers in a random sample which represents 47 per cent of the 1970 Agricultural inquiries and 43 per cent of the Business-Technical inquiries for which feedback was received. Extrapolated simply to all feedback cases in these two sectors, it can be estimated that information supplied by VITA in 1970 has been applied directly in production by 150-200 farmers and 40-50 manufacturing companies. This is a minimum estimate of direct production effects, making no attempt to estimate results in the 65 per cent of inquiries in these two sectors for which no feedback was obtained.

A further inadequacy of such numbers, of course, is that they take no account of demonstration or multiplier effects. The requester in Tanzania who organized local production of an improved bullock harness reports that as many as 100,000 farmers could adopt the harness if its local benefit-cost experience proves favorable. "Our results have been good," he reported, "but field tests will take at least three years. The improved harness costs more than local ones, but can do more (weeding, ridging, cross ties) with oxen than the local harness, and control better. If cultural practices improve, improved harnesses will be an integral part for they permit better use of ox traction."

About half of the 74 implemented projects reported in Chapter II require a period of gestation before becoming productive. Projects requiring one to three years for fruition include some 11 in evaluating and planning new ventures, six in market development, and two in financial management improvement. Medium-to-long term results which could require three or more years for fulfillment include seven applied research and development projects, six contributions to the buildup of new extension services, and two training programs.

VITA services expected to produce near-to-medium term results include development of export markets for producers of handicrafts, fruit, food products, and manufactured goods in northeast Brazil, and vegetable waxes in El Salvador. Management systems for loan appraisal and inventory control are being installed by firms in Colombia and

India. The largest group of projects with a near-term time horizon involves assessment and decision on major new projects and policies; rock salt utilization in Kuwait; banana plantation development in Singapore; starfish in Tonga; and hydroponics in Taiwan; allocation of new industries to countries in the Grupo Andino; assessment of European Common Market effects by the Food and Agriculture Organization; policy study of deficit financing in a Caribbean territory which has always operated with a budget surplus.

Among applications of medium-to-long term gestation, research and development projects appear to have most tangible prospects of fruition. These include fertilizer trials in Tonga, process and equipment development for corn drying in Guatemala, analysis of laterite soils in the northern Nigerian plateau, study of abnormalities in cattle reproduction in Algeria, and uses for tung oil in Argentina. Training programs for the sophisticated management of technology in Argentina and for rural mechanics in Turkey also appear well established. VITA information on village industries based on local resources constitutes basic equipment for a new Extension Center at the University of Rwanda, and has supported initiation of similar university extension efforts at Robert College in Turkey.

Monetary returns to the above production enterprises, and inherent in many projects of near- and medium-term gestation, are substantial. Value of production is not reported on VITA appraisal forms. Estimates of incremental current production could be made based on the type and size of producing unit involved. Value estimates for longer term projects, however, would entail strong assumptions with regard to output volume, probability of success, allocation of benefit to the information input, and time discounting. Any monetary estimate of total benefits that result from information provided by VITA in cases leading to feedback would therefore be tenuous. Such an estimate, moreover, would understate total benefit since feedback cases account for only 34 percent of the total in these three sectors, a proportion which can be taken as appropriate for all inquiries.

Ratings of Development Effect of Inquiries

To devise other consistent measures of development effects, to provide VITA if possible with a new systematic instrument to use in planning and assessing responses to individual inquiries, a scale of probable economic effects and other outreach of different types of inquiry was developed at the outset of the appraisal, and is presented as Evaluation Measure 4. To simulate the procedure being tested for possible VITA use in processing inquiries, the evaluator assigned ratings on Anticipated Effects, as on Quality and Complexity, upon reading the original inquiry letter.

Two principal criteria are reflected in the Effects scale: breadth of coverage, and directness of action responsibility on the part of the

Evaluation Measure 4

RATING SCALE ON
ANTICIPATED IMPACT OR DEVELOPMENTAL EFFECT

These ratings are subject to upgrading in light of the following factors:

Requester has a record of repeated effectiveness

Development agency is known to be in face-to-face contact with action agents

Problem is significant in scope (e.g., multipurpose vs. single-focus, many people directly reached, potential replication, feasibility report vs. product improvement). Rating (5) reflects this factor.

- (5) Emergency or disaster relief.
Multipurpose, intensive program for whole community or region.
- (4) Development agency: national, state or district.
VITA affiliate.
Development bank, Fomento.
Productivity center, industrial advisory service.
- (3) Development agency: community.
Agency serving central or intermediary role in development network: AID, OECD, UNIDO, Federal Clearinghouse, Indian National Scientific Documentation Center.
Community organization.
Cooperative.
Association: farm, farm youth, industry, management, union, professional.
Medium or large enterprise with potential for job creation, use of local resources, exports, new technology.
- (2) Individual agent of development belonging to a network:
community development agent, agricultural or industrial extension agent, Peace Corps Volunteer.
Small enterprise with potential for job creation, use of local resources, exports, new technology.
- (1) Individual with only local development role.
Small enterprise with no particular development effect.

requester. These are often opposing criteria. An upgrading of the defined rating is therefore provided if the requester has a known record of effectiveness or is a development agency well recognized as having direct contact with persons or enterprises responsible for action. Construction and application of this scale, nevertheless, was found to be more difficult than the Quality and Complexity scales, in part due to the blending of these contrasting criteria.

Effect ratings assigned to implemented inquiries are shown in each Evaluation Abstract, Chapter II, and are summarized by sector in Table 19. Sector variation is pronounced in these ratings. Thirty per cent of the implemented Management inquiries are rated 4 or 5 in Effect and 35 per cent are rated 3. In agriculture, eight per cent are rated 4 and 42 per cent are rated 3. Against totals of 65 per cent of Management cases and 50 per cent of Agriculture cases rated 3 or above, only 17 per cent of Business-Technical cases have Effect ratings of 3 or above.

In each sector, Effect ratings of all evaluated inquiries and implemented inquiries are closely parallel. Sectoral variation quite clearly reflects the larger proportion of public development agencies originating inquiries in Agriculture and Management, as compared to the many Technical inquiries from small private firms. Implicit weighting of Effects ratings toward breadth of coverage over directness of action responsibility is seen in these results.* This weighting, though not explicitly intended by the evaluation team, must be kept in mind in interpreting the Effect ratings in Table 19.

Our consideration of direct development results suggests that monetary approximations of immediate production increases could be developed. Indirect demonstration and longer term results of information transfer elude such measures, however. The Effects scale assigns higher weight to these latter values. Judicious use of the two approaches in tandem is as close as we come at this point to establishing or suggesting numerical measures for evaluating the developmental effects of information exchange.

*No concept of time discount was explicitly in mind when the Effect ratings were formulated. It is probable, as seen in the implementation patterns just discussed, that results reaching wide numbers of people through public development agencies have longer gestation periods than private manufacturing production programs. Higher time discounts applied to many inquiries in the Agriculture and Management categories would tend to reduce the Effect ratings of the first two columns of Table 19 as compared to the final column.

Table 19

RATING OF DEVELOPMENTAL EFFECTS
OF IMPLEMENTED INQUIRIES

<u>Rating of Effects</u>	<u>Implemented Cases by Sector</u>			
	<u>Agriculture</u>	<u>Business- Management</u>	<u>Business- Technical</u>	<u>Three Sectors</u>
	<u>Number</u>			
5		1		
4	2	4	3	9
3	11	6	2	19
2	9	3	11	23
1	4	3	15	22
	26	17	31	74
	<u>Percentage</u>			
5		6		1
4	8	23	10	12
3	42	35	7	26
2	35	18	35	31
1	15	18	48	30
	100	100	100	100

Developmental Effects seen in Technology Transfer Studies

Development effects on quite a different longitude come into view in VITA's experience of technology transfer in adhesives and irrigation.

The discovery aspect of information transfer is illustrated by the step through which shoemaking came to be seen as a "linkline" in the broad area of adhesives. When the evaluation team embarked on its review of adhesives inquiries, no one suspected that a single application of adhesives would stand forth as having more sustained interest than any material source or process involved in adhesives production, or that the most frequent application of interest would be in shoe manufacture. In the next set of 68 adhesive inquiries, quite different clusters of applications and material sources might arise. This unpredictability of international industrial inquiries, their unexpected bunching and linking, gives the process a certain excitement, as well as complicating life for VITA.

This is also the process by which relevance is established. Bits of information about adhesives stand in chains of relevancy that wind out in many directions. Which chains have most meaning for international development? There is no easy a priori way to predict what uses, sources, or processes will be most meaningful. Nor are there prescribed indexing or classification guides to determine which descriptor, or modifier, will have most utility. We can now, however, look back on the experience of an organization like VITA - or, with modifications, on the previous growth of "adhesives" industries - to gain clues on how the relevancy of information for retrieval, transfer, and adaptation is determined.

The integrative review performed on VITA adhesives inquiries, it will be observed, has reversed and bridged the sharp discontinuity recorded in Chapter III in VITA's accumulation and use of knowledge on shoe adhesives. The use of such integrative reviews, as a starting point in keeping VITA on the "leading edge" of selected areas of technology development, is suggested by the early history of VITA irrigation cases. In response to an inquiry in April, 1962, VITA Report No. 14 was prepared for one inquirer, and subsequently sent to others, containing detailed techno-economic comparisons of irrigation pipe made of different materials. In February, 1963, when a subsequent inquiry on pipes was received, the coordinator, author of Report No. 14, not only asked a new volunteer to reply to the inquirer but also sent the volunteer a copy of No. 14 and requested his critique. The volunteer replied with the clear information that treated cotton or nylon canvas pipe would be cheaper in this type of application than the plastic pipe cited in the Report. In the period of preparation for the Village Technology Handbook, VITA was thus updating and correcting its earlier knowledge.

The need to avoid complacency, keeping answers real and up-to-date, is emphasized in this record. Here the newness of old questions sent in by fresh inquirers is important. Good questioners are VITA's chief unrecognized asset. The perception of the requester who identifies and articulates a problem, and who tests proposed solutions in real conditions, is the fulcrum of successful change.

The question sets the original value of the inquiry. The cost of meeting it, VITA's input, should rise to this value. In short, the Quality of requests should substantially outrank quantitative measures of Effects as VITA's principal criterion for organizing the response.

In a basic sense, then, the principal developmental effect of VITA is in the process itself: the process of building knowledge relevant to technological progress in developing countries. Tangible implementation of projects is a major test of the relevance of information VITA provides. Continuing efforts to record such implementation and to measure its effects are required in building VITA's cumulative knowledge and ability to service requests.

INTER-AGENCY COOPERATION IN MEETING TECHNICAL NEEDS

Acquaintance with VITA makes it clear that the organization has in many respects moved away from the original "person-to-person" concept of information exchange. This is most evident in the practice of asking volunteers to send all substantive answers through VITA headquarters, in order to maximize the clearinghouse function, improve coordination, and avert inappropriate replies. It is also apparent in the substantial number of queries received from organizations. Organizational requests may be ad hoc; or through informal working agreement, as with the United Nations Industrial Development Organization, the Organization for European Cooperation and Development, and the International Executive Service Corps; or through contractual arrangement, as with the Agency for International Development and the Peace Corps. Two out of five inquiries received by VITA in recent years have an organizational origin.

Private firms and individuals other than missionaries, nevertheless, still constitute the largest category of inquirers, 41 per cent in 1970. Sources of evaluated inquiries are shown in Table 20. The 84 evaluated inquiries from individuals or companies represent 42 per cent of evaluated inquiries; the breakdown of other sources of evaluated cases is also closely parallel to that of all 1970 inquiries.

Among organizational inquiries, those of the Peace Corps are distinctive in that they are almost always from individual Peace Corps Volunteers located in the region to which their questions pertain. Quality ratings of Peace Corps Volunteer requests are also distinctive, as seen in Table 20. Of evaluated Peace Corps inquiries, 76 per cent are rated 3 or above, nearly half of these at 4 or 5 ratings. Only the much smaller number of inquiries from private consultants show higher relative Quality. Except for CARE and FAO, only 30 to 35 per cent of inquiries from other sources categories draw Quality 3 ratings or above.

Quality ratings of inquiries from Peace Corps Volunteers underscore the value of problem definition by persons on the ground who have had analytical training and some subject matter orientation. Inquiries from private consultants, usually nationals of the country concerned, exhibit these same qualities, with much sharper technical focus.

Table 20

SOURCES OF EVALUATED INQUIRIES,
BY QUALITY RATING

<u>Quality Rating</u>	<u>Private Firm or Indiv.</u>	<u>Mission- aries</u>	<u>Peace Corps</u>	<u>Private Consult- ant</u>	<u>Nat'l Devel. Agency</u>	<u>AID</u>	<u>IESC & TECHNO- SERVE</u>	<u>OECD & UNIDO</u>	<u>CARE & FAO</u>	<u>Totals</u>
1	4	1	5	1			1			12
4	3	1	9	3		1(1)			1	18
3	22	7	14		7	2(1)	2	(1)	2	56
2	26	10	8	1	8	1	4	1(6)	1	60
1	29	8	2		13	4(3)	2(1)	(13)		58
Totals	84	27	38	5	28	8(5)	9(1)	1(20)	4	204

Note: Brackets refer to inquiries transmitted through the indicated agency, but classified in this table by originator.

At the other extreme in Quality are inquiries originating with a third party but forwarded to VITA by OECD or UNIDO. These are enumerated in the relevant column of Table 20 in brackets, 65 per cent being of Quality 1. The original source of many of these inquiries is a national development agency, and of others a private firm. Some are bibliographical requests. Others, as indicated in Chapter II, cover abstract management or policy issues. Those focused on specific problems typically show little preparatory development of knowledge. Handling of such inquiries at second or third remove, moreover, limits possibilities for firsthand communication and clarification. It is recommended that VITA, in discussion with agencies concerned, re-examine procedures for the handling of queries transmitted by intermediary agencies. In the context of increasing capabilities on the part of national agencies in many countries, such initiatives by VITA could contribute to a redefinition of the information function of international agencies.

Two sub-categories are involved in the column headed "National Development Agency" in Table 20. The first includes development banks, fomentos, research institutes, industry associations, and industrial advisory agencies. A high proportion of these inquiries are rated 3 or 2 in Quality. The second group, from university extension centers, are typically of Quality 1. Both groups are significant, though with different focus, in efforts to strengthen VITA's contribution through on-site consulting and development of overseas affiliations.

Rates of utilization of VITA information by principal categories of source divide into two broad levels. At around 40 per cent implementation rates stand national development agencies, private consultants, Peace Corps, and AID. Table 21 sets forth these percentages by source of inquiry. The two other principal categories, private firms and individuals, and missionaries, show implementation rates of 32 and 29 per cent, respectively.

In the context of case and technical topic evaluations, examination of request sources and their interaction with VITA is the basis for the following conclusions on maintaining Quality of requests, and on expansion of on-site consulting and affiliations internationally.

The leaven of Peace Corps inquiries in the overall Quality of VITA problem definition is unmistakable. Inquiries from the American Peace Corps are substantially fewer than in the past, however: 509 in 1969, 315 in 1970, and 197 in the first nine months of 1971. Particularly in rural, agricultural applications, it appears necessary for VITA to plan systematically for the encouragement of inquiries from comparable national and international volunteer agencies whose field workers bring alert, analytical eyes to basic problem definition.

A strong flow of inquiries from manufacturers and other business firms is highly welcome as the basis for identifying concrete, current

Table 21

PERCENTAGE OF REQUESTS IMPLEMENTED, BY SOURCE

<u>Source of Inquiry</u>	<u>Implemented Number</u>	<u>Cases Percentage</u>
Private Firm or Individual	27	32
Missionaries	8	29
Peace Corps	15	39
Private Consultant	2	40
National Development Agency	15	53
AID	3	38
IESC & TECHNOSERVE	2	22
OECD & UNIDO	—	—
CARE & FAO	2	50
Totals	<u>74</u>	<u>36</u>

frontiers of technical interaction between developing and industrialized countries. Active VITA liaison with small industry associations, chambers of commerce, and management associations is recommended, to provide member companies with information on VITA services as a basis for maintaining and strengthening such requests.

On-Site Consulting and Overseas Affiliations

It is recommended that the thrust of VITA efforts to expand the effective use of VITA volunteers on short-term overseas consulting tours, and to strengthen the network of agencies engaged in communicating technical needs and solutions, be directed to those problem subjects selected, periodically, for integrative VITA development. Strong current inquiries, both in Quality and number, are a principal basis for selecting such focal problem areas. Building upon good requests, a problem-oriented approach to the extension of overseas activities would involve the following elements:

1. Although ad hoc on-site consulting by a particularly well-qualified volunteer on significant and well-defined individual problems can at times be justified, it is believed that systematic development of this overseas activity must occur in the context of an integrative buildup of VITA adaptive capability in selected fields. The planning of overseas consulting by one or a team of volunteers, then, would follow as timely in the sequence of integrative program measures, for a selected problem area, set forth in the next chapter.
2. In countries or regions which have originated significant inquiries and have thereby generated VITA attention to the chosen problem field, effective working communication with national development agencies, and, where feasible, with private local consultants is important as the basis for VITA on-site work. A VITA policy of periodically marshalling volunteer talent for work on high priority problems implies, over time, that host organizations representing different functions and fields of technology will have interest in effective liaison. In contrast to an emphasis on building VITA counterpart organizations in many countries, an approach favoring short-term collaborative projects and active liaison with several organizational affiliates is indicated.
3. Affiliation based on personal acquaintance and communication with effective developers in national agencies need not be limited, in this view, to any single agency. Such agencies in a particular country are in large part more complementary than competitive, at least when performing complementary functions: functions of development banks, technical research institutes in different branches of technology, management

training institutes, and industrial extension services. On a given integrative project, the host agency serving as a base for VITA on-site consulting efforts may differ from that on another functional project. Sets of agencies collaborating on techno-economic solutions may similarly differ. Whenever appropriate, involvement of private local consultants is also to be encouraged, adding realism to local adaptations and tests. These steps are suggested in advancing the above concept:

A. Upon receiving inquiries of good or average Quality from national development agencies, VITA should undertake to bring more than usual volunteer attention to the problem. Feedback by the overseas agency should be sought in the context of joint contributions to the field, the possibility of on-site consulting being introduced in the same context.

B. Projects involving substantial elements of design, prototype development, field trial, and eventual field demonstration should be identified as objects for joint funding by international development agencies, typically supporting incremental physical facilities and hardware at the overseas institute, plus expenses and VITA overhead for planning the engagement of on-site volunteer consultants.

C. On inquiries involving a high component of management or local business discernment, where volunteers distant from the scene are hard put to see actual ramifications, guidance to the inquirer in contacting management training centers, management associations, and other local counselling sources should be provided. When acceptable to the inquirer, the problem could be considered in correspondence or direct collaboration with such an institution. Host agencies, in this manner, can gradually become referral points for selected types of inquiry, either replying directly or serving to augment VITA's background information on the problem prior to the volunteer's response.

D. Preliminary to such program development, VITA's inventory of factual knowledge on the resources, functions, specialized staff, and accomplished projects of development agencies in other countries should be expanded and updated, through personal visits as feasible and through acquisition and study of current organization directories and critiques. VITA's existing cooperative relationships with over 150 organizations in the

developmental assistance field constitute a strong base for this purpose.

E. On receiving inquiries from relatively inexperienced development agencies - such as a new university extension service, or a young technological research institute - VITA may have opportunity to bring institution-building experience of volunteers together in joint support. It is suggested that such opportunities be explored in conjunction with international donor agencies in the country or region concerned.

F. It is suggested that VITA, as a non-profit organization active in industrial and technological research, apply as a Technical Member in the World Association of Industrial and Technological Research Organizations, WAITRO. VITA involvement in WAITRO would strengthen liaison with organizations in developing countries and would contribute to the growth of an effective international network of adaptive technical agencies.

VI

VITA OBJECTIVES, PRIORITIES, AND PROGRAM DEVELOPMENT

VITA's voluntary corps, decentralized and loose-knit, is the organization's most underutilized resource. The effort of this chapter to examine VITA priorities and program opportunities has as a primary thrust the uncovering of ways in which a greater number of volunteers can engage in VITA's frontier activities.

As a basis for discussion of objectives and new program elements, detailed trends in Problem Subjects will also be examined.

VITA Volunteers and their Utilization

The frequency of involvement of volunteers can be analyzed through Table 22, Utilization of Volunteers in Two Major Skill Classes. Although this sample of volunteers is not random, being based on full enumeration of those on skill cards for two high-frequency Problem Subjects, the fact that more than half these volunteers have not received irrigation or adhesives problems, but problems in other areas or classifications of their skills, suggests that this utilization pattern is reasonably representative of that for all volunteers.

The pattern of volunteer utilization shown on Table 22 refutes the concern, occasionally voiced, that most VITA volunteers are never called upon. In this sample of 240 volunteers, only 33 or 14 per cent have not received any inquiry. Failure to use volunteers is higher, 20 per cent, for those on the irrigation skill card, but for those with adhesives skills only five per cent. As many as 41 per cent, however, have handled only one to five problems. About 20 per cent have answered six to ten inquiries, and 25 per cent have replied to 11 or more queries.

A sub-analysis of the data underlying Table 22 shows that 70 per cent of the volunteers now on the roster in these two skill classes joined VITA in 1967 or later. Some 40 per cent of the volunteers on these skill cards since 1967 have received about one inquiry per year. About 20 per cent have received three to four queries per year, and 20 per cent, five or more queries.

Table 22

UTILIZATION OF VOLUNTEERS IN TWO MAJOR SKILL CLASSES

<u>Frequency of Inquiry References to Volunteers</u>	<u>Number of Volunteers</u>		
	<u>Irrigation</u>	<u>Adhesives</u>	<u>Total</u>
0	28	5	33
1-5	60	39	99
6-10	27	23	50
11-15	19	16	35
16-20	6	6	12
21-25	3	6	9
26-30	-	-	-
31-35	-	2	2
	<hr/>	<hr/>	<hr/>
Totals	143	97	240

Of those volunteers on the roster before 1967, some 36 per cent in adhesives and 20 per cent in irrigation have handled two or more inquiries yearly, the rest averaging one or less.

Adequacy of Utilization

To gain an understanding of volunteers' yardsticks for judging whether they are adequately utilized, a sample survey of volunteers is recommended. Many are unable to answer inquiries at the time needed. Others are reported to desire greater involvement. Even to ascertain seasonality of time constraints, an analysis of volunteer preferences would be desirable.

By the yardstick of adequate utilization of skills, however, much room exists for improvement. Statistical demonstration of high underutilization of adhesives skills was seen in Chapter III. Inspection of the schedule of volunteer involvement in irrigation reveals the same pattern. That increment of management which finds an effective way of drawing more vigorously on known volunteer skills will enjoy a high sense of benefit-to-cost achievement.

Areas of inadequate professional representation

A functional portrayal of VITA volunteers' general and technical business skills, prepared in 1969 and reproduced as Appendix II, exhibits well balanced professional strength. Areas of probable inadequacy can be gauged by comparing the number of volunteers in each category with trends in Problem Subjects.

Problem Subject Trends

Significant recent trends in Problem Subjects are seen in Table 23. It is recommended that VITA review these trends, and undertake periodic future reviews, to identify and explore problems for which new recruitment of volunteers is desirable. Rising recent trends in marketing and cooperatives are especially notable. Sub-analysis of recent cases in these fields, in particular, is recommended to define subject matter needs in concrete terms. If the rapidly rising number of marketing inquiries, for example, includes many market research problems, the 16 volunteers listed on the Roster of Skills in Appendix II under "Market Research and Analysis" are presumably far too few.

Currently important Problem Subjects as seen in Table 23 can be grouped in four major sectors: Agriculture, including Animal Husbandry; Management; Manufacturing-Technical; and Construction. VITA accordingly receives, from current inquirers, widespread guides to program orientation in several of the principal sectors that are crucial to the progress of developing countries.

Table 23

SIGNIFICANT TRENDS
IN PROBLEM SUBJECTS

<u>Problem Subject</u>	<u>Year and Number of Inquiries</u>				<u>TOTAL</u>
	<u>1961- 1965</u>	<u>1966- 1967</u>	<u>1968- 1969</u>	<u>1970- 1971</u>	
	<u>Rising Recent Trend</u>				
Marketing	9	32	81	103	225
Cooperatives	8	16	31	70	125
Vegetable oils	4	17	16	26	63
Water wells	0	11	20	28	59
Export-Import	2	3	18	30	53
	<u>Sustained Recent Trend</u>				
Training	7	26	35	30	108
Storage	10	33	25	28	96
Textiles	7	33	23	32	95
Water supply	14	15	38	28	95
Feasibility	4	28	25	37	94
Kilns	20	27	20	24	91
Seeds	7	22	35	25	89
Animal feed	0	6	47	31	84
Rabbits	7	18	35	23	83
Soaps	9	20	32	20	81
Steel	3	31	27	20	81
Cattle	4	28	23	24	79
Structures	7	23	22	26	78
Fertilizers	4	24	21	28	77
Leather	3	27	25	22	77
Soybeans	1	16	27	29	73
Peanuts	9	20	17	26	72
Adhesives	7	22	19	23	71
Cottage industry	2	12	33	22	69
Boats	1	14	26	21	62
Fish	7	8	25	20	60
Water storage	5	14	27	14	60
Costs	1	12	30	16	59
Swine	6	9	24	20	59
Citrus fruit	3	17	18	17	55
Clothing	5	21	11	17	54

	<u>Substantial but Reduced Recent Incidence</u>				
Water pumps	42	82	44	38	206
Agricultural machinery	6	34	100	37	177
Plastics	14	53	45	38	150
Poultry	18	51	45	31	145
Rice	27	35	44	29	135
Irrigation	9	54	39	31	133
Oils	15	47	33	26	121
Fibers	14	41	30	11	96
Vegetables	6	31	28	20	85
Pottery	15	27	23	17	82
Bamboo	6	20	20	13	81
Coconuts	14	27	21	19	81
Packaging	3	24	31	16	74
Chemicals	0	42	9	22	73
Paper	16	25	12	20	73
Ovens	14	21	18	15	68
Coatings	0	17	31	17	65
Extraction	6	23	15	20	64
Nuts, edible	7	22	15	18	62
Bananas	6	20	20	13	59
Furniture	5	22	14	15	56

Source: Table 16

Priority among VITA Objectives

A philosophy and ordering of objectives among the six working goals set forth in Chapter I may now be proposed.

VITA's personality, in this perception, is most vigorously fulfilled in Objective 2: Unique response to individual inquiries; and Objective 5: Cumulative effect on the state of technology in selected fields. In pair, these two operating themes provide the motivation and the means for enhancing VITA's distinctive contribution to the cross-cultural exchange of technology.

Prominent attention to maintaining, and as timely expanding, the breadth of person-originated inquiries and the quality of VITA's response should be the foremost concern of the board of directors.

Professional excellence in those fields of technical and social development selected for program emphasis is the standard by which VITA should be increasingly judged. In these selected fields, as in VITA's original work in Village Technology, the performance of the organization should be widely visible, an international pacesetter of adaptive development. Active working cooperation with institutes specializing in these problem areas is an important element in VITA's fulfillment of this professional purpose.

Lively volunteer involvement, Objective 6, is indispensable to, and directly supports, the two primary objectives. By placing volunteer involvement in this order just after the first two objectives, we accent the inquirer's perception of need as the fulcrum of healthy change, and stress the importance of an organizing focus to create a cumulative record of technical accomplishment. Volunteers can be expected to display lively initiatives on VITA's paired frontiers; the intensive zone, of concentrated technical adaptation; and the extensive realm, of emerging needs and lone inventors' schemes.

In a clearly defined sense, Objective 3, Quantitative development effects, is an instrumental objective supporting state of the art advances. VITA is more actively in technology than in science. Tangible implementation of projects should be a constant working yardstick to satisfy the originator, and to test the reality of technical progress. But implementation should be on the problem's own terms, not in quest of numbers.

Objectives 4 and 1 will follow, if VITA meets its ordering of the four goals set forth above. The synergy activated in pursuing Objectives 2, 5, and 6 will yield side-products of basic research value, making VITA a unique contributor to cross-cultural change. As the organization adds to its wisdom through the discipline of these action objectives, it will gain increased appreciation of what is meant by

meeting human needs: the fundamental objective.

Criteria for Institutional Support

VITA's periodic selection of special fields for program development, Objective 5, will go far to determine whether the organization is working on lines that are of high program priority for public funding agencies, international or national. If this is indeed the case, it is recommended that these agencies give primacy, as a criterion for judging VITA's accomplishment through use of public funds, to the building of excellence in selected technical fields, rather than to quantitative development targets. Support to VITA can best be seen as the early stages of institution-building, with individual project implementation the instrument for disciplining the institution's growth.

In an unusual way, VITA is on a planetary frontier. An era has arrived when a sense of ecology is part of the consciousness of people in all parts of the world, and when in principle, by widespread agreement, public and private actions in the international transfer of technology should be informed by an ecological viewpoint. As if by serendipity, VITA is in existence as an institution having the form required to guide technical development into lines appropriate for different regions.

This form comprises:

Diverse, voluntary, changing governors, the persons in numerous countries who originate inquiries, the scouts of progress.

Volunteer professional respondents, aware of geography, economy, and culture, and capable of orienting their techniques to the setting of the initiator.

Committed staff and board members serving as guides and transmitting agents, entrepreneurs in identifying promising fields of concentration, and responsive to users and providers of information.

In this form as an international voluntary agency of technical and social change, VITA is in a distinctive position to attract public and private support.

Integrative Program Development

Intensive "state of the art" efforts of the kind observed for irrigation in Chapter III are seen as the primary program instrument

for achieving these institutional objectives. Building on guides to relevance gained through cumulative inquiries, it is recommended that VITA periodically select high priority development problems for concentrated attention. Integrative programs should bring successive problems to the stage of effective field solutions, and should bring field results to a high level of communicability.

An approach to such integrative patterns of work is outlined here.

Program selection

Selection of problems or sets of problems for concentrated work can be done on two paths. (1) One set of action fields is provided by analyzing recent high trends in Problem Subjects. By bringing high incidence problems systematically to the notice of volunteers, VITA can be guided by volunteer interest in the choice of certain subjects for integrative development. (2) Broad problem areas widely recognized as having high priority in developing countries, and spanning significant sets of VITA Problem Subjects, constitute a second zone of action. It is suggested that both paths be pursued.

A candidate area of the second kind is nominated: Small Farm Technology. Millions of small farm operators in developing countries are now exposed to abrupt socioeconomic pressures with the impact of high-yield crop varieties. Issues of appropriate farm technology, equipment, and power interact with issues of unemployment, shifting prices, and population displacement. Solid work by VITA on related sets of small farm problems would build logically on existing talent and information.

Integrative program

"State of the art" development in each high priority field would be programmed for work of three to five or more years' duration.

1. VITA volunteers, at the outset, would glean and consolidate the principal lessons of recent VITA work in the selected field. Generalist volunteers would be brought to Schenectady to identify and define key problems, to participate in refining classifications of Problem Subjects and skills, and to engage in and plan the review of case files. Specialists would join in assessing VITA case materials, to select items that are a continuing resource and to establish the scope of problems that call for field work.

2. In reviewing the record, the subject matter team would identify inquirers whose feedback reports are significant, initiating correspondence as the basis for new feedback and for possible field observations.

3. As necessary in planning the work program, visits to selected

developing countries would be made by VITA management personnel and key volunteers, to assess field needs, observe projects launched by VITA correspondents, and develop cooperative arrangements with host institutions.

4. Program elements to be undertaken on the basis of the above consolidation and planning phases would include:

A. Publication in special bulletins and technical journals of case writeups, feedback information, and field assessments of promising and successful projects.

B. Purposive on-site consulting assignments by VITA volunteers, where possible in effective liaison with host country agencies. Salary compensation should be considered where undue family hardship would otherwise be caused.

C. Team or individual volunteer work in developing design specifications and designs.

D. Prototype and pilot model development in collaboration with agencies or enterprises which can provide necessary physical facilities and inputs.

E. Field trials and, when appropriate, field demonstrations in conjunction with local development agencies.

F. Volunteer involvement in formulating plans for manufacture and market development of proven designs, for financing of new programs, and for dissemination of educational results.

G. Procedures and tests for evaluating results.

H. Procedures for building the results of integrative programs into VITA's continuing resources and activities in information transfer.

Network development

On Problem Subjects selected from high trend topics, it is recommended that VITA explore the participation of volunteers in the technology innovation and monitoring panels organized by the National Academy of Sciences, oriented to the needs of developing economies.

VII

ADVANCING VITA'S CONTRIBUTION TO ADAPTIVE TECHNOLOGY: A SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

The strong conclusion of this evaluation is that the VITA idea works. With relatively limited resources, VITA has achieved a distinctive international role as a voluntary institution which seeks to attune technological development to realistic social and economic needs.

VITA's underlying strength is in its attraction of overseas inquiries from a broad variety of local initiators and developers, who direct attention to their specific needs. This is to say that VITA is a good listener, receptive to unusual queries. Inquiries to VITA often spring from difficult social and geographic conditions. The organization is therefore forced to come to grips with many levels of technical development, from rudimentary to quite sophisticated.

VITA volunteers, in turn, span a wide range of talents and, in a large proportion of instances, demonstrate the perception and skills needed to provide useful answers. The evaluation confirms the ability of such a network of volunteer experts to serve as a viable vehicle for meeting far-flung technical needs. It suggests, though this is not yet adequately tested, that volunteers can take more active part in the progressive upgrading of VITA services.

It is estimated, at a minimum, that information provided by VITA to the Agricultural and Business sectors in 1970, the year for which cases were evaluated, resulted in increased production on 150-200 farms and in 40-50 manufacturing enterprises. These two sectors represented 54 percent of VITA's inquiries in that year; the estimate covers only the 34 percent of inquiries in these two sectors on which feedback from the inquirer had been received. Apart from direct output increases, action had been taken by inquirers on project appraisal, planning, and market development projects to be carried out within one to three years, and on research, development, and extension projects of three to five years' gestation. The wide range of products, types of enterprises, and countries involved in project implementation is shown in the Evaluation Abstracts presented in Chapter II.

The concept of bringing seasoned professional ability to bear on problems sent in by persons in diverse local circumstances has resulted in a strong internal standard of relevance and responsiveness among VITA central staff. In carrying out the evaluation it was found possible to translate this standard into objective, reliable measures of program performance. A yardstick for self-appraisal was thus developed, to be built into future program review and advancement.

Openness to inquiries from diverse ecological zones has resulted, on the other hand, in exponential expansion in the kinds of problems faced by VITA staff. It is clear from this review that VITA has crossed thresholds of size, professional complexity, and geographic outreach that have strained the resources available to manage such extensive activities. In a familiar growth profile, VITA has moved from being a small organism to medium size ahead of the organization's capacity to provide for differentiated middle management functions. Identifying these functions and the types of resources required to fulfill them is the focus of several of the conclusions and recommendations which follow.

The measures recommended below are directed to the two primary objectives established in Chapter VI: maintaining and improving upon VITA's record of individualized, resourceful replies to inquiries; and building a cumulative body of adaptive technology in selected fields of high development priority. To achieve either of these aims, strengthening of central capability for identifying volunteers and for retrieving information is essential.

Strengthening of Central Resources

Central VITA staff have created the core organization and facilities of a clearinghouse: careful personalized search procedures for matching volunteers to problems; a physically compact circular roster of volunteers' resumes; a standard classification system and thesaurus, derived from the federal COSATI system, for problems and volunteer skills; and a working library which includes reference works, topic brochures, and selected materials drawn from VITA case files. Even though equipped with these basic tools, VITA is often not efficient in the clearinghouse task. The complex variety of Problem Subjects handled and of professional skills represented in the volunteer roster make it difficult to conclude search procedures with confidence that the most suitable volunteers have been identified. Systematic memory aids are lacking, accentuating lack of continuity with staff changes.

VITA staff are now engaged in upgrading these systems and in designing a program to introduce more sophisticated methods of

information search and retrieval. The scope of the present evaluation did not include review of internal management procedures or of proposed new information systems; these will not be commented on in detail. The evaluation, nevertheless, strongly points to the need for prompt action on such improvements, and for sustained funding to this end.

In any assessment of the new resources required for this purpose, it is important to recognize that VITA's entire philosophy and style of action turn on the personal attention given to inquiries at VITA headquarters. Personal study and interpretation of each request is feasible only in the degree to which the volunteer roster, library, and information retrieval system are lucid and efficient. On this central resource the following fundamental VITA attributes depend: (a) maintenance of personal orientation in the inquiry service; (b) ability to identify areas of developmental priority, through frequency of requests; (c) accumulation of practical information and tested ideas on recurring problems; (d) encouragement to diversity among originators and problems; (e) coverage of singular but often significant problems in development and ecology; and (f) building of basic data for research toward better understanding of the role of information in the modernization process. Support to the long-term integrity of VITA's contribution in these fundamental realms would appear to have a high call on endowment and other sustained funding by foundations and other donors concerned with the role of science and technics in international development.

Recommendations

In support of VITA's own initiatives to upgrade the central management and information system, these recommendations are made:

1. Full time, permanent assignment of a qualified staff member to organize, and manage, the VITA library, or Information Resource Center, and to maintain this central facility at a continuing high level of efficiency. A major effort is required to introduce library classification categories consistent with those now in use and being evolved for Problem Subjects and volunteer skills, and to organize cataloguing and shelving accordingly.

2. Steady implementation of the review of volunteer resumes to identify volunteers with broad general experience, by field, and to note the specialized skills of others. Skill cards should be progressively modified to show these distinctions. Once volunteers with broad development experience are identified in important fields, selected subject-matter generalists should be invited to participate with VITA staff in reviewing other resumes to pinpoint specialized talents and assign

efficient descriptors. More active involvement of volunteers, it must be recognized, will require conscious staff initiatives. It is urged that the required steps be clearly defined and assigned to those staff members who are in direct communication with volunteers.

3. Engagement of volunteers in reclassification of thesaurus Problem Subjects. The frequency distribution of Problem Subjects listed in Appendix I should serve as a guide, together with the most recent COSATI and other pertinent classifications, in building hierarchies or trees of Problem Subjects to assist non-technical request coordinators in understanding lines of specialization and their interrelationships.

4. Development of a physically distinct section of the Information Resource Center as the source of key materials from VITA problem files. An agreed process for building this active resource is required, including early consolidation of useful materials from all files on Problem Subjects for which integrative VITA programs are undertaken (as suggested below) and on which high Quality inquiries are received; and progressively from all case records.

5. Expansion and updating of the inventory maintained in the Information Resource Center of directories, reports, evaluations, and bibliographical resources of development institutes, development banks, documentation centers, and technical and professional organizations with which VITA is or should be in active communication.

Strengthening Replies to Individual Inquiries

Ratings of inquiry Quality and Complexity introduced in this evaluation are found to be better guides to request processing than the ratings established on Development Effects. The implementation rate reported by inquirers, as well as VITA scores on seven performance factors, are direct functions of inquiry Quality.

It is to be noted that only about 15 percent of the inquiries VITA receives (based on the evaluation sample) are well formulated enough to be assigned a Quality rating of 5 or 4; that is, to constitute a logical and detailed statement of the problem, clear goals, grasp of relevant quantitative facts, and realistic statement of local conditions. A further 28 percent are of Quality 3, representing a workable statement of the problem with some quantitative information, and evidencing a basis of some experience in the field concerned. Of the remaining inquiries, 29 percent are of Quality 2 and 28 percent of Quality 1.

Poor problem definition is often part of the intrinsic difficulty facing an inquirer and causing him to refer to an inquiry service. VITA's person-to-person approach addresses this specific need. If an increasing proportion of inquirers can be stimulated and helped to see and articulate their problems more clearly, VITA's overall effectiveness will greatly increase. This is evident in the clear correlation which has been established in this evaluation between the relative Quality of an inquiry and the VITA reply and the subsequent implementing of the project by the inquirer.

Our analysis has revealed these signs of deficiency in VITA's current handling of Quality 3 and Complexity 3 inquiries: low VITA performance scores on factors of "Finish" and "Critique"; fewer satisfactory volunteer replies relative to the substance of the problem; and somewhat higher feedback indication that information provided by VITA was "not useful".

Recommendations

6. Quality and Complexity ratings should be assigned by coordinators on all inquiries, as a guide to the processing of each case and as benchmarks for subsequent internal program evaluations.

7. Coordinators as a rule should call upon volunteers for all substantive replies to inquiries and should ensure that each reply is independently reviewed prior to its transmittal to the inquirer.

8. Quality 3 and Complexity 3 inquiries should be accorded greater attention, including: full retrieval of relevant past case materials, involvement of generalist volunteers in planning replies, involvement of volunteers with managerial or business experience in the subject field as well as technical specialists, and possible team approaches.

9. A new position of technical adviser should be created, with appointment of a person with a practical field record in overseas development, to support the inquiry service and request coordinators in organizing the approach to inquiries, especially those of Quality 3, Complexity 3 and above.

10. The roster of volunteers with management skills should be reviewed at an early date, with reference to limitations indicated on page 47, to improve selections and to guide enlistment of volunteers with skills now inadequately represented.

11. Requests involving selection of machinery, production methods, labor-capital costs, and output volume should more frequently be referred to volunteers classed as skilled in

Machinery and Machine Design.

12. Inquiries rated 3 or better should be examined as candidates for joint action in cooperation with specialized agencies in the region or country of the request.

13. On inquiries with high ratings, Appraisal Forms sent to the inquirer should be accompanied by individual letters seeking detailed information on follow-up, and stressing the value of substantive feedback reports in advancing technology.

14. Quality 1 and Quality 2 inquiries should be referred to at least one subject-matter generalist in the field, requesting that he assume responsibility for deciding what clarification is to be sought. The recently introduced list of questions should be provided to the volunteer for use at his discretion in eliciting additional details.

15. An overall average of 2 satisfactory volunteer replies should be established as a working goal, compared to the present 1.3 average. Inquiries of higher Complexity and Quality merit an above-average number of effective replies, tackling the question from the different relevant angles.

Integrative Program Development in Priority Fields

Sectoral contrasts in project implementation, and depth evaluations of VITA's record on two Problem Subjects, irrigation and adhesives, point to the value of a cumulative buildup of inquiry service experience in selected fields.

Our review of inquirers' appraisals shows a 36 percent rate of project implementation through information provided by VITA. Agricultural inquiries had the highest implementation rate, 43 percent, followed by Business-Management at 39 percent, and Business-Technical at 31 percent. Agricultural inquiries were of somewhat higher Quality to start with: 50 percent of the Agricultural inquiries were rated Quality 3 or above, compared to 39 percent for the other two sectors evaluated. Agriculture also stands ahead of the other two sectors in average number of satisfactory volunteer replies (1.5 per inquiry as against 1.2 for Business-Management and 1.1 for Business-Technical), in percentage of satisfactory replies from volunteers and organizations, and in performance scores awarded both to VITA and to the inquirer.

Agriculture's consistently stronger position could reasonably be taken as evidence that VITA's sustained activities on rural farm problems have contributed to building greater capability in

this sector. This interpretation should not be pushed too far, however. Agriculture's relative strength can also be related to the innate knowledge of farming possessed by a large proportion of people in developing countries and the fact that in farming it is often possible to identify with some clarity and precision those variables that influence successful change. Manufacturing problems, less familiar in developing countries and involving factors that are more difficult to pin down, present greater difficulty to a distant inquiry service.

Cumulative buildup of knowledge can be seen more clearly in more narrowly defined fields. This is revealed in the assessment of VITA irrigation history, particularly during the period when the Village Technology Handbook was in preparation. Adaptive, and in some instances, innovative solutions to unpromising field situations were achieved. Central competence was enhanced with appointment of staff members who had solid recent field experience of irrigation problems. The record in irrigation, however, and also in the variety of subjects covered in the field of adhesives, shows considerable loss of memory during intervals when few requests were received, undue complacency at times in the past, and both successes and failures in serving a network role in cooperation with other institutions. On both Problem Subjects examined in depth, originators of requests themselves made significant contributions to VITA's accumulation of useful information.

It is evident that, on those subjects on which frequent requests are received, the principle of critical mass operates to strengthen VITA's capabilities in information exchange, adaptation, and innovation. It is concluded from these depth studies, however, that this principle requires explicit reinforcement if VITA is to sustain adequate professional standing in important development fields.

Recommendations

16. Numbers of inquiries in each Problem Subject should be tabulated annually and analyzed to identify fields calling for integrated program development.

17. Major program sectors should be reviewed periodically with international agencies to identify areas of high development priority spanning significant VITA Problem Subjects on which VITA volunteers have strong capability. For instance, as a pressing candidate at this time, Small Farm Technology may be recommended. Building on VITA's performance in agricultural and village development, a five to eight year integrative program focused on the critical and rapidly changing needs of small farm operators in poor countries would put VITA on the frontier of one of history's most urgent social and economic transformations.

18. Negotiations with development agencies for funding of integrative VITA programs should be for time periods of not less than three years, usually five or more years.

19. Initial funding from prospective donor agencies should provide for a one year planning period, for each field of concentrated program development. The planning period would encompass:

A. Expenses of bringing selected volunteers to Schenectady, presumably in vacation periods, for intensive review of VITA case materials, identification and definition of specific urgent problems and relevant geographic areas, reclassification of subjects and skills, and preliminary formulation of an action program.

B. Overseas observation by a core team of volunteers, a representative of VITA's international division, and development agency specialists to assess field projects reported by VITA inquirers, to establish liaison with host agencies and obtain judgments on program proposals, and to assess other resources currently being developed in the problem field.

C. Cross-fertilization through correspondence and regional workshops among competent volunteers, assessing the proposed program.

D. Finalization of program recommendations, budgets, and funding proposals.

20. Integrative programs, to be negotiated with sponsoring agencies, would comprise such measures as:

A. Synthesis of feedback, field observations, and related case materials on successful VITA projects, to be disseminated through appropriate bulletins or development periodicals.

B. Well-defined on-site consulting assignments by VITA volunteers, including effective liaison with host country agencies. Salary compensation should be considered where undue family hardship would otherwise be caused.

C. Development of design criteria and designs, on a team or individual basis.

D. Prototype and pilot development in cooperation with institutions or enterprises which can furnish needed physical facilities.

E. Field trials and, as indicated, field demonstration in conjunction with local extension or development agencies.

F. Management plans, to be prepared by VITA volunteers, for market development and manufacture of proven new equipment, for capitalization of manufacturing programs, and for dissemination of educational and social innovations.

G. Criteria and procedures for eventual evaluation of development effects.

H. Defined procedures for building the results of intensive programs into VITA's on-going information exchange.

Recognition of VITA's Role as a Signaling and Adaptive Agency

VITA has established a distinctive role as a technical scouting, signaling, and adaptive agency. This is an appropriate definition of role for a body of decentralized questioners and volunteer respondents: significantly more than a clearinghouse, but not fully an Institute of Development Technology. It is believed that VITA can best realize its full potential, gaining active cooperation from technological and development institutions, by keeping to modest institutional size and consciously seeking new ways of responding to its decentralized opportunities.

The grass-roots origin of inquiries is of major significance. Private individuals and firms originated some 42 percent of the evaluated inquiries. Nearly 19 percent were sent by Peace Corps Volunteers closely associated with local communities; as a group, Peace Corps Volunteers were responsible for requests of the highest Quality. National development agencies sent 14 percent of the evaluated inquiries, missionaries 13 percent, public international agencies 6 percent, private development agencies 4 percent, and private consultants 2 percent.

VITA's pivotal and interpretive role in the adaptive process is to be seen in the full sequence of events: from problem definition by the local inquirer, to the sifting and connection of elements in the mind of the inquiry coordinator, and its exploration and restructuring by the volunteer. VITA cases repeatedly exhibit adaptation of information, not simply its transfer. The person-to-person approach contributes to an intelligent grasp of the problem, and often to a new synthesis in its resolution. On-going relationships and continuing experimentation are on occasion established, the necessary basis for successive adaptations and for innovation.

Development institutions characterized by more impressive physical programs will, it is believed, increasingly come to recognize the

contribution VITA is able to make through its wide talent bank, its flexibility, and its marshalling of creative ability. On its part, VITA cannot expect to duplicate the local outreach of numerous national institutions. Vigorous liaison, often informal, would instead be productive for both parties.

Recommendations

21. To foster improved Quality while continuing to encourage diversity of inquiries, VITA should continue to enter into arrangements with volunteer agencies, national and international, whose field workers, particularly in rural areas, bring alert, analytical eyes to basic problem definition. The strong flow of queries from individuals and manufacturing companies should also be maintained through active VITA communication with management associations, professional bodies, and small industry associations; and through problem-focused articles in technical and development journals.

22. In countries and regions which have originated significant inquiries, effective liaison with national development agencies, and often with private consultants, is important as the basis for VITA on-site work. Here VITA's role should be complementary, more than competitive. In planning integrative programs, host country liaison should accordingly be established not only with parallel technical agencies, but also with such development entities as industrial banks, management training institutes, extension agencies, and local development corporations.

23. On receiving inquiries from relatively inexperienced development agencies - such as a new university extension service, or a young technological research institute - VITA may have opportunity to bring institution-building experience of volunteers together in joint support. It is suggested that such opportunities be explored in conjunction with international donor agencies in the country or region concerned.

24. Participation of VITA volunteers in select National Academy of Sciences panels monitoring and reporting on technical developments of value to developing countries is recommended, in order to infuse these screening procedures with VITA's realistic overseas experience as well as bringing volunteers into contact with other scientists and researchers.

25. VITA membership in the World Association of Industrial and Technological Research Organizations (WAITRO) is recommended as a further step in building a communication network among adaptive international agencies concerned with technical and social development.

APPENDIX I

VITA PROBLEM SUBJECTS LISTED BY FREQUENCY OF INQUIRIES*

Frequency of Inquiries: Over 200

Agriculture

Chemistry
Construction

Design(s)

Education

Food
Food processing

Machinery
Manufacturing methods
Marketing

Production

Small industry

Water pumps

*In VITA history

VITA PROBLEM SUBJECTS LISTED BY FREQUENCY OF INQUIRIES

Frequency of Inquiries: 101 - 200

Cement	Rice
Concrete	
Controls	Solar
Cooperatives	
Crafts	Textiles
	Training
Electricity, electric, electrical	Utilization
Fruits	Water
	Water treatment
Generator	Wood
Industries	
Irrigation	
Oils	
Pest control	
Photographic projectors	
Plastics	
Poultry	
Preservation	
Preserving food	
Processing	

VITA PROBLEM SUBJECTS LISTED BY FREQUENCY OF INQUIRIES

Frequency of Inquiries: 51 - 100

Adhesives	Feasibility study	Rabbits
Animal feed	Fertilizers	Recreation
	Fibers	Refrigerators
Bamboo	Fishes	Roofs
Bananas	Fish culture	
Batteries & comp.	Furniture	Sanitary eng.
Boats		Seed(s)
	Horticulture-horticulturist	Soap
Books	Hospital	Soils
Bricks	Housing	Soybeans
Bridges		
Business mgmt.	Industrial plants	Steel
		Storage
Cans (containers)	Kilns	Stoves
Cattle		Structures
Ceramics	Leather	Swine
Chemicals		Systems
CINVA-Ram	Management	
	Materials	Tanning
Citrus fruit	Meat	Teaching aids
Clothing	Milk	Tractors
Coatings		Transportation
Coconuts	Nuts (edible)	Tropical fruit
Community dev.		
	Ovens	Vegetables
Concrete blocks		Vegetable oils
Containers	Packaging	
Corn, processing, oil	Paints	Wastes
Costs	Paper	Water - storage
Cottage ind.	Peanuts	Water supply
	Photographic equip.	Water - wells
		Water wheels
Documentation	Pipes	
Driers (apparatus)	Pottery	Weaving
Drilling, drills	Poultry equip.	Well
Drying	Power	Wind
Dyes	Printing	Windmills
	Pumps	Woodworking
Export-import		
Extraction		

VITA PROBLEM SUBJECTS LISTED BY FREQUENCY OF INQUIRIES

Frequency of Inquiries: 26 - 50

Accounting	Dams	Incinerator
Aluminum	Dehydrated foods	Inhibition
Analysis	Dehydration	Ink
Animal husbandry	Development	Insect control
Animal power	Disease (s)	Insecticides
Architecture	Distillation	Instruction manuals
Audio-visual eg.	Earth	Iron
Automobile parts	Eggs	Kerosene
Automobiles	Electrons	Laboratories
Bats	Electronics	Latrines
Beekeeping	Equipment	Law
Beverages	Factories	Libraries
Bibliographies	Feed	Lighting equip.
Blocks, concrete	Filters	Limestone
Book procurement	Finishes	Looms
Boxes	Fishing equip.	Low-cost
By-products	Flour	Lumber
Canning	Footwear	Management eng.
Cashew nuts	Forestry	Mechanics
Cassava	Freezing	Medical equip.
Castings (process)	Fruit juices	Medicine
Chalk-making	Fund raising	Metal craft
Charcoal	Fungi	Metals
Cheese	Furnaces	Methane gas
Chemical ind.	Gases	Mixers
Circuits	Glass	Nutrition
Clay	Glazes	Olives
Cleaner	Goats	Peanut butter
Coffee	Grain crops	Plants
Communication systems	Grasses	Potatoes
Containers	Grinders	Poultry feed
Cooking devices	Hand operated	Poultry keeping
Cooling	Heating	
Copper	Human-powered	
Cordage	Hydraulic rams	
Corn	Hydroelectric power	
Crops		
Cultivation		

Powder	Toys
Power (non-electric)	Traps
Procurement	Treatment
Programming	Trees
Public health	Tropical regions
Purification	
	VITA publications
Raising	Vocational train.
Recreation facilities	
Repairs	Wash, washing, wash bd.
	Waste (industrial)
Resins	Water heaters
Roads	Water piping
Rubber	Water purification
Rust	
	Water tanks
Salt	Wheat
Sawdust	Wheels
School	Wiring
Seafoods	Work
Sewage (disposal)	
	Youth
Shells (sheller, shelling)	
Shoes	
Sisal (henequen)	
Small tools	
Sodium comp.	
Solar cookers	
Solar water heater	
Sound reprod. system	
Spanish language	
Spinning (craft)	
Starches	
Sugar cane	
Tanks	
Tapes	
Tech. instruct.	
Techniques	
TV & equip.	
Tests	
Thresher	
Tiles	
Tobacco	
Tomatoes	

VITA PROBLEM SUBJECTS LISTED BY FREQUENCY OF INQUIRIES

Frequency of Inquiries: 11 - 25

Abrasive	Brass	Contraception
Acids	Bread	Cooking
Additives	Breeding	Copra
Adult education	Brick making	Copying machines
Advertising	Brooders	Coral
Agri-chemistry	Brooms	Corrosion inhib.
Agronomy	Building mater.	Cosmetics
Air	Butchering	Cotton
Air conditioning	Butter	Cotton plants
Aircraft	Cables	Cutting
Alcohol	Calcium comp.	Dairy
Algae	Candles	Dentistry
Alloys	Carbon	Desalination
Animals	Carts	Detection
Animal fat	Castings (object)	Detergents
Antennas	Catalogs	Dies
Apples	Cereals	Diet
Asbestos	Chalkboards	Distribution
Asphalt	Children	Domes (geodesic)
Automobile (mech.)	Chlorination	Domestic animals
Bagasse	Cigarette	Drainage
Bags	Clay minerals	Drugs
Baked goods	Cleaning comp.	Earth block
Baking industry	Coal	Economic dev.
Basket weaving	Cocoa	Economics
Beans	Coconut materials	Electric motors
Bedding--beds	Color--coloring	Electronic equip.
Beer	Communicating	Electroplating
Bicycle	Components	Engine (struct.)
Birds	Compost	Engineering
Bleaching agents	Computer	English lang.
Blindness	Condiments, sauces	Essential oils
Blood	Confections	Eyeglasses
Bone	Consultant	
Bottles		

Facility layout
Farm buildings
Farm tools
Feathers
Fencing

Fermentation
Fiberglass
Financial dev.
Fish meal
Fisheries

Flexible piping
Flies
Floor coverings
Floors
Flowers

Foams
Food preparation
Food preserv.
Freezers
Frogs

Frozen foods
Fruit trees
Fuels
Fur

Galvanizing
Games
Garbage
Gardening
Gold

Grain storage
Grapes
Graphic art
Grinding

Hair
Harness
Harvesters
Health
Herbicides

Herbs
Higher education
Hoists
Home appliances
Home economics

Honey
Hydraulic eng.
Hydroponics

Incubators (poultry)
Insects
Insulation
Investments
Iron industry
Ice

Jewelry
Joint venture
Jute

Kitchen

Land reclamation
Languages
Lathes
Laundering
Lead

Legumes
Library searches
Licensing
Light
Lightning arrestors
Lubricants

Machine tools
Maintenance
Mammals
Mangoes
Manuals

Manual training
Manure
Maps
Medical supplies
Metal coatings

Metallurgy
Milk products
Mills
Minerals
Mining engineering

Mobile
Moistureproofing
Molasses

Molding
Mold (organism)
Mollusks

Motion pictures
Motors
Mushrooms

Nylon

Office equip. & supp.
Office skills
Oil presses
Onions
Ores
Ox yokes

Palm oil
Palm trees
Pamphlets
Papaya
Paper industry

Paper products
Perfumes
Periodicals
Personnel
Pesticides

Pharmacology
Phosphates
Photographic proc.
Photography
Piers

Pineapples
Plant diseases
Planters
Plaster
Plating

Playgrounds
Plows
Plywood
Poisons
Polishes

Polyethylene plastics
Polyvinyl chloride
Ponds
Pork
Portable

Potable water
Power (electric)
Prefabricated bldgs.
Preserves
Presses

Presses (mach'y.)
Primary education
Products
Protective treatment
Proteins

Public relations
Publications
Publicity
Purchasing

Radio
Radio equip't
Radio receivers
Rats
Recipes

Reclamation
Recovery
Refinery
Removal
Research

Rice huller
Rice husks
Rivers
Rodents
Rolling
Rubber products

Safety
Sand
Sanitation
Sawmills
Science

Sea water
Selection
Septic tanks
Sewing
Sharks

Sheep
Shelters
Shells
Silage
Silk

Silos
Silver
Slaughterhouse
Slide projectors
Smoking (food)

Snacks
Soil analysis
Solar heating
Solar power
Sorghum

Sound
Sources
Spices
Spinning wheels
Steam

Still
Stove
Straw
Styrene plastics
Sucrose

Sugar
Sulphur (comp.)
Sunflowers
Surveying
Suspension bridges
Swimming

Tech. info. centers
Technicians
Teeth
Telephone equipm't
Termites

Textbooks
Textile industry
Thermal insulation
Thread
Tin

Tires
Transformers
Transistors
Tropical

Tropical agriculture
Trucks
Turbines

Urban planning

Valves
Varnish
Vegetable fibers
Vehicles
Veterinary medicine

Villages
Visual aids
VITA plans

Washing machines
Water filters
Water lifting
Water power
Water sources

Waxes
Weed control
Welding
Well drilling
Wine

Wire
Wood products
Wood technology
Wooden washing mach.
Writing materials

X-rays

VITA PROBLEM SUBJECTS LISTED BY FREQUENCY OF INQUIRIES

Frequency of Inquiries: 1 - 10

Abaca	Ammonia	Baby food
Absorption	Ammonium compound	Backhoes
Abstracts	Ammunition	Bacteria
Abundance	Amplifiers	Balancer
Acacia	Anchors	Ball bearings
		Balloons
Acetates	Anchovies	
Acetic acid	Anesthetic	Balsa wood
Acoustics	Animal diseases	Banana fibers
Acrylic resins	Anthropology	Bandages
Addiction	Antibiotics	Banking
		Barges
Adobe	Antimony	
Aerial photography	Ants	Bark
Aerosols	Apple trees	Barkcloth
African language	Appraising	Barrels
Agar	Archeology	Batiks
		Battery chargers
Agave	Archit. engineering	
Aggregates	Arid areas	Beaches
Aging materials	Arctic regions	Beams, structural
Agitation	Artificial insemin.	Bearings
Agric. economics	Artificial limbs	Beef
		Beef cattle
Agric. engineering	Art materials	
Agric. extension	Ash	Beehive plans
Agric., vocational	Asparagus	Beeswax
Airboat	Assembling	Beets
Air filters	Astronomy	Behavior
		Bellows
Air pollution	Audioamplifier	
Alfalfa	Audio frequency	Bells
Alkynes	Auto fuel center	Benzines
Alligator	Automatic	Berries
Alloy foundry	Automation	Bilharzia
		Biochemistry
Alpaca	Automotive eng.	
Alternators	Automotive engines	Biology
Aluminum compounds	Automotive industry	Bites
Aluminum alloys	Avocado	Blacksmithing
American Indian		Bladders (anatomy)
		Blasting

Blender	Carbides	Chromium
Block-making (constr.)	Carbohydrates	Church(es)
Block printing	Carbon black	Churn
Blower	Carbonates	Cider
Boilers	Carbon dioxide	Cinder block
Bolts	Carbon monoxide	Cinnamon
Bonding	Carbon paper	Circuit breakers
Book-binding	Cardboard	Citric acid
Book preservation	Carding	Civil defense
Boron	Carob beans	Civil eng.
Botany	Carp	Classification
Bottle caps	Carpentry	Climatology
Braiding mat.	Carpet mfg. eq.	Clocks
Brahma bulls	Casein	Cloves
Braille	Casing (an. int.)	Clutches
Brakes	Casing, well	Coal gas
Brazing	Cast iron	Coal tar
Breadfruit	Castor beans	Cocoa leaf
Brewing ind.	Castor oil	Cockroaches
Bromine	Catalysis	Coconut fiber
Bronze	Catfish	Coconut growing
Brushes	Celery	Coconut oil
Buckets	Cellophane	Coconut shells
Budgets	Cellulose	Coffee trees
Building design	Ceramic coatings	Coffins
Buoyancy	Ceramic eng.	Coils
Business publ.	Ceramic mater.	Collecting
Butterflies	Ceramic proced.	Coin-operated
Buttons	Chains	Coir
	Chemical anal.	Coke - fuel
Cabbages	Chemical biblios	Cold storage
Cabinets	Chemical eng.	Collection method
Cacao	Chemical indicator	College admin.
Cactus	Chemical reactions	Colloids
Cadmium	Child care	Color-fast
Cameras	Chili	Commercial fishing
Camphor	Chlorine	Communications
Canoe	Chlorine comp.	Composite mat.
Canvas	Chocolate	Composition board
Capacitors	Choppers	Compressed air

Compressor
Concentrate
Condensed milk
Condenser
Conductivity

Conservation
Contamination
Contract
Conveyors
Coolants
Cool
Cooling & Vent. eq.
Cork
Cornflakes
Corn planter
Corn sheller

Corral
Correspondence course
Corrosion
Cotton fibers
Cotton gin

Cotton seeds
Cotton textile
Coupling
Counseling
Crackers

Crafts, marketing
Crankshaft
Crayons, wax
Credit union
Crocodile

Crematoriums
Criminology
Crucibles
Crushers
Crustacea

Crystals
Culture
Culture Media
 use Agar-Agar
Culvert(s)
Curare

Curriculum development
Cybernetics

Dairy-Science
Damage
Dark room
Data
Data processing system

Dates
Day care centers
Deafness
Decomposition
Decoration

Decorticators
Defects - materials
Degradation
Dehydrated milk
De-linting

Dental - personnel
Dermatology
Desiccants
Designer
Detonators

Developing countries
Diamonds
Diaphragm
Diathermy
Diatomaceous earth

Diesel (engines)
Diffraction
Digging wells
Direction finding
Disc plows

Dishwasher
Display system
Diving
Dogs
Dolls

Donkey
Dosage
Dowsing
Drafting
Drawing - drawn

Drawing (machine processing)
Drilling machines
Drives
Dry cell batteries
Dry cleaning

Ducks
Ducts
Durability
Dust
Dusters
Dyeing

Earth blocks
Earth handling equip.
Earth models
Earthquakes
Ecology

Editing
Education co-ops
Educ. T.V.
Edukit
Eels

Eggshell supplement
Eggplant
Elasticity
Electric cables
Electric currents

Electric discharges
Electric insulation
Electric engineer
Electric switches
Electrical eng.

Electrical equip.
Electrical insulation
Electrification
Electrochemistry
Electrodes

Electrolysis
Electrolyte
Electrolytic cells
Electronic eng.
Elevators

Embossing	Feldspar	Floods
Embroidery	Felt	Flour products
Employment	Fencer (electr.)	Flourine
Enamel ware	Ferrites	Fluids
Energy - storage	Ferro-cement	Fluorines
Engineer	Fertility - sterility	Fluorescent
Engines	Fiber plants	Flying
Engraving	Fiberboard	Flying squirrel
Entomology	Fiber processing	Fly traps
Environment	mach.	Foam rubber
Enzymes	Fibers (synthetic)	Fodder
Epoxy plastics	Field crops	Food technology
Erosion	Figs	Forage
Escape	Filaments	Forging
Esters	Film readers	Forklift vehicles
Etching	Films	Formaldehyde
Ethylenes	Film strips	Foundations
Eucalyptus	Filmstrip projector	Four-H Club
Evaporated milk	Fique (fiqui)	Freeze Drying
Evaporation	Firearms	French language
Evaporators	Fire control systems	Frequency
Executives	Fire resistant mater.	Frequency converters
Exhaust gases	Fire safety	Friction
Exhaust systems	Fireflies	Frost damage
Expanded plastics	Fireplace	Fruit flies
Explosions	Fires	Fuel oil
Explosive material	Firing	Fuel pumps
External combustion	Fish drying	Fungicides
engine	Fish flour	Game birds
Extrusion	Fish food	Garlic
Factory layout	Fish oils	Gas analysis
Failure (mechanical)	Fishing (hobby)	Gas-fired
Family planning	Fishing industry	Gas generating systems
Fans	Fittings	Gaskets
Fastenings	Flannelgraph	Gasoline
Fats	Flashlamps	Gasoline engines
Fatty acids	Flashlight projector	Gears
Faucet	Flavoring	Geese
Feather flowers	Flax	
Feeders	Fleas	
	Flint	

Gelatin
Gems
Genetics
Geology
Geometry

Geraniums
Geriatrics
Germicides
Ginger
Ginseng

Glass blowing
Glass textiles
Glassware
Gloves
Glucose

Glycerin
Goiter
Golf
Grading
Grafting

Grain mills
Grains
Granite
Grant proposals
Graphite

Grasshoppers
Graters
Gravel
Gravity
Greases

Greenhouses
Groundwater
Guava
Guinea pig

Gum
Gypsum

Hail
Halogenation
Ham
Hammock
Handbag

Handbooks
Hand weaving
Handicapped
Hangar
Harbors

Hardboard
Hardness
Hardware
Harrow
Hats

Hay
Heat
Heat exchangers
Heat-resist.materials
Heat transfer

Heat treatment
Heaters
Helicopters
Hemp
High altitudes

History of (Techno)
Hoes
Home
Home workshop
Homogenizer

Hormones
Horn
Horses
Horseshoe
Hotels

Horsehold equip.
Houses
Housing project
Huller
Human factors eng.

Humidifiers
Humidity
Husker
Hydraulic press. pumps
Hydraulic systems

Hydrocarbons
Hydrofoils
Hydrogen
Hydrology
Hydrolysis

Hydroquinone synthesis
Hygiene
Hygenists

Ice cream
Ignition
Impact
Incense
Incubators (human)

Indeces
Indigo
Induction
Industrial eng.
Industrial prod.

Industrial relations
Industrial res.
Industrial train.
Inertia
Infrared radiation

Infectious diseases
Info. retrieval
Info. theory
Infection
Ink mfr.

Inland waterways
Inoculation
Installation
Institutional feed.
Instructors

Instruments
Instrumentation
Insurance
Intern.comb.engines
International

Internat'l dev.
Inventory
Iodine
Iodine compounds

Ion exchange resins
Ions
Iron alloys
Iron comp.
Isocyanate plastics
Ivory

Jacket
Japanese lang.
Jars
Jeeps
Jet propulsion

Jigsaw
Job analysis
Juice extractor
Journalism
Jungles

Kanthal
Kapok
Kitchen equip.
Kitchen utensils
Knitting
Knives
Kraft paper

Labeled substances
Labels
Labor unions
Lab equip.
Lakes

Laminated plastics
Laminates
Land clearing
Land management
Land use

Landing fields
Landscaping
Language study
Lapidary
Laundries

Layout
Leaching
Leadership
Leaf
Leaf fibers

Leakage
Leather work
Leeches
Lenses
Lepidoptera

Letter press
Librarians
Library packet
Library science
Lignin

Lime
Linguistics
Liquid filters
Liquids
Lithography

Llamas
Loaders
Loans
Lobsters
Locking devices

Logging
Loom parts
Lubrication
Luggage
Lumbering industry
Lye

Machetes
Machine design
Machine shop
Machining
Magic

Magnesium
Magnesium comp.
Magnetic materials
Magnetic properties
Magnetic tape

Magnetism
Magnets
Maguey
Mail order
Malt

Manganese
Maple syrup
Marble
Margarine
Marinas

Marine biology
Marine eng.
Market surveys
Masonry work
Matches

Material farming
Mathematics
Mats
Mattress
Measurement

Measuring devices
Meat packing
Meat processing
preserv.
Mechanical design
Mechanical drawing

Mechanical eng.
Mechanical fasteners
Medical personnel
Medical research
Melting

Mentally retarded
Mercury
Mercury comp.
Metal forming
Metal form. presses

Metal lathe
Metal work
Meteorology
Meters
Methane generator

Methanol
Methyl-methacrylate
Mica
Microbiology
Microfilms

Micro-organisms	Noise	Papain
Microscope	Nursery	Paperboard
Microwaves	Nurses	Papyrus
Midwifery	Nursing	Parasites
Milling machines	Nut shellers	Parasitic diseases
Mineral processing	Oats	Parks
Minerology	Oceanology	Particle board
Mining	Oceans	Particles
Mining equipment	Occupation'l ther.	Passenger vehicles
Mines	Odors	Pasta
Mirrors	Offset printing	Pastures
Misch metal	Oil extractors	Pasturization
Missionary	Oil plants	Patchouli
Models	Oil seeds	Patents
Modern	Oil wells	Patterns
Modification	Okra	Peaches
Moisture	Old folks' home	Peanut oil
Moles	Opaque projectors	Pears
Mops	Optical equip.	Peas
Mortar	Optical materials	Pectins
Mosaics	Ophthalmology	Pedal operated
Mosquitos	Oranges	Pellets
Motion picture photo.	Orchards	Pencils
Motivation	Orchids	Pens
Mowers	Organic chemistry	Pen pal
Mules	Organic materials	People-to-People
Museums	Orphanages	Pepper (condiment)
Music	Oscillators	Pepper (vegetable)
Musical instruments	Oscilloscopes	Peroxides
Nails	Ox drawn	Personnel m'g'm't
Natural resources	Oxidation	Petrochemistry
Neon	Oxides	Petroleum
Networks	Oxygen	Petroleum ind.
Nets	Oysters	Petroleum prod.
Newsletter	Packaging food	Pewter
Newspaper	Packing materials	pH
Newsprint	Packs	Phenolic plastics
Nickel	Paint applicators	Phenols
Nickel alloys	Painting	Photochemistry
Nickel-cadmium batteries	Paint thinners	Photoelectric equip.
Nightsoil	Paleontology	Photoengraving
Nilling machines	Palm kernels	Photographic
Nitrates	Palmetto fibers	enlargers
Nitrogen	Panels	Photographic film

Photographic techn.	Potassium compounds	Quality control
Photo sensitivity	Power converters	Quarries
Phys. ed.	Power distribution	Quartz
Physics	Power equip.	Quinine
Pianos	Power plants	
		Radiation effect
Piassava	Power sources	Radiators
Pickers	Power sources (elec.)	Radio broadcasting
Pigments	Power supplies	Radio commun.
Pigeons	Premixed foods	Radio transmitters
Pile driving	Pressure cookers	
		Railroad cars
Pipelines	Pressure vessels	Railroads
Pipe fittings	Prevention	Rain
Pistons	Prestressed concrete	Raincoats
Placement	Preventive medicine	Rainfall
Plankton	Printed circuits	
		Raisins
Plant nutrition	Printing presses	Rakes
Plant physiology	Prisms	Ramie
Plant science	Privies	Raspberries
Planting	Procedures	Razor blades
Plants (ind.)	Proofreading	
		Reactor lining repair
Plasterboard	Propanes	Reading
Plaster casts	Propellers	Real estate
Plaster of paris	Proposals	Recapping tires
Plasticizers	Protective clothing	Reconstitution
Playing cards	Pruning	
		Recorder
Plumbing	Psychiatry	Recording systems
Police	Psychology	Recordings
Polishing	Public address syst.	Records - discs
Political science	Public administration	Records - document
Pollution	Public utilities	
		Recruiting
Polyester	Publishing	Rectifiers
Polymers	Puffing	Reduction
Polypropylene	Pumice	Reeds
Polyurethane	Punch press	Refineries
Population		
	Purslane	Refining (metallurgy)
Porcelain	Pyrethrum	Reflectors
Portuguese lang.	Pyrites	Reforestation
Positioning devices	Pyrometric cones	Refractory metals
Postal equip.		Refrigerated
Potassium		

Refrigeration--systems
Regional
Regulators
Rehabilitation
Reinforced concrete

Reinforced materials
Reinforcing
Relays
Religions
Remedial education

Repellents
Reproduction
Reproduction (copying)
Reptiles
Restaurants

Resistors
Retailing
Rice growing
Rickshaws
Rivets

Rock
Rockets
Rodenticides
Rods
Roller bearings

Rolling mills
Room deodorizers
Roots
Rotary
Rotenone

Rotogravure
Rule
Rum
Rural
Rural areas
Rural electrification

Sage
Sailboats
Sailing
Sales
Salinity

Salting foods
Salts
Sampling
Sandpaper
Sandalwood

Sanitary napkins
Sanitary ware
Saris
Sauces
Sausages

Saws
Scaling
School desks
Science teaching
Scissors

Scorpions
Scrap
Scraper
Screen
Screws

Sculpture
Scythe
Sealing compounds
Seals
Seals - sealant

Seaweed
Secondary educ.
Sedimentation
Semiconductors
Separation

Separators
Servomechanisms
Sewage treatment
Sewers
Shafts

Sharpener
Shearing
Sheds
Sheet metal
Sheets

Shellac
Shellfish
Shipping
Ships
Shipyards

Shoe cleaner
Shoe polish
Shopping centers
Showers
Shredders

Shrimps
Shrinkage
Shutters
Sieves
Silicates

Silicon alloys
Silicon (comp.)
Silicon (plastics)
Silk screen
Silkworms

Site planning
Size
Skiing
Slate
Sleep learning

Slides (fasteners)
Slides (photo)
Smelting
Smoke
Smudge pots

Snails
Snake bite
Snakes
Snow
Snow vehicles

Social commun.
Social psychology
Social sciences
Social security
Social service

Social studies
Social welfare
Sociology
Sodium hydroxide
Softener

Soil conservation
Soil--fertility
Soil mechanics
Solar cooling
Solar distillation

Solar energy
Solar furnaces
Solar generators
Solar radiation
Solar stills

Soldering	Steel wool	Taps
Solids	Stencils	Tartar
Solubility	Sterilization	Taste
Solvent extraction	Sterilizers	Taxes
Solvents	Stock broker	Taxidermy
Sonar	Stocking	Tea
Sound generators	Storage tanks	Teaching Eng.as a
Sound--motion picture proj.	Strawberries	foreign lang.
Sound reproduction (discs)	Strength	Teaching methods
Sound reproduction (tapes)	Stresses	Teak
Sour sap	Struc. eng.	Technical
Spanish	Students	Tech.assistance
Spanish moss	Substitutes	Tech. innovation
Spark plugs	Sugar beets	Technical writing
Speaking	Sugar (mfg.)	Technology
Specifications	Sulfur	T. E. F. L.
Spectroscopy	Sulphuric acid	Teflon
Speech	Sundials	Temperature
Speed regulators	Sun-drying	Tennis
Spinning (IWD)	Sunflower seed	Tents
Sponges	Supports	Terpenes
Sports equip.	Surface active	Terrain
Sprayers	substances	Textile printing
Sprays	Surface properties	Thatch
Sprayer, spray	Surfaces	Theater
Spreaders	Surfacing	Theology
Spring	Surgical instr.	Therapy
Springs (Mech.)	Swamps	Thermodynamics
Sprinklers	Sweet	Thermoelectricity
Stabilized earth	Sweetening	Thermometers (mrg.)
Stabilized (tion)	Sweet potatoes	Thermoplastics
Stage	Swimming pools	Thermosetting plastics
Stainless steel	Switches	Thermostats
Stamp collecting (hobby)	Synthesis	Thorium
Standards	Synthetic rubber	Tides
Standardization	Syrup	Tie dyeing
Starfish	Systems analysis	Tie making
Statistics	Table	Ties
Steel (Ind.)	Talc	Timber
	Tankers	Time studies
	Tannic acid	
	Tapa	

Timing devices
Titanium compounds
Toilet
Toilet articles
Tools

Torque
Tourist industry
Towels
Towers
Toxins and antatoxins

Trade
Traffic
Trailers
Transite
Translation

Transmission lines
Transmissions
Transmitter (receiver)
Transport--properties
Trash rack (river)

Tropical deterioration
Tropical medicine
Tropical trees
Trout
Tubewells

Tugboars
Tumblers
Tung oil
Tung oil--trees
Tungsten

Turmeric
Turnips
Turpentine
Turtles
Types
Typewriters

Ultrasonic radiation
Underground
Underground (struct.)
Underwater
Underwear
U.S.Govt.

Upholstering
Urban areas
Urban housing
Urea
Urethanes
Used

Vaccines
Vacuum
Vacuum apparatus
Vacuum bottles
Vacuum cleaners

Value engineering
Vanilla
Vegetable juices
Veneers
Ventilation

Vermiculite
Vibration isolaters
Vibrations
Viewing screens
Vinyl plastics

Vinegar
Viscosity
Vises
Vitamins
VITA Volunteers
Vocational instruct.

Vocations
Vodka
Voltage
Voluntarism
V.T.H.
Vulcanization

Walls
Walnuts
Wall coverings
Warehouses
Warning systems

Warping
Waste disposal
Waste (agricultural)
Watch
Water closets

Water coolers
Water distil.
Water dowsing
Waterglass
Water melons

Water plants
Water pollution
Water softeners
Waterwarp
Wear, resistance

Weather--forecasting
Weather-proofing
Weevils
Weighing
Well castings

Well constr.
Well digging
Well location
Well--paints
Whales

Wheelbarrows
Wheelchairs
Whiskey
Whitewash
Wigs

Wildlife
Winding
Windows
Wind power
Wind power (mech.)

Wire mesh
Wood carving
Wood finishing
Wood fuel
Wood pulp

Wood seasoning
Workshop
Wringers
Writing

Yarns
Yarn preparation
Yeasts
Yogurt (making)
Yoke
Yucca
Yucca use (cassava)

Zippers
Zoology
Zoos, zoological (gardens)

APPENDIX II

ROSTER OF SKILLS

1. General Business Services

A. General Management - 464

- Planning - 57
- Economics/Economic Evaluation - 213
- Co-operatives - 43
- Small Business/Cottage Industries - 114
- Licensing/Franchising/Joint Ventures - 3
- Commercial Law - 10
- Patents - 24

B. Financial - 131

- Banking (Borrowing, Lending, etc.) - 14
- Investments (Asset Management) - 17
- Accounting - 100

C. Marketing - 407

- Market Research & Analysis - 16
- Export-Import - 41
- Merchandising - 228
- Sales Promotion/Advertising - 56
- Pricing - 66

D. Personnel - 887

- Technical Training - 82
- Industrial Relations - 19
- Community Relations - 69
- Literacy Education - 80
- Personnel Management - 31
- Vocational Training - 596

II. Technical Business Services

A. Product Development - 448

Design Engineering & Evaluation - 323
Testing
Quality Control - 54
Packaging - 46
Feasibility Studies - 25

B. Engineering Services - 2268

Civil - 262
Electrical/Electronics - 375
Chemical - 447
Mechanical - 702
Industrial - 67
Agricultural - 104
Metallurgy - 121
Materials - 129
Safety - 58
Human Factors - 3

C. Production and Facilities Planning - 196

Production Planning and Forecasting - 71
Facility Layout - 2
Maintenance Engineering - 40
Control Systems - 16
Industrial Engineering - 67

D. Procurement/Inventories - 65

Inventory Control - 10
Purchasing - 55

E. Crafts - 800

Mosaics/Ceramics - 58
Art - 37
Leather - 17
Wood - 310

Metal - 133
Basketry - 2
Needlework/Sewing/Embroidery - 33
Glass - 43
Pottery - 24
Painting/Graphic Arts - 133

F. Infrastructure - 199

Power Sources - 17
Waste Disposal - 39
Transportation - 41
City-Town Planning - 33
Architecture - 69