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ABSTRACT

This study is based on a comparison of data from two independent studies of technology utilization and dissemination methodology that sought to identify the behavior characteristics of "linkers" and "stabilizers" and their relative existence within different groups of technical personnel. Hypothesis for this study is that the distribution of the linker-stabilizer behavior characteristic has a general base in terms of technically trained personnel and is not unique to a select population. Comparison of responses to a survey questionnaire administered to a sample of 1,128 naval civil engineering officers and a similar questionnaire administered to a sample of 1,598 federal government civil engineers indicates that commonality of technical training is a more dominant factor than the decision to be a naval officer or a government employee. The appendix contains copies of both survey questionnaires, as well as a series of histograms and tables comparing questionnaire responses for each of the populations studied. (JG)

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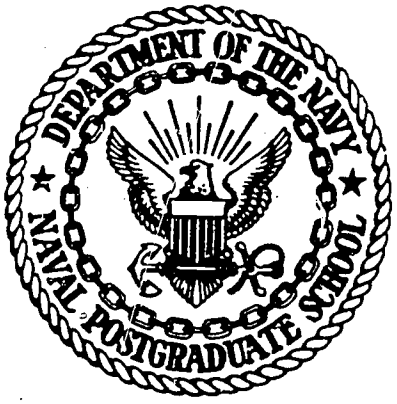

TECHNOLOGY TRANSFER AND UTILIZATION METHODOLOGY; FURTHER ANALYSIS OF THE LINKER CONCEPT

by

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30 June 1974

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INTRODUCTION

The importance of the utilization of applicable knowledge by more than one organization is now being more frequently recognized as an economic factor in our society. In like manner the degree of utilization of the output of research and/or engineering activities is directly related to the extent to which that output is adopted.

The factors influencing the flow of information, technology, innovation, and knowledge from a source to a user has attracted the interests of researchers during the last decade such that several bibliographies have been prepared covering the major works in this area, (Havelock 1969, Sovel 1969), and conferences dealing with the subject have been organized.[1,2]

Perhaps the justification for further analysis of this problem is that there appears to be a new surge of interest by many organizations to attempt to enhance the utilization of available knowledge by an overt act of establishing better and more efficient information exchange facilities. One example of this effort is that of the National Technical Information Service, which has made available a computerized search service of the abstracts of over 300,000 government supported research and development projects (NTIS Report, p. 3, 1973).

Another example is a publication by the National Science Foundation (Anuskeivicz, 1973) which is a survey of current Federal technology transfer and research utilization activities. Several Federal departments, commissions

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[1] Throughout the remainder of this paper the word knowledge will be used to represent the aggregate of the terms; information, technology, innovation and knowledge.

[2] Some examples of conferences are: University of Denver, Snowmass-at-Aspen, Colorado, 1969; Battelle-Northwest, Seattle, Washington, 1972; Pennsylvania Office of Science and Technology, Harrisburg, Pennsylvania, 1972; George Washington University, 1973.

and/or activities that have taken overt action to implement an office of technology transfer are identified and a contact in the form of a name and address is given. Similar programs to catalogue and make available knowledge in order to enhance its utilization are in progress at the State level.[1]

It seems that the expanded interest in more extensive utilization of existing knowledge may have been generated from several independent actions, however. Two that are readily identifiable are, (1) the President's Message to Congress on Science and Technology in March 1972 which declared: "Federal research and development activities generate a great deal of new technology which could be applied in ways which go well beyond the immediate mission of the supporting agency. In such cases, I believe, the government has a responsibility to transfer the results of its research and development activities to wider use in the private sector--" and (2) the Accounting Office (GOA) Report of December 1972 which recommended: (a) that a government-wide policy for technology transfer with guidelines be issued to Federal agencies to implement a formal, active technology transfer process; and (b) that the Secretary of Defense establish a policy and procedures to encourage more extensive application of existing defense technology to civilian problems.

FORMAL vs INFORMAL COMMUNICATIONS

Documentation, search facilities, and distribution channels, are significant elements in the methodology model that considers and describes the process of the flow of technical information from the source to the user which is presented as Figure 1. Formal communications are identified as a separate segment of the model of methodology of technology transfer and

[1] Some of the states with programs are: Pennsylvania, Massachusetts, Michigan, California, North Carolina and Kentucky.

utilization. It seems important, however, to recognize that there are a number of informal factors which are presented as a behavioral and/or sociological segment in the same model. These factors contribute heavily to the success of the utilization of knowledge by an organization. For example: "Practicing technologists prefer to use their peers and fellow employees as directories for information" (Knox, 1973, p. 416).

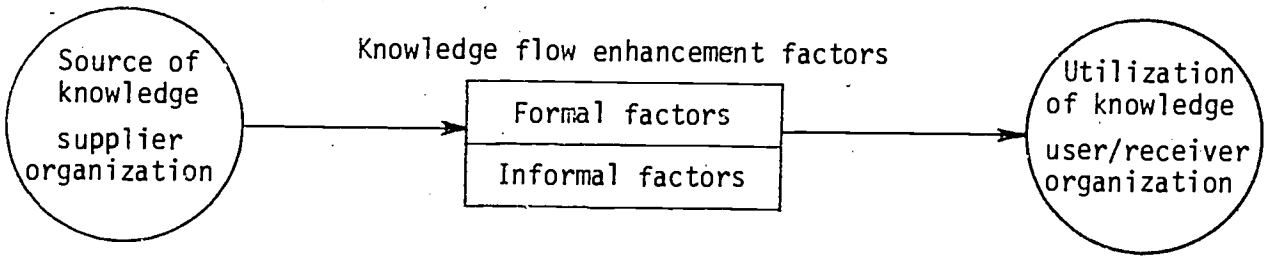

Figure 1a.

A simplified model indicating the movement of knowledge from the Source to the User/Receiver.

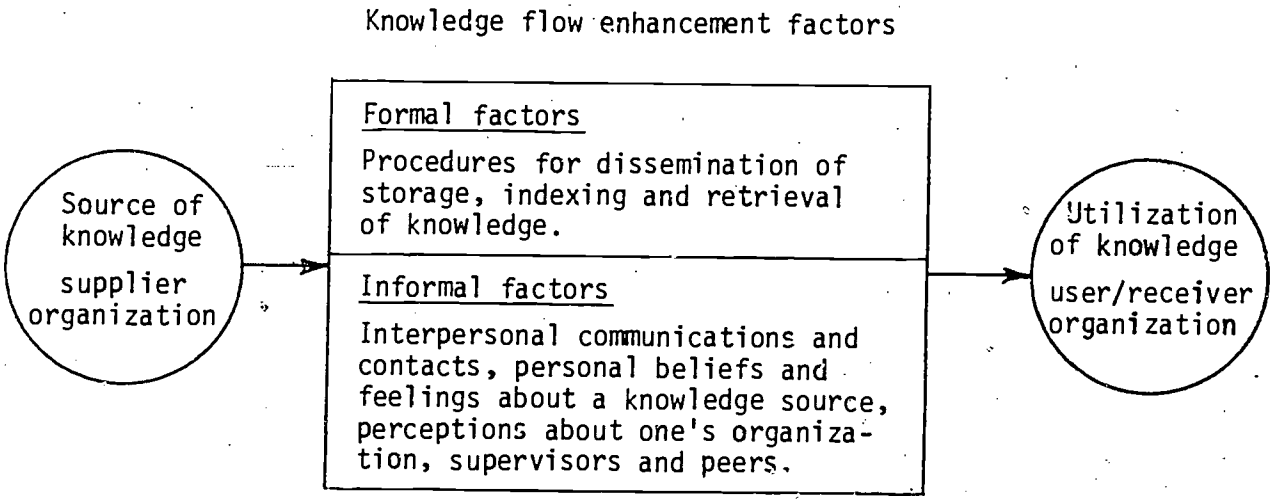

Figure 1b.

The knowledge flow enhancement factors are defined here according to the classification, Formal vs Informal.

There have been a small number of studies conducted which examine the extent of the use of formal vs informal knowledge flow enhancement factors. Formal knowledge flow enhancement factors are defined as publications and documented information and the processes enabling their dissemination, storage, indexing, and retrieval; informal knowledge flow enhancement factors are defined as interpersonal communications channels of face to face contact, telephone, telegraph, messages, written correspondence and interpersonal beliefs, feelings and perceptions. Four such studies, Glock (1958) of 77 scientists, Auerbach (1965) of 1375 scientists, Rosenbloom and Wolek (1967) of 3200 scientists and engineers, and Graham and Wagner (1967) of 326 managers of research and development projects, agreed within a few percent that the communication channel usage was divided, informal 55% and formal 45%.

These studies showed that the interpersonal or informal channels play a fundamental and important role and are utilized by individual scientists and engineers in a majority of the instances in their daily information obtaining activities.

LINKER-STABILIZER FACTOR

In the study by Creighton, Jolly, and Denning, 1972, the predictive model of the methodology of technology transfer attempted to more precisely identify the specific factors of the knowledge flow enhancement model. Figure 2 presents their model in a modified form that attempts to relate each factor to either the source or the user/receiver organization.

One of the behavioral factors identified in the Creighton, Jolly, Denning, model described in Figure 2 is the linker. The linker refers specifically to the person to person aspect of technology transfer. People who are

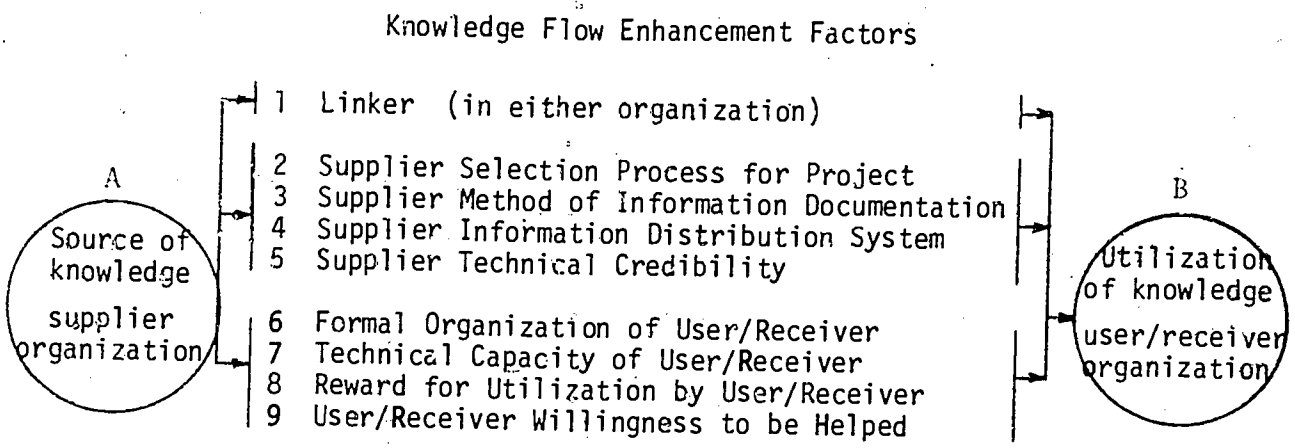

Figure 2.

Predictive Model of the Methodology of Technology Transfer from "A" Supplier Organization to "B" User Organization where Factors are Associated with Supplier or User. The one exception is the Linker Concept which has a unique relationship.

likely to contribute to the technology transfer process have been determined to be more than just people who are interested in new ideas and implementation. These key individuals have characteristics that may be described as different from their colleagues. They are innovative, willing to accept risk, active in multi disciplines, have more information contacts, have a high credibility with peers, cosmopolite, and oriented toward outside information sources, (Baker 1967, Holland 1972, p. 40, Rogers and Shoemaker 1971, Blackwell 1969, p. 19, Allen 1969, p. 18, Bell 1963, p. 91). A person with these and other related characteristics has been identified as a 'linker' (Rogers and Jain 1969, p. 3, Farr 1969, p. 1, Havelock 1971, p. 7-16, Creighton, Jolly, Denning 1972, p. 5).

When the predictive model of the methodology of technology transfer from the supplier organization to the user organization was developed, the linker concept attracted more attention than the other factors for several reasons.

The linker concept seemed to act as a bridge between the source of knowledge and the user/receiver of the knowledge. The bridge concept suggested that the linker concept was dynamic rather than passive to the extent that it could perhaps be responsible for and explain modifications of behavior patterns and changes in perceived barriers to the flow of technology utilization. The formal definition of a linker is (Creighton, Jolly, Denning, 1972): An individual who through his own initiative seeks out scientific knowledge, is an early knower of innovations, and acts as an intermediary between the source of knowledge and the individuals or organizations who put it to use. (See Figure 3.)

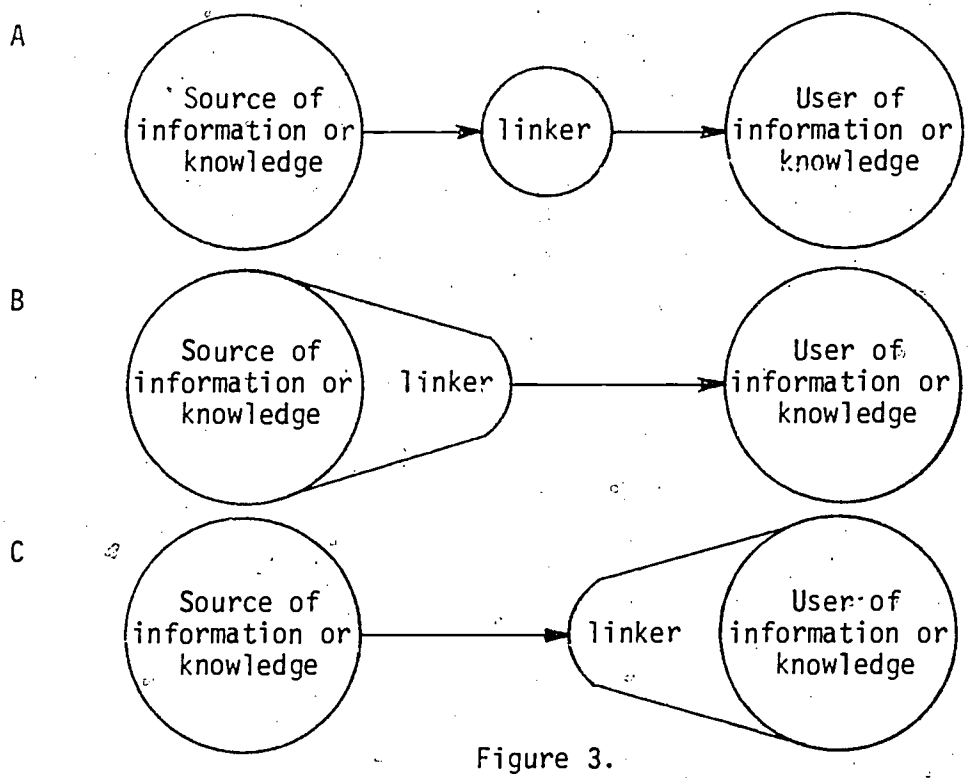

Figure 3.

The linker concept suggests a third party may be important in the transfer of information/knowledge from the source to the user. This linker, however, may be independent or may in fact be a member of either the Source or the User organization.

Several early researchers have recognized various forms of the linker concept. Different names and a range of definitions have been applied. Examples of names used are: great man (Glock and Menzel 1958); scientific troubador (Menzel 1964, Hodges and Nelson 1965); internal consultant (Allen et al 1968); technological gate keeper (Allen, Piepmeier and Cooney 1971); and opinion leader (Lazarsfeld et al 1948, Katz 1957).

It is important to recognize that although the term linker implies a third party between the source of knowledge and the user of knowledge, he need not be part of an independent organization (see Figure 3.). The linker may be a member of either the source of knowledge organization or the user of the knowledge organization, but probably operates best if he is aligned more closely with the user organization (Doctors, 1969, p. 101).

LINKER-STABILIZER STUDY

When the net balance of effort expended in order to accomplish technology transfer was evaluated it became apparent that the behavioral factors were far less understood and far less quantified than the procedure for dissemination, storage, indexing and retrieval of knowledge. This awareness was the prime force that supported the justification for the first study of the linker concept by Creighton, Jolly and Denning in 1972, which had the title, "Enhancement of Research and Development Output Utilization Efficiencies Linker Concept Methodology in the Technology Transfer Process." In this study it was hypothesized that there exists a relationship between the output efficiency utilization of research and development and the behavioral characteristics of the individuals in the user organization. Linker and stabilizer type performance were defined and a methodology for identifying such individuals was formed into a measuring

instrument. The instrument was administered to 1726 Naval Officers within the Civil Engineering Corps. A response rate of 65 percent (1128 usable returns) was recorded. These data were analyzed and validated by personal interviews of those whose scores indica extremes in the characteristics intended to be measured.

The results of this research may be most easily summarized by studying Figure 4. Figure 4 clearly shows that the population has a distribution approximating a normal distribution of the characteristic being measured. Those displaying very strong linker characteristics are shown on the right with the division line between potential linkers and linkers selected as 1.83 standard deviations to the right of the mean.

Those persons whose performance scores placed them in the opposite polar position were chosen to be called stabilizers and were identified as 1.83 standard deviation to the left of the mean.[1]

REPLICATION STUDY

One of the most severe limitations to the initial research study was that the instrument used to identify the linkers and stabilizers had been administered to a population unique in that they were all Naval Officers. This limitation to the study was recognized and to some extent corrected by a Naval Postgraduate School thesis study, (Claassen 1973). Claassen administered an

[1] Care should be exercised in making any assumption about the individual classified as a stabilizer. It is true that their characteristics are the polar opposite of the linker, however, their value to the organization has not been studied for this research. It is intuitively believed, however, that they supply a critical stabilizing force that is necessary and desirable in order to maintain the organization equilibrium. It can be logically argued that either an excess or a deficiency of linkers and/or stabilizers could be sufficiently disruptive as to destroy the effectiveness of an organization.

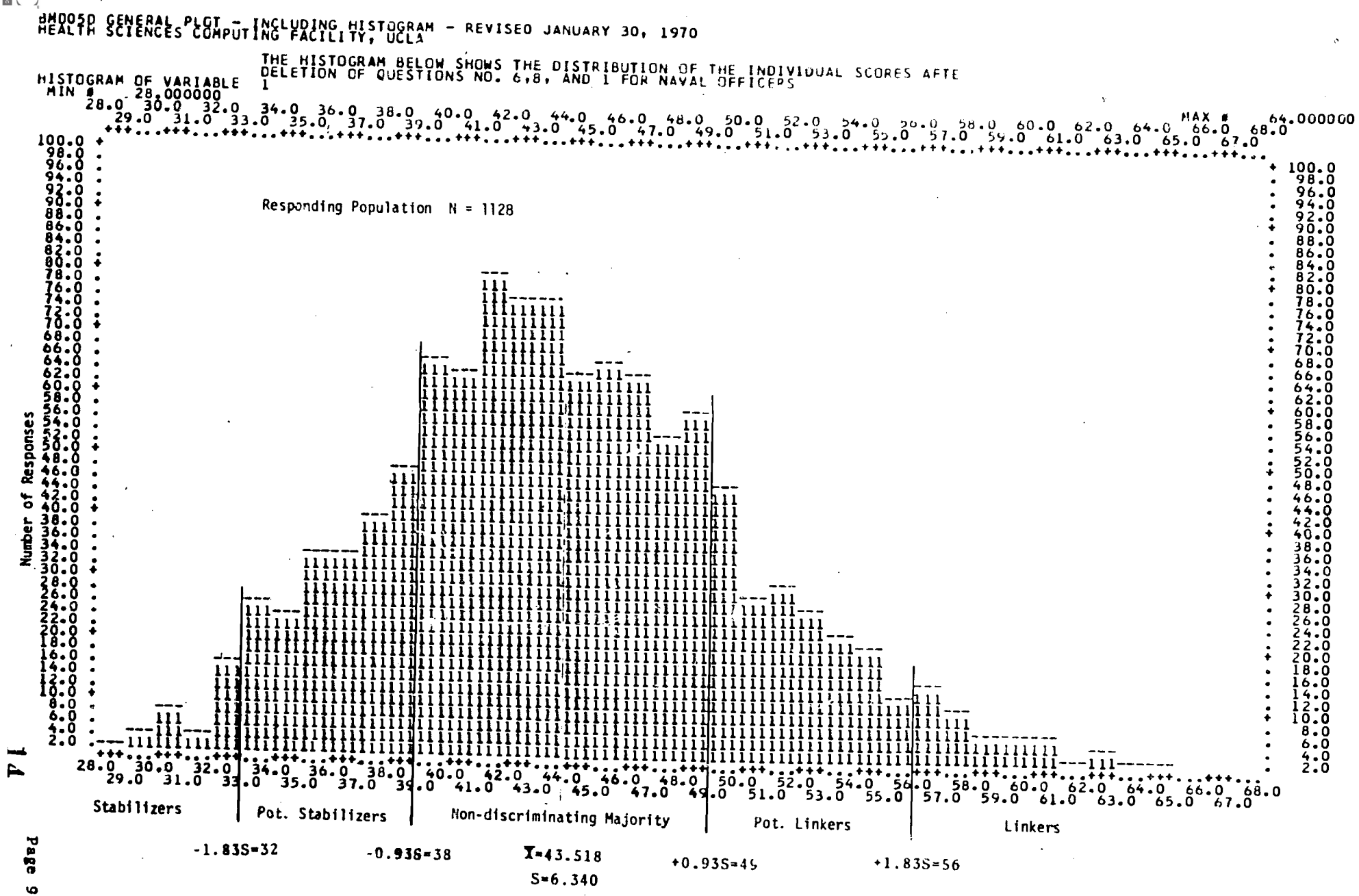

Figure 4

Histogram of the scores of the Naval Officer ivil Engineers to the questionnaire which was intended to measure the magnitude of their stabilizer-linker traits.

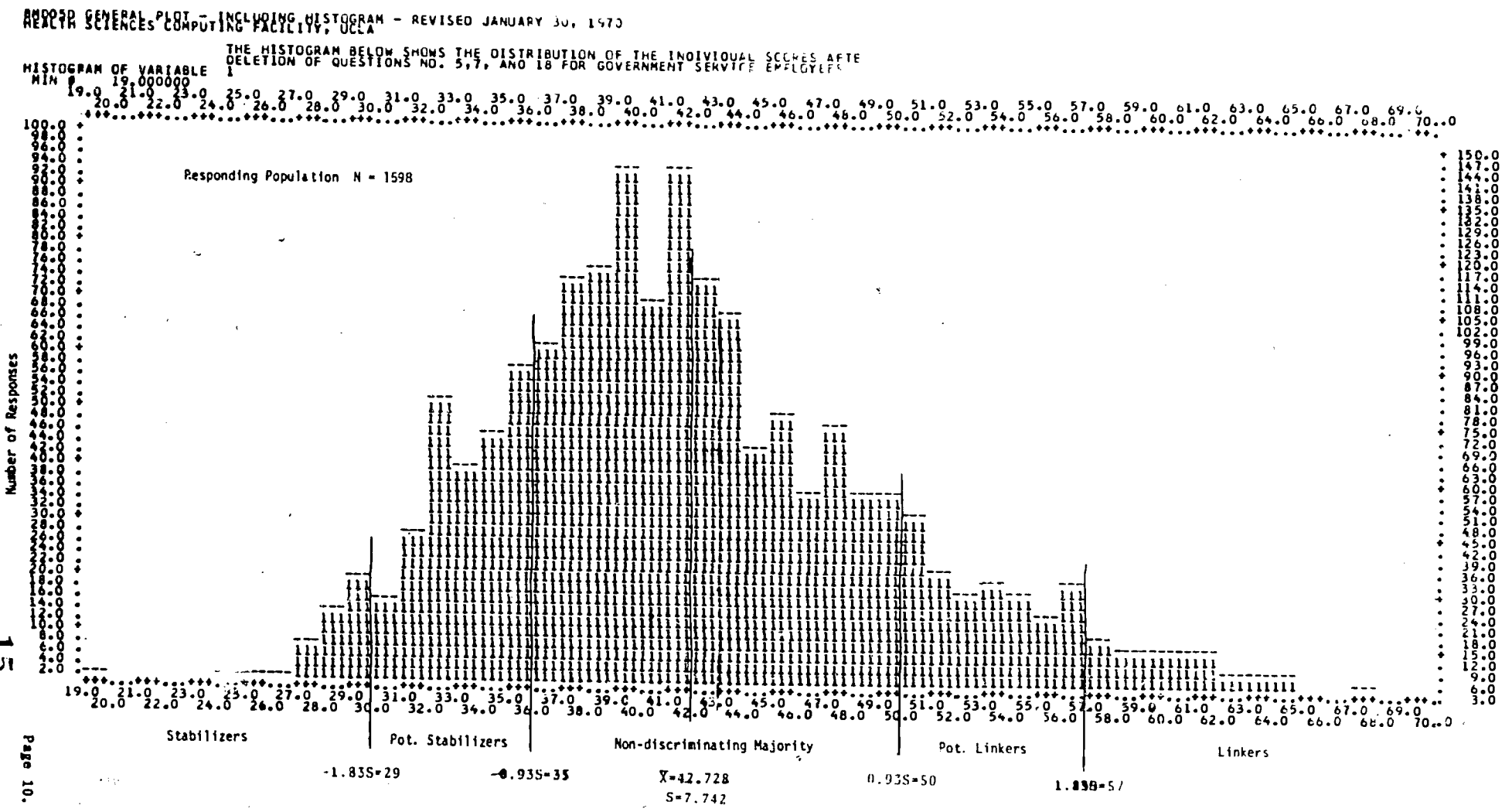

Figure 5

Histogram of the scores of the Government Service employees to the questionnaire which was intended to measure the magnitude of their stabilizer-linker traits.

instrument, only slightly modified, from the Creighton, Jolly, Denning study in order to make it appropriate to the civilian sector, to a sample of 2954 persons selected at random from a parent population of 4464, GS 8 and above civilians working for the Naval Facilities Engineering Command. There were 1598 usable returns received giving a response rate of 54 percent. A histogram of the Claassen study is presented as Figure 5. Claassen concluded that discriminate analysis showed that it was not possible to distinguish between the two populations. Claassen stated that there was some indication that linkers in the two populations studied reached linker qualifying scores through different channels, however, no analysis was made in his study (Claassen 1974, p. 39).

DY OBJECTIVE

The concept that it is possible to qualify as a linker or a stabilizer through different combinations of performance appeared to justify further examination. Further, the original raw data were available from the two studies that have been cited. This paper, then, is an in depth analysis of the similarities and differences of preferences and performance of respondents that resulted in similar total scores that fell within the range classified as stabilizers and/or linkers. The objective of the analysis was to develop some reasonable support for the belief that, "the distribution of the linker-stabilizer behavior characteristic has a general base in terms of technically trained personnel and is not unique to a select population."

COMPARATIVE ANALYSIS OF LINKER-STABILIZER DATA

The method of scoring the response of the sample populations was to sum the scores from the individual questions in order to obtain a linker-stabilizer score. A copy of the complete instrument along with the scoring code is given in Appendix C for the Government Service Employees and in Appendix D for the Naval Officers. Each question had a maximum possible score of five for the perfect linker. For the analysis used, fifteen questions were considered appropriate such that a perfect score would have been seventy five.

The initial comparison of the scores of the two sample populations of technically trained personnel, in terms of their linker-stabilizer behavior trait, gave the following:

	Mean	Standard Deviation
Naval Officer	43.518	6.340
Government Service Employee	42.728	7.742

When tested statistically the hypothesis must be rejected that these two sample populations were from the same parent population.[1] Claassen (1973, p. 30) did not comment on a statistical comparison of the difference of the mean of the two sample populations, but rather concentrated his effort in order to show that the instrument was able to satisfactorily identify the Linkers, Potential Linkers, Middlemen, Potential Stabilizers, and Stabilizers in each of the separate populations. Hence by using multivariate stepwise

[1] Using the assumption that X_1 and X_2 are normally distributed and that σ_1 and σ_2 are known. Then $z = 2.92$. Hence $P(z>2.92) = 0.0018$. This then indicates that there is only a 0.0018 chance that the means tested could have come from the same population.

discriminate analysis Claassen (1973, p. 31) was able to show that the "... statistic was highly significant at a critical value of 0.99 in both cases, leading to the conclusion that the test grouped the subjects very well ... ."

Histograms of the two populations have been given in Figure 4. and Figure 5. In addition individual histograms of each of the questions are shown in Appendix A of this report.

The non-parametric statistical tests Chi-square and Kolmogorov-Smirnov were used to attempt to identify similarities and differences in the distribution of the responses by the Naval Officers and the Government Service Employees to the same (or equivalent) individual question. These two statistical tests, when applied to the score distribution of the individual questions, gave little or no discrimination in terms of identifying responses that would describe the similarities or differences of the two sample populations.

After extensive analysis of the histograms, Appendix A, it became apparent that an approach that could prove useful was to aggregate the question responses by summing only the percentages falling in the three highest response positions of each question. The argument for this approach was based on the concept that in a continuum the precise answer was not as important as the general magnitude of the answer. Or stating in another way, the trend is more important than the specific position on a continuum.

This approach was applied and the sums of the top three percentages of five possible responses to each question were determined.[1] These sums were

[1]The percentages associated with the answer to response 3, 4, and 5 were added togetner to give the aggregate score.

then tested using the statistic Chi-square. The pairs of questions which gave a significant Chi-square at the 0.05 level are underlined and are used as the basis of difference statements. This information is shown as Figure 6. Three question pairs, GS001/NAV002, GS013/NAV014, and GS014/NAV015 do not have a response design that can be considered a continuum. In their case only specific responses could be compared. These question pairs, answer values, and Chi-square statistic are shown in Figure 7.

The results presented in Figure 6. and Figure 7. may be generalized under two headings, 'Characteristics that are Different' and 'Characteristics that are Similar.' These will both be discussed. The characteristics that are similar will be presented first.

CHARACTERISTICS THAT ARE SIMILAR

It may be postulated that areas can be identified in which the linker-stabilizer behavior trait distribution, whether a technically trained Government Service Employee or a technically trained Naval Officer will be very similar.

To some degree this observation may be explained by a recognition that the initial technical training of a Civil Engineer is basically the same and the option to become a Naval Officer or Government Service Employee is a secondary consideration that has limited impact on the initial behavioral pattern formation.

For many of the questions the analysis tabulated in Figures 6. and 7. indicated that the responses could have come from the same population. These questions are listed here in detail in order to support the general hypothesis of the research that is: The distribution of the linker-stabilizer behavior characteristic has a general base in terms of technically trained personnel and is not unique to a select population.

	GS SUM	NAV SUM	CHI-SQUARE
GS002/NAV003 Hears about new work related developments sooner.	85.9	79.5	0.51
GS003/NAV004 Three or more non routine work related ideas per month.	44.2	58.2	3.37
GS004/NAV005 Attend three or more professional meetings per year.	46.9	27.6	13.5
GS006/NAV007 Sought further information 3 or more times in last month.	47.3	57.3	1.75
GS008/NAV009 Subordinates or peers came to you for information 8 or more times in month.	35.4	35.1	0.003
GS009/NAV010 Regularly read 5 or more journals, magazines or newspapers.	58.0	60.9	0.13
GS010/NAV011 Hold membership in 3 or more work related organizations.	16.0	19.4	0.60
GS011/NAV012 Social aspiration upper-middle class or above.	88.5	94.4	0.37
GS012/NAV013 Medium risk or above in use of work related new products.	94.5	90.9	0.21
GS015/NAV016 Recommended to colleagues 3 or more new ways during last month.	45.9	36.7	2.31
GS016/NAV017 Accept medium or higher risk when involving risk and security.	62.4	71.7	1.2
GS017/NAV018 Cautious to eager to adopt new ideas.	94.9	96.7	0.03

Figure 6.

Summation of Three Top Responses to Questions

Shown here is a tabulation of the sum of the percentages falling in the three highest responses to a question for questions whose answers are a continuum. The value of the Chi-square is given. The 0.01 significance for Chi-square is 6.63, 1 D.F. Those questions exceeding this value are underlined. The Government Service Employees are compared to the Naval Officers, i.e. the Naval Officer response was selected as the expected value.

	GS VALUE	NAV VALUE	CHI-SQUARE
GS001/NAV002 Placed highest credibility on personal knowledge.	40.0	46.1	0.81
GS001/NAV002 Placed second highest credibility on experimentation.	35.7	29.8	1.2
GS013/NAV014 Depends on the literature as information source.	24.6	53.6	15.7
GS013/NAV014 Depends on personal experience as information source.	37.6	7.6	118.0
GS014/NAV015 Mutual work related interest with people doing similar work.	10.8	51.7	32.36
GS014/NAV015 Mutual work related interest with fellow workers.	51.7	14.7	93.13

Figure 7.

A Comparison of Selected Responses Only

For questions that were not a continuum, in the simplest sense, selected discrete answers were compared. The value of the Chi-square is given (.01 = 6.63, 1 D.F.).

Twelve of the fifteen questions support the above stated hypothesis. They are:

GS001/NAV002

The type of information upon which the respondent placed highest credibility was, first, personal knowledge, and second, experimentation, for both the civilian and military personnel.

GS002/NAV003

The feeling as to the time when one learns about new work related developments is at the same time or considerably before for both population samples.

GS003/NAV004

When the percentage of responses for persons supplying three or more work related project ideas are compared, the responses from the separate populations are similar.

GS006/NAV007

The estimated number of times that a technical person felt that he sought further information in the last month, of a non-routine nature about his work, was most often three or more times for both population samples.

GS008/NAV009

Individuals reporting a frequency of eight or more for the number of times that subordinates, peers and or supervisors sought further information through direct contact was similar for both population samples.

GS009/NAV010

The number of journals, magazines, and newspapers which were regularly read by the technical personnel was most often reported as five or more for both population samples.

GS010/NAV011

The distribution of the membership pattern of work related organizations, for those holding membership in three or more professional organizations, was very similar for both populations samples.

GS011/NAV012

The social aspirations, within the next ten years, for all of the respondents was sharply peaked about the upper middle class.

GS012/NAV013

The risk willingness involving the use of new products in the work situation was perceived to be medium to high for both groups of technical persons.

GS015/NAV016

The number of recommendations to colleagues of new ways to do things during the past month was reported to be mostly one or two by both population samples, and was similar for both population samples for three or more recommendations per month.

GS016/NAV017

The willingness to accept risk by both population samples was similar when comparing the sum of the medium to high risk responses.

GS017/NAV018

Both population samples perceived that their feelings about adopting a new idea was most often described by "discreet use of."

These twelve areas of investigation of behavior support the argument that people engaged in technical work tend to respond as a uniform class or group in terms of the linker concept.

CHARACTERISTICS THAT ARE DIFFERENT

In contrast, certain areas of investigation of perceived behavior were found to be quite different between the two population samples. The biases of the respondents in the population samples that resulted in a high linker score tended to oscillate among these questions in a manner that concelled the aggregate difference. These question response differences are important and produce an insight about the expected behavior of the separate populations.

The differences found in Figures 6 and 7. may be generalized by stating several logical sub-hypotheses.

Technically trained Naval Officers tend to behave differently than their technically trained civilian Government Service Employee colleagues by:

NAV005 Attending fewer professional meetings and/or conventions per year.

NAV014 Depending more heavily on the literature as a principle source for information for work related projects.

NAV015 Centering their mutual work related interests with people doing similar work.

Technically trained Government Service Employees tend to behave differently than their technically trained Naval Officer colleagues by:

GS004 Attending more professional meetings and/or conventions per year.

GS013 Using personal experience more often as a principle information source for work related projects.

GS014 Centering their mutual work related interests with their fellow workers.

These sub-hypotheses seem to have logical explanations. Naval Officers tend to have their assignment changed every two to three years. This high mobility tends to be a barrier to the developing of affiliations with professional groups that hold professional meetings, seminars and conventions. It also seems logical that the high mobility would tend to encourage the Naval Officer to depend upon the literature as a principle source for information for work related projects. This same argument may be extended to the Naval Officer's tendency to center his mutual work related interests with people doing similar work.[1]

The permanent nature of the Government Service Employee's assignment would tend to encourage the development of affiliations with professional

[1] This is a study of civil engineers and therefore people doing 'similar work' are here defined as other civil engineers. It should be noted that even though the Naval Officer Civil Engineer is very mobile, he will most often have a civil engineering related assignment.

organizations having chapters or divisions located in the geographic area near his work assignment. This type of membership would logically lead to the attendance at professional meetings, seminars and conventions. Further the permanent nature of the Government Service Employee's assignment would also tend to encourage the development of a large inventory of job related experiences. These experiences would be a rich source of technical expertise for future problem solving. Finally the more permanent work assignment would also nurture long standing peer relationships that would explain the concentration of mutual work related interests with their fellow workers.

It seems that the measurable differences in linker-stabilizer response between the Government Service Employee and the Naval Officer are reasonably easy to rationalize and therefore, do not offer a major threat to the hypotheses that, 'the distribution of the linker-stabilizer behavior characteristic has a base in terms of technically trained personnel and is not unique to a select population.'

CONCLUDING SUMMARY

Two independent studies of technology utilization and dissemination methodology dealing with the identification of the behavioral characteristics of linkers and stabilizers and their relative existence within a group of technical personnel have appeared in the literature (Creighton, Jolly, Denning 1972, and Claassen 1973). The first of these studies (Creighton et al 1972) analyzed the responses of 1128 Naval Civil Engineering Officers, the second study (Claassen 1973) analyzed the responses of 1598 Government Service Civil

Engineers and related technical personnel. Both studies successfully identified the linker and the stabilizer segments of the population sample that was investigated. Using discriminate analysis Claassen concluded that it was possible to distinguish between the two populations in term of their linker-stabilizer scores. Claassen further stated that there was some indication that the linkers and stabilizers in the two populations studied may have reached their qualifying scores through different channels, however, no analysis was made in his study.

The concept that it is possible to qualify as a linker or a stabilizer through different combinations of behavioral performance (different channels) appeared to justify further examination.

The hypothesis that, 'the distribution of the linker-stabilizer behavior characteristic has a general base in terms of technically trained personnel and is not unique to a select population,' was selected as the hypothesis to be proven by this research.

The success of the research here reported is based on the argument that in a continuum of possible answers to the specific questions used to identify the linker-stabilizer characteristic, the precise answer was not as important as the general magnitude of the answer when looking at the similarities and differences of the population samples. Or stated in another way, the trend is more important than a specific position on a continuum when investigating the aggregate population sample.

Each question had five possible answers. Using this approach the top three responses were summed together. When these sums were tested statistically it was possible to show that twelve questions had a similar response such that the respondents could have come from the same population. There were three questions, when their response was tested, that provided statistical proof their response was expected to have come from different populations.

The twelve questions with the similar response supported the hypothesis that, 'the distribution of the linker-stabilizer behavior characteristic has a general base in terms of technically trained personnel and is not unique to a select population.' The remaining three questions were then analyzed. A rationale was developed in order to explain away their apparent disagreement with the hypothesis. The rationale put forward was that Naval Officers have a high mobility in that their assignment may be for only two or three years. In contrast the Government Service Employee holds a relatively permanent assignment. This rationale was effective as a means of explaining the behavior reported by the three questions that indicated a very significant difference between the two population samples.

It seems reasonable then, accepting the limitations of this research, to present the following hypothesis as proven to be true:

'The Linker-Stabilizer behavior characteristic has a general base in terms of technically trained personnel and is not unique to a select population.'

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APPENDIX A

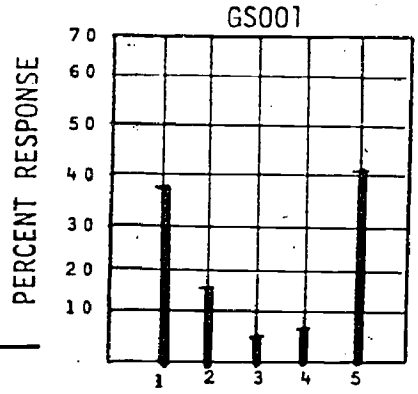
A family of histograms. Pairs of questions are shown where the pairs are equivalent questions that have been administered to the Naval Officers and to the Government Service Employees. The numbers shown are percentage response from a sample. The Naval Officer response was 1128 and the Government Service Employees was 1598.

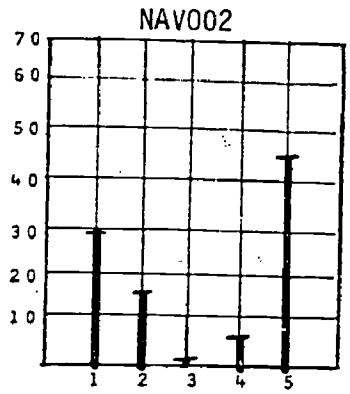
The numbering of the questions on the instrument used for the Naval Officers and the instrument used for the Government Service Employees were different. For example, question GS002 is the equivalent of NAV003. The equivalent questions are paired for comparison.

It was decided by Claassen (1973, p. 28) that question pairs GS005/NAV006, GS007/NAV008 and GS018/NAV001 were not equivalent and were therefore deleted from the comparison analysis. With these questions deleted there were fifteen pairs of equivalent questions that were used for the analysis.

The type of information upon which you would place highest credibility.

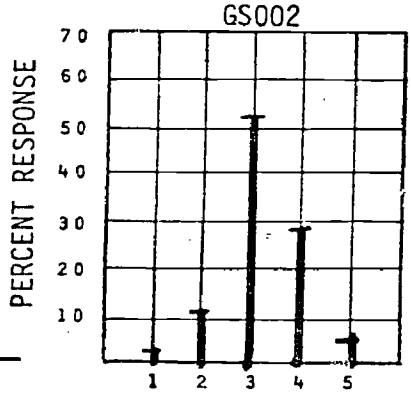
5. personal knowledge
4. associated staff
3. vendors
2. literature
1. experimentation

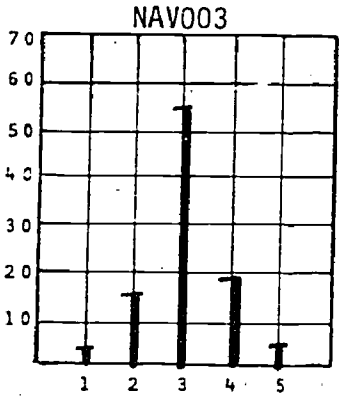




I feel that I hear about new work related developments _____ most of my colleagues.

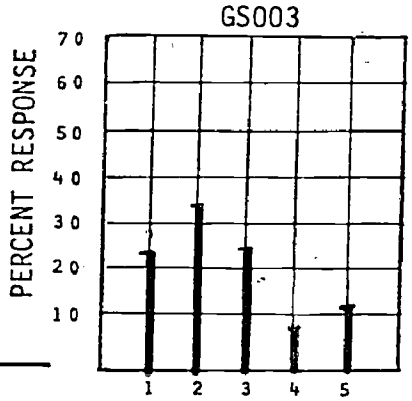
5. considerably before
4. sooner than
3. at about the same time as
2. later than
1. sometime later

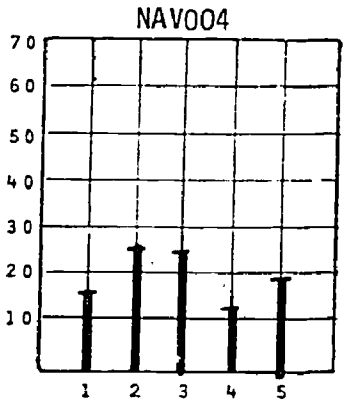




Number of nonroutine, work-related projects have been completed for which you supplied the original idea?

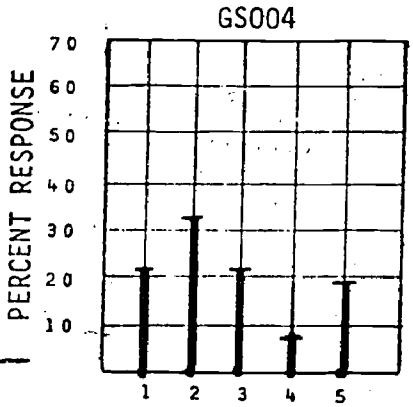
5. more than
4. 5-6
3. 3-4
2. 1-2
1. 0

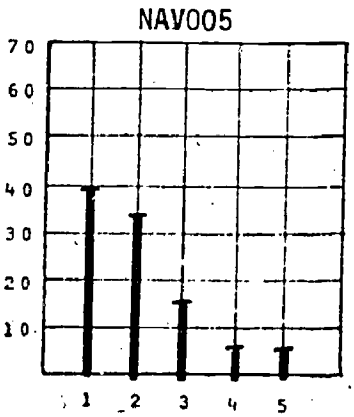




Number of formal work-related meetings or conventions which you attended last year which involved personnel other than your immediate circle of colleagues.

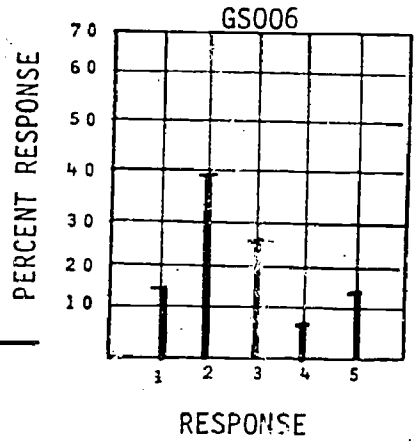
5. more than 6
4. 5-6
3. 3-4
2. 1-2
1. 0

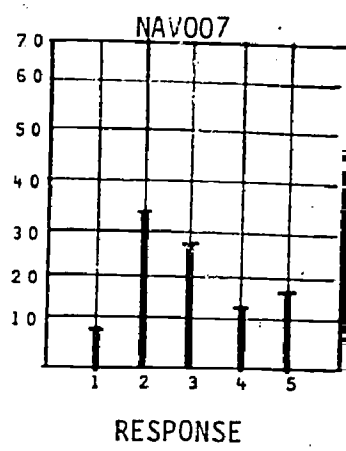




Number of times you sought further info in the last month--non routine about your work.

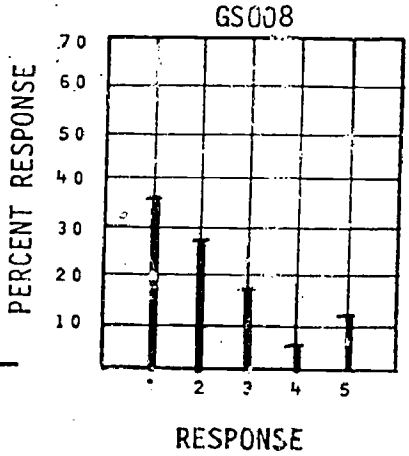
5. more than 6
4. 5 to 6
3. 3 to 4
2. 1 to 2
1. none

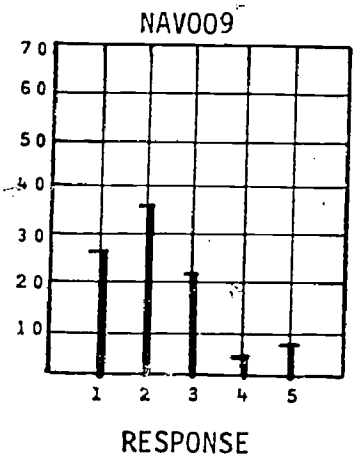




Frequency that subordinates, peers and/or superiors came to you during past month for advice--not a function of formal job.

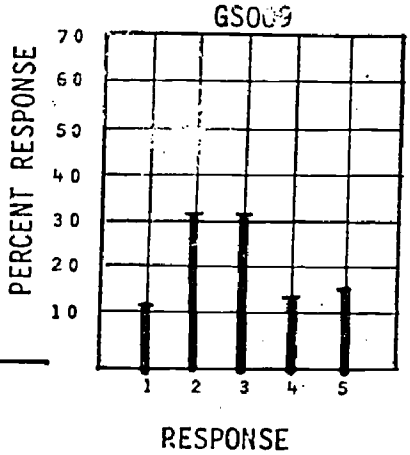
5. more than 15
4. 11 to 15
3. 8 to 10
2. 4 to 7
1. 0 to 3

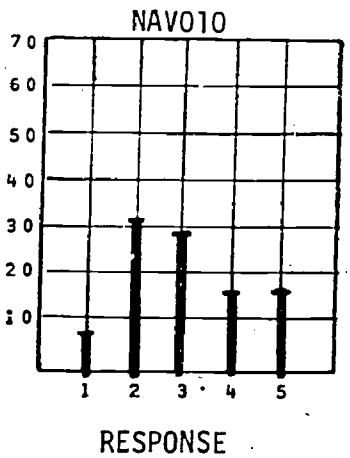




The number of journals, magazines, and newspapers which you regularly read.

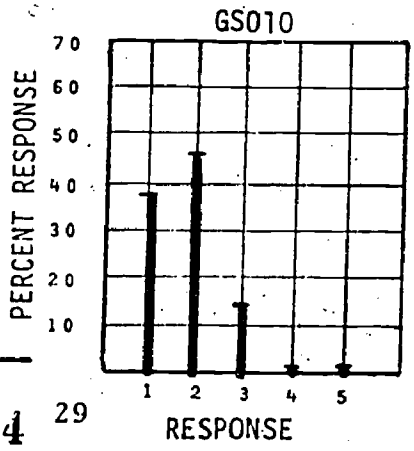
5. more than 8
4. 7 to 8
3. 5 to 6
2. 3 to 4
1. 1 to 2

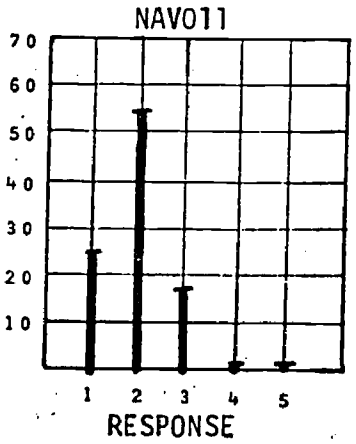




The number of work-related organizations to which you hold current membership.

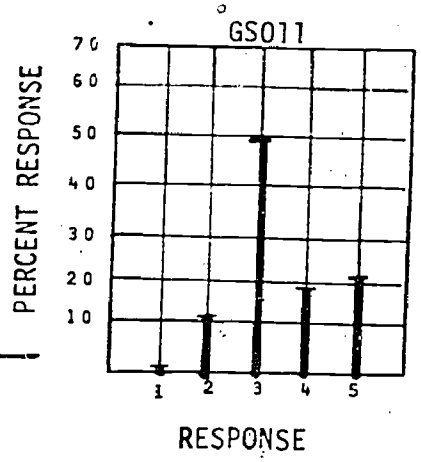
5. more than 6
4. 5 to 6
3. 3 to 4
2. 1 to 2
1. none

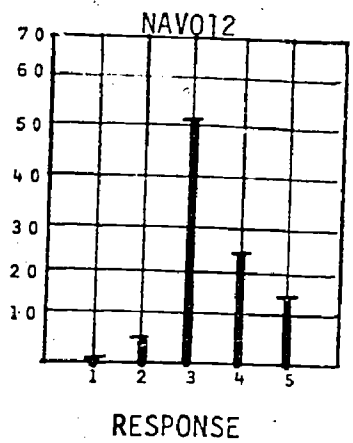




Social aspiration within next 10 years.

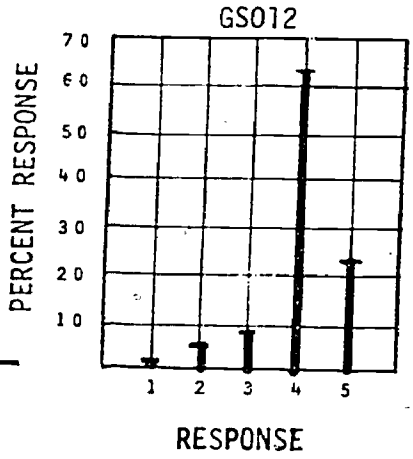
5. upper
4. lower-upper
3. upper-middle
2. middle
1. lower middle

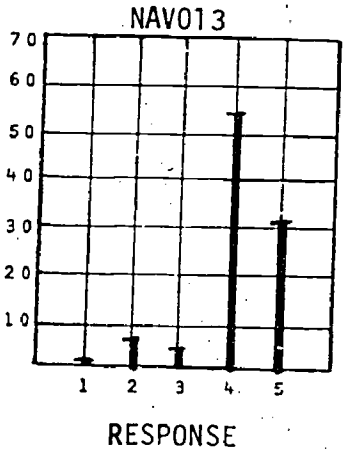




Measure of risk involving work and use of a new product.

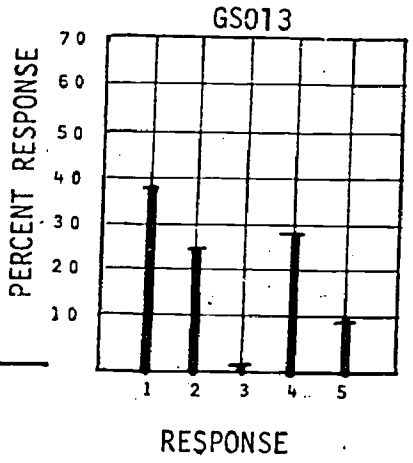
5. highest risk
4. high risk
3. medium risk
2. low risk
1. no risk

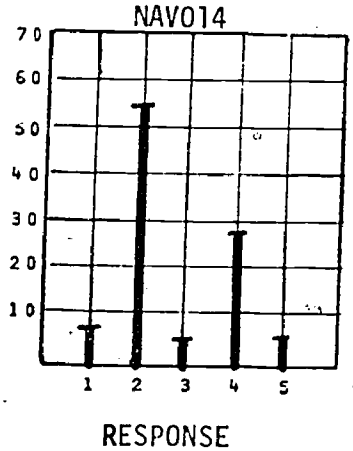




Information sources for work-related projects and/or problems.

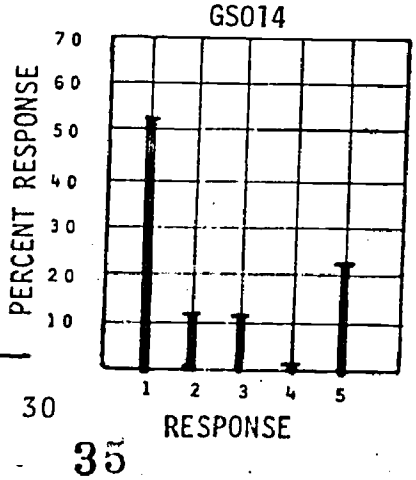
5. extrenal sources
4. colleagues
3. sales representatives
2. literature
1. personal experience

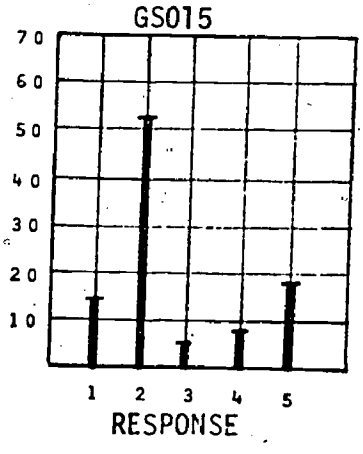




With whom do you have mutual work-related interests?

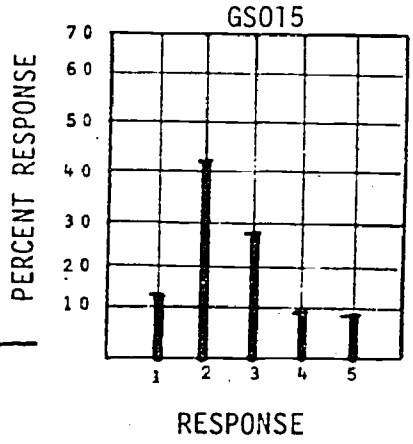
5. many groups-geographically dispersed
4. several groups in your locale
3. community associates
2. people doing similar work
1. fellow workers

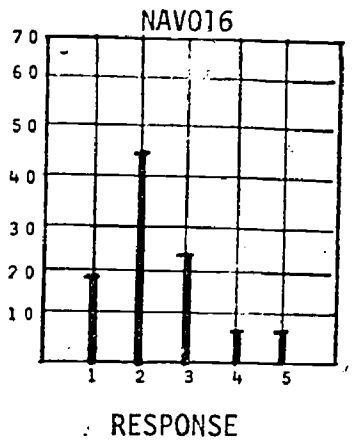




Recommendations to colleagues of new ways to do things during past month.

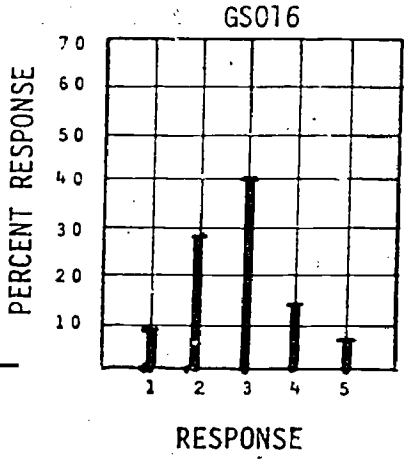
5. more than 6
4. 5 to 6
3. 3 to 4
2. 1 to 2
1. none

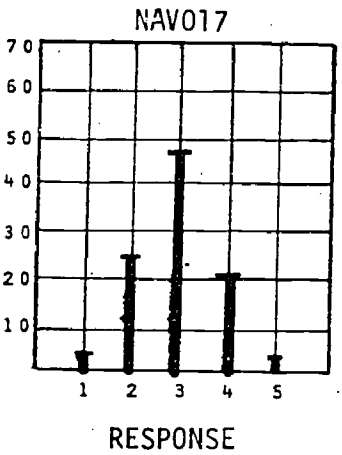




Measure of risk involving work and security.

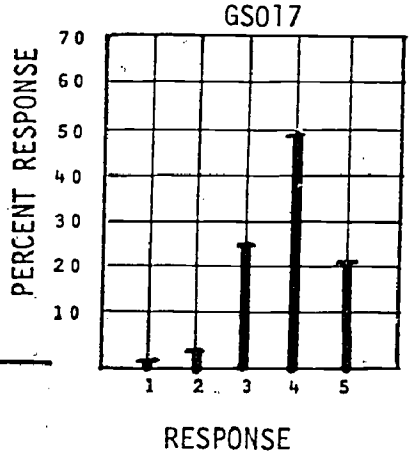
5. highest risk
4. high risk
3. medium risk
2. low risk
1. no risk

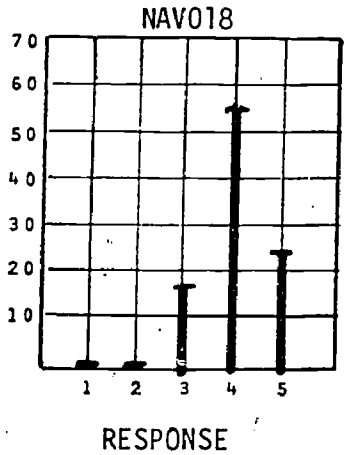


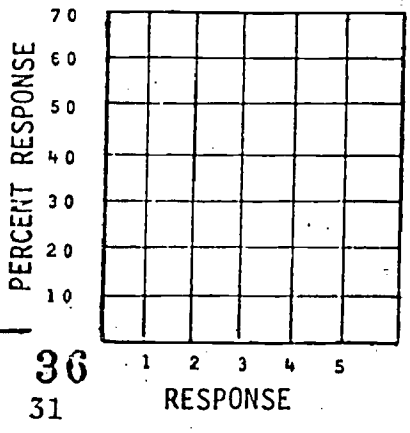


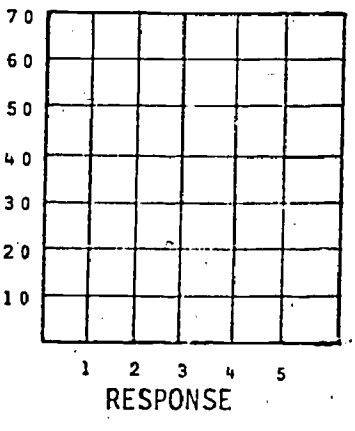
Feelings about a new idea.

5. eager to adopt
4. discreet use of
3. cautious
2. skeptical
1. use proven only









APPENDIX B

Appendix B is a tabulation of question response percentages and where appropriate the sum of percentages. These percentages are tabulated for all questions.

Pair		RESPONSE 1	2	3	4	5	SUM 3+4+5
1	GS001	35.7	16.6	0.9	6.7	40.0	
	NAV002	29.8	16.4	0.3	7.4	46.1	
2	GS002	2.6	11.5	52.4	27.0	6.5	85.9
	NAV003	4.0	16.1	56.4	19.9	3.6	77.9
3	GS003	22.3	33.4	23.9	8.7	11.6	44.2
	NAV004	15.4	26.4	26.1	12.2	19.9	58.2
4	GS004	20.7	32.2	20.4	8.3	18.2	46.9
	NAV005	39.3	33.0	15.7	6.3	5.6	27.6
5	GS006	13.5	39.2	25.8	8.4	13.1	47.3
	NAV007	8.8	34.0	28.4	12.0	16.9	57.3
6	GS008	35.9	28.6	17.4	5.5	12.5	35.4
	NAV009	27.7	37.3	21.0	5.8	8.3	35.1
7	GS009	11.1	30.9	30.3	12.9	14.8	58.0
	NAV010	7.9	30.9	29.4	16.0	15.5	60.9
8	GS010	38.5	45.4	13.6	1.7	0.7	16.0
	NAV011	26.3	54.2	17.1	1.9	0.4	19.4
9	GS011	0.7	10.7	49.7	18.7	20.1	88.5
	NAV012	0.5	5.1	52.	26.2	15.7	94.4
10	GS012	1.0	4.5	8.9	62.8	22.8	94.5
	NAV013	0.3	8.6	5.8	54.5	30.6	90.9
11	GS013	37.6	24.6	1.1	27.1	9.6	
	NAV014	7.6	53.6	4.7	27.8	6.0	
	GS014	51.7	10.8	10.7	4.0	22.7	
	NAV015	14.7	51.7	5.7	8.7	18.8	

Pair							
13	GSO15	12.4	41.7	27.9	8.9	9.1	45.9
	NAVO16	18.9	44.3	22.9	6.7	7.1	36.7
14	GSO16	9.9	27.7	40.2	14.2	8.0	62.4
	NAVO17	3.2	23.9	47.2	20.5	4.0	71.7
15	GSO17	1.8	3.2	24.9	49.1	20.9	94.9
	NAVO18	0.4	1.8	17.0	56.3	23.4	96.7

APPENDIX C

Shown is a copy of the instrument used to identify the Linker-Stabilizer characteristics of the Government Service employees. Following the instrument is shown the scoring arrangement.

APPENDIX C

GOVERNMENT SERVICE EMPLOYEE

PROFESSIONAL PREFERENCE CENSUS

Please circle the letter which most nearly describes your answer or reaction to the question.

1. Indicate the type of information upon which you would place highest credibility.

   a) Personal knowledge
   b) Associated staff
   c) Vendors and/or trade councils
   d) Literature - journals, books, etc.
   e) Analysis and experimentation

2. Indicate which combination of words, when placed in the following sentence, would most accurately describe you: I feel that I hear about new work-related developments _____ most of my colleagues.

   a) considerably before
   b) sooner than
   c) at about the same time as
   d) later than
   e) sometime later

3. In the past year, how many nonroutine, work-related projects have been completed for which you supplied the original idea?

   a) 0 b) 1-2 c) 3-4 d) 5-6 e) More than the above

4. Indicate the number of formal work-related meetings and/or conventions which you attended last year and which involved personnel other than your immediate circle of colleagues.

   a) 0 b) 1-2 c) 3-4 d) 5-6 e) More than 6

5. Given a choice of the type of work you could perform on the job, which would you choose?

   a) a project with multiple solution methods and a broad range of possible objectives.
   b) a project with a specific objective but alternative solution methods.
   c) a pre-defined non-routine assignment.
   d) a challenging assignment in which the alternatives and objectives are determined primarily by you.
   e) a pre-defined routine assignment.

6. In the past month how many times have you sought further information, other than that of a routine nature, about a new idea or ideas which you thought to be useful to your work?

   a) 0 b) 1-2 c) 3-4 d) 5-6 e) More than the above

7. For the past 2 years a very close friend has had a strong desire to take a vacation in a foreign country. The trip will cost about $2000. He can leave anytime within the next year and could save $2000 or more in a year. What would you advise him to do?

   a) Charge the entire trip on credit.
   b) Save for 3 months with the balance credit.
   c) Save for 6 months with the balance credit.
   d) Save for 9 months with the balance credit.
   e) Save for 1 year and pay cash for the entire trip.

8. Indicate the frequency with which your subordinates, peers, and/or superiors came to you in the past month for work-related information and/or advice which was not a function of your formal position.

   a) 1-3 b) 4-7 c) 8-11 d) 11-15 e) More than the above.

9. Indicate the total number of journals, magazines, and newspapers which you regularly read:

   a) 1-2 b) 3-4 c) 5-6 d) 7-8 e) More than the above

10. Indicate the number of work-related organizations to which you hold current membership.

    a) 0 b) 1-2 c) 3-4 d) 5-6 e) More than the above

11. Indicate the level within the social strata to which you would aspire to be 10 years from now.

    a) Upper
    b) Lower-Upper
    c) Upper-Middle
    d) Middle
    e) Lower-Middle

12. Mr. C., a civil engineer, who is employed by a medium sized construction firm recently learned of a new building material which is used extensively in Europe but never adopted in the United States. The building material appears to have several advantages in terms of substantial cost reduction, superior insulation qualities, and

relative ease of construction as compared to its counter part in the United States.

After a thorough investigation, Mr. C. obtained extensive and reliable information on the characteristics, costs, and advantages of new material. Further, his company could easily obtain exclusive manufacturing rights for use in the United States.

Imagine that you are Mr. C. Indicate which of the following would best describe your approach to the building material.

a) Recommend that the new idea be utilized in the firm's next major building project so as to take advantage of the substantial cost savings.
b) Recommend that the building material be used in one of the firm's small, local building projects as as to test its acceptance.
c) Recommend that the firm construct a non-commercial prototype.
d) Recommend that the firm engage the services of an independent consultant.
e) Recommend that the firm wait until the building material has received considerable commercial application in the United States.

13. Which of the following do you tend to rely upon most heavily as a source of information for work-related projects and/or problems.

a) Literature
b) Sales representatives
c) Personal experience
d) Colleagues
e) Sources external to your organization

14. With whom do you have mutual work-related interests?

a) Fellow workers.
b) People doing similar work outside your organization.
c) Community associates.
d) Several groups in your locale.
e) Many groups, not necessarily in the same geographical area.

15. During the last month, indicate the relative frequency with which you recommended to a colleague a specific item of interest on a work-related topic, e.g., a journal article, research report, or any information on new ways to do things.

a) 0 b) 1-2 c) 3-4 d) 5-6 e) More than the above.

16. Assume that for some reason a very close friend is forced to find another job. Some of the companies he has contacted are new and although their future success is uncertain, they offer potential salaries above that which he is now receiving. Indicate which company you would advise your friend to join.

	CHANCES FOR COMPANY SUCCESS	PROSPECTIVE SALARY INCREASE
a)	2 in 10	200%
b)	4 in 10	100%
c)	6 in 10	50%
d)	8 in 10	25%
e)	Survival Guaranteed	0%

17. Indicate which of the following best characterizes your approach to an innovative idea:

a) Very eager to adopt new ideas.
b) Discreet use of new ideas.
c) Deliberate for sometime before adopting a new idea.
d) Skeptical and cautious about adopting a new idea.
e) Prefer to only use proven ideas.

18. What is your present position/GS rating? _____
To what position/GS rating do you aspire? _____

19. How long have you worked at the job to which you are presently assigned? _____

20. Give a brief description of the nature of your job.

APPENDIX C (CONT.)

Scoring for Government Service Employee Professional Preference Census:

Question	Number of Points				
	a	b	c	d	e
1	5	4	3	2	1
2	5	4	3	2	1
3	1	2	3	4	5
4	1	2	3	4	5
5	4	3	2	5	1
6	1	2	3	4	5
7	5	4	3	2	1
8	1	2	3	4	5
9	1	2	3	4	5
10	1	2	3	4	5
11	5	4	3	2	1
12	5	4	3	2	1
13	2	3	1	4	5
14	1	2	3	4	5
15	1	2	3	4	5
16	5	4	3	2	1
17	5	4	3	2	1

APPENDIX D

Shown is a copy of the instrument used to identify the Linker-Stabilizer characteristics of the Civil Engineering Type Naval Officers. Following the instrument is shown the scoring arrangement.

APPENDIX D

NAVAL OFFICER

PROFESSIONAL PREFERENCE CENSUS

1. Assuming that you were to make the Navy a career, what would be the highest rank to which you would aspire?

   a) Lieutenant Commander
   b) Commander
   c) Captain
   d) Rear Admiral
   e) Admiral

2. Indicate the type of information upon which you would place highest credibility.

   a) Personal knowledge
   b) Associated staff
   c) Vendors and/or trade councils
   d) Literature-journals, books, etc.
   e) Analysis and experimentation

3. Indicate which word, when placed in the following sentence, would most accurately describe you: I feel that I hear about new work-related developments in my professional area _____

   a) considerably before
   b) sooner than
   c) at about the same time
   d) later than
   e) sometime after

4. In the past year, how many nonroutine, work-related projects have been completed for which you supplied the original idea?

   a) 0 b) 1-2 c) 3-4 d) 5-6 e) More than the above

5. Indicate the number of technical and/or scientific society meetings and/or conventions which you attended last year which involved personnel other than your immediate circle of colleagues.

   a) 0 b) 1-2 c) 3-4 d) 5-6 e) More than the above

6. When you are on the job, do you most prefer work that is:

   a) concerned with accomplising a specific task
   b) concerned with attempting to solve a challenging but not specifically assigned task

c) concerned with accomplishing those tasks for which I am individually responsible
d) concerned with the efficient utilization of resources
e) none of the above

7. In the past month how many times have you sought further information about a new idea or ideas which you thought to be useful to your work?

a) 0 b) 1-2 c) 3-4 d) 5-6 e) More than the above

8. Mr. E., a civil engineer, who is married and has three children recently decided to perform some major improvements upon his house (cost approximately $1,000). Mr. E. realized that the improvements were not urgently required but would make life at home more comfortable for the E. family. Consequently, Mr. E. was faced with a decision as to how he should finance the home improvements because such seemed to be the sole determinant as to when the E's could utilize these improvements. Indicate which of the following financial decisions you would advise Mr. E., to make for his home improvements.

a) Borrow the necessary money immediately at 18% annual interest.
b) Save for 6 months and borrow the remainder at 10% annual interest.
c) Save for one year and borrow the remaining at 7% annual interest.
d) Save for two years and pay cash for the improvements if present interest rates remain the same.
e) Make no improvements.

9. Indicate the frequency with which your subordinates, peers, and/or superiors came to you in the past month for work-related information and/or advice which was not a function of your formal position.

a) 1-3 b) 4-9 c) 10-15 d) 16-20 e) More than the above.

10. Indicate the total number of journals, magazines, and newspapers which you regularly read:

a) 1-2 b) 3-4 c) 5-6 d) 6-8 e) More than the above

11. Indicate the number of technical, scientific, and/or professional societies to which you hold current membership.

a) 0 b) 1-2 c) 3-4 d) 5-6 e) More than the above

12. Indicate the level within the social strata to which you would aspire to be 10 years from now.

a) Upper
b) Lower-Upper
c) Upper-Middle
d) Middle
e) Lower-Middle

13. Mr. C., a civil engineer, who is employed by a medium sized construction firm recently learned of a new building material which is used extensively in Europe but never adopted in the United States. The building material appears to have several advantages in terms of substantial cost reduction, superior insulation qualities, and relative ease of construction as compared to its counter part in the United States.

After a thorough investigation, Mr. C. obtained extensive and reliable information on the characteristics, costs, and advantages of the new material. Further, his company could easily obtain exclusive manufacturing rights for use in the United States.

Imagine that you are Mr. C. Indicate which of the following would best describe your approach to the building material.

a) Recommend that the new idea be utilized in the firm's next major building project so as to take advantage of the substantial cost savings.
b) Recommend that the building material be used in one of the firm's small, local building projects so as to test its acceptance.
c) Recommend that the firm construct a non-commercial prototype.
d) Recommend that the firm engage the services of an independent consultant firm so as to verify the information obtained and to test market acceptance.
e) Recommend that the firm wait until the building material has received considerable commercial application in the United States.

14. In your experience, which of the following do you tend to rely most heavily upon as a source of technical information for work-related projects and/or problems?

a) Literature-books, government manuals, and professional trade and technical journals.
b) Vendors-representatives of, or documentation generated by suppliers or potential suppliers.
c) Personal experience-ideas which were previously used by yourself in similar situations and recalled directly from memory.
d) Staff-selected members of your staff who are not assigned directly to the project being considered.
e) External sources-sources which do not fall into any of the above categories.

15. Indicate the group of people to whom you primarily relate.

a) Officers within your specialized field.
b) Work-related colleagues (both military and civilian).
c) Community associates.
d) I have a primary reference group but it is people other than those listed above.
e) I do not have a primary reference group.

16. During the last month, indicate the relative frequency with which you recommended a specific item of interest, e.g., journal article, research report, or a lead to either to a colleague which dealt with a work-related topic.

a) 0 b) 1-2 c) 3-4 d) 5-6 e) More than the above

17. Mr. A., a middle management executive, who is married and has one child, has been working for a corporation since graduation from college five years ago. He is assured of a lifetime job with a modest, though adequate, salary, and liberal pension benefits upon retirement. On the other hand, it is very unlikely that his salary will increase much before he retires. While attending a convention, Mr. A. is offered a job with a small, newly founded company which has a highly uncertain future. The new job would pay more to start and would offer the possibility of a share in the ownership if the company survived the competition of the larger firms.

Imagine that you are advising Mr. A. Listed below are several probabilities or odds of the new company's proving financially sound.

Please check the lowest probability that you would consider acceptable to make it worthwhile for Mr. A. to take the new job.

a) The chances are 1 in 10 that the company will prove financially sound.
b) The chances are 3 in 10 that the company will prove financially sound.
c) The chances are 5 in 10 that the company will prove financially sound.
d) The chances are 7 in 10 that the company will prove financially sound.
e) The chances are 9 in 10 that the company will prove financially sound.

18. Indicate which of the following best characterizes your approach to an innovative idea:

a) Very eager to adopt new ideas
b) Discreet use of new ideans
c) Deliberate for sometime before adopting a new idea
d) Skeptical and cautious about adopting a new idea
e) Prefer to only use proven ideas

19. Biographical data.

a) Please indicate the type of organization you are working in at the time.

_____

b) Please indicate the title of your billet and present rank. _____
c) How many years have you held your present rank? ____
d) How many years did you hold your previous rank? ____

APPENDIX D (CONT.)

Scoring for Naval Officer Professional Preference Census:

Question	Number of Points				
	a	b	c	d	e
1	1	2	3	4	5
2	5	4	3	2	1
3	5	4	3	2	1
4	1	2	3	4	5
5	1	2	3	4	5
6	2	5	3	4	1
7	1	2	3	4	5
8	5	4	3	2	1
9	1	2	3	4	5
10	1	2	3	4	5
11	1	2	3	4	5
12	5	4	3	2	1
13	5	4	3	2	1
14	2	3	1	4	5
15	1	2	3	4	5
16	1	2	3	4	5
17	5	4	3	2	1
18	5	4	3	2	1

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