SOME CORRELATES OF RESEARCH INVOLVEMENT: A STUDY IN THE SOCIOLOGY OF SCIENCE

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ABSTRACT

Much of the contemporary sociology of science has been influenced by Robert K. Merton and his students. Although there is a substantial body of literature in this field there has been a dearth of empirical research on the scientists themselves.

The writings of Merton and others have suggested relationships amongst the following four variables: (1) commitment to the ethos of science, (2) desire for recognition, (3) preference for research, and (4) research involvement. Five hypotheses linking these variables were derived from the literature reviewed. Measures for each of these variables were constructed in order to test the hypotheses.

The data provided slight support for the hypotheses. However, only the relationship between commitment to the ethos of science and research involvement was found to be strong enough to warrant acceptance of the hypothesis. Problems arising from the study prevented outright acceptance or rejection of the remaining four hypotheses.

TABLE OF CONTENTS

LIST OF TABLES

INTRODUCTION

Robert K. Merton has been one of the most prominent students of the social organization of science. His major contributions to this area have been his description and analysis of the ethos of science and his studies on the reward system of science. The latter studies have dealt with the institutional reward, recognition, and the manner in which it is sought and allocated.

A large proportion of the recent literature in this area has been published either by Merton and his students or by sociologists who have been influenced by his writings. Sociologists of science who have relied upon the Mertonian approach to science have generally assumed that the ethos of science still affects the conduct of contemporary scientists. This assumption has been questioned, however, and in the absence of sufficient empirical evidence, it remains an open question. In addition, another shortcoming which is associated with the Mertonian approach is a relative lack of empirical research on the desire for recognition on the part of individual scientists.

Although there is no theory of the sociology of science which would guide research in this area, the writings of Merton and other sociologists of science who have been

influenced by him have suggested relationships amongst the following four variables: (1) commitment to the ethos of science; (2) desire for recognition; (3) preference for research and (4) research involvement. The primary purpose of this investigation is, then, to study the relationships amongst these variables.

The present study is not without limitations. In view of the state of the theory of the sociology of science and the relative lack of empirical research in the area, this thesis should be regarded more as a pilot study than a definitive work. The relationships amongst the variables have been investigated with a relatively undeveloped measurement instrument and the data were gathered from a relatively small population of academic scientists. In spite of these problems it is hoped that the results of the present study will serve to indicate the feasibility of continued research in this area of sociology. Given the necessary time and money, this research could be extended to include scientists from academia as well as industry and government. Such a study would undoubtedly overcome the limitations of the present investigation and produce much more significant results.

CHAPTER I

REVIEW OF THE LITERATURE

Although Robert K. Merton and others have provided numerous insights into the conduct of scientists and the workings of the institution, science, a coherent body of theory in the sociology of science has yet to emerge. In view of the apparent lack of theory to guide research in this area, discussion in the following sections of this chapter will consist basically of a review of some general sociological theory on institutions and of the literature considered relevant to the understanding of commitment to the ethos of science and desire for recognition. Hypotheses derived from the literature reviewed will be stated at the end of the chapter.

Institutions have been defined as organizations of roles (Gerth and Mills, 1953: 13). Roles, in turn, are "(1) units of conduct which by their recurrence stand out as regularities and (2) which are oriented to the conduct of other actors." (Gerth and Mills, 1953: 10). As an individual becomes socialized into an institutional role, he internalizes institutionally appropriate rules of conduct. These rules of conduct channel human behavior in "one direction as opposed to many other directions that would be theoretically possible" (Berger and Luckmann, 1966: 55).

In addition to internalizing normative aspects of the institution, the individual also internalizes the affective components (emotional and motivational) of the institution. In their description of the impact of the institution upon the individual, Gerth and Mills write:

> Institutions not only select persons and eject them; they also form them. . . . [I]nstitutions imprint their stamps upon the indivdual, modifying his external behavior as well as his inner life. For one aspect of learning a role consists of acquiring motives which guarantee its performance. (1953: 173).

This concept of role-motive is similar to two Parsonian concepts, value and value commitment. Both of these concepts have motivational components which are postulated as affecting the actions of actors in social systems. On this point, Parsons has written:

> [Values are] conceptions of the desirable which are applied to objects and standing at varying levels of generality [sic]. When institutionalized, they are such conceptions as are held by members of the society themselves and to which they hold motivational commitments (1967: 147).

Commitment to values obligates members of a social system to engage in activites which will optimize the realization of the desired goals embodied in the values (Parsons, 1968).

The concept, value commitment, links both the institutional and the individual levels of analysis. At the institutional level of analysis, value commitments are held by most members of a system or sub-system (institution). Actions

which are effectuated by value commitments at the institutional level are, preseumably, governed by institutional norms. Value commitments on the individual level of analysis are held in varying degrees by the members of institutions. Varying value commitments in individuals would then motivate varying degrees of involvement in activity which would result in the fulfillment of institutional goals.

THE ETHOS OF SCIENCE[1]

Scientists, like other members of society, are socialized into an institution and hold varying degrees of commitment to the values of science. The normative structure which affects the conduct of scientists has been called the "ethos of science". The ethos of science is made up of the institutional goal -- the extension of certified knowledge -- and four sets of institutional imperatives (norms) derived from this goal. The four institutional imperatives are universalism, communism, disinterestedness and organized skepticism (Merton, 1968: pp. 606-607). These norms function to facilitate the fulfillment of the institutional goal and to maintain the institutional structure.

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[1]Merton originally discussed the Ethos of Science in a paper written in 1942. The paper was subsequently incorporated into all three editions of Social Theory and Social Structure, (1949, 1957, 1968). All references to this study are made to the 1968 edition.

Universalism refers, in part, to the impersonal criteria employed in the evaluation of the merit of scientific works and to the assessment by colleagues of a scientist's role performance. Participation in an institution is possible for anyone who possesses the requisite competence. Science, it is claimed, has no national boundaries. Anyone, regardless of background or personal beliefs, may make a contribution, (Merton, 1968: 607-610).

Merton's discussion of intellectual communism centres about the property rights of scientific productions. Once scientific knowledge is discovered and certified, it belongs to a common pool of scientific knowledge which must be made available to anyone. Merton writes:

> Property rights in science are whittled down to a bare minimum by the rationale of the scientific ethic. The scientist's claim to his intellectual property is limited to that of recognition and esteem which, if the institution functions with a modicum of efficiency, is roughly commensurate with the significance of the increment brought to the common fund of knowledge (1968: 610).

Another norm subsumed under the label of communism is the norm which demands the free and open dissemination of knowledge. "Secrecy is the antithesis of this norm, full and open communication is its enactment." (Merton, 1968: 611).

Disinterestedness is a "pattern of institutional control . . . which characterizes the behavior of scientists." (Merton, 1968: 613. Conformity to the imperatives subsumed

under the rubric of disinterestedness ensures that the scientist submits himself to the scrutiny and authority of his fellow scientists. "The translation of the norm of disinterestedness into practice is effectively supported by the ultimate accountability of scientists to their compeers" (Merton, 1968: 613).

Organized Skepticism[2] is the last of the four imperatives discussed by Merton. Two important functions fulfilled by this norm are the prevention of the hasty adoption of new ideas and the prevention of the development of dogmatism in scientific thinking (Merton, 1968: 614-615).

Subsequent discussions of the normative aspects of science have been elaborations of Merton's original work. Barber (1952), has added two more values of science to Merton's list. The more important of these is individualism. Individualism refers to the scientist's responsibilities to the institution of science in the conduct of his research. The second value, freedom of investigation, is in turn related to individualism. This value demands that scientists should be able to investigate any topic they desire, without imposed restrictions.

More recently, Merton's description of the normative

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[2]For a detailed definition of organized skepticism the reader is referred to Merton (1968: 601-602).

structure of science has been slightly modified by Storer (1966), Parsons (1968) and Parsons and Platt (1970). Parsons and Platt have called their version of the ethos of science cognitive rationality, and have applied it to the entire American academic system. They write:

> Cognitive rationality obligates academic men to engage in the development, the manipulation, and the transference of bodies of knowledge judged in terms of its emperical validity. Such activity is pursued on behalf of scholarly, academic, and disciplinary communities in order to develop knowledge. (1970: 5).

The authors continue their discussion by noting:

> Research . . . is . . . the purest embodiment of the value of cognitive rationality, . . . and has become the highest obligation in the value hierarchy. (1970: 17).

High commitment to cognitive rationality or to the ethos of science obligates scientists to do a particular type of research, pure or basic research[3] (Shepard, 1956B; Storer, 1963 and Coser, 1965). The pure science sentiment

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[3]The label pure research has recently been replaced by the term basic research. The difficulties associated with defining the term, basic research, have been discussed by Kidd (1959). The United States National Science Foundation definition of basic research is research in which ". . . the primary aim of the investigator is a fuller knowledge or understanding of the subject under study rather than a practical application thereof." Applied research on the other hand, is defined as research directed toward the practical application of knowledge." (NSF64-28, p. 73). These are the definitions which will be used in the present study.

of the traditional ethos of science is exemplified by what Merton calls the "apocryphal toast of the Cambridge mathematicians, 'To pure mathematics and may it never be of any use to anyone'." (1968:597). Those who are highly committed to the ethos of science would, presumably, prefer basic research to applied research, or to any other activity that is distracting from the institutional goals of science.

THE SCIENTIFIC ROLE

The nature of the scientific role may be inferred from the preceeding discussion. Commitment to the ethos of science prescribes the activities of scientists. Activities regulated by the ethos of science may be considered the role expectations of the scientist. The most important obligation of scientists, perhaps, is the advancement of knowledge. This obligation may be fulfilled by the scientist's involvement in research or other related forms of scholarly activity, such as theorizing. Unless this obligation is met, the institutional goal will not be attained. Thus, scientists must, above all, conduct research.

After the results of research are known, they must be made available to the entire scientific community in order that they may be competently assessed by other scientists. Assessment of a contribution must be conducted with

detached neutrality. If the contribution meets the criteria used in judging it, the contribution should be deemed valid. If a scientist incorporates the works of other scientists into his own, he must acknowledge the other scientists by citing their works in footnotes. Actions of scientists which fulfill the institutional goal and which are guided by the institutional imperatives result in successful performance of the scientific role.

Successful role performance in science is likely to be rewarded by a system of honorific awards.[4] The most important of these rewards is recognition -- the social approval which is granted to the scientist by colleagues who are considered competent to assess the quality of his role performance. As Merton puts it, "recognition and fame become symbol and reward for having done one's job well." (1957: 455).

The recognition bestowed upon scientists for their accomplishments is important to both the institution and the individual scientist. Colleagual recognition functions as

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In science, there is an emphasis on the originality of contributions. Often, two or more scientists may make similar contributions simultaneously. In cases such as these, the scientist whose contribution is received first may get all the rewards to the exclusion of other scientists. Under such conditions, priority disputes may arise. (Merton, 1957).

a mechanism of social control within the institution. Hagstrom notes:

> Social control in science is an exchange system, a system wherein gifts of information are exchanged for recognition from scientific colleagues. Because scientists desire recognition, they conform to the goals and norms of the scientific community. By rewarding conformity, this exchange reinforces commitment to the higher goals and norms of the scientific community. (1965: 52).

Indifference to the response of colleagues results in decrease in the institutional control of the scientist's actions. If conditions of mass indifference to colleagual recognition prevailed amongst scientists, the reward system could not operate and the institution might disintegrate.

The desire for recognition may become so important for some scientists that the motive of seeking the reward may displace the institutional motive -- the advancement of knowledge (Merton, 1963).[5] Interest in recognition for its own sake has been considered an incentive to conduct research. (Hagstrom, 1965; Storer, 1966; Merton, 1969; Eiduson, 1962; Reif, 1961 and Reif and Strauss, 1965). Regardless of the motive, scientists must still perform the institutional role if they want recognition. But they cannot get colleagual recognition if they do not advance knowledge and make it

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[5]Desire for recognition is defined as the importance which scientists place upon gaining honorific rewards which are granted for successful work role performance. Only competent colleagues may bestow recognition on the scientist.

available for others to evaluate.

REVIEW OF RELEVANT RESEARCH

Researchers who employ the Mertonian approach to the sociology of science have generally assumed that the normative aspects of present-day science are unchanged from those in Merton's description of the ethos of science.[6]

West (1960), without openly criticizing the Mertonians, demonstrated that there was a substantial departure from the classical position on the values of science.[7] He

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[6]The most prominent trend in current research on the sociology of science is the application of Mertonian concepts at the institutional level of analysis. With the exception of Ben-David's works (1960, 1962, and 1965), most of the literature on science and scientists tends to be atheoretical or descriptive.

Several articles have been written on scientists from developing nations. Such studies often report a reluctance on the part of scientists to return to their country of origin if they have been studying abroad. The reasons cited for this reluctance are usually the lack of sophisticated research facilities in developing nations or that the scientists might be expected to work at applied research. One possible interpretation of these findings is that the scientists have become highly committed to the ethos of science. Many of these articles are to be found in Minerva (1961 to the present). A selected number of papers have also been edited and published in book form by Shils, (1968).

Although the non-normative aspects of science are of no concern to this study, attention is directed to two bibliographics found in Barber and Hirsch (1962), and Kaplan (1964 and 1965).

[7]West's primary reference for this "classical position" was Barber (1952).

indicated that only a relatively small percentage (35%) of the scientists in his sample were in favour of absolute freedom of choice in research topics. Further, only 50% of West's respondents felt that scientists should withold information from their colleagues. Furthermore, Kaplan (1964: 855-857) using West's findings as a basis for his argument suggested that the values of science have changed from the time when the ethos of science first became institutionalized.

Other studies, however, report findings which indicate that scientists still hold the values of science in varying degrees. Results from research carried out in 1959-1960 by Roger Krohn show that the values of academic scientists are more like the values of the traditional scientist than those of scientists employed in non-academic research organizations.[8] Krohn does not, however, indicate how much the values of each group differ from those of traditional science.

Box and Cotgrove found three different types of scientist: the public, the private, and the instrumental. Each type is distinguished by differing commitments to the values of science. The public type is the most committed.

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[8]One of Krohn's findings which indicates that the scientists in his study have internalized the goals of advancing knowledge is the following: more than three-quarters of university basic medical and physical biological personnel hoped to make an important theoretical discovery, and thus expand their opportunity for free research (Krohn, 1971, p.135).

The instrumental is the least committed, and could quite easily change careers. (1966:22). The private type of scientist on the other hand, lies between these two extremes in his commitment to the values of science. These findings indicate that those who are highly committed to science hold values similar to those of ethos of science.

Research has consistently found dissatisfaction amongst the research personnel in industrial laboratories. This led several scholars who made this observation to hypothesize that this dissatisfaction arises from two conflicting demands upon the scientist: (1) those of the organization and (2) those engendered by the ethos of science (Marcson, 1960; Kornhauser, 1962 and Shepard, 1956a).[9] The source of the problem is described by Marcson. He writes:

> The industrial laboratory and the recruit become involved in two types of expectation: the recruit expects to fulfill his expectations about basic research; the laboratory expects the recruit to become a productive and creative researcher in terms of devices. This divergence explains itself in strain and conflict (1960: 73).

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[9]Not all the problems in industrial laboratories however result from the conflicting demands upon the scientist. Some studies reporting strains and dissatisfactions have found them to be related to variables such as style of leadership in work groups, decision-making policies, and work load (Likert, 1969; Pelz and Andrews, 1966; Evan, 1962 and Miller, 1967).

On the other hand, Glaser (1964) found a relative absence of strains and dissatisfactions when the goals of the organization and the goals of science coincided. Although these studies suggest that some scientists may have internalized the ethos of science, none of the investigators studied the values of the scientists directly.

Taguiri (1970) employed the Allport-Vernon-Lindsey Scale of Values to compare the value orientations of scientists and managers in an industrial laboratory. He found that scientists scored higher than managers on the theoretical section of the scale, which has contents similar to those of the ethos of science. This finding suggests that the ethos of science still affects scientists. It is conceivable that the scientists scored higher on the theoretical section of the Scale of Values because they have been more exposed to the institution of science. This difference between the values of managers and scientists could thus be a factor in strained relationships in the laboratory.

Other findings from research on scientists in non-academic settings also suggest that the ethos of science may affect contemporary scientists. Vollmer (1969) reports that 53% of the scientists in his sample who were working in applied research preferred to work in basic research. This is congruent with the hypothesized relationship of basic

research to the ethos of science (Shepard, 1956b). Another consistent finding in studies of non-academic laboratories is the 25 to 40 percent of those who are dissatisfied would prefer to move to academic settings (Marcson, 1960; Kornhauser, 1962; Glaser, 1964; Rudd, 1968; and Krohn, 1971). While these findings may be interpreted as evidence of the effects of the ethos of science upon the individual scientist, there is still a large proportion of industrial scientists who do not want to move to universities or do basic research. Findings such as these show that some of the scientists may have adapted themselves to the organizational demands, or that they never were as highly committed to the ethos of science as those who are dissatisfied.[10]

Since 1965, a substantial proportion of the empirical research in the sociology of science has been focussed on the reward system of science.[11] These studies have usually

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[10]Box and Cotgrove (1966) have found a correlation between commitment to science and dissatisfaction with applied research. They have suggested that commitment to science be included as a major independent variable in future studies of organizational scientists. This is also suggested by Miller (1967), who found a strong positive relationship between length of training and degree of alienation in the organization which he studied.

[11]Zuckerman (1970) offers insights into the reward system of science as well as a summary of most of the research on this subject.

tended to support Merton's hypothesis that recognition accrues in proportion to the significance of the research contribution (Merton, 1968: 610). Findings from such investigations have also been accepted as evidence of universalism of science[12] (Crane, 1965; Cole, 1970; and Gaston, 1970). Although these studies were conducted at the institutional level of analysis, they indicate that scientists are universalistic at the individual level of analysis. From this one could infer that contemporary scientists still conform to the ethos of science.

Although West (1960) and Kaplan (1964) suggest that the values of science have changed, no other scholar has produced any further support for this contention. To the contrary the majority of the studies reviewed provide evidence indicating that Kaplan's criticism is unwarranted. Data from these studies show that the ethos of science still affects scientists. In addition, the findings of Box and Cotgrove (1966) and Taguiri (1970) also demonstrate that scientists have varying commitments to the ethos of science.

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[12] Cotgrove and Box (1966) and Rudd (1968) found that scientists in England have reacted to industrial laboratories in a manner similar to that of American scientists. One may conclude from this that universalism in science is international.

The fact remains, however, that the problem raised by Kaplan's criticism is a valid one and the values of contemporary scientists must be investigated.

RECOGNITION

Very few studies have investigated the alleged importance of recognition to individual scientists. Zuckerman and Merton (1970) and Ziman (1968) have shown that obtaining recognition, in its various forms, tends to assure the scientist of colleagual approval. Recognition has also been shown to have a reinforcing effect on scientists' activities and levels of performance (Glazer, 1964; Cale and Cole, 1967).

No study has yet examined the desire for recognition in scientists. Evidence that the desire for recognition exists, however, comes primarily from biographical and autobiographical sources or from explanations or descriptions of the behavior of scientists (Reif, 1961; Eiduson, 1962; and Caplow and McGee, 1958). One study, however, found that "the actual provision of status rewards was associated with achievement" (Pelz and Andrews, 1966: 139). Although this finding does not demonstrate that desire for recognition motivates scientists to become involved in research, it may be interpreted as evidence in support of the desire for recognition as motive for research.

Findings from non-empirical studies on recognition

indicate that it is important for scientists to have their works recognized by their colleagues. These studies also suggest that the desire for recognition may provide an important incentive for research. Whether scientists do indeed desire recognition remains to be ascertained empirically.

HYPOTHESES

The literature reviewed suggests the possibility of relationships amongst the following variables: commitment to the ethos of science, desire for recognition, preference for research, and research involvement. These relationships have been hypothesized to be:

I. There is a positive relationship between commitment to the ethos of science and research involvement.

Ia. There is a positive relationship between commitment to the ethos of science and preference for research.

II. There is a positive relationship between desire for recognition and research involvement.

IIa. There is a positive relationship between desire for recognition and preference for research.

III. There is a positive relationship between commitment to the ethos of science and the desire for recognition.

CHAPTER II

METHODOLOGY

POPULATION

The Faculty of Science at the University of Manitoba includes ten departments. These are Mathematics, Statistics, Microbiology, Zoology, Botany, Earth Sciences, Physics, Computer Science and the Biological Teaching Unit. The faculty members of the first eight departments comprise the population or universe for purposes of this study. These departments were included for two reasons: (1) members of these departments represent a group whose values are most likely to approximate the traditional values of science, (2) scientists in these disciplines have been studied by sociologists of science such as Hagstrom (1965).

A list of all faculty members on the payroll was obtained from the Office of the Dean of Science. This list was presumed to be exhaustive; it totalled 149. Since twenty-five faculty members were unavailable during the research period, the final population numbered 124.

Because the reduced population size was too small to warrant a random sampling procedure such as the one suggested by Kish (1953: 177), it was decided to distribute the questionnaire to the total population.

Shortly after the distribution of the questionnaires

it was learned that seven additional subjects of various departments would not be available for the study, thus reducing the population to 117. Seventy-eight questionnaires were returned. Of these, five were not usable and four more were returned after the data had been analyzed. The total number of subjects studied, therefore, was sixty-nine.

SCALING AND MEASUREMENT

The questionnaire which was used included eighty questions, divided into three sections.[1] The first section consisted of thirty questions intended to gather information on the control and dependent variables, while the second included thirty-seven Likert-type questions forming a pool of items for the commitment to the ethos of science scale. The third and last section contained thirteen questions related to the respondents' personal goals and subjective feelings. In keeping with the rule of thumb suggested by Sjoberg and Nett (1968), that the "sensitive questions should be placed in the middle or toward the end of questionnaires" (p. 220), this order was observed.

Commitment to the ethos of science was initially defined operationally as the degree of agreement or disagreement with a series of statements which are face valid

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[1]See Appendix I.

indicators of this construct.[2] The questions relevent to the establishment of the commitment to the ethos of science[3] scale were drawn from three sources. Some were borrowed from Krohn's 1971 Study and from the work currently being carried out by Mr. W.T. Phelan as part of his doctoral research at the University of Chicago. The remaining questions were constructed expressly for the purposes of this study. The latter were in part paraphrases of some of Merton's statements. Several of the questions overlapped in content, but this was done purposely for the formation of the scale.

The operational definition of desire for recognition is the relative importance scientist-subjects assign to each of a series of questions about certain selected personal goals. The questions used in the establishment of the desire for recognition scale were derived from biographies of scientists, published interviews and articles in which motives of scientists were discussed (Reif, 1961; Reif and Strauss, 1965). Most of the items in this section relate to personal goals that are assumed to be specific to a career in science and relevant to colleagual recognition.[4]

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[2]"Face valid measures are measures which focus directly on the variable in which the tester is interested. The relevance of the measuring instrument to what one is trying to measure is apparent on the 'face of it'" (Selltiz, et al., 1959: 165).

[3]See Appendix I, Questions 31-67.

[4]See Appendix I, Questions 68-77.

Research involvement is operationally measured by the degree of the scientist's investment in his research. Three questions were designed for the measurement of research involvement.[5] They were intended to determine the number of research projects engaged in by the scientist at the time of this study, the number of colleagues working with him, and the number of hours per week devoted to research.

Preference for research is used to refer to the scientist's preferential allocation of time to research as opposed to any other activity. This variable was measured by only one question[6] which asked the scientist to indicate his preference for teaching, administration or research.

SCALING PROCEDURES AND SELECTION OF ITEMS

Scales for commitment to the ethos of science and the desire for recognition were formed by factor analyzing the intercorrelation matrices of the items for each scale. Factor analysis expresses the relationships among many items to a smaller number of more general variables. The new relationships amongst the variables in the intercorrelation matrix are represented in a factor matrix. Variables which have the highest and purest factor loadings (those items which have high factor loadings on one factor and low factor loadings

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[5]See Appendix I, Questions 21, 22 and 23.

[6]See Appendix I, Question 29.

on the other factors) are selected for inclusion in the scales.

The application of factor analysis as a technique for constructing scales is advantageous for two reasons: (1) unidimensional scales are formed, (2) those items which have the highest and purest factor loadings are also the best indicators of the variable. Factor loadings are the correlation coefficients between the items and the underlying factors.

The original intercorrelation matrix, however, may be reproduced from the factor loadings by summing the cross products of the rows of the factor matrix (Fruchter, 1954: 35). Thus, items which have the highest factor loadings on the same factor will also intercorrelate highly with each other. This correlation may then be considered a coefficient of equivalence which is a form of reliability coefficient.[7]

The factor model used in this study is the principal factor model with varimax rotation.[8] This model yields orthogonal (uncorrelated) factors. Items selected from the factor matrix according to the criteria outlined above form scales

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[7]The coefficient of equivalence tells how well the test score agrees with other equivalent measures made at the same time. It is obtained by giving two forms of the same test in close succession. (Cronbach, 1960: 137, See also Selltiz, et al, 1959: 174).

[8]Extensive discussions of this factor model may be found in Harman (1967) and Fruchter (1954).

which are uncorrelated with each other.

The initial factor analysis of the thirty seven items which were designed to measure commitment to the ethos of science yielded unsatisfactory results. The first factor accounted for only 14%[9] of the total variance in the inter-correlation matrix. It was then decided to delete certain items from the scale on the basis of item analysis.

Although the technique of item analysis is itself used for construction of scales, its application to these items was only to select these which had the most discriminatory power. The item analysis technique employed in this study was developed by Sletto (1937). Items which had a scale value difference ratio[10] exceeding 0.400 were retained.

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[9]See Table 2, Appendix II.

[10]The Scale Value Difference Ratio (SVDR) is a measure of the discriminative power of the item. The SVDR is calculated by dividing the Scale Value Difference (SVD) by the maximum possible scale value difference (MPSVD)

$$\left(SVDR = \frac{SVD}{MPSVD}\right)$$

The scale value difference is the difference between the low half mean and the high half mean for each item when the division of scores is based on the total score.

$$(SVD = \bar{X}hi_t - \bar{X}lo_t)$$

The maximum possible scale value difference is the difference between the low half mean and the high half mean when the division of scores is based on individual items.

$$(MPSVD = \bar{X}hi_t - \bar{X}lo_t)$$

Twenty two of the original thirty seven items were rejected.

Fifteen items had SVDR values exceeding 0.400. They were factor analyzed again.[11] The first factor in the unrotated principal factor matrix accounted for 26% of the total variance in the intercorrelation matrix. This factor was clearly identifiable as a general commitment to the ethos

TABLE 1

Intercorrleation Matrix of Commitment to Ethos of Science Items

	Question Content	1	2	3	4
1.[12]	Communism	-			
2.	Goals	.218	-		
3.	Universalism	.261	.480	-	
4.	Universalism	.497	.375	.545	-

Spearman-Brown Reliability Coefficient[13] = .72

[11] See Appendix II, Tables 4, 5, and 6.

[12] These numbers refer to Questions 59, 63, 64, and 66 in Appendix I. The items selected in accordance with the procedure outlined above are: (1) Freedom to communicate with other scientists is essential to the advancement of knowledge; (2) The primary goal of science is the advancement of knowledge; (3) The quality of a contribution to scientific knowledge should be judged independently from its author's reputation; (4) One's personal biases should not affect his assessment of another scientist's work.

[13] $NN_r = \frac{Nr}{1+(N-1)r}$ where r is the mean intercorrelation and N is the number of variables.

of science factor. An inspection of the rotated factor matrix revealed that there were many specific factors, and that no one factor had more than two items with high factor loadings. Thus, items with the highest and purest factor loadings on the first factor of the unrotated factor matrix were selected to form the commitment to the ethos of science scale.

The factor analysis of the ten items in the desire for recognition[14] scale was better than the commitment to the ethos of science scale. The first factor accounted for 38% of the total variance. It was identified as a desire

TABLE 2

Intercorrelation Matrix of Desire for Recognition Items

	1	2	3
1.[15]			
2.	.638		
3.	.560	.726	

Spearman-Brown Reliability Coefficient = .84

[14] See Appendix II, Tables 7, 8 and 9.

[15] These numbers correspond to Questions 68, 72 and 74, Appendix I. These questions asked the respondents to indicate how important each of the following was as a personal goal:

(1) A successful career as a scientist.
(2) A reputation as a good scientist.
(3) Obtaining recognition from my colleagues.

for recognition factor. Three items were selected for the desire for recognition scale (See Table 2).

Factor analysis was not applied in the construction of the research involvement scale. The items were only intercorrelated with each other and the reliability coefficient was calculated.

TABLE 3

Intercorrelation Matrix for Research Involvement Items

	1	2	3
1.[16]			
2.	.249		
3.	.632	.133	

Spearman-Brown Reliability Coefficient = .62

The intercorrelation matrix of research involvement items reveals inconsistent relationships amongst the indicators. Such relationships indicate that the variable is not

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[16]These numbers correspond to Questions 19, 21, and 22, Appendix I. The following questions were used for measuring research involvement:

(1) How many research projects are you currently working on?
(2) If you are currently involved in research, how many hours per week do you invest in your research?
(3) If you are currently conducting research, how many collaborators are working with you?

unidimensional. As a result, only one indicator, hours per week in research was used to measure this variable.

VERIFICATION OF HYPOTHESES:

Scale scores for commitment to the ethos of science and desire for recognition were calculated by summing the scores across the individual items of the composite indicators of each variable. Scores for preference for research and research involvement were the responses to the single items which were designed for the measurement of these variables. The hypothesized relationships amongst the variables were then tested by calculating the correlation coefficients between each of the variables.

Although the hypotheses only specify positive relationships amongst the variables, it has been necessary to construct a criterion for an acceptable strength of relationship. This criterion for acceptance was constructed by calculating the correlation coefficient necessary to produce an F.- ratio significant at the .05 level of significance based on a sample size of 69. The correlation coefficient necessary to produce an F.- ratio of this magnitude is .24. Relationships amongst the variables which reached this criterion were accepted as evidence in support of the hypotheses.

A random sample was not drawn for this study. This

has prevented the use of tests of statistical significance and inferential statistics. Thus, the statistics used will be purely descriptive.

CHAPTER III

FINDINGS

INTRODUCTION

As discussed in Chapter I, this study attempts to investigate relationships amongst the following variables: commitment to the ethos of science, desire for recognition, preference for research, and research involvement. Five hypotheses were derived from the literature involving the relationships amongst these variables. To test these hypotheses, data from the questionnaires were analyzed in the manner proposed in Chapter II. The presentation of findings is organized into three sections: (1) descriptive information on the sample, (2) distributions of the study variables, and (3) analyses of the hypothesized relationships.

DESCRIPTION OF THE SAMPLE

Most of the respondents in the population may be considered professionally young. The mean professional age (number of years since Ph. D.) was 7.64 years, and the standard deviation, 5.87 years. The distribution of professional age in the sample is represented in Table 4. It should be noted that the lowest professional age category contains the greatest number of subjects.

The relatively low professional age of the population

is also reflected in the number of years the respondents have been in their respective departments. The mean length of time in department is 6.47 years. The distribution of

TABLE 4

Distribution of Scientists by Professional Age

AGE	NUMBER
1 - 5	34
6 - 10	18
11 - 15	8
16 - 20	8
21 - 25	1
26 - 30	0
TOTAL	69

$\bar{X}$ = S = 5.87

years in the department is described in Table 5. As was the case with professional age, the lowest category contains the largest number of subjects. This would indicate the most of the scientists in the population are both professionally young and relatively new to the University of Manitoba.

While the population is professionally young, the respondents seem to have been active researchers. The mean number of papers published is 15.38 (standard deviation is 13.56).

Judging from previous behavior, the productivity of the respondents is likely to continue. All but two respondents in the population are currently engaged in research.

TABLE 5

Distribution of Respondents by Number of Years in Department

YEARS IN DEPARTMENT	NUMBER
0 - 5	45
6 - 10	9
11 - 15	7
16 - 20	3
21 - 25	5
26 - 30	0
TOTAL	69

X = 6.48 S = 6.42

The amount of time invested in research varies widely. The mean number of hours invested in research per week/per person is 26.87 (standard deviation is 14.22). Another finding which suggests continued productivity of the respondents is the fact that 54% chose research as the activity they prefer over others.

In sum, the distributions of the background variables in the sample show that most of the respondents are young, productive, and seem to exhibit professional rather than organizational orientations.

The mean score on the composite indicator of commitment to the ethos of science is 17.12 and the standard deviation is 1.69. Although this mean score suggests that the majority of the res ondents are highly committed to the ethos of science, the standard deviation indicates that there is

little variation in the scores on this scale.

The distribution of scores on the composite indicator of desire for recognition has a mean of 18.61 and a standard deviation of 4.49. This indicates that the respondents do have varying degrees of desire for recognition.

Preference for research was measured by a single item which was assigned scores ranging from 1 to 3. The mean score was 1.51 and standard deviation was .66. Research involvement was also measured by a single item -- hours per week in research. As was stated above the mean number of hours invested per week was 26.87 and standard deviation was 14.22. The scores on both these variables appear to discriminate well among the respondents.

TESTS OF HYPOTHESES

The hypotheses are to be tested in the manner reported at the end of Chapter II.

Parsons and Platt (1970: 5) have asserted that research "has become the highest obligation in the value hierarchy" of cognitive rationality. This suggests that commitment to the ethos of science should be related to preference for research, since it is through research that a scientist fulfills his obligation. The correlation coefficient between commitment to the ethos of science and preference for research

was found to be .05. This correlation offers little support for the hypothesized relationship between commitment to the ethos of science and preference for research. Because of this, a further examination of this relationship was carried out.

TABLE 6

Intercorrelation Matrix of Commitment to the Ethos of Science Items and Preference for Research

		1	2	3	4	5
1.	Communism	-				
2.	Goals	.218	-			
3.	Universalism	.261	.480	-		
4.	Universalism	.497	.375	.545	-	
5.	Preference for Research	.115	.122	.004	.188	-

Table 6 summarizes the relationships between the commitment to the ethos of science items and preference for research. Items one through four are the indicators of commitment to the ethos of science. Item 5 is preference for research. The relationships in this table do not provide any additional support for the hypothesized relationship between commitment to the ethos of science and preference for research.

The relationship between commitment to the ethos of science and research incolvement was tested by examining the correlation coefficient between the indicators of these two variables. The correlation coefficient between them was .32.

This finding is significant enough to be accepted as evidence of a relationship between commitment to the ethos of science and time invested in research. This suggests a similarity to Glaser's (1964) finding of a relationship between institutional motivation and time in research.

Recognition has been hypothesized to be an incentive for research (Merton, 1957; Hagstrom, 1965; Storer, 1966; Rief, 1961). If scientists do indeed desire recognition, there will be a positive relationship between measured research involvement and desire for recognition. In the present study, the relationship between measured research involvement and desire for recognition was found to be .19, a figure too low to warrant acceptance of the hypothesis. Because of this, the relationship between desire for recognition and research involvement was examined further. Table 7 summarizes the relationships between the items used to measure the correlation between the two variables.

TABLE 7

Intercorrelation Matrix of Desire for Recognition Items and Research Involvement Items.

		1	2	3	4
1.	Successful Career	-			
2.	Good Reputation	.638	-		
3.	Obtaining Recognition	.560	.762	-	
4.	Time in Research	.234	.158	.102	-

Items one, two and three refer to the desire for recognition. Item four, is the research involvement item. The relationships between the desire for recognition items and the research involvement item are relatively low, but consistent.

The low correlation between the two variables examined may be explained in part by the fact that only quantitative aspects of research involvement were considered in this study. Desire for recognition may be more strongly related to qualitative aspects of research involvement through its influence on choice of research topic. For example, a scientist might choose a research topic in a new area, and, if successful, greatly enhance his career and establish his reputation. This has been suggested by Hagstrom (1965), Reif (1961) and Rief and Strauss (1965).

If recognition is exchanged for information, as Hagstrom (1965) suggests, and if scientists desire recognition, scientists with such aspirations should prefer research over other activities. The relationship between desire for recognition and preference for research in this study was found to be .09. This value does not meet the criterion for acceptance of the hypothesized relationship.

Merton (1963) and Hagstrom (1965) have both suggested relationships between commitment to the institution of science and desire for recognition. Merton (1963: 122, for

example, writes:

> In general, the need to have accomplishment recognized which for the scientist means that his knowing peers judge the work worth the while, is the result of deep devotion to the advancement of knowledge as an ultimate value. Rather than being at odds with dedication to science, the concern with recognition is usually a direct expression of it.

When the correlation coefficient between the indicator of desire for recognition and the indicator of commitment to the ethos of science was inspected, a low positive relationship (r = .12) between these variables was found. The intercorrelation matrix of all the indicators of desire for recognition and commitment to the ethos of science was examined. These relationships are summarized in Table 8.

TABLE 8

Intercorrelation Matrix of Commitment to Ethos of Science Items and Desire for Recognition Items.

	1	2	3	4	5	6	7
1. Communism	-						
2. Goals	.218	-					
3. Universalism	.261	.480	-				
4. Universalism	.497	.375	.545	-			
5. Successful Career	-.018	.159	-.039	.000	-		
6. Good Reputation	.180	.189	-.094	-.097	.638	-	
7. Obtain Recognition	.009	.363	.031	.049	.560	.726	-

Items one to four in Table 8 are the commitment to the ethos of science items. The remainder of the items are the desire for recognition items. The relationship between these two sets of variables is low and inconsistent.

The previous sections of this chapter contained examinations and discussions of the relationships of desire for recognition and commitment to the ethos of science with other variables. For the sake of clarity Table 9 provides a summary of these relationships.

TABLE 9

Intercorrelation Matrix of Variables in the Hypotheses

	CE	DR	PR	RI
Commitment to Ethos of Science	-			
Desire for Recognition	.12	-		
Preference for Research	.05	.09	-	
Research Involvement	.32	.19	.44	-

In the present chapter, findings obtained from the analysis of the data were presented and discussed. The data contained some evidence supportive only of one of the five hypothesized relationships amongst the study variables.

CHAPTER IV

CONCLUSIONS

INTRODUCTION

The analysis of the data which was presented in Chapter III revealed the presence of weak relationships amongst the variables. Although they perhaps offered support for some of the hypotheses, only one of the relationships was strong enough to permit acceptance of the hypotheses.

Before drawing any conclusions from the analysis of the data, however, the reader must be made aware of certain problems in this study. These problems stem from the measurement instruments, the sampling procedures, and the nature of the theory from which the hypotheses were derived.

PROBLEMS OF MEASUREMENT

One of the major problems of the measurement technique was the lack of variation in the scores of commitment to the ethos of science. This indicates that the scale does not have the ability to discriminate well. The lack of discriminatory power in the scale raises doubts about the instrument's ability to measure differences in commitment to the ethos of science.

Measurement of desire for recognition was less difficult than that of the foregoing variable. The composite

indicator for the former discriminated amongst the respondents better than did the commitment to the ethos of science scale.

A second and similar problem stemmed from the use of the criterion value ($r = .24$). The magnitude of the F. - ratio is dependent upon the size of the correlation coefficient and the size of the sample. Some of the correlations obtained might have been acceptable if a large sample had been used in this study.

The problems of the measurement instruments, statistical procedures and the lack of evidence do not enable us to accept the hypotheses. If the reason for the weak relationships lies primarily in the measurement instruments however, rejection of the hypotheses becomes difficult because it entails the assumption that the scales are relatively problem-free. This assumption, however, cannot be made. Rejection of the hypotheses also entails questioning the validity of a large segment of sociological theory. To raise such problems on the basis of findings produced by inaccurate measurement techniques is not advisable.

SAMPLING PROBLEMS

The inadequate findings might also have been the result of a small population size. Had a sample been drawn

from a larger and more diversified population, the conclusions reached may have been more representative of the institution of science, and may have lent some support to the hypotheses.

Whether the scientists at the University of Manitoba are similar in their orientation and attributes to scientists in other institutions could not be determined. The geographic factor and the reputation of the institution might be variables affecting the type of scientists who choose to come and establish themselves here.

Most of Merton's data on the scientist's concern over recognition has been gathered from biographical accounts of scientists who were pre-eminent in their fields. Other studies have also examined scientific elites rather than scientists of lesser prestige. This bias may have affected the theoretical formulations of Merton and those employing the Mertonian approach to the sociology of science.

PROBLEMS OF THEORY

Up to this point there has been constant reference to the "Mertonian approach" to the sociology of science. This term has been used not in order to distinguish this approach to the subject matter from other possible approaches, but to indicate that it is more an approach, rather than a

theory. This distinction has been made because there is no set of interrelated, well-defined propositions in the writings which would qualify the Mertonian approach as a theory in the strict sense. The hypotheses were derived from statements about scientists in the literature reviewed. It is, therefore, possible that these statements were misinterpreted. If there had been a formally stated theory of the behavior of scientists from which hypotheses could be rigorously derived, the possibility of such misinterpretation would have been minimized.

SUGGESTIONS FOR FURTHER RESEARCH

In view of the lack of empirical research on scientists and in the light of the findings of this study, the first suggestion for future research is self-evident. Sociologists of science should devote more attention to the study of individual scientists then they have in recent years. Further, if future researchers rely upon the Mertonian approach in the study of the values of scientists, they should endeavour to develop an adequate scale for the measurement of commitment to scientific values.

It does not seem likely that the normative structure of science crashes down upon scientists to produce uniformly molded scientists. Types of scientists with varied commitments to science have been empirically differentiated (Box

and Cotgrove: 1966). Socialization into science could thus be the subject of future research. Studies on socialization into the institution should focus upon the acquisition of the values of science or upon the formation of scientific identities. Research on such topics would further both the understanding of the normative aspects of science and the process of adult socialization.

In future research on recognition, efforts should be made toward the development of a measurement instrument for the desire for recognition. If desire for recognition is as important to the understanding of scientists' behavior patterns as the Mertonian approach implies, a scale for the measurement of this variable is long overdue. It is also suggested that scientists' reference groups be studied. Recognition from specific-others may be more important than recognition from non-specific-others such as journal editors or the general scientific community.

The foregoing suggestions for future research have been intended for the study of individual scientists. In recent years, there has been a lack of disciplined macro-sociological studies of the relationships between science and other institutional spheres of society. Another suggestion for future research therefore, is the study of the relationships between science and society. If such studies

are pursued, they should deal with contemporary relationships in addition to historical ones.

Although the findings of this study lend some support to the Mertonian contentions, this support is not strong enough to warrant unqualified acceptance of the hypotheses as has been indicated previously. It is hoped that the findings of this study have demonstrated the need for operationalizing the Mertonian concepts and developing scales for their measurement. Undoubtedly, more research in this area of sociology of science will produce more refined measurement instruments which will greatly facilitate future studies.

As it has been noted, a theory to guide research in this area has yet to be developed. The Mertonians have introduced concepts and indicated relationships amongst some variables. Since little empirical research has been done thus far, more studies should be carried out in order that a theoretical framework may be developed to guide future research.

APPENDIX I

THE QUESTIONNAIRE

1) Department _____

2) Rank _____

3) How many years have you been in the department? _____

4) In what year did you receive your Ph. D.? _____

5) Have you ever held a post doctoral fellowship? Yes__ No__

6) If yes, where was it held? _____

7) Are your main interests theoretical___, experimental____,

other _____

Please answer the following questions as best you can. If you cannot recall the exact number of times you have performed the following activities, please state the approximate number.

8) How many different research projects have you worked on during your entire career? _____

9) How many different research projects have you worked on during the past five years? _____

10) How many papers have you written during your entire career? _____

11) How many papers have you written during the past five years? _____

12) How many of the published papers were written by yourself? _____
in collaboration with others? _____

13) How many times have you been invited to read papers or give lectures to learned colleagues during your entire career? _____

14) How many papers have you presented at meetings of scientific societies during your entire career?_____

15) How many meetings of scientific associations to you attend annually?_____

16) How many scientific associations do you belong to?_____

17) How many times during your entire career have you acted as a referee for journal articles?_____

18) On how many journal editorial boards have you served during your entire career?_____

19) How many research projects are you currently working on?_____

20) If none, do you expect to be involved in research in the near future? Yes____ No____

21) If you are currently involved in research, how many hours per week do you invest in your research?_____

22) If you are currently conducting research, how many collaborators are working with you?_____

23) Are your collaborators (if any) (A) Post doctoral fellows ___ (B) Graduate students ___ (C) Faculty members at the University ___ (D) in industry ___ (E) in government___ (F) others ___.

24) Have colleagues ever consulted with you on their research problems? Yes___ No___

25) Approximately what proportion of these colleagues are (A) from other departments or research institutes in Canadian universities _____ (B) from departments and research institutes outside Canada _____?

26) How many theses and dissertations have you directed during your entire career?_____

27) How many students are you currently advising?_____ Masters?_____ Ph.D._____

Please rank the following activities according to how much time you allocate to each of them. If you allocate

the largest proportion of your time to the activity, please indicate by writing 1st in the blank space following the activity. If the activity involves the second largest proportion of your time, please indicate by writing 2nd in the space following the activity, etc.

28) (A) Research_____ (B) Teaching_____ (C) Administration___

29) Please rank the following activites according to your personal preference (1st, 2nd, 3rd): (A) Research_____ (B) Administration_____ (C) Teaching_____

30) Do you feel that you have any commitment to the next generation of scientists? Yes____ No____

Please indicate your agreement or disagreement with each of the following statements. If you strongly agree with the statement, please circle SA. If you agree, circle A. If you feel neutral or are unable to indicate, please circle N. If you disagree with the statement, please circle D. If you strongly disagree with the statement, please circle SD.

	Strongly Agree	Agree	Neutral	Dis-Agree	Strongly Disagree
31) Scientists should be more concerned about advancing their careers than advancing knowledge.	SA	A	N	D	SD
32) Receiving citations in the works of other scientists is an indiation that others think well of one's research efforts.	SA	A	N	D	SD
33) It is not important that one's colleagues think highly of his work.	SA	A	N	D	SD

34)	Science policy and defence policy are too closely related to each other in Canada and the U.S.A.	SA	A	N	D	SD
35)	Self denial is the mark of a great man.	SA	A	N	D	SD
36)	Enjoying a reputation as a good scientist is more important than having a high salary	SA	A	N	D	SD
37)	Scientists do not have enough influence in the formation of national and international science policy	SA	A	N	D	SD
38)	It is important that one's colleagues recognize his contributions to his field	SA	A	N	D	SD
39)	Only other scientists are capable of evaluating scientific research	SA	A	N	D	SD
40)	It is not important that a scientist make significant contributions to his field of specialization	SA	A	N	D	SD
41)	The merit of one's work may best be judged by its immediate practical uses	SA	A	N	D	SD
42)	Research should be justified as an end in itself	SA	A	N	D	SD

43)	Recognition should be granted to those who make important contributions to scientific knowledge	SA	A	N	D	SD
44)	Being a successful scientist is having others find your work valuable	SA	A	N	D	SD
45)	Scientists should be responsible for the practical uses which are made of their discoveries	SA	A	N	D	SD
46)	A scientist's primary loyalty should be to the institution in which he is employed	SA	A	N	D	SD
47)	Scientists should devote most of their time to the solution of socially relevant problems	SA	A	N	D	SD
48)	A scientist's primary loyalty should be to his fellow scientists	SA	A	N	D	SD
49)	It is unfortunate that the pursuit of scientific work happens to be associated with making a living	SA	A	N	D	SD
50)	The most important activity for scientists is basic research	SA	A	N	D	SD
51)	Recognition is not important to scientists	SA	A	N	D	SD

52)	Only scientists should be allowed to make international science policy	SA	A	N	D	SD
53)	A scientist's primary concern when conducting research should be the practical application of his findings	SA	A	N	D	SD
54)	A scientist should always try to publish his research findings	SA	A	N	D	SD
55)	Science must be kept free from political authority	SA	A	N	D	SD
56)	Scientific knowledge should not be the personal property of one scientist in particular	SA	A	N	D	SD
57)	Scientific findings should be published regardless of their possible consequences	SA	A	N	D	SD
58)	Sometimes a scientist is justified in withholding some of his knowledge from others	SA	A	N	D	SD
59)	Freedom to communicate with other scientists is essential to the advancement of knowledge	SA	A	N	D	SD
60)	A scientist should devote most of his time to his research	SA	A	N	D	SD
61)	Teaching detracts time and effort that should be invested in research	SA	A	N	D	SD

62) It is not important that a scientist should make a contribution to his field SA A N D SD

63) The primary goal of science is the advancement of knowledge SA A N D SD

64) The quality of a contribution to scientific knowledge should be judged independently from its author's reputation SA A N D SD

65) Science has no political boundaries SA A N D SD

66) One's personal biases should not affect his assessment of the scientific merit of another scientist's work SA A N D SD

67) A scientist should have complete freedom to choose any research topic he finds interesting SA A N D SD

Indicate how important each of the following is to you as a personal goal toward which you are either now striving or hope to begin striving toward in the near future. Use the numbers point 1 to 9, with 1 indicating that it is "very unimportant", 5 indicating that it is now "moderately important", and 9 indicating that it is "extremely important".

68) A successful career as a scientist_____

69) Experiencing the joy of discovery _____

70) Publishing papers in prominent journals in my field____

71) Material security_____

72) A reputation as a good scientist_____

73) Pursuing knowledge for its own sake_____

74) Obtaining recognition from my colleagues_____

75) Applying my knowledge to solve socially relevant problems _____

76) Financial success_____

77) Being regarded as an authority in my field_____

In responding to the following statements, please indicate your response by placing a check mark beside the category which best describes your feeling.

78) My contributions to scientific knowledge have received adequate recognition? Yes___ Yes with reservations___ No with reservations___ No___

79) I am concerned about having my work anticipated by someone else. Always____ Sometimes_____ Hardly ever_____ Never_____

80) At times I feel that I am competing with others in my field. Always____ Sometimes____ Hardly ever____ Never____

APPENDIX II

TABLE 1 - Intercorrelation Matrix for Thirty Seven Commitment to Ethos of Science Items

SIMPLE CORRELATION COEFFICIENTS ***** UNIVERSITY OF MANITOBA *****

VARIABLE	1	2	3	4	5	6	7	8	9	10
	11	12	13	14	15	16	17	18	19	20
	21	22	23	24	25	26	27	28	29	30
	31	32	33	34	35	36	37			
1	1.0000000									
2	-0.0653979	1.0000000								
3	-0.0729490	-0.0453157	1.0000000							
4	0.2820593	0.1340377	0.0771467	1.0000000						
5	0.0263554	-0.0875328	-0.3537718	-0.0235814	1.0000000					
6	-0.2036184	-0.0181737	0.0221384	C.1100301	-0.0316742	1.0000000				
7	0.0266838	0.0452072	0.0382411	C.1438938	-0.1102515	0.0426952	1.0000000			
8	0.0342701	0.0885159	0.5004423	0.1858931	-0.0663149	0.2539710	-0.0798001	1.0000000		
9	0.1117278	0.0977065	-0.0684001	0.0667433	-0.0464881	-0.1323277	0.0181960	-0.0784721	1.0000000	
10	0.0433187	0.0414557	0.1919481	-0.0029260	0.0139967	0.0440555	0.1728268	0.3479139	0.0419345	1.0000000
11	0.2132614	-0.1535854	0.2700000	-0.0204493	-0.2511072	-0.0184420	0.1393076	0.1451456	0.1844210	0.3936244
	1.0000000									
12	0.0227627	0.1733119	0.1079695	-0.0083276	-0.0867838	0.2053933	0.1398100	0.1165187	0.1494026	0.2065098
	0.2852376	1.0000000								
13	0.1534715	-0.0375981	0.0545213	-0.0444719	-0.0331539	0.1495565	-0.0199436	0.0674020	0.1961908	C.1185636
	0.3319504	-0.1595852	1.0000000							
14	-0.0245643	0.1843818	-0.1936166	-0.2361580	0.0450171	0.1110367	-0.0828934	-0.0801860	0.0374271	-0.0769074
	-0.1466376	0.0708405	-0.0344224	1.0000000						
15	-0.2204634	0.2511691	-0.0536756	-0.1055679	0.1583983	-0.3866013	0.0687171	0.0119445	-0.0702353	0.1610891
	0.0630094	-0.0385363	-0.0620280	0.1186093	1.0000000					
16	0.0904269	-0.1220807	0.0809948	C.0854551	-0.2256941	0.0514516	0.0697568	-0.1654156	-0.0048168	0.0259980
	0.3281818	0.1404563	0.2702355	-0.2573895	0.0633205	1.0000000				
17	-0.1143314	0.0576804	-0.2821702	-0.0899132	0.0550087	0.0237637	0.0645077	-0.1458129	0.0457336	0.0812877
	0.1100569	0.1961561	0.0969872	-0.0259804	0.1201761	0.2700260	1.0000000			
18	-0.0190060	-0.0939185	0.1089546	-0.0299008	0.0964596	0.1826447	-0.0498170	0.1993501	0.0801956	0.0900536
	0.0526049	0.2948434	0.1404364	0.1557312	-0.1610354	-0.3453175	-0.1612366	1.0000000		
19	0.2438477	-0.0150576	-0.1757745	-0.0354217	0.1519939	0.0816480	0.1306228	-0.0313672	0.0479557	0.0966502
	0.1377543	-0.0498036	0.0552538	0.0392637	-0.0044587	-0.0995770	-0.2029861	-0.0805514	1.0000000	
20	-0.0233918	0.1910595	0.0000000	0.2205207	0.2198471	0.2701417	0.0327001	0.4275217	0.0006089	0.2840784
	0.1458492	0.2268515	-0.0048571	-0.0021562	0.2916414	-0.0418438	0.0879683	0.2668847	0.2239593	1.0000000
21	-0.1594843	0.0161094	0.2759463	0.0364617	0.1535431	-0.1416500	-0.1366197	0.3032358	-0.1869240	0.1486058
	-0.0975239	-0.1193774	-0.0145358	-0.0064516	0.2969440	-0.1749142	-0.1476389	0.0750425	-0.1263282	-0.0009105
	1.0000000									
22	-0.0493125	0.1306136	-0.1526148	-0.0927827	0.1521720	0.0973147	-0.0307670	-0.2155570	0.1460875	0.0355155
	0.0545410	0.2115024	0.0446561	0.1987321	0.0957170	-0.0440029	-0.1091205	0.2089806	0.0782839	0.1452844
	-0.0623052	1.0000000								

3355

TABLE 1, cont'd - Intercorrelation Matrix for Thirty Seven Commitment to Ethos of Science Items.

23	0.2984865	-0.1171434	0.1147385	0.1618938	-0.3484867	-0.0321259	0.0331536	0.0845928	0.1169461	0.2236506	
	0.6597467	0.2511618	0.3473975	-0.1865903	0.0486843	0.3827470	0.2559330	-0.1408235	0.0616926	0.0092911	
	-0.1001151	-0.1600525	1.0000000								
24	-0.0185637	0.2041250	0.1412760	-0.2492425	-0.1797598	-0.0822330	-0.0563738	-0.1746531	0.0852289	-0.0278556	
	-0.1704294	0.4555570	0.1459160	0.1543221	0.1381577	0.0149247	0.0619001	0.0071700	-0.0274948	-0.0425458	
	0.0582919	0.1297318	0.1208171	1.0000000							
25	0.1311685	-0.1709419	0.0144603	0.1049402	-0.1065523	0.1746663	0.1613209	0.0961751	0.1191185	0.1738204	
	0.1536175	-0.0097827	0.2330841	-0.1065105	0.0312140	0.1637119	0.0110872	-0.0282555	0.1746512	0.2318397	
	-0.0154212	0.1094410	0.1875513	-0.0203015	1.0000000						
26	0.0868767	-0.0604440	-0.0219127	-0.1099164	-0.3417500	0.1434178	0.3534021	-0.1408681	0.0306286	0.1016352	
	0.3468535	0.1800146	0.1590778	-0.0023057	-0.0115057	0.1327258	0.1636502	0.0467123	-0.0200230	-0.1424838	
	0.0774094	0.0195379	0.2613601	0.3230332	0.3113482	1.0000000					
27	-0.1574971	0.3396966	-0.0452020	-0.1012080	-0.1277324	-0.0708526	0.0933440	-0.0319327	0.0395592	-0.0132656	
	-0.1134599	0.3304055	0.0807439	0.0319355	0.1506950	-0.0181921	0.0633758	0.0214125	-0.1298094	-0.0241573	
	-0.1119045	0.0712310	-0.1241661	0.4260975	0.0296358	0.1368842	1.0000000				
28	-0.1240190	0.1843532	0.0000002	-0.0586173	-0.1523706	0.0070082	-0.0159811	0.1285463	0.0526205	0.0063101	
	0.0587314	0.2666135	0.0867348	0.1133988	0.0968594	-0.0223087	-0.0455585	0.1026180	-0.1393609	-0.0337264	
	-0.0786243	0.1295465	0.0505243	0.2491856	-0.0343337	0.1155053	0.6924011	1.0000000			
29	0.0951317	0.0164763	0.2564541	0.0465795	-0.2672260	0.2006862	0.0830529	0.2277189	0.1896736	0.1864650	
	0.4222329	0.4014934	0.1751058	-0.0504520	-0.0871700	0.1134773	0.0058139	0.1412922	-0.0929933	0.1261330	
	-0.0668877	0.1243888	0.3104793	0.2719968	0.2825043	0.4403247	0.1546428	0.3473499	1.0000000		
30	0.1123762	0.1716728	0.2477682	0.1420365	-0.1116703	0.1907786	0.0576726	0.4276019	0.1444204	0.4644449	
	0.2824114	0.1765168	0.0983765	-0.1712041	0.0876961	-0.2059134	-0.1555428	0.2063766	0.2017010	0.4862568	
	0.0830762	-0.0421284	0.0831507	0.0326114	0.1581066	-0.0318676	-0.0146081	0.0517702	0.3110963	1.0000000	
31	0.0824866	-0.0249233	-0.1011947	0.0265381	0.0517631	0.0847374	0.0185452	0.0085074	-0.1646185	0.2160038	
	0.0429188	0.1103774	-0.0533738	-0.1277815	0.1499615	0.0441889	0.1030433	0.1078595	0.0427034	0.3344103	
	-0.1780680	-0.0658884	0.0229464	-0.0506143	-0.2322166	-0.1412430	-0.1511462	-0.2306661	-0.0608321	0.4654811	
	1.0000000										
32	0.1193175	-0.0323086	-0.0868133	-0.1111817	0.1324940	0.1346189	-0.0192445	0.1159097	-0.0283991	0.3241674	
	0.1325929	0.0487435	0.1474810	0.0771403	0.2554959	-0.1120957	0.1251420	0.0662563	0.0211537	0.2809536	
	0.1903077	-0.0648049	0.0800538	0.1921358	0.0936941	0.1419851	0.0422467	-0.0293164	0.0575172	0.3013391	
	0.2253568	1.0000000									
33	-0.0113370	0.1795964	-0.0000001	-0.1090007	-0.0600970	0.1089502	0.0523013	0.0265140	0.0478381	0.0849061	
	0.0257139	0.2398608	0.1546416	0.1479511	0.0987149	-0.0138466	0.1995361	0.1509901	0.1009596	0.1836119	
	0.1842537	-0.1171132	0.0956460	0.3387614	0.1640566	0.2877773	0.2729754	0.1109042	0.2183494	0.1257904	
	-0.0047184	0.3028271	1.0000000								
34	0.0745474	-0.2775971	-0.0259704	-0.0756286	-0.1165881	0.0837390	0.1507003	-0.0988888	0.0629474	0.3217779	
	0.2414419	0.1638692	0.1354403	-0.0655877	0.1257631	0.0310947	0.2214394	0.0199924	0.0953562	0.1503659	
	0.2111878	-0.0883194	0.3091625	0.1207824	0.4253408	0.4169260	0.0616123	0.0801640	0.2612506	0.1552737	
	-0.0491344	0.2058566	0.4803285	1.0000000							
35	0.0989028	0.0576382	-0.0642940	0.2203617	-0.0761240	0.1621317	0.1485886	0.0502347	0.0422569	0.0994714	
	0.1704285	0.0738561	0.2415659	-0.0060886	-0.1680483	0.0192455	0.0962302	0.1043151	0.1142938	0.1655067	
	-0.1354192	-0.0730585	0.2017733	0.0423122	0.1725994	0.1418048	-0.0023466	0.1233486	0.2315850	0.1717657	
	0.0769438	0.0436820	0.4466617	0.1931139	1.0000000						
36	0.1245237	-0.2677655	-0.0131311	0.0920897	-0.1836481	0.1453383	0.1004257	0.0149338	0.1167580	0.0678566	
	0.2630347	0.2084863	0.0634861	-0.0317786	-0.1409581	-0.1382571	0.0648384	0.1072972	0.0882792	0.1614025	
	-0.0805194	-0.0250492	0.3013161	0.2385046	0.2942981	0.3740481	0.1610985	0.2294646	0.4977894	0.2602676	
	-0.0265743	0.2659787	0.3754974	0.5456269	0.3123425	1.0000000					
37	-0.0711231	0.2127032	-0.0347127	0.0027525	0.1581903	-0.0106915	0.0754135	0.1465927	0.1742564	0.2743174	
	0.2828783	0.2158618	0.1156100	-0.1125028	0.2025210	0.0598983	0.0557873	0.1422390	0.1478671	0.4297771	
	0.0518271	0.2645936	0.1372746	0.2223554	0.2431142	0.0869782	0.2314516	0.3428705	0.3123304	0.3377324	
	0.0918618	0.3380338	0.3668557	0.1442332	0.3349631	0.2370139	1.0000000				

TABLE 2. Principal Factor Matrix for Initial Pool of Items for Thirty Seven Commitment to Ethos of Science Scale.

NUMBER OF FACTORS RETAINED = 11

CUMULATIVE PERCENT OF VARIABILITY ACCOUNTED FOR BY FACTORS

14.042 22.244 30.225 36.406 42.221 47.627 51.999 56.251 59.897 63.476 66.909

PRINCIPAL FACTOR MATRIX-

	1	2	3	4	5	6	7	8	9	10	11
VAR 1	0.18393	-0.04021	-0.41404	-0.16267	-0.32122	0.05584	0.06675	0.03352	-0.17660	0.34319	-0.19103
VAR 2	0.04315	0.19522	0.47075	0.13914	-0.00248	0.43404	-0.28215	0.15232	-0.08731	0.21156	-0.43139
VAR 3	0.19649	0.09735	-0.22921	0.75039	0.22139	-0.07760	0.09492	-0.03150	-0.03491	-0.00056	-0.12467
VAR 4	0.07571	-0.16176	-0.36924	0.13912	-0.19836	0.19493	-0.42384	0.33319	0.12631	0.10813	-0.01404
VAR 5	-0.26515	0.43285	0.14409	-0.45137	-0.04430	-0.03059	0.17710	0.09388	0.31623	0.03040	0.16349
VAR 6	0.25539	0.16172	-0.16104	0.00821	-0.51196	-0.08965	-0.16317	-0.29598	0.26908	-0.16707	-0.37324
VAR 7	0.23072	-0.11994	-0.08632	-0.11055	-0.00472	0.06999	-0.26052	0.23072	-0.27336	-0.50144	-0.26168
VAR 8	0.30045	0.53297	-0.19604	0.51451	0.07786	-0.09348	-0.08930	0.01490	0.22231	0.07637	-0.10132
VAR 9	0.21816	-0.13138	0.05167	-0.04338	-0.22449	0.21191	0.28823	0.26395	-0.04916	0.22429	0.16996
VAR 10	0.48000	0.35722	-0.15445	-0.00082	0.28858	0.08848	0.15487	-0.01077	-0.05415	-0.17362	-0.07781
VAR 11	0.62428	-0.16908	-0.33608	0.05217	0.16480	0.25096	0.38773	-0.03852	-0.08855	0.02967	0.01413
VAR 12	0.51793	-0.04958	0.25102	0.14114	-0.15772	0.30297	0.07363	-0.32126	0.08385	-0.17169	-0.07373
VAR 13	0.40295	-0.17379	-0.11675	-0.04590	-0.05331	0.11048	0.28207	-0.06413	0.33568	0.34739	-0.10472
VAR 14	-0.08161	0.03107	0.43758	-0.15118	-0.22411	-0.15115	0.19724	-0.18085	-0.03657	0.13539	-0.44961
VAR 15	0.07883	0.23038	0.32946	-0.20275	0.65667	0.16900	0.07595	0.21208	-0.05148	-0.05326	-0.10876
VAR 16	0.16074	-0.44280	-0.30324	-0.07183	0.26181	0.44577	-0.03908	-0.02230	0.32365	-0.06792	-0.11064
VAR 17	0.17521	-0.24560	0.07158	-0.42098	0.26670	0.20386	-0.24659	-0.34108	0.34133	-0.07501	0.00205
VAR 18	0.21083	0.34160	0.16122	0.17791	-0.38930	-0.18269	0.27073	-0.28752	0.14179	-0.11086	0.13049

TABLE 2, cont'd. Principal Factor Matrix for Initial Pool of Items for Thirty Seven Commitment to Ethos of Science Scale.

VAR 19	0.12574 -0.22073	0.19660	-0.14322	-0.39377	-0.22449	-0.00941	0.16829	0.32814	-0.35611	0.11860		
VAR 20	0.40848 -0.02710	0.66351	0.00993	-0.17664	-0.04180	0.19521	-0.09538	0.04545	0.17230	-0.14337		
VAR 21	0.00531 -0.17604	0.30360	0.09084	0.21863	0.49083	-0.48096	0.11020	0.12409	0.18982	0.13591		
VAR 22	0.06285 -0.08061	0.06319	0.34369	-0.11186	-0.30475	0.21976	0.50829	0.18720	0.13181	-0.31348		
VAR 23	0.53067 0.02128	-0.34135	-0.40941	-0.02770	0.21623	0.21929	0.07725	-0.05217	0.01141	0.24288		
VAR 24	0.36834 -0.10255	-0.26397	0.49767	0.07967	0.11651	0.00679	0.14791	-0.17438	-0.25558	0.20763		
VAR 25	0.44941 -0.10657	-0.08332	-0.19769	-0.16785	-0.06417	-0.22844	0.04268	0.46640	0.23278	-0.20488		
VAR 26	0.50645 -0.25066	-0.45925	0.03885	-0.06633	0.05168	-0.28678	0.00810	-0.03203	-0.14214	-0.26663		
VAR 27	0.25338 0.11523	-0.19471	0.63366	0.19206	-0.00924	0.14036	-0.25178	0.11312	-0.02391	-0.02509		
VAR 28	0.31706 0.24491	-0.17012	0.54390	0.33312	-0.11599	0.11048	-0.10677	0.14738	0.07266	0.01880		
VAR 29	0.67755 0.08888	-0.16362	0.02304	0.29669	-0.16693	-0.00480	0.06856	-0.00018	-0.00418	-0.12334		
VAR 30	0.51698 0.09604	0.58660	-0.14557	0.14715	-0.02092	0.10632	-0.02506	-0.01497	-0.32790	0.01869		
VAR 31	0.08988 0.17306	0.42535	-0.17664	-0.25064	0.08232	0.33191	-0.14516	-0.48853	-0.31068	-0.11821		
VAR 32	0.37801 0.00019	0.32395	0.10362	-0.31616	0.24884	-0.18524	0.05678	-0.22943	-0.07041	0.16082		
VAR 33	0.52455 -0.12145	0.00192	0.32887	-0.21316	0.05691	-0.32047	-0.29243	-0.09796	0.04730	0.27403		
VAR 34	0.58604 0.06949	-0.11179	-0.06711	-0.24260	0.20730	-0.47250	-0.05641	0.05657	0.05775	-0.12657		
VAR 35	0.44076 0.06143	-0.00210	-0.06499	-0.17299	-0.27683	-0.03425	-0.37814	0.05088	0.07997	0.26936		
VAR 36	0.62233 0.34165	-0.15045	-0.00628	-0.10044	-0.20026	-0.37993	-0.11998	-0.01077	-0.17313	-0.01989		
VAR 37	0.57159 0.24411	0.26240	0.30390	-0.14953	0.04391	0.19337	0.01821	0.27862	0.10834	0.04069		

TABLE 3. Rotated Factor Matrix for Thirty Seven Commitment Ethos of Science Items.

ROTATED FACTOR MATRIX ***** UNIVERSITY OF MANITOBA *****

	1	2	3	4	5	6	7	8	9	10	11	COMMUNALITY
VAR 1	-0.31917	0.03465	-0.24551	-0.11707	-0.21638	-0.12115	-0.14697	0.15227	-0.49433	0.01309	-0.05253	0.53063
VAR 2	-0.08762	0.08785	0.33171	0.04330	0.04502	-0.01314	0.01006	0.06615	-0.06578	-0.02286	-0.81959	0.81055
VAR 3	-0.16679	0.04822	-0.10030	0.75064	-0.05242	-0.19581	-0.30906	0.02959	0.02534	-0.04412	0.04119	0.74544
VAR 4	0.04769	0.01986	-0.02316	0.09089	-0.10052	0.01548	-0.02817	0.72476	-0.12359	-0.05485	-0.13125	0.58338
VAR 5	-0.24563	0.05287	-0.23301	-0.16297	0.06183	-0.05968	-0.62671	-0.00070	0.01387	0.32931	0.00690	0.65282
VAR 6	0.02416	0.07004	-0.11795	0.05163	-0.79918	-0.14629	0.06811	0.10693	0.04608	-0.16863	-0.11193	0.74132
VAR 7	-0.03870	0.11766	0.03242	-0.10089	0.00918	0.01833	-0.03706	0.12036	-0.02863	-0.74833	-0.06510	0.60791
VAR 8	0.02529	0.22989	0.03538	0.74752	-0.21647	-0.07623	0.05301	0.28697	0.02969	0.09594	-0.06673	0.76592
VAR 9	-0.29792	-0.06872	0.28340	-0.13890	0.04945	0.05940	0.15815	0.02457	-0.39680	0.11334	0.06361	0.39902
VAR 10	0.25348	0.48174	-0.02877	0.35199	0.06186	-0.09871	0.21440	-0.04631	-0.01234	-0.22901	0.02866	0.53615
VAR 11	0.75849	0.26182	0.08976	0.15499	0.03243	0.01478	0.01533	0.10204	0.17114	0.17394	0.19334	0.78478
VAR 12	0.31379	0.27782	0.45491	-0.00349	-0.38134	-0.00415	0.05268	-0.20068	0.15164	-0.12092	-0.11007	0.62082
VAR 13	0.62898	0.12675	0.04469	0.06060	0.18535	0.19572	0.14044	0.04950	0.07867	0.17877	-0.03118	0.55130
VAR 14	-0.16774	-0.16384	-0.01895	-0.08172	-0.26661	-0.15832	0.09759	-0.50333	-0.15230	0.05424	-0.37580	0.58839
VAR 15	0.01344	0.21857	0.03761	0.14013	0.60975	0.11605	0.32298	0.20429	0.16186	0.12987	-0.30550	0.73671
VAR 16	0.66069	-0.10060	-0.06963	-0.15896	0.08548	0.13664	-0.02213	0.18433	0.36237	-0.18110	-0.09236	0.70984
VAR 17	0.30795	0.09210	0.04087	0.37870	0.01324	0.29381	0.08060	0.02393	0.57634	0.05131	-0.09216	0.68526
VAR 18	-0.13310	0.19526	0.19777	0.21034	-0.52556	-0.00634	0.22817	-0.21375	-0.06903	0.20408	0.22229	0.60903
VAR 19	0.01006	0.12607	0.22242	0.14523	0.04391	0.12914	0.19196	0.00460	0.64172	0.20096	-0.10873	0.60605
VAR 20	-0.00404	0.55262	0.04232	0.16516	-0.17167	-0.19002	0.50768	0.23403	-0.00331	-0.06707	-0.15253	0.74033
VAR 21	-0.14727	-0.14783	-0.16413	0.67514	0.24964	0.27872	0.13639	0.16029	0.11714	0.08522		

2357

TABLE 3, cont'd. Rotated Factor Matrix for Thirty Seven Commitment Ethos of Science Items.

[illegible]	[illegible]	-0.03398	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.73344
VAR 22	0.03590	-0.05175	-0.05139	0.24673	-0.11902	-0.18039	0.31646	0.58556	-0.30274	-0.17633	-0.12356	0.69522
VAR 23	0.77799	0.11513	0.09735	0.00811	0.01487	0.09384	-0.17435	-0.20295	0.11202	-0.04096	-0.08151	0.72956
VAR 24	0.18822	-0.17060	0.01407	0.46025	-0.00472	0.08153	-0.25284	-0.19748	-0.50126	-0.08046	-0.01651	0.64417
VAR 25	0.22944	0.21709	-0.21056	-0.00010	0.13487	-0.05631	-0.26160	0.37328	0.21872	-0.15253	-0.46359	0.65927
VAR 26	0.24481	0.16080	-0.14025	0.14411	0.00200	-0.10874	-0.31764	-0.15937	-0.28876	0.01641	-0.60446	0.71337
VAR 27	-0.11611	-0.20561	-0.07513	0.76796	-0.08153	0.09269	-0.13897	-0.02108	-0.05875	0.14247	-0.08283	0.71678
VAR 28	-0.00984	-0.02431	-0.10906	0.79872	0.04534	-0.00595	-0.05780	0.02221	0.01630	0.05457	0.02995	0.66061
VAR 29	0.34159	0.23079	0.09232	0.49975	0.20983	-0.26777	-0.11784	-0.04972	-0.00122	-0.08865	-0.24877	0.63006
VAR 30	0.03450	0.02773	0.69897	0.14792	0.34863	-0.07001	-0.12886	0.02325	0.15347	-0.31879	-0.05144	0.78382
VAR 31	-0.02607	-0.01178	0.83448	-0.17594	-0.20962	-0.04143	0.01704	-0.09530	0.00931	0.10455	0.07680	0.80008
VAR 32	0.06311	0.00945	0.39443	-0.08334	0.09422	0.07306	-0.52269	0.14884	-0.24359	-0.01245	0.07575	0.54140
VAR 33	0.02784	-0.12963	0.02396	0.22733	-0.02527	-0.07615	-0.79576	-0.01104	-0.09312	0.02540	-0.05359	0.72181
VAR 34	0.16831	0.38772	0.01469	0.02865	0.12442	0.04762	-0.60886	0.10500	-0.06077	0.05773	-0.36032	0.71603
VAR 35	0.14293	-0.01709	0.06464	0.17082	-0.14703	-0.22571	-0.49708	-0.03203	0.37239	-0.14512	-0.00039	0.53448
VAR 36	0.07110	0.51000	0.11397	0.33173	-0.05912	-0.14601	-0.51478	-0.10459	0.03494	-0.19270	-0.19682	0.76604
VAR 37	0.16496	-0.01175	0.29167	0.48212	0.03753	0.14103	-0.29226	0.47018	0.12665	-0.10732	-0.01642	0.70047

TABLE 4. Item Analysis of Commitment to Ethos of Science Items.

TABLE 5. Intercorrelation Matrix for Commitment to Ethos of Science Items Selected by Item Analysis.

VARIABLE	1	2	3	4	5	6	7	8	9	10
	11	12	13	14	15					
1	1.0000000									
2	0.2539700	1.0000000								
3	0.0443574	0.3479144	1.0000000							
4	0.2693908	0.1165187	0.2665074	1.0000000						
5	0.1455574	0.0674017	0.1185688	0.1595861	1.0000000					
6	0.2721399	0.4275166	0.2840750	0.2268493	-0.0048555	1.0000000				
7	0.1745659	0.0961746	0.1738192	-0.0057828	0.2330647	0.2318390	1.0000000			
8	0.1434170	-0.1408679	0.1016339	0.1600143	0.1590779	-0.1424844	0.3113475	1.0000000		
9	0.2006866	0.2277293	0.1864648	0.4014953	0.1751055	0.1261334	0.2825052	0.4403265	1.0000000	
10	0.1527776	0.4276012	0.4644393	0.1765166	0.0983768	0.4862550	0.1581059	-0.0318672	0.3110967	1.0000000
11	0.1089494	0.0265151	0.0845060	0.2358602	0.1546418	0.1836113	0.1640552	-0.2877752	0.2183490	0.1257904
	1.0000000									
12	0.0837392	0.0988895	0.3217741	0.1638687	0.1354391	0.1503647	0.4253389	0.4169235	0.2612512	0.1552727
	0.4883240	1.0000000								
13	0.1621317	0.0502335	0.0994723	0.0738563	0.2415670	0.1655062	0.1725992	0.1418044	0.2315865	0.1717658
	0.4465581	0.1931136	1.0000000							
14	-0.1453376	-0.0149746	0.0678551	0.2084866	0.0894876	0.1614030	0.2942972	0.3740479	0.4977909	0.2602667
	0.3754952	0.3456246	0.3123629	1.0000000						
15	-0.0100913	0.1465929	0.2743142	0.2156612	0.1156102	0.4297765	0.2431132	0.0969771	0.3123311	0.3372886
	0.3666540	0.1842222	0.3349608	0.2370136	1.0000000					

TABLE 6. Principal Factor Matrix of Commitment to Ethos of Science Items.

NUMBER OF FACTORS RETAINED = 11

CUMULATIVE PERCENT OF VARIABILITY ACCOUNTED FOR BY FACTORS

26.773	40.282	48.454	56.022	63.212	69.756	75.297	80.351	84.587	88.485	91.666

PRINCIPLE FACTOR MATRIX

	1	2	3	4	5	6	7	8	9	10	11
VAR 1	0.35583	-0.13756	-0.45705	0.41097	-0.35340	-0.40747	-0.16572	0.06279	-0.24141	0.17077	0.07946
VAR 2	0.37350	-0.63424	-0.21866	-0.05168	-0.11371	-0.06682	-0.10540	-0.22206	0.07053	-0.54018	-0.01397
VAR 3	0.47995	-0.38036	-0.06762	-0.46077	0.08674	0.41522	-0.26914	-0.10547	-0.29439	0.17236	-0.14636
VAR 4	0.45092	-0.04244	-0.29075	0.46116	0.50854	0.18345	-0.19399	0.32520	0.11492	0.05702	-0.23534
VAR 5	0.32703	0.13389	-0.13917	0.29390	-0.49179	0.61829	-0.02614	0.01618	0.32461	0.03826	0.14801
VAR 6	0.51158	-0.58728	0.17235	0.02870	-0.04220	-0.27456	0.01353	0.32080	0.08020	0.07791	0.00100
VAR 7	0.31880	0.16915	-0.07605	-0.37366	-0.48264	-0.05558	0.26908	0.35360	0.00452	-0.03966	-0.15773
VAR 8	0.44175	0.61326	-0.36856	-0.12781	0.07253	0.05502	0.03260	0.01977	-0.36789	-0.04048	0.23011
VAR 9	0.65465	0.14843	-0.34163	0.10644	0.27319	0.04342	0.41530	-0.16503	-0.01250	-0.19868	-0.04724
VAR 10	0.56450	-0.53546	-0.01384	-0.10992	0.06019	0.02382	0.12670	-0.27622	0.07135	0.31854	0.26189
VAR 11	0.57996	0.29882	0.42598	0.19510	0.06066	-0.08949	-0.38215	0.02781	-0.00999	-0.18849	0.23121
VAR 12	0.63413	0.33633	0.03463	-0.42385	-0.02437	-0.09933	-0.39076	0.02229	0.17073	-0.02662	-0.05603
VAR 13	0.49690	0.14738	0.45027	0.38427	-0.24930	0.02056	0.03946	-0.34828	-0.21681	0.04231	-0.34719
VAR 14	0.64414	0.35819	0.00593	-0.08215	0.15763	-0.30840	0.13001	-0.23565	0.34694	0.18632	-0.04762
VAR 15	0.57389	-0.17147	0.47673	0.05873	0.15178	0.15943	0.32007	0.27882	-0.15258	-0.07942	0.15784

TABLE 7. Rotated Factor Matrix for Commitment to Ethos of Science Items Selected by Item Analysis.

ROTATED FACTOR MATRIX ***** UNIVERSITY OF MANITOBA *****

	1	2	3	4	5	6	7	8	9	10	COMMUNALITY
	11										
VAR 1	0.03878	0.03637	-0.02745	0.10793	-0.06156	-0.93757	-0.02302	0.07909	-0.09922	-0.13273	
	-0.39203										0.93949
VAR 2	0.01716	-0.20713	0.16174	0.02644	-0.02435	-0.14838	-0.02922	0.03185	0.07707	-0.53930	
	0.00653										0.96700
VAR 3	-0.03753	-0.92481	0.10853	0.13081	-0.02505	0.03603	-0.07473	0.10983	-0.06855	-0.16783	
	-0.05879										0.96147
VAR 4	0.09405	-0.10904	0.12298	0.93728	-0.08572	-0.11876	-0.10424	-0.06875	-0.06855	-0.02309	
	0.01174										0.95997
VAR 5	0.21016	-0.04346	0.01200	0.03346	-0.96878	-0.05473	-0.06389	0.11966	-0.05878	-0.02303	
	-0.10678										0.98442
VAR 6	0.14474	-0.17860	0.59249	0.16526	0.10924	-0.34085	-0.10386	0.22598	0.37307	-0.26336	
	0.02361										0.83027
VAR 7	0.12219	-0.06353	0.16924	-0.07563	-0.13760	-0.09826	-0.06626	0.89511	-0.16121	-0.03465	
	-0.05065										0.91729
VAR 8	0.29849	-0.07942	-0.03212	0.04140	-0.04672	-0.12570	-0.27829	0.18680	-0.84617	0.17230	
	0.01489										0.88266
VAR 9	0.46184	-0.00234	0.20176	0.34729	-0.07127	-0.00715	0.09991	0.11362	-0.06923	-0.31090	
	-0.16194										0.89668
VAR 10	0.49348	-0.53765	0.44301	-0.08188	-0.12075	-0.22587	0.07329	-0.13324	0.06786	-0.24494	
	0.03105										0.88983
VAR 11	0.68168	0.06449	0.28984	0.08546	-0.08753	-0.05956	-0.82725	-0.07664	-0.14044	-0.01590	
	-0.26830										0.89553
VAR 12	0.34325	-0.27671	-0.10320	0.07670	-0.01067	0.03817	-0.69810	0.41502	-0.13717	-0.04074	
	0.01252										0.89270
VAR 13	0.13243	-0.05168	0.15536	-0.00834	-0.11625	-0.09514	-0.18270	0.04732	-0.02606	0.00383	
	-0.93299										0.97376
VAR 14	0.83370	0.02971	0.04314	0.11660	0.01725	-0.03120	-0.30423	0.18558	-0.18062	0.03993	
	-0.16069										0.89971
VAR 15	0.32877	-0.10497	0.86362	0.11086	-0.03944	0.12857	-0.14584	0.11855	-0.11934	-0.03373	
	-0.19876										0.87836

TABLE 8. Intercorrelation Matrix for Desire for Recognition Items.

SIMPLE CORRELATION COEFFICIENTS ***** UNIVERSITY OF MANITOBA *****

VARIABLE	1	2	3	4	5	6	7	8	9	10
1	1.0000000									
2	0.3544526	1.0000000								
3	0.3577119	0.3700826	1.0000000							
4	0.2773450	0.0185739	0.1979511	1.0000000						
5	0.7264518	0.3972194	0.4534797	0.2748381	1.0000000					
6	0.4030758	0.3076896	0.2986805	0.0667551	0.3897914	1.0000000				
7	0.5607227	0.2032663	0.5777868	0.2966293	0.6389849	0.3791460	1.0000000			
8	-0.0665704	0.1289165	-0.0773980	0.1281239	0.0457744	0.1021439	-0.0430524	1.0000000		
9	0.3285065	0.0086611	0.2030041	0.4566286	0.2342371	0.2577653	0.3982507	0.2512675	1.0000000	
10	0.4108639	0.1586452	0.3851048	0.1551865	0.4261591	0.3155822	0.6453623	-0.0146140	0.2326602	1.0000000

TABLE 9. Principal Factor Matrix for Desire for Recognition Items.

NUMBER OF FACTORS RETAINED = 8

CUMULATIVE PERCENT OF VARIABILITY ACCOUNTED FOR BY FACTORS

	38.692	52.497	63.874	72.123	79.489	86.008	90.815	95.34

PRINCIPLE FACTOR MATRIX

	1	2	3	4	5	6	7	8
VAR 1	0.78550	-0.09583	-0.01951	0.20762	-0.4C836	-0.17404	-0.13668	0.04207
VAR 2	0.46230	-0.34022	0.61990	0.32336	0.16626	0.04501	0.06064	0.36788
VAR 3	0.66885	-0.22893	-0.06340	0.09782	0.52520	0.32403	-0.13367	-0.21790
VAR 4	0.42252	0.62078	-0.21980	0.44396	0.05695	0.06609	0.42616	-0.03227
VAR 5	0.81643	-0.13236	0.06603	0.19477	-0.17857	-0.27971	-0.08014	-0.24943
VAR 6	0.58213	-0.08732	0.33034	-0.38750	-0.35300	0.43537	0.25063	-0.13061
VAR 7	0.84175	-0.02913	-0.26714	-0.16453	0.13419	-0.07500	-0.08859	-0.08085
VAR 8	0.06500	0.57064	0.67001	-0.20921	0.21264	-0.29513	-0.03096	-0.18545
VAR 9	0.50136	0.67491	-0.07002	-0.09374	-0.07329	0.24970	-0.35027	0.27553
VAR 10	0.66561	-0.10316	-0.24905	-0.45041	0.19502	-0.29554	0.24098	0.26729

TABLE 10. Rotated Factor Matrix for Desire for Recognition Items.

ROTATED FACTOR MATRIX ***** UNIVERSITY OF MANITOBA *****

	1	2	3	4	5	6	7	8	COMMUNALITY
VAR 1	0.16972	0.21467	-0.12941	0.19664	-0.84753	0.16495	0.10087	-0.03429	0.88716
VAR 2	0.04110	-0.03438	0.08326	0.94151	-0.21722	0.12177	-0.01673	-0.16862	0.98697
VAR 3	0.16770	0.06885	-0.06519	0.19944	-0.18773	0.10775	0.07982	-0.91070	0.95949
VAR 4	0.06055	0.21039	0.05978	-0.01431	-0.15443	-0.00455	0.95758	-0.08381	0.99955
VAR 5	0.18130	-0.01944	0.09538	0.13387	-0.86359	0.13153	0.11987	-0.25961	0.90512
VAR 6	0.13828	0.10477	0.05311	0.12511	-0.21763	0.94340	-0.00436	-0.11766	0.99980
VAR 7	0.53856	0.22597	-0.02645	-0.05375	-0.49723	0.12986	0.09952	-0.47657	0.84582
VAR 8	-0.01493	0.12205	0.98014	0.07331	0.02571	0.04239	0.05586	0.05569	0.99020
VAR 9	0.10669	0.92767	0.14581	-0.03484	-0.14360	0.10660	0.22821	-0.09152	0.98687
VAR 10	0.94130	0.06698	-0.01026	0.06039	-0.21005	0.11738	0.04649	-0.13820	0.97345

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