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RELATIONSHIPS BETWEEN SUBJECT MATTER CHARACTERISTICS AND THE STRUCTURE AND OUTPUT OF UNIVERSITY DEPARTMENTS [1]

ANTHONY BIGLAN[2]

University of Washington

The social structure and output of scholars at the University of Illinois are examined in terms of the characteristics of their academic subject matter. On the basis of an earlier multidimensional analysis (Biglan, 1973) academic areas were clustered according to their (*a*) concern with a single paradigm (hard vs. soft), (*b*) concern with application (pure vs. applied), and (*c*) concern with life systems (life system vs. nonlife system). Depending on the characteristics of their area, scholars differed in (*a*) the degree to which they were socially connected to others, (*b*) their commitment to teaching, research, and service, (*c*) the number of journal articles, monographs, and technical reports that they published, and (*d*) the number of dissertations that they sponsored.

This article examines relationships between the characteristics of academic subject matter and the structure and output of university departments. Despite considerable attention to university organization in recent years, the possibility that the subject matter requires or contributes to particular kinds of organization has not been systematically evaluated. In an earlier article (Biglan, 1973), scholars' judgments identified three important features of academic subject matter. Academic areas differ according to (*a*) the existence of a single paradigm, (*b*) their concern with practical application, and (*c*) their concern with life systems. This study defines limits on the generality of organization studies that are restricted to a single academic area and calls attention to the dangers inherent in ignoring subject matter characteristics.

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[2] Requests for reprints should be sent to Anthony Biglan, Department of Psychiatry, University of Wisconsin, 427 Lorch Street, Madison, Wisconsin, 53706.

University Departments

Department Structure and Output

Social connectedness among faculty members. Unlike departments in most formal organizations, university departments do not have clear lines of authority in which some members must answer to others. Oncken (1971) showed that the typical university department has a distribution of control that is egalitarian. In the absence of a clear, formal structure, informal relations among colleagues—their social connections—may be crucial to the department's functioning efficiently. Informal social connections also appear important for research activities, at least in the sciences. Hagstrom (1964) found teamwork to be characteristic of physical science research. In these areas, the scholar's informal relations with his colleagues are a prime source of technical information (Menzel, 1962) and appear to contribute to his scholarly productivity (Pelz & Andrews, 1966).

Despite the apparent importance of social connectedness among scholars, its extent in different academic areas has not been investigated. The present study examines whether social connectedness varies with the characteristics of academic subject matter. Of particular interest is the question of whether high social connectedness is characteristic of areas other than physical sciences. A second and equally significant question is whether social connectedness is positively associated

with scholarly productivity in areas other than the hard sciences. Despite the evidence just cited for such a positive relationship in hard science areas, the relationship between social connectedness and scholarly productivity has not been investigated in other areas.

Three aspects of scholars' social connectedness are examined in the present study. First, an individual may be connected to others in the sense that he likes working with them. Second, he may be connected by the extent to which others influence him. Finally, an individual is connected to others to the extent that he actually collaborates with them. Since teaching and research activities may engender different degrees of social connectedness, these three aspects of connectedness are examined separately for the two activities.

Commitment to teaching, research, administration, and service. Considerable controversy has raged in academia in recent years concerning the relative emphasis that should be placed on teaching and research. However, appropriate standards for these and other scholarly activities may depend on the nature of the area. What evidence exists indicates that the emphasis on, and significance of, teaching differs in physical and social science fields. Scholars in social sciences emphasize educating the whole student and evidence a more personal commitment to students than do those in physical sciences (Gamson, 1966; Vreeland & Bidwell, 1966). Although informative, these studies need to be extended and elaborated. First, we need to examine whether emphasis on research, administration, and service activities also differs according to academic area. Moreover, it is important to know if scholars in the various areas simply differ in preferences for these activities or if they actually spend different amounts of time on them. Both of these questions are examined in the present study. The commitment of scholars in different areas to teaching, research, administration, and service are examined in terms of (*a*) liking for the activity and (*b*) the amount of time they actually spend on the activity.

Scholarly output. The evidence is rather strong that different measures of scholarly output do not converge (Smith & Fiedler, 1971). Thus, a variety of output measures are included in the present study. In the case of research, the quantity of monographs, journal articles, and technical reports are included as well as a measure of journal article quality that is based on the rated quality of the journal in which it is published. The effectiveness of graduate training at the doctoral level is indexed by ratings of the quality of the first jobs that graduate students obtain upon completing their degrees and the number of doctoral dissertations sponsored. Unfortunately, no index of undergraduate teaching effectiveness was available.

Despite research on relationships among scholarly output measures (cf. Cole & Cole, 1967), the question of whether these measures differ systematically with academic area appears not to have been examined. The answer to this question has important implications for the way we shall evaluate faculty members. If, for example, faculty members produce different numbers of monographs depending on their area, then we may want to weight monographs differently when evaluating scholars in different areas.

METHOD

Data on department structure and output were collected at the Urbana campus of the University of Illinois in the spring of 1968. The university is a large, state-supported institution with an extensive commitment to research and graduate eduction. Most academic disciplines are represented on the Urbana campus; there are over 100 distinct curricula.

In the early stages of research, data were collected on the organization of 47 departments. Since one purpose of our research was the study of the characteristics of successful graduate programs, only departments granting PhDs were included in the sample.

Sources of Data

The chief sources of structure and output data were questionnaires, archival records, and faculty members' judgments of certain outputs. The questionnaire asked scholars about the structure of their social relations and their commitment to teaching, research, administration, and service. Department heads in 47 departments were contacted through the Dean of the Graduate College. They were asked to fill out the questionnaire and to ask the members of their department to do the same. The remaining members of the faculty received their questionnaires by mail. Response rates within the departments ranged from 19% to 100%, and the overall rate was 55%. Because of their low response rate, some departments were deleted from the present

TABLE 1

OPERATIONAL MEASUREMENT OF SOCIAL CONNECTEDNESS AND COMMITMENT VARIABLES

Variable	Description
Social connectedness	
Number of others—like to work with	Respondents to the questionnaire listed people they said they liked to work with on teaching, research, and administration. The number of people named for each of these tasks was the measure.
Number of sources of influence	Respondents were asked to indicate the individuals and groups who influenced their research goals and teaching procedures. The number of sources indicated was the measure.
Collaboration	Respondents to the questionnaires indicated the number of fellow faculty members with whom they worked directly on research and teaching.
	A second measure of research collaboration was obtained by tabulating the number of coauthorships each faculty member had on his journal articles.
Commitment	
Preferences	Questionnaire respondents were asked to distribute 100 points among the following tasks in accordance with their preferences for each task: teaching, research, department administration, university administration, and service.
Time allocation	In a similar manner, respondents distributed 100 points among these tasks to indicate the proportion of time they spent on each. Since respondents also indicated the number of hours they spent on all university work, it was possible to devise measures of time spent on each activity.

study. The average response rate of departments retained in this study was 65%.[3]

Archival records provided data about publication quantity and the first jobs which finishing graduate students obtained. An official university pamphlet entitled *Publications of the Faculty* is published annually. It lists all monographs, journal articles, technical reports, and dissertations sponsored by faculty members during the preceding year. Departmental records provided information on the specific jobs obtained by all graduate students who had completed their PhDs in the years 1964–1968.

It was important to obtain measures of the quality of jobs and publications as well as their quantity. Our approach to this problem was to ask faculty members to rate the quality of graduate students' first jobs and the journals in which the scholars in our sample had published.

Operational Measurement of Variables

Table 1 lists social connectedness and commitment variables and describes the specific operations involved in deriving each. All but one of these variables was derived from the questionnaire.

Measures of publication quantity were tabulated for each faculty member who received a questionnaire. The quantity of four kinds of publications was tabulated: monographs, journal articles, dissertations sponsored by the scholar, and technical reports.

A separate paper (Biglan, Oncken, & Fiedler, 1971) presents a detailed description of the development of the journal article and first-job quality measures and presents evidence relevant to their reliability and validity. Briefly, the measure of journal article quality was derived for each questionnaire respondent who had published at least one article in the period 1964–1967. The measure was based on the ratings of journal quality that were described above. Each of the journals in which the scholar had published during the 4-year period of interest was noted, and the quality score for that journal was recorded. Then the quality scores

[3] Comparison of respondents and nonrespondents for all departments included in the original sample indicated that nonrespondents were more peripheral members of the department. They were less likely to have advanced degrees, had a smaller percentage of their time devoted to the university and department, and spent more of their time on teaching. Although these differences were statistically significant, none accounted for more than 2.1% of the variance. In another analysis, the relationships between subject matter characteristics and return rate were examined by correlating the return rate of each department with three measures of the characteristics of the department's subject matter (Biglan, 1973). Response rate was significantly related to the degree of concern with application ($r = .50$, $p < .05$), indicating that departments in applied areas had higher rates of response. The two other measures—existence of a paradigm and concern with life systems—were not significantly related to return rate ($r = -.13$ and $r = .03$, respectively).

TABLE 2

CLUSTERING OF ACADEMIC TASK AREAS IN THREE DIMENSIONS

Task area	Hard		Soft	
	Nonlife system	Life system	Nonlife system	Life system
Pure	Astronomy Chemistry Geology Math Physics	Botany Entomology Microbiology Physiology Zoology	English German History Philosophy Russian Communications	Anthropology Political science Psychology Sociology
Applied	Ceramic engineering Civil engineering Computer science Mechanical engineering	Agronomy Dairy science Horticulture Agricultural economics	Accounting Finance Economics	Educational administration and supervision Secondary and continuing education Special education Vocational and technical education

were summed and divided by the number of journal articles the scholar had published. An index of the quality of the first jobs of each scholar's graduate students was developed in essentially the same manner. A score for the quality of each job was obtained by averaging the judges' ratings. The final job quality measure for the scholars was then derived by averaging these quality scores for all of the jobs that the particular scholar's graduate students had obtained.

Analysis of Data

In an earlier article (Biglan, 1973), a multidimensional analysis of 36 academic subject areas was presented. Three dimensions were derived from the judgments of scholars at the University of Illinois. The dimensions involved (*a*) the existence of a single paradigm (hard–soft), (*b*) concern with practical application (pure–applied), and (*c*) concern with life systems. It is possible to cluster areas on the basis of their position on each of these three dimensions. Table 2 presents an organization of areas in eight clusters. The table lists the areas included in each cluster. Each cluster centroid is located in a different octant of the three-dimensional space and can thus be characterized according to whether it is hard or soft, pure or applied, and concerned with life systems or not.

This clustering suggests an analysis of variance approach to our examination of relationships between area characteristics and department structure and output. Specifically, a three-way analysis of variance design corresponding to Hard versus Soft × Pure versus Applied × Life System versus Nonlife System was employed in the analysis of structure and output data. Thus, each subject's data falls into one of the octants of this three-way design. In examining the way in which area characteristics mediate relationships between social connectedness and scholarly output, a four-way analysis of variance was performed. Here the four factors correspond to the high versus low social connectedness by the three area factors just mentioned.

RESULTS

Hard versus Soft Areas

Social connectedness. Hard and soft areas differ significantly on one of three measures of social connectedness in teaching and on three of the four measures of social connectedness in research. In each case, it is the hard areas that are higher in connectedness. For teaching activities, scholars in hard areas report greater collaboration with fellow faculty members ($\bar{X}_H = .66$) than do those in soft areas ($\bar{X}_S = .29$, $F = 17.52$, $df = 1/429$, $p < .01$). There were no differences in the number of people with whom they reported liking to work on teaching or in the number of reported sources of influence on the courses they teach. For research activities, scholars in hard areas like to work with significantly more people on research ($\bar{X}_H = 1.93$) than do those in soft areas ($\bar{X}_S = 1.36$, $F = 14.29$, $df = 1/584$, $p < .01$). Similarly, hard area scholars report more sources of influence on their research goals ($\bar{X}_H = 2.12$, $\bar{X}_S = 1.70$, $F = 21.74$, $df = 1/569$, $p < .01$). The extent to which scholars collaborate with other faculty members on research did not differ according to the hard–soft distinction or according to any of the other area characteristics. Many

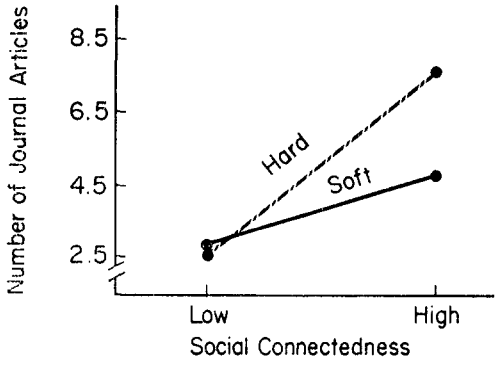

FIG. 1. Interaction between social connectedness and the hard–soft factor on journal article publications.

respondents appeared not to understand the instructions to this question. As a result, a second measure of research collaboration, the number of journal coauthors, was included in the study. Analysis of this measure showed that hard area scholars have a significantly greater number of coauthors ($\bar{X}_H = 5.67$) than do their soft area ($\bar{X}_S = .63$) counterparts ($F = 47.48$, $df = 1/473$, $p < .01$).

Commitment. Hard and soft area scholars differ significantly in their commitment to teaching and research. As compared with hard areas, scholars in soft areas indicate a greater preference for teaching ($\bar{X}_H = 37.1$, $\bar{X}_S = 48.7$, $F = 41.63$, $df = 1/620$, $p < .01$) and actually spend more time on it ($\bar{X}_H = 19.1$, $\bar{X}_S = 26.4$, $F = 42.29$, $df = 1/603$, $p < .01$). For research, the situation is just the reverse. Hard area scholars show significantly greater preference for research than do those in soft areas ($\bar{X}_H = 41.1$, $\bar{X}_S = 31.8$, $F = 22.89$, $df = 1/620$, $p < .01$) and actually spend more time on it ($\bar{X}_H = 23.0$, $\bar{X}_S = 15.1$, $F = 37.97$, $df = 1/603$, $p < .01$). The analyses also revealed three-way interactions among the three area characteristics (i.e., hard–soft, pure–applied, life system–nonlife system) in both preference for ($F = 21.08$, $df = 1/620$, $p < .01$) and time spent on research ($F = 13.79$, $df = 1/603$, $p < .01$). These interactions indicate that differences between hard and soft areas in preference for, and time spent on research, are greatest in applied life system areas (agriculture and education) and pure nonlife system areas (physical sciences and humanities). In other words, the greatest differences on these variables are between agriculture and education and between physical sciences and humanities.

Scholarly output. The rate of publication of monographs and journal articles are both related to the hard–soft distinction. Scholars in hard areas produce significantly fewer monographs than do those in soft areas ($\bar{X}_H = .08$, $\bar{X}_S = .28$, $F = 14.54$, $df = 1/473$, $p < .01$), and they produce significantly more journal articles ($\bar{X}_H = 6.21$, $\bar{X}_S = 2.72$, $F = 25.31$, $df = 1/473$, $p < .01$) than soft area scholars. Caution, however, is appropriate in considering this last result. Since, as was shown above, the incidence of joint authorship is greater in hard areas and since journal articles were credited to the scholar when he was not first author, the greater incidence of journal articles in hard areas must be in part due to the same article being credited to more than one scholar.

The relationship between social connectedness and scholarly output. A significant interaction was found between social connectedness and the hard–soft factor in their effects on journal article publication ($F = 6.22$, $df = 1/473$, $p < .01$). This interaction is shown in Figure 1. It indicates that social connectedness is more strongly related to journal article publication in hard areas than it is in soft areas. A second interaction between social connectedness and the hard–soft factor indicates that social connectedness and scholars' technical report publication are positively related in hard areas but negatively related in soft areas ($F = 4.32$, $df = 1/473$, $p < .01$).

Two other significant interactions are appropriately presented here. The social con-

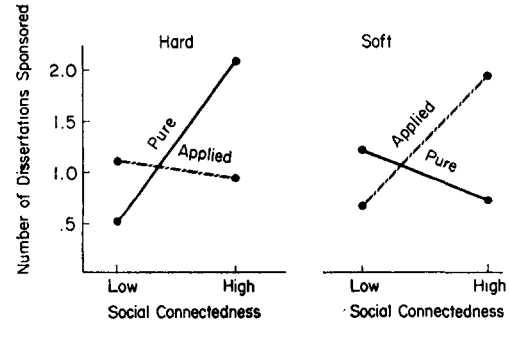

FIG. 2. Interaction among social connectedness, the hard–soft factor, and the pure–applied factor on number of dissertations sponsored.

nectedness, hard–soft, and pure–applied factors significantly interacted in their relationship to the number of dissertations that the scholars in our sample sponsored ($F = 13.91$, $df = 1/473$, $p < .01$). Figure 2 illustrates this interaction. Positive relationships between connectedness and dissertations sponsored occurred in hard, pure areas such as physics and physiology and in soft, applied areas such as education and finance. An almost identical interaction occurred for the quality of graduate students' first jobs ($F = 7.17$, $df = 1/473$, $p < .01$). Job quality is positively related to social connectedness in hard, pure areas and in soft, applied areas; job quality and connectedness are unrelated in the remaining areas.

Pure versus Applied Areas

Social connectedness. Pure and applied areas differ significantly on one of three measures of teaching connectedness and two of four measures of research connectedness. Scholars in applied areas like to work with significantly more people on teaching than do scholars in pure areas ($\bar{X}_A = 1.30$, $\bar{X}_P = .93$, $F = 10.13$, $df = 1/584$, $p < .01$). Similarly, applied area scholars like to work with more people on research than do those in pure areas ($\bar{X}_A = 1.88$, $\bar{X}_P = 1.41$, $F = 9.98$, $df = 1/584$, $p < .01$). And they report more sources of influence on their research goals than do the pure area scholars ($\bar{X}_A = 2.18$, $\bar{X}_P = 1.63$, $F = 37.47$, $df = 1/569$, $p < .01$). A significant interaction between the pure–applied and hard–soft factors was also found for number of sources of influence on research goals ($F = 14.44$, $df = 1/569$, $p < .01$). It showed that the difference between pure and applied areas on this variable is larger for hard areas (e.g., physics vs. engineering) than it is for soft areas (e.g., education vs. English).

Commitment. Scholars in pure areas like research activities more than do those in applied areas ($\bar{X}_A = 33.3$, $\bar{X}_P = 39.7$, $F = 11.02$, $df = 1/620$, $p < .01$). However, according to our results for time spent, pure area faculty do not actually spend more time on research. Applied area scholars like service activities more than do those in pure areas ($\bar{X}_A = 7.8$, $\bar{X}_P = 3.4$, $F = 33.81$, $df = 1/603$, $p < .01$) and actually spend more time on them ($\bar{X}_A = 4.4$, $\bar{X}_P = .26$, $F = 12.75$, $df = 1/603$, $p < .01$). A significant three-way interaction on preference for service shows that the main effect difference between pure and applied scholars' preference is primarily due to the high degree of liking for service that was reported by individuals in education (soft, applied, life system fields) and engineering (hard, applied, nonlife system fields) areas ($F = 15.49$, $df = 1/620$, $p < .01$). A similar result occurred for the amount of time actually devoted to service, but it was only significant at the .05 level.

Scholarly output. Pure and applied areas differ in the production of technical reports and the rated quality of their graduate students' first jobs. Applied area scholars publish more technical reports ($\bar{X}_A = .46$, $\bar{X}_P = .16$, $F = 6.64$, $df = 1/473$, $p < .01$), and the rated quality of graduate students' first jobs is higher in applied areas than it is in pure areas ($\bar{X}_A = 5.82$, $\bar{X}_P = 4.85$, $F = 10.30$, $df = 1/75$, $p < .01$).

The relationship between social connectedness and scholarly output. The relationship between social connectedness and rate of monograph publication differs, depending on whether the area is pure or applied ($F = 4.09$, $df = 1/473$, $p < .01$). In pure areas, connectedness is positively related to monograph publication, while in applied areas the scholars' social connectedness makes no difference. An interaction was found among the social connectedness, pure–applied, and life system factors in their relationship to the technical report publication of scholars. Social connectedness and technical report output are positively related in applied life system fields (education, agriculture), negatively related in pure life system areas (life and social sciences), and unrelated in other areas ($F = 4.25$, $df = 1/473$, $p < .01$).

Life System versus Nonlife System Areas

Social connectedness. Scholars in life system and nonlife system areas differ in the number of people with whom they like to work on teaching. Those in life system areas like to work with significantly more people ($\bar{X}_{LS} = 1.28$, $\bar{X}_{NL} = .94$, $F = 8.85$, $df = 1/584$, $p < .01$). Moreover, there is a significant three-way interaction for the effects of area

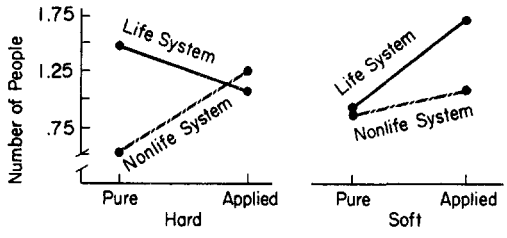

FIG. 3. Three-way interaction for number of people with whom respondent likes to work on teaching.

characteristics on the number of people with whom scholars like to work on teaching activities ($F = 12.43$, $df = 1/584$, $p < .01$). The interaction is illustrated in Figure 3. It appears due to the differences between life system and nonlife system areas in hard, pure areas and in soft, applied areas. In both sets of areas, scholars in life system areas (i.e., life sciences and education) report liking to work with more people on teaching than do their counterparts in nonlife system areas (physical sciences and humanities).

The life system factor is related to only one of the four measures of research connectedness. Scholars in life system areas report significantly more sources of influence on their research goals than do scholars in nonlife system areas ($\bar{X}_{LS} = 2.03$, $\bar{X}_{NL} = 1.79$, $F = 6.94$, $df = 1/569$, $p < .01$).

Commitment. Life system and nonlife system areas differ significantly on both measures of commitment to teaching, but they do not differ in commitment to any other scholarly activities. Scholars in life system areas indicate that they like teaching less than do scholars in nonlife areas ($\bar{X}_{LS} = 38.7$, $\bar{X}_{NL} = 47.6$, $F = 26.40$, $df = 1/620$, $p < .01$). And, the life system scholars actually spend less time on teaching ($\bar{X}_{LS} = 20.2$, $\bar{X}_{NL} = 26.3$, $F = 21.50$, $df = 1/603$, $p < .01$) than their nonlife counterparts. A significant interaction ($F = 9.96$, $df = 1/603$, $p < .01$) among all three area factors showed that time spent on teaching is particularly small in agricultural areas (hard, applied life system areas).

Scholarly output. Life system areas did not differ significantly from nonlife system areas on any of our measures of scholarly output.

Relationships between social connectedness and scholarly output. Significant interactions occurred between social connectedness and the life system factor as they are related to the number of dissertations sponsored ($F = 6.91$, $df = 1/473$, $p < .01$) and the quality of graduate students' first jobs ($F = 8.57$, $df = 1/473$, $p < .01$). Social connectedness is positively related to both of these output measures in areas that do not involve life systems, but is not related to them in life system areas.

DISCUSSION

The Existence of a Paradigm

The term "paradigm" refers to a body of theory that is subscribed to by all members of a field (Kuhn, 1962). The paradigm serves important organizing functions; it provides a consistent account of most of the phenomena of interest in the area and, at the same time, defines problems which require further study. Fields that have a single paradigm are characterized by greater consensus about appropriate content and method than are nonparadigmatic fields.

The present study suggests that a paradigm also permits structural and output features to develop that are not possible in nonparadigmatic areas. The paradigm permits greater social connectedness among scholars, particularly on their research. The common framework of content and method which it provides for the members of the field means that their attempts to work together will not be hindered by differences in orientation. In nonparadigmatic fields, on the other hand, scholars must work out a common definition of problems and method of approach before they can begin to work together. Our findings concerning social connectedness are that output relationships suggest that the paradigm may even *require* social connectedness in a way not true of soft or nonparadigmatic areas. Social connectedness is related more positively to both journal article and technical report publication in hard areas than it is in soft areas. Menzel's (1962) studies of physical sciences suggest that colleagues of the hard area scholar enhance his productivity by providing him with important technical information relevant to work on the paradigm. Connectedness may also be more highly related to scholarly output in paradigmatic areas because the paradigm permits research problems to be efficiently

broken into subproblems with confidence that the results for each part can be reintegrated.

The paradigm also appears to permit a more abbreviated form of scholarly communication. Compared to scholars in soft or nonparadigmatic areas, those in hard or paradigmatic areas publish fewer monographs and more journal articles. In paradigmatic areas, it is not necessary to provide detailed descriptions of the content and method that underlie a piece of research; these are understood by anyone familiar with the paradigm. In this case, journal articles, with their restrictions on length, provide an appropriate means of communication. In the soft areas, where paradigms are not characteristic, the scholar must describe and justify the assumptions on which his work is based, delimit his method or approach to the problem, and establish criteria for evaluating his own response to the problem. Such an undertaking requires a monograph-length work.

The paradigm may also account for the differences between hard and soft areas in commitment to teaching and research. The greater commitment of hard area scholars to research may be because important graduate training takes place in the research setting. As Kuhn (1962) suggests, budding scholars must be socialized to the regnant paradigm. One way for this to occur is for the graduate student in a hard area to work with a faculty member on his research. In nonparadigmatic areas, research is more independent and idiosyncratic (cf. the smaller social connectedness on research in soft areas). Thus, the faculty member will have less need for graduate research assistants, and at the same time, the graduate student will probably profit more from independent study than he will from working under a faculty member.

Concern with Application

Concern with application apparently requires a number of things of the individuals in a department. These include commitment to service activities, publication of technical reports, and a generally more socially connected collegial structure. The applied area scholar indicates a greater liking for service activities and actually spends more time on them. Perhaps as a compensation for this commitment, scholars in applied areas report less liking for research activities than do their colleagues in pure areas. The service function of applied areas is also evident in the finding that scholars in applied areas publish more technical reports than their pure area colleagues. Presumably, technical reports provide an ideal format for communicating detailed research results to the groups and individuals who are serviced by applied areas.

Emphasis on the practical value of the scholar's work apparently leads him to rely on the evaluation of others. Compared with scholars in pure areas, those in applied areas report liking to work with more people on both research and teaching activities. And, applied area scholars report that their research goals are influenced by more sources. Examination of questionnaire responses indicated that many of these sources are outside agencies. This is particularly true in agricultural and engineering areas.

At least for some applied areas, it appears that the scholar's social connections to outside agencies increase the likelihood of his producing technical reports. Thus, in applied areas such as education and agriculture, social connectedness is related positively to the rate of technical report publication. In such pure areas as life and social sciences, these variables are related negatively, and in all remaining areas they are unrelated. One reason for these findings could be that when scholars in education and agriculture areas are high on our social connectedness measure, it is because they are connected to outside agencies which also encourage the scholars to write technical reports. In the social and life sciences, however, the scholar who scores high in social connectedness is probably connected to his colleagues. Such contacts would detract from, rather than enhance, his or her production of consumer-oriented technical reports.

Concern with Life Systems

The most distinctive characteristics of life system areas involve their graduate training. In many life system areas, this function appears to be performed by faculty members acting as a committee of the whole. Scholars in these areas report liking to work with more people on teaching activities. In nonlife areas,

the social connectedness of scholars is related positively to the number of dissertations they sponsor and the quality of their graduate students' first jobs. This is most likely because the scholars' connections help him find good jobs for students and this enhances his attractiveness as a sponsor of dissertations. However, in life system areas, social connectedness is not related to the sponsoring of dissertations or to first-job quality. Anecdotal evidence indicates that in many of these departments, the graduate student's work is periodically reviewed by a committee of faculty members. Moreover, job placement tends to be conducted by the central administration of the department. These factors would tend to diminish the importance of the social connections of the student's dissertation adviser.

In addition to these features, life system areas evidence less commitment to teaching activities. They like them less and spend less time on them than scholars in nonlife areas do. It may be that, like hard areas, life system areas train their graduate students in research settings. This is known to be the case for most life sciences at Illinois.

One characteristic of life system areas that does not involve graduate training is the influence on scholars' research goals. Individuals in life system areas are influenced by more people than are those in nonlife system areas. Examination of the questionnaires indicated that this is primarily a matter of the influence of outside agencies. It is possible that society has a more immediate and pressing concern for the products of research in these fields; fields such as education and life sciences are more directly relevant to the needs of large numbers of people. Hence, agencies outside the university attempt to shape directly the research being done in these fields.

Some Implications

The findings of this study have important implications for the conduct of research on universities and for our procedures and practices in evaluating university faculty members.

Research on universities. The present study suggests the inadvisability of at least two approaches to studying university organizations. One approach is to collect organizational data in a variety of fields and ignore area differences (Hill & French, 1967) in analyzing relationships among variables. This procedure is likely to mask different relationships in different areas. For example, for the data of the present study collapsed over area, we find a slight positive relationship between social connectedness and (*a*) rate of journal article publication ($F = 3.99$, $df = 1/473$, $p < .01$) and (*b*) number of dissertations sponsored ($F = 4.77$, $df = 1/473$, $p < .01$). But, as the results presented earlier show, the relationship between connectedness and these output variables may be significantly different, depending on the area. Thus, lumping together data from different areas may provide an inaccurate account of the organization of specific areas.

A second approach to organizational studies in universities is to restrict them to one or a few academic areas. This isn't bad in itself, but the findings presented here suggest that such studies will not be generalizable to dissimilar academic areas. For example, studies of collegial relations in the physical sciences indicate that social connectedness is high in these fields (Hagstrom, 1964) and that it enhances scholarly productivity (Menzel, 1962; Pelz & Andrews, 1966). The present study places distinct limits on the generality of these findings; it suggests that they hold also for engineering, agricultural, and life science areas, but not for such soft areas as education, humanities, and social sciences.

Evaluation of faculty members. The results of this study show that universitywide standards for the evaluation of faculty members will not be possible. To begin with, areas differ in their norms concerning commitment to teaching, research, and service. Hard areas evidence a greater commitment to research and a lesser commitment to teaching when compared with soft areas. Similarly, service is a distinctly more significant activity in applied areas than it is in pure areas. Thus, when we establish standards for evaluating the scholar's work, we shall first need to consider the relative importance of each of these scholarly activities in his or her area. Similar considerations arise when we examine the ways in which scholarly output is related to academic area. Hard area scholars publish more journal

articles and fewer monographs than do those in soft areas; applied area scholars publish more technical reports than do pure area scholars. In light of these findings it would be a mistake to give a journal article, monograph, or technical report the same weight when evaluating scholars in different areas. In sum, it appears that any attempt at universal standards for academia will impose a uniformity of activity and output which is inconsistent with the particular subject matter requirements of specific areas.

SUMMARY

The structure and output of university departments are related to three characteristics of academic subject matter. The existence of an agreed upon paradigm in an area provides a structured framework that appears to encourage certain forms of organization. Compared to nonparadigmatic areas, those with a paradigm evidence greater social connectedness on research activities, greater commitment to research, less commitment to teaching, the publication of more journal articles, and the publication of fewer monographs. Moreover, social connectedness is positively related to journal article and technical report publication in paradigmatic areas, but this is not true of other areas. The organization of applied areas is distinct from that in pure areas. Applied areas evidence a greater commitment to service activities, a higher rate of technical report publication, and a greater reliance on colleague's evaluations. In contrast to nonlife system areas, scholars in life system areas appear to function as a group in training their graduate students and evidence a generally smaller commitment to teaching activities. Moreover, the public's interest in life system research is suggested by the greater influence of outside agencies on the research goals of life system scholars.

These results point to the need to consider subject matter characteristics in studying academic organizations. They define limits on the extent to which studies in one area can be generalized to areas whose subject matter is different and indicate why studies of academic organizations should not lump together data that come from different areas. Finally, the study points to the need for evaluative standards that are appropriate to the particular activities and outputs of the academic area.

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