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PROJECT PERFORMANCE AND GROUP LONGEVITY:
AN INVESTIGATIVE LOOK AT SOME INTRAGROUP TRENDS

by
Ralph Katz

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ABSTRACT

The primary thrust of this paper deals with the ways in which employees' reactions to their work environments change over time. Generally, speaking, as employees pass from one phase in their work lives to the next, different concerns and issues are emphasized; and the particular perspectives that result produce different behavioral and attitudinal combinations within job settings. In particular, a three-transitional stage model of job longevity is discussed to illustrate the major kinds of concerns that seem to preoccupy and guide employees as they work at a given job position. Whether or not certain behavioral tendencies implied by this job longevity model actually materialize for any given individual is strongly dependent on the kinds of reinforcements and social/task supports encountered by the individual within his immediate project or work group. Thus, the group can either enhance or inhibit certain trends depending upon the average length of time the group members have worked together, or group longevity. Based on data collected from 50 R&D project groups, this paper argues that the performance and innovativeness of long-tenured R&D groups tends to deteriorate significantly with increasing group longevity when such groups tend to buffer and isolate themselves from certain key areas both within and outside the organization. These findings are then discussed in the more general terms of managing group processes over time.

Project Performance and Group Longevity: An Investigative Look at Some Intragroup Trends

Group and individual member activities do not occur all at once or at a single point in time; they transpire through time. One of the major problems in behavioral science research, in general, and in the study of groups and project teams, in particular, has been the general neglect of such temporal factors. Without an appreciation of the importance of time as a variable, the question of how a group is doing will receive an incomplete answer. What is needed, therefore, is a more temporally-based framework for analyzing and conceptualizing the different kinds of trends that are likely to take place within a group as its team membership ages. For example, how does the performance of a project group vary as a function of the length of time its members have been working together; and just as important, what specific factors seem to influence the direction of such performance tendencies?

The Influence of Job Longevity

Based on some recent research efforts, Katz (1980) has been working to develop a more general theory for describing how employees' perspectives unfold and change as they journey through their own discrete sequences of job situations. In particular, a three-transitional stage model of job longevity has been proposed to illustrate how certain kinds of concerns might change in importance

according to the actual length of time an employee has been working in a given job position. Generally speaking, each time an employee is assigned to a new job position within an organization, either as a recent recruit or through transfer or promotion, the individual enters a relatively brief but nevertheless important "socialization" period. With increasing familiarity about his or her new job environment, however, the employee soon passes from socialization into the "innovation" stage which, in turn, slowly shifts into a "stabilization" state as the individual gradually adapts to extensive job longevity, i.e., as the employee continues to work in the same overall job for an extended period of time. Figure 1 summarizes the sequential nature of these three stages by comparing the different kinds of issues that are most likely to influence employees as they cycle through their various job positions.

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 Insert Figure 1 About Here
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Underlying these kinds of changes is the basic idea that over time individuals try to organize their work environments in a manner that reduces the amount of stress they must face and which is also low in uncertainty (Weick, 1969; Katz, 1978; Pfeffer, 1980). According to this argument, employees strive to direct their activities toward a more workable and predictable level of certainty and clarity. In the process of adjusting to prolonged periods of job longevity and stability, therefore,

most employees have probably succeeded in building a work pattern that is familiar and comfortable -- a pattern in which routine and precedent play a relatively large part. They may have, as a result, become increasingly content or ensconced in their customary ways of doing things, their established routines and interactions, and their familiar sets of task activities and responses. Most likely, employees feel safe and comfortable in such stability for it keeps them feeling secure and confident in what they do yet requires little additional effort.

Job Longevity and External Vigilance

Given these kinds of developmental trends, one can easily argue that with increasing amounts of job longevity, employees may gradually become less receptive toward any change, innovation, or toward any piece of information threatening to disrupt significantly their comfortable and predictable work practices and patterns of behavior (Staw, 1977; Katz, 1980). One of the potential consequences of this kind of "status-quo" perspective is that in time employees may become increasingly insulated from outside sources of relevant information and important new ideas (Pelz & Andrews, 1966; Dubin, 1972). As individuals become more protective on their current work habits, interests, and problem-solving approaches, the extent to which they are willing to expose themselves to new or alternative ideas, suggestions, solution strategies, and constructive criticisms may become progressively less and less.

Rather than becoming more vigilant towards their external work environments, they may become increasingly complacent about outside events and new technological developments.

Furthermore, one must also realize that under these kinds of circumstances, any external or environmental information that does, in fact, become processed by such individuals might also not be viewed in the most open and unbiased fashion. Janis and Mann (1977), for example, discuss at great length the many kinds of cognitive defenses and distortions commonly used by individuals in processing outside information in order to support, maintain, or protect particular decisional policies and strategies. In short, as employees adapt to long-term job longevity and stability, the desire to seek out and actively internalize new knowledge and new developments may become very slim indeed.

The Influence of Groups

The degree to which this kind of stability and insulation actually materializes for any given individual depends, of course, on the overall situational context. Individuals' perceptions and responses do not take place in a social vacuum but evolve through successive encounters with their work environments (Crozier, 1964; Katz and Van Maanen, 1977; Salancik and Pfeffer, 1978). Much of an employee's reactions tend to develop over time as he or she continues to interact with various aspects of their job and organi-

zational surroundings. Thus, one must carefully consider the situational context in which task assignments are being carried out in order to understand more fully how individuals define and interpret their work experiences and to gain a more complete picture of individual behavior.

In any job setting, one of the more important elements affecting individual perspectives is the nature of the particular group or project team in which one is a contributing member (Schein, 1978; Katz and Kahn, 1978). And ever since the well-known Western Electric Studies (Cass and Zimmer, 1975), much of our research in the social sciences has been directed toward learning just how powerful group associations can be in influencing individual member behaviors, motivations, and attitudes (Asch, 1956; Shaw, 1971; Hackman, 1976). The impact of groups on individual responses is substantial, if not pervasive, simply because groups mediate most of the stimuli to which their individual members are subjected while fulfilling their everyday task and organizational requirements. Accordingly, whether an individual experiencing long-term job longevity eventually enters the stabilization period and becomes increasingly isolated from new ideas, methods, and outside developments may strongly depend on the particular reinforcements, pressures, and behavioral norms encountered within one's immediate project or work group (Katz, 1965; Likert, 1967; Weick, 1969).

Generally speaking, as members of a project group continue to work together over an extended period of time and gain experience

with one another, their pattern of activities are likely to become more stable with individual role assignments becoming more well-defined and resistant to change (Bales, 1955; Porter, Lawler, and Hackman, 1975). Insulation from external sources of information and influence, then, may be more a function of the average length of time the group members have worked together, i.e., group longevity, rather than varying according to the particular job longevity of any single individual. Thus, a project group might either exacerbate or ameliorate the insulation of individuals from outside developments and expertise just as previous studies (see Seashore, 1954 and Stoner, 1968, for example) have shown how groups can enforce or amplify certain standards and norms of individual behavior.

Despite this possibility, organizational areas must be able to collect and process information from outside sources in order to keep informed about relevant external developments and new technological advances (Thompson, 1967; Katz and Kahn, 1978). The importance of gathering and disseminating information from external domains is accentuated in R&D project groups given their dependence on external information and new technological developments as well as their need for effective coordination with other organizational areas, including marketing and manufacturing (Achilladeles, Jervis, and Robertson, 1971; Utterback, 1974). Furthermore, the works of Allen (1977), Menzel (1966), and others have demonstrated rather convincingly that oral communications, rather than technical reports, publications, or other formal

written media, are the primary means used by technologists to collect and transfer outside information and important new ideas into their project groups.

Given the strategic importance of oral communications in organizations, in general, and in R&D project groups, in particular, it is imperative that we begin to examine explicitly the effects of any variable purporting to influence the linkages between a project group and its external technological and work environments. Specifically, the present research investigates the influence of group longevity on the amount of interaction between project groups and their various outside sources of information and new ideas. As the team "ages" and becomes more stable, will its individual members begin to ignore and isolate themselves from external areas of information and influence; essentially by communicating less frequently with colleagues and peers outside their project team? In addition, if there is the tendency for project groups to separate themselves from outside sources of technology and information with increasing group longevity, then to what extent is such external insulation paralleled by increasing levels of internal group interaction and cohesiveness; that is, substituting internal expertise and wisdom for externally-derived ideas, possibilities, and suggestions.

Group Longevity and Project Performance

Insulation from external technical ideas and influences can, of

course, be very serious in its consequences, perhaps even fatal. Much depends, however, on the nature of the team's work and how its insulation (or conversely how its contact with outside domains) actually comes about. Project groups working on fairly routine, simple tasks in a relatively stable technological environment, for example, may not necessarily suffer as a result of less external vigilance for internal expertise and experience may be sufficient. As project groups function in a more rapidly changing technological environment and work on more complex tasks requiring greater levels of creativity and innovativeness, the effects of external isolation are likely to be significantly more dysfunctional. In general, extant research has consistently shown that the technical performance of R&D project groups is strongly associated with outside contact (e.g., Allen, 1977; Hagstrom, 1965; Shilling and Bernard, 1964), although the particular method by which R&D groups can effectively draw upon external technological developments and information can significantly differ (Katz and Tushman, 1980; Allen, Tushman, and Lee, 1979).

Nevertheless, given the critical importance of outside communication and the possible impact of group longevity on the amount of such outside interaction, it is likely that the technical performance of project groups will also vary with group longevity or average group tenure. In fact, three previous studies have shown supporting evidence for this belief. Shepard (1956) was the first to relate the mean tenure of group members to performance. For the

small number of R&D groups in his sample, he found that performance increased up to about 16 months average tenure, but thereafter decayed. In another study, Pelz and Andrews (1966) uncovered a similar curvilinear relation between mean group tenure and performance -- the "optimum" group longevity mix occurring at around the four or five year mark. Finally, Smith (1970) was also able to replicate this finding when he showed performance peaking at a mean tenure of three to four years from a study of 49 R&D groups in an oil firm.

By itself, the idea that R&D project performance may tend to deteriorate with increasing levels of mean project tenure raises more questions than it answers. In particular, why were the performances of the longer-tenured project groups significantly lower on the average? Are they simply staffed by larger numbers of less able or less motivated engineering professionals, for example, or are there important behavioral variations in how project members actually conduct their day-to-day activities that can help to account for these significant performance differences?

The present study investigates once again the relationship between group longevity and the overall technical performance of R&D project groups. But this time, the research will focus on clearly defined project teams, direct rather than individually aggregated measures of project performance; and most important, it will try to explain any uncovered performance variations in terms of changing amounts of outside project communication. Thus, if project performance is found to vary curvilinearly with

group longevity, then it is hypothesized that technical communications to sources outside the project team will follow a pattern similar to that of project performance. On the other hand, as the project team isolates itself from external areas over time, technical communications within the project itself will increase -- at least until some saturation point is reached.

METHODOLOGY

Research Setting

This study was carried out at the R&D facility of a large American Corporation. Geographically isolated from the rest of the organization, the facility employed a total of 345 engineering and scientific professionals, all of whom participated in our study. The laboratory's professionals were organized into seven departmental labs (or groups) which, in turn, were organized into 61 separate projects or work areas. These project groupings remained stable over the course of the study, and each professional was a member of only one project team. Complete data was successfully obtained on a total of 50 project groups.

Technical Communication

To measure actual communications, each professional was asked to keep track (on specially prepared lists) of all other professionals with whom he or she had work-related, oral communication on a given sampling day. These sociometric data were collected on a randomly chosen day each week for 15 weeks. The sampling of days was constrained to allow for equal numbers of weekdays. Respondents were asked to report all oral, work-related contacts both within and outside the laboratory's facility (including whom they talked to and how many times they talked with that person during the day.)

They were instructed not to report contacts that were strictly social, nor did they report written communications.

These research procedures are similar to those used in other sociometric communication studies, including Allen and Cohen (1969) and Whitley and Frost (1973). During the 15 weeks, the overall response rate was 93 percent. Moreover, 68 percent of all reported communication episodes within the laboratory were reciprocally mentioned by both parties. Given these high rates of response and mutual agreement (see Weiss and Jacobson, 1960 for comparative data), these methods provide a relatively accurate log of the verbal interactions of all professionals within this laboratory.

Project communication is a measure of the average amount of technical communication per person per project over the fifteen weeks. As discussed by Katz and Tushman (1979), six mutually exclusive communication measures were operationalized for each project group as follows:

1. Intraproject: The amount of communication reported among all project team members.
2. Departmental: The amount of communication reported between the project's members and other R&D professionals within the same functional department.
3. Laboratory: The amount of communication reported between the project's members and R&D professionals outside their functional department but within the R&D facility.
4. Organizational: The amount of communication reported by the project's members with other individuals outside the R&D facility but within other corporate divisions such as marketing and manufacturing.

5. Professional: The amount of communication reported by project members with external professionals outside the parent organization including universities, consulting firms, and professional societies.
6. Operational: The amount of communication reported by project members with external operational areas including vendors and suppliers.

Communication measures to these six independent domains were calculated by summing the relevant number of interactions reported during the 15 weeks with appropriate averaging for the number of project team members, see Katz and Tushman (1979) for details. Though the overall response rate was extremely high, the raw communications data for incomplete respondents were proportionately adjusted by the number of missing weeks.

Project Performance

Since comparable measures of project performance have yet to be developed across different technologies, a subjective measure, similar to that used by Lawrence and Lorsch (1967), was employed. Each Department Manager (N = 7) and Laboratory Director (N = 2) was separately interviewed and asked to evaluate the overall technical performance of all projects with which he was technically familiar. They were asked to make their informed judgements based on their knowledge of and experience with the various projects. If they could not make an informed judgement for a particular project, they were asked not to rate the project. Criteria the managers considered (but were not limited to) included: schedule, budget,

and cost performance; innovativeness; adaptability; and the ability to cooperate with other parts of the organization. Each project was independently rated by an average of 4.7 managers on a seven-point scale (from very low to very high). As the performance ratings across the nine judges were highly intercorrelated (Spearman-Brown reliability = .81), individual ratings were averaged to yield overall project performance scores.

Project Task Characteristics

In R&D settings, tasks can differ along several dimensions, including time span of feedback, specific vs. general problem-solving orientation, and generation of new knowledge vs. utilization of existing knowledge and experience (Rosenbloom and Wolek, 1970). Based on these dimensions, the following task categories were developed with the help of the laboratory's management.

- a. Basic Research: Work of a general nature intended to apply to a broad range of applications or to the development of new knowledge about an area.
- b. Applied Research: Work involving basic knowledge for the solution of a particular problem. The creation and evaluation of new concepts or components but not development for operational use.
- c. Development: The combination of existing feasible concepts, perhaps with new knowledge, to provide a distinctly new product or process. The application of known facts and theory to solve a particular problem through exploratory study, design, and testing of new components or systems.
- d. Technical Service: Cost/performance improvement to existing products, processes, or systems. Recombination, modification and testing for systems using existing knowledge. Opening new markets for existing products.

Using these definitions, respondents were asked to select the category which best characterized the objectives of their project and to indicate, on a three-point scale, how completely the project's objectives were represented by the selected category. The twelve possible answers were scored along a single scale ranging from completely basic research to completely technical service. As in Pelz and Andrews (1966), respondents were also asked to indicate what percentage of their project's work fell into each of the four categories. A weighted average of the percentages was calculated for each respondent. The scored responses to these two questions were then averaged (Spearman-Brown reliability = .91).

By pooling individual members' responses to obtain project scores, we could easily identify a project as being predominantly either: (1) Research (a combination of basic and applied research categories); (2) Development; or (3) Technical Service. As discussed in Katz and Tushman (1979), analysis of variance was used to ensure the appropriateness of combining individual perceptions of their activities for the aggregate categorization of each particular project group.

Tenure and Demographic Data

During the course of the study, demographic data was also collected from the laboratory's professionals, including their age, educational degrees, and an estimate of the number of years and months that they had been associated with their specific project group, with their functional Department, and with the overall laboratory facility.

RESULTS

Project Performance

The 50 projects have mean group tenures ranging from several months to almost 13 years with an overall sample mean of 3.41 years and a standard deviation of 2.67 years. The mean rating of project performance, as provided by the evaluators, ranged from a low of 3.0 to a high of 6.4. Mean performance for the overall sample of 50 projects is 4.59.

When project performance was plotted as a function of the mean project tenure of team members, there is some indication that performance was highest in the 2 to 4-year interval, with lower performance scores both before and after.

To get a better idea of whether any distinct pattern might emerge from the relationship between group longevity and project performance, the original data were subjected to a smoothing technique, using a simple, moving average procedure (see Anderson, 1971, $Us = 10$). The resultant calculations, plotted in Figure 2, illustrate very clearly that performance was highest for projects with a mean group tenure of between two and four years. More interestingly, these smoothed data points also suggest the possibility that performance might

begin and continue to decline for projects whose members had averaged more than four years of work on their particular project assignments. Clearly, such a pattern of findings calls for additional analysis.

Insert Figure 2 About Here

To get a clearer picture of any significant differences in the distribution of actual project performance scores as a function of group longevity, the fifty groups were divided into a number of different mean group tenure categories. Based on the smoothed pattern from Figure 2, there seemed to be at least 3 different tenure periods represented within the data: (1) 0.0 to 1.5 years; (2) 1.5 to 4.9 years; and (3) 5 or more years. For additional exploratory purposes, the 30 project groups falling within the middle tenure range were subdivided further into 3 equal categories, as shown in Table 1. The first 0.0 to 1.5-year interval corresponds to the initial learning or building phase previously depicted through the curvilinear performance findings of Shepard (1956), Pelz and Andrews (1966) and Smith (1970). In a similar fashion, the last category of project groups, representing teams whose members have worked together for at least an average of 5 years, corresponds to the low performance interval revealed by these previously cited studies as well as to the time period commonly used to estimate the half-life of technical information (Dubin, 1972).

Insert Table 1 About Here

An examination of the average performance scores of projects within each of the five tenure categories of Table 1 clearly supports the curvilinear association between project performance and mean project tenure within this organization. On the average, performance was significantly lower for project groups whose group longevities were either less than 1.5 years or were more than 5 years. Contrastingly, performance was significantly higher across all three middle tenure categories.

Age of Team or Age of Individual?

Almost by definition, projects with higher mean tenure were also staffed by older engineers. This raises, of course, the possibility that the performance decay associated with high levels of group longevity had little to do with the team per se. It may have resulted, instead, from the increasing obsolescence of individuals as they aged. The correlation between project performance and the mean age of project team members was slightly negative ($r=-.18$) but far from significant statistically. Nevertheless, in the interval in which project performance decayed, that is, beyond a mean project tenure of 2.5 years (see Figure 2), there was a slightly stronger negative relation, though still not significant. For those 30 projects with a mean tenure of at least 2.5 years,

the correlation between performance and the mean age of project members was $-.28$; whereas, the corresponding relation between performance and the mean project tenure of project members was both negative and significant ($r=-.39$; $p<.05$). A third variable, mean organizational tenure of project members, was also correlated with these two aging type variables and, as a result, should be included in any comparative analysis.

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 Insert Table 2 About Here
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The partial correlations of Table 2 demonstrate more convincingly that it is tenure with the project team and not age or organizational tenure that is more likely to influence project performance. Neither individual age nor organizational tenure showed any negative association with performance when project tenure was controlled. In fact, organizational tenure correlated positively, albeit not significantly, with performance when project tenure was held constant. It may be that projects staffed by longer term employees fare somewhat better, provided these veteran employees are not retained on any single project team for too long a time.

Clearly, there are any number of strategies for reassigning or rotating individual engineers among project groups. All or nearly all of the team members could be replaced every several years, or members could be replaced individually at more frequent

intervals. Different strategies such as these will obviously result in markedly different distributions of project tenure among team members. In the organization under study, it is evident that many such strategies were pursued, resulting in a wide variety of distributions of project tenure.

Using the standard deviation of project tenure across team members as one measure of these distributions, we once again discovered a strong curvilinear relation between project performance and these variance measures. As shown by Figure 3, project performance was greatest when the standard deviation in project tenure was about three years. This was true for all 50 projects as well as for the relatively long-term project teams. In other words, it appears that project teams performed best when their team memberships had not been completely stable but instead there had been some frequency in the turnover of team personnel. On the other hand, when project member tenures were too widely dispersed, performance was also found to be low. Such findings suggest that project groups must balance their needs for gradual turnover with reasonable amounts of team stability. Periodic turnover of personnel may help to keep a team alert and vigilant, but constantly changing membership may also detract from performance.

Insert Figure 3 About Here

Project Communication

Having established a strong connection between group longevity and the overall technical performance of the 50 R&D project teams within the current site, we can now proceed to investigate factors which might be inhibiting or facilitating group performance as team membership ages. It was previously hypothesized that if performance was found to vary with mean project tenure, then technical communication to sources outside the project team would follow a similar pattern. More specifically, part of the contributing reasons for any decline in project performance with increasingly high levels of group longevity might be connected with relatively lower levels of outside communication. Members of such project groups would essentially be paying less and less attention to external sources of ideas and information, relying more and more on their own levels of expertise and wisdom.

In order to examine these effects empirically, we tested for significant differences in the actual communication patterns of the sample's project groups to each of the six communication domains (see Methodology section) as a function of group longevity. Significant variations were discovered in 3 of the communication domains: intraproject, organizational, and external professional. Communications to each of the other 3 areas revealed no strong differences across project teams across the 5 tenure categories.

Insert Table 3 About Here

Table 3 shows the significant variations in actual communication to the 3 different areas across the 5 categories of group longevity. In support of our hypothesis, contacts outside the R&D facility varied curvilinearly with group longevity in a pattern congruent to that of project performance. Specifically, contacts with other organizational divisions and with external technical professionals increased in the initial range of mean group tenure, but such contacts were significantly lower as project group membership became more stable. There may be, as a result, some tendency within this facility for project groups to become more isolated from outside sources of information and influence as the mean tenure of project team members increases to a relatively high level.

What is somewhat surprising from Table 3 is the additional strong curvilinear association between mean project tenure and intraproject communication. We had previously posited that with increasing tenure and declining outside communications, team members would gradually become more cohesive, most likely resulting in more rather than less intraproject communication. If project groups become insulated in such a way that their members discussed less of their technical matters outside their groups, then one might expect such groups to show an increased tendency to rely on their own internal capabilities and judgements. The results from Table 3, however, indicate that members of high tenured project groups not only had fewer contacts with other organizational divisions

and with external professionals but also had fewer interactions amongst themselves. To illustrate all of these results more clearly, Figure 4 displays together the communication and project performance scores as a function of group longevity.

Insert Figure 4 About Here

Given these lower levels of intraproject, organizational, and external professional communication, the next important question is whether such differences can account for the comparatively lower performance ratings of their project groups. To accomplish this meaningfully, one must first be clear that project communications to these different areas are key contributors or facilitators of project performance. Previous research has shown that this may not be the case. More specifically, Allen (1977) and Katz and Tushman (1980) have demonstrated that different categories of project tasks require significantly different patterns of communication for more effective technical performance.

By categorizing R&D project groups into research, development, or technical service kinds of activities (see methodology for specific definitions), numerous studies have consistently shown that development project performance is not positively associated with technical communications outside the organization; if anything, they have been found at times to be inversely related (see Allen, 1977 for a recent review of these studies). In

contrast, the overall performances of both research and technical service kinds of project groups have been positively connected with levels of external professional communication.

In a similar fashion, intraproject communication has been shown to be more importantly related to the performance of research project groups than to the performance of development type projects (Farris, 1972; Allen, 1970). Development projects, on the other hand, were found to be higher performing when they maintained high levels of communication with individuals from other organizational divisions, especially their clients within manufacturing and marketing (Katz and Tushman, 1979).

Given these significant variations in communication effectiveness, one cannot accurately investigate the impact of communications on the upward and downward slopes of the performance-tenure relationships for all project groups combined. One must separately test, instead, for the explanatory effects of communication in each of the three project groupings. Accordingly, for each task category, Table 4 examines the inverse part of the relationship between performance and mean project tenure after controlling for the effects of communication.¹

 Insert Table 4 About Here

¹An analysis of covariance test was not used to determine whether any of the communication measures were significant covariates in the overall performance-tenure relationship because of the small number of projects in many of the cells. Instead, partial correlations are used to examine independently the effects of communication on the initial positive slope and their later effects on the negative slope.

professionals. These findings, that is, the seemingly beneficial effects of intra-organizational communication coupled with the apparently neutral or perhaps dysfunctional effects of external communications, are completely consistent with current research evidence and thinking on effective technology transfer (Allen, 1977; Allen, Tushman, and Lee, 1979; Katz and Tushman, 1979). Parallel partial analyses for both research and technical service project groups could not be meaningfully performed because of insufficient sample sizes. Nevertheless, the analyses that we have been able to perform clearly suggest the important influence of technical communication in both increasing and decreasing overall project performance as team membership ages.

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Insert Table 5 About Here
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DISCUSSION

The thrust of these findings emphasize the important influence of group longevity on the behaviors of project team members. In examining the overall technical performances of the various project groups within a single R&D facility, a curvilinear relationship was uncovered between these performances and the mean project tenures. As in several previous studies, performance was found to increase steadily to a mean project tenure of about 2 years after which performance seemed to remain at a relatively high level. After the 4th year period of mean tenure, however, project performances were generally found to be lower. These differences in project performance at different stages of group longevity, moreover, were present independent of the actual age of project team members and independent of the particular project task areas. In particular, decays in the performance of long-tenured project teams were found for all categories of project groups, including research, development, and technical service.

Certainly it is possible that, on the average, the long-tenured project groups were staffed by relatively less technically competent or perhaps less motivated engineers, although the average job tenure of project supervisors from the 10 long-tenured groups did not significantly differ from the average job tenure of supervisors from the 30 projects within the middle range of group longevity. Nor were there any significant differences in overall educational

levels, technical reports written, or in the number of professionally sponsored journals read (at least on a self-report basis).

What is important to realize is that in addition to project performance, there were clear behavioral differences across the mean project tenure continuum, namely, project communications to certain key areas. More specifically, members of both short and long-tenured project groupings communicated less often amongst themselves, less often with individuals from other organizational divisions, and less often with external professionals from the larger R&D community. Since the discussion and transfer of technical information and new ideas, especially from outside sources, is an important component of effective project performance (Boorman, 1975; Allen, 1977), it seems reasonable to attribute, at least in part, the overall lower technical performance of the long-tenured project teams to such communication reductions.

It is also important to emphasize that it is not a reduction in project communication per se that can lead to a deterioration in overall performance. Indeed, some of the measures of project communication did not diminish with higher levels of mean project tenure. Rather a decline in performance is more likely to stem from a project group's tendency to insulate itself from sources that can provide more critical kinds of evaluation, information, and feedback. Since research, development, and technical service project groups differ significantly in the kinds of communication patterns that are necessary for effectively gathering and

processing technical information, project groups within each of these task categories are likely to suffer more, in terms of performance, when there is widespread isolation from its more critical communication areas. Thus, overall performance may suffer when research and technical service project members fail to pay sufficient attention to events and information within their external R&D community or when development project members fail to communicate sufficiently with their client groups from marketing and manufacturing.

This is not to say that external developments in technology are unimportant to development-type project groups. On the contrary, they are exceedingly important! What is implied by our findings is simply that the performances of development projects are not affected adversely by having all of their members communicate less often with external professionals. This occurs because development groups, unlike research or technical service projects, are more effectively linked with their external technical environments through specialized boundary spanning individuals labelled gatekeepers (Allen, 1977; Katz and Tushman, 1980) than through widespread, decentralized external interactions. As a result, the impact of project tenure on development project performance may be more sensitive to the emergence and use of technical gatekeepers than to its effect on the amount of external contacts conducted by all project members. Although this kind of study cannot be done with the present data base, it is interesting to note that of the 5 development groups with an average tenure of at least 5 years, none had a technical gatekeeper as part of their project membership. Indeed, it

would be extremely important to determine whether the performance of long-tenured development project teams would be maintained or even enhanced through the gatekeeping function!

Group Influence

What is also important to emphasize from this study is that how individuals eventually adapt to their long-term tenure on a given project can be greatly influenced by their project colleagues. In the current organizational facility, for example, there were no clear trends in any of the communication patterns of individual engineers when plotted as a function of job tenure. Only when the engineers were grouped according to their projects were there clear and obvious decreases in certain communication measures as a function to increasing levels of group longevity.

On a broader conceptual level, then, the behavioral patterns of the long-tenured project groups within this site support the idea that, over time, group members may come to share a more common set of beliefs about their work setting. Burke and Bennis (1961), for example, showed from their longitudinal research on groups that as members continued to interact, there was a strong tendency for them to increase their consensus with one another, essentially moving towards greater perceptual congruity. Thus, it is likely that as group members continue to work together over a long period of time, they will continue to reinforce their common views and commitments. Such shared beliefs not only provide a great deal of certainty and

reassurance to group members but they also become quite impervious to change.

In particular, the way engineering project groups come to view their external technological environments can be very critical. Given the relatively low levels of external professional communication for the long-tenured project groups, members may have reached some sort of consensus concerning the relevance and usefulness (or lack thereof) of outside technological developments. Project groups with increasingly stable memberships may have developed and strengthened their belief that they possess sufficient expertise and knowledge in their specialized areas of technology that it is not necessary to consider very seriously the possibility that outsiders might have produced important new ideas or information relevant to the accomplishment of their tasks. This perceptual outlook has come to be known in the R&D community as the "Not Invented Here" or NIH Syndrome. According to this stereotypical viewpoint, outside groups are so far behind that they could not possibly produce anything that might be very important.

Regardless of whether such an attitude is warranted, project groups holding this type of belief tend to bias adversely their views and evaluations of any seemingly competitive ideas, innovations, or products stemming from sources outside their own group. Moreover, the more insulated or remote a project group becomes from these outside sources, the less differentiated and more global such sources become in the eyes of project team members,

eventually coming to view them as one large homogeneous entity (Katz and Kahn, 1978).

The findings within the present site clearly lend support to this NIH Syndrome. Nevertheless, additional research from other facilities is needed to ascertain just how deterministic the current patterns are with respect to project performance, group longevity, and project communication. Different patterns, for example, might emerge with different kinds of organizational climates, different personnel and promotional policies, different economic, growth, or marketing conditions, and different organizational structures. Perhaps a facility organized around some type of matrix structure for example, might be able to maintain the effectiveness of long-tenured project groups provided their members remained strongly linked to their functional or technical specialty groups. In a general sense, then, we need to consider the different kinds of trends and changes that are likely to take place within a group as its team membership ages, and just as important, we need to uncover the kinds of tasks, structures, and practices that are likely to prove useful in keeping a project group innovative and high performing as its members continue to work together.

Intraproject Communication

The fact that intraproject communications were also significantly lower with higher levels of mean project tenure was somewhat surprising. It was expected that with decreases in external professional communi-

cations, project members would focus less on outside sources of technology and would come to rely more heavily on their own project colleagues for expertise and guidance, yielding greater cohesiveness and greater levels of intraproject communication. This did not turn out to be the case, however. One possible explanation for this reversal is that as members continue to work in their project groups for long periods of time, they become increasingly specialized in their specific technical areas and project assignments, resulting in greater role differentiation and less common interaction among project members (Porter, Lawler, and Hackman, 1975; Katz and Kahn, 1978). As pointed out by Bales (1955) many years ago, over time there is a strong tendency for groups to adapt to their work environments through (1) increased division of labor; (2) greater distribution of resources; (3) authority differences; and (4) status distinctions. As a result, role functions and expectations become clearer with increasing differentiation between leaders and followers, specialists and generalists, those who are competent in a certain problem area and those less so, etc., etc.

Essentially, this argument suggests that as project members build a history with one another, each member creates his or her own niche, gaining in security and assurance and reducing uncertainty. Gradually, their intellectual environments, their problem-solving approaches and strategies, and their knowledge of each other's capabilities and contributions become more bounded and stable. They come to know each other well, know what to expect from each other, and

consequently, there may be less need for talk and interaction among all project members. Over time, then, group members may tend to create differences among themselves, thereafter functioning in ways that regularize and stabilize these differences. And if members succeed in erecting such differentiated shells around themselves, their overall level of intragroup interaction may decline; thus, causing the group to lose access to much of its internal talent and reducing their ability to learn new ideas and innovative patterns from one another.

In this paper, we have been able to touch on only a few of the possible factors that might be important in seeking an answer to our originally posed question of how is the group doing. Yet, in a general sense, the challenge in managing and staffing project groups probably lies in the ability to maintain stability and continuity within the group yet retain sufficient flexibility to keep abreast of external developments in order to detect and internalize relevant changes and advancements. Thus, it is in the knowledge of how to organize and manage between adaptation and adaptability that we need to learn so much more.

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Job Longevity
Stages

Primary Areas
of Concern

Stage 1. SOCIALIZATION: Reality Construction⁺

- a) To build one's situational identity
- b) To decipher situational norms and identify acceptable, rewarded behaviors
- c) To build social relationships and become accepted by others
- d) To learn supervisory, peer, and subordinate expectations
- e) To prove oneself as an important, contributing member

Stage 2. INNOVATION: Influence, Achievement, and Participation

- a) To be assigned challenging work
- b) To enhance one's visibility and promotional potential
- c) To improve one's special skills and abilities
- d) To enlarge the scope of one's participation and contribution
- e) To influence one's organizational surroundings

Stage 3. STABILIZATION: Maintenance, Consolidation, and Protection

- a) To routinize one's task activities
- b) To preserve and safeguard one's task procedures and resources
- c) To protect one's autonomy
- d) To minimize one's vulnerability
- e) To cultivate and solidify one's social environment

⁺The listed items are not meant to be exhaustive; rather the intent to illustrate both the domain and the range of issues within each stage.

FIGURE 1. A Model of Job Longevity

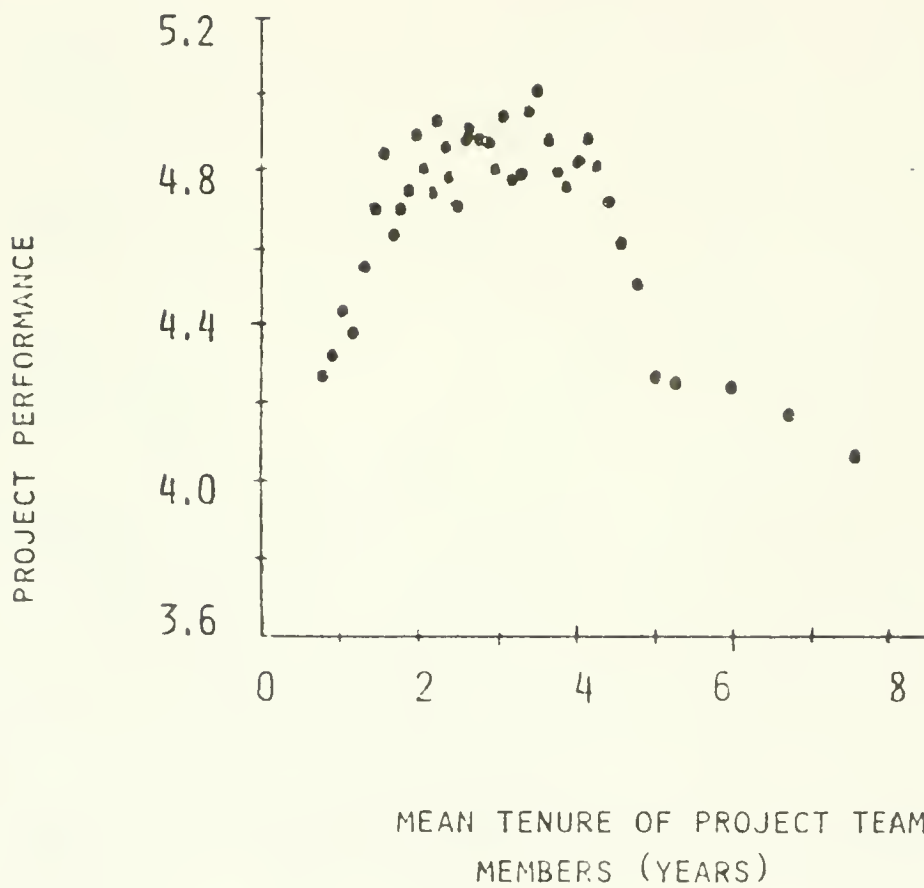


FIGURE 2 . PROJECT PERFORMANCE AS A FUNCTION OF THE MEAN TENURE OF PROJECT TEAM MEMBERS (SMOOTHED DATA)

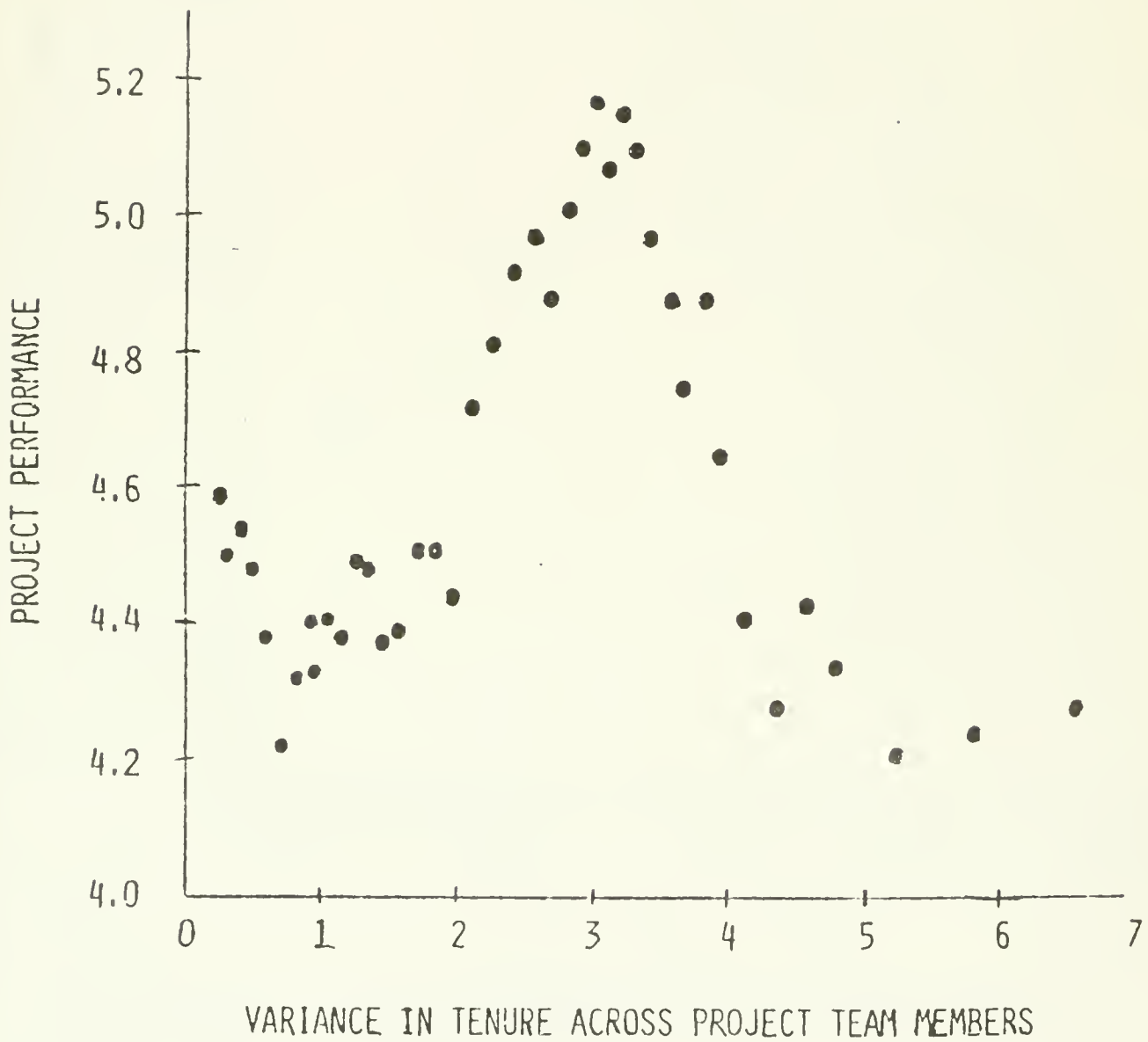


FIGURE 3. PROJECT PERFORMANCE AS A FUNCTION OF STANDARD DEVIATIONS (SMOOTHED DATA)

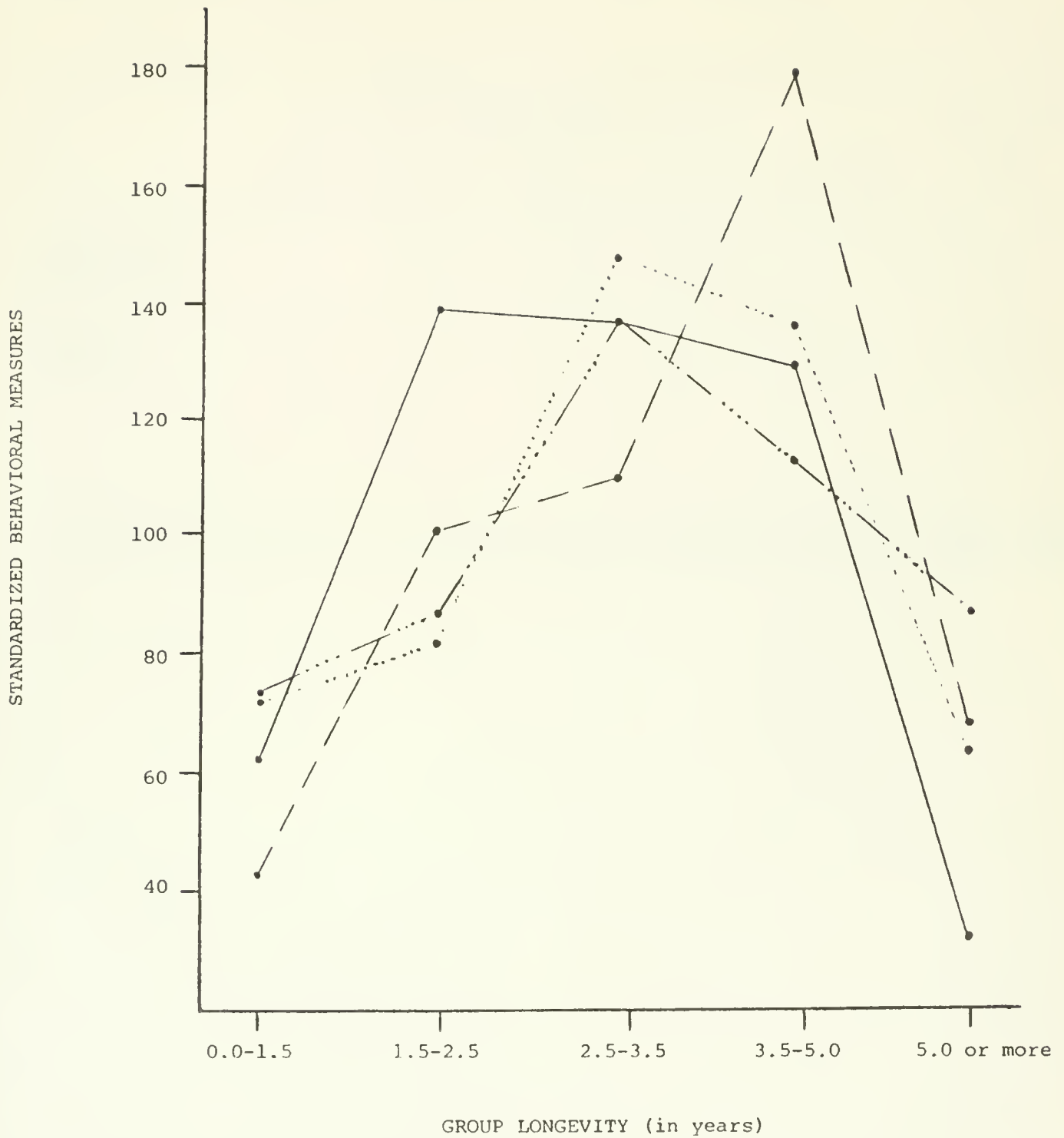


Figure 4. Standardized Performance and Communication Means
By Group Longevity

————— = Project Performance
 - - - - - = Intraproject Communication
 - · - · - = Organizational Communication
 ······ = External Professional Communication

TABLE 1. Project Performance as a Function of Group Longevity

	Categories of Group Longevity (in years)					All Project Groups
	0.0-1.5	1.5-2.5	2.5-3.5	3.5-5.0	5.0 or more	
Mean Project Performance**	4.29	4.89	4.87	4.82	4.07	4.59
Standard Deviations	0.99	0.67	0.70	0.59	0.52	0.76
No. of Projects	10	10	10	10	10	50

** Based on a 1-way ANOVA test, the mean project performance scores are significantly different across the five group longevity categories [$F(4,45)=2.89$; $p<.05$].

TABLE 2. Partial Correlations Between Project Performance and Various Aging Variables for Projects with Average Member Tenure of at Least 2.5 Years.

Aging Variables	Correlations with Project Performance	Partial Correlations	(Variables Controlled)
a) Mean project tenure of project members	-.39**	-.28* -.33**	(Mean age) (Mean organizational tenure)
b) Mean organizational tenure of project members	-.23	.20 -.05	(Mean project tenure) (Mean age)
c) Mean age of project members	-.28	-.08 -.19	(Mean project tenure) (Mean organizational tenure)

N=30; *p<.10;**p<.05

TABLE 3. Mean Communication Frequencies as a Function of Group Longevity

Areas of Communication	Categories of Group Longevity (in years)					All Project Groups
	0.0-1.5	1.5-2.5	2.5-3.5	3.5-5.0	5.0 or more	
Mean Intraproject Communications**	42.0	101.0	110.0	180.0	69.0	100.0
Mean Organizational Communications* (per person per month)	17.5	20.3	30.0	25.6	20.4	22.8
Mean External Professional Communications* (per person per month)	0.81	0.98	2.04	1.83	0.69	1.27
No. of Projects	10	10	10	10	10	50

A 1-way ANOVA test was used to test for significant mean difference across the five group longevity categories (* $p < .10$; ** $p < .05$)

Note 1. Because intraproject communication frequencies had to be adjusted for the number of possible interactions (see Katz and Tushman, 1979), intraproject communication scores can not be linked to an absolute scale. To show relative intraproject differences across the various categories, however, the intraproject measures have been standardized to an overall sample mean of one hundred.

TABLE 4. Partial Correlations Between Mean Project Tenure and Project Performance for Projects with Mean Tenure of at Least 2.5 Years.

Project Type	Correlation of Performance with Mean Project Tenure	Partial Correlation of Performance with Mean Project Tenure	(Communication Variables Controlled)
Research: (N=6)	-.62*	I	
Development: (N=12)	-.39*	-.46* -.20 -.42*	(Intraproject) (Organizational) (Professional)
Technical Service: (N=12)	-.44*	-.20 -.45* -.36	(Intraproject) (Organizational) (Professional)

* $p < .10$; ** $p < .05$

I = Insufficient number of research projects for partial analyses.

TABLE 5. Partial Correlations Between Mean Project Tenure and Project Performance for Projects with Mean Tenure of Less Than 2.5 Years.

Project Type	Correlation of Performance with Mean Project Tenure	Partial Correlation of Performance with Mean Project Tenure	(Communication Variable Controlled)
Research: (N=6)	.19	I	
Development: (N=9)	.57**	.28 .32 .70**	(Intraproject) (Organizational) (Professional)
Technical Service: (N=5)	.64*	I	

* $p < .10$; ** $p < .05$

I = Insufficient number of projects for partial analyses.

