Investigating the Not Invented Here (NIH) syndrome: A look at the performance, tenure, and communication patterns of 50 R & D Project Groups

By Ralph Katz and Thomas J. Allen
Sloan School of Management M.I.T. Cambridge, USA

Abstract: The Not-Invented-Here (NIH) syndrome is defined as the tendency of a project group of stable composition to believe it possesses a monopoly of knowledge of its field, which leads it to reject new ideas from outsiders to the likely detriment of its performance. The authors have carried out an empirical test of the extent to which the rate of communication between a project group and the outside world decreases with mean project tenure and how far performance decreases with project tenure.

The study, carried out in a large laboratory, shows that performance increases up to 1.5 years tenure, stays steady for a time but by five years has declined noticeably. This tendency is best accounted for by the marked decline in communication rate among group members and between them and critical external sources of information. The authors analyse the significance of this finding and suggest means of maintaining the vitality of long-standing project teams.

Engineers have long recognized the problems facing a technical group should its membership remain constant too long. General folklore among R & D professionals holds that a group of engineers whose membership has been relatively stable for several years may begin to believe that it possesses a monopoly on knowledge in its area of specialization. Such a group therefore does not consider very seriously the possibility that outsiders might produce important new ideas or information relevant to the group. This has come to be known in the R & D community as the "Not Invented Here" or "NIH" syndrome.

NIH AND INCREASING PROJECT INSULATION

According to the NIH syndrome, then, stable project teams become increasingly cohesive over time and begin to separate themselves from external sources of technical information and influence by communicating less frequently with professional colleagues outside their teams. Rather than striving to enlarge the scope of their information processing activities, long-tenured groups become increasingly complacent about outside events and new technological developments. The extent to which they may be willing or even feel they need to expose themselves to new or alternative ideas, suggestions, and solutions lessens with time.

In spite of this belief, the fact remains that groups, including those of long standing membership, must still collect and process information from outside sources in order to keep current technically. Project members rarely have all the required knowledge and expertise to complete their tasks successfully; information and assistance must be drawn from many sources outside the project. Moreover, research findings by Allen (1977), Menzel (1965), and many others have consistently shown that personal contacts, rather than written technical reports or publications, are the primary means by which engineering professionals acquire important technical ideas and information from outside sources. In testing for the NIH syndrome, therefore, it is hypothesized that project groups whose members have been working together over a long period of time (i.e., project teams whose members are averaging high levels of group or project tenure) will have significantly less communication with other professionals both within and outside the organization.

NIH AND DECREASING PROJECT PERFORMANCE

If project communication with internal and external colleagues diminishes significantly as mean group tenure increases, and if such communications are essential to technical performance, then one should also expect a strong inverse relationship between group tenure and project performance. Several studies, in fact, have presented evidence to support such an association. Shepard (1956) was the first to relate performance to mean group tenure as measured by averaging the lengths of time individual members had been working within the group. He found that performance increased up to about 16 months average tenure, but that performance gradually decayed with increasingly higher levels of group stability. Pelz and Andrews (1976) uncovered a similar curvilinear connection between mean tenure and performance. In their study, however, the "optimum" group tenure seemed to fall at about the four year mark. Smith (1970) also showed R & D group performance peaking at a mean tenure of about three to four years.

The present study investigates once again the association between mean tenure and technical performance of R & D groups. This time, however, the research will focus on clearly defined project teams. It is not clear in the previous research studies whether "groups" are project teams or whether they are functional, disciplinary, or specialty-based groups. It is presumed that there was a mix of both types in each of the three previous studies. The reason for our project focus is a practical one. It is expected that results could differ considerably for project as opposed to functional or disciplinary groups. The project team with its more intense focus on a specific product or problem could be expected to obsolesce more rapidly than a functional group (Marquis and Straight, 1965). In the latter case, the fact that members are normally all working within a single discipline or technical specialty can help group members keep in closer touch with developments within that particular specialty. Contrastingly, members of project teams tend to become over time more narrow and more highly specialized in the technical problem areas associated with their specific project assignments. In this process, they are drawn away from and begin to lose touch with the more recent developments within their technical specialties.

In addition to this distinction, our study will also examine the explanatory part of the NIH syndrome. Communication by project teams is expected to decline significantly with mean group tenure. As a result, one should be able to account for the decline in performance, with increasing mean tenure, through the intervening variable, communication.

Accordingly, the following hypotheses will be tested:

1. The relationship between the mean tenure of project members and the project's overall technical performance will be curvilinear with performance reaching its highest levels between a mean project tenure of two to four years and decaying thereafter.

1A. As a corollary to the above hypothesis, it is expected that project performance will also be related to regular and gradual turnover of project personnel. To test this, the variance across the project tenures of individual group members should also vary curvilinearly with project performance.

2. Technical communication to information sources outside the project team will follow a pattern similar to that of project performance, peaking between two and four years of mean group tenure and decreasing thereafter. In particular:
   a. Technical communication by project members with professional colleagues *inside* the organization (i.e., internal communications) will be significantly lower for teams with high levels of mean group tenure.
   b. Technical communication by project members with professional colleagues *outside* the organization (i.e., external communications) will be significantly lower for teams with high levels of mean group tenure.

RESEARCH SETTING AND METHOD

This study was conducted among all the R & D professionals (N = 345) of a large corporate R & D facility. The laboratory's professionals were organized into seven separate departments which, in turn, were divided into a total of 61 distinct projects. These project groupings remained stable over the course of the study, and each professional was a member of only one project team. Complete project data were successfully obtained on a total of 50 groups, representing 82% of all projects within this facility. Other findings from this same data base have recently been reported in Katz and Tushman (1981).

TECHNICAL COMMUNICATION

To measure communication data, professionals were asked to report (on specially provided lists) those individuals with whom they had technical communication on a randomly chosen day each week for 15 weeks. Sampling was constrained to provide equal representation of all weekdays. Respondents reported all personal contacts both within and outside the organization, including the name of the individual with whom they talked and how many times they talked to that person during the day. They did not report communications which were strictly social, nor did they report written communications. During the 15 weeks, the overall response rate was 93 per cent. Although the overall response rate was extremely high, the raw communications data for incomplete respondents were proportionately adjusted by the number of missing weeks. Moreover, 68 percent of all communication interactions within the R & D organization were reciprocally reported by both parties. These research procedures are similar to those used in other sociometric communication studies such as Allen and Cohen (1969), Whitley and Frost (1973), and Tomlin (1981) and provide a clear, accurate picture of the professionals' communication patterns.

As discussed by Katz and Tushman (1979), six mutually exclusive communication measures were operationalized for each project group as follows:

INTERNAL COMMUNICATIONS

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 organization.
4. Organizational: The amount of communication reported by the project's members with other individuals outside R & D but within other corporate functions such as marketing and manufacturing.

EXTERNAL COMMUNICATIONS

5. Professional: The amount of communication reported by project members with 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.

The amount of communication with these four internal and two external categories of people was calculated by summing the number of interactions reported during the 15 weeks and normalizing for the number of project members (see Katz and Tushman, 1979 for details). Except for the correlation between Department and Laboratory Communication ($r=0.31$; $p<.05$), none of the six measures of project communication were significantly intercorrelated (.10-level of significance or less).

PROJECT PERFORMANCE

Since the laboratory's management could not develop objective performance measures which would be comparable across the laboratory, a subjective measure similar to that used by Lawrence and Lorsch (1967) was employed. All Department Managers ($N=7$) and Laboratory Directors ($N=2$) were interviewed individually and asked to evaluate the overall technical performance of all projects with which they were technically familiar. Each was asked to make an informed judgment based on knowledge of and experience with the projects. If they could not make an informed judgment for a particular project, they were asked not to rate that project. Criteria the managers considered (but were not limited to) included: schedule, budget, and cost performance; innovativeness; adaptability; and cooperation with other organizational areas. Each project was independently rated by about five managers using a seven-point scale that ranged from very low to very high. Since there was a very strong consensus across the performance ratings of the nine judges (Spearman-Brown reliability = 0.81), individual ratings were averaged to yield overall project performance scores.

PROJECT CHARACTERISTICS AND INDIVIDUAL DEMOGRAPHICS

Each professional was asked to specify the degree to which his project assignment involved research, development, or technical service activities (see Katz and Tushman, 1979). By pooling individual members' responses to obtain project scores, we could easily identify a project as being predominantly either research, development, or technical service. As discussed in Tushman (1977), analysis of variance was used to ensure that there was sufficient agreement among project members with respect to the classification of their project.

Finally, each professional provided information on age, education, and an estimate of the number of years and months of association with a particular project group and with the overall R & D organization. These individual age, project, and organizational tenures were averaged across project members to obtain measures of mean age, mean project tenure, and mean organizational tenure. It is important to recognize that mean group tenure is not the length of time the project has been in existence, but rather it measures the average length of time project members have interacted with each other. Thus, the measure of group tenure is not tied to project phase nor necessarily related to how long R & D professionals per se have been working in that particular problem area within the company. The mean, then, is used to obtain a representative picture of how long project members have worked together and shared mutual experiences. The mean, however, only represents the central tendency of the project tenure distribution among project members. As a result, we will also examine the distribution about the mean using variance measures.

RESULTS

PROJECT PERFORMANCE

The 50 projects have mean group tenures ranging from several months to almost 13 years with an overall 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 50 projects was 4.59. When project performance is plotted as a function of mean project tenure of team members (Figure 1), there is some indication that performance is highest in the two to four year interval, with lower performance scores both before and after.

To get a clearer picture of the underlying relationship between mean group tenure and project performance, these original data were subjected to a smoothing technique using a moving median procedure (Tukey, 1977). The specific smoothing technique used is what Tukey calls a 3RSSH smooth (Tukey, 1977, p. 231ff). The results, plotted in Figure 2, illustrate very clearly that performance is highest for projects in the medium range of mean tenure. More interestingly, the smoothed data show a marked decline in performance for projects whose members have worked together for more than five years. Given this exploratory analysis, more confirmatory statistical procedures will now be used to investigate the relationship among project performance, mean group tenure, and project communication using only the

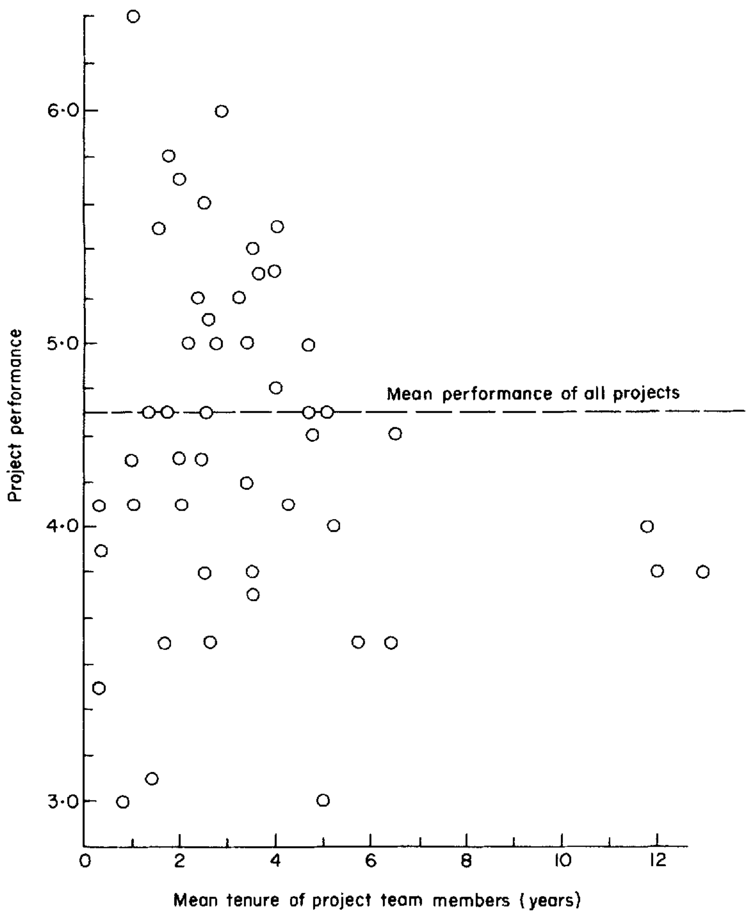

Figure 1. Project Performance as a Function of the Mean Tenure of Project Team Members (Raw Data).

original raw data. Smoothed data are presented only to better illustrate relationships. All analyses are performed on the unsmoothed data.

To test for significant differences in the distribution of project performance as a function of mean project tenure, the 50 groups were divided into five separate mean group tenure categories. Based on the curvilinear patterns in Figures 1 and 2, there appear to be at least three different tenure periods represented within the original data: (1) 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 equally subdivided into three separate categories, as shown in Table 1. The first 0 to 1.5 year interval corresponds to the initial learning or building phase previously discussed by 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 more than five years, corresponds to the low performance interval shown in these same studies as well as to the time period commonly used to estimate the half-life of technical information (Dubin, 1972).

An examination of the actual mean performance scores of projects within each of the five tenure categories of Table I strongly supports the curvilinear association hypothesized between project performance and mean project tenure. Within this organization, performance was, on the average, significantly lower for project teams whose mean tenures were either less than 1.5 years or were more than 5 years. In contrast, performance was significantly higher across all three middle tenure categories (i.e., between 1.5 and 4.9 years).

GROUP TENURE OR AGE OF INDIVIDUALS?

Almost by definition, projects with higher mean tenures are also staffed by older engineers. This

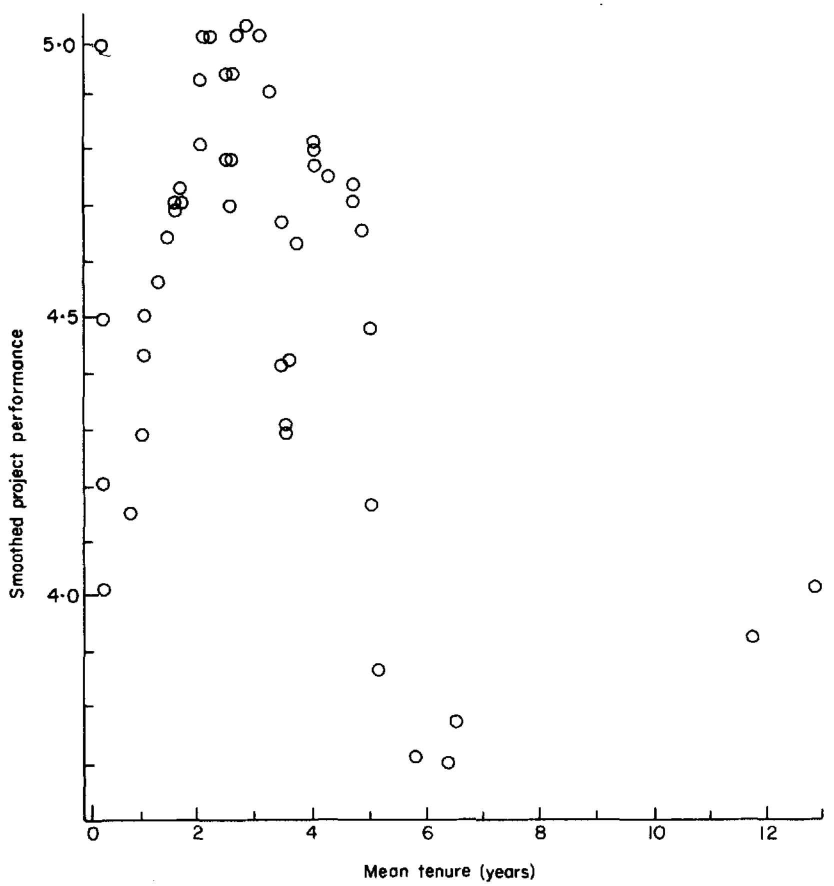

Figure 2. Smoothed Project Performance as a Function of the Mean Tenure of Project Team Members.

Table I

Project Performance as a Function of the Mean Tenure of Project Team Members

	Mean Project Tenure (in years)				
	0–1.4 (N = 10)	1.5–2.4 (N = 10)	2.5–3.4 (N = 10)	3.5–4.9 (N = 10)	5 or greater (N = 10)
Mean Project Performance*	4.29	4.89	4.87	4.82	4.07
Standard Deviations	0.99	0.67	0.70	0.59	0.52

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

raises, of course, the possibility that the performance decay associated with longer tenure had little to do with the team per se. It may have resulted, instead, from the increasing obsolescence of individuals as they aged. For the entire population, the correlation between project performance and the mean age of project team members is slightly negative ($r = -0.18$) but far from significant statistically. In the downward sloping interval of project performance, that is beyond a mean project tenure of 2.5 years, there is a slightly stronger negative relation, although still not significant. For those 30 projects with a mean group tenure of at least 2.5 years, the correlation between performance and the mean age of project members was -0.28; the corresponding relationship between performance and mean group tenure of project members is both negative and significant ($r = -0.39$; $p < 0.05$). A third variable, mean organizational tenure, is also correlated with the other two aging variables and is included in the next analysis.

The partial correlations of Table II demonstrate convincingly that it is tenure with the project team and not age or organizational tenure that influences project performance. Neither individual age nor organizational tenure shows any negative association with performance when project tenure is controlled. In fact, organizational tenure correlates positively, although not significantly, with performance when project tenure is held constant. It may be that projects staffed by longer term employees perform slightly 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 assigning or rotating individual engineers among project groups. All or nearly all of the team members could be replaced every few years, or

Table II

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	−0.39**	−0.28*	(Mean age)
		−0.33**	(Mean organizational tenure)
(b) Mean organizational tenure of project members	−0.23	0.20	(Mean project tenure)
		−0.05	(Mean age)
(c) Mean age of project members	−0.28	−0.08	(Mean project tenure)
		−0.19	(Mean organizational tenure)

N = 30; *$p < 0.10$; **$p < 0.05$

members could be changed individually at more frequent intervals. Different strategies such as these can obviously result in markedly different distributions of project tenure among team members even though mean tenures may be similar. 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 explored the relationship between project performance and these variance measures. As before, the smoothing procedures developed by Tukey (1977) were used to determine the general form of any possible association. The smoothed pattern shows a distinct curvilinear relation between project performance and the standard deviation of project tenure (Figure 3). Project performance is highest when the standard deviation in group tenures is about three years. This is true for all 50 projects as well as for the relatively long-tenured project teams. In other words, it appears that project teams perform best when their team memberships have not been completely stable, but where there has been some turnover of team personnel. On the other hand, when tenures are too widely dispersed, performance is also 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 will create confusion and detract from performance.

PROJECT COMMUNICATION

Having demonstrated a strong connection between group tenure and technical performance for R & D project teams, we can now turn to factors that might be inhibiting group effectiveness as team membership ages. As part of the NIH syndrome, it was 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, one of the contributing reasons for the decline in project performance with increasing mean tenure might be decreased outside contact and interaction. Members of such project groups would be paying less attention to outside sources of ideas and information, relying more on their own expertise and wisdom.

To examine this issue empirically, we tested for significant differences in the *actual* communication behaviour of research, development, and technical service projects as a function of mean tenure. Communication varies significantly with tenure in three cases: Intraproject, Organizational and External Professional. Communications to the other three areas, i.e., Department, Laboratory, and External Operational, did not

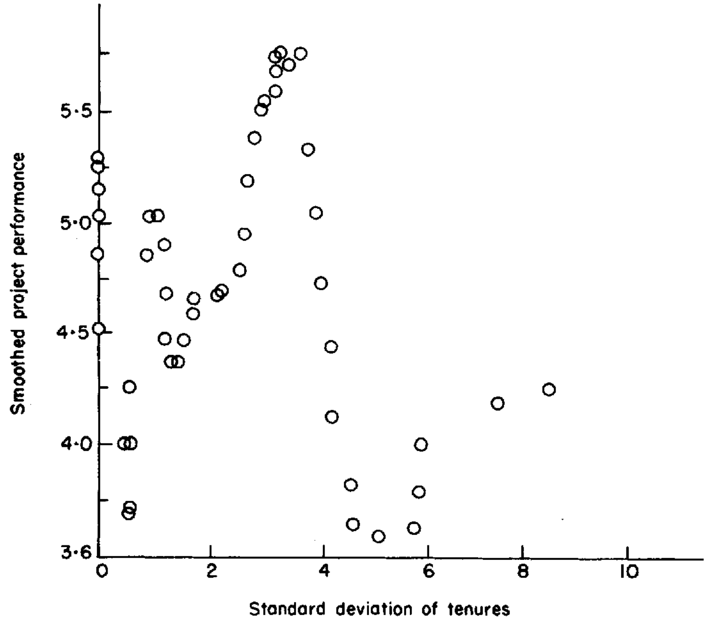

Figure 3. Smoothed Project Performance as a Function of Standard Deviation in Individual Project Tenures.

Table III

Correlations Between Group Tenure and Performance and Communications for Projects with Mean Tenure of at Least 2.5 Years

Variables Correlated With Mean Group Tenure	Project Type: Research (N=6)	Development (N=12)	Technical Service (N=12)	All Projects (N=30)
CORRELATIONS:				
a) Project Performance	−0.62*	−0.39*	−0.44*	−0.43***
Internal Communications				
b) Intraproject Communication	−0.26	−0.14	−0.72***	−0.39***
c) Organizational Communication	0.27	−0.53**	−0.12	−0.20
External Communications				
d) External Professional Communication	−0.51	−0.23	−0.38	−0.37**

*p<0.10; **p<0.05; ***p<0.01

diminish significantly with increasing tenure for any type of project, i.e., research, development, or technical service.

Communication, as performance, follows a pattern of decline with mean group tenure after 2.5 years (Table III). It is a different type of communication, however, that shows the greatest decay with each of the three types of R & D activity. For technical service projects, communication among project members themselves shows the greatest decline. For development projects, it is communication with the rest of the organization; and for research projects, it is external professional communication.

The remarkable thing about this set of results is that it appears to be the most important type of communication for each activity that has the greatest decline with tenure. Previous research (e.g., Allen, 1964; 1977; Allen, et al., 1980; Baker, et al., 1967; Pelz and Andrews, 1976) has shown very clearly that for development projects the best sources of technical information lie within the organization. Communication with other members of the R & D staff, of marketing and manufacturing, and of other functions shows consistently positive correlations with performance for development projects. In the present study, it is just this type of communication that decays most with increasing team tenure. In the case of research projects, the findings are just as clear. Communication with colleagues outside the organization is most important for members of research teams (Allen, et al., 1979; Katz and Tushman, 1979; Hagstrom, 1965).

For technical service projects, the evidence is not as strong. However, there is some indication that communication among project members is most important for the performance of these projects. Allen, et al. (1980) have shown, for example, that communication activity between project members and the project manager correlates significantly with performance for technical service projects.

So it is almost as though some demon were at work, selecting the most useful form of communication in each instance and causing it to decay most with increasing mean tenure of project members. Development project teams isolate themselves most from organizational colleagues; research teams from external colleagues, and technical service team members from each other.

It is impossible, at this point, to determine why this should be so. We can, however, look more deeply into the relationships to determine whether the decreases of different forms of communication with tenure are in fact related to project performance. This is indeed the case (Table IV). When organizational communications are held constant, the relationship between tenure and performance for development projects changes from a significant negative value to nearly zero. Similarly, when intraproject communication is held constant for technical service projects, the negative performance-tenure correlation approaches zero. Unfortunately, there were too few research groups to permit such an analysis for research projects. Nevertheless, it appears that increasing team tenure

Table IV

Relations Between Project Performance and Mean Tenure of Project Members Controlling for Communication (Projects with Mean Tenure of 2.5 Years or More)

Type of Project	Relation Between Tenure and Performance: r	r partial	Type of Communication Held Constant
Research (N = 6)	−0.62*	à	
Development (N = 12)	−0.39*	−0.46*	Intraproject
		−0.19	Organizational
		−0.42*	External Professional
Technical Service (N = 12)	−0.44*	−0.17	Intraproject
		−0.45*	Organizational
		−0.36	External Professional

*$p < 0.10$;
à = Too few research projects for partial analyses

operates on the particular form of communication that most affects performance to create the effect of decreasing performance with increasing stability in project membership.

DISCUSSION

The findings presented here emphasize the important influence of mean group tenure on the communication activities and performances of project teams. In examining the technical performance of project groups, a curvilinear relationship is found to exist between performance and mean project tenure. As in several previous studies, performance is found to increase steadily until mean tenure reaches about 1.5 years after which performance remains high but then gradually declines. The decline sets in clearly by the fourth or fifth year. This decay in project performance operates independently of the actual age of project team members and is independent of the type of R & D being performed. Similar decays in performance were found for all categories of projects whether research, development, or technical service.

By itself, the observation that R & D project performance declines significantly with high levels of group tenure raises more questions than it answers. Why were the performances of longer-tenured project teams significantly lower on the average? Were they staffed by proportionately less able or less motivated engineers, or were there important differences in how project members actually conducted their day-to-day activities that could help to account for these significant differences in technical performance?

Information gathered during a recent follow-up visit to the organization shows that the same proportion of professionals from both the long and medium tenured project teams were promoted to higher laboratory positions during the five year interval since the collection of the original data. Fifteen percent of the engineers who had been working on projects in the medium range of group tenure (i.e., between 1.5 and 5.0 years) were promoted to higher level managerial positions. The comparable percentage for engineers working in the ten long-tenured projects was 13 percent. In addition to managerial promotions, 12 percent of the engineers from medium-tenured project teams were promoted to positions on the technical side of the organization's dual ladder system. The comparable percentage for the long-tenured teams was slightly higher, roughly 19 percent. Such promotional histories strongly suggest that neither individual competence nor perhaps the importance or visibility of the project can account for the significant difference in technical performance between medium and long-tenured project groups.

As hypothesized, it is the reduction in communications of project members to key information sources that accounts for the performance differences. For projects whose group memberships had remained relatively stable over time, team members were communicating less often amongst themselves, less with individuals in other parts of the organization, and less with external professionals from the larger R & D community. Since the discussion and transfer of technical information and new ideas is important to effective project performance in R & D, it seems reasonable to attribute, at least in part, the lower technical performances of long-tenured groups to these differences in communication.

It is important to emphasize that it is not a reduction in project communication per se that leads to the deterioration in performance. Indeed, some of the measures of project communication did not diminish with increasing mean tenure. Rather a decline in performance is more likely to stem from a project team's tendency to ignore and become increasingly isolated from sources that provide more critical kinds of evaluation, information, and feedback. Since research, development, and technical service projects differ significantly in the kinds of communication important to them, projects in each of these categories are more likely to suffer when members are isolated from their most critical information sources. Thus, overall performance will suffer when research teams fail to pay sufficient attention to new advances and information within their relevant external R & D community, when technical service groups fail to interact among themselves, or when development project members fail to communicate with individuals from other parts of the organization, particularly R & D, marketing, and manufacturing.

This is not to say that external developments in technology are unimportant for development projects. 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 projects, unlike research groups, are most effectively linked with their external technical environments through specialized boundary-spanning individuals labelled gatekeepers (Allen, 1977, Katz and Tushman, 1981) rather than through direct external interactions by all project members. Gatekeepers are defined as those key R & D professionals who are both high internal and external communicators and who are also able to effectively transfer external ideas and information into their project groups. As a result, the impact of project tenure on development project performance may be more sensitive to the emergence and use of technical gatekeepers rather than being affected by the amount of external contact conducted by all project members. Although such an analysis cannot be done with the present data base, it is interesting to note that of the five development projects with an average tenure of at least five years, none had a technical gatekeeper within their membership. Thus, while lower levels of external contact may not directly affect the performance of development projects, reduced project communication in general might affect the extent to which gatekeepers are able to emerge in long-tenured project groups.

IMPLICATIONS

To gain additional insight into the curvilinear relationship portrayed in Figure 2, a regression curve was fitted to the smoothed data. By observation, the relationship appears to be of the form $Y = aX^{b}e^{-cX}$ where Y and X represent project performance and average project tenure respectively. Fitting the smoothed data to this type of nonlinear equation, the regression analysis yielded the following functional model:

$$Y = 4.77\,X^{0.08}e^{-0.04X}$$

where Y = Project Performance
X = Mean Tenure of Project Members

This equation, moreover, seems to be a reasonably good fit as it accounts for over 49 percent of the variance in the smoothed performance data ($R = 0.71$).

Based on this regression model, one can think of project performance as a function of the product (or interaction) of two distinct factors. The first factor influencing performance is a positive component of the form $Y = aX^{b}$, resulting from team members developing better and more effective working relationships; e.g., a kind of team-building component. In contrast, the second factor is inversely associated with performance, stemming perhaps from the development of the NIH syndrome. As team membership remains stable, communication with the rest of the technological world is reduced leading to an exponential type decay in performance of the form $Y = e^{-cX}$. Using the previously derived regression parameters, each of the component factors and their intersection are drawn in Figure 4.

While the regression relationship between project performance and mean team tenure is an inverted U-shaped curve, its two major component shapes are very different. The first component term rises rapidly with mean tenure showing the positive effects of "team-building." Team members develop better understanding of one another's capabilities, better understanding of the relevant technologies, better working relationships, etc., and such improvements are reflected in rapidly increasing performances. The team-building effect gradually tapers off, and as a result, its gradient with performance diminishes. At the same time, the exponential decay term has set in, resulting in part from reduced communication. Between these two component curves lies the area for potentially influencing project performance. As we gain additional understanding of the reasons underlying this exponential

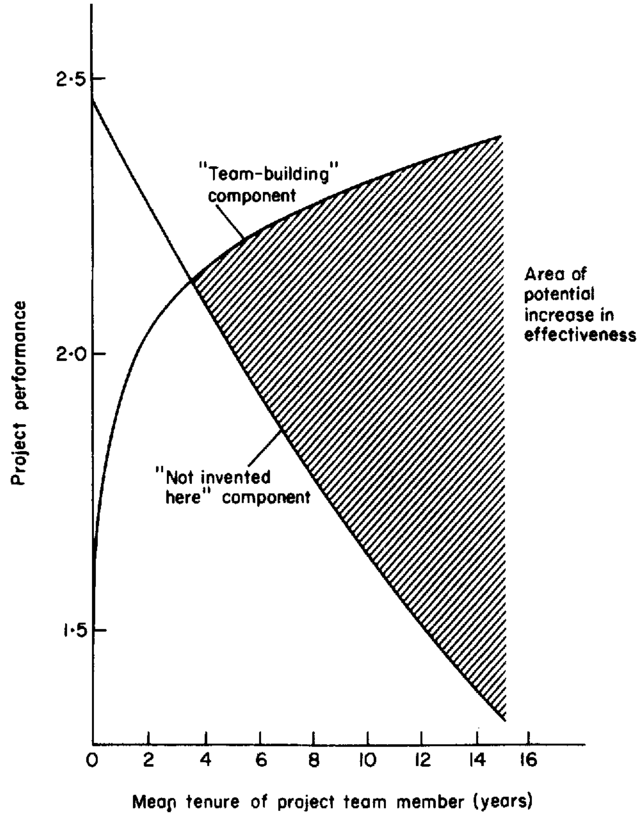

Figure 4. The Relationship Between Mean Group Tenure and Project Performance Analyzed into its Components.

decay, policies can be implemented to counter such effects in order to have the relationship between mean project tenure and performance approximate more closely to the team-building curve.

In particular, the data suggest that the communication of project team members and its subsequent effects on technical performance might be strongly influenced and managed through staffing decisions. Specifically, it would seem that the energizing and destabilizing function of new members can prevent a project group from developing interactions and behaviours characteristic of the NIH syndrome. Whether or not project groups can circumvent the NIH syndrome without some rejuvenation from newcomers is the next question that needs to be investigated. In the present organization, none of the ten project groups with a mean team tenure of five or more years was among the higher performing projects. We cannot, as a result, determine from the present sample the extent to which effective long-tenured project groups might have been able to maintain their effectiveness through appropriate high levels of communication and interaction with their more critical areas. Clearly, additional research is needed to ascertain just how deterministic the current findings are with respect to project performance, mean tenure, and project communication.

A TEMPORAL PERSPECTIVE

Underlying these kinds of change is the basic idea that over time individuals try to organize their work environments in a manner that reduces the amount of stress and uncertainty they must face (Katz, 1980; Pfeffer, 1981). According to this argument, employees strive to direct their activities toward a more workable and predictable level of certainty and clarity. The lower levels of intraproject communication, for example, strongly suggest that as project members work together and gain experience with one another, their project activities are likely to become more stable with individual role assignments and contributions becoming better defined and more resistant to change.

Based on such a perspective, we must begin to develop more comprehensive frameworks for analyzing how individuals and groups adapt to their situations over long tenure periods (Katz, 1981). Working in a given position for a considerable period of time, an employee establishes work patterns that are familiar and comfortable, patterns in which routine and precedent play a relatively large part. Recent findings by Katz (1978a, 1978b) suggest, for example, that with increasing project tenure, members may gradually become less responsive to the challenging aspects of their technical assignments. Instead, they become increasingly committed to their current problem-solving strategies, their customary ways of doing things, and their traditional modes of conduct. The longer individuals have actively participated in and become responsible for a given set of policies or strategy decisions, the stronger their attachment to such policies and strategies even though they may eventually become outdated and inappropriate (Staw and Ross, 1978). Furthermore, in the process of solidifying their contributions and commitments, individuals may come to rely more heavily on their own knowledge, views, experiences and capabilities, thereby reducing their attentiveness to outside sources of information and expertise. It is possibly trends like these that cause project communication to deteriorate with prolonged group tenure. In short, as employees adapt to increasing amounts of job stability, they may become less open and receptive to new and innovative approaches and procedures, preferring instead the predictability of their secure and familiar environments and the confidence which it brings.

The degree to which these tendencies actually materialize for any given individual depends, of course, on the extent to which the overall situation either reinforces or extinguishes such tendencies. Ever since the Hawthorne experiments, it has been generally acknowledged that the pressures and interactions within a given work group can significantly influence the behaviours, motivations, and attitudes of its individual members. In essence, the group controls the stimuli to which the individual is subjected.

How individuals eventually adapt to prolonged tenure on a given project, therefore, is probably influenced to a great extent by their project colleagues. In particular, the greater the mean tenure of project team members, the more these previously described tendencies are likely to occur and be reinforced. In the current organizational sample, for example, it is important to point out that there was no clear trend 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 was there a clear and obvious decrease in certain communication measures as a function of mean project tenure. Insulation, then, may be more a function of the average length of time group members have worked together rather than varying according to the particular project tenure of any single individual. Furthermore, our findings suggest that it is not just the mean that is important, it is also the distribution of project tenures among team members that must be considered.

In a general sense, we need to consider the many kinds of changes that are likely to take place within a group as its team membership ages, and more importantly, we need to uncover the kinds of managerial pressures, policies, and practices that can be used to keep a project effective and high performing under such tendencies. In addition to such managerial interventions, it would be even more important to determine if and how a project group can keep itself highly energized and innovative. The challenge to industry in general, and to organizations in particular, is to learn to effectively organize and manage projects in a world characterized by a more rapidly changing and complex technology coupled with a more maturing and stable population.

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