An Empirical Test of the Not Invented Here (NIH) Syndrome: A Look at the Performance Tenure, and Communication Patterns of 50 R&D Project Groups

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INTRODUCTION

Engineers have long recognized the problems facing a technical group should its membership remain constant for too long a period of time. General folklore among R&D engineers would hold that a group of engineers whose membership has been relatively stable for several years may begin to develop the attitude that it possesses a monopoly on knowledge in its area of specialization in the sense that it is not necessary to even consider the possibility that outsiders might be producing important new ideas or information relevant to the accomplishment of the group's tasks. This has come to be known in the R&D community as the "Not Invented Here" or "NIH" Syndrome. This perception holds that the competition is so far behind that they could produce nothing of importance to the group.

Three studies have shown supporting evidence for this belief. Shepard (1956) was the first to relate the mean tenure of group members to performance. He found that performance increased up to about 16 months average tenure, but thereafter decayed. Pelz and Andrews (1966) uncovered a similar curvilinear relation between mean group tenure and performance. In their study, however, the optimum group tenure seemed to occur at about the four or five year mark. Smith (1970) was also able to replicate the finding when he showed performance peaking at a mean tenure of three to four years from a study of 49 groups in an R&D laboratory of an oil firm.

The present study investigates once again the relationship between mean group tenure and the overall technical performance of the group. This time, however, the research will focus on clearly defined project teams.[1] The reason for the project team 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 working on a variety of different technical problems within their functional areas can help group members keep in closer touch with developments within their particular specialty. Constrastingly, 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 and in this process, they are drawn away from and begin to lose touch with recent developments within their technical specialties.

In addition to this distinction, our study will also examine the second part of the NIH Syndrome. According to this belief, stable project teams would be expected to become increasingly cohesive over time, and consequently, would begin to separate themselves from external sources of influence by communicating less frequently with colleagues outside of their project team. Accordingly, the following hypotheses will be tested:

1. The relation between the mean tenure of project members and project performance will be curvilinear, reaching a maximum between a mean tenure of two to four years and decaying thereafter.

1A. As a corollary to this hypothesis, it is expected that project performance will be related to regular and gradual turnover

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1 It is not clear in the previous research whether "groups" are project teams or whether they are functional, disciplinary, or specialty-based groups. It is presumed that there is a mix of both types in the three studies.

of project personnel. To test this, the variance in tenure of project team members will also vary curvilinearly with project performance.

2. Technical communication to sources outside of the project team will follow a pattern similar to that of project performance, peaking between two to four years of mean tenure and decaying thereafter. In particular:

   a. Technical communication with professional colleagues within each individual's own functional department will be highest for teams of low tenure and will decay thereafter.

   b. Technical communication with sources in other organizational divisions such as marketing and manufacturing will be highest for teams of low to medium tenure and will decay thereafter.

   c. Technical communication with professional colleagues outside of the organization will be highest for teams of low to medium tenure and will decay thereafter.

3. Technical communication within the project team itself will increase as a function of mean tenure. This will be true at least until some saturation point is reached, after which communication will remain relatively constant.

RESEARCH SETTING AND METHOD

This study was carried out at the R&D facility of a large corporation in the United States. This facility is isolated from the rest of the corporation and employs approximately 735 people. This study focuses on all the professionals within this facility (n = 345). The laboratory's professionals were organized into seven departmental labs (or Groups) which, in turn, were organized into 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.

Tenure and Demographic Data

Each professional respondent was asked to complete a general questionnaire, providing information on age, education, and an estimate of the number of years and months that he or she has been associated with their specific project team, with their functional Group, and with the overall laboratory facility.

Technical Communication

To gather communication data, each professional was asked to identify on a specially provided list those individuals 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 provide equal representation of each of the weekdays. Respondents were asked to report all oral, work-related communications within and outside the laboratory (both to whom they talked and how many times they talked to that person during the day). They were not asked to report contacts which were strictly social, nor did they report written communications.

During the 15 weeks, the overall response rate was 93 percent. Moreover, 68 percent of all the communications within the laboratory were reported by both parties (see Weiss and Jacobson, 1960, for comparative data). These research procedures are similar to those used in other sociometric communication studies such as Allen and Cohen (1969), Whitley and Frost (1973), and Schwartz and Jacobson (1977).

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, suppliers, and customers.

Communication measures to these six internal and external 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. Communication to these various areas is reported in terms of communications per person per week.

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. Each Departmental Group manager (n = 7) and the two laboratory directors were interviewed individually. They were asked to evaluate the overall technical performance of all the projects with which they were technically familiar.

Each manager interviewed was 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 = 0.81), individual ratings were averaged to yield overall project performance scores.

Project Task Characteristics

Finally, each professional was asked to specify the degree to which his or her project assignments involved research, development, or technical service kinds of activities. By pooling the 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 the appropriateness of combining individual perceptions of their activities for the aggregate categorization of each particular project.

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 is plotted as a function of the mean project tenure of team members (see Figure 1), there is some indication that performance is highest in the 2 to 4 year interval, with lower performance scores both before and after.

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Insert Figure 1 About Here
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To get a clearer picture of any significant differences in the distribution of project performance as a function of mean project tenure, the fifty groups were divided into five tenure 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).

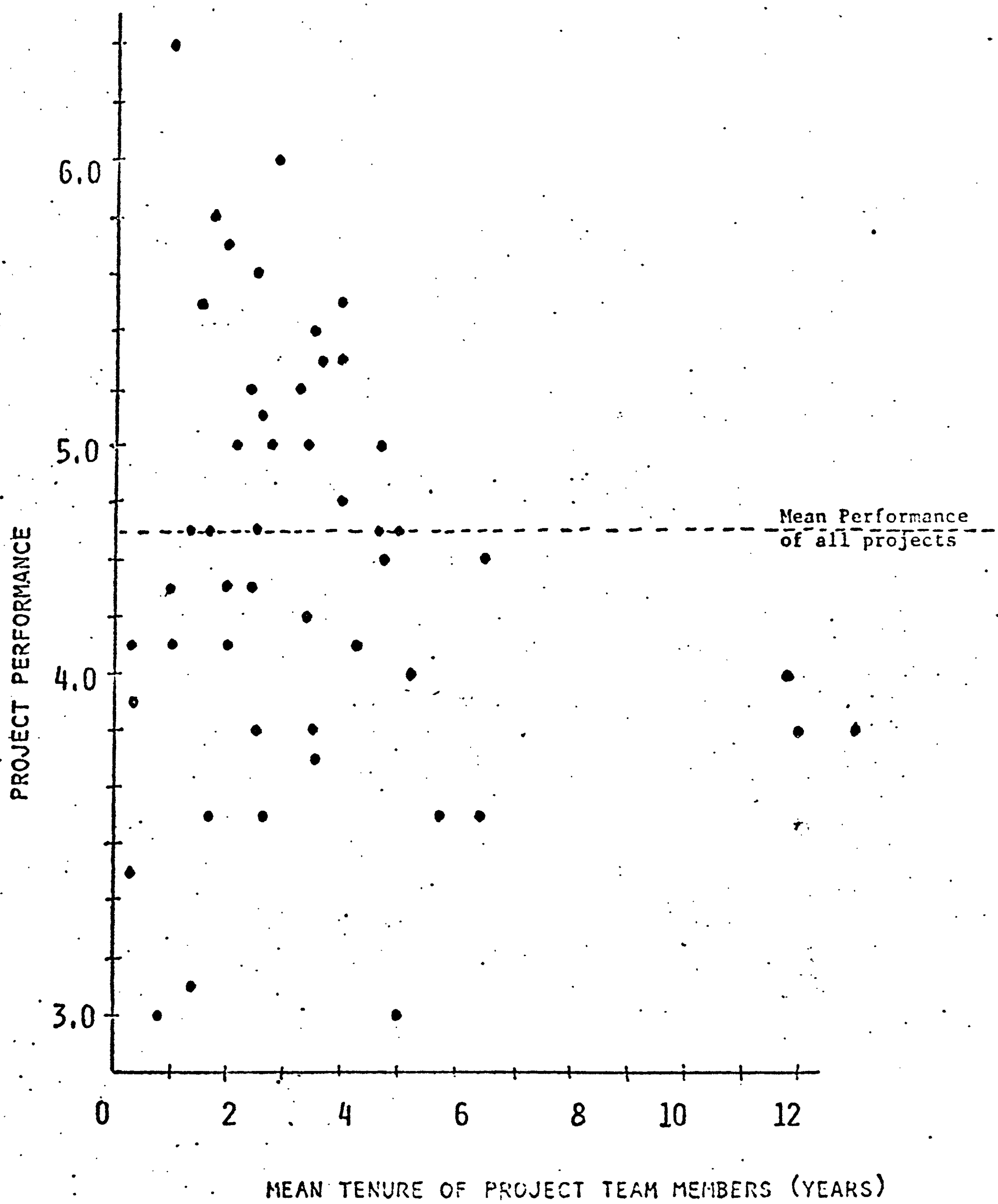

FIGURE 1. PROJECT PERFORMANCE AS A FUNCTION OF THE MEAN TENURE OF PROJECT TEAM MEMBERS (RAW DATA)

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Insert Table 1 About Here

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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. Performance was significantly lower for those project groups whose mean tenure was five or more years. Contrastingly, performance was highest across the three middle tenure categories.

To better understand the nature of the relationship between mean project tenure and project performance, the original data were subjected to a smoothing technique, using a simple, moving average procedure (see Anderson, 1971; $U_s = 10$). The resultant calculations, plotted in Figure 2, illustrate very clearly that performance was highest for projects with a mean tenure of between two and four years. More interestingly, these smoothed data points also show that performance begins and continues to decline for projects whose members had averaged four or more years of work on the particular projects. Such a pattern of findings clearly supports the first hypothesis.

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Insert Figure 2 About Here

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To gain additional insight into the nature of the curvilinear relationship as portrayed through Figure 2, a regression curve was fitted to the smoothed data. By observation, the relation 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

TABLE 1. 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. [$F(4,45) = 2.89$; $p<.05$].

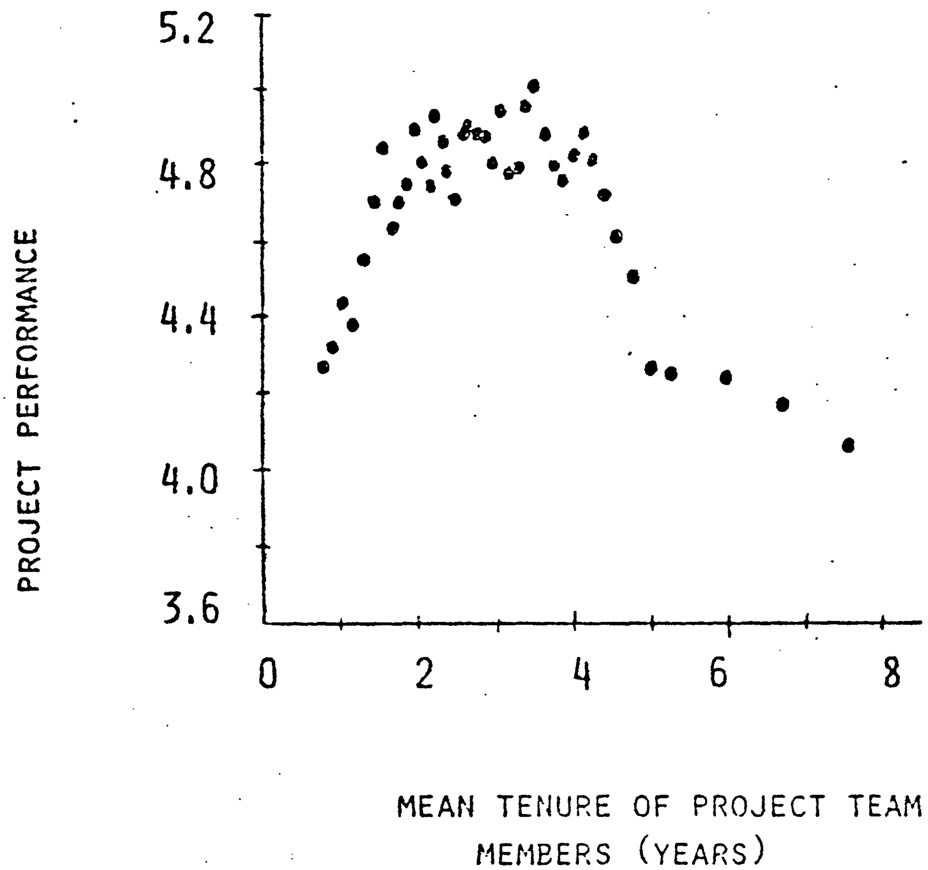

FIGURE 2. PROJECT PERFORMANCE AS A FUNCTION OF THE MEAN TENURE OF PROJECT TEAM MEMBERS (SMOOTHED DATA)

smoothed data to this type of nonlinear equation, the regression analysis yielded the following functional model:

$$Y = 4.89X^{.27}e^{-.10X} \quad \text{where} \quad Y = \text{Project Performance}, \; X = \text{Mean Tenure of Project Members}$$

This equation, moreover, seems to be a reasonably good fit as it was able to account for over 80% of the variance in the smoothed project performance data ($R = .91$).

Based on this regression model, one can think of project performance as a function of the product (or interaction) of two distinct kinds of factors. The first factor influencing performance is a positive component of the form $Y = aX^{b}$, most likely resulting from team members developing better and more effective working relationships; e.g., a kind of team-building component. Constrastingly, 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 parameters from the previously reported regression analysis, each of these component factors and their resulting interaction effect on project performance are drawn in Figure 3.

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Insert Figure 3 About Here

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The overall smoothed relationship between project performance and the mean tenure of project team members within this R&D facility is shown by the uppermost curve. Below this relation are the two major component factors. The first component term rises rapidly with mean project tenure, showing the positive effects of "team-building." Team members develop better understandings of one another's capabilities, better understandings of the involved technologies, better

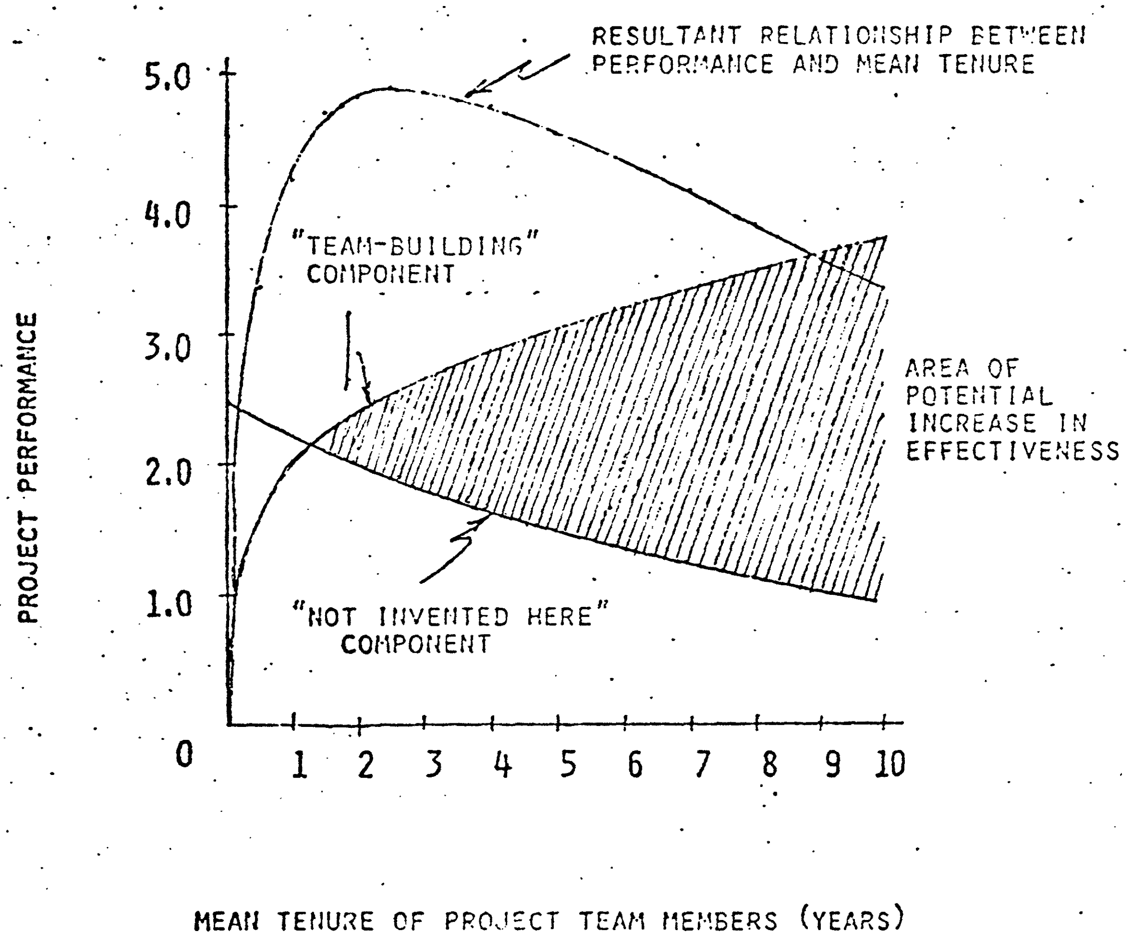

FIGURE 3. THE RELATIONSHIP BETWEEN MEAN TENURE PROJECT AND PERFORMANCE, ANALYZED INTO ITS COMPONENTS

working relationships, etc., and such improvements are reflected in rapidly increasing performances. The team-building effect, however, gradually tapers off, and as a result, its gradient with performance diminishes. At the same time, the exponential decay term has set it, resulting from factors which have not as yet been determined, but nevertheless causing eventual deteriorations in project performances. In fact, were it not for the team-building effect, project performance might have simply decreased monotonically from the beginning. Between these two component curves lies the area for potentially influencing project performance. Once we have gained a better understanding of the reasons behind this exponential decay, policies can be implemented to counter such effects in order to have the relation between mean project tenure and performance approximate more closely the team-building curve.

Age of Team or Age of Individuals?

Almost by definition, projects with higher mean tenure are also staffed by older engineers. This raises, of course, the possibility that the performance decay has little to do with the team per se. It may result, instead, from the increasing obsolescence of individuals as they age. The correlation between project performance and the mean age of project team members is slightly negative (r=-.18) but far from significant statistically. Nevertheless, in the interval in which project performance decays, that is beyond a mean project tenure of 2.5 years, there is a slightly stronger negative relation, though still not significant. For those 30 projects with a mean tenure of at least 2.5 years (see Table 2), the correlation between performance and the mean age of project members is -.28; whereas, the corresponding relation between performance and the mean project tenure of project members is both negative and significant ($r=-.39$; $p<.05$). A third variable, mean organizational tenure of project members, is also correlated with these two aging type variables and, as a result, should be included in any comparative analysis.

Insert Table 2 About Here

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 show any negative association with performance when project tenure is controlled. In fact, organizational tenure correlates positively, albeit not significantly, with performance when project tenure is 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

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*	(Mean age)
		-.33**	(Mean organizational tenure)
b) Mean organizational tenure of project members	-.23	.20	(Mean project tenure)
		-.05	(Mean age)
c) Mean age of project members	-.28	-.08	(Mean project tenure)
		-.19	(Mean organizational tenure)

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

discovered a strong curvilinear relation between project performance and these variance measures. As shown by Figure 4, 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, a project performs best when team membership has not been completely stable but there has been some frequency in the turnover of team personnel. On the other hand, if project member tenures are too widely dispersed, performance was also found to be low. Such findings suggest that a project group must balance its need for gradual turnover with a reasonable amount 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 4 About Here

Project Communication

Having established a strong connection between mean project tenure and the overall technical performance of the 50 R&D project teams within the current site, we can now proceed to investigate the different kinds of factors which might be inhibiting or facilitating group performance as team membership ages. As part of the "Not Invented Here" syndrome, it was hypothesized that if performance was discovered to decline with increasing levels of mean project tenure, then part of the contributing reasons for such a decay might be found in relatively low levels of communication to sources outside these low performing project groups. In particular, members of such project groups would be paying less

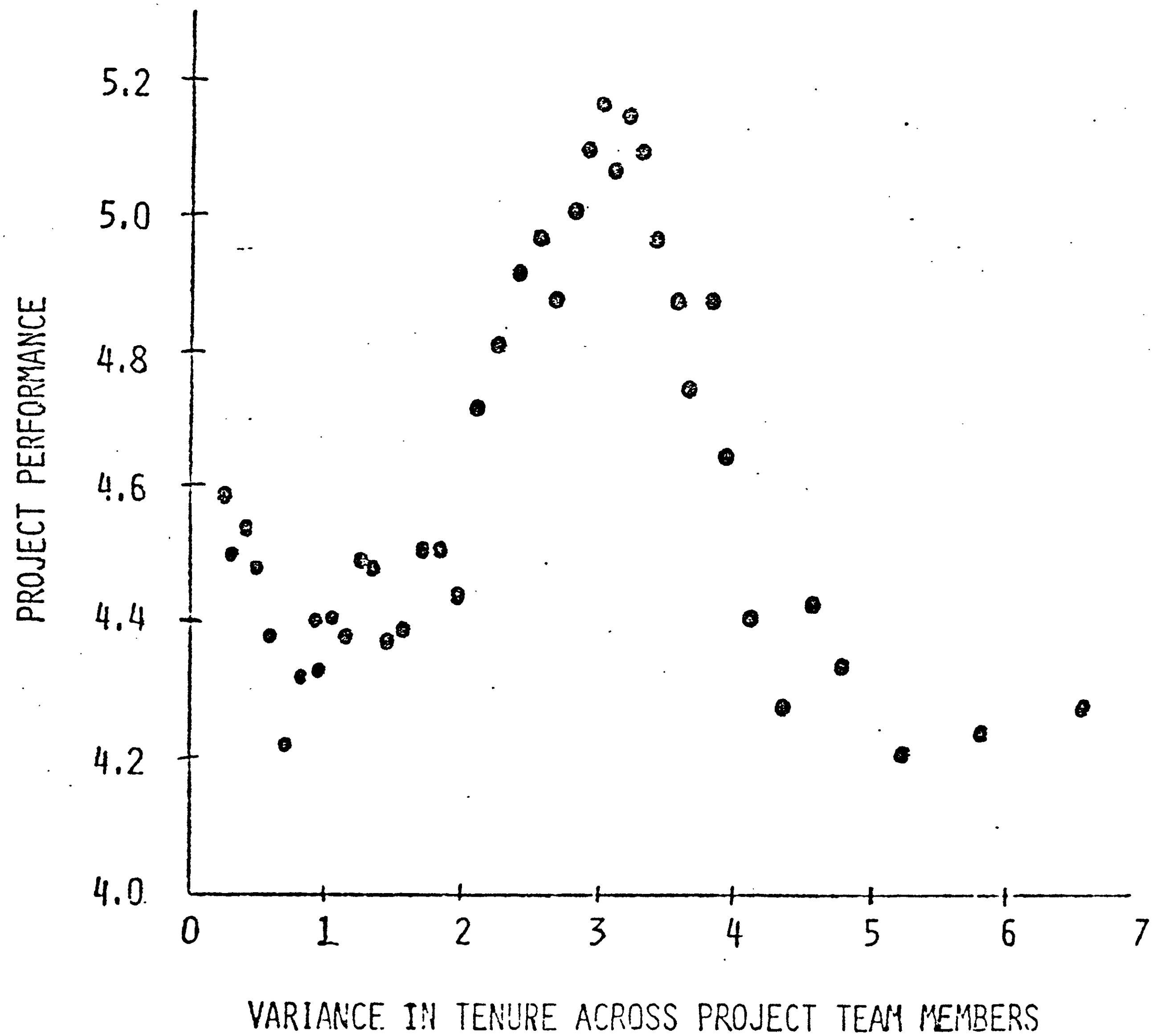

FIGURE 4. PROJECT PERFORMANCE AS A FUNCTION OF STANDARD DEVIATIONS (SMOOTHED DATA)

and less attention to external sources of ideas of information, relying more and more on their own levels of expertise and wisdom.

In order to examine empirically this NIH issue, Table 3 presents some comparative findings based on the actual communication patterns of the sample's project groups. Since performance was shown to vary inversely with the mean project tenure of teams averaging 2.5 years of tenure or more, Table 3 reports similar correlations between mean project tenure and the amounts of communication each of the project groups had with various sources both within the organization (i.e., internal areas) as well as with sources outside the organization (i.e., external areas). In partial support of the second hypothesis, the correlations from Table 3 clearly show that the level of technical communications with external professionals varies inversely and significantly with mean project tenure in a fashion similar to the findings for project performance. There appears to be, as a result, some tendency within this facility for project groups to isolate themselves from external technology as the mean tenure of project team members increases.

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Insert Table 3 About Here
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In addition to external professional communication, it was also hypothesized that with decreasing performance, members of project groups with higher levels of team tenure would interact less often with other internal professionals from both the team's own functional department as well as from the other functional departments within the laboratory. The correlational results from

TABLE 3. Correlations Between Mean Project Tenure and Project Communications for Projects with Mean Tenure of at Least 2.5 Years.

Communication Measures	Correlation with Mean Project Tenure
Internal:	
a) Intraproject	-.38**
b) Departmental	-.0[illegible]
c) Laboratory	-.[illegible]
d) Organizational	-.11
External:	
e) Professional	-.32**
f) Operational	.03

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

Table 3, however, do not support such parallel tendencies as there were no strong declining trends in the levels of communication between project groups and any of the other internal or external areas including the project's functional department, other laboratory departments, professionals from other organizational divisions, or external vendors and suppliers.

What is also surprising from Table 3 is the significantly negative association between mean project tenure and intraproject communication. Hypothesis 3 had argued 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. The results from Table 3, however, indicate that members of high tenured project groups not only reduced their contacts with external professionals but also had reduced interactions amongst themselves.

Given these reductions in intraproject and external professional communication, the next important question is whether such differences can account for the comparatively lower performance ratings of these project groups with higher levels of mean project tenure. 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 (1979) 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.[2] 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 manufacturing and marketing (Katz and Tushman, 1979).

Given these significant variations in communication effectiveness, one cannot accurately investigate the impact of communications on the negative slope of the performance-tenure relationships for all project groups combined. One most separately test, instead, for the explanatory effects of communication in each of the three project groupings. Accordingly, for each task category, Table 4 presents the relationship between performance and mean project tenure after controlling for the effects of communication. Although only external and intraproject communications were shown to vary inversely and significantly with project tenure (see

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[2] For a more extensive discussion of these differences, see Tushman and Katz, 1980.

Table 2), organizational communication was included in the analyses of Table 4 because of its previously demonstrated importance in the performance of development project groups.

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Insert Table 4 About Here
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As shown in Table 4, the simple correlations between project performance and mean project tenure remained negative and significant for all three project type categories. Moreover, the partial correlational analsyes suggest that mean project tenure may affect project performance, at least in part, by operating through reductions in particular areas of technical communications. With respect to development projects, only organizational communication covaried sufficiently with both performance and mean project tenure to account for the latters' significantly negative association. Contrastingly, both intraproject and external project communication were able to reduce the significance in the performance-tenure relation in the case of technical service projects. Unfortunately, there were not enough research project groups within our site to test the possible contributing roles of either low intraproject or low external professional communication in the declining performances of long-term research teams.

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*	(Intraproject)
		-.20	(Organizational)
		-.42*	(Professional)
Technical Service: (N=12)	-.44*	-.20	(Intraproject)
		-.45*	(Organizational)
		-.36	(Professional)

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

I = Insufficient number of research projects for partial analyses.

DISCUSSION

The thrust of these findings emphasize the important influence of mean project tenure on the behavior 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 established between these performances and the mean tenures of project team members. 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 deteriorate. This decay in performance with increasingly high mean tenure, moreover, was present independent of the actual age of project team members and independent of the particular project task areas. In fact, similar performance decays were found for all categories of project groups, including research, development, and technical service.

By itself, the idea that R&D project performance tends to deteriorate significantly with high levels of mean project tenure raises more questions then it answers. 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.

In trying to formulate a more complete explanation, the actual communication patterns of all project groups with a mean tenure of at least 2.5 years were comparatively investigated. In parallel with the findings for project performance, it was found that project communications to certain key areas significantly declined as a function of increasing mean project tenure. More specifically, members of 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 (Allen, 1977; Katz and Tushman, 1979), it seems reasonable to attribute, at least in part, the overall lower technical performance of these 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 ignore or isolate itself from those 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 member 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 individuals 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 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, Tushman and Katz, 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. Nevertheless, the tendency within this R&D site for the longer tenured project teams to isolate themselves from sources of external technology strongly supports the N.I.H. syndrome.

The fact that intraproject communications also declined significantly with new project tenure was somewhat surprising. As part of the N.I.H. syndrome, it was expected that external professional communications might decrease with higher levels of project tenure. By focusing less and less on external sources of technology, it was thought that project members would come to rely more heavily on their own project members for expertise and guidance, resulting in greater cohesiveness and greater levels of intraproject communication. In the case of intraproject communications, however, the opposite turned out to be the case. One possible explanation for this reversal is that as members continue to work in their project groups for long periods of time, they tend to become more and more specialized in their specific technical areas and project assignments, resulting perhaps in greater role differentiation and less common interaction among project members (Weick, 1969; Katz & Kahn, 1978). Furthermore, there is some recent evidence to suggest that with increasing tenure, project members can become less responsive to the challenging features of their job demands (Katz 1980). As a result, they may become more complacent about their everyday work environments, carrying out their project responsibilities more routinely and more perfunctorily. These kinds of changes may simply result in less problem-solving types of activities among project members as they continue to work together on the same overall project. Whether project members become more or less cohesive dispositionally, in spite of their reduced levels of intraproject communication, remains to be tested.

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 (Pfeffer, 1980). According to this argument, employees strive to direct their activities toward a more workable and predictable level of certainty and clarity.

Given this kind of temporal perspective, it is essential that we begin to develop a more comprehensive framework for analyzing how individuals and groups adapt to their job situations over long periods of tenure. Having worked at a given job position for a considerable period of time, for example, employees may have been able to establish a work pattern that is familiar and comfortable, a pattern in which routine and precedent play a relatively large part. As such, they may become more 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 more likely they will become increasingly attached to such policies and strategies even though they may have become outdated and inappropriate. Furthermore, in the process of solidifying this kind of commitment, individuals may eventually come to rely more heavily on their own knowledge, views, experiences, and capabilities and become less attentive to outside sources of information and expertise. It is because of trends like these perhaps that external communications can deteriorate with long-term tenure. In short, as employees adapt to increasing amounts of job stability, they may become less open and receptive to new and innovative kinds of approaches and procedures, preferring instead the predictability of their secure and familiar environments and the confidence which it brings.

The degree to which these kinds of tendencies actually materialize for any given individual depends, of course, on the extent to which the overall situational context either reinforces or extinguishes such tendencies. And ever since the Hawthorne experiments, it has been generally acknowledged that the particular conditions and interactions within a given work group can significantly influence the behaviors, 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 their long-term 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. Furthermore, our findings clearly suggest that it not just the mean that is important, it is also the distribution of project tenures among team members that must be considered. As shown through Figure 4, project performance was significantly and curvilinearly related to to variances in the distributions of project members' tenures.

What these findings suggest is that the communication patterns of project team members and their subsequent effects on overall technical performance can be strongly influenced and managed through staffing decisions. Specifically, it would seem that the energizing and destabilizing function on new members can prevent a project group from developing interactions and behaviors characteristic of the NIH syndrome. Whether or not project groups can circumvent the NIH syndrome without some rejuvenation from new project members is the question that needs to be addressed next. In the present R&D facility, none of the 10 project groups with a mean team tenure of 5 or more years were among the facility's higher performing projects. We cannot, as a result, determine from the present sample the extent to which long-tenured project groups might be more effective if they maintained appropriate 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. Different trends, for example, might emerge with different kinds of organizational climates, different personnel and promotional policies, different economic or marketing conditions, and different organizational structures. If a facility is organized around some type of matrix structure, for example, are long-tenured project groups able to maintain their effectiveness as long as their members are also strongly linked to their functional or technical specialty groups?

In a general sense, then, we need to consider the many kinds of changes that either have or 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 these kinds of external managerial interventions, it is just as important to determine if and how a project group can keep itself highly energized and innovative. The challenge to our industries, in general, and to our organizations, in particular, is to learn to effectively organize and manage their projects in a world characterized by a more rapidly changing and more complex technology coupled with a more maturing and more stable population.

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