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Project Team Aging: A Failure to Replicate

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INTRODUCTION

The phenomenon of "group aging" is one that has been reported over the years by a number of separate investigators. Shepard (1956) was the first to relate group performance to the mean tenure of group members. He found that performance increased with increasing average tenure up to about 16 months, but decayed as group membership remained stable over longer periods. Pelz and Andrews (1976) found a similar curvilinear relationship between mean tenure and performance. In their study, performance reached its maximum at a mean tenure of four years (Figure 1). In yet another study, Smith (1970) showed a performance peak at four years, just as Pelz and Andrews found. Finally, the present authors (Katz & Allen, 1982) reported, for 50 projects in a U.S. chemical company, a clear curvilinear relationship with performance again reaching a maximum at about the three to four year point for mean project team tenure and decaying significantly thereafter (Figure 2).

There is therefore substantial evidence for the existence of the reported curvilinear relationship between mean tenure and project team performance. The research has been conducted by a number of independent investigators, who have examined groups and project teams across a number of very different industrial settings at different points in time. Katz and Allen (1982), after reporting their observations, go on to attribute this effect to the well-known "not-invented-here" syndrome. According to this explanation, and supported by data reported by themselves and by Pelz and Andrews, groups gradually define themselves

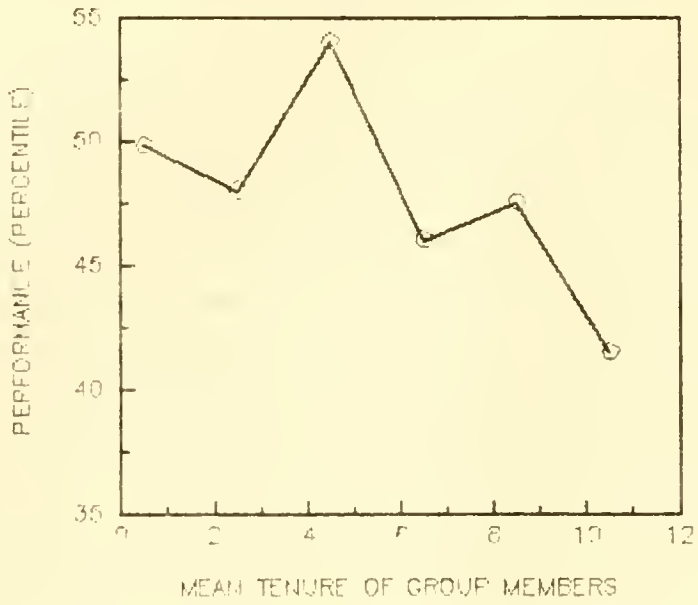

Figure 1. Performance as a Function of Mean
(Adopted from Katz & Andrews, 1976)

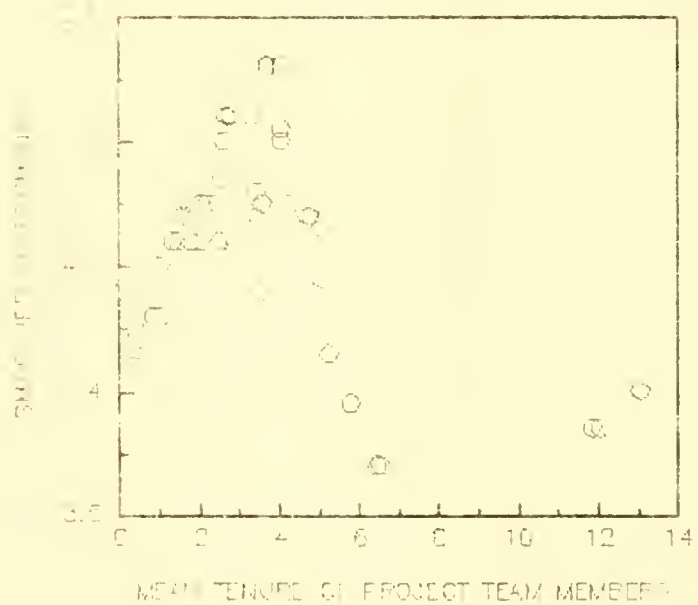

Figure 2. Project Team Performance as a Function of
(From Katz & Allen, 1982)

into a narrow field of specialization and convince themselves that they have a monopoly on knowledge in their area of specialty. Such increased specialization creates an appearance to the outside world of decreased relevance, which leads to a decrease in the team's motivation to communicate with and respond to the outside world (Rogers and Shoemaker, 1971; Katz and Allen, 1985). As a result, long-tenured teams expose themselves less and less to critical sources of external contact and information (Janis, 1972; Katz, 1982; Allen, 1987). It is this isolation and more narrow focus which in turn leads to poorer performance. In a sense, group success often creates the conditions for eventual failure. When a group has been successful there is a tendency for management to keep the "winning team" together. If this continues for too long however, conditions may set in which can lead to the observed deterioration in the group's expected performance.

PRESENT STUDY

Although relationships between performance and group age now have been reported by at least four different studies, we still know very little about those groups that to maintain creative performance over sustained periods of time. While there may be an "average" tendency for performance to decline with higher levels of group age, there is as yet no empirical basis from which to suggest how one might organize and manage long-term project groups in order to benefit from the continuity of a team approach and still overcome the negative aspects of "NIH," i.e., of increased

insulation, stability, specialization, and homogeneity (Katz and Allen, 1982 & 1985).

All of this led the authors to test the phenomenon further with a large sample of 181 project teams in nine organizations. The primary objectives of the study were twofold: first to identify from this new sample those long-tenured teams that were able to remain effective over an extended period of time and secondly to try to discover how they were able to accomplish this. In essence, what are some of the particular managerial and organizational factors that significantly differentiate high-performing long-tenured teams from low-performing ones, and what are the implications of these findings for keeping a group together and creative over time?

Sample

The selection of the nine participating organizations could not be made random, but they were chosen to represent several distinct sectors and industries. Two of the organizations are government laboratories, one in the U.S. Department of Defense the other in the National Aeronautics and Space Administration; three are not-for-profit firms doing most of their business with government agencies. The four remaining organizations are in private industry: two in aerospace, one in the electronics industry and one in the packaged goods industry.

Project Performance

Since objective measures of performance that are comparable across different technologies have yet to be developed, we used a subjective measure similar to that of many studies, including Lawrence and Lorsch (1967) and Katz and Tushman (1981). In each organization, we measured project performance by interviewing managers who were at least one hierarchical level above the project and functional managers, asking them to indicate on a 5-point Likert-type scale whether a project team was performing above, below, or at the level expected of them, given the particular technical activities on which they were working. Managers evaluated only those projects with which they were personally familiar and knowledgeable. Evaluations were made independently and submitted confidentially to the investigators. As in the previously mentioned studies, we did not prescribe the criteria to be used by the managers, believing that they should employ those criteria that they believed to be most relevant. Discussions with the evaluators indicate that the criteria used included, but were not limited to, schedule, budget, and cost performance; innovativeness; adaptability; and the ability to cooperate with other parts of the organization. On the average, between four and five managers evaluated each project. The evaluations showed very strong internal consensus within each organization (Spearman-Brown reliabilities range from a low of 0.74 to a high of 0.93). It is therefore safe to average the ratings of individual managers to yield reliable project performance scores. In addition to the internal evaluations, an expert panel of independent,

outside R&D professionals exhaustively evaluated a small subset of our project base (N=8). The ordering of their project performance evaluations agreed perfectly with the ordering of our own aggregated measures of performance. Such agreement between two separate sources strongly supports the validity of our project performance measures. To clarify the distinction between high and low project performance among all 181 project teams, performance measures were converted to standardized scores with a mean of zero (the original sample mean was 3.32).

Team Tenure

Over 2,000 individuals in the nine organizations completed a fairly lengthy questionnaire. The instrument dealt with a wide range of issues many of which have been reported elsewhere (Katz & Allen, 1985; Allen & Katz, 1986). Among the questions was one which asked each individual to indicate the exact duration of his association with the project team which was identified on the front page of the questionnaire. Mean team tenure (or group age) was calculated by averaging the individual project tenures of all project members. There was also a long series of questions dealing with various relationships specific to the project assignment, to the organization's management, to the individual's work orientation, and so on.

In each organization, short meetings were scheduled with all members of the technical staff to explain the general purposes of the study, to solicit their voluntary cooperation and to distribute the questionnaire to each

engineer individually. Respondents varied in age from 21 to 65 with a mean of 43 and standard deviation of 9.6 years.

RESULTS

When project performance scores for the 181 projects are standardized and plotted against the mean tenure of project team members, there is no indication whatever of the curvilinear relationship reported in the earlier studies (Figure 3). The performance scores have been standardized to an overall mean of zero so that high and low performance deviations are shown above and below the middle dotted line in standard deviation units. The dispersion of performance scores is symmetrical throughout the tenure range. There are a large number of low performing projects with mean tenure in excess of four years, but there is a roughly equal number of high performers as well. In fact, the highest performing project team in the entire sample had a mean tenure greater than eight years, and two project teams with mean tenures greater than 15 years have performance scores that are more than one standard deviation above the mean.

Even when the data are statistically smoothed using Tukey's (1977) 3RSSH method, as they were in our earlier study (Katz & Allen, 1982), no clear pattern emerges (Figure 4). A decay in performance is therefore not an inevitable consequence of "group aging"! Many project teams manage to maintain their performance levels with high levels of team tenure. The important question now becomes, what is it that distinguishes the higher

Figure 3. Project Performance as a Function of Mean Tenure of Team Members.
(N = 181)

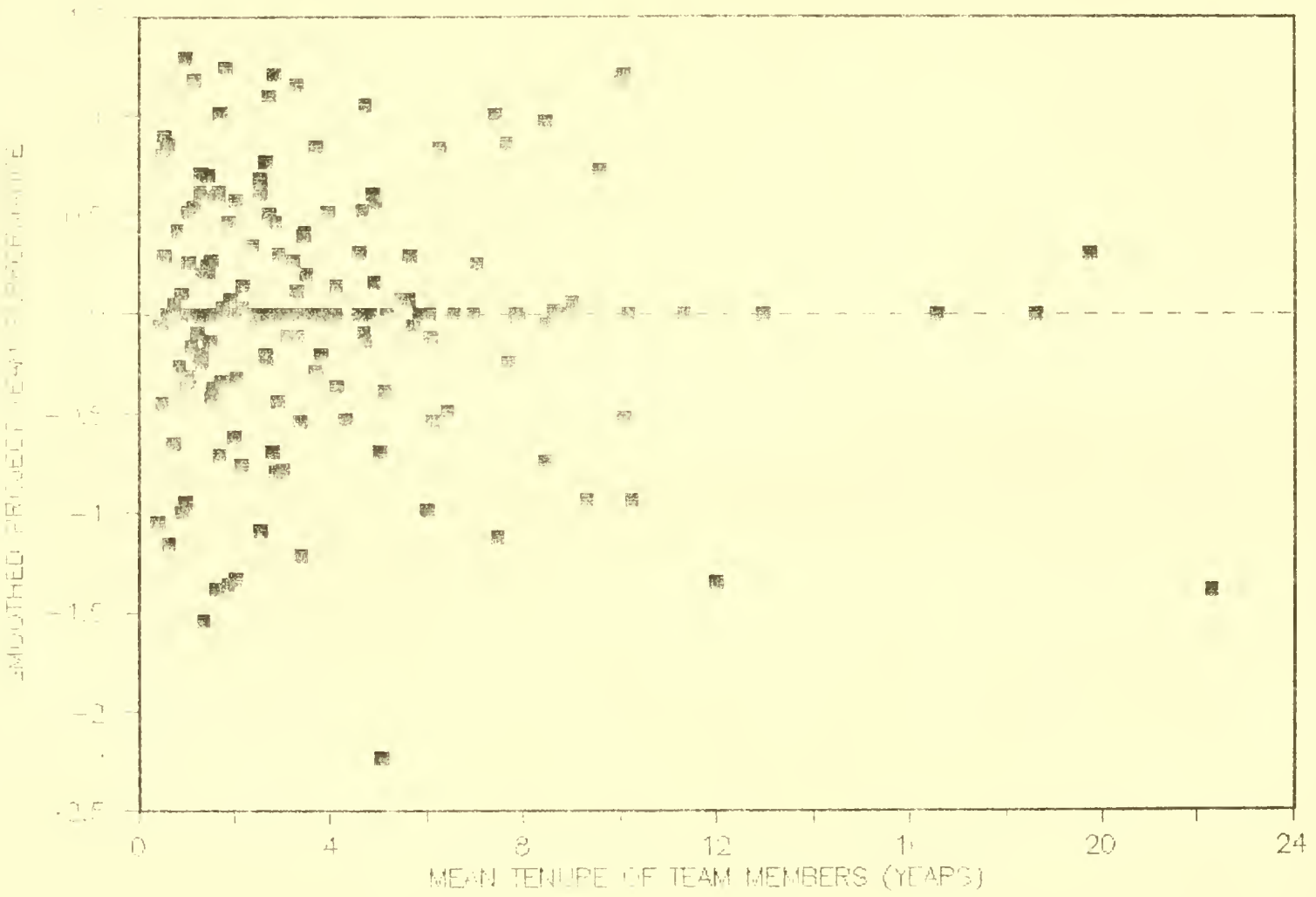

Figure 4. Smoothed Project Team Performance as a Function of Mean Tenure of Project Team Members. (N = 181)

performing long tenured teams? But first, let us examine the data a little more closely in comparison with the earlier studies.

Project Type and Comparison with Earlier Results

Recent studies suggest that not all R&D project groups are alike in the way they should be managed, in the way they communicate, or in the kinds of tasks they pursue (Allen, et. al., 1979; 1980). In particular, R&D projects can be categorized along a continuum ranging from research to development to technical service (Katz and Tushman, 1981).

When projects are separated into the three types and the data are reanalyzed using the same statistical smoothing process as before, some patterns emerge that at least partially explain some of the curvilinear findings from the earlier studies. There are very real and clear differences in the patterns shown in Figures 5, 6 and 7. In the case of research projects, performance decays after about four years, only to return to a point closer to the mean in the case of teams that are still "older". Similarly, in the cases of development and technical service teams, there are mean tenure points at which performance drops to a fairly low level only to recover to an average or better level for longer-tenured teams. Whether these patterns really indicate something that is happening with "middle-aged" teams or whether they are just noise is impossible to determine from the present data. Moreover, the fact that the drops in performance occur at different mean tenure points for the

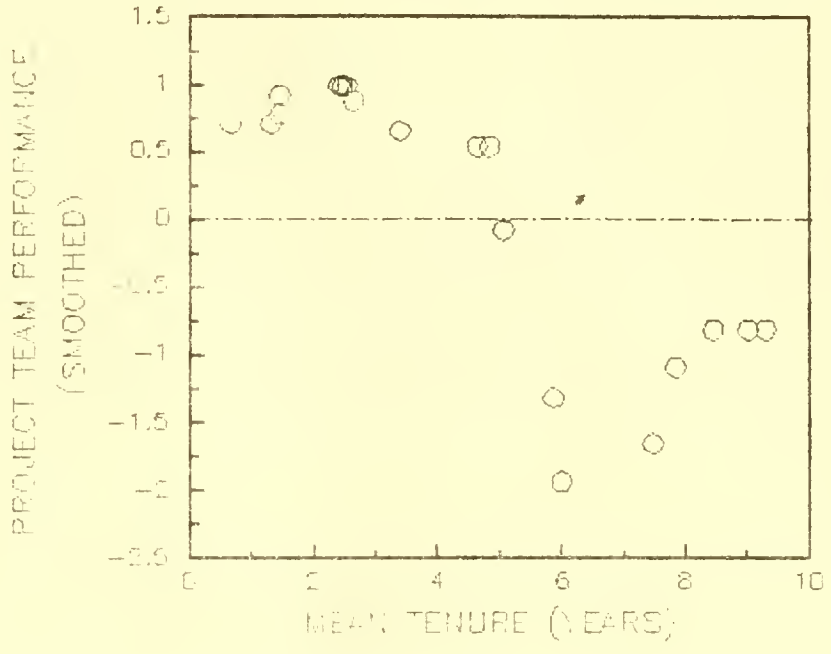

Figure 5. Project Team Performance as a Function of Mean Tenure of Team Members on Research Projects.

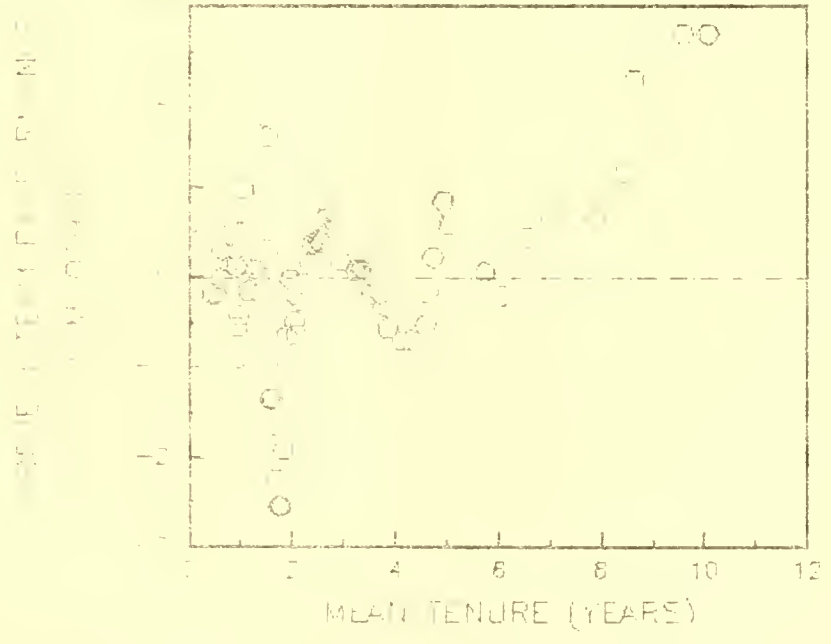

Figure 6. Project Team Performance as a Function of Mean Tenure of Team Members on Development Projects.

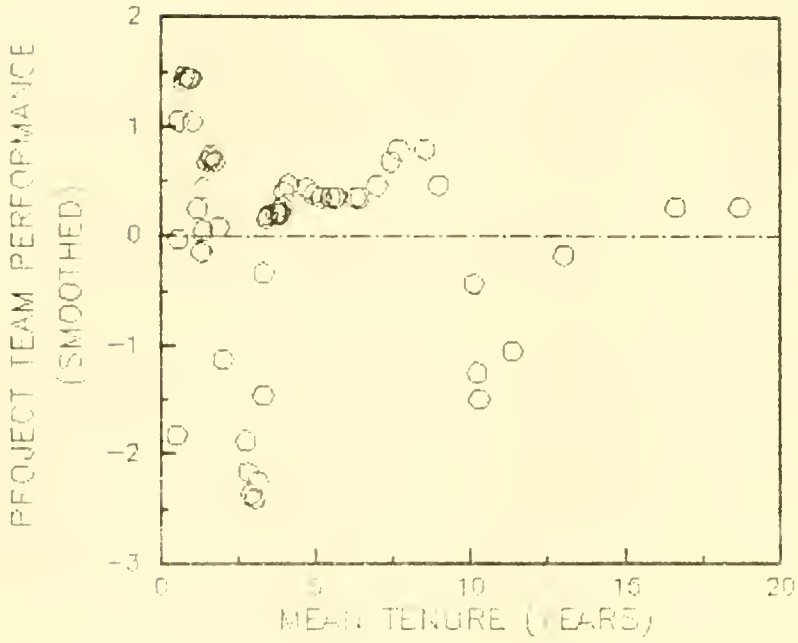

Figure 7. Project Team Performance as a Function of Mean Tenure of Team Members on Technical Service Projects.

different project types makes this even more difficult to determine. These different patterns, however, may help to explain our inability to simply reproduce previous findings. None of the earlier studies examined project teams whose mean tenure exceeded eight years. It could well be that whatever is causing the decay in performance among the "middle-aged" teams of Figures 5 through 7 also caused the observed decay in the earlier studies.

There are distinct drops and recoveries in performance that can be seen in Figures 5, 6 and 7. These occur at different points for projects within each of the three types of R&D activity: between four and five years for research teams, at two and four years for product development teams, and at three and ten years for technical service teams. One can even see this pattern to some degree in our earlier data (Figure 2). Following the drop in performance that occurs between four and six years, there appears to be some recovery by the two longest-tenured projects. Now all of this may be simply spurious or an artifact of the smoothing technique. Nevertheless, it is worth speculating whether there could be certain points in a team's development that are quite critical. And it may be that at these points some set of relationships develop, both internal and external to the team, that ultimately have a strong effect on the project group's overall performance.

The fact that long-tenured project teams exhibit such a substantial variance in performance, some apparently falling victim to the "NIH"

syndrome and becoming less effective while others maintaining high performance, provides an opportunity to see what kinds of relationships underlie the variance in performance. Fortunately, the survey asked project team members a number of questions about themselves, their relationships with the organization, and most importantly, about their relationships with both their project and functional management.

Comparing High and Low Performing Long Term Project Teams

There are a number of interesting ways in which the high performing long-tenured project teams differ from their less successful counterparts. This is particularly true of the way in which the teams relate to both their project and their functional management.

Each project team member was asked to evaluate on a seven-point scale both the project manager and the relevant department head or functional manager along a number of leadership dimensions related to the management and technical support of the project. The questions were independently asked for both project and functional managers, affording the opportunity to test the degree to which the responses might be similar or different for each of these managerial roles. Within each team, responses were aggregated separately to obtain overall team measures of project and functional managers that could then be related to project team performance.

Role of the Project Manager. Perhaps the most striking characteristic of the data in Table I is the general lack of any strong relationship between the team's perceptions of project manager's characteristics and behaviors and the project team's performance. Only three of the 19 leadership attributes that were measured relate significantly to performance. It is interesting to note that these three all relate to the role of the project manager in coupling the project team to the rest of the organization. We have argued elsewhere (Katz and Allen, 1985) that this is the project manager's principal role. It is possible that this role is especially critical for long-tenured teams. It is also interesting to see how little direct effect the other project manager attributes have on the project's performance.

Role of Functional Managers. Once again, most of the leadership attributes do not correlate very strongly with performance (Table II). The two significant exceptions are noteworthy, however. Both statements relate to the role of the functional manager as that of connecting to underlying technologies. This is in accord with our earlier description of this role as one that manages the technological input to the organization (Katz & Allen, 1985; Allen, 1986; Allen & Hauptman, 1987). Long-tenured teams perform better when functional managers provide technical information; maintain currency regarding professional activities; are technically and professionally involved with team members and maintain high performance standards. In short, they function to protect the long-run technical capabilities and competencies of the project team. But as

Table I

Project Manager Attributes and Performance of Long-Tenured Project Teams

Project manager	Correlation with project team performance	
	r	p
disseminates important and relevant information concerning state-of-the art technical advances.	0.04	N.S.
manages meetings very effectively.	0.14	N.S.
is effective in keeping me informed about my overall performance.	0.05	N.S.
keeps current and is well-informed about the latest professional.	0.06	N.S.
has the ability to recognize and mediate conflicts between groups or individuals	0.31	0.02
is an excellent sounding board for new ideas.	-0.01	N.S.
is particularly effective at providing original ideas or fresh approaches.	0.08	N.S
encourages us to participate in important decisions.	-0.09	N.S
has important and useful contacts with other R&D professionals outside this organization.	0.15	N.S
maintains high standards of performance	0.19	N.S
is heavily involved in the technical details of my work.	-0.06	N.S
has been very instrumental in my professional development and I have learned a great deal from him	0.14	N.S
has considerable influence which is useful in obtaining the various resources necessary to carry out my work, effectively	0.27	0.04
provides excellent and constructive feedback on my written materials and reports	-0.03	N.S
has excellent conceptual understanding of my work.	-0.03	N.S
is effective at providing appreciation and recognition for work well done.	-0.03	N.S.
has important and useful contacts with other R&D professionals within this organization.	0.31	0.02
has a good understanding of the applied techniques and methods I use in my work.	-0.01	N.S
assigns me to jobs or tasks on which I am challenged professionally to perform well.	0.01	N.S

Table II

Functional Manager Attributes and Performance of Long-Tenured Project

Functional manager	Correlation with project team performance	
	r	p
disseminates important and relevant information concerning state-of-the-art technical advances.	0.37	0.05
manages meetings very effectively.	-0.06	N.S.
is effective in keeping me informed about my overall performance.	0.15	N.S.
keeps current and is well-informed about the latest professional activities.	0.48	0.01
has the ability to recognize and mediate conflicts between groups or individuals.	-0.04	N.S
is an excellent sounding board for new ideas.	-0.05	N.S.
is particularly effective at providing original ideas or fresh approaches.	0.05	N.S.
encourages us to participate in important decisions.	-0.03	N.S.
has important and useful contacts with other R&D professionals outside this organization.	-0.02	N.S
maintains high standards of performance.	0.27	N.S
is heavily involved in the technical details of my work	0.27	N.S
has been very instrumental in my professional development and I have learned a great deal from him.	0.28	N.S
has considerable influence which is useful in obtaining the various resources necessary to carry out my work, effectively	0.19	N.S
provides excellent and constructive feedback on my written materials and reports	0.21	N.S
has excellent conceptual understanding of my work.	0.02	N.S
is effective at providing appreciation and recognition for work well done	0.23	N.S
has important and useful contacts with other R&D professionals within this organization.	0.15	N.S
has a good understanding of the applied techniques and methods I use in my work	0.07	N.S.
assigns me to jobs or tasks on which I am challenged professionally to perform well.	0.29	N.S

long-tenured project teams perform better when the functional manager provides the technological connection, they also need and perform better when the project manager provides a strong organizational connection for integrating and using these technical abilities.

Contrast with Newly Formed Groups

Given that the leadership roles of project and functional managers are critical, albeit in very different ways, to the performance of long-tenured teams, to what degree is this a characteristic only of such teams? The other teams in our sample, i.e., more newly-formed teams, also vary in performance. Does the differentiation of project and functional roles also explain some of the performance variations in these "younger" teams or are other differences going to be more important?

To examine this question, long-tenured teams are compared with more newly-formed teams (mean tenure of less than 18 months) to see the degree to which they differ in terms of how the leadership factors correlate with performance.

When this comparison is done, the pattern of overall results can best be seen by simply contrasting the direction of the bars in the graphs as shown in Figures 8 and 9. In each of these figures, the magnitudes and directions of the performance correlations for each of the leadership statements are represented by bars. The correlations for project manager

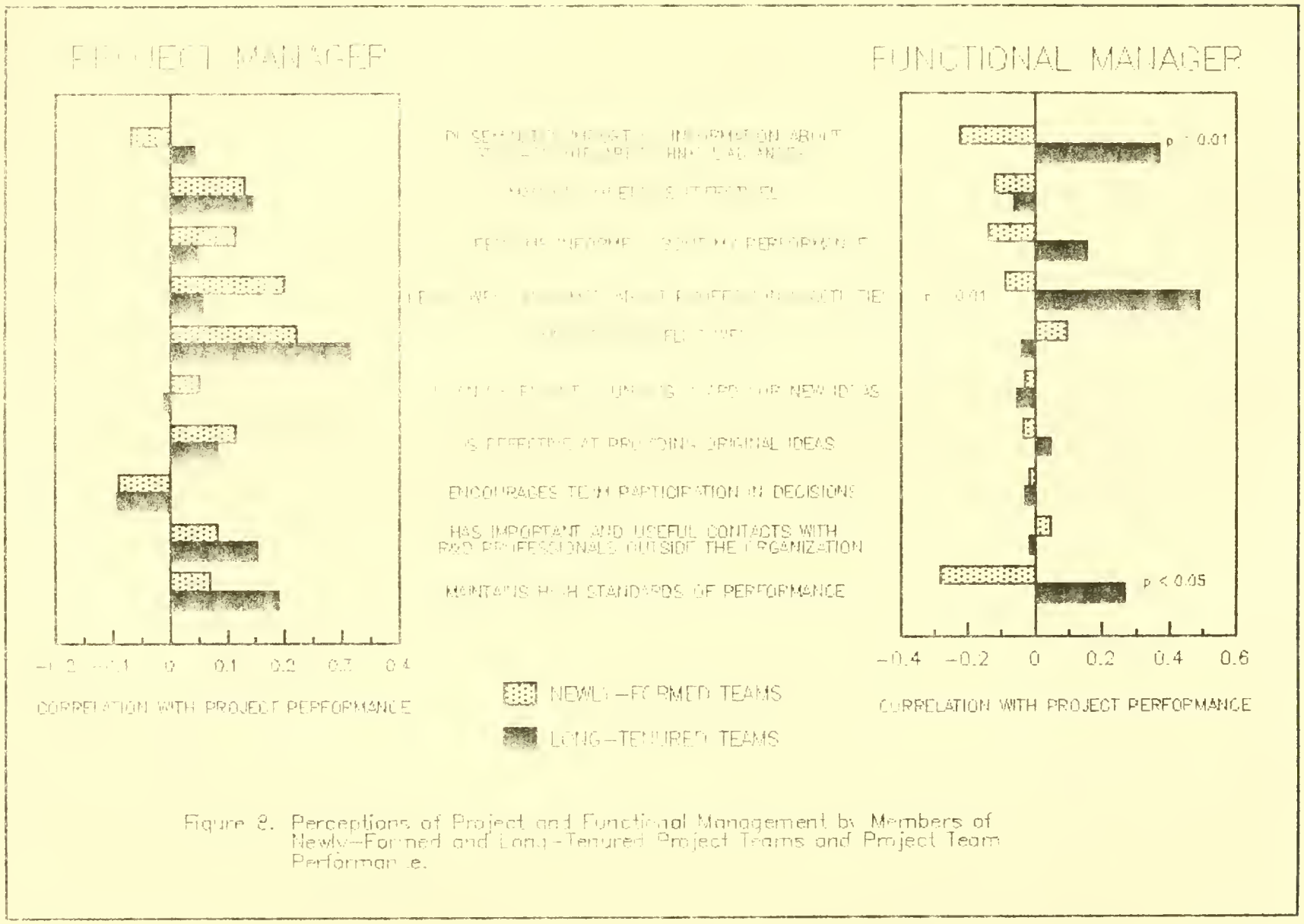

Figure 2. Perceptions of Project and Functional Management by Members of Newly-Formed and Long-Tenured Project Teams and Project Team Performance.

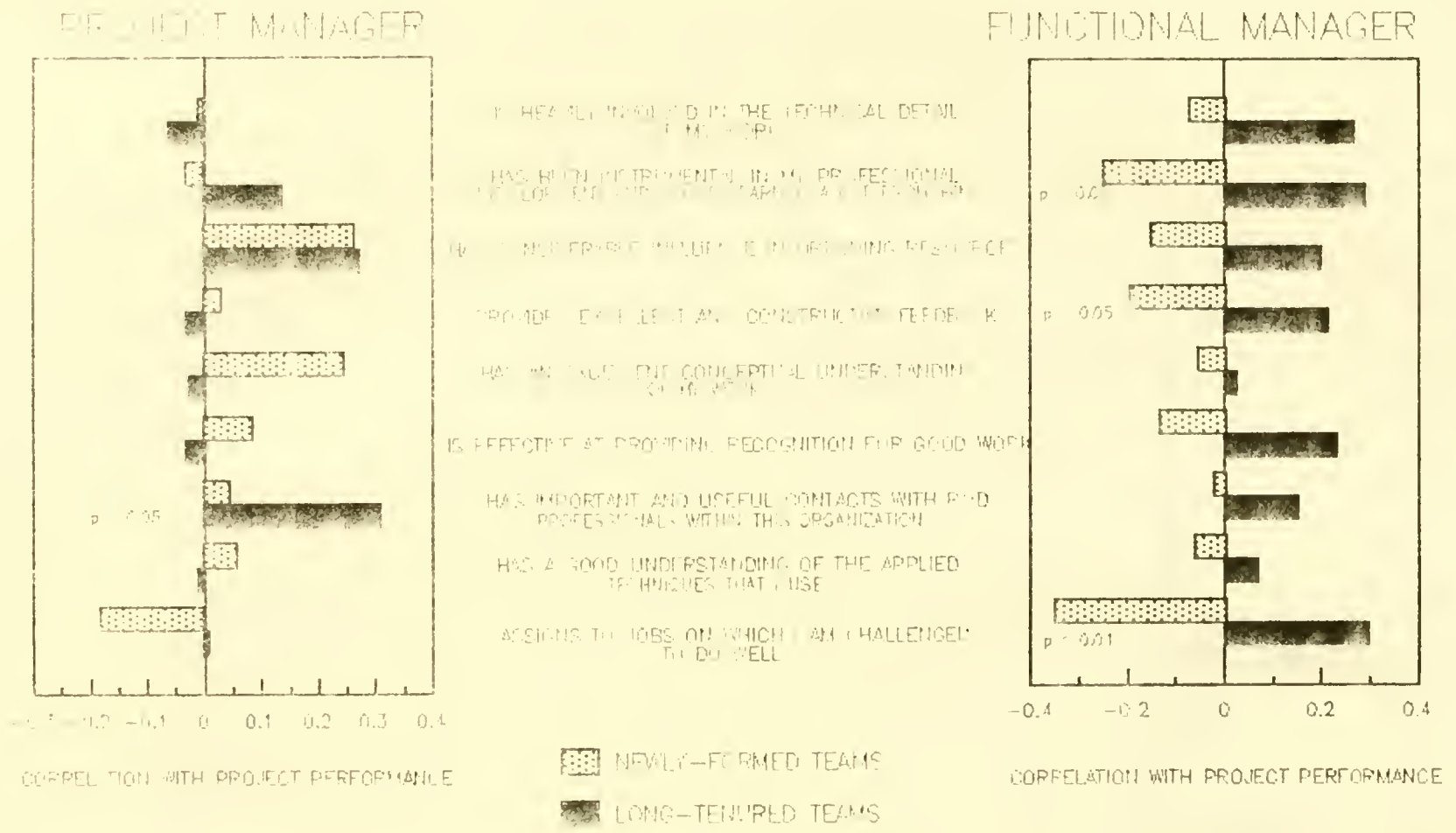

Figure 9. Perceptions of Project and Functional Management by Members of Newly-Formed and Long-Tenured Project Teams and Project Team Performance.

attributes for both the newly-formed and long tenured teams are shown on the left; those for the functional managers are shown on the right. On each side, "p-values" are displayed when the correlations between "young" and "old" teams are significantly different.

What is immediately obvious in these comparisons is that the bars for newly-formed and long-tenured teams are generally in the same direction on the project manager side but often in different directions on the functional manager side. In other words, project managers should treat both "young" and "old" teams similarly in order to foster high performance. This is not true for functional managers. The role of functional management needs to be very different; either more or less pronounced, depending upon how long group members have been working and interacting together. This is particularly true in areas relating to technology and its development. Functional managers need to be much more concerned with providing technical information, professional development opportunities, feedback and challenge, and to insist on high performance standards for project team members who have been away from their specialty departments for extended time periods.

DISCUSSION AND CONCLUSIONS

The notion that both project and functional management affect project team performance, but in different ways, is neither a new nor a surprising discovery. What is most interesting in the present results is to understand just how important effective functional management may be to the performance of long-tenured teams.

While the project manager's roles and responsibilities for connecting the project team to the rest of the organization are equally important regardless of the length of time that the team has been working together, the importance of functional management increases with team age. Katz and Allen (1982) have shown that teams tend to isolate themselves from their basis of technical knowledge as they age. Pelz and Andrews (1976) showed that teams prefer narrower, more specialized work, as they age. It is the role of the functional managers to prevent these two effects from developing. The functional managers must insure that those of their staff, who are on longer term project assignments, continue to be well connected to the relevant technologies either directly or indirectly through on-going interactions with key technical gatekeepers (Allen, 1977). Long-tenured team members must also be sufficiently stretched and stimulated to remain broad and open-minded in their approaches to and uses of those technologies.

Too often, there is a tendency to allow just the opposite to happen. The longer a department member is assigned to a project or series of projects, the less concern there is for that individual on the part of functional management. This is true even in matrix organizations. Functional managers devote a lot of attention to those members of their departments who are not on project assignment or who are between project assignments. They either want to get these people into direct charges (projects) or they have them performing work which falls within the charters of their departments. (IR&D, for example). As a consequence, those who have been given long term, continuing project responsibility and, "taken care of," so to speak often receive less attention until a real problem emerges. They are not on the functional manager's budget, they are well acquainted with their assignments, they are well experienced, and as a result, seem to need less direction in their work either from functional or even project management. It is no wonder then that functional management often forgets about them and that they consequently are allowed to slip easily into the "not invented here" syndrome.

The net conclusion to this study is a very simple one. As a team ages, two different but essential leadership roles become increasingly important. There must be strong, influential management to link and integrate the team with the organization's goals, resources, expectations, etc. It is the project manager who must make sure that the team has the appropriate attention of the organization and that the team and the organization are

in synchronization. Research has consistently shown that one of the most important factors inhibiting the speed and development of new products is the lack of continuity in the focused commitment on the part of the organization to the project team's efforts (Schon, 1967; Maidique, 1980). For a variety of reasons, including reorganizations, resource reallocations, promotions and reassignments, etc., the continuity of organizational attention is often compromised. For example, in his study of long-term development efforts in the design and manufacturing of semiconductor chips during the 60's and 70's, Vanderslice (1983) showed that there was simply too much rotation of project managers and their organizational counterparts to maintain a continuity of effort that would foster speedy and effective performance. One of the most important roles of the project manager, then, is to make sure that the team continues to have the appropriate attention of the organization and that it is able to interface effectively within this political context.

But this managerial role alone is not sufficient to overcome the strong trends toward NIH that often emerge within long-tenured teams. There also needs to be effective functional management to prevent the development of NIH. Functional management has the responsibility to keep their staffs up-to-date and continuously challenged. This must be a serious and credible effort for it is the "technical culture" they try to establish that will ultimately affect the obsolescence, work orientations, and communication networks of the technical workforce (Allen and Katz, 1986).

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