Work Environment, Organizational Relationships and Advancement of Technical Professionals

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INTRODUCTION

The purpose of this research is to investigate the relationships between characteristics of engineers, their perceptions of their work environment, the relationships they have with their project and functional managers, their career goals and promotion histories. While companies expend a great deal of effort in recruiting and selecting technical professionals for employment, relatively little effort is put into properly managing the environment, which they face during their early years with the organization. Many years ago, in a classic study of newcomers to AT&T showed that the factors mostpredictive of success five years after joining were the challenge of the first assignment and the importance of that project to the organization. Those individuals who worked on challenging and important assignments were rated as higher performers five years later. Those who were given less challenging and important assignments tended to become either low performers or leave the company (possibly to become high performers elsewhere) (Hall and Nougaim, 1968). Katz and Tushman (1983) found that those newcomers who had gatekeeping supervisors early in their careers were more likely to have been promoted five years later. In both of these studies the predictor of performance was external to the individual and was an aspect of the environment which could be directly controlled by management. This study attempts to extend this research by examining both the characteristics of engineers and their perceptions of their work environment as causal influences on

the career advancement of these engineers. It compares what people of different ages, and presumably at different stages of their careers, want from their career and expect to receive from their employing organization and their perceptions of their project and functional supervisors' ability to provide resources (i.e. budget and access to people both inside and outside the organization) as explanatory variables to predict the likelihood of promotion.

THEORETICAL FRAMEWORK

The research begins with two simple propositions. First, those people who want to be promoted are more likely to be promoted and second, those people with access to organizational resources including money and technical contacts in the organization are more likely to be promoted. Both these propositions are deeply rooted in behavioral research. The former arises from the expectancy theory of motivation, which predicts that people work to accomplish tasks they think can be completed successfully in exchange for rewards that they value and expect to receive for adequate task performance. People have expectations concerning their ability to complete a given task as well as expectations of the rewards they are likely to receive for different levels of performance. They also have affective and cognitive assessments of the value of rewards they perceive themselves likely to receive relative to the difficulty of, and their interest in the task before them. Engineers are therefore expected to be more motivated and to work harder for rewards they value. Other factors, such as training and talent, being equal, those who work harder and who

want to be promoted are more likely to be promoted.

The second relevant theorewcal framework is taken from research on access to resources in organizations. Salancik and Pfeffer (1977) argue that those subunits within organizations which are able to gain control of resources critical to the organization become more powerful. Although Salancik and Pfeffer's work utilized organizational groups as the focal unit, their theory might reasonably be applied to individuals, as is done in the current study. Assuming that funding and access to key technical personnel are critical resources and that producing good technical work helps the organization meet a critical contingency for continued funding, engineers who work for managers who are able to provide them with these resources are more likely to perform better and be promoted than those engineers who are less able to gain access to these resources. In addition to the higher performance that access to resources may enable, the managers with better access to resources may be more able to help engineers working for them gain promotions as rewards for high performance. This group of managers may also be responsible for projects which are more important to the organization. Engineers working for them are assigned to critical projects where their performance is more visible to higher level managers. This is essentially what Katz and Tushman (1983) found, since gatekeepers tend to be higher performers and are also more visible to management.

RELATED RESEARCH

The subject of career progress and performance of engineers and scientists is a topic which has attracted a number of investigators over the years. Pelz and Andrews (1976), for example, studied a broad range of environmental and individual characteristics as predictors of performance. They found that high performance was associated with creative tensions between security and challenge. Akin to Yerkes-Dodson's Law (Yerkes & Dodson, 1908), they found that extremely loose or overly constraining environments inhibited creativity and productivity. Performing a variwy of tasks, such as basic and applied research or administrative duties, was one dimension of creative tension. People who were confined to a single task were not as productive. Pelz and Andrews attributed this to the juxtaposition of different information which increased the likelihood of linking disparate ideas. They found that giving scientists freedom to choose their approach to problem solving coupled with some strategic direction from their supervisor, to help them set research goals, led to higher performance. This creative tension between tactical autonomy and accommodation to their supervisor's strategic direction helped align the researcher's program with the organization's goals. They found that constraints on time and frequent interaction with other researchers were also associated with high performance. Freedom coupled with links to the organization and their peers was yet another factor associated with high performance.

Pelz and Andrews also looked at the characteristics of the scientists.

Those who depended upon their own initiative to locate ideas and who had a stronger belief in those ideas performed better. They found that those with a narrow focus early in their career performed less well but that as people matured a narrowing and specialization led to higher performance. Pelz and Andrews' findings are rich and draw out some aspects of a mosaic for understanding what leads scientists to be high performers.

Other research concurs with these findings. Bailyn (1985), in an exploratory study of technical personnel, found the typical pattern of control in many R&D organizations was contrary to what Pelz and Andrews' data indicate leads to higher performance. Bailyn describes new technical people being given strategic autonomy and then having tactical limits placed upon them, rather than giving them strategic direction and more tactical autonomy.

Andrews and Farris (1972) in a follow-up to the original work by Pelz and Andrews examined the relationshipwetween time pressure and performance. They found that those scientists who wanted and experienced above average time pressure were higher performers five years later. These scientists were higher communicators, more motivated by their work, and involved in administrative as well as technical duties. They were also well integrated into their employing organization.

Using a communications sampling method, (Allen, 1977), Katz and Tushman (1983) extended Pelz and Andrews' work to examine how

gatekeepers influence the career paths of their subordinates. Katz and Tushman found that subordinates who had gatekeeping supervisors were more likely to remain with the organization and were more likely to be promoted. Since 80 percent of gatekeepers in their study were first line supervisors, they had frequent direct interactions with new engineers. Katz and Tushman argue that in addition to technical knowledge, these gatekeepers very likely communicated other information about the organization and helped to socialize the recruits and to integrate them into the organization.

In another study, Bailyn (1980) examined the career goals of MIT graduates and discovered two contrasting career patterns: an Engineering-Organizational career pattern and a Scientific-Professional career pattern. The EO-pattern people, who included engineers and managers, looked to their organization for their definitions of success and achievement, while the SP-pattern people looked at their careers in terms of their discipline and professional peers and did not perceive their careers as closely based in any particular organization in the same manner as did people in the EO-pattern group. People following the EO-pattern indicated that the opportunity for high pay and promotion were very important job attributes for them, while the SP-pattern people thought the chance to be creative and original was more important.

Schein (1982) also studied the careers of technical personnel. His scheme employs the concept of a career anchor which acts like a center of competence and meaning. Career anchors develop over a number of years

as people age and pass through different phases of their career. In Schein's scheme, new hires negotiate a psychological contract with the organization early in their tenure. Over time their experiences provide feedback regarding their competencies and motivations, and help them to adjust their cognition to fit what they may be able to expect from the organization in terms of pay and promotion. Unlike Bailyn, Schein considers engineers to be following careers more similar to the SP-pattern, and as essentially different from those pursuing managerial careers.

The current study examines how career outcomes, as defined by promotion, non-promotion, or turnover, are affected by characteristics and perceptions of staff engineers in a not-for-profit R&D laboratory. This study uses promotion onto either the technical or managerial ladder as an indicator of high performance. This differs from Pelz and Andrews' more subjective assessment of research creativity and productivity as performance indicators. Employing promotion as a metric of high performance does not necessarily distinguish clearly between high and low technical performers. It instead distinguishes those who have been successful organizational performers. The study also uses the engineers' self-perceptions as well as their perceptions of the environment, age and organizational tenure as independent and possibly causal variables.

RESEARCH METHOD

The data for this study were gathered over an approximately ten-year period. In 1978, a group of 311 engineers and managers in a not-for-profit R&D organization were surveyed on their career goals, what they preferred in work assignments; what types of work were most likely to motivate them to work to attain a feeling of accomplishment; their perceptions of their current assignment; their relations with both functional and project managers, and their expectation as to whether high performance on their current assignment would lead to promotion. In 1988, this group was re-examined to determine what had happened in terms of organizational advancement. They were then categorized on this basis into those promoted onto the managerial ladder or the technical ladder (cf. Allen and Katz, 1982), those who received no promotion, and those who left the organization. The analysis is based on a subset of the original 311, comprising a group of 235 people who were all staff engineers (i.e. neither managers nor in a technical ladder position) at the time of the initial survey in 1978 and who could be identified in the 1988 follow-up.[1]

[1] Since both surveys were anonymous, individual identities were never available, but responses could, in most cases, be easily matched on the basis of age, organizational tenure, education and similar demographic measures.

RESULTS

Three dependent variables were constructed from the career outcome data. The 235 individuals were grouped into those who were promoted (N = 55) and those who were not promoted (N = 98). The promoted group was further subdivided into those who were promoted onto the managerial ladder (N = 42) and those who were promoted onto the technical ladder (N = 13). An additional separation was made between those who remained with the organization (N = 154) and those who left the organization (N = 81). One individual who was promoted into a special administrative staff position was included in those who remained with the organization, but was excluded from the groups who were promoted onto the technical or managerial ladders. The promotion was not a line promotion and could not be readily compared to the other two types of promotion.

Tenure and Career Outcomes

Age and tenure in the organization were studied as primary causal influences on promotion. Career motivations change as people age. People develop different levels of involvement at work, some accomodate to their life outside of work, while others single-mindedly concentrate on their careers. People learn whether they are going to be promoted and adjust their cognitions to fit their circumstances. While age may directly affect career aspirations, another important variable is organizational tenure. Those who have been with an organization longer are both better

known and have greater knowledge of what is required to move up in a particular organization. (Age and organizational tenure are strongly but not perfectly correlated in this sample ($r = 0.55$, $p < 0.001$).)

Listed in Table I are the number of staff engineers in five-year age strata. Note that there were no people under 22 and the oldest age stratum was broadened to include three people between the ages of 61 and 63. Also listed in Table I are the percentage of people within each age stratum who left the organization or who were promoted during the intervening ten years. There were moderately strong inverse relationships between age and leaving ($r = -0.30$, $p < 0.001$) and between age and promotion ($r = -0.31$, $p < 0.001$). This is caused largely by the exceptionally high turnover of those under 26. In general, younger engineers were more likely to leave. They were also more likely to be promoted, especially into management (Tables II and III).

The first result was expected. The second may be surprising, until one considers that those who were over 40 and who were promotable had probably already been promoted and those who remained as staff engineers past this age, while still being able to perform high quality technical work, may have come to be viewed by others in the organization as unsuitable for promotion onto either ladder. The mean ages for the different career outcome groups are listed in Table II. Students' t-tests demonstrate significant differences between the unstratified age data for the promoted and non-promoted groups as well as between those who stayed with the organization and those who left. Those promoted onto

the technical ladder tend to be older than those promoted onto the managerial ladder ($r = -0.23$, $p < 0.05$). Only one technical promotion was given to someone who in 1978 was under 36, while 17 managerial promotions were given to those who were under 36 in 1978 (Table III and Figure 1). This accounts for eight percent of the technical promotions versus 42 percent of the managerial promotions.

TABLE I

Career Outcome in 1988 as a Function of Age in 1978

		Left Company		Stayed			
				Promoted		Not Promoted	
Age (in 1978)	N (in 1988)	N	percent				
22 - 25	28	24	86%	3	75%	1	25%
26 - 30	24	9	38	8	53	7	47
31 - 35	23	7	30	7	44	9	56
36 - 40	29	8	28	12	57	9	43
41 - 45	24	3	13	8	38	13	62
46 - 50	39	6	15	8	24	25	76
51 - 55	38	7	18	7	23	24	77
56 - 63	22	9	41	2	15	11	85
unknown	8						
	235	73		55		99	

The percentage of people within each age stratum (Table I) who left indicate that the youngest group and the oldest group were more likely to

leave, with those in the middle age strata being most likely to stay. This bi-modal turnover distribution suggests that those who left comprise younger engineers who probably went elsewhere to work and older engineers most of whom probably retired.

The relationship between organizational tenure and promotion is very weak ($r = -0.08$, p = n.s.). There were no differences between mean tenure for those promoted versus those not promoted or for those who received a promotion onto the technical ladder versus those who received a promotion onto the managerial ladder. This result is not necessarily what one might expect. It could be argued that those who had been in the organization longer than some critical period would be more integrated into the communications network; would be more deeply socialized and would have better information regarding what was necessary for promotion. The process of being integrated into communication networks

TABLE II

Career Outcome in 1988 as a Function of Age in 1978

Outcome	Mean Age	Standard Deviation	t	p
Promoted	39.8	9.2	4.05	< 0.001
Not Promoted	45.9	8.8		
Technical Promotion	43.5	7.1	1.73	N.S.
Managerial Promotion	38.6	9.5		
Left Company	36.8	13.2	4.72	< 0.001
Stayed With Company	43.7	9.4		

is expected to have a logistic, or s-curve, shape. Previous work shows that more than three years are required to become sufficiently integrated into a communication network to function as a technological gatekeeper (Allen, 1977). Saturation within any particular network may be expected to occur after three to five years (Allen, 1977). The data for this study do not indicate the actual date of promotion, only that at the end of ten years an individual had or had not been promoted. No measure is available from the intervening critical period during which people were becoming part of the networks within this organization. So, within the context of this study there is no evidence of a relationship between organizational tenure and promotion. Nor from the above argument would one be expected, since the critical time period during which communication networks develop and socialization take place is considerably less than the ten year period between the two measurements. On the other hand, it must be observed that promotions in this organization are not based on the criterion of tenure alone (or perhaps even at all), but more likely on the

TABLE III

Promotion as a Function of Age				
	Managerial Promotion		Technical Promotion	
Age (in 1978)	N	percent	N	percent
22 - 25	3	100%	0	0%
26 - 30	7	88	1	12
31 - 35	7	100	0	0
36 - 40	9	75	3	25
41 - 45	5	63	3	37
46 - 50	3	37	5	63
51 - 55	7	100	0	0
56 - 63	1	50	1	50
N	42		13	

basis of merit, as most organizations claim but many do not practice. The one significant relationship that does exist is between tenure and staying in the organization. Thirty-three of the 68 people (48 percent) who had been with the organization for less than one year at the time of the initial survey in 1978 had left during the intervening year. Partial correlation coefficients for career outcomes and age and tenure indicate that age is the more important variable for explaining career outcome (Table IV).

TABLE IV

Correlations Between Career Outcomes, Age and Organizational Tenure

Career Outcome	Age	Age Controlling for Tenure	Tenure	Tenure Controlling for Age
Left the Company	-0.30	-0.25	-0.18	-0.02
	$p < 0.001$	$p < 0.001$	$p < 0.005$	N.S.
Were Promoted	-0.31	-0.32	-0.08	0.11
	$p < 0.001$	$p < 0.001$	N.S.	N.S.

The next issues explored are the relationships between career motivations and outcomes, and between age and career motivations. The engineers were asked to indicate on a scale from one to seven the degree to which they wanted their careers to be a progression of promotions on a technical ladder or increasing managerial responsibility or a series of interesting and challenging project assignments, independent of any promotion. It was hypothesized that people who wanted their career to be a progression up the managerial ladder were more likely to receive a managerial promotion than those who wanted their career to be a

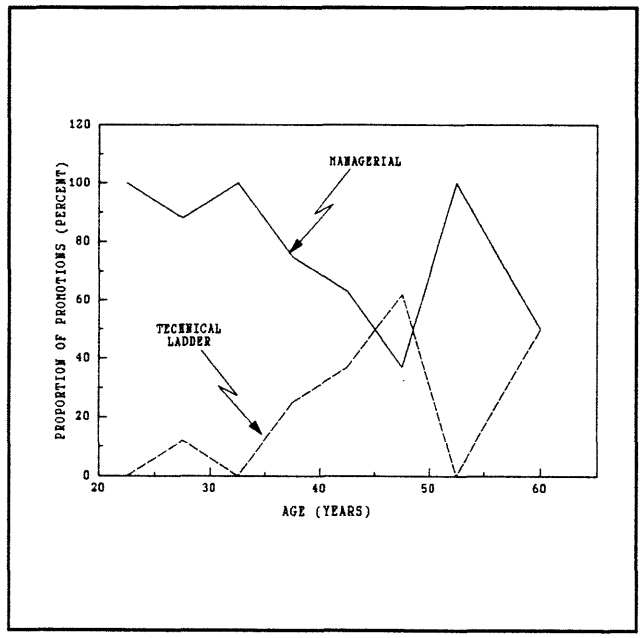

Figure 1. Age Distribution of Promotions on the Managerial and Technical Ladders.

progression up the technical ladder. The results did not support this hypothesis. People who viewed their career as a progression up the technical ladder were more likely to be promoted on the technical ladder ($r = 0.18$, $p < 0.02$). There is no statistically significant relationship between a preference for a managerial career and managerial promotion.

Another unexpected finding is that those people who left the organization

TABLE V

Preferred Career Paths and Career Outcome

Career Outcome	Career Viewed As:		
	Technical	Managerial	Project
Left the company	-0.17	0.03	-0.07
	$p < 0.01$	N.S.	N.S.
Were Promoted	0.18	0.10	-0.05

were less likely to view their career as a progression up the technical ladder ($r = -0.17$, $p < 0.01$). This result is probably unique to the particular organization and indicates it to be a hospitable one for the more technically oriented engineer.

Tenure, at least in this organization, leads to a declining interest in managerial promotion but not in technical ladder promotion (Table VI).

Moreover, as can be seen from the partial correlations, the decline is attributable to organizational tenure, independent of the individual's age.

TABLE VI

Correlations Between Age, Organizational Tenure and Degree of Preference for Three Career Paths

Career Viewed As:	Age	Tenure	Tenure, Controlling for Age
Technical	-0.01	-0.04	-0.04
	N.S.	N.S.	N.S.
Managerial	-0.01	-0.17	-0.20
	N.S.	$p < 0.01$	$p < 0.01$
Project-Oriented	0.07	0.16	0.14
	N.S.	$p < 0.01$	$p < 0.02$

While an individual's career orientation is related in only a limited way to promotion, turnover, and organizational tenure and unrelated to age, the rewards that people feel they were likely to receive are strongly linked to age, organizational tenure, and promotion. Reward expectations were assessed by asking the engineers to what degree they thought high performance on their current assignment would lead to promotion or to interesting project assignments. Expectations of receiving a promotion onto the technical ladder decline with both organizational tenure ($r = -0.26$, $p < 0.001$) and age ($r = -0.22$, $p < 0.001$). A similar pattern of correlations is found for expectations of receiving a management promotion and organizational tenure ($r = -0.17$, $p < 0.01$) and age ($r = -0.22$, $p < 0.001$). Note that only age correlates with expectations of

receiving challenging assignments as a reward for high performance on their current projects ($r = -0.15$, $p < 0.02$), while organizational tenure does not (Table VII).

TABLE VII

Correlations Between Reward Expectations, Age and Organizational Tenure

Expectation of Reward	Age	Age Controlling for Tenure	Tenure	Tenure Controlling for Age
Technical Ladder Promotion	-0.22	-0.10	-0.26	-0.17
	$p < 0.001$	N.S.	$p < 0.001$	$p < 0.01$
Managerial Promotion	-0.22	-0.16	-0.17	-0.06
	$p < 0.001$	$p < 0.01$	$p < 0.01$	N.S.
Project Assignments	-0.15	-0.12	-0.11	-0.02
	$p < 0.02$	$p < 0.01$	N.S.	N.S.
Promotion (Average of Technical & Managerial)	-0.27	-0.16	-0.25	-0.13
	$p < 0.001$	$p < 0.01$	$p < 0.01$	$p < 0.05$

The partial correlations indicate that expectations of receiving a managerial promotion decline more as a function of age, while tenure has a stronger effect on the expectation of receiving a technical promotion. In general, those who were younger perceived themselves as more likely to receive a promotion as a reward for high performance on their current assignment.

The only outcome related to reward expectations is promotion onto the

managerial ladder (Table VIII). Those people who were promoted are more likely to have expected a managerial promotion as a reward for high performance ($r = 0.35$, $p < 0.001$).

TABLE VII

Correlations Among Managerial Promotion, Age and Organizational Tenure

Career Outcome	Expectation of Managerial Promotion	Controlling for Age	Controlling for Tenure
Promotion	0.35	0.30	0.34
	$p < 0.001$	$p < 0.01$	$p < 0.001$

The correlations among the three reward expectations are shown in Table IX. The three are strongly intercorrelated, particularly the expectation of technical or managerial promotion. People expect that high performance on their current project will lead to a reward but are unsure of just what the reward will be. Consequently, a single indicator of promotion

TABLE IX

Correlations Among Reward Expectations

Expectation of:	Expectation of:	
	Managerial Promotion	Challenging Project Assignment
Technical Ladder Promotion	0.48 $p < 0.001$	0.49 $p < 0.001$
Managerial Promotion		0.19 $p < 0.005$

expectation is formed for each person by averaging their responses to the

two questions regarding expectation of managerial and technical ladder promotion. This indicator is then used to examine how expectations of promotion vary with age and tenure.

Listed in Table X are the mean values for promotion expectancy for each age stratum. These data are consistent with the hypothesis that people change their expectations of being promoted as they grow older, and also with the selection effect which leaves only those who are not promotable or who chose to not be promoted in the older strata. The relationships between age and promotion expectation is the same for those who remained with the organization and those who left ($r = -0.28, p < 0.001$ vs. $r = -0.28, p < 0.01$).

TABLE X

Promotion as a Function of Age

Age	N	Strength of Expectation of: Promotion (Average of Technical & Managerial)	Technical Ladder Promotion	Managerial Promotion	Project Assignment
22 - 25	27	4.09	4.41	3.65	4.65
26 - 30	25	4.92	5.13	4.64	5.36
31 - 35	24	3.83	3.91	3.63	4.29
36 - 40	29	4.02	4.24	3.79	4.11
41 - 45	24	4.46	4.38	4.54	4.21
46 - 50	34	3.74	4.15	3.38	4.18
51 - 55	34	3.13	3.29	2.97	3.91

Preferred Job Opportunities And Outcomes.

Moving from explicit career preferences and reward expectations, the engineers were also asked what sort of opportunities they want in a job. None of these items related to promotion, although three of them do relate to turnover (Table XI). Those people who want to work on projects important to the organization or to work on projects leading to advancement are more likely to stay with the organization, while those who want the opportunity to be original and creative are more likely to leave. These findings are consistent with Bailyn's (1980) two career patterns. Those people who valued the opportunity to achieve within the context of the organization resemble the EO-pattern group and remained with the organization, while those who valued the chance to be creative and original appear to be more like the SP-pattern group. They were less attached to this particular organization. Controlling for age and organizational tenure has negligible effect on the correlations listed in Table XI.

TABLE XI

Correlations Between Job Opportunities and Turnover

	Controlling For Age and Tenure
Work on Jobs that are Important to the Organization	-0.14 $p < 0.05$
Work on Projects that Lead to Advancement	-0.20 $p < 0.01$
Have Freedom to be Creative and Original	0.13 $p < 0.05$

Preferred Approach to Work, Feelings of Achievement and Career Outcomes

The engineers were also asked about their preferred approaches to work and about the achievements that would give them the greatest feelings of accomplishment. People who preferred to spend enough time to find general principles which apply in many situations were less likely to be promoted ($r = -0.20$, $p < 0.01$), while those who preferred to plan out a long-range series of tasks and then perform them systematically were more likely to be promoted ($r = 0.14$, $p < 0.04$). Neither age nor tenure are significantly correlated with either preference.

The engineers who indicated that publishing a paper or developing a concrete answer to a technical problem would provide a feeling of success were more likely to remain with the organization, but these same two preferences were also inversely associated with promotion (Table XII). Those who were not promoted appear to have been more attached to the technical aspects of their work. Those who left the organization, like those who were promoted, were less likely to experience a feeling of achievement from developing concrete answers to technical problems. Either those who left the organization had not experienced any successes from developing concrete answers or they were more like the managers and had less interest in this part of the work.

This second interpretation is consistent with the earlier result presented

TABLE XII

Correlations Between Success Measures and Career Outcomes

	Left	Promoted
Publishing a Paper	-0.16 $p < 0.02$	-0.16 $p < 0.05$
Developing a Concrete Answer to a Technical Problem	-0.15 $p < 0.02$	-0.16 $p < 0.05$
Developing a Product of Superior Technical Quality	-0.09 N.S.	-0.17 $p < 0.05$

concerning the lower interest in technical ladder promotion exhibited by those who left the organization, but is inconsistent with the interpretation that those who left were more likely to be following an SP career pattern.

In addition, those who left indicated that they received less feedback on performance from their job ($r = 0.16$, $p < 0.01$) which is consistent with both interpretations.

Job Characteristics and Career Outcomes

The engineers were also asked to assess their current jobs along a number of dimensions. These questions related to the engineers' overall job roles and did not focus on particular project assignments. Being promoted went along with having almost complete responsibility for deciding how and when the work is done, having considerable influence in most decisions about the work, and having conflicting demands placed upon them (Table XIII). Age and tenure were not related to either having complete

responsibility or to having considerable influence. Both age and tenure were inversely related to the job being free of conflicting demand, but controlling for age and tenure has little effect upon the correlation between promotion and conflicting demands. Tension between self-determination and environmental demands is associated with promotion.

TABLE XIII

Correlations Between Characteristics of Previous Job and Promotion

Characteristics of Current Job	Controlling for Age and Tenure
Complete Responsibility	0.15 $p < 0.05$
Considerable Influence in Job-Related Decisions	0.21 $p < 0.01$
Free From Conflicting Demands	-0.18 $p < 0.02$

Project Characteristics and Career Outcomes

In addition to questions about their overall job, respondents were also asked about the technical aspects of their current project, their project group, and about their involvement in non-technical and administrative decisions. Included in the questions asking engineers to assess the technical and project group aspects of their current project were two which asked them if they experienced periods of extreme time pressure while working on their projects. The engineers who reported often being under extreme time pressure because they were behind on important deadlines were less likely to leave the organization ($r = -0.16$, $p < 0.01$).

Being under extreme time pressure can be interpreted as an indicator of importance of an assignment. (Less important assignments have little time pressure.) This being the case, the results are in accord with Hall and Nougain's (1968) finding that those given more important and challenging assignments were less likely to leave the company.

This item does not, however, discriminate in a statistically significant manner between those promoted and not promoted (Table XIV). The second question regarding time pressure asked engineers to assess whether they were under time pressure to produce reports, tests or other results that were urgently needed by other people. Responses to this question do separate out those who were promoted ($r = 0.18$, $p < 0.02$), while not being predictive of staying or leaving ($r = 0.08$, n.s.).

TABLE XIV

Correlations Between Time Pressure and Career Outcomes

			Controlling for Age and Tenure	
	Left	Promoted	Left	Promoted
Time Pressure Caused by Being Behind on Important Deadlines	-0.16 $p < 0.01$	0.09 N.S.	-0.13 $P < 0.05$	0.13 N.S.
Time Pressure to Complete Reports, Tests, etc., Exerted by Other People	-0.11 N.S.	0.15 $P < 0.05$	-0.08 N.S.	0.18 $P < 0.02$

Andrews and Farris found that scientists who reported being under above average time pressure were higher performers five years later. The two

questions concerning time pressure in the current study assessed whether people were behind on deadlines or whether they were under time pressure because someone else was waiting for the output of their work.

TABLE XV

Correlations Between Involvement in Non-Technical Project Activities and Project-Related Decision Making and Career Outcomes

	Left	Promoted
AUTONOMY:		
Decision by Self to Work on Project	-0.13 $p < 0.05$	0.18 $p < 0.02$
Personal Influence Over Goals and Objectives	-0.05 N.S.	0.18 $p < 0.02$
INFLUENCE BY OTHERS:		
Direct Contact with Customers	0.04 N.S.	0.19 $p < 0.02$
Assigned to Project by Functional Manager	0.22 $p < 0.01$	-0.10 N.S.
Deadlines Set by Higher Level Manager	0.11 N.S.	0.16 $p < 0.05$
Difficulty Changing Schedules	-0.15 $p < 0.02$	0.17 $p < 0.05$
NON-TECHNICAL ACTIVITIES:		
Involved in Administrative Activities	-0.04 N.S.	0.23 $p < 0.01$
Participated in Writing of Current Contract	0.15 $p < 0.02$	0.10 N.S.
Involved in Future Planning	-0.01 N.S.	0.27 $p < 0.001$

Time pressure in this study is associated with staying in the organization

and, when the time pressure is caused by external agents (i.e. the engineers are performing time-critical tasks), time pressure is associated with promotion. The interdependency that is implied by the second question fits with Pelz and Andrews' and Andrews and Farris' findings that those people who are closely tied to the social system and are performing work aligned with the goals of the overall organization are better performers. All of the people who felt time pressure appear to have felt responsible for accomplishing their tasks. Those who had other people exerting the pressure may have been helping the organization meet critical contingencies. They gained power in return. They also felt their work to be more important, since the demands of other people is the most effective means of communicating organizational importance of the work

Responses to two other questions regarding the current project and related to turnover. Those people who stayed with the organization were more satisfied overall ($r = 0.16, p < 0.01$) and thought that other groups in the organization were usually cooperative ($r = 0.11, p < 0.05$). The first finding supports Ross and Zander's research (as reported in Lawler, 1973) which demonstrated dissatisfaction to predict turnover. People leave if they don't like their current situation and perceive an alternative as available and preferable.

Taken together, these results indicate that a positive affective response to an organization is an indicator of how well a person fits an organization's social system and culture. Presumably, those who are better integrated into communications networks and have aligned their

goals with the organizaton's are likely to be more satisfied.

The next questions assessed the engineers' involvement with non-technical and administrative aspects of their projects. Career outcomes were correlated with a number of items. These items can be grouped into those relating to the engineers' autonomy, the time constraints placed upon them, their contacts with people higher in the hierarchy, and their involvement in administrative activities (Table XV). The engineers who were promoted tended to believe that they had more influence in choosing to work on their projects and more influence in setting final goals and objectives for their projects. Those who were promoted also reported more direct contact with the customer as well as being more influenced by higher-level managers on their deadlines. Difficulty changing deadlines is also associated with being promoted. Involvement in administrative activities and future planning are associated with promotion.

Turnover is associated with a lack of autonomy and easily changed deadlines, the latter probably indicating assignments of lesser importance. Those engineers who left the organization had less choice in project assignment and their functional manager had more influence in the decision. This group indicate that deadlines are less difficult to change possibly implying that they were working on non-critical tasks. The last item relating to turnover is involvement in writing the current project contract. Those who were involved in writing the current project contract were more likely to leave, although this item is not related to promotion. This is difficult to explain, unless they left to join the customer

organization.

Perceptions of Project and Functional Managers and Outcomes

The last aspects of the environment which will be discussed are the engineers' relations with functional and project managers. Three items were used to assess staff engineers' perceptions of their project and functional managers' influence.

When asked to indicate whether their project managers or functional managers had more influence over their work, over the overall conduct of the organization and over pay and promotions, those engineers who left were slightly more likely to indicate that their functional managers had relatively more influence over their work ($r = 0.15$, $p < 0.05$) and the overall conduct of the organization ($r = 0.17$, $p < 0.05$). There were no differences for pay and promotion and there were no differences for those promoted and not promoted. These data reinforce the dependence upon the functional manager as a predictor of turnover.

CONCLUSIONS

The results presented provide mild support to the first hypothesis that people who want to be promoted are more likely to be promoted. The engineers who were promoted tended to prefer a managerial career. They also tended to indicate that high performance on their current projects could lead to a promotion into management. The results do not support

the second hypothesis that access to resources via a manager will increase an engineer's chances of being promoted. In fact, almost the opposite was found. Those who rely upon their functional manager for technical resources, including contacts inside and outside of their organization as well as technical information and ideas are more likely to leave the organization.

What has been demonstrated is the importance of integrating one's self into the social networks of the organization and of aligning one's goals with those of the organization in such a way that autonomy over project choice and work goals is constrained by the needs of other people in the organization. Integration in social networks involves being connected to sources of technical information and to higher-level managers. Lack of autonomy or lack of the skills necessary to become self-sufficient within the organization lead to turnover.

The results support Hall and Nougaim's (1968) finding that those newcomers who work on important and interesting tasks are better performers five years later and Lee's finding that a heavy work load, early in an engineer's tenure leads to subsequent high performance. The above analysis illuminates some of the underlying mechanisms. The analysis also provides strong support for Pelz and Andrews' finding that autonomy coupled with social ties to a research organization lead to high performance. The study demonstrates the existence and effect of these "creative tensions" using promotion and turnover rather than research creativity and productivity as measures of performance.

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