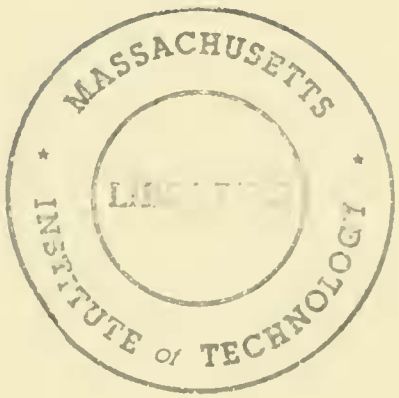
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An Investigation Into the Managerial Roles and Career Paths of Gatekeepers and Project Supervisors in a Major R&D Facility*

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An Investigation Into the Managerial Roles and Career Paths of Gatekeepers and Project Supervisors in a Major R&D Facility

R&D project teams must process information from outside sources in order to keep informed about relevant external developments and new technological innovations (Myers and Marquis, 1969). Furthermore, empirical studies over the past 15 years have demonstrated that oral communications, rather than written technical reports or publications, are the primary means by which engineering professionals collect and disseminate important new ideas and information into their project groups (Allen, 1977). While such personal contacts may be essential, there are alternative communication structures by which R&D groups can effectively draw upon information outside their organizations (Katz and Tushman, 1979). In particular, the research reported here focuses explicitly on the role played by gatekeepers in the effective transfer and utilization of external technology and information.[1] Since most gatekeepers are also project supervisors, this study also contrasts the managerial roles and subsequent career paths of gatekeeping supervisors against project supervisors not functioning as gatekeepers.

Communication and Performance

Generally speaking, previous research has shown that project performance is strongly associated with high levels of technical communication by all project members to information sources within the organization (i.e., high levels of internal communication). The positive findings of Allen (1977), Pelz and Andrews (1966), and Farris (1972) strongly argue that direct contacts between project members and other internal colleagues can enhance project effectiveness.

While direct communication by all project members may be effective for internal communications, the particular method for effectively keeping up-to-date with technical advances outside the organization are probably very different. Numerous studies, for example, have shown that project performance is not positively associated with direct project member communication to external information areas. In fact, most studies have found them to be inversely related (e.g., Allen, 1977; Katz and Tushman, 1979; Baker, Siegmann and Rubenstein, 1967). It seems that most engineers are simply unable to communicate effectively with extraorganizational information sources.

One explanation for these significant differences stems from the idea that technological activities are strongly local in nature in that their problems, strategies, and solutions are defined and operationalized in terms of particular strengths and interests of the organizational subculture in which they are being addressed (Katz and Kahn, 1978; Allen, 1977). Such localized definitions and shared language schemes gradually unfold from the constant interactions among organizational members, the tasks' overall objectives and requirements, and the common social and task related experiences of organizational members. These idiosyncratic developments are a basic determinant of attitudes and behaviors in that they strongly influence the ways in which project members think about and define their various problems and solution strategies.

Such localized perspectives eventually become a double-edged sword. As long as individuals share the same common language and awareness, communication is rather easy and efficient. Conversely, when individuals do not share a common coding scheme and technical language, their work-related communications are less efficient, often resulting in severe misperceptions and misinterpretations (Dearborn and Simon, 1958). Thus, the evolution of more localized

languages and technological approaches enables project members to deal effectively with their more local information processing activities within the organization; yet at the same time, it hinders the acquisition and interpretation of information from areas outside the organization. This lack of commonality across organizational boundaries serves as a strong communication impedance causing considerable difficulty in the communications of most engineers with external consultants and professionals (Allen, 1977; Price, 1965).

Given this burden in communicating across differentiated organizational boundaries, how can project groups be effectively linked to external information areas? One way is through the role of project gatekeeper; that is, certain project members who are strongly connected to outside information domains but who are also capable of translating technical developments and ideas across contrasting coding schemes (Allen and Cohen, 1969). Through these key members, external information can be channelled into project groups by means of a two-step communication process (Coleman, Katz, and Menzel, 1966). First, gatekeepers gather and understand outside information, and subsequently they translate it into terms that are more meaningful to their locally constrained colleagues. Gatekeepers, as a result, perform an extremely valuable function, for they may be the principal means by which external ideas and information can be effectively transferred into R&D project groups.

While substantial literature applauds this gatekeeper concept, there is virtually no direct evidence that gatekeepers enhance project performance. Support has to be inferred indirectly either from the empirical findings of Katz and Tushman (1979) and Allen, Tushman, and Lee (1979) or from the case studies in project SAPPHO (Achilladeles, Jervis, and Robertson, 1971).

Our initial research question, then, concerns the association between project gatekeepers and technical performance. Is this relationship positive across all forms of R&D activity or are some project areas more effectively linked to external technology through direct contact by all project members rather than through a gatekeeper? Moreover, if gatekeepers are necessary for effective technology transfer, then must they be the primary source for collecting outside information, or can they also serve to facilitate the external communication of their more locally constrained colleagues?

Gatekeepers, Performance, and the Nature of the Task

The need for a two-step process of information flow depends on a strong communication impedance between the project group and its external information areas. To the extent that different technical languages and coding schemes exist between project members and their external technical environments, communication across organizational boundaries will be difficult and inefficient. In particular, most technological activities (unlike the sciences) are strongly local in nature. The coupling of bureaucratic interests and demands with localized technical tasks and coding schemes produces a communication boundary that differentiates these project groups from their outside areas. Product development groups in different organizations, for example, may face similar problems yet may define their solution approaches and parameters very differently (Katz and Tushman, 1979; Allen, 1977). As a result, it becomes increasingly difficult for most technologists to integrate external ideas, suggestions and solutions with internal technology that has become locally defined and constrained. It is hypothesized, therefore, that locally oriented projects (i.e., development and technical service projects) will require gatekeepers to provide the necessary linkages to

external information areas -- without gatekeepers, direct external contacts by members of local projects will be ineffective.

Contrastingly, if external information sources do not have different language and coding schemes from members of the project group, then a significant communication impedance will not exist. Work that is more universally defined (scientific or research work, for example) is probably less influenced and constrained by local organizational factors, resulting in less difficulty vis-a-vis external communications. Under these conditions, project members are more likely to share similar norms, values, and language schemes with outside professional colleagues, thereby, permitting effective communication across organizational and even national boundaries. They are simply more capable of understanding the nature of the problems and corresponding solution approaches employed by their relevant external colleagues. Hagstrom (1965), for instance, found a strong positive correlation between the productivity of scientists and their levels of contact with colleagues from other universities. For universally defined tasks, therefore, it is hypothesized that gatekeepers are not required to link projects with their relevant external information areas; instead, direct outside interaction by all project members is more advantageous. The nature of a project's work, therefore, should be a critical factor affecting the development of localized languages and orientations and consequently will moderate significantly the relationship between project performance and the usefulness of gatekeepers.

Role of Gatekeepers

If gatekeepers enhance the performance of project groups working on locally defined tasks, then what specific information processing activities of gatekeepers contribute to higher project performance? There

are at least two alternatives. The more traditional explanation is that gatekeepers function as the primary link to external sources of information and technology -- information flows through these key individuals to the more local members of the project team (Allen and Cohen, 1969). Relevant external information is transferred effectively into a project group because of the capable boundary spanning activities of the project's gatekeeper.

Another possibility is that gatekeepers also assume an active training, development, and socialization role within their work groups. From this perspective, gatekeepers not only gather, translate, and encode external information, but they also facilitate the external contacts of their project colleagues. By helping to direct, coach, and interpret the external communications of their fellow project members, gatekeepers act to reduce the communication boundary separating their projects from outside information areas.

If gatekeeping permits other project members to communicate effectively with external areas, then for localized projects with gatekeepers, there should be a positive association between a project's external communication and its performance. On the other hand, if gatekeepers do not play this more active role, then an inverse relation is more likely to exist between the external communications of locally oriented group members and project performance. Because gatekeepers work and interact so closely with other project members about technically related problems, it is hypothesized that gatekeepers fulfill this larger role of both gathering outside information and facilitating the external communications of their project colleagues.

Gatekeepers and Project Supervisors

If most gatekeepers are also first-level project supervisors (Allen, 1977), then to what extent can any project supervisor substitute as a gatekeeper and play this linking role to external areas? Supervisors of locally oriented projects who are not gatekeepers face the same communication impedance as their project subordinates when communicating externally. As a result, without the benefit of a gatekeeper, the communications of non-gatekeeping supervisors outside the organization will be inversely related to project performance. In contrast, supervisory gatekeepers are capable of communicating effectively across organizational boundaries and consequently will show a positive association between external communication and project performance.

Finally, if there is a significant distinction between the information processing activities and capabilities of project supervisors who are gatekeepers and those who are not, then to what extent will they also have different career paths within the technical organization. Are gatekeeping supervisors, for example, more likely to be promoted to particular laboratory positions than non-gatekeeping supervisors? From an exploratory point of view, this research describes the career paths of these different kinds of project supervisors over a 5-year period. The key issues are whether gatekeeping and non-gatekeeping supervisors were promoted and utilized differently within the organization over this time period, and whether they are currently effective in their respective career positions.

Methodology

This study was conducted at the R&D facility of a large American Corporation. Employing a total of 345 professionals, the laboratory was

organized into 7 departments, each containing its own set of projects. At the time of our study, 61 separate project groups existed across the 7 departments. These groups remained stable over the data collection period, and each professional was a member of only one project group.

Communication

To measure actual communications, each professional kept track of all other professionals with whom he or she had work-related oral communication on a randomly chosen day each week for 15 weeks. The sampling of days was arranged to allow for equal numbers of weekdays. Respondents reported all contacts both within and outside the laboratory's facility, including whom they talked to and how many times they talked with that person. Social and written communications were not reported. An overall response rate of 93% was achieved over the 15 weeks. In addition, 68% of all communication episodes reported within the laboratory were reciprocally mentioned by both parties. Given these high rates of response and mutual agreement, these sociometric methods provide a rather accurate picture of the verbal interactions for all laboratory professionals.

For each project member, internal communications was measured by summing the number of work-related contacts reported over the 15 weeks between that member and all other professionals within the organization. External or outside communication was measured by summing the member's reported communications to other professional individuals outside the organization, including R&D consultants, professors, vendors, customers, and the like.

As discussed by Katz and Tushman (1979), these individual scores were also aggregated to obtain project measures of internal and external communication.

Conceptually, project gatekeepers are defined as those members who are high internal communicators and who also maintain a high degree of outside communication. In line with previous studies (see Allen, 1977). this study operationalized gatekeepers as those project members who were in the top fifth of both the internal and external communication distributions. Gatekeepers were identified in 20 project groups while 40 projects had no gatekeepers within their memberships.

Project Type

R&D tasks differ along several dimensions, including time span of feedback, specific vs. general problem-solving orientation, and the generation of new knowledge vs. utilization of existing knowledge and experience (Rosenbloom and Wolek, 1970). Based on these dimensions, distinct project categories were defined ranging from research to development to technical service. Such a categorization also forms a universal (research) to local (technical service) project continuum. As discussed by Katz and Tushman (1979), respondents were asked to use these specific project definitions and indicate how well each category represented the objectives of their task activities. A second question asked respondents to indicate what percentage of their project work fell into each of the project categories. A weighted average of these two answers was calculated for each respondent (Spearman-Brown reliability = .91)

To categorize projects, however, the homogeneity of members' perceptions of their task characteristics had to be examined to check for the appropriateness

of pooling across individual project members (see Tushman, 1977 for details). As pooling was appropriate, individual responses were averaged to get final project scores, yielding 14 Research, 23 Development, and 23 Technical Service projects. Research projects carried out more universally oriented scientific work (discovering new knowledge in glass physics, for instance) while development and technical service projects were more locally oriented in that they worked on organizationally defined problems and products.

Project Performance

Since comparable measures of project performance have yet to be developed across different technologies, a subjective measure was employed. Each Department and Laboratory Manager (N = 9) was separately interviewed and asked to evaluate the overall technical performance of all projects with which he was technically familiar. Whenever an informed judgement could not be made, they were asked not to rate the project. From these interviews, each project was independently rated by an average of about 5 managers using a seven-point scale ranging from very low to very high. These individual ratings were averaged to yield overall project performance scores (Spearman-Brown reliability = .81).

Follow-up Study

Approximately 5 years after these previously described data were collected, we returned to this R&D facility to locate the current laboratory positions of the original set of project supervisors. During this time interval, a dual ladder promotional system had been installed. According to the company, the technical ladder was introduced to reward individual professionals whose "technical competency and contributions are

well-recognized." All technical ladder positions were above the original project supervisory level. As a result, we were able to determine from our follow-up analysis whether a project supervisor had either (1) been promoted up the managerial ladder, (2) been promoted up the technical ladder, (3) had not been promoted above the project level, or (4) had left the R&D facility.

Finally, a very high-level manager currently investigating problems associated with the dual ladder system was asked to evaluate the particular project supervisors who had been promoted up the technical ladder (N = 12). Based on his knowledge of the current technical contributions of these individuals, each was rated on a 4-point scale ranging from low to high. Unfortunately, similar performance ratings for project supervisors promoted up the managerial ladder could not be obtained.

Results

Gatekeeper Presence and Project Performance

The performance means reported in the first row of Table 1 clearly indicate that, in general, the performances of projects with gatekeepers were not significantly different from the performances of projects without gatekeepers. As previously discussed, however, locally oriented projects (i.e., development and technical service) should display a positive association between gatekeeper presence and project performance. Universal-type or research projects, on the other hand, should show an inverse relation between gatekeeper presence and project performance.

The breakdown of performance means by project type strongly supports these differences in the appropriateness of the gatekeeping function. As shown by Table 1, research projects without gatekeepers were significantly higher performing than research projects with gatekeepers. It may be that research projects are more effectively linked to external information areas

through direct member contacts.

Insert Table 1 About Here

In sharp contrast, development projects with gatekeepers were significantly more effective than development projects without gatekeepers. Unlike research groups, then, development projects are linked to outside information areas more effectively through the use of gatekeepers. No significant differences in project performance, however, were discovered between technical service groups with and without gatekeepers. As a result, the mechanisms used by technical service projects to import external information effectively remain unclear.

Role of Gatekeepers

It was suggested that on locally oriented tasks, gatekeepers may do much more that simply channel outside information into their project groups. They may also act to reduce communication impedance, facilitating the external communications of their fellow project colleagues. In contrast, locally oriented projects without gatekeepers will have no clearly effective link to external areas.

Results reported in Table 2 support these ideas. For local projects without gatekeepers, there was a consistent inverse association between members' external communication and project performance. For projects with gatekeepers, however, a significantly different pattern emerged -- external communication was positively associated with project performance. Furthermore, these correlational differences were strong even after the direct communication effects of gatekeepers were removed! For both development

and technical service groups, gatekeepers and their project colleagues were able to communicate effectively with outside professionals.

Insert Table 2 About Here

The significant correlational differences between projects with and without gatekeepers strongly support the argument that gatekeepers influence the ability of local project members to communicate effectively with external sources of technical information. Members of research projects, on the other hand, do not seem to face a communication impedance when communicating externally, for Table 2 shows that the level of outside interaction by all research project members was positively associated with performance independent of a gatekeeper's presence within the group. Gatekeepers as a result, may not play an important information processing role in the more universally oriented research projects, but they appear to play a vital role in the more locally defined development and technical service projects.

Gatekeepers and Project Supervisors

Can project supervisors substitute for gatekeepers in linking their projects to external information areas? The correlations reported in Table 2 do not support this position. For development and technical service projects, the greater the external communication of project supervisors who were not gatekeepers, the lower their project's performance. Generally speaking, therefore, supervisors are not necessarily an effective link to external domains. Contrastingly, the association between outside contact and project performance was very positive for supervisors who were also gatekeepers. Such significant correlational differences strongly imply that supervisory status alone cannot effectively deal with the demands for

keeping in touch with outside information sources.

In light of these significant role differences, were gatekeeping and non-gatekeeping supervisors likely to receive the same kinds of promotions? The results of Table 3 suggest they did not. The follow-upstudy of the facility some 5 years later reveals that almost all of the gate-keeping supervisors had been promoted up the managerial ladder. Of the 12 gatekeeping supervisors remaining with the company, 11 are in higher-level managerial positions. Although non-gatekeeping supervisors were almost as likely to be promoted, they were not as likely to receive managerial promotions. Almost as many non-gatekeeping supervisors were promoted up the technical ladder as were promoted up the managerial ladder. In fact, of the 13 project supervisors who had made it up the technical ladder, only one had been a technical gatekeeper![2]

Insert Table 3 About Here

While gatekeeping supervisors were essentially promoted up the managerial ladder, could one have differentiated between non-gatekeeping supervisors promoted managerially and those promoted technically? The means reported in Table 4 indicate that there were significant communication differences between these two promotional categories. Project supervisors promoted up the technical ladder had only half as many internal interactions as project supervisors selected for managerial positions. Interestingly enough, there were almost identical levels of internal communications for gatekeeping and non-gatekeeping supervisors promoted to managerial positions. External communications did not differentiate between the promotional ladders of non-gatekeeping supervisors. Thus, the level of interpersonal activity and skills that one has demonstrated within the organization may have been a

strong factor in shaping one's promotional ladder within this dual ladder system.

Insert Table 4 About Here

Finally, it is important to mention that neither of our original measures of internal or external communication could significantly predict the current contributions of project supervisors now positioned on the technical ladder. Instead, as shown by Table 5, the current performances of professionals on the technical ladder are significantly lower for project supervisors who had headed technical service activities than for project supervisors who had been in charge of either development or research project work. Given their relatively low level of outside contact in the first place, (at least when compared with their gatekeeping counterparts), these findings suggest that the technical ladder (at least as presently operationalized in this and in similar facilities) may be less appropriate for R&D professionals whose work experiences, activities, and orientations have been on the "local" side of the technological continuum. In light of the small number of cases in Table 5, however, considerably more research is needed to corroborate these results.

Insert Table 5 About Here

Discussion

In engineering and scientific environments, there are at least two distinct methods by which R&D project groups can keep abreast of technical ideas and developments outside their organizations: (1) direct contact by all project members and (2) contact mediated by project gatekeepers. Our

findings suggest that the effectiveness of these two alternatives is strongly affected by the communication impedance separating project groups from their external information areas. Universally-oriented research projects, for example, face little communication impedance when processing outside ideas and information since their work is less constrained by local organizational factors. Therefore, instead of relying on gatekeepers to keep informed about outside developments and advances, members of higher performing research groups were able to rely on their own external contacts. In fact, a significant inverse relation between project performance and gatekeeper presence was uncovered among the facility's 14 reseach groups.

As project activities become more specialized and locally defined, however, language and cognitive differences between project members and external professionals increase, creating substantial communication impedance and more tendentious information flows. As a result, individual interaction across organizational boundaries becomes more difficult and ineffective. To wit, higher performing development and technical service groups had significantly less outside contact by all project members. Nevertheless, important technical information must be acquired from relevant outside sources. Gatekeeping, as a result, can be a necessary and effective process for transferring external technology into localized project groups. In particular, within our sample of development projects, those with gatekeepers were considerably more effective than those without gatekeepers. Thus, what are needed to introduce outside information effectively into development projects are specialized project individuals who keep current technically, are readily conversant across different technologies, and who are contributing to their project's work in direct and meaningful ways, i.e., technical gatekeepers (Allen, 1977).

Unlike development projects, the performances of technical service projects were not positively related to the presence of gatekeepers even though their project members could not communicate effectively with outside information areas (see Table 2). One possible explanation for these differences stems from differences in the nature of their work. In contrast to development projects which typically involve dynamic technologies, new knowledge, and/or new products, technical service work tends to deal with more mature technologies, existing knowledge, and/or existing products. Because these technologies are more stable and can be understood more easily by the organization's management (Frost and Whitley, 1971), the specialized gatekeeper role may not be necessary. Instead, the managerial hierarchy may be able to keep members sufficiently informed about external events and information through formal operating channels (Walsh and Baker, 1972; Allen, Tushman, and Lee, 1979).

Generally speaking, the particular method by which R&D projects can effectively connect with external technical information appears to differ significantly across the research, development, and technical service spectrum of R&D activities. The particular method being strongly contingent on both the nature of the project's work and the stability of the involved technologies. Thus, it seems that the combination of localized yet dynamic technologies necessitates the active presence and participation of gatekeepers within engineering project groups.

The Gatekeeping Role and Project Supervision

In linking local project groups to extra-organizational areas, our results indicate that gatekeepers not only bring in outside information, but just as important, they facilitate the external communication of their

more locally oriented colleagues. As a result, localized engineering projects with gatekeepers are in a better position to take advantage of external technology since other members are now capable of communicating effectively across organizational boundaries. This additional capacity lessens the project's complete dependence on gatekeepers for gathering and disseminating all important outside information.

In research-type tasks, on the other hand, gatekeepers are not an effective method for obtaining external information; nor does it appear that they serve in any communication facilitating capacity. In higher performing research projects, members did not rely on gatekeepers for their external information; in a sense, they functioned as their own technical gatekeepers!

One should also note that many supervisors of locally-oriented projects could not adequately perform a gatekeeping role in linking their projects to outside technology. In contrast to gatekeeping supervisors, the external interactions of supervisors who were not gatekeepers were negatively associated with project performance. While these non-gatekeeping supervisors may have developed important internal linkages, they are unable to fulfill the same external function as their gatekeeping peers. Such findings suggest distinguishing between two types of project leaders: (1) locally oriented supervisors who may be appropriate for more administrative and technical support activities and (2) gatekeeping supervisors who may be more contributive on product and process development activities.

These different capabilities also seem to have lead to different kinds of career paths. All project gatekeepers remaining in the organization over a 5-year period were promoted along the managerial ladder. Almost all non-gatekeeping supervisors were also promoted during this interval.

However, only about half were positioned on the managerial ladder -- the other half being promoted along the technical ladder. While there were no strong differences between the technical performances of project groups which had supervisors promoted managerially versus those which had supervisors promoted technically, there had been very strong differences between their communication activities. Those selected for managerial positions had been high internal communicators; in fact, they were as high as project gatekeepers. In sharp contrast, supervisors promoted along the technical ladder had been extremely low internal communicators. Thus, what differentiated between these two alternative career paths for non-gatekeeping supervisors was not technical competence but interpersonal competence.[3] Supervisors who had behaviorally demonstrated their ability to interact effectively with other professionals within the organization were given higher level managerial responsibilities and positions. Such findings strongly argue that technical skills were not sufficient for attaining high level managerial positions; rather technical and interpersonal skills had to be combined. As emphasized by Mintzberg (1973) and Schein (1978), high level R&D managers should not only be technically competent, but they should also be able to communicate and interact effectively with other individuals, especially since many of their work responsibilities are either carried out or interfaced with these people.

Finally, of the technically promoted project supervisors who are now poor contributors, proportionately more have come from supervising technical service work. One explanation is that in most organizations, individuals promoted up the technical ladder are given considerably more freedom to define where and how they will make their technical contributions. As a result, it becomes very difficult to manage and integrate them with other project

colleagues and activities. Over time, therefore, their work becomes increasingly independent and self-contained. In some sense, they are asked to function like a creative research scientist but in a technological work environment. This new role may be particularly troublesome for professionals who had become accustomed to technical support work in which the technologies were often well understood and more stable and in which the tasks were often more structured. (Allen, Tushman, and Lee, 1979).

Conclusions

In conclusion, gatekeepers perform a critical role within R&D settings that often goes unrecognized. By realizing the importance of the gatekeeping role within development tasks, R&D managers can link their product or process efforts to sources of external technology more effectively. A manager could examine, for example, the extent to which important technologies utilized within various development projects are actually "covered" by a gatekeeping type person. However, the degree to which these communication activities can be managed may be limited. Gatekeeping is an informal role in that other project engineers must feel sufficiently secure and comfortable psychologically to approach gatekeepers with their technical problems, mistakes, and questions without fear of personal evaluation or other adverse considerations (Allen, 1977). Therefore, to the extent that the organization tries to formalize such a gatekeeping function, it runs the risk of inhibiting the very kinds of interaction it wishes to promote.

This is not meant to imply that gatekeeping cannot be managed or helped; on the contrary, it can. In fact, a number of R&D facilities have instituted formal gatekeeper programs. What is important to recognize is that the interest and ability of individuals to link with external technology cannot

be suddently "decreed" by management. Typically, such outside professional interests are a "given" and are not easily influenced by the organization, although they can be made easier to pursue. What can be more easily influenced is the degree to which gatekeepers are actually present and participating in project tasks as well as their accessibility to other project members. Their work positions, for example, could be located close to other project engineers to foster easier and more frequent communication. However, the development of sufficient internal contacts and communications to be an effective gatekeeper takes time. In the present sample, for example, all of the gatekeepers had been working in their present project groups for a period of at least two years! In short, the external side of the gatekeeping role is usually being performed by the gatekeeper anyway. It is the internal side that can be facilitated and made more effective.

Footnotes

1. Gatekeepers are defined as those key individual technologists who are strongly connected to both internal colleagues and external sources of information (Allen and Cohen, 1969).

2. This particular gatekeeper was initially promoted up the managerial ladder but was switched to a technical ladder position when it became clear that he was not functioning effectively as a laboratory manager.

3. This is particulary important since most companies with technical ladders "claim" to reward individuals for outstanding technical contributions. Gatekeepers as individuals, moreover, typically represent the most technically competent first-level supervisors within laboratories (see Allen, 1977), and they were promoted managerially. Thus, supervisors promoted along the technical ladder were probably not the most technically competent individuals, nor were they keeping in touch with external technology to the same extent as gatekeepers. Perhaps it is these deficiencies that cause many companies to have substantial difficulty with their dual ladder systems.

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TABLE 1. Project Performance as a Function of Gatekeeper Presence and Project Type

Project Type	Mean Performance For Projects: With Gatekeepers	Without Gatekeepers	Mean Difference in Performance
All Projects	4.70 (N=20)	4.53 (N=40)	0.17
PROJECT TYPE			
Research	4.22 (N=5)	4.92 (N=9)	-0.70**
Development	4.91 (N=8)	4.15 (N=15)	0.76***
Technical Service	4.80 (N=7)	4.67 (N=16)	0.13

**$p < .05$ and ***$p < .01$ indicate significant mean differences in project performance.

TABLE 2. Correlations Between Project Performance and External Communication By Project Type and Gatekeeper Presence

Measures of External Communication For:	Correlation With Performance for Projects: With Gatekeeping Leaders	Without Gatekeeping Leaders
Research Projects:		
a) All project members	.53	.46*
b) All members excluding project leaders†	.37	.70**
c) Project leaders	.55 (N=5)	.29 (N=9)
Development Projects:		
a) All project members	.31	-.45**
b) All members excluding project leaders	.55*	-.21
c) Project leaders	.37	-.51**
	(N=8)	(N=15)
Technical Service Projects:		
a) All project members	.31	-.19
b) All members excluding project leaders	.64*	-.03
c) Project leaders	.77*	-.34*
	(N=7)	(N=16)

†In the first column of correlations, project leader refers to the project's gatekeeper, 75% of whom were also project supervisors. In the second column, project leader simply refers to the project's supervisor.

*$p < .10$; **$p < .05$; Pairwise correlations that are significantly different at the $p < .10$ level or less have been underlined.

TABLE 3. Comparison of Promotions of Gatekeeping and Non-Gatekeeping Project Supervisors Along the Dual Ladder Over a 5-year Period

Laboratory Position of Project Supervisors After 5 Years	Supervisory Role: Project Supervisors Who Were Also Gatekeepers	Supervisory Role: Project Supervisors Who Were Not Gatekeepers
a) Percent promoted to managerial positions above the project level.	73.3	37.2
b) Percent promoted to technical positions above the project level.	6.6	27.9
c) Percent not promoted to positions above the project level.	0.0	16.2
d) Percent no longer employed.	20.0	18.6
Totals	100.0% (N=15)	100.0% (N=43)

TABLE 4. Comparisons of Mean Internal and External Communications of Project Supervisors Promoted Over the Next 5 Years

Promotional Positions Above the Project Level	Mean Internal Communication (per person per week)	Mean External Communication (per person per week)
a) Gatekeeping supervisors promoted to managerial positions (N=11)	74.3[a]	4.8[a]
b) Non-gatekeeping supervisors promoted to managerial positions (N=16)	70.6[a]	1.5[b]
c) Supervisors promoted to technical positions† (N=12)	39.7[b]	1.4[b]

†Of these 12 project supervisors, only one had functioned as a project gatekeeper.

Note: In each column, means with superscript "a" are significantly greater than means with superscript "b" at the $p < .01$ -level.

TABLE 5. Performance Ratings of Project Supervisors Promoted Up the Technical Ladder By Project Type

	----Prior Type of Project Supervision----		
	Research (N=4)	Development (N=5)	Technical Service (N=3)
Mean Performance Ratings**	3.75	3.40	1.67

**Mean performances are significantly different at the $p < .05$ -level.